## 2015 KoSFoST International Symposium and Annual Meeting

### 2015 Annual Meeting Organizing Committee

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<tr>
<th>Position</th>
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<td>Noh, Bong Soo</td>
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<td>President-elect</td>
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<td>Vice Presidents</td>
<td>Hwang, Jae-Kwan</td>
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Food beyond Science and Technology

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<td>10:00~12:30</td>
<td>Scientific Writing</td>
<td>Young Scientist Lecture 1</td>
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<td>International Symposium 2</td>
<td>Food Microbiology Division</td>
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<td>International Symposium 3</td>
<td>Special Seminar &quot;HACCP&quot;</td>
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* Registration 1F Lobby / Headquarter R.208
Abstract of Distinguished Lifetime Achievement Award Lecture
A Role of a Protein Chemist in the Field of Food Preservation

Kyung Bin Song

Department of Food Science and Technology, Chungnam National University, Korea

Food preservation is a field of broad subject that covers food processing, food engineering, and food microbiology as well as food chemistry. Therefore, it appears that it includes the entire area of food science and technology. Luckily, I happen to teach and research the field of food preservation. Prior to joining Chungnam National University, my main research area was protein chemistry and enzymology during my MS, PhD, and post doctorate program. Based on the basic knowledge regarding protein chemistry, my research has been focusing on food preservation at CNU. The effect of gamma-irradiation on the molecular properties of proteins was the first research project. Since the study using typical proteins, such as BSA and beta-lactoglobulin, my research topic had been switched to the microbial inactivation technique using gamma-ray, electron beam, and UV-C irradiation for better food quality and extension of shelf-life of foods, particularly fresh-cut vegetables. Therefore, non-thermal processing has been one of my main research topics. In addition to the physical technique, chemical treatments, such as aqueous chlorine dioxide, organic acids, and essential oils, have been applied. To further improve the microbial inactivation, hurdle technology using combined treatments using aqueous chlorine dioxide/fumaric acid or aqueous chlorine dioxide/UV-C irradiation have been applied to various types of processed foods as well as fresh-cut vegetables and fruits. Another major research topic of mine has been the preparation of edible protein films and their application in food packaging. The source of protein films has been from plant seed oil residue, animal food proceeding by-products, and agricultural and marine by-products, which are mostly inexpensive. Preparation of protein films needs the use of appropriate plasticizer and cross-linking agent to have proper mechanical and water barrier properties. In addition, to provide anti-oxidative and antimicrobial activity to the films, essential oils, such as grapefruit seed extract and coriander oil, have been added to the film-forming solution. Prepared protein films have been applied to the packaging of processed foods, and the results suggest that protein films can be used as antimicrobial and anti-oxidative packaging materials for foods. Overall, all the research output has been obtained by graduate students at the CNU. I am very lucky to have good graduate students, and I would like to mention that all the credits to this honorable academic award should be given to those students.
Abstract of “InGye” Award Lecture
Utilization of Rice Bran as a Source of Bioactive Phytochemicals

Sung-Min Kim, Hye-Young Shin, Hyun Soo Kim¹, Seung-Taik Lim*

Graduate School of Life Sciences and Biotechnology, Korea University, Korea
¹Seolgok Research & Development, Korea

Rice bran (RB), a by-product from the milling of brown rice, contains a variety of bioactive phytochemicals, but is rarely utilized mainly due to its instability against rancidity. Simple thermal treatment such as autoclaving or microwave heating appeared effective in inactivating the residual oxidase responsible to the rancidity. RB, in general, contains rice germ, and thus may be fractionated to inner and outer bran layers (IBL and OBL, respectively), and rice germ (RG). RG contains higher levels of vitamin E and phytosterols than IBL and OBL. IBL contains the highest amounts of tocotrienols, squalene and octacosanol, whereas OBL contained the highest amount of γ-oryzanol. A simple anaerobic treatment of RB after moisturizing provides metabolic stress and enhance the biosynthesis of gamma-aminobutyric acid (GABA). Maximum GABA level (523 mg/100 g) was obtained by an anaerobic storage of RB at 30% moisture content for 5 h at 40°C after an addition of glutamic acid (5 mM), which was approximately 17 times higher than that in the control. As another approach to enhance bioactivity was a treatment with cell wall degrading enzymes such as Celluclast, Ultraflo, and Pentopan. It increased the extractability of residual phenolic acids from RB by approximately three times. Additionally, black rice bran (BRB) containing pigments could be used as a potent source of phytochemicals. By a solid-state fermentation with Aspergillus sp., substantial increase in ferulic acid content in BRB could be achieved (over 30 times after 3 days). These physical, enzymatic, and fungal treatments assure that RB is a superior source of various nutraceuticals and cosmeceuticals.
Abstracts of Plenary Lectures
Challenges and Opportunities in Food Science and Technology Innovations

Howard Q. Zhang
Western Regional Research Center
USDA Agricultural Research Service, USA

Today's food industry faces enormous challenges. On one hand, increased world population demand an ever increasing quantity of food products, global food security. Industrialization in population dense areas also command foods that are convenient, nearly ready made, to fit the life style of working individuals and families. Growth of production in agricultural commodities in future years may not match growth of populations, especially in regions with limited natural resources for agricultural production. Production, transportation, storage and distribution of food products must provide solutions to this increased demand by an increasing population. On the other hand processed foods are indicated to have contributed to increased human health issues. Food safety is still a major issue in many countries. The increased scale of production operation tends to generate a more significant food safety issue, resulting in massive product recalls and outbreaks. Product formulation that make use of high fat, high sodium and high sugar contents has the blame for causing obesity in many parts of the world where foods are plentiful and inexpensive. People simply over dose. How to make processed foods healthy yet marketable remains a major challenge. Consumer demand of safe and high quality foods is also a challenge that the food industry faces. All of these challenges prompt to innovation in food science and technology. While the challenges are difficult to overcome, the opportunity for solving such problems is also rewarding. Processing and packaging technologies play a key role in global food security. Quality, safety, shelf life stability, and resource sustainability are most important considerations while tackle food security issues. Recent development in nonthermal processing technologies, such as high pressure processing and pulsed electric fields provide a great opportunity to enhance product quality while maintaining product safety and shelf life. Some of these technologies also reduce the resource intensity, in the forms of reduced thermal energy use, and reduced water use. Infrared blanching and pealing of tomato may greatly reduce chemical and water use. Improving healthfulness of foods by exploring use of non-traditional ingredients. Recent examples include processed fruit bars for children to increase fruit intake, use of grape seeds for health benefits, and UV treating mushrooms for increased vitamin D availability. Food science and technology innovation is the answer to a significant challenge that the world faces today. Although there is no one solution that solves all problems, each technology and innovation incrementally contributes to the total solution in food security, safety and healthfulness.

Is Control of Water-Lipid Interfaces the Key to Inhibiting Lipid Oxidation?

Eric A. Decker, D. J. McClements
Department of Food Science, University of Massachusetts Amherst, USA

Lipid oxidation in many food systems is promoted by transition metals decomposing lipid hydroperoxides into free radicals. Since lipid hydroperoxides are surface active and metals are often in the aqueous phase, the lipid-water interface can be the site of free radical generation. In oil-in-water emulsions, emulsion droplet interfacial properties such as charge and thickness impact lipid-metal interactions. Lipid-water interfaces also exist in bulk oils due to the ability of the minor components of oil to form association colloids. The formation of the water-oil interface in association colloids will increase lipid oxidation rates as well as the prooxidant activity of transition metals. Lipid-water interfaces also impact the activity of antioxidants. When emulsifier conditions favor maximizing antioxidants concentrations at the water-oil interface, antioxidant activity is increased. It will be important to develop a more thorough understanding of how the physical and chemical properties of oil-water interfaces impact the activity of both prooxidants and antioxidants at water-oil interfaces so that new innovative antioxidative technologies can be developed.
Bridge between Food Chemistry and Microbiological Ecology
- Regulation of Bacterial Metabolisms by Chemical Components from Tea, Soy Pulp, and Red Beet

Yasuyuki Hashidoko
Research Faculty of Agriculture, Hokkaido University, Japan

Microorganisms often respond to secondary metabolites produced by plants or other microorganisms by exhibiting hidden functionalities, such as morphological differentiation, drastic metabolic changes, and etc. Food materials sometimes contain such secondary metabolites that have biological activities toward microorganisms. Here, I present some examples of biologically active chemical substances contained in tea, soy pulp, and red beet root tuber.

1) Inhibition of indole degradation and biofilm induction in the presence of gallic acid contained in tea. We screened rhizosphere bacteria from dipterocarpus saplings growing in a tropical peat swamp forest in Central Kalimantan, Indonesia, and isolated many L-tryptophan- and indole-degraders. *Burkholderia unamae* CK43B was isolated as a powerful indole-degrader that could utilize indole as a sole nitrogen source. Upon exposure to 0.5 mM gallic acid, which is common in green tea and other hydrolysable tannin-containing plants, indole degradation by *B. unamae* CK43B was strongly inhibited. Moreover, standing cultures of *B. unamae* CK43B in shallow Petri dishes produced unique extracellular polymeric substances. In *Escherichia coli* K-12, indole plays a role as an auto-regulatory signaling molecule that accelerates or represses biofilm formation. In a co-culture of *E. coli* K-12 and the indole-degrader *B. unamae* CK43B in LB medium, active biofilm formation was observed only when the culture medium was supplemented with 1 mM gallic acid. In this gallic acid-containing co-culture medium, more than 0.05 mM indole was detected as the secondary metabolite of *E. coli* K-12, due to gallic acid-induced repression of indole degradation by *B. unamae* CK43B. The biofilm formed contained both *B. unamae* CK43B and *E. coli* cells at a ratio of 1:3-1:6.

2) A *Bacillus* sporulation-inducing factor is isolated from soy pulp (okara). We found that soy pulp and a MeOH extract induce the production of cyclic oligopeptide antibiotics and spore formation in vegetative cells of a *Bacillus amyloliquefaciens* strain that was isolated from the roots of Chinese cabbage harvested and stored during the winter in Hokkaido. *B. amyloliquefaciens* cultured in nutrient broth medium produced only small amounts of the cyclic oligopeptide antibiotics iturins and fengycins. However, antibiotic production was greatly enhanced when a MeOH extract of soy pulp was added to the medium. The active factor in the soy pulp, which was purified by several types of chromatography, including reverse phase silica gel, gel filtration, ion exchange, and a diol column, showed a weak response in a ninhydrin test. The purified factor also induced pellicle formation and sporulation of vegetative cells of *B. amyloliquefaciens* in MOPS-MgCl₂-L-glutamine containing medium (MSg). In addition, this active substance clearly induced sporulation of *B. thuringiensis*, which is utilized as bioinsecticide.

3) Easy preparation of betanin, a red pigment in red beet, and its derivatized products having activity toward unicellular microorganisms. The red beet tuber contains betanin, a betalain-type water-soluble red pigment in which 5-O-glucosylated L-DOPA is covalently bound to betalamic acid by an imine bond that is a key in its remarkable antioxidant activity. Although betanin is chemically unstable, we have established an easy and rapid purification method for this pigment. Via imine exchange reactions, the purified compound was derivatized into many betalain analogs possessing imine bonds between betalamic acid and various amine compounds. The biological activity of the generated betalamic acid-conjugates toward unicellular microorganisms was investigated.

These studies show the presence of a clear linkage between natural product chemistry and regulatory functions in microorganisms. Such linkages may offer a clue into future prospects for the unknown functionalities of food materials and wastes.
Abstracts of 2015 KoSFoST International Symposia

IS1 Glocalization of Ethnic Food
IS2 Functional Marine Oligosaccharide for Blood Glucose Management: From Bench to Market
IS3 Food and Microorganisms: Are They Friends or Enemy?
IS4 Meat Safety and Production: Notes for the Meat Industry
The ethnic food market in the US grew to $3 billion in 2011 and is expected to be $4 billion by 2016. However, this accounts for only 0.3% of the total US food and drink market. The top three US ethnic food markets presently are Mexican/Hispanic food, Asian food and Indian food. Mexican/Hispanic food remains the category leader with $1.6 billion in sales; however, its market share decreased during 2009-2011. During the same period, the Asian food market grew by 4.6% and is expected to continue to grow to reach $1.1 billion by 2016. The market trends for ethnic foods in the US are similar to global trend. The ethnic food market is still evolving, and thus lends itself to potential growth opportunities for food technologists/manufacture companies in the future. A key challenge to the ethnic food industry is to be able to predict future societal trends. Ethnic food sales is influenced by increasing regional population diversity, economic status, as well as competition with local restaurants. In general, understanding the target consumer and their shopping behavior is crucial. Immigrants are the core consumers for an ethnic food, and young families with their kids under age 18 being the prime consumers. Sauces and seasonings have become the leading products during the last 5 years; these products encourage greater consumption of ethnic foods at home. Health factors are the main considerations for shoppers of sauces and seasonings because these products are typically viewed as being high in sugar, sodium and preservatives. Food manufacturers and marketers will be more likely to attract more women and senior consumers by promoting the health benefits of their products. The top 10 healthiest ethnic cuisines are Greek, California fresh, Vietnamese, Japanese, Indian, Italian, Spanish, Mexican, South American and Thai. Unfortunately, Korean food is not among these, suggesting that more effort is needed to influence health professionals outside of the Korean community. Although authenticity is generally considered the most important key factor for ethnic foods, this aspect is more critical with local restaurants than for manufacturing companies. For example, tacos served in the US is very remote from authentic Mexican tacos; however, it is still recognized as a Mexican food. Tacos were created by American entrepreneurs and then patented for fast food business model and food manufacturing. Skyline Chili is a famous regional fast food restaurant in Cincinnati, not in Mexico City. In order to remain competitive, companies have to focus on product development that blends authenticity with familiarity, through significant effort in technical innovation and taking global ownership locally. This essentially means that a Japanese individual, for example, can take ownership of Korean food, while a Korean can take ownership of Chinese food through the creation of new ethnic foods as well as new business models. Creating a globally sustainable business demands a unique balance between standardization and glocalization. The glocalization of food products should not only be limited to modifying taste, flavor, ingredients or packaging; it should include harmonizing the new culture with local culture. Through this, one can build a strong brand equity that includes not only corporate capital gain but also include how customers think and feel about the product, that is, to make your customers have specific, positive thoughts, feelings, beliefs, opinions, and perceptions about your product. The future, as we know it, is very unpredictable. Globalization/glocalization is getting more complicated with rapid societal changes. However, there remain tremendous market opportunities with ethnic foods for individuals/manufacturers who can deliver new innovative products.
Kimchi and \textit{Gimjang} Culture in Korea

Wan-Soo Park  
General Director of World Institute of Kimchi, Korea

Kimchi is a collective term of Korean traditional fermented vegetable foods, which is fermented for a certain period after salting the main ingredients, including kimchi cabbage, radish, cucumber, etc., and adding the seasoning mixed with red pepper powder, garlic, spring onions, \textit{jeot-gal} (salted fish & seafood), etc. Traditionally, kimchi is originated from storing vegetables during the winter, and most Koreans enjoy eating kimchi even today. In general, people have been making kimchi at home by themselves, but the current trend is an increase in consuming kimchi products made in a factory. In addition, as of 2013, kimchi products are exported to 61 overseas countries. Kimchi is a naturally fermented healthy food for modern people, because of neither sterilization nor addition of chemical preservatives. There are similar vegetable pickles to kimchi, including \textit{Sauerkraut} in Germany, pickles in the West, \textit{Pao-tsai} in China, \textit{Achar} in Southeast Asia and \textit{Tsuke-mono} in Japan. These pickles complete their processes with primary manufacturing processes of preserving the vegetables in vinegar or salt. However, kimchi shows the difference in ingredients and manufacturing methods from those pickles in that it has secondary manufacturing processes of maturing by mixing all sorts of spices and supplementary ingredients such as spring onions, garlic, red pepper, ginger, radish and \textit{jeot-gal} which will have different functionality again after salting main ingredient such as kimchi cabbages. While going through the processes, the salted cabbages have effectively mingled with the taste of seasoning and as the storage period increases, various kinds of lactic acid bacteria can grow and nutritional functional materials can be generated. Especially, since kimchi is a fermented food that is distributed with live lactic acid bacteria, its nutritional superiority can be maintained. In this presentation, definition, production characteristics and health benefits of kimchi as well as origin, changes, sustenance and global values of kimchi and \textit{gimjang} culture will be discussed. World Institute of kimchi is trying to introduce the cultural values of kimchi as well as its health functionality, and also strives to take kimchi's place as a global food by harmonizing the \textit{gimjang} culture with other local eating cultures through studying different eating cultures.

Trends of Seafood Utilization in Japan and Glocal Strategy of Japanese Seafood Industry

Shugo Watabe  
Kiasato University School of Marine Biosciences, Japan

Originally nutritional values of fish and shellfish have been regarded as animal protein resources which are comparable to those of livestock animals. Now, seafood produced not only from fish and shell fish but also from seaweed is now widely accepted to be healthy as human consumption in the world. This is because seafood has been demonstrated to improve lipid metabolism and have benefits of antihypertension, stimulation of fibrinolysis and antiobesity. Typical substances are \(\omega-6\) fatty acids which prevent blood circulation-related diseases. Seaweed also has various functionalities such as immunostimulation and antioxidant activity due to the presence of bioactive substances such as carotenoids and mucous polysaccharides. Fish muscle is not only consumed as raw but also processed to various types of food including surimi-based, heated gel products such as kamaboko and imitation crab meat which are now distributed to various countries in the world. Among seafood products in Japan, these surimi-based products account for about 20%, being the most abundant. However, some fish are supplied to produce fishmeal due to a low market price and even discarded on board because the cost to bring them back to the fishing port is over the market price. If such fish are able to be processed to more valuable products such as surimi-based products or materials for functional peptides, it will greatly contribute to the effective and sustainable utilization of marine bioresources which are now believe to be limited, but not inexhaustible.
Halal! Can It Be a Savior of Lagging Korean Food Exporters?

Jang Suh Noh

Korea Institute of Halal Industry, Korea

Recently, not hallyu fever but “halal” fever is sweeping across South Korea. This halal fever began as President Park Geun-hye paid an official visit to the United Arab Emirates (UAE). Korea and UAE signed a MOU on cooperating in halal food trade. She was seen in a photo visiting the Grand Mosque wearing Muslim women’s traditional dress. The scene reminded me of an ancient Korean novel “Shim Chung Jun”. Why did she enter the heart of the Islam world instead of “Indangsu”? As she clearly reveals back in Korea, she recognizes UAE as a gateway to the global Muslim food market. So her gesture can be read as a sign of opening wider Muslim world. Muslim consumable food is called “Halal” food. The Arabic “Halal” means “permissible by the God”. Most food in the world are permissible (Halal) but a few non-permissible foods. Pig and its derivatives and alcohol are the most critical non-halal foods. The size of the global Muslim food market is US$1,292 billion (17.7% of global expenditure) in 2013. According to a research, the market size is foreseen to double to US$2,537 billion (21.2% of global expenditure) in 2019. See other products. Halal cosmetics consumption in 2019 is expected to reach US$73 billion, increasing from US$46 billion in 2013. Halal pharmaceutical expenditure is also anticipated to expand to US$103 billion in 2019 from US$72 billion in 2013. Then, is the global Halal market easy to grab? Of course, not. If you want to sell your food in this market, you should get the Halal certificate first. Halal certification is the process to verify whether a food product is processed following the standards or guidelines prescribed by the Islamic laws. So the basic character of Halal certification is regulative. Today, Halal certification is expanding its territory very rapidly. First, the scope of Halal certification widens. Halal cosmetics and Halal pharmaceuticals have been recently added to the list of Halal certification standards and guidelines. Logistics service also has become subjected to the Halal certification in Malaysia. Second, Indonesia, the biggest Muslim country in the world, is preparing for enforcing a newly passed law called “Halal product assurance law”. Under this law, all the food products distributing in Indonesia need to be halal certified with no exception. Third, Arabs are opening their eyes on the Halal certification. U.A.E. is the front runner as she has introduced her own Halal certification system for the first time among the G.C.C. countries. Such phenomena foretell us global halal regulations will get more tightening while the global Halal market will get bigger. For non-Muslim countries such as Korea, this kind of foretelling sounds challenging. Then, what do we have to do? One of recent eye-catching initiatives by the Korean government is a plan to install an Halal exclusive production zone (“HEZ”) in the Korea National Food Cluster. The prime goal of establishing a HEZ is to secure the Halal integrity of the supply chain of Halal products “from farm to fork”. Given the tightening Halal environment, securing Halal integrity is a key to success. What else? To change the current Halal fever in Korea into a productive energy, it is necessary for the Korean government to take more systematic approach with a long-term perspective. A good benchmark is Malaysia’s “Halal Industry Development Master Plan” (2008-2020). It is regarded as a strong pillar to bolster Malaysia to the current position as the global Halal industry leader.
Potential Mechanisms of the Anti-diabetic Actions of Chitosan Oligosaccharide

Young-Cheul Kim

Department of Nutrition, University of Massachusetts Amherst, USA

It is estimated that by the year 2025, there will be approximately 300 million people affected by type 2 diabetes (T2D) worldwide. Although the precise molecular mechanisms are not fully understood, it is clear that obesity constitutes a major risk for the development of insulin resistance and overt T2D. There is, however, substantial evidence that individuals with similar degrees of obesity show strikingly different risks of developing diabetes with altered expression of genes involved in adipocyte differentiation. It is now recognized that individuals with impaired preadipocyte differentiation to adipocytes develop hypertrophic adipocytes with severe insulin resistance and T2D. In addition, a lack of adipose tissue in humans and animals also leads to insulin resistance and T2D due to an inability to accommodate excess calories, which will lead to ectopic deposits of excess lipids. Thus understanding the underlying mechanisms of adipocyte-specific gene regulation and insulin resistance will help develop new therapeutic strategies for the treatment and prevention of diabetes. The diabetes and weight control by lifestyle modifications through diet and dietary bioactive components have been increasingly recognized as an important strategy to prevent these health problems as well as to promote overall health. Recent studies in our collaborative research and others have shown that chitosan oligosaccharide is a functional polysaccharide with several health benefits, particularly improving diabetic conditions. However, the mode of action by which this nutritional agent chitosan oligosaccharide may favorably alter glucose and lipid metabolism associated with T2D is not well known. In this presentation, we will provide a mechanistic basis for the anti-diabetic actions of chitosan oligosaccharide as evidenced by our preclinical and clinical intervention studies.

Development of Functional Foods Tailored for Type 2 Diabetes Prevention
- Focus on Chitosan Oligosaccharide

Emmanouil Apostolidis

Department of Chemistry and Food Science, Institute of Food Science, Technology and Nutritional Biochemistry, Framingham State University, USA

Type 2 diabetes accounts for 90 to 95% of all diagnosed cases of diabetes. According to the CDC, in 2007, 23.7 million people (10% of American adults) in the U.S. had diabetes and by 2050 the number of Americans with diabetes will jump to 33%. Diabetes cost Americans $174 billion to manage in 2007 - a figure that is expected to skyrocket with the CDC's latest estimates. It is important to recognize that optimal diet-induced prevention of type 2 diabetes onset is critical to reducing the attendant morbidity and cost associated with treatment of diabetes. To this extend, food companies need to develop functional foods specifically tailored for the prevention of type 2 diabetes either by retarding glucose absorption in the GI tract or by stimulating glucose absorption in fat and muscle cells via insulin sensitizing effect. In this presentation we will present an outline of the research efforts that need to be performed for the development or definition of such natural products/ingredients/compounds, which include product characterization, in vitro screening, bioavailability studies, “active” compound characterization, animal trials and clinical trials. Finally, suitable strategies will be suggested, to incorporate these ingredients into the food matrix and eventually design functional foods tailored for type 2 diabetes prevention.
Type 2 diabetes Mellitus (T2DM) is a metabolic disorder of glucose metabolism that affects 381.8 million people worldwide, generating immense health care costs, $548.5 billion (IDF, 2013). T2DM is strongly linked to a cluster of chronic diseases such as obesity, dyslipidemia, and cardiovascular disease. Recent research suggests that dietary factors that effectively improve abnormalities of T2DM could represent a novel approach to intervene the development of metabolic disorders. It is important to recognize that optimal diet-induced prevention of type 2 diabetes onset is an effective strategy to reduce the expected increases in morbidity and cost associated with treatment of diabetes. Postprandial hyperglycemia has been recognized as an early defect in patients with T2DM and is primarily due to impaired insulin secretion or insulin resistance, as well as the amount and digestion rate of consumed carbohydrate, which is the main source of blood glucose. Controlling postprandial plasma glucose levels is critical in the early treatment of T2DM and is thus one of the primary targets for anti-diabetic drugs. Several studies have previously shown that chitosan (COS) and chitosan oligosaccharide (GO2KA1) have blood glucose-lowering effects. However, different results have been reported due mainly to the differences in molecular weight (MW), viscosity in the intestine, and solubility of chitosan. Therefore, we investigated the inhibitory activities of chitosan oligosaccharides with different molecular weights on various carbohydrate digestion-related enzymes such as sucrase, maltase, glucoamylase and α-amylase, and the long-term effects of water soluble low MW chitosan oligosaccharide (GO2KA1, <1,000 Da) on control of blood glucose level using db/db mice, a well-recognized animal model of T2DM. Furthermore, various parameters for physiological changes in animals such as body weight, food intake, blood glucose, cecum weight, adiponectin, hemoglobin A1c (HbA1c), glucose tolerance, total cholesterol, HDL, GPT, and triglyceride were evaluated. This is the first report of chitosan oligosaccharides significantly inhibiting intestinal α-glucosidase, resulting in delayed glucose absorption and thereby suppressing postprandial hyperglycemia. These in vivo results provide potential mechanisms of action of GO2KA1 and also help develop bioactive chitosan oligosaccharide-based products as nutraceuticals.
The Effect of Chitosan Oligosaccharide (GO2KA1) on Blood Glucose Control in Healthy Individuals and Subjects with Prediabetes

Sung-Hoon Jo
Department of Chemistry and Food Science, Institute of Food Science, Technology and Nutritional Biochemistry, Framingham State University, USA

Type 2 diabetes is a disease characterized by insufficient insulin production in the body or a reduced ability to effectively use produced insulin, leading to blood glucose levels that are elevated above the normal range and damage to vital organs over time. Type 2 diabetes accounts for 90-95% of diabetes cases with 25.8 million cases in 2007 in the United States alone. As of 2013, 347 million people worldwide have diabetes and, at the current rate, diabetes will be the 7th leading cause of death worldwide by 2030. In 2011, the Centers for Disease Control reported that 79 million Americans have been diagnosed as prediabetic, an intermediate state of hyperglycemia with blood glucose above normal but below the diabetes threshold. Therefore, prevention or delay in progression of prediabetes to overt diabetes with either dietary or pharmacological intervention has paramount importance. α-Glucosidase inhibitors, such as acarbose, are the only oral anti-diabetic agent approved for the treatment of pre-diabetes. A low dose of acarbose has been shown to be effective for pre-diabetes management by delaying the absorption of carbohydrates in the gut. We and others have previously reported that chitosan and chitosan oligosaccharide (GO2KA1) reduced postprandial blood glucose levels via inhibition of carbohydrate hydrolysis enzymes (α-glucosidase) in both animal and in vitro models. Therefore, we expanded our studies to evaluate the effect of GO2KA1 on blood glucose control in both healthy individuals and subjects with prediabetic conditions. First, the effects of GO2KA1 on postprandial blood glucose levels in adults with normal blood glucose levels were investigated. Postprandial blood glucose levels were measured at 30, 60, 90, and 120 min after sucrose administration with and without 500 mg of GO2KA1. GO2KA1 administration reduced the area under the blood glucose curve (AUC) and the blood glucose peak (C_{max}) values, while the time of peak plasma concentration of blood glucose (T_{max}) value was significantly (\(p<0.05\)) increased, compared to controls. GO2KA1 reduces postprandial blood glucose level via slower absorption of glucose in the small intestine based on carbohydrate hydrolyzing enzyme inhibition. Second, we evaluated the effect of GO2KA1 supplementation on glucose control in subjects with prediabetes in a randomized, double-blind, placebo-controlled clinical trial. Subjects with prediabetes were randomly assigned to the GO2KA1 intervention group or the placebo group for 12 weeks. We assessed the serum levels of glucose, insulin, and C-peptide by oral glucose tolerance test (OGTT), HbA1c, pro-inflammatory cytokines, and plasma adiponectin at baseline and after the 12 week intervention period. The treatment group showed a significant decrease in the serum glucose level at 30 min (\(p<0.013\)) and at 60 min (\(p<0.028\)). Also, the plasma level of HbA1c (\(p<0.023\)) and the pro-inflammatory cytokines (IL-6 and TNF-α) were reduced and plasma adiponectin was increased in the GO2KA1 intervention group after the 12 week treatment. However, the placebo group did not show any significant changes in these biomarkers. Our data indicate that GO2KA1 supplementation favorably changes blood parameters associated with diabetes, resulting in reduction in progression of prediabetes to diabetes in humans. Furthermore, with the understanding of the mechanism of action, bioactive chitosan oligosaccharide can be further developed as valuable nutraceuticals.
Human milk contains numerous components that shape the microbial content of the developing infant gastrointestinal tract. A prominent feature of milk is an array of complex glycans and glycoconjugates that serve a passive immune function by sequestering and deflecting pathogens while simultaneously enriching a protective, milk-oriented microbiota (MOM) often dominated by bifidobacteria. Recent research suggests the timing of establishment, and proper function of, a MOM is critical for infant development. An infant’s MOM is initially established through environmental transfer to the gut and subsequently shaped by diet (milk) and host genetics. Once established, MOMs dominated by bifidobacteria exhibit low residual milk glycans and higher levels of short chain fatty acids in the feces, suggesting a strongly saccharolytic colonic microbiota. The mechanistic basis for milk glycan consumption by bifidobacteria has been the subject of active research. Different infant-borne bifidobacteria contain specific glycosidases and transport systems required to utilize free glycans or glycoconjugates. Consumption of milk glycans enhances specific bifidobacterial interaction with the infant host through both direct and indirect routes. Growth on free milk glycans results in increased bifidobacterial binding to epithelial cells and beneficially modulates intestinal function. In addition, metabolites generated during growth on milk glycans dampen inflammation and strengthen gut barrier function. In aggregate, these studies suggest a co-evolutionary relationship between mammalian milk glycans, infant-borne bifidobacteria and the infant host resulting in a programmed enrichment of a protective bifidobacterial-dominant MOM during a critical stage of infant development. Importantly, disruption of this programmed enrichment, by poor environmental transfer, antibiotic use, or infection, can lead to a “poorly functioning” MOM that may pose a risk for negative health outcomes. Further analysis of this naturally evolved system will shed light on effective pre- and probiotic tools that support and ensure a protective MOM for all at risk infants.
FIPHA: Fitness Pattern based Heuristic Approach to Unravel Novel Virulence Regulators and Vaccine Targets in Zoonotic Pathogen Edwardsiella Bacteria

Qiyao Wang*, Guanhua Yang, Minjun Yang1, Yuanxing Zhang
State Key Laboratory of Bioreactor Engineering, School of Biotechnology, East China University of Science and Technology, China
1Shanghai - MOST Key Laboratory of Health and Disease Genomics, Chinese National Human Genome Center at Shanghai, China

As important zoonotic organisms causing infections in humans, Edwardsiella bacteria are also notorious leading fish pathogens haunting worldwide aquaculture industries. However, the taxa are now widely recognized to be misclassified, which hurdled the understanding of the epidemiology and development of effective diagnostics and vaccines. The efforts in recent years have been put into the genome deciphering, comparative genomic analysis and genotyping method establishment. Phylogenomic analysis revealed that Edwardsiella tarda strains display two major highly divergent genomic types (genotypes), EdwGI and EdwGII, and the former represents a genotype of fish-pathogenic isolates including two recently proposed novel species E. piscicida and E. anguillarum. Based on these findings, novel and effective vaccines against Edwardsiella have been developed to combat this fulminating pathogen. To further illuminate the bacterium’s pathogenesis and stress adaptation mechanisms, we here present the fitness pattern based heuristic approach (FIPHA) to unravel novel virulence regulators and vaccine target. The strategy harness the power of transposon insertion site sequencing (Tn-seq) to interrogate the fitness pattern of each gene’s mutant en mass by sequencing the massive highly saturated transposon-based mutant libraries at time course of Edwardsiella infection development in turbot model. The functionally related genes, such as T3SS and T6SS genes, as well as the established T3SS/T6SS regulators were proved to have similar in vivo fitness patterns, which validate our strategy. The approach also demonstrated that several novel in vivo T3SS/T6SS regulators as well as metabolic pathways displayed the T3SS/T6SS-like in vivo fitness patterns. This newly developed strategy is a promising technique for systematic functional genomics as well as vaccinology research.

Gut Microbiota Enhances Larval Development of High Sugar Diet-fed Fruit Fly, Drosophila melanogaster

Jin-Woo Bae
Department of Biology, Kyung Hee University, Korea

All metazoan guts possess complex microbial communities which influence host physiology and metabolism. Host factors, such as dietary pattern, are known to affect the community and composition of gut microbiota. Recent evidences suggest that the altered gut microbiota may responsible for the obesity and subsequent development of complications associated metabolic syndromes, such as diabetes mellitus. However, the impact of gut microbial alteration and potential role of increasing bacterial species during progress of obesity still remain unclear. Here, we show that the resident microbiota enhances larval development of high sugar diet (HSD) fed Drosophila melanogaster. Bacterial mono-associations of resident uracil secreting bacteria such as Gluconobacter morbifer and Lactobacillus brevis, or uracil supplementation to axenic larvae enabled the animals to have more enhanced development than mono-associations of other commensal microbes under HSD-fed condition. A longitudinal metagenomic analysis of fly’s gut microbiota revealed that chronic feeding of HSD resulted in the dominance of uracil secreting bacteria that generally accounted for minor proportion in the gut of normal diet fed flies. Redox signaling induced by bacterial uracil promotes larval growth by regulating sugar and lipid metabolisms through activations of p38 mitogen-activated protein kinase. These results indicate that the modulation of gut microbiota contribute to alleviate the HSD derived deleterious effects, such as hyperglycemia, thereby providing a new mechanism for redox dependent host protective role of uracil secreting bacteria that were previously known as opportunistic pathobionts.
Alteration of gut microbiota composition is associated with diverse immune disorders and restoration of dysbiosis in disease state with beneficial microorganism could confer the health benefits. Recently we have developed a screening system to selectively identify probiotic strains that could enhance the generation of CD4+Foxp3+ regulatory T cells (iTregs). Using the system, we identified a mixture of probiotics (IRT5) that up-regulates iTregs in vivo. Administration of the IRT5 induced both T-cell and B-cell hypo-responsiveness and down-regulated T helper (Th) 1, Th2, and Th17 cytokines without apoptosis induction. It also induced generation of CD4(+)Foxp3(+) iTregs from the CD4(+)CD25(-) population and increased the suppressor activity of naturally occurring CD4(+)CD25(+) Tregs. Conversion of T cells into Foxp3(+) Tregs is directly mediated by regulatory dendritic cells (rDCs) that express high levels of IL-10, TGF-β, COX-2, and indoleamine 2,3-dioxygenase. Administration of probiotics had therapeutic or prophylactic effects in experimental disease models of inflammatory bowel disease, atopic dermatitis, hapten-induced contact hypersensitivity, rheumatoid arthritis, myasthenia gravis and multiple sclerosis. The immunoregulatory effect of the IRT5 probiotics is associated with enrichment of CD4(+)Foxp3(+) Tregs in the inflamed regions. Currently, we are investigating the molecular mechanism of iTreg generation mediated polysaccharide from probiotics using germ free system. Collectively, the administration of probiotics that enhance the generation of rDCs and Tregs represents an applicable treatment of inflammatory immune disorders.

Transcriptomic Insights into the Control of Foodborne Pathogens-sialic Acid Catabolism of Vibrio vulnificus as a Therapeutic Target

Next generation sequencing was applied in order for the high-throughput identification of virulence genes of Vibrio vulnificus, a foodborne pathogen. Among the genes expressed specifically within the host environments, the nan gene cluster required for transport and catabolism of N-acetylneuraminic acid (Neu5Ac, sialic acid) was identified. For the enteropathogens facing a limited nutrient availability in the host gut, catabolic utilization of Neu5Ac, a mucin sugar, is crucial for the pathogenesis. The nan gene cluster of V. vulnificus consists of two divergently transcribed operons, nanTPSLAR and nanEK nagA. A mutation of nanR abolished the extensive lag phase observed for the bacteria growing on Neu5Ac and increased transcription of nanTP and nanE, suggesting that NanR is a transcriptional repressor of both nan operons. Mutagenesis approaches, in vitro transcription, and isothermal titration calorimetry experiments demonstrated that N-acetylmannosamine 6-phosphate (ManNAc-6P) specifically binds to NanR and functions as the inducer of the nan operons. The combined results propose a model in which NanR represses both operons tightly, and ManNAc-6P displaces NanR from its operator in the presence of Neu5Ac, presumably encountered in the host intestine, rendering expression of the nan gene cluster. The complex structure of NanR with ManNAc-6P was determined. The results of structural, electron microscopic, biochemical, and in vivo analyses demonstrated that NanR forms a dimer of which two monomers create an arched tunnel-like DNA-binding space. The space contains positively charged residues for the interaction between the NanR dimer and nan operator DNA. This interaction is alleviated by ManNAc-6P-mediated relocation of residues in the ligand-binding domain of NanR, which results in the relief of a repression by NanR and induction of nan gene transcriptions. Survival studies of mice challenged with a ManNAc-6P-binding-defective mutant strain of V. vulnificus demonstrated that this relocation of the NanR residues is important for the pathogenesis of V. vulnificus. In summary, this study discovers precise regulatory mechanisms for nan gene expressions in V. vulnificus accompanying an atypical interaction between NanR and nan operator DNA, and its alleviation via ManNAc-6P binding. All of these discoveries could provide a platform for the development of novel strategies to control enteropathogenic bacteria.
Sources of Variation in Meat Quality

Tommy L. Wheeler
Meat Safety and Quality Research Unit, USDA, Agricultural Research Service, Clay Center, USA

The eating quality of meat is very important to consumers. Most studies indicate tenderness is the most important trait for consumer satisfaction of steaks. The biological basis for variation in meat tenderness will be discussed. This will include the effects of breeds, genetics, management practices, and strategies for improving meat tenderness. Understanding variation in lean color stability will be discussed. Technologies for predicting meat tenderness and lean color stability will be presented.

Safety and Value-addition of Meat Products Using Non-thermal Technologies

Cheorun Jo
Department of Agricultural Biotechnology, Seoul National University, Korea

The increasing demand, globalization of trade, and distribution from centralized processing offered major challenges to meat industry. Contamination of meat and meat products with pathogens is responsible for severe foodborne disease and results in tremendous economic loss. Because thermal treatment induces side effects in sensory, nutritional, and functional properties of meat, non-thermal processes has developed and utilized. This presentation introduces new approaches using non-thermal technologies for adding additional value in addition to safety of meat and meat products. The subject content includes reduction of chemical toxicity by irradiation, compositional modification by high hydrostatic pressure, and, recent finding of synthetic nitrite replacement in processed meat by cold plasma technology.
Escherichia coli O157:H7 Contamination of Raw Beef Products: High Event Period Investigation

Terrance M. Arthur
Meat Safety and Quality Research Unit, USDA, Agricultural Research Service, Clay Center, USA

Processing plants experience sporadic peaks in contamination rates where multiple Escherichia coli O157:H7-positive lots are clustered in a short time frame. These peaks have been referred to as “High Event Periods” (HEP) of contamination. Through various analyses, it was determined that individual HEP show little to no diversity of strain genotype. Hence, each HEP has one strain type that makes up most if not all of the contamination. This is shown to differ from the genotypic diversity of E. coli O157:H7 found on the hides of cattle entering processing plants. These results pose a potential challenge to the current model for finished product contamination during beef processing. In addition, E. coli O157:H7 strains isolated from HEP appear to possess a high potency for “mature” biofilm formation after incubation for 4 to 6 days. Biofilms of the HEP strains also exhibited strong resistance to sanitization. These results suggest that biofilm formation and sanitization resistance could have a role in HEP beef contamination by E. coli O157:H7.

Innovative Thermal/Non-thermal Processing to Control Foodborne Pathogens in Meat Products

Dong-Hyun Kang
Department of Food and Animal Biotechnology, Seoul National University, Korea

Significant increases in foodborne illnesses over the past few decades have been reported. Various thermal and non-thermal pasteurization methods have been studied to guarantee the microbiological safety of meat products. Superheated steam (SHS), near-infrared (NIR) heating, ohmic heating, radio frequency (RF) heating, and microwave (MW) heating are promising alternatives to conventional thermal pasteurization methods. The main advantage of using SHS is the large amount of heat transferred to food when steam condenses on food surfaces, which rapidly increases the surface temperature. NIR heating is gaining popularity because of its higher thermal efficiency and fast heating rate/response time compared to conventional heating. Recently, several studies have employed infrared heating for surface pasteurization of precooked deli meats. Ohmic heating, RF, and MW heating are regarded as volumetric forms of heating in which thermal energy is generated directly inside the meat products. Therefore, a high-quality meat product as well as one that is microbiologically safe can be successfully manufactured in a short processing time. Non-thermal pasteurization methods such as ultrasound (US), ultraviolet (UV) radiation, antimicrobial gas and aerosolization, among others, have the ability to inactivate foodborne pathogens consequently preserving the sensory and nutritional quality of meat products. US could be combined with several aqueous sanitizers to enhance the antimicrobial activity. UV radiation does not leave a residue and does not involve high cost. Antimicrobial gas and aerosolization could be used to increase the microbial safety of fresh food products as well as meats during transportation and storage. These novel thermal and non-thermal pasteurization methods hold potential for producing high-quality and safe meat products.
Abstracts of Nongshim Industry-Academy Symposium
Selection of Mineral Water Based on the Relationship between Health and Food

Jae Youn Ko
Department of Foodservice Management, Kyung Hee University, Korea

Recently, customers are increasingly interested in buying and drinking mineral water due to the improvement in standards of living, health concern, healing, and well-being. With the rising interest in health and wellness and concern of soft drink, mineral water became to receive attention and there has been a rapid change of food and beverage culture in the foodservice industry. Mineral water is a vital element for human being. It is good for optimum health and proper hydration. Also it has functional characteristics and design of the product and appeals to consumer's emotions. Customers worried about the purity of tap water because of environmental pollution and they came to recognize that mineral water not only offers the convenience of dietary life but also matches well with the food. Finally mineral water shows the fastest growth. According to Nielsen Korea, the market for domestic mineral water in 2013 was 466 billion won and it has been increased by 10% in October 2014 to a total of 494.8 billion won. Moreover, the competition among big enterprises is intensifying.

As there has been a rising issue of drinking mineral water, the market expands, and there are a variety of brands and different types of mineral water, customers need to aware the mineral water accurately. First, with the relationship between health and drinking water, mineral water contains a lot of minerals which is good for health. When the body lacks water, it can even lead to lifestyle related diseases such as allergy, obesity, asthma, constipation, high blood pressure, diabetes, and chronic fatigue. Many elderly who live in the longevity village all over the world drink water which comes from the mountain 2,000 meters above the sea level. The pure water from the valley is hexagonal water which has high hardness and hint of sweet alkaline and contains a lot of calcium and magnesium. Therefore, if people drink water rich in calcium and magnesium, they can stay young and healthy. Also it has a healing effect. Since there are various mineral waters that is highly effective in adult disease, cardiovascular system, weight-loss, skin care, and fatigue recovery and good for baby and pregnant women, the professional advice is very important when selecting mineral water.

Second, with regard to the food and mineral water, mineral water can be divided into still water and sparkling water. Total Dissolved Solids (TDS), hydrogen exponent (pH), and hardness have an effect on the taste of food. Korean food goes well with soft water and Western food matches well with hard water. Also the water with high TDS is suitable for heavy food and low TDS for light food. There is a good pair such as pH of the food and pH of the mineral water. Also depending on the carbonation, the appetizer is good pair with the bold water, vegetable with the effervescent water, fish with the light water, and beef or pork with the classic water. Finally, mineral water will fulfill conditions for physiological functions of the body and capture the attention of customers with the blue ocean marketing strategy of food and health.
**NOIA-2**

**Analyzing Characteristic of Commercial Mineral Water Influences on the Food Physically and Chemically**

Bong Soo Noh  
*Department of Food Science and Technology, Seoul Women's University, Korea*

The mineral content of the seven kinds of commercial bottled water were investigated as well as physical and chemical changes in food. Mineral content of commercial bottled water was analyzed by ICP-MS. Mg, Ca, Na, and K are 0.56-21.96, 2.38-93.37, 0.75-15.37, 0.57-6.90 mg/L respectively. Na/K ratio of 'Isis' is most close to 1, and 'Seoksu', 'Cheonnyeondongan baby water', 'Samdasoo', 'Baeksansu' were followed. The highest ratio of Mg/Ca is 'Cheonnyeondongan baby water', and 'Baeksansu', 'Samdasoo' were followed. Volatile compounds of commercial bottled water were measured by electronic nose. The commercial bottled water showed different patterns of volatile compounds. 'Evian' showed much more volatile compounds comparing to 'Seoksu', 'Baeksansu' according to electronic nose analysis. 'Calizzano' - Italian mineral water - had a little volatile compound. In the case of powdered milk, solubility was expected to differ depending the mineral contents. Analyzing the solubility of the powdered milk, no significant difference was found. Dongchimi was prepared using commercial bottled water and it was stored for 7 days period. pH, total acidity, texture and electronic nose analysis were studied. As the longer storage period, all sample's pH tended to decrease up to 3.8 and maintained. The time to decrease to that level was different for each type of mineral water. The initial fermentation rate was different due to the different mineral contents of water. As fermentation progresses, the difference in mineral contents was ignored by the organic acids produced. As a result of analyzing the hardness and chewiness to the Texture Analyzer, high values of hardness and chewiness were found in 'Calizzano', 'Cheonnyeondongan baby water' and 'Seoksu', while distilled water, 'Baeksansu' and 'Evian' showed low value one. Organic acid produced during fermentation influence of pH of Dongchimi rather than mineral contents of water. Volatile component was increased relative to the storage time and increasing degree of volatile components depended upon water type. Also, it is considered that alcohol fermentation was influenced by mineral of water. In order to examine that, characteristics of rice wine using distilled water, tap water and 'Baeksansu' were evaluated. In case of alcohol contents, when 'Baeksansu' was 9.3% at 2nd day of fermentation, tap water and distilled water was 7.6, 6.2% respectively. The rice wine made with distilled water was the weakest ability to produce alcohol. The reason for difference of initial fermentation rate was mineral contents. The pH of the rice wine made 'Baeksansu' and tap water decreased to 3.7 until 2nd day of fermentation, and then increased gradually. The pH of rice wine made by distilled water reduced to 3.6 until 3rd day of fermentation, and then increased. In case of total acidity, rice wine made by 'Baeksansu' decreased slowly after rising sharply to 9% until 3rd day of fermentation. There was a difference for each mineral water, after that there was no significant difference. Initially, the influence of the type of water was high. As the fermentation progresses, the influence of organic acids and microorganisms becomes higher. Through these studies, it will be able to predict that what kinds of water give effects in various type of food.

**NOIA-3**

**Characterization of the Elements or Species in Natural Mineral Water from Asian and European Countries or Areas**

Ho-Sang Shin  
*Department of Environmental Education, Kongju National University, Korea*

The elements or species of interest natural mineral water include fluoride, chloride, nitrate, sulphate, phosphate, sodium, potassium, magnesium, calcium, molybdenum, vanadium and silica. And water taste indices of natural mineral water were studied. Composition of mineral water over seventeen mineral water samples from Asian and European countries or areas were analyzed. As analytical results, ion ratios of Na/K and Mg/Ca showed high values in natural mineral water samples from volcanic area and the natural mineral water from Beak-Du Mountain was found to have high silica and molybdenum concentrations. Na/K and Mg/Ca ratios are known to have the high relationship to hypertension and cardiovascular disease (CVD), otherwise, silica and molybdenum are known to have the positive effect on Alzheimer disease and cancer.
A General Introduction to Amino Acids

Miro Smriga
International Council on Amino Acid Science (ICAAS), Belgium

Amino acids are simple molecules made of carboxyl and amino groups. In spite of their structural simplicity, amino acids are the oldest nutrients on earth. They have been used up as the source of life from primordial forms to the appearance of modern humans. The importance of amino acids is well reflected in two simple facts. First, amino acids compose as much as 20 percent of the human body either in the protein bound form or free (non-bound) form. Those amino acids that make up tissues are the building blocks of proteins and, with water, the building blocks of life. Nine amino acids are considered nutritionally essential for humans and must be ingested daily in our diet. Second, free amino acids are the natural secret of taste and substantially contribute to taste of all protein-containing foods. Also, food sauces and condiments are rich in countless combinations of free amino acids that can individually taste sweet, sour, bitter or umami. It is reasonable to assume that it has been the case throughout at least several thousand years of the human history. While ninety percent of amino acid use is directly or indirectly linked to human food and nutrition, the newly realized non-nutritive (health) benefits of amino acids draw scientific attention towards supplemental use. This attention is channeled especially to amino acids arginine, glutamine, lysine and three branched-chain amino acids (leucine, isoleucine and valine, commonly known as BCAA). All of the above are produced by industrial fermentation. Amino acid fermentation-based production is a modern, plant-based and environmentally friendly manufacturing method. Industrial fermentation utilizes the natural ability of some microorganisms to convert nutrients to various vital components such as amino acids. Fermentation industry, including production of amino acids, has its origins in traditions that go back hundreds of years both in age-old fermentation techniques of Europe (i.e., beer brewing) and culinary practices of Eastern Asia. For those historic reasons, most of regulatory agencies, including the US FDA, recognize fermentation ingredients and foods as “natural”.

The Functional Effects of BCAA in Sports Nutrition

Kiwon Lim
Lab. of Exercise Nutrition, Department of Physical Education and Physical Activity & Performance Institute, Konkuk University, Korea

Protein intakes in the dietary reference intakes for Korean (DRI) recommend as 70 g/day for men, and women are encouraged to consume 55 g. Valine, leucine, and isoleucine are called to branched chain amino acid (BCAA) as an easy-amino acid to be mobilized in energy source compared to other amino acids. Muscle pain caused by exercise is generally considered to be peripheral fatigue, and this is due to muscle damage. The BCAA ingestion prior to exercise might reduce peripheral fatigue. It is well-known that central fatigue occurs to be due to increased brain tryptophan level, a precursor of serotonin synthesis. However, it is known that BCAA ingestion prior to exercise can decrease central fatigue by inhibiting tryptophan uptake into brain, because BCAA has an antagonist effect for amino acid transporters in brain cell. In addition, BCAA intake has been reported that endurance capacity can be improved by promoting of fat oxidation, this is lead to delay fatigue. The 10 g/kg/day of amino acid intake in short-term is allow in healthy people. In long-term (1 year) experiment, it has been reported to be safe to 1.25 g/kg/day intake.
Glutamate as Flavor Component: Flavor Interactions and Flavor Enhancers

Nobuyuki Sakai
Tohoku University, Japan

There are many researches showing interactions between olfaction and taste. Many of them supported that the interactions are not innate, but are learned through our daily eating experiences. Stevenson (2009) called this phenomenon as “learned synesthesia”. The authors also showed the interactions between flavor and taste are learned and processed by higher cognitive systems in rats and humans. Here the interactions between umami taste and dashi flavors are developed by the daily eating experience of Japanese traditional cuisine. Twenty flavors (such as sea weed, bonito, onion, garlic, ginger etc. by courtesy of YAMAHO CO., Ltd.) were used as flavor stimuli. Taste stimuli are monosodium glutamate (umami substance, MSG), miso soup, and Katsuo Dashi (bonito soup stock). Participants tasted these stimuli, 12-20 stimuli in a day, and evaluated the strength of umami taste, the palatability, congruity between taste and flavor with 100 mm visual analogue scales. The results of evaluations analyzed with the participants’ daily eating experience showed the interactions between taste and flavor are developed by their own daily intake of traditional Japanese cuisine, especially dashi soup. Glutamate also acts as flavor enhancer. There are many studies showing that the glutamate enhances salty taste of dashi soup. The authors are studying about the brain mechanisms underlying this enhancement with Near-Infra-Red Spectroscopy. In this talk, the authors will show some preliminary data involved in salty enhancement by the glutamate.

Evaluation of Antioxidant Properties of Amino Acids in Oil-in-water Emulsion Systems under Riboflavin Photosensitization

HyeJung Ka, JaeHwan Lee*
Department of Food Science and Biotechnology, Sungkyunkwan University, Korea

Amino acids are known as antioxidant or prooxidant in oil-in-water (O/W) emulsions. Effects of amino acids on the oxidative stability in O/W emulsions under riboflavin photosensitization were determined by analyzing headspace oxygen content, conjugated dienes, and lipid hydroperoxides. Generally, tyrosine and aspartic acid acted as antioxidant and cysteine and tryptophan were prooxidant in O/W emulsions. In addition, histidine, methionine, tyrosine and cysteine increased oxidative stability, while tryptophan decreased. Further studies were conducted to determine antioxidant or prooxidant properties of glutamic acid and monosodium glutamate (MSG) in O/W emulsions made of different emulsifier’s charge or pH conditions. Sodium dodecyl sulfate (SDS), tween 20, and cetyltrimethylammonium bromide (CTAB) were selected as anionic, neutral, and cationic emulsifiers, respectively and pH 4.5, 7.0, and 8.5 were used. Generally, addition of glutamic acids decreased the rates of lipid oxidation in emulsions stabilized with CTAB as pH increased from pH 4.5 to 8.5. In Tween 20 stabilized emulsions, antioxidant properties of glutamic acid decreased as pH increased. These results were observed also in samples stabilized with SDS. Antioxidant properties of MSG were decreased as pH increased in samples with cationic emulsifier, CTAB. However, emulsions stabilized with Tween 20 showed the lowest oxidative stability of MSG at pH 7.0 followed by pH 4.5 and 8.5. In addition, changes of antioxidant properties of MSG were not affected by pH conditions in SDS stabilized emulsion. Overall, these results show that antioxidant properties of glutamic acid and MSG in O/W emulsions are different depending on the pH conditions and emulsifiers charge.
Abstracts of Ottogi Industry-Academy Symposium
OTIA-1

The Effect of GABA Rinse Free Rice on Reduction of Blood Pressure and Anti-stress Effect

Hidenori Mizuno
Deputy General Manager, Engineering Division, Satake Corporation, Japan

The authors conducted a double-blind, placebo-controlled parallel-group comparative study to confirm the effect of continuous adoption of GABA rinse free rice on health related functions such as reduction of blood pressure and stress. In the study, 46 Japanese men and women aging from 40 to 65 years old having high blood pressure (effective number of samples 39) have consumed 150 g (after cooking 300 g) per day of sample food for 8 weeks. During the 8 weeks of adoption period and following 2 weeks of observation period, the blood pressure and stress of the subject have been measured. As the result, the subject adopting GABA rinse free rice showed significantly low value on waking systolic BP at home after 6 weeks and 8 weeks of starting adoption and also 1 week after finishing adoption. It was also confirmed that the subject adopting the GABA rinse free rice showed better results in the Visual Analogue Scale on the questionnaire compared to those subject consuming placebo samples.

OTIA-2

Development of Biofood Materials and Functional Food Products with Enhanced Levels of GABA

Suk-Heung Oh
Department of Food & Biotechnology, Woosuk University, Korea

γ-Aminobutyric acid (GABA) is a non-protein amino acid which is produced primarily by the α-decarboxylation of L-glutamic acid catalyzed by the enzyme glutamate decarboxylase (GAD). GABA functions in animals as a major inhibitory neurotransmitter. Many neurological disorders such as seizures, Parkinson's disease, stiff-man syndrome, and schizophrenia are known to be related to alterations in GABA and GAD levels in the brain. Alcoholics have a remarkably low plasma GABA concentration and reduced expression of GABA receptors in the brain. GABA-enriched foods such as milk, soybean, gabaron tea, red-mold rice, and Chlorella have been reported to depress the elevation of systolic blood pressure in spontaneously hypertensive rats (SHRs). Therefore, GABA has potential as a functional bioactive component of foods and pharmaceuticals. GABA and GAD have been found in animals, bacteria, and higher plants. Currently, our research team has studied germinated brown rice, soybean, and lactic acid bacteria, etc for applications in GABA production; particular interests are ways to maximize production by improvement to existing methods and strains. Our team has found that GABA and some free amino acids such as alanine in germinated brown rice are remarkably increased by joint treatment with chitosan and glutamic acid. In addition, strain isolation and its mass culturing were already attempted with the intention of producing GABA using methods compatible with industrial and functional materials. Further, attempts at producing high-GABA dairy products and functional food products, using developed high GABA materials and high GABA-generating strains, have been successful. The GABA producing lactic acid bacteria, soybean, and germinated brown rice will be discussed for applications in dairy and other health products that can exploit the functional properties of GABA, for producing highly effective functional food products.
γ-Aminobutyric acid (GABA) produced by decarboxylation of L-glutamate is a five-carbon monocarboxylic acid widely distributed in nature, including microorganisms, animals and higher plants. It acts as a major inhibitory neurotransmitter of the central nervous system and has diverse health benefits, such as the stimulation of immune system and prevention of neurological disorders, diabetes and cancer, as well as well-known physiological functions, such as hypotensive, sedative and diuretic effects. Lately, some lactic acid bacteria have received greater attention due to their genes (gad) encoding glutamate decarboxylase (GAD), which involve *Lactobacillus brevis* and *Lactococcus lactis*. Most probably, the presence of gad extends the probiotic nature of lactic acid bacteria and thereby enhances the function of lactic fermented foods because lactic acid bacteria possess their own health benefits such as the prevention of diarrhea, enhancement of immune system and prevention of allergic disease and food hypersensitivity. Indeed, GABA has been found not only in grains, especially brown rice and soybean, but in various lactic fermented foods. In the meantime, brewed vinegar produced through acetic acid fermentation has been of increasing interest due to its possible health functions such as promoting recovery from exhaustion, regulating blood glucose and blood pressure, aiding digestion and promoting calcium absorption. It has also been known that green tea has diverse health-promoting effects such as the control of biological rhythm, enhancement of immune system and prevention and recovery from disease. Furthermore, both green tea and vinegar beverage have received more attention lately because they are all effective not only in enhancing body-weight loss and thereby improving obesity, but in anti-aging or protecting skin. In an effort to develop multi-functional fermented beverages made of green tea (here referred to as the class of ‘biofoods’), therefore, two independent tracks of research were carried out in parallel by my research group, as follows: (1) the development of a functional beverage with enhanced level of GABA via lactic acid fermentation of green tea leaves; and (2) the development of a functional vinegar beverage via acetic acid fermentation of green tea leaves. As a first step for this, two strains of lactic acid bacteria and three strains of acetic acid bacteria, which had been isolated from green tea leaves and fruits, respectively, and identified as *L. brevis*, *Pediococcus pentosaceus*, *Acetobacter pasteurianus* (one strain each) and *A. lovaniensis* (two strains) based on their 16S rRNA gene sequences, were selected as fermenting microorganisms (viz. starter cultures) for lactic acid and acetic acid fermentations of green tea leaves, respectively, due to their relatively faster rates of acid production, growth and/or GABA production in suitable culture media. Subsequently, fermentation conditions were optimized by adjusting the essential conditions, for instance, the initial concentration of edible alcohol, type and concentration of carbon source, fermentation temperature, etc. Finally, fermentation and functional characteristics of green tea-based fermented beverages developed through either lactic acid or acetic acid fermentation were evaluated by analyzing the contents of organic acids and GABA. Extending this research beyond single-step fermentations, it is expected that the outcomes from two tracks of this research will be successfully merged into a single novel-type of ‘ultra-multi-functional fermented beverage’ in further studies by using either a simultaneous or an independent two-step fermentation process including both lactic acid and acetic acid fermentations. This biofood will provide multiple health benefits derived from lactic acid and acetic acid fermentations, and green tea as well.

**OTIA-4**

To Predict Long-term Success of New Food Product: Reviewing Sensory Analytical Tools

Seojin Chung

*Department of Nutritional Science and Food Management, Ewha Womans University, Korea*

Developing a new food product that has long product life cycle is the most challenging goal but a goal product developers want to achieve. Even when a product is successfully introduced in the market, a long-term success is rarely guaranteed. Many sensory analytical tools are developed and available for various purposes in food product development. In the present review, acquired liking theories, sensory based consumer testing methods, and case studies on repeated food exposure will be covered. Additionally, the advantage and limits of the consumer testing methods will be mentioned. The factors to be considered in predicting long-term acceptance of foods will be discussed. Finally, a possible experimental method and design for predicting long-term success of new product will be proposed.
Abstracts of Special Seminar
- HACCP
The Implementation of HACCP for Livestock Products in Korea

Sung-Il Kim
Agro-Livestock and Fishery Products Safety Bureau, Ministry of Food and Drugs Safety, Korea

The accredited HACCP establishment is certified by 3 channels in Korea. Firstly, slaughterhouses, processing plants of livestock products, and feed factories are certified by NVRQS, National Veterinary Research & Quarantine Service (The present: Animal and Plant Quarantine Agency). This is accounted for 69% of total HACCP certifications in October 2006. Second, KFDA, Korea Food & Drug Administration (The present: Ministry of Food and Drugs Safety) is in charge of ordinary foods and beverages, which accounted for 25% in the same period of time. Thirdly, fishery products for export, which accounted for 6% at the same period of time, are certified by Ministry of Maritime Affairs & Fisheries (MMAF). Based on the revised Livestock Products Processing Act, HACCP systems were applied to the Korean livestock products in December 1997. All Slaughterhouses are under the mandatory control of HACCP systems from July 2003. Non-government organization of Korea Livestock Products HACCP Management Institute (KLPHMI) started in September 2006. KLPHMI, entrusted from NVRQS. The organization have carried out HACCP certification and follow-up management, survey and research, and sanitary education and training of HACCP experts. In same year, the name of organization was changed to Korea Livestock Products HACCP Accreditation Service (KOLPHAS). In 2011, KOLPHAS was designated as Quasi-government Entity. Korea is now expanding and activating to apply HACCP system for all steps from livestock farms and table.

A Survey and Microbial Surveillance Study to Improve HACCP Accreditation Rate in Small and Medium-sized Dairy Farms and an On-farm Creamery in Korea

Kun-Ho Seo
KU Center for Food Safety, College of Veterinary Medicine, Konkuk University, Korea

HACCP certification in dairy farm becomes mandatory in Korea, although only 4.7% of small and medium-sized dairy farms (SMDFs) in Korea are certified with Hazard Analysis Critical Control Points (HACCP) program in 2013. To identify major hurdles in introducing HACCP program and to promote HACCP accreditation rate in SMDFs, we conducted a survey study using a structured questionnaire in 17 HACCP-certified and 15 HACCP-noncertified dairy farms from September to November in 2014. We also investigated the microbiological contamination levels in an on-farm creamery to identify effective critical control points (CCPs) during artisan cheese manufacturing process. Seventy-three percent of HACCP-noncertified dairy farms have only two workers, suggesting that simple and on-farm friendly HACCP program should be developed or integrated HACCP team from government and milk companies should assist the management of HACCP program in SMDFs. The major types of on-farm dairy creamery are “both cheese and fermented milk” type (63%). The main causes that hinder the adoption of HACCP program in SMDFs were “difficulties in recording” (40%), and “management of facilities to meet HACCP standard” (27%). Forty-six percent of respondents chose “development of checklist-format recording sheet” as the best measure to simplify the recording sheets. In addition, “adding the description of management standards in the recording sheets” was preferred second mostly (31%). “Development of recording sheets for each type of dairy processing farms” could be an option for improving the effectiveness of HACCP management. A total of 1 Salmonella, 13 S. aureus, 21 E. faecalis, and 16 E. faecium were isolated from various milk production lines and cheese manufacturing processes. Of these, 70.6% were from the samples obtained before teat washing and milk pasteurization. The difference in the antibiotic resistance patterns of milk isolates and cured cheese isolates was observed suggesting that contamination in the cured cheese could occur after pasteurization process. Based on these results, we suggest that milk pasteurization and teat washing are most important CCPs for reducing the microbiological hazard in final dairy product. Furthermore, it may be necessary to equip measures to prevent post-pasteurization contamination and to ensure the safety of final dairy product. In conclusion, the simplified and integrated recording sheets with minimized and effective CCPs as well as feasible standards for dairy facility and management systems should be implemented to increase the accreditation rate of HACCP program in SMDFs.
The Safety for Processed Livestock Products

Joonbae Hong
Korea Consumer Agency, Korea

Shifting from industrialization in the 1960’s to consumer-oriented society in the 1980’s, grain-oriented foods patterns were changed to the consumption of livestock processed products. Since a variety of livestock and processed livestock products were imported in Korea though WTO and FTA, consumers have wanted safe and healthy foods. This proceedings present consumer dispute resolutions and prevalence of pathogenic bacteria in livestock and processed products. The main consumer related disputes and resolutions were milk and processed meat products. For example, some consumers experienced food poisoning symptoms such as diarrhea and stomachache after consumption of processed livestock products within the expiration date. Deterioration and fungal contamination in processed livestock products were found. Even though some foods were over the expiration date, food poisoning and allergic symptoms were not presents. Foreign materials such as carbide and iron powder, etc. were found in infant milk powder. After food poisoning outbreaks from the ingestion of milk powder, consumers asked if the powder was contaminated by Enterobacter Sakazakii or food-borne pathogens or not. In case of processed products, tooth damage information was received after consumption of home shopping products. According to KCDC food poisoning report in 2013, egg, egg products and poultry were related with Salmonella spp., Campylobacter spp., respectively. Six livestock processed products (pressed ham, sausage, and Jerked meat) were contaminated by L. monocytogenes in 2011 as report of QIA. Consumers have wanted safe and healthy processed livestock products. The management systems of alien substances in food should include rapid response to consumer complaints, allowing for quick recall. Additionally, Advanced HACCP during production, processing and selling process should be established in livestock facilities to ensure sanity and consumer health.

Monitoring of Foodborne Bacteria from Meat and Environmental Factors of HACCP Applied Retail Shops in Korea

Seung-Hee Baek
Research and Analysis Department, Korea Livestock Products HACCP Accreditation Service, Korea

HACCP is an internationally recognized system for food safety management. Particularly, this system is required to meat processing plants because livestock products are vulnerable to microbial contamination during the processing process. It is important to monitor the hygiene level continuously as well. This study is to report about the monitoring results of hygiene level and microbiological hazard analysis of HACCP applied meat retail shops. Moreover, we analyzed the correlations with the foodborne bacteria and environmental factors. A total of 113 meat and 340 environmental samples were collected from 60 HACCP applied retail shops located in geographically different area in 2012. The isolation was performed for the indicator organisms (aerobic bacteria, E. coli and coliform), S. aureus, L. monocytogenes, Salmonella spp. and E. coli O157:H7. To characterize the isolates, PCR including Repetitive-Element PCR was conducted for virulence genes and molecular typing. The results were analyzed by ANOVA and DiversiLab profile system. The total bacteria count was 4.50±1.10 log CFU/g (beef) and 4.77±0.99 log CFU/g (pork), and was more found from the meat of large-scale shops than small ones despite no significant difference. A total of 13 foodborne microorganisms were found : 9 L. monocytogenes and 3 S. aureus. Of the isolates, 9 isolates were frequently found in large-scale shops (9/13, 69.2%). All L. monocytogenes were belong to 1/2c type (9, 100%), and the others were 4 S. aureus which were not detected any toxin in this study. The Rep-PCR results showed genetically high relatedness (>90%) for except for each 1 isolate. This study suggests that the large-scale meat shop could be more contaminated than the small/middle shops because of large amount of livestock products although HACCP was applied. Additionally the presence and generically high similarity of foodborne bacteria implies the possibility of same channel for contaminated raw meat.
Abstracts of Special Seminar
- Reduction of Sodium
**The Study for Association between Obesity and Salt Intake in Korea**

Dae Won Jun  
*Hanyang University School of Medicine, Korea*

Excess sodium intake is expected to be linked to obesity and obesity-related indices. However, there are not enough scientific evidence regarding the effects of excess sodium intake on obesity and obesity-related indices. The purpose of this study was to identify the association of sodium surfeit with obesity and obesity-related indices and the effects of a low-sodium diet on weight and metabolism related biomarkers in Korea. To see the relation between sodium intake and obesity, we analysed the data of the Korea National Health and Nutrition Examination Survey. After then, we performed a case-control study using 3-day food diaries and urine collected for 24 hours in 120 subjects. Finally, to confirm the cause relationship between sodium intake and obesity, we conducted randomized control clinical trial using 80 obese subjects. The data of the Korea National Health and Nutrition Examination Survey showed that men in the top 10% of sodium intake had two times higher risk of obesity than those who ate less than 2 grams of sodium. Female had 1.5 times higher risk of obesity. According to the case-control study, obese people was found to tend to have salty foods; eat soup or stew to the last drop; and enjoy processed foods containing a lot of sodium. Additionally, high sodium intake was demonstrated to have positive relationship with CT-scanned visceral fat and insulin level. Even after adjusting conditions such as age and energy consumption, sodium intake was linked to abdominal obesity and insulin resistance. A 2-gram low-sodium diet was offered to 80 obese people every meal for two months and the low-sodium and low-calorie educations were given for the next two months. According to the randomized controlled trial, the group with a low-sodium diet experienced a decline in blood pressure, fasting glucose level, and insulin resistance. The intervention of the 2-month low-sodium diet raised the awareness of a salty taste. Then a 2-month follow-up study observed that the changed awareness of a salty taste was led to the continuous decrease in total caloric intake and sodium intake. The overall 4-month low-sodium diet was safe and caused no side effects such as insulin resistance and the errors of lipid metabolism. It was a successful study with the compliance of more than 80%. This study is the first large-scale randomized controlled trial that produced clinical evidence of the effect of a low-sodium diet on lowering blood pressure, fasting glucose level, and insulin resistance. This is also the first randomized controlled trial that successfully carried out a long-term low-sodium diet by developing a 2-gram low-salt diet in Korea.

**A Guideline for Sodium Reduction of Processed Foods**

Eui-Su Kim  
*Korea Food Industry Association, Korea*

As a composition of salt, sodium is naturally ingested in the process of taking in table salt. Salt has a significant meaning in food processing. In general, this adds flavor including a salty taste and plays an important role in forming a tissue, rheologically. Also, this helps in improving preservability of foods by controlling growth of microorganisms. But since the excess sodium intake has been pointed out as the cause for occurrence of high blood pressure, heart diseases, stroke, osteoporosis, kidney stone, stomach cancer, etc., there has been an active effort to reduce sodium in processed foods, worldwide. This paper aims to introduce the quality changes of sodium-reduced samples within the expiration date and the results of sensory evaluation, along with the outcome of the Development Project of A Guideline for Sodium Reduction of Processed Foods, which has been implemented in Korea since 2012.
Sodium Reduction Efforts by the Korean Instant Noodle Industry

Jung Kun Lee
Nong Shim Co., Ltd., Korea

Instant Noodle industry stared at 1960 in South Korea. Instant Noodle business has been growing together with customers’ love and attention until now. Instant noodle is become very famous food and many Korean enjoy an instant noodle for a meal. Over 80 percent of Korean teenager consumes instant noodles more than one time per week (citation). Instant noodle has several advantages. First one is good taste; Instant noodle’s taste matches to Korean customer’s preference. Second one is convenience, it is easy to make and cook therefore instant noodle is good replacement of a meal. Last one is price, it is very reasonable price. Nongshim has more than 67 percent of market share of instant noodle. Since 2010, Instant Noodle market appears to have reached a plateau. Because low birth rate is decreased, customers more concern healthy food and life, and income of Korean customer is increased. Although some misunderstanding is spread that instant noodle is main factor of high sodium intake of Korean, Nongshim try to make reduced sodium products by sodium substance technique and research about human sensory and taste mechanism since 2007. The low sodium project of Nongshim contributes to government policy of sodium reduction.
Abstracts of Special Seminar
- Foods for Mental Health
Research and Development Project for the Mental Health Food

Daeseok Han

Research Group of Innovative Special Food, Korea Food Research Institute, Korea

Research group of innovative special food in Korea Food Research Institute is committed to research and development of mental health foods for improving the quality of life. We have progressed the projects to develop the functional foods for anti-stress, enhancing sleep and cognitive qualities, and appetite suppressants from natural products in Korea. In this presentation, we will introduce three major results of the projects related to mental health studies, which were presented below. Continued and elevated levels of glucocorticoid hormone (cortisol) resulting from dysfunction of the hypothalamic-pituitary-adrenal (HPA) axis is one of the most prominent neurobiological findings in stress. In addition, glucocorticoid receptor (GR) antagonists have been encouraged for potential therapeutic benefits in stress-related disorders. We have studied the anti-glucocorticoid activity of the more than 300 natural products from Korea by hormone-responsive element reporter in vitro assay, and we have found that the dried root bark of Morus alba extract markedly decreased luciferase activity in response to cortisol in a concentration-dependent manner. Our finding demonstrated that the M. alba extract could possess a potent antagonistic activity against glucocorticoid, at least in part. In our in vivo results demonstrated that treatment of the M. alba extract significantly reduced the number of ultrasonic distress vocalizations after restraint-induced stress in rats, and decreased the HPA axis response to the stress, as indicated by an attenuated corticosterone response and decreased c-fos immunoreactivity in the hippocampal hypothalamic PVN region. Also, we have determined that sanggenon G, as a major active compound from M. alba extract causes an anti-stress effect by the interaction with the serotonergic system. Presently, the double blind randomized controlled trial was initiated to determine the safety and efficacy of M. alba extract. Over six hundreds food and plant resources were screened for neurotransmitters related to sleep-wake cycle. Among them, Gamtae (Ecklonia cava) extract (GE) showed the most effective in both in vitro and in vivo assays. The effects of GE on sleep-wake profiles in mice were evaluated in comparison with the sedative-hypnotic diazepam, and their hypnotic mechanism was also investigated. GE (250 and 500 mg/kg) produced a significant decrease in sleep latency and an increase in the amount of non-rapid eye movement sleep (NREMS). GE had no effect on EEG power density, an indicator of the depth or intensity of NREMS. Diazepam produced a typical decrease in delta activity. These results imply that GE induces NREMS similar to physiological sleep. The hypnotic effect of GE was completely blocked by flumazenil. These findings support the idea that the hypnotic effects of GE should be attributed to the positive allosteric modulation of GABA A receptors at the BZD-binding site. Gamtae extract (GE), the product-specific health functional food with sleep-enhancing effects has been first approved from KFDA. Also, we have determined that the memory ameliorating effects of active compounds (curcumin, demethoxycurcumin and xanthorrhizol) from Curcuma xanthorrhiza on scopolamine-induced spatial memory deficits in mice. To investigate the cholinacetyltransferase (ChAT) and acetylcholinesterase (AChE) activity, we performed western blot and immunohistochemistry. These compounds treated groups were significantly increased ChAT immunopositive activity, and were suppressed the increase of AChE expressions in the hippocampal CA3 region. These results suggest that active compounds from C. xanthorrhiza prevent the dysfunction of the neuronal cholinergic system in scopolamine-induced memory impairment mice. In summary, E. cava extract, the product of specific health functional food with sleep-enhancing effects, has been first approved from KFDA. The root bark of Morus alba (Chinese name of “Sang-Bai-Pi”) has anti-stress effects on an acute or chronic stress in various animal models. C. xanthorrhiza prevent the dysfunction of the neuronal cholinergic system in scopolamine-induced memory impairment animal model.
MHSS-2

Food Effects in Human Learning and Memory: How Can Researcher Screen the Effective Substances?

Yoohun Noh
College of Medicine, Chung-Ang University, Korea

There is intense interest in the studies related to the potential of various functional foods to modulate neuronal function and thereby influencing memory, learning and cognitive function. Various natural compounds may exert particularly powerful actions on molecular events that underlie the acquisition and consolidation of new memories in the brain. However, finding of functional compound from natural products requires considerable time and effort for improvement of human's learning and memory. Methods for hunting of safe and effective compounds play a vital role in finding successful nutraceutical and drug candidates. However, the considerable diversity of screening models from animal models, tissue models, to cell models and so on, may cause some trouble in choosing the suitable one. This lecture presents how to learn and memorize from molecule mechanism to behavior and suggests the evaluation markers in animal and cellular studies. Presentation provides a toolbox of experimental screening models that have been used to discover new nutraceutical or drug candidates from natural products. Furthermore, valid clinical methods for confirming selected compounds are also suggested according to the age of subjects, function, effects. Finally, we discuss way of improving screening systems, as well as future directions.

MHSS-3

Safe Sleep-inducing Substance Search from the Food with Neurophysiological Research Methods

Young-Ho Jin
Department of Physiology, School of Medicine, Kyung Hee University, Korea

Ever increasing complexity of the modern society and demanding mental work negatively effect sleep time and quality. Many different kind of sleep-inducing medicines and supplements already available but each of them have problems. For example, most of the potent sleeping drugs cause drug dependency and tolerance, hence, the law strictly controled it's use. The less potent sleeping-inducing supplements including natural products have other problems. Most of them have live toxicity, cause drug interactions, or fatigue and lethargy after awakening. Therefore, potency and safety is essential for the searching of new sleep-inducing substance. We are trying to find new sleep-inducing substances form the food with the coordinated work with Korea Food Research Institute (KFRI). We evaluated candidate substances from licorice, glabridin, using patch-clamp methods in acutely isolated dorsal raphe neurons of the rat. Glabridin potentiated GABA-induced responses by positively modulating GABA$_A$ receptor responses similar with hypnotic drug zolpidem. Externally applied GABA-evoked currents were potentiated by glabridin in a concentration dependent manner. The glabridin potentiation ratio was 2.2 times larger than the maximum potentiation to the hypnotic benzodiazepine receptor full agonist diazepam. Benzodiazepine receptor antagonist, flumazenil (3×10$^{-7}$ M), failed to inhibit glabridin (3×10$^{-7}$ M)-induced potentiation. This result implies that glabridin may exhibit hypnotic effects without dependency and tolerance by potentiating GABAergic inhibition in dorsal raphe neurons through binding other than benzodiazepine binding site on GABA$_A$ receptor.
Relationships between Dietary Intake and Cognitive Function in Healthy Korean Children and Adolescents

Seung Wan Kang1,2,3*, Jin Young Kim1,3, Dae-Keun Kim1,3
1The Research Institute of Nursing Science, Seoul National University, Korea
2College of Nursing, Seoul National University, Korea
3National Standard Reference Data Center for Korean EEG, Korea

It has long been suspected that the relative abundance of dietary intake affect cognitive function. The aim of the study was to explore the dietary intake and cognitive function in healthy Korean children and adolescents. 318 healthy children who haven’t been diagnosed of neurologic or psychiatric disorder were evaluated (168 girls and 150 boys; age of 11.8±3.6 years). Analysis indicators were food frequency questionnaires (FFQs) which consisted of 76 items, neurocognitive test which consisted of symbol digit modalities test (SDMT), Verbal memory, Visual memory, shift attention test, reasoning test and Digi-span F/B, and event-related potential (ERP). Both verbal memory and SDMT percentile were significantly higher in girls than boys (p<0.05). Among the ERP parameters, NoGo early (suppression) amplitude, P3b amplitude was significantly higher in girls than boys and NoGo early (suppression) latency, N1 novelty latency was significantly lower in girls than boys (p<0.05). FFQ analysis of shellfish, vegetables, seaweeds intake were significantly higher in girls than boys and legumes, coke, fast foods intake were significantly lower in girls than boys (p<0.05). Fiber, Vit E, Vit K, Vit C, Vit B1, folate, potassium, iodine intake were significantly higher in girls than boys (p<0.05). Noodles consumption showed negative correlation with verbal memory, SDMT, shift attention test, reasoning test (p<0.05). Fast foods consumption showed negative correlation with SDMT, reasoning test (p<0.05). Coke consumption showed negative correlation with verbal memory (p<0.05). Mushrooms consumption showed positive correlation with visual memory, reasoning test (p<0.05). Nuts consumption showed positive correlation with SDMT (p<0.01). Dietary intake and cognitive function were generally better in girls than boys. The consumption of healthy foods seemed correlated with good cognitive function. These results suggest that diet may be closely related to cognitive function even in healthy children and adolescents.
Food Safety for Consumers

Seung Sin Lee
Department of Consumer Information Science, Konkuk University, Korea

Out of the consumption areas, food consumption is indispensable in a global environment. It is important to improve consumer's quality of life by affirming relationships amongst food safety experiences, food safety capabilities, and food safety confidence.

1) Consumers and Food Safety Incidents and Consumer Damage Status
According to a study by the Bureau of Statistics, consumer anxiety towards food safety has increased steadily since 1997, reaching 69.0% in 2008, and 45.1% in 2014. Consumer anxiety regarding food safety appears to be in relation to ongoing food safety incidents, and food-related hazard information currently occupies the No. 1 concern in Consumer Trends of the Korea Consumer Agency Information.

2) Consumer Food Safety Experience
Consumer food safety experience is when consumers directly feel and assess the level of safety. Overall, it consists of food safety awareness, food production and distribution related safety, food safety policy and administration, available food safety information and education, and anxiety towards food hazards. These safety experience levels are slightly different than those experts speak of as consumer experiences of food safety with the addition of psychological risks.

3) Consumer Food Safety Capability
Consumer food safety capability and food safety experience send and receive mutual influences. Consumer capability is defined as consumer knowledge, attitude, and functions that enable consumers to serve as a sound consumer. Dividing food safety capability into food safety information, food safety attitudes, and food safety acts, and then affirming the relationship with food safety experience can help make improvements in food safety experiences.

4) Consumer Food Safety Confidence
Food safety includes the category confidence as consumers lack the ability to objectively and accurately evaluate food safety. Therefore forming a positive attitude toward the government's food safety policy is an important factor in consumer food safety confidence.
Increases in the effectiveness of national food safety policies are expected by improving consumer food safety experiences and food safety capability, and building food safety confidence.
In addition, by providing consumer education and information that matches consumer characteristics, there is a need to not only minimize the size of vulnerable classes in food safety but also enable all consumers to consume food assuredly. The government, municipalities, businesses and consumers must all communicate and collaborate together for the common goal of food safety.

A Study on the Effectiveness of Food Safety Information Disclosure

Ju-Chan Kim
Department of Public Administration, Kwang Woon University, Korea

The information about the food safety is closely related to the health and quality of life. Because of information asymmetry between consumers and suppliers, government intervention seems necessary condition to get sufficient information about food safety. Government regulates producers and suppliers to provide sufficient information about food safety like nutrition labeling and origin mark. The necessity for the government regulation is that consumers can make a rational choice based on this information. This study tries to analyze the effectiveness of food safety information policies like nutrition labeling, origin marking, nutrition signpost labeling, in terms of government regulation policy.
Research and Application of Imported Food Risk Prediction

Hyuk Dong

Food Import Policy Division, Ministry of Food & Drug Safety, Korea

By increasing international trade, the amount of imported food is increasing every year. However, the food safety agencies currently adopt the historical information of manufacturer, importer, products, and random sampling to ensure the safety of imported foods. Hence, a variety of factors in addition to the history of the imported food need to be considered for proper safety regulation of imported foods and the effective inspection system should be adjusted for risk prediction of imported foods stuff. In this study, we developed the efficient algorithm and management system to predict risk factors of imported foods. First, the current status of inspection system for imported foods was analyzed, giving a way for advanced system to Food Safety Authority. An inspection system with document review, sensory evaluation, and lab test were specifically required to enhance the inspection system of the National Food Safety Agencies. The problem of imported food inspection is a simple and single random testing which comes along with unnecessary tests during random inspection. In this research, we established and optimized big-data mining platform and logistic algorithm to improve imported food inspection system through benchmarking advanced systems in other countries. Finally, the inspection system in this paper has the function of intelligent machine learning algorithm, which is calculated by key management of high-risk factors such as high-risk countries, and the average trading volume of food products. Now we can develop efficient standards and platforms of the imported food inspection system. The results in this paper also need to consider a more variety of factors, which can improve conventional system. Through further research, we can ensure imported food inspection work efficiency.

Recent Food Safety Information Service in Korea

Sung Hee Choi

Division of Food Safety Information, National Food Safety Information Service, Korea

Food safety has been a growing concern among people over the last decades. Outbreaks of disease in animals that could be transmitted to humans, or the presence of chemicals above acceptable limits in feed and food, can threaten both the quality and safety of products. Therefore, the food safety information is very seriously considered. The relevant government authorities and local governments have provided the food safety information to people through their own internet portal sites and distribution of various reports. As the food safety information is indispensable to prevent the food safety accident in advance and to build the alert notification system, the Food Safety Information Service has intensified the preventive management of food safety with more enhanced test and check of imported and distributed foods through the systematic collection and analysis of food safety information and provide the food safety information to people such as food industry to offer the well defined food safety information. Also, we're supported in order to enable food traceability are implemented to enhance food safety. Traceability is a way of responding to potential risks that can arise in food, to ensure that all food products in country are safe for people to eat. It’s vital that when national authorities or food businesses identify a risk they can trace it back to its source in order to swiftly isolate the problem and prevent contaminated products from reaching consumers. We’re introduced to help better understand the process of food traceability system, offers a wide range of information regarding the adoption process and benefits of industry. And, we’re conducting a wide range of policy research related to food safety. Current research areas include food safety regulatory impact analysis studies, imported food safety management, based on national and international food standards, improvement of food related legislation, health functional food adverse event national verification system, such as food safety level assessment system. We shared our work with industry players, government agencies such as the KFDA, and other academics. Therefore, we act as a hub of information services platform that connects food safety information.
Abstracts of Special Seminar
- Reduction of Benzo(a)pyrene
Benzo[a]pyrene-induced Toxicity or Cancer Depends on Dose, Route-of-administration, Target Organ, and Genetics

Daniel W. Nebert

Professor Emeritus,
Department of Environmental Medicine, and Center for Environmental Genetics
Department of Pediatrics & Molecular Developmental Biology, Division of Human Genetics
University of Cincinnati Medical Center, USA
Affiliate Faculty, Department of Environmental & Molecular Toxicology, Oregon State University, USA
Consultant, Department of Environmental Health Sciences, Yale University School of Public Health, USA

The ubiquitous prototypical polycyclic aromatic hydrocarbon (PAH), benzo[a]pyrene (BaP), is an environmental carcinogen found in tobacco smoke, combustion processes, charcoal-grilled foods, and PAH-contaminated surfaces of roofs, playgrounds and highways. Because BaP is predominantly metabolized by CYP1A1 and CYP1B1, we studied Cyp1a1 and Cyp1b1 knockout (k.o.) mice, comparing results with wild-type (WT). Various combinations of WT and k.o. mice carrying intestinal CYP1A1 can tolerate large doses of oral BaP (125 mg/kg/day) without apparent toxicity. Various k.o. mice lacking CYP1A1 globally, or specifically in intestine, develop immunotoxicity and die within 32 days, indicating that intestinal inducible CYP1A1 is absolutely required for detoxication of oral BaP. CYP1A1/1B1 double-k.o. mice are protected from immunosuppression and early death, due to absence of metabolic activation of BaP by CYP1B1 in immune cells. Lower doses (12.5 mg/kg/day) of oral BaP result in adenocarcinoma of proximal small intestine (PSI) in CYP1A1-null mice. CYP1A1/1B1 double-k.o. mice show no PSI cancer, but instead develop squamous cell carcinoma of preputial gland duct (PGD). BaP-metabolizing CYP1B1 in PSI, and CYP3A59 in PGD, are most likely the principal enzymes involved in tumor initiation in epithelial cells of these two tissues. Oncogenes and tumor-suppressor genes, up- and down-regulated during tumorigenesis, are completely different between these two developing cancers. When the above-described mice are given intraperitoneal BaP at similar doses, no toxicity or cancer is seen. This “oral BaP Cyp1 mouse paradigm” represents a powerful gene-environment-interactions teaching tool--showing that toxicity versus cancer depends on dose, route-of-administration, target organ, and tissue-specific Cyp1 gene expression. Because virtually every vertebrate (including human) is known to possess intestinal inducible CYP1A1, these experiments suggest that oral BaP intake might be relatively safer than one would predict.
Benzpyrene and Other PAHs in European Food - Analysis, Risk, Laws, and Current Situation

Hans Steinhart*, Peter Fuerst

Institute of Food Chemistry, University of Hamburg, Germany
1Chemical and Veterinary Analytical Institute Münsterland-Emscher-Lippe (CVUA-MEL), Germany

In 2008, the European Food Safety Authority (EFSA) performed a risk assessment on polycyclic aromatic hydrocarbons (PAHs) in food. The assessment focused on those PAHs that were regarded by the Scientific Committee on Food (SCF) and JECFA as potentially genotoxic and carcinogenic. These are benzo[a]anthracene, benzo[b]fluoranthene, benzo[j]fluoranthen, benzo[k]fluoranthene, benzo[ghi]perylene, benzo[a]pyrene, chrysene, cyclopenta(cd)pyrene, dibenz[a,h]anthracene, dibenzo[a,e]pyrene, dibenzo[a,h]pyrene, dibenzo[a,i]pyrene, dibenzo[a,l]pyrene, indeno[1,2,3-cd]pyrene, 5-methylchrysene, and benzo[c]fluorene. In the European Union (EU), these PAHs are considered a priority group in the assessment of the risk of long-term adverse health effects following dietary intake of PAHs. An evaluation showed that benzo[a]pyrene is not a good indicator for occurrence of PAH levels in food as up to 39% of food samples found negative for benzo[a]pyrene contained other genotoxic and carcinogenic PAHs with the highest number of positive results found for chrysene and benzo[a]anthracene. Based on the available data relating to occurrence and toxicity, EFSA concluded that the sum of benzo[a]pyrene, chrysene, benzo[a]anthracene and benzo[b]fluoranthene (PAH4) is the most suitable indicator of PAHs in food. The median dietary exposure across European countries was calculated both for mean and high dietary consumers and varied between 235 ng/day (3.9 ng/kg b.w. per day) and 389 ng/day (6.5 ng/kg b.w. per day), respectively for benzo[a]pyrene alone, and 1168 ng/day (19.5 ng/kg b.w. per day) and 2068 ng/day (34.5 ng/kg b.w. per day), respectively for PAH4. The two highest contributors to the dietary exposure were cereals and cereal products, and sea food and sea food products. For average consumers, the margins of exposure (MOE) based on the bench mark dose lower confidence limit for a 10% increase in the number of tumour bearing animals compared to control animals (BMDL10) are above 10,000 and thus indicate a low concern for consumer health at the average estimated dietary exposures. For high level consumers, the respective MOEs are close to or less than 10,000, which as proposed by the EFSA Scientific Committee indicates a potential concern for consumer health and a possible need for risk management action. EFSA also explored whether a toxic equivalency factor (TEF) approach in the risk characterization of the PAH mixtures in food could be applied and concluded that the TEF approach is not scientifically valid because of the lack of data from oral carcinogenicity studies on individual PAHs, their different modes of action and the evidence of poor predictivity of the carcinogenic potency of PAH mixtures based on the currently proposed TEF values. Based on the risk assessment of EFSA, in 2011 the European Commission has set maximum levels (MLs) for benzo[a]pyrene and the sum of benzo[a]pyrene, chrysene, benzo[a]anthracene and benzo[b]fluoranthene (PAH4) for a number of foodstuffs by Commission Regulation (EU) No 835/2011 amending Commission Regulation (EC) No 1881/2006. Foodstuffs have to comply with both MLs. The requirements for methods of sampling and analysis for the official control of the levels of PAHs in foodstuffs are laid down in Commission Regulation (EC) No 333/2007 amended by Commission Regulation (EC) No 836/2011. The two main analytical techniques for determining PAHs in foods are high performance liquid chromatography (HPLC) coupled to a fluorescence detector (FLD) and gas chromatography-mass spectrometry (GC-MS). Both of these methods are sufficiently sensitive for determining PAH concentrations usually found in foods. The GC-MS methods have become popular methods for analysing PAHs in foods. This is due to the selectivity of the MS-detector, the use of mass spectral data for reliable confirmation of PAHs, and the possibility to use isotope labelled PAHs as internal standards. Single quadrupole MS is the main detection technique applied, but the use of tandem mass spectrometry (GC-MS/MS) is increasing because it improves specificity and sensitivity of the MS-methods. In the latter case, the collision energy is used to destroy interfering matrix compounds, while the PAHs are extremely stable at the applied conditions.
Risk Assessment of the Polycyclic Aromatic Hydrocarbons (PAHs) in Refined Oils

Yun Jeong Cho, Hyung Min Kim, Wan Heo, Jun Ho Kim, Jung Min Choi, Young Jun Kim*

Department of Food and Biotechnology, Korea University, Korea

This study was designed to evaluate health risk of commercial refined oils with the contamination degree of polycyclic aromatic hydrocarbons (PAHs). Four major carcinogenic PAHs, including chrysene, benzo[e]anthracene, benzo[b]fluoranthene and benzo[a]pyrene, were identified and quantified in the extracts of 423 oil samples collected from Korean markets by gas chromatography and mass spectroscopy. To assess the exposure of PAHs by food ingestion, the values of 4 PAHs were converted into benzo[a]pyrene equivalents using toxic equivalency factor (TEF). The margin of exposure (MOE) was calculated using benchmark dose lower confidence limit (BMDL10) values and the exposure level of B[a]P and 4 PAHs to two groups of consumers depending on the amount of ingestion (average and high). The highest mean values of 4 PAHs in refined oils were within the permissible limit: chrysene 1.42 μg/kg in flexed-seed oil, benzo[b]fluoranthene 1.03 μg/kg in palm oil, benzo[e]anthracene 0.51 μg/kg in olive oil, and benzo[a]pyrene 0.49 μg/kg in margarine. Soybean oil showed the highest value of total PAHs among the tested oils when TEF was used. The MOE values of all oil samples were close to 100,000 or higher which is considered to be safe without further concern. The present study suggests that the health risk of PAHs in commercial refined oils is lower than regulatory limit.

Benzo[a]pyrene and Volatiles in Sesame Oil: Safety and/or Quality?

Ji-Yoon Jeong, Young-Suk Kim*

Department of Food Science and Engineering, Ewha Womans University, Korea

Sesame oil is widely used as a seasoning ingredient in some Asian countries mainly due to its characteristic flavor. Roasting or grilling process of sesame seeds at high temperature can produce pyrazine and other volatiles related to its sensory properties. However, this process can also lead to the formation of benzo[a]pyrene (BaP). BaP, one of the polycyclic aromatic hydrocarbons (PAHs), is a highly lipophilic compound and contain five aromatic rings in its structure. It is well known that BaP is genotoxic, carcinogenic and highly hazardous to human. For these reasons, refining, bleaching, filtration processes have been applied for reducing BaP concentration in sesame oil. But, they can lead to change in volatiles profiles which can affect consumer preference for sesame oil. Therefore, it is required to decrease BaP concentration by minimizing volatile profiles in sesame oil. In this study, we will discuss it for both safety and quality of sesame oil.
Benzo[a]pyrene Management from Food Manufacturing Process

Min Gyoo Kim, Kwang Yong Ko*

CJ CheilJedang Quality Safety Center, Korea

The Benzo[a]pyrene is a member of polycyclic aromatic hydrocarbons (PAHs), and the level of benzopyrene has been increased due to the elevated emission quantity of organic compound. In food, PAHs may be formed during food processing and domestic food preparation, such as, smoking, drying, roasting, frying or grilling. Some of PAHs are known as carcinogenic to human and classified as IARC group 1, so some countries established their regulations of residue limits in food or environment. Also in Korea, 11 of residue limit of Benzo[a]pyrene were established in processed foods (2015). Benzo[a]pyrene are commonly present in refined oils and smoked meat, and some agricultural products contain some levels of Benzo[a]pyrene. So food manufacturers have shown great interests in reduction of Benzo[a]pyrene residue levels because most violations associated with exceeding residue limits are found in refined oil and smoking meat products. In CJ CheilJedang managed Benzo[a]pyrene on separate procedure as other hazard materials on some products and raw materials like as sesame oil, dried bonito bush, smoked ham. Benzo[a]pyrene were mostly generated on frying process of sesame seed, so we controlled heat and cooling temperature for reducing Benzo[a]pyrene levels in manufacturing processes. The case of super critical extraction oil was no frying process, so it controlled raw material as sesame seed powder. And also, we improved filtering and storage conditions and analyzed Benzo[a]pyrene from final products. In case of ham products, the residual Benzo[a]pyrene levels may vary depending upon the intensity and duration of the smoking process, so research has been done to develop optimal conditions to minimize Benzo[a]pyrene residue levels. And Benzo[a]pyrene levels in products are periodically analyzed to monitor and manage the residue levels of Benzo[a]pyrene. Raw materials, such as bonito bush are managed in collaboration with suppliers to maintain optimal conditions so that raw materials and finished products would be continuously managed to secure the safety.
Abstracts of Special Seminar - FOODPOLIS
FOODPOLIS is a new industrial cluster being built in Korea focused on global agri-food exports and research and development. The complex houses businesses, research institutes, and public organizations. Established by the Korean Ministry of Agriculture, Food and Rural Affairs (MAFRA), our primary objective is to help build Korea's food industry by encouraging shared growth between large and small enterprises and the agricultural sector. We hope to foster intense collaboration, sparking knowledge sharing and innovation. Companies within the industrial complex benefit from a range of incentives, various R&D support centers, and programs ranging from food functionality evaluation to food quality and packaging. Located near Iksan city on Korea's west coast on a total area of just over 3.5 million square meters of land, the cluster provides a clear strategic advantage for companies eyeing the Asian food market. It's the perfect export platform.

Consumer product tests have been conducted by sensory analysis which is based on subjective mind or consciousness (CONS) states. Food acceptance by consumers plays an important role in the choice and purchase of food. But food acceptance presented by hedonic scale value cannot be reflected by CONS states and it is difficult to predict the preferences of individuals and groups of consumers unless their context is understood, including factors such as food centeredness, geological environment, cultural traditions, and social aspects of food preferences. In this context, a simplified method of cognitive sensory evaluation (CSE) was developed using a questionnaire based on four dimensions of consciousness (CONS). The four dimensions are defined by 5th CONS, 6th CONS, 7th CONS, and 8th CONS, respectively. Various food-related complexes are classified into the relevant CONS and constructed a consciousness oriented questionnaire, simplified Cognitive Sensory Questionnaire (sCSQ). The dimensions of sCSQ cover health, sensitivity, criterion, knowledge, beliefs, association, habit, desires, inheritance, transcendence, and soul. This work aimed to categorize consumers into groups according to their consciousness levels and to analyze differences in the attitudes toward specific food products among the groups. Cognitive Sensory Evaluation Table (CSET) as a new presentation format was developed which considers the effects of various factors and the dimensions of consciousness of given groups of consumers on food acceptance. Applying the CSET method to practical use, several food items were tested with the sCSQ. CSET pattern reveals how consciousness dimensions effect on the acceptance of food.
Brazil is the world’s largest coffee producer, accounting for one third of world production, but Brazilian coffee quality has always been considered inferior to that of coffees produced in other countries, such as Colombia and Guatemala. Another major variety of coffee is Robusta which accounts for 30% in the world production and it is primarily used for instant coffee and blending with Arabica coffees. Majority of Robusta coffee flavors are described as harsh, rubbery, and bitter. The aim of this study was to develop a new method for improving the flavor quality of Robusta and Brazil coffee by gentle germination of green coffee beans (GCB). Two different treatment methods were developed to germinate or hydrolyze GCB in order to modulate two important flavor precursors such as sucrose, glucose, and amino acids; soaking followed by germination (G) or germination with enzyme addition (E). After germination with or without enzyme, the non-volatile compounds in GCB including carbohydrates, free amino acids, caffeine and chlorogenic acids were analyzed by HPLC and UPLC. The volatile aroma compounds in roasted coffee were analyzed by HS-SPME/GC-MS. Sucrose and glucose levels were decreased or increased depending on the treatments, but most of the free amino acids were increased for both pre-treated GCB. After the treatments, undesirable flavor compounds were decreased, whereas desirable compounds were significantly increased in the pre-treated and roasted coffee beans. These newly developed technologies demonstrated the possibility of quality improvement of flavor quality of coffees, especially produced in Brazil and Vietnam.

How Food Pleasure Works?

Nakeon Choi
SIAS Co., Ltd., Korea

Taste (food pleasure) is always the most important factor in food choice. There has been great progress in food processing and flavoring techniques, but little progress in understanding of nature of food pleasure and perception itself. Principles of making good food taste are not part of any food science curriculum. The main reason is maybe the complexity of the subject and lack of scientific approach. I have studied many food pleasure theories and selected three most important factors; rhythm of sensation (taste, smell, touch, sight, and hearing), benefit from food to gratify one's hunger, and provide nutrition, mind set and brain work (especially focus on mind works). Recently there is many progresses in neural science and physiology and the knowledge from this science can play important role in understanding food perception and palatability. Understanding how brain work will offer valuable insight about how food pleasure works, which will reduce the difficulty in explaining why people like it.
Role of Flavor Chemistry and Technology in Food Industry

Hyung-Hee Baek

Department of Food Engineering, Dankook University, Korea

Flavor is the most important factor when we select foods in the market. Food industry makes every effort to develop palatable foods through flavor research. Flavor research includes flavor analysis, flavor chemistry, and flavor technology. Flavor analysis is performed by aroma isolation and instrumental analysis. Gas chromatography-olfactometry is essential in recent flavor research. More recently, real-time flavor analysis by atmospheric pressure chemical ionization mass spectrometry is widely used. Up to date techniques in flavor analysis will be introduced in this presentation. Flavor chemistry deals with the mechanisms of flavor formation, which help solve flavor related problems in food industry. There are many off-flavor problems to be solved in food industry. Cases associated with off-flavors encountered in food industry will be introduced and presented on how it was detected and solved. Flavor technology plays an important role in solving flavor problems in food industry and developing food flavorings and savory flavors. Application of flavor technology in food industry will be presented. Korean traditional foods have unique and characteristic flavor. Additionally, flavor issues in Korean traditional foods will be discussed in this presentation.
Abstracts of Regional Symposium
- Yeongnam Sea Grant Center
**YSRS-1**

Korea-China FTA and Development of Seafood Industry

**Dohoon Kim**

*Department of Marine & Fisheries Business and Economics, Pukyong National University, Korea*

In order to respond effectively to the Free Trade Agreement (FTA) between Korea and China, it is firstly necessary to analyze the competitiveness of fisheries trade between Korea and China, and to estimate strategic seafood export products for Korea-China FTA in fisheries sector. The results of analyses indicate that Korea has comparative advantages in export items such as Spanish mackerel, flatfish, cod, roe in frozen fish (0303), and squid, sea cucumber, oyster in molluscs (0307). In addition, tuna in prepared or preserved fish (1604), sea cucumber in crustacean, molluscs and other aquatic invertebrates (1605) have comparative advantage in exporting to China. Based on these results, it is possible to find out the directions for developing seafood industry. Most of all, the supply of fisheries such as fish, shellfish, etc. must be secured safely from both domestic production and import. Second, various types of seafood, in particular fresh and processed types of seafood, must be developed for increasing domestic consumption and international export. In particular, a careful consideration on eco-labelling systems, environmental certifications for seafood, is also needed for developing seafood industry.

**YSRS-2**

The Current State and Challenge of Marine Bio-industry in Busan

**Hyung-Pil Seo**

*Marine Bio-industry Development Center, Busan Techno-Park, Korea*

With increasing in attention on well-being and LOHAS, people have been focused on healthy functional effects of marine organisms. Consequently, the consumption of seafood products and marine healthy functional foods is tending to increase. The marine bio-industry has rapidly developed according to the current trends. However, local marine bio-industry in Busan has several problems for sustainable development, since most companies involved in the marine bio-industry are small business model such as poor capital and small employee. Therefore, it is an urgent need to make plan to convert the local companies as a value-added business model companies. In addition, there is no obvious definition and criterion on marine bio-industry. Of course, no status and statistical analysis on marine bio-industry is available in local area. These situations result in a difficulty to make a plan of marine bio-industry development policy. Here, it is suggested that the local marine bio-industry development master plan based on the current status analysis on marine bio-technology industry in Busan. This presentation will contribute to promote the marine bio-technology industry in Busan through the medium and long term development strategies.
The State of Korean Fisheries R&D and Development Plan for K-Seafood

Jae Wook Choi
Fisheries R&D Management Center, Korea Institute of Marine Science & Technology Promotion, Korea

*Oenanthe javanica* is well known as a natural herbal medicine that is used in Asian countries to treat a number of disorder, such as jaundice, hypertension and polydipsia. We examined whether *Oenanthe javanica* extract (OJE) could be included in a healthy diet to enhance memory. OJE inhibited acetylcholinesterase (AChE) activity and blocked H₂O₂-induced cytotoxicity and the production of reactive oxygen species (ROS) in SH-SY5Y neuroblastoma. According to these results, we proposed that OJE could improve stress-induced memory impairment and AChE activity in the brain. To confirm the effect of OJE on memory, OJE was administered to stressed rats for four weeks. In a Y-maze test, disturbed cognitive functions were recovered with OJE treatment. The OJE also reduced AChE activity in the stressed rat brains. In addition, we tested whether OJE could reverse ethanol-induced memory deficits of rats and block AChE activities in the brains. We found that OJE improved significantly ethanol-induced cognitive impairments and reduced AChE activities in the brains of ethanol-treated rats. We investigated whether the intake of the OJE during 12 weeks could improve memory impairment of Tg2576 mice and decrease soluble amyloid-b1-42 proteins in the mouse brains. Interestingly, the OJE treatment alleviated significantly memory impairment of Tg2576 mice and reduced soluble amyloid-b1-42 (Ab) levels in the mouse brains compared with non-treated Tg mice. These results suggest that *Oenanthe javanica* extract may be an effective agent for the prevention of the memory impairment.

The Present State and Challenge of Seafood Processing Industry

Jin-Soo Kim*, Sang In Kang, Min Soo Heu
Department of Seafod Science & Technology, Gyeongsang National University, Korea
1Department of Food & Nutrition, Gyeongsang National University, Korea

Seafood is a rich source of easily digestible protein that also provides polyunsaturated fatty acids, vitamins, and minerals for human nutrition and health. For the reasons, demand for the seafood from most consuming public has consistently increased during recent years. With better appreciation of the human nutrition and health benefits of seafood, there has been an increase in the harvesting of wild fish and fish aquaculture including concurrently mass-caught fish, such as anchovy, mackerel and, mackerel pike. Increased harvesting leads to a greater abundance of by-products. These by-products could serve as an excellent food resource for extracting taste compounds, muscle, mineral, enzymes, lipids and collagen. However, most seafood processing by-products are conventionally used to produce fish meal and fertilizer or are directly discharged into estuaries, resulting in environmental pollution. Recent developments in fish processing technology are oriented towards technology up-gradation, diversification and quality assurance. These have led, among others, to a great demand for seafood/seafood-based convenience products in ready-to-eat or ready-to-cook forms. There are several factors, which have influenced this demand. One is the increasing affluence and the consequential changes that have influenced the eating habits, particularly in the western countries, which have resulted in the demand for diversely processed value added convenience products based on fish. There is also an increasing trend of eating away from home and this has triggered the growth of fast food trade serving value added fish based products. In the sense, the seafood processing industry currently has to face new challenges due to insufficiency and inefficient use of seafood resource, inherent problems related to unattractive fishy odor and small bone, texture, small size and high fat content, and shortage on development of new products required by consumers, especially new generation. This presentation will introduce kinds of new generation-considered seafood products or nutraceuticals using concurrently mass-caught fish and seafood processing by-products, and discuss the preparations and the characterizations.
Abstracts of Academic Division Symposium

D1  Animal Foods Division
D2  Soy Processing & Utilization Division
D3  Carbohydrate Division
D4  Food Engineering Division
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Prevalence and Virulence Characteristics of Shiga Toxin-producing Escherichia coli from Animal Meat Products in Korea

Jang Won Yoon1*, June Bong Lee1, Dalmuri Han1, Jeong Hoon Park1, Hyung Tae Lee1, Hyun Seok Joh1, Yeon Soo Jung2, Suk Shin2, Yong Ho Park2, Chong Hae Hong1

1Institute of Veterinary Science & College of Veterinary Medicine, Kangwon National University, Korea
2College of Veterinary Medicine, Seoul National University, Korea

Shiga toxin-producing Escherichia coli (STEC) causes mild food poisoning to the life-threatening hemolytic uremic syndrome. Consumption of raw or undercooked meat is the most common route of transmission of STEC. Here, we investigated the prevalence of STEC in the 174 retailed meats from the 11 markets and the 106 meat by-products from the 6 slaughter houses in South Korea during the years 2013-2014. A total of 157 (56.07%) E. coli and 3 (1.07%) Salmonella species were isolated and the only 7 (4.45%) isolates had the stx1 or 2 genes. Our experimental analyses revealed that they belonged into the 4 different serotypes including O91:H14, O121:H10, O91:H21, and Ont:H20. Moreover, two STEC O91:H14 isolates were non-motile on the 0.3% tryptic agar plates although they had a functional copy of the fliC gene. Determination of the virulence genes by PCR demonstrated that none carried the eae, tir, and espB genes, indicating the absence of the LEE pathogenicity island in these STEC isolates. In contrast, they all possessed the ecpA gene with or without the saa gene, previously known as an adhesin for LEE-negative STEC isolates. The plasmid profiling demonstrated that the 4 STEC isolates harbor the 60-megadalton virulence plasmid, which was confirmed by the PCR against the ehxA gene. Although its biological significance is unclear, two STEC O121:H10 isolates could not produce the rpoS gene product. Notably, our STEC isolates were highly susceptible to the antimicrobials evaluated and one clonal set of STEC isolates were identified in this study. Further study might be needed to elucidate the in vivo virulence of the STEC isolates as well as to define geographical difference between our STEC and those from other countries.

Meat Safety Issues and Diffusion of HACCP System to Slaughter House in Japan

Yukio Morita

Laboratory of Food Hygiene II, Tokyo Kasei University, Japan

Japanese beef (Wagyu) produced 3 slaughter houses has exported to the United State (U.S.) from 1992. On 1999, the three slaughter houses had to introduce HACCP system for export the beef to the U.S. On 2000 and 2010, Foot-and-Mouse Disease (FMD) occurred in Miyazaki prefecture, Japan. After FMD outbreak, exporting meat had stopped immediately. However, on 2011, OIE recognized Japan for FMD free country where vaccination is not practiced. Therefore, now many slaughter houses have restarted to export meat to the U.S., Canada, EU, Hong Kong, Singapore, Mexico, Philippines, Malaysia, Indonesia, UAE, Macao, Thailand, and Vietnam, etc. In these countries, The U.S., Canada, EU, and Hong Kong need HACCP system in slaughter house exporting these countries. Ministry of Health, Labor, and Welfare (MHLW) revised meat inspection law and food sanitation law. The special features in the lows, slaughter house and food processing company are able to select “former sanitation system mainly composed of prerequisite program” or “HACCP system” from April, 2015. Ministry of agriculture, forestry and fisheries (MAFF) were promoting good agricultural practice (GAP) to farm in Japan, simultaneously. According to our previous research, beef surface of slaughter house introduced HACCP system was hygienic. We could not isolate Escherichia coli on all beef samples processed the slaughter house with HACCP system examined in our study. We expect to decrease food poisoning cases because of promoting HACCP system to slaughterhouse, and to export hygenic meat to many countries.
Protein Biomarkers for Beef Color Stability

Surendranath P. Suman
Department of Animal and Food Sciences, University of Kentucky, USA

Color of fresh beef is an important quality trait influencing consumers’ purchase decisions. The interactions between myoglobin and small biomolecules in the sarcoplasm of post-mortem skeletal muscles govern beef color stability. Proteomic tools were employed to examine the sarcoplasmic proteome profile of beef muscles to explain the molecular basis of color stability. The results demonstrated that the sarcoplasmic proteomes of color-stable (Longissimus lumborum) and color-labile (Psoas major) beef muscles are different and contribute to muscle-specific color stability. Color-stable Longissimus lumborum demonstrated greater \( p < 0.05 \) abundance of antioxidant proteins (peroxiredoxin-2 and peptide methionine sulfoxide reductase) and chaperones (stress-induced phosphoprotein-1 and heat shock protein-27 kDa) than the color-labile Psoas major muscle. Antioxidant proteins minimize discoloration by preventing lipid oxidation and metmyoglobin formation, whereas chaperones improve myoglobin stability and color stability by preventing protein aggregation and denaturation. Further studies examined the proteome basis for animal effect on color stability variations in beef Longissimus lumborum. The findings demonstrated that the greater \( p < 0.05 \) abundance of glycolytic enzymes (phosphoglucomutase-1, glyceraldehyde-3-phosphate dehydrogenase, and pyruvate kinase M2) in color-stable Longissimus lumborum steaks than in their color-labile counterparts contributes to improved color stability possibly through regeneration of NADH, which is an important cofactor in metmyoglobin reduction. Statistical analyses of color traits and proteomic data indicated that beef color stability is positively correlated \( p < 0.05 \) to antioxidant proteins, glycolytic enzymes, and chaperones. These results suggested that several sarcoplasmic proteins could be utilized as biomarkers for fresh beef color stability.

MicroRNA in Milk as Immune Modulator: Perspective and Application

Sangnam Oh
BK21 Plus Graduate Program, Department of Animal Science and Institute of Agricultural Science & Technology, Chonbuk National University, Korea

MicroRNAs are a class of naturally generating, small non-coding RNA molecules, about 21-25 nucleotides in length. MicroRNAs are partially complementary to one or more messenger RNA (mRNA) molecules, and their main function is to down-regulate gene expression in a variety of manners, including translational repression, mRNA cleavage, and deadenylation. Circulating microRNA in body fluids has emerged as potential biomarkers of various diseases including many types of cancers, hypertension, and diabetes. These types of microRNAs are encapsulated by microvesicles or exosomes that can be transfer to other cells to regulate gene expression in recipients. Recent studies demonstrated the presence of miRNA in human breast milk with tissue specificity. These miRNAs were relatively resistant to low acid pH levels similar to those found in the human stomach condition. Milk derived miRNAs are highly involved immune-related microRNAs that regulate various immune systems including B and T cell maturation and activation. To evaluate the biological and immunological activity of miRNAs from bovine milk products, we established the efficient RNA extraction method and the quantification method of amount of immune-related microRNAs from raw mature milk to several types of pasteurized milks using RT-qPCR. Our study provide a basis for understanding the physiological role of milk microRNAs and a new potential standard for determining the quality of raw milk or milk-related commercial products as well as a new way to look at lactation.
Recent Trends in Probiotic Food and Supplements

Jung-Hee Lee
Korea Yakult Co., Ltd., Korea

Probiotics are live microorganisms including lactic acid bacteria and some Bacillus that provide health benefits when administered in adequate amount. The well-known functions of probiotics are the maintenance of digestive health and the regulation of immune system. In recent years, probiotics market is being driven by dairy drinks, beverage and functional foods. The total probiotic market was $24.2 billion in 2011 and is expected to grow at 6.8% (CAGR) from 2012 to 2017 to reach $36.0 billion by 2017. In Korean domestic market, the size of the probiotics market grow to 69 billion won in 2013, up 35 percent from 58.3 billion won in 2012, and is forecast to grow more than 20 percent in 2014. Also it is expected to grow at 15.0% (CAGR) from 2012 to 2017 to reach 139.5 billion won by 2017. Recently, companies are expanding investments in R&D to find more effective probiotics of new function and develop more efficient manufacturing process for improving stability. As a result such, CJ CheilJedang discovered a special lactobacillus plantarum from kimchi which was already launched as “CJLP-133” and helps reduce skin immunity hypersensitivity reaction. Also, Korea Yakult will plan to put on a new product on the probiotic market that it exerts potent anti-photoaging activities by improving wrinkle formation and dryness. Therefore, as the market size is growing, the products with long shelf life and functional probiotics will have a huge impact on the future probiotic market.

Health Benefits of Stinky Tofu Consumption in Asian Diets

Wen-Huey Wu
Department of Human Development and Family Studies, National Taiwan Normal University, Taiwan

Stinky tofu, a popular fermented soy food traditionally consumed in China, Taiwan, and South Asian Countries was recently found to contain a significant amount of S-equol which in general is produced in gut by bacteria from isoflavone daidzein, and rarely exists in food. S-equol possesses selective estrogenic activity, may lower the risk of breast, and prostate cancers, improve menopausal symptoms, and reduce bone loss. About 80% of Caucasians and 50% of Asians cannot produce S-equol from isoflavones by their gut bacteria. So, the food source of S-equol is important especially for this population. Our survey in Taipei night markets found commercial stinky tofus contained about 2.3 mg S-equol/serving (1.2±1.0 mg/100 g, n=138). The data are comparable to those found in China. They also found cooking method influenced equal contents. Urinary kinetics of isoflavones after ingesting stinky tofu showed rapid and high absorption of S-equol. Therefore, stinky tofu can be a promising source of S-equol in Asian diets for its high content and high bioavailability.
Evidences of Bacillus subtilis var. Natto Products (NKCP) for the Improvement of Blood Flow

Masahito Hitosugi
Department of Legal Medicine, Shiga University of Medical Science Otsu, Japan

The fermented soybean product natto is a popular traditional food in Japan. NKCP, whose main component is bacillo-peptidase F, is a natto-derived dietary food supplement. Its direct fibrinolytic and serine protease activity for human blood and antithrombotic activity in rats after administrating orally were confirmed. We also found blood pressure-lowering effect with orally taking NKCP by cross-over, double-blind clinical study. Furthermore, relief of low back pain, shoulder stiffness, and coldness of the extremities, all of which were caused by blood flow disturbances was shown in patients with lifestyle diseases. The use of dietary supplements NKCP, which was based on the Japanese traditional food natto, is useful for the prevention of thrombotic diseases. Also, it helps to decrease blood pressure and relieve subjective symptoms for patients with lifestyle diseases receiving medical care.

Anticancer and Antiobesity Effect of Doenjang (Korean Fermented Soypaste)

Kun-Young Park
Department of Food Science and Nutrition, Pusan National University, Korea

Doenjang is an important component of the Korean diet. Doenjang has been shown to have greater antimutagenic and anticancer activities than other fermented soybean foods such as cheonggukjang (Korean-style natto) and miso and non-fermented soybeans. The chemopreventive effect of doenjang and the modes of action in vitro and in vivo will be introduced. Long term fermentation of soybeans and bamboo salt used during the fermentation increased the chemopreventive activities. Doenjang extract and active compounds of genistein and linolic acid in doenjang showed strong antimutagenicity, anticarcinogenic activities and antitumor effect in S-180 transplanted Balb/c mice. G1 or G2-M phase was arrested and p53 and p21 induced in human cancer cells by doenjang and genistein. We developed doenjang with the grain-type meju using probiotic mixed starter cultures of Aspergillus oryzae, Bacillus subtilis and Lactococcus lactis to improve the qualities and anticancer effect of doenjang. Administration of the doenjang using probiotic mixed starter cultures ameliorated the symptoms of colon cancer induced by AOM and DSS colon carcinogenesis in C57BL/6 mice. The doenjang reduced the incidence of neoplasia and decreased the levels of serum pro-inflammatory cytokines such as IL-6 and TNF-α and iNOS and COX-2 expression levels in colonic tissue. In addition, it increased Bax and reduced Bcl-2 expression levels and increased p21 and p53 expression in the colonic tissue. The black soybean doenjang (BSD) and doenjang fermented for long period effectively showed antiobesity effect both in vivo and in vitro system. They significantly reduced weight gains, the levels of serum triglyceride and cholesterol. In addition, high fat diet (HFD) + BSD remarkably downregulated SREBP-1c and PPAR-γ, which are critical transcription factors for adipogenesis, These results indicate that BSD have an anti-obesity effect, which can reverse the effects of HFD on body weight, adipose tissue weight, serum lipid contents and adipogenesis transcription factors.
**D2-4**

**Differential Effects of Powdered Whole Soy Milk and Its Hydrolysate on Antiobesity and Antihyperlipidemic Response: Compared to Casein as a Protein Source**

Ji Young Choi¹, Yong-Jin Jeong², Myung-Sook Choi¹*

¹Department of Food Science and Nutrition, Food and Nutritional Genomics Research Center, Kyungpook National University, Korea, ²Department of Food Science and Technology, Keimyung University, Korea

This study was performed to compare the effects of powdered whole soy milk and its hydrolysate & the processed soymilk and its hydrolysate on the alteration of lipid metabolism and their possible effects on antiobesity in C57BL/6N mice fed a high-fat and -cholesterol diet. Casein was used as a dietary protein source for control group. The mice were divided into a control group (20% casein) and four test groups: soy milk (SM, 20% soy milk protein), soy milk hydrolysate (SMH, 20% hydrolyzed soy milk protein), whole soy milk (WSM, 20% whole soy milk protein), and whole soy milk hydrolysate (WSMH, 20% whole soy milk hydrolysate protein). They were fed experimental diets for 5 weeks. The body weight and adipose tissue weights were significantly lowered in SMH, WSM, and WSMH groups compared to the control group despite providing an isoenergetic diet. Plasma lipid concentrations and hepatic fatty acid synthase (FAS) and glucose-6-phosphate dehydrogenase (G6PD) activities were significantly lowered in all soy milk groups; however, the hepatic lipid contents and malic enzyme (ME) activity were only significantly lowered in the WSM and WSMH groups, compared to the control group. Data suggest that powdered WSM or WSMH appears to be more beneficial than SM or SMH in overall antiobesity and antihyperlipidemic properties following in the order WSMH/WSM, SMH, SM, and casein.

**D3-1**

**Beyond Glycemic Control: Functions of Caloric and Non-caloric Carbohydrates**

Pavinee Chinachoti

Global Innovation Center, Thai Union Frozen Products, Thailand

Carbohydrate is one of the most important nutrients in our diet both from overall health and exercise performance. Some functional properties including glycemic index (GI), prebiotic properties, and lower-caloric sweetening effect, have been mostly used to aid formulation of lower GI products. While debates about usefulness of GI continues, better understanding of what carbs do in the body under physical and metabolic stresses should be carefully considered in order to be more effective in controlling and managing healthy carbohydrate functions. For example, performance of muscle relies on carbohydrate energy that is related to muscle glycogen, liver glycogen, and blood glucose. Managing carbohydrate in the diet in order to reduce carbohydrate loads and subsequently insulin sensitivity is considered as key among over-weighted individuals. Use of sugar substitutes, prebiotics or dietary fiber and supplements remain tools that can support (but not as replacement of) the larger efforts to control of caloric component intake for individuals with higher risks of metabolic imbalance.
Strategies for Controlled Enzymatic Production of Various Prebiotic Oligosaccharide Candidates from Hemicellulosic Biomass

Tae-Jip Kim
Department of Food Science and Biotechnology, Chungbuk National University, Korea

L-Arabinose and D-xylose are major components of hemicellulosic biomass widely distributed in plant cell walls. Recently, arabino- and xylo-oligosaccharides (AOs and XOs) have been studied for prebiotics candidates with health-benefits. These oligosaccharides can be obtained from natural carbohydrate polymers such as arabinans and xylans. A variety of hydrolases catalyzes the degradation of arabinans or xylans. Sometimes the actions of accessory enzymes can stimulate the enzymatic production of AOs or XOs. To date, however, most of research works have been focused on the complete enzymatic saccharification for the bio-ethanol or the alternative sweeteners. In the present study, various exo- or endo-type arabinan-degrading enzymes are developed and re-categorized on the basis of their unique modes of action and substrate preferences. The step-wise treatments of these enzymes will be applicable to the generation of AOs with varied branch structures and chain lengths. Also, endo-xylanases and some accessory enzymes are studied on their synergistic modes of action. The treatments of xylanase in combination with accessory enzymes can produce a variety of XOs. Cost-effective enzymatic production of AOs and XOs will promote the practical approaches to reveal the relationships between probiotics and prebiotics.

Application of Non-starch Polysaccharides in Food

Eun Jung Lee
Department of Bio-Food Analysis, Bio Campus, Korea Polytechnics, Korea

Non-starch polysaccharides (NSPs) are used in many foods. Especially fiber is an important aspect of diet and nutrition. Recently, food manufacturers have responded to the consumer demand for foods with fiber content by developing products in which high fiber ingredients are used. These have unique properties that raise the fiber level and also serve other functions in the formulation of food products. For example, Cellulose ethers are used for a wide range of different functions within food: thickening, gelling, generating mouth-feel, film-forming, foaming, improving bake-stability, improving freeze-thaw stability, preventing crystal growth, stabilizing suspensions or emulsions, and encapsulation. Especially, these are showed significant reduction in oil uptake in food and also used in dietary fat absorption inhibitor.
**D3-4**

**Immunostimulating Sulfated-polysaccharides from Marine Algae and Their Application in Food Industry**

**SangGuan You**

*Department of Marine Food Science and Biotechnology, Gangneung-Wonju National University, Korea*

Sulfated polysaccharides (SP) were extracted from marine algae, fractionated using ion-exchange chromatography, and investigated to determine their structural characteristics and immunomodulatory activities. The crude and fractionated polysaccharides were mainly composed of carbohydrates, sulfates and uronic acid including various amounts of proteins. The sulfated polysaccharides stimulated a macrophage cell line, Raw 264.7 cell, inducing considerable nitric oxide (NO) and various cytokines productions through the up-regulated mRNA expression. The NO inducing capacity of the SPs from algae was closely involved with their structural features such as sulfate and protein contents and molecular weight. The structure-activity relationship was highly dependent on the origins of the SPs. These results suggested that the SPs from marine algae could be strong immunomodulators and be applied not only in foods but in nutraceutical products.

**D4-1**

**Evaluation of Food Texture Using Mastication Measurements**

**Kaoru Kohyama**

*Food Function Division, National Food Research Institute, National Agriculture and Food Research Organization, Japan*

Most food properties are perceived through oral receptors during eating. Food oral processing is a dynamic process, in which a mouthful of food is reduced in heterogeneity and converted into a swallowable bolus. During this short period (<100 s), food is broken down, mixed with saliva, and a bolus is prepared, ready for swallowing. Food never reaches an equilibrium state, although it is homogenized. Instrumental test results are often inconsistent with sensorily perceived food texture. Instruments normally perform a much simpler movement and at a slower rate than human mastication and do not accord to moisture and temperature changes during oral processing. Moreover, many receptors are used for determining the mechanical properties, size, shape, and movement during temporal/spatial changes of food materials. I will introduce unique studies on food texture based on mastication measurements in humans. One example is the use of a multiple-point pressure sensor that may be used as a mechanical sensor of an instrument and can be inserted into the mouth with food. Another example is electromyography of masticatory muscles during chewing and swallowing. These physiological methods well analyze the human mastication system and can correlate instrumental and sensory results.
Reliable prediction of textural (or rheological) properties of food materials with respect to processing conditions is very important to design an adequate process and equipment accordingly. The dynamics of changes in the textural properties of food materials is determined by a series of chemical reactions and transport phenomena during thermal processing. The transport phenomena include heat, mass, and momentum transfer. The major chemical reactions related to textural properties are protein denaturation and starch gelatinization. These phenomena and reaction kinetics should be coupled as they affect each other, so called “multi-physics”. Thus, to understand and optimize the complex processes efficiently, and to design novel thermal processes or equipment for tailored product textural quality, computer simulation based on the multi-physics approach is a very useful solution. Compared with other engineering fields, such as aerospace and automobile, the adoption of this technology has been much less spotlighted in the food processing area. This presentation covers how to set up mathematical models for individual transport phenomena, how to model the dynamics of changes in textural properties of food materials during thermal processing, and how to couple all of the physical phenomena and solve them simultaneously with the help of a computer. The examples include dynamics of changes in viscoelastic properties of a tofu during frying with stress relaxation and a discrete linear Maxwell model. The justification of using reaction kinetics for the dynamics of textural changes is also presented.

The rheological approaches on the physicochemical attributes of dairy products: mechanical perspectives

The physicochemical attributes of dairy products, such as texture, melting, and whey separation, are key criteria for quality and consumer acceptance. In many dairy products, cheese and yogurt can be considered as viscoelastic material and are formed by the coagulation (or gelation) of milk protein via proteolysis and acidification. The manufacturing variables, such as heat treatment, incubation temperature, inoculation rate, mineral content or pH, during cheese and yogurt making process are a crucial factor on the physicochemical attributes of cheese and yogurt. Those attributes can be explained on the chemical interactions of milk components (e.g., electrostatic repulsions or hydrophobic attractions). Various rheological tests, such as small amplitude oscillatory rheology and large deformation test, can provide the information on the forces and chemical interactions, which can be related with the formation and internal integrity of rennet or acid-induced gel like cheese and yogurt. Those rheological measurements can also be used to determine the physicochemical attributes of cheese and yogurt. An understanding of physicochemical attributes can allow dairy manufacturers to enhance texture and melting properties and avoid undesired problems like whey separation in dairy products including cheese and yogurt.
Practical Insights into Normal Stress in the Food Application Environment

Suyong Lee
Department of Food Science & Technology and Carbohydrate Bioproduct Research Center, Sejong University, Korea

The rheological properties of foods are generally as people have learned to expect them to be. Therefore, rheological measurements are quite critical in the food industry as a useful tool to evaluate the quality attributes of the raw materials, the intermediate products, and the final products. Although the basic concept of stress and strain is key to all rheological analysis, the lack of fundamental information on the foods derived from their complicated structure and composition, discourages the food industry from scientifically interpreting the rheological properties of the foods. In this study, rheological approaches based on normal stress were applied from different perspectives and then correlated with a variety of food quality attributes. Specially, new rheological techniques (e.g., squeezing flow, planar extensional, and impulse methods) that can be readily applied in the field of food processing, were tested for more practical applications. This study may thus provide an opportunity for the food manufacturers to move toward the consistent control of food qualities by understanding normal stress-based rheological techniques.

Beneficial Effects of Seafood Extracts on Skin Photoaging

Hyo Jung Kim
Research Institute for Biological Functions, Chubu University, Japan

Environmental stimuli, such as UVB irradiation, play a pivotal role in the mechanism underlying melanin synthesis. Exposure to sunlight promotes the overexpression of melanogens like endothelin (ET)-1 and stem cell factor (SCF) in keratinocytes, which could lead to paracrine activation and proliferation that in turn renders cells more susceptible to transformation, subsequently resulting in the synthesis and activation of tyrosinase for melanin induction. The development of natural pigmentation inhibitor has become a new approach and recently, marine species have been targeted for screening of cosmeceutical compounds. However, the active compounds for treating and preventing hyperpigmentation disorders have caused many side effects including depigmentation in normal skin color as well as skin irritation, contact dermatitis, and exogenous ochronosis in dark skin. Therefore, downregulation of environmental stimuli-induced melanogenesis without affecting constitutive pigmentation could be an improved method for the measurement of antimelanogenic effects. In light of these concerns, we have carefully evaluated the inhibitory effects of extracts from seafoods on melanogens-triggered hyperpigmentation both in normal human melanocytes and human epidermal equivalents. All the tested extracts did not show any direct changes on tyrosinase activity assays using cell lysate and attenuated the ET-1 plus SCF-activated intracellular signaling pathways, suggesting that the extracts from marine species might exhibit skin whitening effects in abnormally hyperpigmented status, but not in normal skin conditions, thus evidencing its in vitro/in vivo safety.
Characterization of a Novel Alkaline Arylsulfatase from *Marinomonas* sp. FW-1 and Its Application in Desulfation of Red Seaweed Agar

Xiaoting Fu*, Xueyan Wang

College of Food Science and Engineering, Ocean University of China, China

A marine bacterial strain *Marinomonas* sp. FW-1 capable of hydrolyzing sulfate ester bonds of p-nitrophenyl sulfate and agar was isolated from the coastal area of Qingdao, China. This study was focused on the purification of the enzyme and to apply it for enzymatic production of agarose instead of the traditional chemical method. The enzyme was purified by ultrasonic cell disruption, ammonium sulfate precipitation, ion-exchange, and gel filtration chromatographies, in that order. The molecular weight was determined by SDS-electrophoresis, and various characteristics were determined. Finally, it was apply to remove the sulfate group from the agar of red algae. The arylsulfatase was purified to homogeneity by ion-exchange and gel filtration chromatographies with a recovery of 13% and a fold of 54. The arylsulfatase was composed of a single polypeptide chain with the molecular mass of 33 kDa. The pH and temperature optima of the arylsulfatase were pH 11 and 45°C, respectively. It was stable over pH 7-77 and at temperature up to 65°C. The purified arylsulfatase was applied to degrade the sulfate of agar, and the result indicated that, the rate of removal the sulfate group in *Gelidium* and *Gracilaria* agar were 86.11% and 89.61%, respectively. Therefore, it is the first report on arylsulfatase purified from *Marinomonas* sp. bacterium. The results of this study lay a good foundation for enzymatic production of agarose.

Histamine Fish Poisoning in Taiwan

Yung-Hsiang Tsai

Department of Seafood Science, National Kaohsiung Marine University, Taiwan

Histamine fish poisoning (HFP), also called scombroid poisoning, is an allergy-like form of food poisoning which attributed to seafood consumption. Histamine is a chemical hazard and the main causative agent of scombroid poisoning. Fish with high levels of free histidine, the enzyme substrate converted to histamine by bacterial histidine decarboxylase, are those most often implicated in HFP. HFP accounted for 56 incidents and 2310 cases in Taiwan between 1994 and 2012. The sailfish, swordfish and marlin fillets have become the most frequently implicated fish species in scombroid outbreaks in Taiwan. In addition, canned mackerel, dried milkfish, tuna dumpling, mahi-mahi fillet and milkfish stick also recently implicated in food borne poisonings. The most suspected fish samples contained 37 to 293 mg/100 g of histamine. Given the allergy-like symptoms of the victims and the high histamine content in the suspected fish samples, these food-borne poisonings were strongly suspected to be due to histamine intoxication. High levels of histamine occurred in fish resulted from fish contaminated by histamine-forming bacteria in boat or processing environments, and mishandled and thawed in time-temperature abused.
Sleep is vital to maintain health and well-being due to its primary function of providing rest and restoring the body’s energy levels. However, insomnia is currently a widespread health complaint, and has become a prevalent and disruptive problem worldwide. In developed countries, natural sleep aids have become popular as alternatives to prescription sleep drugs to improve sleep quality and avoid side effects. In recent, Gamtae extract (GE), the product-specific health functional food with sleep-enhancing effects has been approved from KFDA. GE contains marine polyphenol phlorotannins from Gamtae (Ecklonia cava). The effects of GE on sleep-wake profiles in mice were evaluated in comparison with the sedative-hypnotic diazepam, and their hypnotic mechanism was also investigated. GE (250 and 500 mg/kg) produced a significant decrease in sleep latency and an increase in the amount of non-rapid eye movement sleep (NREMS). GE had no effect on EEG power density, an indicator of the depth or intensity of NREMS. Diazepam produced a typical decrease in delta activity. These results imply that GE induces NREMS similar to physiological sleep. The hypnotic effect of GE was completely blocked by flumazenil. These findings support the idea that the hypnotic effects of GE should be attributed to the positive allosteric modulation of GABA A receptors at the BZD-binding site. In clinical polysomnography study, GE significantly reduced wake after sleep onset (WASO) of volunteers.

In recent years, a considerable amount of research has focused on the liberation of bioactive peptides which are encrypted within food proteins, with a view to utilizing such peptides as functional food ingredients aimed at health maintenance. These functional properties of proteins can be improved by specific enzymatic hydrolysis under controlled conditions. Meanwhile, biologically active peptides obtained from marine animal species are considered to have diverse activities, including immunomodulatory, antimicrobial, antioxidant, antithrombotic, hypocholesterolemic, antihyper-tensive actions, and so on. Especially, shellfish contain significant levels of high quality protein and are therefore a potential source for biofunctional high-value peptides. Mytilus coruscus belongs to the family Mytilidae, one of the main cultured species of marine shellfish in Korea, and has been used as food and medicine for thousands of years. Ruditapes philippinarum is a genus of marine bivalve molluscs, in the family Veneridae. R. philippinarum is one of the main cultured species of marine shellfish in East Asia as well as the Mediterranean, and has been used as food. Pacific oyster, Crassostrea gigas, naturally occurring in Japan, China, and Korea, is now a worldwide species for oyster cultivation industries. It is economically important and has had the highest worldwide production of any cultured aquatic animal species since 1993. Therefore, we purified novel bioactive peptides from various shellfishes. For the purification, eight proteases were applied for enzymatic hydrolysis. Among these enzymatic hydrolysates, the most active hydrolysate was further purified using a flow filtration system and consecutive chromatographic methods. Finally, we obtained eight novel bioactive peptides, and the sequences of the purified peptides were investigated.
Application of Bacteriophages and Their Endolysins for Biocontrol of Clostridial Pathogens

Melinda Mayer, Emma Meader, Matthew Dunne¹, Teresa Gervasi, Rob Meijers¹, Arjan Narbad

Institute of Food Research, United Kingdom
¹European Molecular Biology Laboratory (EMBL), Germany

The development of new antimicrobial agents as an alternative to antibiotics is a matter of worldwide importance. Bacteriophage therapy was initiated against dysentry nearly 100 years ago, however the advent of the discovery of the antibiotics resulted in the decline of this technology in the West. In the last decade the problem of antibiotic resistance has resulted in renewed interest in development of new therapies based on phages and phage products. We investigated the use of a specific bacteriophage, ΦCD27 in a human colon model of C. difficile infection (CDI) and demonstrated a significant reduction in the burden of C. difficile cells and toxin production with phage treatment but lysogenic nature of the phage limited its application. An endolysin CD27L derived from this phage was purified and its mode of action was established after determination of its 3D structure by protein crystallisation. Engineering of the cell wall binding domain improved its activity and its potential use in treatment of CDI was demonstrated since it retained its specificity without any detrimental effect on commensal gut microbiota. In parallel we also identified another endolysin CP25L that specifically targeted the pathogen C. perfringens which is a major cause of human food borne poisoning but caused necrotic enteritis in animals, particularly poultry. The cp25l gene was cloned and expressed in E. coli and the gene product demonstrated lytic activity against all 25 C. perfringens strains tested. The probiotic strain Lactobacillus johnsonii FI9785 was subsequently engineered for extracellular secretion and in vivo delivery of the endolysin to the gastrointestinal tract for biocontrol of C. perfringens.

Antimicrobial Compounds Produced by Bacterial Isolates from Korea Domestic Honey

Hyungjae Lee

Department of Food Engineering, Dankook University, Korea

In total, 796 bacterial strains were isolated from thirteen different varieties of Korea domestic honey. Among them, a bacterial stain (No. 518) isolated from a variety of honey was found to show high level of antimicrobial activity against a food pathogen, Listeria monocytogenes ATCC 15313. The isolate was identified as a strain of Bacillus cereus by 16S rDNA sequencing, so it was designated as B. cereus BFF518. The antimicrobial compound from B. cereus BFF518 was partially purified through 70% ammonium sulfate precipitation, followed by Octyl-Sepharose CL-4B. Subsequently, a single active compound was purified using reverse-phase HPLC (RP-HPLC) with C18 column. The purified compound was completely inactivated by pronase E, proteinase K, and α-chymotrypsin, indicating that the active compound is proteinaceous. The compound exhibited antibacterial activity not against Gram-negative bacteria such as E. coli and Salmonella enterica, but against Gram-positive food pathogens including Bacillus cereus ATCC 14579, Staphylococcus aureus KCTC 1916, and L. monocytogenes ATCC 15313. In this study, we attempted to isolate natural microbiota of different varieties of Korea domestic honey as new sources of bacterial isolates, producing novel antimicrobial peptides. The antimicrobial peptides from natural microbiota may be highly applicable in the food, agricultural, livestock and pharmaceutical industries to prevent or control spoilage and pathogenic microorganisms.
Bacteriocins from Lactic Acid Bacteria: Characterization and Potential Applications

Takeshi Zendo1*, Kenji Sonomoto1,2

1Department of Bioscience and Biotechnology, Faculty of Agriculture, Kyushu University, Japan
2Department of Functional Metabolic Design, Bio-Architecture Center, Kyushu University, Japan

A wide variety of bacteria including lactic acid bacteria (LAB) are found to produce antibacterial peptides ribosomally, which are called bacteriocins. LAB bacteriocins prevent the growth of gram-positive bacteria and are thought to contribute to preservation of fermented foods. LAB bacteriocins generally exert antibacterial activity through quick action on bacterial cell membrane and can be degraded easily by intestinal digestive enzymes without leaving residues to the environment, which lets them considered as safe antimicrobial agents. In particular, nisin A, the most representative bacteriocin produced by some strains of Lactococcus lactis, has been utilized as a food preservative in more than 50 countries. Based on its safety, we have also developed various applications of nisin A such as prevention and cure agents of bovine mastitis and oral care agents. For further extensive applications of LAB bacteriocins, we are screening new LAB isolates for novel bacteriocin production. To obtain various novel bacteriocins rapidly, we developed a method to evaluate bacteriocins, which uses culture supernatants of LAB isolates as samples and comprises statistical analyses of antimicrobial spectra against about 10 indicator strains and molecular mass determination with LC/MS. The developed method enabled us to discover various novel LAB bacteriocins such as lacticin Q and lactocyclicin Q. Lacticin Q is a leaderless bacteriocin produced by L. lactis QU 5 and shows a broad antimicrobial activity spectrum and high activity through pore formation on bacterial cells. Lactocyclicin Q is a circular bacteriocin produced by Lactococcus sp. QU 12, whose N- and C-terminal amino acid residues are bound with a peptide bond. In addition, we discovered a variety of bacteriocins from various LAB species. Among them, appropriate bacteriocins are expected to be selected and used according to their characteristics to satisfy our varied purposes.

Potential of Antimicrobial Compounds from GRAS Microorganisms in Food Bio-preservation

Hae Choon Chang

Department of Food and Nutrition, Kimchi Research Center, Chosun University, Korea

Spoilage of food and feed due to microbial deterioration by food-borne pathogens is a worldwide problem that impacts public health, food security, and the economy. Chemical and physical food preservation techniques are commonly utilized. Recently, consumers have made demands for high quality, safe, fresh (or minimal processed), natural, and extended shelf-life foods. Thus, the need for naturally produced antimicrobial agents has increased. Natural food preservatives used in the food industry are mainly plant-derived products. Although these have less toxicity compared to chemical preservatives, they carry a distinct flavor and taste due to their plant origin, resulting in undesirable sensory characteristics for food usage. On the other hand, antimicrobial compounds obtained from microorganisms have no flavor or taste, which are ideal characteristics for a food additive. Microbial antimicrobial agents approved by the KFDA are nisin from the GRAS microorganism Lactococcus lactis as well as lysozyme, polyllysine, and natamycin from non-GRAS microorganisms. Even though LAB produced antimicrobial compounds, it showed a narrow antimicrobial spectrum as well as insufficient antimicrobial activity as a food preservative. Such limitations can be overcome by development of new antimicrobial agents from GRAS microorganisms. In this study, we isolated GRAS microorganisms harboring strong antimicrobial activities as well as broad antimicrobial spectra from kimchi and daenjang and identified antimicrobial compounds. In addition, we evaluated the antimicrobial capacity of isolated GRAS microorganisms as biopreservatives in a food model.
Role of Food and Nutritional Scientists Contributing Creative Economics through Technology Commercialization

Taesun Park
Department of Food and Nutrition, Yonsei University, Korea

Supported by the research and development grant money funded by Korean government, the quantity and quality of scientific papers published by Korean faculties and researchers have been increased substantially for the last 20 years. The outcomes of research and development conducted in Universities should also be reflected in economic growth in Korea through successful technology commercialization. In the field of Food and Nutrition, intellectual properties obtained from laboratories should be protected properly as patents and then licensed out to companies where it is needed for the commercialization of health functional foods, cosmetics, or drugs. It is the time to discuss efficient models connecting technologies from laboratory to products alive in market.

Industrial Potential of Fingerroot (Boesenbergia pandurate (Roxb.) Schltr.) as an Anti-obesity and Anti-aging Nutraceutical

Jae-Kwan Hwang
Department of Biotechnology, Yonsei University, Korea

Fingerroot (Boesenbergia pandurate (Roxb.) Schltr.), belonging to Zingiberaceae, is an edible tropical medicinal plant that has long been traditionally used to treat various diseases. B. pandurate extract (BPE), standardized by panduratin A as a bioactive compound, decreased triglyceride accumulation in both 3T3-L1 adipocytes and HepG2 hepatocytes through AMP-activated protein kinase (AMPK) signaling and increased mitochondrial biogenesis in L6 myoblasts through peroxisome proliferator-activated receptor gamma coactivator-1 α (PGC-1α). In high-fat diet (HFD)-induced C57BL/6J mice, BPE (200 mg/kg/day for 8 weeks) significantly reduced body weight gain with improving serum lipid profiling. BPE also reduced fat pad mass and adipocyte size in fat tissue and inhibited the development of nonalcoholic fatty liver by decreasing hepatic triglyceride accumulation in liver. In addition, BPE increased running distance and skeletal muscle mass in normal and HFD-induced obesity mice. It was also found that BPE (200 mg/kg/day for 13 weeks) markedly suppressed wrinkle formation, and transepidermal water loss (TEWL) through inhibiting matrix metalloproteinases (MMPs) in UVB-induced HR-1 hairless mice. Both anti-obesity and anti-aging activities of BPE were clinically evidenced by two independent human studies. Overall, it is anticipated that BPE could be employed as a potential material for anti-obesity and anti-aging health functional foods.
Development of New Health Food Using Panax Ginseng Berry Industrialization

Chan-Woong Park
R&D Center, Amorepacific Co., Korea

*Panax ginseng* has been widely used in Korea, China, and Japan as an herb with health benefit for more than 2,000 years and has become a major health ingredient around the world. However, most research and technology had focused on the root of ginseng so that only conventional ginseng extract or root products could be introduced to consumers in health food market. Moreover the “Ginsana” product of Pharmaton Co. has been classified as a representative ginseng product in the world ginseng health food market. We have been interested in the other part of *Panax ginseng* that different parts of the ginseng could have different bioactivity. In order to find out new value from *Panax ginseng* and develop a new ginseng health food for global market, the standardization technology for *Panax ginseng* berry and a couple of function of ginseng were investigated. Nowadays, we are seeing that there is dramatically increasing social and scientific interest in health aging as aging population all through the world. People have started to understand the importance of health-life to make better quality of life with health food products. We have tried to identify the new bioactive compound and have succeeded to develop the new health food including ginseng berry. The ginseng berry product is expected to get different value and can give a help our ginseng farm industry has a new income source as well.

Patenting Strategies for Inventions Relating to Health Functional Food

Boo-Hyun Yang
Zenith Patent and Law Firm, Korea

For commercialization of health functional foods, it is generally understood that patents to protect inventions have to be obtained. Patentable inventions relating to health functional foods includes (i) compositions for improving a certain disorder such as obesity, diabetes, bone disorders, post-menopausal symptoms and allergic conditions, as well as (ii) methods for preparing active ingredients. Furthermore, patents for protecting own inventions have to be issued with claims as broad as possible. As such, patenting inventions relating to health functional foods need suitable strategies such as types and amount of experiments, claim drafting and writing patent specification. Herein, successful patenting strategies will be suggested.
Time-of-Flight (TOF) GC-MS systems are now well established, and are used for many different applications worldwide. They possess many advantages over traditional scanning instruments, such as an extremely fast acquisition rate, a freedom from spectral bias, and the ability to acquire full mass range spectra for compounds present at very low level. The first two features allow the use of very efficient spectral deconvolution algorithms. LECO’s provides four TOF GC-MS systems, compromising a GC-TOFMS, a GCxGC-TOFMS, a GC-HRT and a GCxGC-HRT instrument. Each system has particular strengths which make it ideal for the complex and demanding analyses frequently required in the food industry. The GCxGC systems provide very high peak capacity, and can achieve excellent chromatographic resolution. This coupled with the spectral deconvolution allow for the determination of a maximum number of components in complex samples, even those at very low level. The high resolution (HRT) systems are able to measure mass extremely accurately, less than 1 ppm is routine, which is useful in structure confirmation and determination. This lecture will demonstrate the use of TOFMS systems in the resolution of problems encountered in the food industry. Among these will be the analysis of edible oils, pet food aroma profiling, beer aroma profiling, hop flavor profiling to determine and optimize process parameters, and the identification of essential oil profiles in food flavours derived from plant natural products. The results discussed indicate that comprehensive gas chromatography is a powerful technique in the food and flavour industry as it allows a better understanding of the complex spectrum of flavour components contained in the sample. Accurate measurement of molecular mass allows confident formula assignment and assists in structural assignment.

Antioxidant Activity of Volatile Compounds Isolated from Broccoli (\textit{Brassica oleracea} L.) Sprouts by GC and GC-MS

Hae Won Jang*, Takayuki Shibamoto

Food Analysis Center, Korea Food Research Institute, Korea

1Department of Environmental Toxicology, University of California, Davis, USA

Broccoli (\textit{Brassica oleracea} L.) sprouts have received much attention recently because they contain various bioactive constituents, which are not present in broccoli. However, there are virtually no reports on their biological activities, including antioxidant, bactericidal, and anti-inflammatory. Moreover, there are no reports on the biological activity of the volatile compounds from broccoli sprouts. In the present study, volatile extracts of broccoli sprouts were obtained by a steam distillation under reduced pressure, followed by a liquid-liquid continuous extraction and then examined for their antioxidant activities using aldehyde/carboxylic acid and lipid/malonaldehyde (MA) assays. All samples exhibited dose-dependent antioxidant activity. The antioxidant activity ranged from 74.5±0.5% (less volatile sample) to 99.5±0.5% (volatile sample) at the level of 500 μg/mL. Antioxidant activity of samples obtained from broccoli sprouts was comparable to that of known antioxidants, α-tocopherol and BHT. Subsequently, volatile extracts were analyzed by gas chromatography and gas chromatography-mass spectrometry to identify principle antioxidants. Among the 43 compounds positively identified by gas chromatography/mass spectrometry, 4-methylpentyl-isothiocyanate (2.48 μg/g) was found in the greatest concentration, followed by 4-thiophenethylisothiocyanate (10.63 μg/g), 3-methylthiopropylisothiocyanate (14.55 μg/g). These isothiocyanates are known to possess antioxidant properties. Possible phenolic antioxidants found are 4-(1-methylpropyl)-phenol (0.012 μg/g), 4-methylphenol (0.159 μg/g) and 2-methoxy-4-vinylphenol (0.009 μg/g). The present study demonstrates that broccoli sprouts are a good source of natural antioxidants.
Accurate Analysis of Hazardous Material in Food by LC-MS

Byungoo Kim

Center for Organic Analysis, Korea Research Institute of Standards and Science, Korea

LC/MS is more frequently used these days in food analysis area as it allow accurate determination of trace amount of hazardous materials such as veterinary drug residues, pesticides, mycotoxins, and micronutrients in food because of its high selectivity and sensitivity. However, analytical methods based on LC/MS usually suffer from matrix effects (ion suppression/enhancement), and ignoring these factors can cause strong biases in measurement results. Several techniques can be used to deal with the matrix effect issues. Infinite dilution of extract can be used but is limited as it reduces sensitivity. Matrix matching calibration is another solution if blank sample with ideally same matrix, or standard addition method can be used. Isotope Dilution Mass Spectrometry (IDMS), using isotope labeled analogues of target analytes as internal standards, has been believed to be the solution for matrix effects. Our laboratory, the national metrology institute (NMI) of Korea, is developing reference methods for food analysis which can provide national standards to ensure reliability of food testing laboratories. Those reference methods are based on IDMS because IDMS is known to provide accurate analytical results without systematic bias through the accurate correction of the recovery on target analytes along the sample clean up processes. However, we observed in several cases that matrix effects were not completely compensated when deuterium-labeled analogues of target analytes are used as internal standards. Those deuterium-labeled analogues have slightly different chromatographic retention times from their corresponding target analytes and can experience different ionization conditions. A few examples of those cases and solutions for these adverse effects will be presented. Solutions adopted were more rigorous sample clean-up and optimizing chromatographic separation. Recently, we adopted a standard addition method in combination with isotope dilution techniques for alternative solution when those strategies do not work.

Micro plate Chemiluminescence Enzyme Immunoassay for Aflatoxin B1 in Agricultural Products

Jin-Ming Lin

Department of Chemistry, Beijing Key Laboratory of Microanalytical Methods and Instrumentation, Tsinghua University, China

Aflatoxins (AF) are toxic compounds which are produced as secondary metabolites by the fungi of *Aspergillus flavus* and *Aspergillus parasiticus* growing on a variety of agricultural products. It was first discovered and confirmed in the study of Britain “X” disease about died turkeys in 1969. Aflatoxins are a group of compounds containing molecular structure of a coumarin and a double-furan ring. These toxins are known to be carcinogenic, mutagenic, teratogenic and immunosuppressive. Among the 18 identified aflatoxins, the major ones are AFB1, AFB2, AFG1, and AFG2. AFB1 can cause chromosome aberration and DNA damage to animal and plant. AFB1 exists widely in agricultural products, such as peanuts, corn, soybean, and rice, which can enter animal or human food chain and result in food safety problems. Therefore, developing a detection method for AFB1 in agricultural products with specificity and sensitivity, high throughput, rapidity and simpleness has great practical significance. AFB1 is a small molecule without immunogenicity, and only has antigenicity that is immunoreactivity between antigen and antibody. In this work, chemiluminescence enzyme immunoassay (CLEIA) based upon antibody coated format with low detection limit was designed for the determination of AFB1 in agricultural products. The proposed method used the antibody coating micro plate as solid phase, and a horseradish peroxidase (HRP)-luminol-H₂O₂ system with high sensitivity was introduced in the assay. Effects of several physicochemical parameters were investigated. The proposed method has been successfully applied to the determination of AFB1 in 15 agricultural samples and showed a good correlation compared with the commercially ELISA kit. An automatic multi-channel ink-jet ejection chemiluminescence method and its application luminal-HRP will also be introduced.
Development of Analysis Method for PFCs Migrated from Utensils and Packaging Materials Coated with Fluorocarbon Resin

Jae-Chun Choi*, Hee-ju Choi, Se-Jong Park, Meehye Kim
Food Additives and Packaging Division, Ministry of Food and Drug Safety, Korea

A perfluorinated compounds (PFCs) are used in the manufacturing of food packaging articles including non-stick coatings for cookware, and also paper coatings with oil and moisture resistance. In this study, we have developed method for the analysis of 16 PFCs (PFOA, PFOS and PFDS, etc..) migrated from the above food packaging articles to food simulants. Liquid chromatography-tandem mass spectrometry (LC/MS/MS) using electrospray ionization(ESI) in negative ion mode was employed to determine residues of PFCs by using a gradient reversed-phase method with ammonium acetate/methanol. The method was validated for PFCs analysis by measuring recovery, limit of detection (LOD), limit of quantification (LOQ), and linearity of calibration curve. Recovery, LOD and LOQ showed good results. The recovery of 16 PFCs showed 78.1-116.0%. A good linearity was established for 16 PFCs in a range of 0.25-30 μg/kg, with R²=0.99. The developed method in this study would be used as the basic information for food packaging articles safety management.

Gut-microbe Symbiosis and Dysbiosis: A View from Drosophila

Won-Jae Lee
National Creative Research Initiative Center for SymbioSystem and Department of Biological Science
Seoul National University, Korea

Gut microbiota is found in virtually any animals, from invertebrates to vertebrates. It is now evident that gut microbiota directly influences a variety of aspects in animal physiology such as immunity, development, and metabolism. However, the exact molecular mechanisms by which gut microbiota achieves the host physiological homeostasis are largely unexploited. Here I will present and discuss recent discoveries regarding the molecular dialogues between bacteria and animals, using a genetic Drosophila model organism. Specifically, I will introduce how gut epithelia react to pathogens by using oxidant weapons, how beneficial gut bacteria influence host immunity and development, and how gut immunity distinguishes between beneficial commensal bacteria and life-threatening pathogens. Future studies in this direction in different invertebrate and vertebrate animal models will certainly provide a unique opportunity to better understand the evolutionarily conserved dialogue between prokaryotes and eukaryotes.
A Pathway Engineering Platform for Lactic Acid Bacteria

Wentao Kong1,2, Chen Liao1,2, Venkata S. Kapuganti3, Ting Lu1,2*
1Department of Bioengineering, 2Institute for Genomic Biology and 3Department of Chemical and Biomolecular Engineering, University of Illinois at Urbana-Champaign, USA

Recent developments in synthetic biology have positioned lactic acid bacteria (LAB) as one major class of cellular chassis for therapeutic and food-related applications. To achieve the full potential of LAB, one fundamental prerequisite is the capacity for rapid engineering of complex gene networks, such as natural biosynthetic pathways and multi-component synthetic circuits, into which useful cellular functions are encoded. Here, we present a synthetic biology platform for rapid construction and systematic optimization of large-scale gene networks in LAB. The platform involves a shuttle for hosting target networks and two associated strategies that enable efficient genetic editing and phenotypic validation. By using a nisin biosynthesis pathway and its 70 variants as examples, we demonstrated multiplex, continuous editing of small DNA parts, such as ribosome-binding sites, as well as efficient manipulation of large building blocks like genes and operons. To further showcase the platform, we applied it to decode the architecture-function relationship of the nisin pathway by generating additional 32 pathway variants and comparing their phenotypes with the predictions from a mathematical model. This work demonstrates the feasibility of rapid and advanced engineering of complex gene networks in LAB, fostering their applications in biomedicine and other areas. It also aids in the development of synthetic biology fundamentals from the engineering of individual parts and modules to the programming of complex systems.

The Novel Metabolic Pathway of 3,6-Anhydro-L-galactose for Producing Bio-based Products Using Red Macroalgae

Eun Ju Yun1, Saeyoung Lee1, In-Geol Choi1, Kyoung Heon Kim1,2*
1Department of Biotechnology, Korea University Graduate School, Korea
2Department of Food Bioscience and Technology, Korea University, Korea

Marine macroalgae are under active consideration as third-generation biomass to be used for producing bio-based products such as fuels and chemicals owing to the abundance of carbohydrates in macroalgae. Macroalgae generally contain no lignin unlike lignocellulose that is considered as second generation biomass. However, macroalgae contain unique sugars, which are not common in terrestrial plants and is not fermentable. In order to fully utilize the carbohydrates of macroalgal biomass for the production of biofuels and chemicals, the metabolic pathways of macroagal sugars need to be understood. Uronate and 3,6-anhydro-L-galactose (AHG), the rare sugars of brown and red macroalgae, are the examples of rare sugars of brown and red macroalgae, respectively. The elucidation of the metabolic pathway and the pathway engineering of uronate in ordinary fermentative microorganisms have been already completed. However, AHG, the main sugar component of red macroalgae, has remained unknown until we have elucidated the novel catabolic pathway of AHG in this study. We have identified two novel enzymes and their corresponding genes as the key metabolic enzymes and genes for the conversion of AHG into a common metabolite, 2-keto-3-deoxy-galactonate (KDGal) through the integrated analyses of metabolite and transcriptome of Vibrio sp. EJY3 grown on AHG. From these two metabolic steps, 3,6-anhydrogalactonate (AHGA) and KDGal were identified as the metabolic intermediates. Especially, this is the first discovery of AHGA is as a metabolite for any living organisms.
Genetic Tools for Rapid Profiling of Single Cell Enzyme Activities

Seung-Goo Lee*, Dae-Hee Lee, Haseong Kim, Soo Jin Yeom

Synthetic Biology and Bioengineering Research Center, Korea Research Institute of Bioscience and Biotechnology (KRIBB), Korea

Synthetic biology, an emerging field of increasing scientific interest, involves the design and construction of new genetic parts, advanced device, and the artificial biological systems for useful applications in research and industry. Our efforts focus mainly on the development of new genetic devices for single cell analysis and high throughput screening platform. We use various flow cytometry and colony imaging techniques that are coupled with artificial genetic circuits to detect key compounds in microbial cells. Finding and engineering of important enzymes, precise regulatory parts, and new metabolic pathways are challenged eventually to yield microbial cell factories. In this presentation, we report new tools for rapid analysis of diverse enzymes using an artificial genetic circuit, based on the recognition of catalytic products, which are created by enzymatic or metabolic reactions. The catalytic product activates a transcriptional factor to express a fluorescent reporter gene. In cells harboring this genetic system, various enzymes such as cellulase, lipase, phosphatase, tyrosine phenol-lyase, methyl parathion hydrolase, and isoprene synthase were successfully detected using a high throughput flow cytometry. Eventually, the hyper sensitivity, versatile applicability, and quantitative nature of this genetic circuit along with flow cytometry techniques can provide a widely applicable tool-box for discovering and engineering novel enzymes and pathways in a single cell level. In addition, I am going to discuss about our development of fluorescence resonance energy transfer-based biosensors to rapidly quantify different sugars in beverage samples, fermentation broths, and in living yeast cells.

Molecular Mechanism of Peroxide Sensing in Bacteria

Inseong Jo, In-Young Chung¹, Hee-Won Bae¹, Jin-Sik Kim, Saemee Song, You-Hee Cho¹, Nam-Chul Ha*

Department of Agricultural Biotechnology, Center for Food Safety and Toxicology, Research Institute for Agricultural and Life Sciences, Seoul National University, Korea

¹Department of Pharmacy, College of Pharmacy, CHA University, Korea

Pathogens can cope with the hydrogen peroxide generated from host immune systems. OxyR, a bacterial peroxide sensor, is a LysR-type transcriptional regulator (LTTR) that regulates the transcription of defense genes in response to a low level of cellular H₂O₂. Consisting of an N-terminal DNA-binding domain (DBD) and a C-terminal regulatory domain (RD), OxyR senses H₂O₂ with conserved cysteine residues in the RD. However, the precise mechanism of OxyR is not yet known due to the absence of the full-length (FL) protein structure. Here, we determined the crystal structures of the FL and RD of Pseudomonas aeruginosa OxyR and its C199D mutant proteins. The FL crystal structures revealed that OxyR has a tetrameric arrangement assembled via two distinct dimerization interfaces. The C199D mutant structures suggested that new interactions that are mediated by cysteine hydroxylation induce a large conformational change, facilitating intramolecular disulfide bond formation. More importantly, a bound H₂O₂ molecule was found near the Cys199 site, suggesting the H₂O₂-driven oxidation mechanism of OxyR. Combined with the crystal structures, a modeling study suggested that a large movement of DBD is triggered by structural changes in the regulatory domains upon oxidation. Taken together, these findings provide novel concepts for answering key questions regarding OxyR in the H₂O₂-sensing and oxidation-dependent regulation of antioxidant genes. Pathogens, including food-poisoning bacteria, could be efficiently controlled, if the appropriate inhibitor of OxyR of bacteria is developed in the future.
Enzymes have been widely used as catalysts in lipid science and technology, and, therefore, they have been especially useful for industrial purposes such as production, modification, processing, and purification etc. of lipids and lipid-related materials. Enzymes used for lipid science and industry include lipases, phospholipases, esterases, oxygenases, and lipoxigenases etc. The substrate specificity of lipases can be classified into fatty acid specificity, positional specificity, alcohol specificity, triacylglycerol specificity, acylglycerol specificity, and hydrophobicity/hydrophilicity of the substrate. Lipases possessing substrate specificity, catalyze hydrolysis, esterification, alcoholysis, and esterification etc. Lipases have been used for specific and nonspecific synthesis of structured lipids, and for concentration of particular fatty acids such as EPA and DHA. Phospholipases are used for degumming process of fats and oils, whereas lipoxigenases are used for modification of fatty acids. The main points for the consideration of enzymatic processing can be different from case to case, and from place to place, and they include the process efficiency, product quality, environmental pollutions, social perception, and progress of green technologies etc.

Metabolic syndrome is typical common disease, a cluster of metabolic disorders, such as abdominal obesity, dyslipidemia, hypertension and diabetes mellitus. Metabolic syndrome is also associated with the nonalcoholic fatty liver disease (NAFLD). Although the mechanisms underlying disease development are awaiting clarification, recent studies suggest that the quality of dietary lipids is a contributing factor in the development and prevention of metabolic syndrome. We studied the physiological functions and molecular actions of bioactive lipids, such as phospholipids, ω3-PUFA-containing lipids, conjugated fatty acids and structured lipids in the development of metabolic syndrome. It is suggested that phospholipids have beneficial health promotion effects compared with triacylglycerol (TAG). For example, partial replacement of dietary TAG to phospholipid can alleviate the experimental fatty liver. In addition, administration of phosphatidylcholine (PC) rich in ω3 PUFA from salmon roe compared with egg PC showed the alleviation of obesity-related disorders through the suppression of fatty acid synthesis, the enhancement of FA β-oxidation and the increase in serum adiponectin level in obese experimental rodents. Interestingly, dietary phosphatidylinositol (PI) resulted to suppress the accumulation of abdominal adipose tissues and NAFLD and alleviate insulin-resistance through the transcriptional regulation of lipid and glucose metabolism. Peroxisome proliferator-activated receptors (PPARs), sterol regulatory element binding proteins, and nuclear factor κB contribute to these nuclear actions of bioactive lipids with complex interactions. Recent study revealed that PI modulates immune cell functions. Furthermore, the striking ability of certain phospholipids to regulate the production of adipocytokine profiles, such as the increase in adiponectin level and the decrease in TNF-α and MCP-1 levels were demonstrated. The convincing evidence has been found that EPA and DHA improve lipid metabolism, therefore fish oils gather attention as healthy lipids. However, physiological functions of other w3 high-unsaturated fatty acids, docosapentaenoic acid (DPA, 22:5ω3) and tetracosahexaenoic acid (THA, 24:6ω3) are not known. We studied EPA, DPA, DHA and THA functions related to lipid metabolism in human liver HepG2 cells. As the results, THA exerted the strongest suppression on the synthesis of TAG and cholesterol ester, and the order of the strength was THA>DHA>DPA>EPA. These finding support our data shown by animal study. In conclusion, the function of bioactive lipids as dietary adiponectin inducers is worth considerable attention with respect to the alleviation of metabolic syndrome.
Understanding Bioavailability and Metabolism of Carotenoids

Steven J. Schwartz

Department of Food Science, The Ohio State University, USA

Foods rich in carotenoids are associated with a reduced risk of several chronic diseases. Specifically, tomatoes, rich in lycopene, have been shown to reduce the risk of prostate cancer; other fruits and vegetables, rich in xanthophylls (oxygenated carotenoids), are associated with improved eye health. The protective effects of carotenoid-containing foods are likely due to a combination of phytochemicals and their metabolites. Understanding the chemical and metabolic changes tomato phytochemicals undergo in vivo is important for elucidating the biological function of this fruit. In addition, use of unique varieties, processing methods, and co-consumption with other foods can enhance carotenoid absorption and conversion of provitamin A carotenoids to vitamin A. Research in our laboratory has shown increased lycopene bioavailability from the tangerine tomato, a unique tomato variety, compared to a traditional red tomato. The impact of food matrix on carotenoid absorption will also be shown, using a human clinical trial comparing carrots, tomatoes and papayas as an example. Our findings support the impact of lipid on increased bioconversion of provitamin carotenoids to vitamin A from both carrots and a unique variety of high β-carotene tomatoes. More recently, the absorption and metabolism of 13C-labeled lycopene as a tracer using HPLC-qTOF-MS has been conducted. Currently we are applying mass spectrometry techniques to the metabolomic analysis of bioactive components present in carotenoid rich foods and their metabolites present in biological samples to better understand functional activity.

Recent Research Trends in the Application of Nanoemulsion in Food Science

Mi-Jung Choi

Department of Bioresources and Food Science, Konkuk University, Korea

The application of nanotechnology to food, medical and pharmaceutical industries has paid great attention from the scientific community. Driven by the increasing consumers’ demand for healthier and safer food products and the need for edible systems able to encapsulate, protect, and release functional compounds, researchers are currently focusing their efforts in nanotechnology to address issues relevant to food and nutrition. Nanoemulsion technology is particularly suited for the fabrication of encapsulating systems for functional compounds as it prevents their degradation and improves their bioavailability. Especially, the use of active lipophilic substances such as antimicrobials and health-related compounds in the food industry is still a challenge due to their poor water solubility and instability in food formulations. Nano-sized structures such as nanoemulsions of oil-in-water are regarded as useful tools with a great potential in the food sector to incorporate food ingredients. Reducing the size of the active compounds incorporated within a solution would increase the surface area per mass unit of nanoemulsions, thus enhancing solubility and stability in foods. In addition, the ability of the active lipids to penetrate across biological membranes is also enhanced, thus boosting their biological functionality. An overview of the most significant studies reporting data about the potential benefits of active lipid nanoemulsions over conventional emulsions is presented. This presentation focuses on nanoemulsions and provides an overview of the production methods, materials used (solvents, emulsifiers, and functional ingredients) and of the current analytical techniques that can be used for the identification and characterization of nanoemulsions.
**Membranome: Basic and Applied Aspects of Lipid Membrane**

Hiroshi Umakoshi

Bio-Inspired Chemical Engineering Lab., Graduate School of Engineering Science, Osaka University, Japan

A “Biomembrane” is a highly-organized self-assembly of biomolecules (i.e. lipid, protein etc.) and a key interface for the survival of biological cell. The “Membranome” can be defined as the properties of vesicle (or liposome), which arise from the bilayer “molecular assembly” of amphiphiles, focusing on “emergent properties” which are not present in the “individual components”, and is gradually recognized as an important research methodology to investigate the potential functions of vesicles (or liposome) and to apply them for the bioprocess design. A liposome possesses several benefits in the recognition of (bio)molecules, where it can recognize them with (i) electrostatic, (ii) hydrophobic interaction, and (iii) stabilization effect of hydrogen bonds in the hydrophobic nano-environment with high order. A molecular recognition with high selectivity can be achieved by the simple liposome membrane on its surface through the combination of (i)-(iii). Our final goal is the creation of “Bio-Inspired Chemical Engineering” based on the “Membranome” by selecting “liposome or vesicle membrane” as a “platform” to perform the “recognition” and “conversion” of biomolecules. We are now investigating “How to design the liposome membrane?” and “What to use the designed liposome membrane?”. In the former case, we are accumulating the fundamental data on the “microscopic properties” of the liposome membrane, such as phase equilibrium behaviors, hydration, membrane fluidity, micro-domain size, hydrophobic and electrostatic potentials of the micro-domain, and molecular behaviors by using multi-fluorescent probe spectra analysis, membrane surface Raman spectroscopy, and dielectric dispersion analysis. Based on the fundamental results, we are investigating the possible application, such as (a) asymmetric recognition (optical resolution) of amino acids, (b) preparation of artificial enzyme/chaperone, (c) smart (stimuli-responsive) drug delivery system and so on. In the planning presentation, I would like to give a talk about our “Membranome” strategy, together with some examples.

![Diagram](image)

**Fig.** Basic Concept of “Bio-Inspired Strategy” for NEXT Chemical Process
Reviews on the Food Export Made in Korea and Its Quality and Safety Control

Kwang-Geun Lee
Department of Food Science and Biotechnology, Dongguk University, Korea

Export of Korean foods has been increasing rapidly last 5 years. In 2014 the total sales of Korean food export increased by 4.8% and up to 8.25 billion $. It is almost 2 times of increasing rate of national export of Korea (2.3%). Especially processed foods leads the incensement of total sales in Korean food exports and its sales up to 5 billion $ in 2014. In this presentation the trend of Korean food exports would be reviewed. In food exports the important aspects for food company and academia are quality and safety control. These control points should be prepared based on laws and regulations in each country. In addition technological basement is supposed to be prepared. Moisture sorption isotherm and various hurdle technology for the foods are carefully compiled. Development of more novel technology is required for domestic foods companies in near future.

Food Safety & Quality Related Regulation and Policy in China Market - Sharing Views and Experiences from the Korean Employee of Multinational Company in China

Jehyeong Jin
Consultant - TCM (Technical Contact Manager) for China, Taiwan, and Korea
Unilever PLC c/o Unilever R&D Center, China

China market is considered as the land of opportunity thus most of global food companies want to start their own business in China. There should be lots of huddles in making successful stories in China market, such as high competition, different Chinese consumer needs, and difficulty in hiring talented workers etc. One of the most critical huddles would still be low understanding of the food regulations and policies from Chinese government. In this session, some observations and thoughts about Chinese regulatory environments will be shared with having 8 years working experience in the global company located in China, 6 years as the R&D manager and 2 years as the Supply Chain manager. It would be good if this session would be helpful to any Korean food companies or organizations which want to come to China market in the future.
Strategies of Global Flavor and Beverage Companies for Entering and Developing International Market

Youngmok Kim
Senior Research Scientist, Synergy Flavors Inc., USA

Now we live in the era of globalization. People on this planet use same language (English), communicate via same communication method (SNS), live and work with same technological device (cell phones, tablets), watch and find others on the other side of the earth (youtube, google…), can go almost anywhere in a day (improved air transportation), and so on. For most technology based companies like Apple, for example, what they need is to make “globalized or standardized” product like iphone that can be used anywhere in the world without any “country friendly “modification. However, when we talk about food, the meaning of “globalization” gets weaker because people still eat their own foods in each country and they will continue it. This is why food companies need to have specific “custom made strategies” for every single country. It is not an easy task to do because each country has its own unique culture that people have been familiar with and its own regulation to protect their citizens. In this talk, real strategies to penetrate international market being used by global flavor and beverage companies will be reviewed and discussed. Specifically, how US based global companies enter and develop their market share while competing other global and local companies. Also, how global companies deal with regulation in each country will be addressed.

Food Safety Management Strategy in China for Globalization of Food Business

Min Gyoo Kim
CJ Cheiljedang Quality Safety Center, Korea

The CJ group started doing food business in 1994 in China now has 5 factories in the division of food manufacturing business and operates 99 stores in the food service business. As food businesses expand throughout in China, CJ opened a food safety center in Qingdao, China in 2006 and has performed a risk management to ensure a local food safety and to establish a pre-inspection system for local manufacturers/suppliers exporting raw materials to South Korea. In 2013, CJ food safety center in Qingdao acquired a certification of CNAS (China National Accreditation Service) for 76 testing items in the area of food chemistry and microbiology and has performed world-class analyses for the risk management of food hazards. For food safety of food manufacturing businesses in China, CJ has implemented on-site food safety evaluation programs by a professionally trained auditor every year. CJ also manage all potential risk factors that may arise in CJ-operating food service businesses through implementation of pre-inspection program for raw material suppliers and on-site food hygiene management. In addition, CJ operates a risk analysis program to identify any concerns associated with food safety proactively and to ensure compliance of food safety laws and regulations in China. In May 2015, CJ food safety center re-opened in Beijing, China as many CJ’s food business units expand across the China including Beijing. Therefore, newly opened food safety center will provide reassurance to consumers by implementation of more powerful food risk management systems in China.
How Should We Prepare and Present Samples for Accurate Sensory Results?

Kwang-Ok Kim
Department of Food Science and Engineering, Ewha Womans University, Korea

In order to obtain valuable information, good sensory practices are essential. However, often sensory work is poorly conducted, thus leading to meaningless results. Therefore, when sensory evaluation is conducted, many factors have to be carefully considered. These include panel selection and training (if necessary), test protocol, test environment, sample preparation and presentation, etc. In particular, among these factors, sample preparation and presentation protocols are often overlooked. The presentation will be focused on these matters.

How Can We Better Understand Motives Underlying Consumers' Food Choices?
An Overview of Recent Methodological Developments

Gastón Ares
Departamento de Ciencia y Tecnología de Alimentos, Facultad de Química, Universidad de la República, Uruguay

Food choice is a complex phenomenon which involves the selection and consumption of foods and beverages. Understanding motives underlying consumers’ food choices is considered a key step for the design of strategies aimed at promoting healthier dietary patterns and the development of successful food products. The majority of our everyday choices are made without much effort and deliberation and are determined by experiential, affective and intuitive processes. However, most current practices in consumer science require consumers to think about their behaviour, which could compromise the validity and reliability of the data. Besides, most of the approaches commonly used to study consumers’ perception of food products create an artificial setting which does not reflect the real context in which foods are consumed. Awareness of the limitations of common practices for studying consumers’ food choices has prompted the development of new methodological approaches which involve more natural settings and more spontaneous evaluations. In this context, the aim of the presentation is to provide an overview of recent methodological developments which can enable a better understanding of how consumers’ make their food-related decisions. Special focus will be given to three specific areas, consumer tests under imagined or real contexts, retrieval and analysis of social media and the application of psychophysiological techniques, to stress the advantages of enlarging the methodological toolbox of sensory and consumer researchers.
**D12-3**

**You're Taking it out of Context: Using Immersive Technologies to Improve Traditional Consumer Sensory Testing**

Christopher T. Simons*, Gretchen A. Guttman, Drew Hathaway, Ron G. Bangcuyo, Jamie L. Zumach, Kacey J. Smith, Alex M. Pierce

Department of Food Science & Technology, The Ohio State University, USA

Traditionally, sensory consumer testing is completed in sensory booths where the influence of non-product (i.e. environmental) attributes is managed. However, these highly controlled environments strip away meaningful contextual information important in forming consumer perceptions, liking and behaviors. We utilized immersive technologies to depict various consumption or preparation scenarios to better gauge the impact of context on perception and liking of foods and beverages. In study one, the influence of a virtual bar environment on ethanol perception was studied. Ethanol thresholds were measured from the same individuals in traditional sensory booths (TSBs) and our immersive technologies laboratory wherein pre-recorded audio-visual footage obtained from a local bar was displayed on a video wall. Contrary to our hypothesis, thresholds obtained in the two environments were not significantly different despite the fact that most panelists identified the virtual bar scenario as considerably more distracting. In study two, coffee-liking was assessed in TSBs and a virtual coffeehouse replete with the audio, visual and olfactory cues found normally in this environment. We found significant differences in preference order and liking for coffees evaluated by the same people in the two settings and showed hedonic data collected in the virtual coffeehouse to be more discriminating and a more reliable predictor of future coffee liking unlike data collected in TSBs. Additionally, we found consumers to be more engaged in testing when evaluating coffees in the virtual coffeehouse, an outcome that likely also contributed to improved data quality. In study 3, we are assessing the impact of a “preparation” scenario on cookie liking. Hedonic responses are recorded in a TSB and a virtual home-style kitchen wherein an actor is baking cookies. Results from this study will also be reported. Together, these studies will be used to demonstrate the varied impact and importance of extrinsic contextual information in shaping perceptions and acceptance of foods and beverages.

**D12-4**

**Another Way to Measure Like and Dislike Percepts in Consumer Acceptance Testing**

Han Sub Kwak

Department of Food Science and Nutrition, Dankook University, Korea

In consumer acceptance testing, a 9-point hedonic scale, which was developed based on a bipolar conceptualization, has been widely used for consumer acceptance testing. Recently, the human bivariate conceptualization process (HBCP), which had the opposite point of view from the bipolar conceptualization, was introduced to measure positivity and negativity separately in psychology. The objective of this study was to apply the HBCP to the consumer acceptance test and compared to the 9-point hedonic scale. Consumer acceptance testing using like and dislike unipolar scales was conducted to identify the correlation of like and dislike percepts for familiar and unfamiliar food products. Low correlation coefficients \( r = -0.54 \) to \(-0.06\) were calculated for unfamiliar products, while higher correlation coefficients \( r = -0.76 \) to \(-0.32\) presented for familiar products. Consumers were close to independent for the determination of their like and dislike percepts. This trend was more significant for unfamiliar products. Lower correlation coefficients were the supporting evidence for human bivariate conceptualization. Approximately 2/3 of consumers rated both the like and dislike percepts, while the rest rated either the like or dislike percept. Consumers who marked ‘neither like nor dislike’ on the 9-point hedonic scales were compared to the degrees of their like and dislike percepts. Most consumers who marked ‘neither like nor dislike’ on the 9-point hedonic scale did not have equal degrees of like and dislike percepts or ‘0’ for both the like and dislike percepts. The comparison of principal component analysis (PCA) for the 9-point hedonic scale and like and dislike unipolar scales showed consumers’ distinctive like and dislike directions in the PCA biplots of the like and dislike unipolar scales. Throughout this study, consumers displayed bivariate conceptualization in determining the degree of their like and dislike percepts. More precise measurement of consumer acceptance could be achieved by using like and dislike unipolar scales.
The anti-inflammatory effects of conjugated linoleic acids (CLA, 18:2) have been previously reported. However, it is noteworthy that most studies tested CLA by comparing with the vehicle treated controls in vitro. Therefore it is in a doubt if CLA could substitute the conventional dietary lipids for an immunomodulatory purpose. In the current study, the effect of most abundant CLA isomer (c9,t11) and the half-and-half mixture of c9,t11 and t10,c11, as well as conventional dietary lipids such as linoleic acid (18:2n-6) and oleic acid (18:1n-9) were tested for their ability to modulate phagocytosis and cytokine production in murine macrophage-like RAW264.7 cells. By using FITC-labeled dextrin and latex beads, both c9,t11 isomer and the mixture treated cells exhibited the suppressed phagocytosis as assessed by flow cytometry. Furthermore, 12h and 24h stimulation of RAW264.7 cells by *E. coli* derived lipopolysaccharides (LPS), CLA treated cells produced decreased amount of pro-inflammatory cytokines, i.e., TNF-alpha and IL-6. However, the secretion of anti-inflammatory cytokine IL-10 was not observed in the culture medium, indicating that CLA isomers specifically suppress pro-inflammatory machinery while not affecting anti-inflammatory properties. The current study not only confirms the previous studies but also takes the advantage with the proper controls of conventional lipids. Detailed in vivo studies are needed for dissected mechanistic investigations.

Traditional Asian rice-based diets are associated with high insulin sensitivity and relatively low insulin secretion capacity and ß-cell mass. A low insulin secretory capacity increases the susceptibility to develop type 2 diabetes in Asians. However, the westernization of lifestyle including diets high in fat and low in traditional foods increases the risk of insulin resistance that cannot be compensated for by increased ß-cell function. Thus, westernization of Asian diets increases the prevalence of metabolic diseases such as obesity, type 2 diabetes, hypertension, dyslipidemia, stroke, retinopathy, myocardial infarction and neurodegeneration. The most common risk factor of the metabolic diseases is the increased insulin resistance due to attenuated insulin signaling in different tissues. The combination of low insulin secretion capacity and increased insulin resistance rapidly leads to type 2 diabetes. Alzheimer's disease is known as type 3 diabetes since Alzheimer's disease is related to increased brain insulin resistance. The accumulation of ß-amylloid in the hippocampus results in cognitive dysfunction and exacerbates hepatic insulin resistance and insulin secretion. Red pepper contains capsaicinoids such as capsaicine and capsiate. The ingredients have different impacts on decreasing fat mass, improving insulin sensitivity and potentiating glucose-stimulated insulin secretion. The pungency of red peppers is dependent upon the different proportions of capsaicinoids. The varieties of red peppers have functionalities in obesity, type 2 diabetes and cognitive function. The moderate and severely pungent red peppers improves glucose tolerance by potentiating glucose-stimulated insulin secretion and increasing ß-cell mass, but mildly pungent red pepper enhances insulin sensitivity and increases hepatic glycogen storage without changing insulin secretion capacity and ß-cell mass. In addition, the moderate and severely pungent red peppers are found to prevent the memory deficit and exacerbation of insulin resistance by blocking tau phosphorylation and ß-amyloid accumulation in diabetic rats with experimentally induced Alzheimer’s-like dementia. Red pepper paste (gochujang), a Korean traditional food, is a fermented product of red pepper and soybeans. Red pepper pastes are produced by fermenting red pepper and *meju* fermented soybeans with *Bacillus subtilis* and *Apergillus sojae*. The consumption of red pepper paste improved hepatic insulin sensitivity by potentiating phosphorylation of STAT3-->AMPK-->ACC and decreasing PEPCK expression. Therefore, red pepper with different pungencies and red pepper paste differently alleviates various metabolic diseases, such as obesity, type 2 diabetes and Alzheimer’s disease.
Research Initiative of Probiotics to Mitigate the Agents in Poultry Flocks Using US Kimchi in Delmarva Region and Groundwork of Its Potential Properties as Fermentation Starters

Jung-lim Lee

Department of Human Ecology, Food Science & Biotechnology, College of Agriculture and Related Sciences, Delaware State University, USA

Kimchi is historically a genuine Korean fermented food that contains dominant numbers of probiotic lactic acid bacteria (LAB), weak acids, vitamins, fibers and other functional phytochemicals produced during the fermentation process. Kimchi could be served as an alternative source of LAB supplements for use in US agri/food products for food protection and applications. LAB are generally recognized as safe (GRAS) for use in food products and are able to inhibit the growth of pathogens like Salmonella. To date, in spite of prominent wellness properties, study of US kimchi made in Delmarva region has not been initiated for the purpose of developing probiotics for poultry safety and commercial products. This project investigated the food safety challenge area that aim to isolate bacteriocin producing LAB from kimchi and broiler chickens showing antimicrobial effects against Salmonella spp. and evaluate probiotic characteristics of the LAB isolates, to disseminate mass communications, as a stepping stone, for better understanding regarding Korean foods to US citizens, as well as to develop American-friendly fermented products in the near future markets. All ingredients for four types of homemade kimchi were prepared in the Delmarva region and a total of 388 LAB-like strains were screened from the kimchi and commercial kimchi as well as broiler chicken intestines and feces for their ability to inhibit the growth of Salmonella Typhimurium, S. Newport, S. Heidelberg, and S. Enteritidis. There were a total of 50 isolates which showed positive bacteriocin-production with zones of inhibition against 1 or more Salmonella spp. In order to isolate LAB showing probiotic abilities, bile and acid resistance, antibiotic susceptibility, and enzyme tolerance studies had been administrated to these candidates. A total of 16 isolates were identified by 16S rDNA sequencing. There were 5 lactic acid bacteria isolated in this study that showed strong probiotic characteristics. By using the BLAST, these bacteria have been identified as Lactobacillus casei, Lactobacillus saniviri, Leuconostoc mesenteroides, Lactobacillus crispatus, and Lactobacillus johnsonii. The extension strategy was established to involve two different levels of intervention; stakeholders, especially college students, answered experience of having kimchi through an on-site survey and examined stereotypes of people’s behaviors regarding Korean/Asian foods to local communities. In addition, the LAB isolates, as a starter, were adopted to a preliminary research for a fermentation process associated with the main agri products in Kent County. Further ongoing studies towards multi- and interdisciplinary approaches will be required for empowering this project.
Functional and Bioactive Properties of Yuja Tea and Sesame Oil

Young-Jun Kim
Food Safety Center, OTTOGI Corporation, Korea

Korea is a major producer and consumer of yuja products, which are exported to over 50 countries throughout the world. The exported amount of yuja products in metric tons was 9,739 to Asia, 561 to North America, 144 to Europe, 54 to Oceania, and 4 to Latin America for the year 2009, respectively. Yuja (Citrus junos Sieb ex Tanaka) is commonly used as raw material (flesh and peel) in South Korea due to its charming aroma and pleasing flavor. It is mostly used as a sweetening agent in teas during the long Korean winter as well as jams and other beverages. The flesh and peel of the yuja are rich in citrus bioflavonoids (rutin, narirutin, naringin, hesperidin, neohesperidin, naringenin, and hesperetin), which are considered potentially beneficial for health (i.e. anticancer, and anti-inflammatory, and cardiovascular protective effects). The objective of this study was to improve an individual bioflavonoid detection method using HPLC, to compare the concentrations of flavonoids, phenolics, and antioxidant activities (DPPH, ABTS, and ORAC) of yuja depending on harvest time and the four Korean harvest regions (Goheung, Wando, Geoje, and Jindo). These results showed that yuja as a citrus fruit incorporates rich antioxidant activities and the citrus peel could be a useful resource as a food ingredient and gives insight to its potential application to promote health benefits. In the case of sesame oil, sesame (Sesamum indicum L.) is composed of 50% lipid and 20% protein. It is one of the most important oil seed crops in the world. Lignans and lignan glucosides present in sesame appear to be the important functional components such as antioxidant, anti-cholesterolemic and antihypertensive properties. The main lignans are sesamin and sesamolin in sesame oil, and the major lignan glucosides is sesaminol glucosides in sesame seed. An HPLC method was developed for the simultaneous determination of lignans (sesamin, sesamolin, sesamol, sesaminol) and sesaminol glucosides (sesaminol triglucoside, sesaminol 1→2 diglucoside, sesaminol 1→6 diglucoside) in sesame seed and sesame oil. This study revealed that the contents of lignin and lignin glucoside varied widely depending on the region it was grown (Korea, India, China, Sudan, Ethiopia, and Pakistan).

Sweet and Umami Substances in Natural and Fermented Food

Masanori Kohmura
Quality Assurance & External Scientific Affairs Department, Ajinomoto Co., Inc., Japan

Sweetness and umami are considered as savory taste. Typical sweet substances in nature are sugars, and in general, protein does not taste but several sweet and sweetness-inducing proteins were discovered from traditional fruits. Five sweet proteins, Monellin, Thaumatin, Pentadin, Mabinlin, Brazzein and two sweetness-inducing proteins, Miraculin and Curculin have been reported. Miraculin is not sweet by itself but modifies sour taste to sweet taste. Curculin is sweet by itself and also has an activity similar to that of Miraculin. Typical umami substances in nature are glutamate and ribonucleotides such as IMP and GMP. Foods rich in free glutamate, such as tomatoes, cheese have been used in cooking because of their flavorful qualities. Glutamate has been a component of fermented seasonings such as fish sauce in ancient Rome and in Asia for more than 1200 years but discovery of glutamate as an umami substance from a traditional Japanese soup stock made from seaweed was in 1908. Foods rich in ribonucleotides, such as meat, fish and mushroom have also been used in cooking for long time but discovery of IMP as an umami substance from dried bonito, a traditional Japanese smoked and fermented fish, was in 1913. Ribonucleotides do not have taste themselves but enhance umami taste of glutamate. It is called synergism. Nowadays, glutamate and ribonucleotides are commercially produced by fermentation. Recent studies indicated that sweet taste is transduced by the receptor consist of heterodimer T1R2+T1R3, while umami is transduced by the receptors consist of heterodimer T1R1+T1R3, and mGluRs. Molecular mechanisms of interaction of sweet receptor and sweet substances, and synergistic effect of umami are proposed. Because sweet and umami tastes share a common receptor subunit, the T1R3, recent molecular and sensory studies suggested sweet and umami taste perceptions may be connected.
Umami Peptides in *Joseon Ganjang*: A Possible Modulators on Human Bitter Taste Receptors

Mee-Ra Rhyu
Korea Food Research Institute, Korea

Proteolysis occurs during ripening of protein-rich food. The resulting hydrolysates play an important role in enhancing flavor and taste of food. Taste-active peptides including umami peptides characterized from the hydrolysates of protein-rich food during maturation. A typical Korean soy sauce, *Joseon ganjang* rich in protein, is a Chinese type of soy sauce, produced using only soybeans with two-step fermentation involving mold fermentation and brine fermentation. It confers a savory taste to the food when used sparingly and has long been used as a primary seasoning in Korea. When we consume a food, human gustatory system is capable of identifying five major taste qualities: sweet, sour, bitter, salty, and umami, and perhaps several sub-qualities. Taste receptor cells, which are clustered into taste buds, are activated by taste stimuli via several transduction pathways. Salts and acids utilize apically located ion channels for transduction, while bitter, sweet and umami stimuli utilize G-protein-coupled receptors (GPCRs) and second-messenger signaling mechanisms. An important food-related taste question which remains largely unanswered is: How do taste perceptions change when multiple taste stimuli are presented together in a food rather than when presented alone? In our recent study, umami-active fraction of *Joseon ganjang* showed significant bitter-masking effect. The interaction between umami and bitterness has been explored in human bitter taste receptor (hTAS2R) using a Ca\(^{2+}\)-flux signaling assay in hTAS2R16-expressing cells. Recent progress of umami-bitter taste interaction will be discussed in this presentation, which was supported by grants from Korea Food Research Institute.

Defining Traditional *Doenjang* flavor Using Sensory and Flavor Chemistry Approach

Mina K. Kim
Department of Food Science and Biotechnology, Dongguk University, Korea

*Doenjang*, fermented soybean paste, is a traditional Korean food ingredient and is widely used for many Korean cuisines. Current consumer trend is seeking traditionally-made food as an alternative to mass-produced, commercialized food option. Recent studies revealed that consumer expectation on traditional *doenjang* are not in agreement with sensory attribute that drive consumer liking of *doenjang* products. Defining “traditional” flavor that appeals to consumer liking is crucial for *doenjang* product development. Considering the regional and cultural difference of consumer perception, defining the “traditional” flavor associated with *doenjang* was investigated using consumers from pre-determined demographic criteria by free word associating test, and “Gu-soo flavor” was highly associated with typical “Traditional” *doenjang* flavor. Volatile compound analysis using Gas Chromatography-Mass Spectrometry revealed that the key flavor compounds highly associated with *doenjang* with high intensity of “Gu-soo” flavor. Finally, sensory modality that consumers are associating with “Gu-soo” flavor was determined using consumer acceptance test with limited sensorial modality information, and visual and orthonasal sensation were most influential factor to consumer perception of “traditional Gu-soo” flavor in traditional *doenjang* flavor.
Future Technological Assignments in the Korean Traditional Foods

Ha-Yull Chung
Hankyong National University, Korea

Future technological assignments for setting up the Korean traditional foods industry as a core field in agro-food business were proposed. The first one is to investigate the superiority of the Korean traditional food. Its own taste, story and health functionality need to be discovered. For stepping on global market, consumer preference and trend regarding the taste of K-food should be studied so that tailor made type, especially fitting for local taste and customs, of the Korean traditional food can be developed and provided. An easy standard manual for preparing the Korean traditional food with local food materials is necessary for introducing to unfamiliar foreigners. In addition, the global trend of low sodium diet is requiring up-grade processing technologies and development of salt-substitute or taste enhancer which are helpful for reducing sodium intake while providing constant taste and assuring food safety.

Nano-engineered Surfaces for Prevention of Biofilm and Bacterial Adhesion

Soojin Jun
Department of Human Nutrition, Food and Animal Sciences, University of Hawaii, USA

Due to ever increasing trends in food safety, food manufacturers should take sanitary/ hygienic processing/packaging into key consideration. Minimizing the attachment of spoilage and pathogenic organisms to food contact surfaces and packaging materials is one of the major challenges in the fields of food science and biosafety. The bacteria adhering to the surface can produce subsequent hard-to-remove biofilms that potentially cause cross-contamination of processed foods. The contamination of spoilage to the food leads to shorten product shelf-life and, if foodborne pathogens are present, the consumption of contaminated food may possess a health hazard to consumers. In particular, a variety of surfaces in food packaging are vulnerable to development of biofilms as bacterial community is formed by adhering pathogens from native microflora in raw materials for prolonged contact time. It is now recognized that 80% of food outbreaks are related to biofilms. Therefore, inhibition of initial adhesion of biofilm-forming pathogenic cells on food contact surface is critically needed to minimize foodborne pathogen outbreaks. Bacterial adhesion is highly influenced by the substratum topography, i.e. roughness and porosity. Recent advancements in fabrication have made it possible to create well-organized nanostructures (i.e. nanoporous and nanopillared) uniformly over a large surface area of a metal specimen. Nanosmooth (control) and nanoporous stainless steel foil surfaces were fabricated by precisely anodizing the degreased specimen in a 5% vol. of perchloric acid in anhydrous ethylene glycol. The applied voltage and anodization time were varied to obtain different pore diameters. The presences of 50 and 80 nm nanoporous patterns significantly inhibited the adhesion of L. monocytogenes by 2.0 to 2.3 log-cycles, depending on the pore diameters. It was found that nanoscale surface patterning and treatments are capable of enabling precise controls of molecular, physical, and biochemical interactions that govern bacterial adhesion to the solid substratum.
Development of Degassing Valves for Food Packaging Using Ring Type Rubber Disk

Jae Young Oh*, Ha Kyoung Yu

Department of Packaging and Logistics, Korea Conformity Laboratories, Korea, 1Soft Pack Co., Korea

One-way degassing valves are designed to allow pressure to be released from an air-tight package while preventing air from getting back into the package. Air, especially the oxygen (O2) portion of air, can have negative effects on the package contents and its freshness. The most common application of the one-way degassing valve is for fresh roasted coffee. Demands of one-way degassing valves have been increasing with the high growth of global coffee market. In this study, we have developed one-way degassing valves for coffee and food packaging using ring type rubber disk, named SP valve. Its quality and performance was verified with test results to be equal with that of global top maker's product, Goglio valve. SP valves showed 820-1,200 Pa of opening pressure, 10-50 Pa of closing pressure, 1.2-1.6 L/min of flow rate. And, the SP valve applicable to ferment food packaging is expected to contribute to globalize Korean traditional food.

Microwave Packaging Trend for Food Safety

Eun Jin Park

Packaging Center, CJ Cheil-Jedang Co., Korea

Various microwave packaging techniques have been developed since the Food Processing Technology Advances. The microwave oven is to heat the food by dielectric heating of water in the food-itself, as a result of irradiating a specific high frequency. And then, the food can be heated below the freezing point of water. In the microwave packaging, food ingredients and heat-resistance of packaging material is one of the most important design factors. When you design to microwave packaging of Korean Food, the packaging material should be considered to heat-resistance because oily and spicy ingredients are rising rapidly temperature in a microwave cooking. There are dumplings, charcoal chicken gangjung and BBQ bar, etc with microwave oven in Korean frozen ready meal market. Consumers purchase at CVS and eat frozen ready meals by using microwave. Their packaging sealant material is LLDPE which is lack of thermal resistance, so thermal transform occur on the surface of sealant layer. It says not cooked in the microwave oven, but many consumers do not recognize this and use a microwave oven and so requires the development of Sealant Materials. As a result, CJ packaging center developed new sealant grade called F-CPP. Steam packaging technology also has developed steadily in microwave packaging. It is generated to inner moisture pressure of container or pouch when microwave cooking from food water molecule. After regular cooking time, lid film or pouch-itself are opening and steam comes out slightly through designed hole or special structure. It is useful to reduce cooking time and food container temperature is equalized. Recently, CJ packaging center developed new self venting pouch called Smart-Steam. The susceptor is a material where a thin film of aluminum is applied to PET film by vapor deposition, and then laminated to thin paper. If a susceptor is used in a microwave oven, it absorbs microwaves and can heat the surface to around 200℃ using the principle of induction heating. The feature of this packaging is that it can heat food in a short time without using a flame and give the food a golden brown color and crispy texture. Lamination type between susceptor and substrates (such as paper or other film) and the kind of adhesives are the main key in a susceptor packaging. A few years ago, CJ packaging center developed new crispy pouch called Smart-Crispy.
Innovation Trends of Food Packaging

Tae Hong Cheong
Packline Company, Korea

Packaging industry continues growing each year in terms of market size and quality. Especially in the packaging industry of Asia, annual growth rates as well as the size of the MS (market share) are dramatically increasing in comparison to other continents. In Korea, the quality of the packaging industry due to GDP (Gross Domestic Product) growth will be more developed and changeable than now. This development of quality is giving a lot of influence on the packaging methods, packaging materials and packaging style. As the trends of consumers are changed, the market for functional packaging and eco-friendly packaging are growing rapidly. Innovation packaging means value enhancement of the food products by adding the function of packaging. When you use the microwave oven, you can also shorten the cooking time with the ability of the package, it is possible to cook food products more delicious. Using functional packaging, continuous extending and enhancement of the food shelf life can provide the consumers with fresh food products for a long time. Recent trends of consumers are convenience, comfort, connectivity, sensory, healthy, and individualism. According to the change of consumer needs, consumer packaging is changed. Trends in the packaging are convenience, sustainability, universal design and freshness packaging. The Case studies shows what packaging innovation products begin with. I explain you how to implement the consumer needs technically and beneficially. In particular, they describe how to start a successful packaging innovation idea. And they explain that the new packaging technology is incorporated into the food products.

Challenges of the Japanese Rice Industry in the Declining Rice Consumption: Development and Marketing Strategies for Value-added Rice

Shoji Shinkai, Mayuho Oishi
Fukuoka Women's University, Japan

Rice consumption in Japan has been declining over 40 years, and the rice consumption per capita is about 60 kg that is about a half of that in 1960s. However, rice is still the main staple for Japanese and so do CKD (chronic kidney disease) patients. Rice includes protein, and therefore, CKD patients need to control rice consumption, which results in lowering patients’ QOL. For CKD patients, several low-protein rice products have developed and available in the market, however, qualities of the products may not be satisfactory to patients in terms of quality and accessibility (marketing). There seem to be mismatch between producer side and consumer side. If improvements are made on qualities and marketing of those low-protein rice products, QOL of CKD patients will be improved. So, this study tried to understand consumers' recognitions and behaviors on low-protein rice products so that mismatch between producers and consumers will be reduced. To do so, questionnaire survey was exercised to nutritionists at hospitals in Japan in 2014. The results showed that improvement in quality attributes (taste, texture, color, etc.) were needed to increase popularity. Also, disclosure of higher level of scientific evidence was requested by respondents.
**D16-2**

**Functional Properties and Health Benefits of Thai Jasmine Rice**

**Somsri Charoenkiatkul**

Institute of Nutrition, Mahidol University, Thailand

Rice is a major food crop for more than half of the world's population and Asian in particular. Thai Jasmine rice or Khao Dok Mali 105 (KDML) is well-known among consumers. Although brown rice (BR) contains more nutrients and bioactive components compared to white rice (WR), it is less acceptance due to its dark appearance and hard texture. Then parboiled germinated brown rice (PGBR) has been developed to improve its taste and further enhance its nutritional value and health functions. Three forms of KDML were investigated for functional properties and health benefit related to NCD by using *in vitro*, animal and human model study. PGBR had the highest content of GABA, \( \gamma \)-tocotrienol, \( \gamma \)-oryzanol, ferulic acid and \( p \)-coumaric acid. A study performed by cell culture model using either Caco-2 or HepG2 cells demonstrated that intestinal cellular uptake of such bioactive compounds from PGBR was greater than those of BR. GABA and phenolic acids of digested PGBR were more available for targeted cells and exhibited a greater antioxidant and anti-inflammatory activities than BR. The animal study aimed to investigate the effects of rice on the resistance of oxidative stress, DNA damage, liver fibrosis, brain damage and hepatotoxicity in Sprague-Dawley rats induced with CCL4. The anti-hypercholesterolemia and anti-hypertension were also studied. The results showed that PGBR could protect liver from oxidative stress leading to liver fibrosis and cirrhosis and also protecting the neural cell death from oxidative stress. Moreover, it could reduce blood pressure and serum lipid in hypertensive and hypercholesterolemia rats. The short and long term human study was conducted to investigate the effect of KDML rice on level of blood glucose and insulin in type 2 diabetic elderly. The results implied that consumption BR or PGBR could control blood sugar better than WR, while PGBR stimulated lower insulin than BR. PGBR consuming could significantly decrease TC, LDL cholesterol and inflammatory markers. These results demonstrated that PGBR can be considered as nutritious and health promoting food due to its potential functional property which could be benefit for reducing the risk of NCD.

**D16-3**

**Consumer Customized Rice Breeding and Food Processing Technology Research**

**Sea-Kwan Oh**, Induck Choi, Hye-Young Park, Koan-Sik Woo, Soon-duck Yoon, Wook-Han Kim

Department of Central Area Crop Science Crop Post-Harvest Technology Division,
National Institute of Crop Science, RDA, Korea

Rice industry situation in Korea became difficult due to the recent rice tariffication and reduced domestic consumption. Thus, the National Institute of Crop Science, RDA, have pursued a research regarding rice cultivar development, which was tailored for the latest consumer trends. At 2014 present, 241 rice varieties developed in NICS, RDA, were provided to farmhouse in which 178 varieties was for steamed rice, and 63 varieties for rice processing purpose. The RDA have been tried to improve rice quality in terms of paratability, functionality and processing properties in order to enhance domestic rice competitiveness. This effort became to cope with the rice tariffication and also enable for sustainable rice supply to Korean people. The recent collaborative research between farmers and food processing companies developed a shared growth model, which contributed to increment of farmhouse income through extensive provision of customized rice varieties. As a recent successful example, a joint research between NICS and Kooksoondang revealed that rice cv. Seolgang was easily fermented with high alcohol yield and plain brew taste. This result confirmed that ‘Seolgang’ has excellent brewing properties. Thus, the RDA intervened for the Kooksoondang to make a contract of cultivating 370 ha with farmhouse. The ‘Baekseju’ made from ‘Seolgaeng’ has high quality and taste, which contributes to build consumer confidence. It eventually leads to an increment in sales, which could achieve the desired result as a successful model. In addition, based on the ‘Seolgaeng’ case, the RDA is focused on the breeding program to develop consumer tailored rice varieties, and expand the research and development program to produce rice bread, rice noodle and processed rice using those rice cultivars. We will try to contribute to expand domestic rice consumption through industrialization of consumer tailored rice cultivar, and continue to spread the win-win strategies between farmhouses and food processing companies.
Dietary Education to Promote Rice Consumption

Juhyeon Kim
Department of Hotel Culinary Art, Dong Seoul College, Korea

White rice is a refined grain that is a staple food in many parts of the world. Korea has a long history of the rice based on dietary traditions. According to the recent rapid changes in a dietary pattern, the rice consumption of the Koreans was decreasing every year in all ages. For the country's food security, the future of agriculture, and the health of the people, it is necessary to support a new policy for rice consumption. According to the report, nowadays rice consumption has increased in the US. This may be the result from a public emphasis on healthy lifestyles, the rising demand for gluten-free foods. It has been mentioned that rice consumption is associated with higher diet quality. In the US study, it was found that rice eaters consumed less saturated fat, more fiber, higher amounts of iron and potassium. In addition, it was reported that rice eaters were significantly less likely to be overweight or obese; they also had reduced risks for high blood pressure, increased waist circumference, and metabolic syndrome. Despite nutritional educations, the ratio of breakfast intakes is reduced and the consumption of traditional foods has also been reduced in Korea. The rice education programs should be developed according to a changing food market environment by considering the dietary tradition and the programs, for example ‘nutrition and health of rice’, ‘history and culture of rice’, ‘rice cooking practice’, etc. should be carried out faithfully by consumer-oriented strategy.
Abstracts of Young Scientist Lecture 1
Application of Omics-based Biomarkers in Human Intervention Studies: Exploring the Antioxidant and Anti-inflammatory Properties of Korean Black Raspberry

You Jin Kim*, Ji Yeon Kim¹, Oran Kwon
Department of Nutritional Science and Food Management, Ewha Womans University, Korea
¹Department of Food Science & Technology, Seoul National University of Science & Technology, Korea

The salutary effects and mechanisms of nutritional intervention may remain hidden since maintenance of homeostasis has a wide spectrum of “normal values” in healthy or sub-healthy individuals. This contemporary and improved version of current nutritional intervention strategies requires the integration of “omics” technologies. The application of omics technologies will provide more robust and relevant information for determining how each individual responds to nutritional intervention, providing a more holistic analysis of physiological responses and therefore new prospects leading to personalized nutrition. Hence an omics approach may be postulated to assist in the identification of sensitive biomarkers or patterns to provide accurate outcome determinants and to better define an individual’s health. Therefore, this proof-of-concept study attempted to examine how effectively an omics approach reveals the efficacy of nutritional intervention. The fruit of Korean black raspberry (KBR) was chosen as a model compound. In a four-week, randomized, double-blind, placebo-controlled, parallel-design study, forty-eight sedentary and overweight adults with 23-30 kg/m² received to either KBR or placebo. ¹H NMR-based metabolome profiling in blood and urine were applied as omics technologies. The presentation will provide more detail on intervention and results.

Adequacy of Subcritical Water Extraction for Recovering Flavonoids from Plants and Scale-up for Practical Application

Min-Jung Ko
Department of Food Science and Engineering, Ewha Womans University, Korea

Flavonoids are polyphenolic compounds added as an antioxidant and supplement to nutraceuticals, and reportedly help prevent damage such as cancer and heart disease. The extraction of flavonoids is ordinary conducted using organic solvent like methanol for long extraction time (> 3 h). However, subcritical water (10 MPa) could be an alternative medium for extracting non-polar flavonoids by varying temperature-dependent dielectric constant. As the temperature of water is increased, the polarity of water decreases (ε = 53 at 110°C to ε = 36.5, at 190°C). That’s why it is selective extraction. This study determined the optimum conditions for subcritical water extraction (SWE), such as the time and temperature, for extracting flavonoids from ten plants, and their dependence on the chemical structure of flavonoids (polarity of side chains and the presence of sugar, and double bonds). Flavonoids having an OH side chain were optimally extracted at lower temperatures than O-CH₃ and H side chains. The optimal temperatures of the glycoside forms including sugar were lower than of the less-polar aglycones. Apigenin, having double bonds, was extracted well at a higher temperature than naringenin. In the case of flavanols, the SWE was more effective for extracting epimercatechins than epi catechins. The SWE selectivity based on chemical structure of flavonoids obtained from this study could be practically used for the effective extraction of functional flavonoids from various plants. The effectiveness of SWE was to determine the extracting flavonoids of pilot-scale SWE. In this study, large-scaled extraction was examined by self-facilitated subcritical water extractor (8 L capacity), and recovery rate of flavonoids similar to lab-scale were obtained at the same conditions. The overall results could be used to characterize the mechanisms involved in the SWE of flavonoids, and to deliver practical applications to related industries for the effective extraction of polyphenolic compounds from various types of plants.
Mechanism of ER Stress and Inflammation to Hepatic Insulin Resistance in Obesity

Ok-Kyung Kim*, Woojin Jun, Jeongmin Lee¹
Department of Food and Nutrition, Chonnam National University, Korea,
¹Department of Medical Nutrition, Kyung Hee University, Korea

The liver is vital in maintaining normal glucose homeostasis, which is tightly regulated by insulin and glucagon during postabsorptive and fasting periods. However, following the development of impaired hepatic insulin action, the liver produces insulin resistance characterized by an impaired ability of insulin to inhibit glucose output, and finally causes gluconeogenesis. Thus, insulin resistance in the liver has a similar pathogenesis than type 2 diabetes. Insulin resistance occurs when the body is producing insulin sufficiently but the tissues respond abnormally to it. A major factor in the development of insulin resistance is obesity, yet the molecular mechanisms between obesity and hepatic insulin resistance are controversial. Obesity is defined as a medical condition with an abnormal accumulation of body fat, and it carries high risks for health problems, including metabolic syndrome, cardiovascular diseases, type 2 diabetes mellitus, and certain types of cancer. It has been reported that the risk of developing diabetes mellitus had a 10-40-fold greater increase at a BMI > 30 compared with a normal BMI. Although the molecular mechanism linking obesity to hepatic insulin resistance is unclear, it has been widely reported and suggested that hepatic endoplasmic reticulum (ER) stress and inflammation induced by obesity lead to the development of hepatic insulin resistance and gluconeogenesis. In most obese patients, white adipose tissue is characterized by an increased secretion of free fatty acids (FFA), leptin, and pro-inflammatory cytokines, including tumor necrosis factor alpha (TNF-α) and interleukin-6 (IL-6). The “portal hypothesis” suggests lipolysis of white adipose tissue expansion aggravates the influx of FFA into the blood, which leads to impaired IRS signaling and hepatic steatosis. In addition, expansion of white adipose tissue in an obese state leads to decreased secretion of adiponectin, which inhibits gluconeogenesis and improves insulin sensitivity in the liver. Excess energy intake leads to an increase in the concentration of blood glucose and insulin produced by beta cells in the pancreas. This blood environment that results from chronic increases in inflammation and ER stress has negative effects on insulin signaling in the liver.

Pressure-Ohmic-Thermal Sterilization (POTS): Studies on Product Quality and Microbiological Safety

Sung Hee Park
Department of Bioindustrial Technologies, Konkuk University, Korea

Synergy of combining pressure-electric field-heat for preserving shelf-stable low-acid foods was investigated. Our hypothesis was that synergy of pressure (rapid temperature increase with instant adiabatic cooling) can be simultaneously combined with ohmic heating (rapid internal heat generation) to produce microbiologically safe and better quality shelf stable low acid food products. Quality studies of pressure ohmic thermal sterilization (POTS) were carried out using a laboratory scale POTS cell that loaded into a pressure chamber. It essentially consisted of a sample holder with a stationary electrode and a movable electrode. Such design enabled the sample to receive simultaneous or sequential delivery of pressure-electric field and thermal treatment to products. POTS enabled the rapid temperature come-up time within 1.45 min to 105°C under 600 MPa through synergy between pressure and electric field. POTS had the rapidest temperature come-up time to 105°C within 1.45 min followed by ohmic heating (3.58 min) and pressure assisted thermal processing (PATP, 6.84 min). POTS treated carrots showed better crunchiness index (CI) of 0.76 as compare to PATP (CI=0.57) and ohmic heated (CI=0.62) carrots. Combined effects of pressure (600 MPa), electric field (50 V/cm), and heat (105°C) and their selected combinations were investigated for the inactivation of two pressure-thermal resistant bacterial spores of Bacillus amyloliquefaciens and B. stearothermophilus. The influence of food matrices on microbial susceptibility to the treatments was tested using green pea puree (pH 6.1), carrot puree (pH 5.0), and tomato juice (pH 4.0) while sterile 0.1% NaCl solutions (pH 5.0 & 7.0) served as controls. POTS treatment inactivated B. amyloliquefaciens and B. stearothermophilus spores suspended in 0.1% NaCl at pH 7.0 by 4.6 and 5.6 log during 30 min treatment. B. stearothermophilus spores were more susceptible to the POTS treatment than B. amyloliquefaciens spores. Increasing acidity of the food matrices accelerated the inactivation of both spores. The spores investigated followed a non-linear inactivation kinetics and Weibull model could explain the POTS spore inactivation. In conclusion, this study demonstrated POTS is a promising technology for producing microbiologically safe and better quality shelf stable low acid vegetable products.
Inhibition of Diabetic Nephropathy by Purple Corn Anthocyanins and Chrysin

Min-Kyung Kang*, Jung Han Yoon Park, Young-Hee Kang

Department of Food and Nutrition, Hallym University, Korea

Diabetic nephropathy (DN) is one of the major diabetic complications and the leading cause of end-stage renal diseases. DN occurs in 35-40% diabetic patients with either type 1 or 2 diabetes mellitus symptoms. DN is characterized by glomerular and tubular basement membranes thickening, mesangial matrix expansion and hypertrophy, culminating renal fibrosis and glomerular sclerosis. There are a number of studies dealing with inhibitory effects of natural compounds on diabetes-associated renal dysfunction and disorders. The current study investigated renoprotective effects of anthocyanin-rich extracts of purple corn (PCA) on high glucose (HG)-induced glomerulosclerosis and of naturally occurring flavonoid chrysin on renal tubular epithelial-mesenchymal transition (EMT)-mediated tubulointerstitial fibrosis. PCA markedly inhibited mesangial matrix expansion through blocking HG-induced collagen accumulation and mesangial hyperplasia of human renal mesangial cells. In addition, PCA allayed monocyte trafficking onto glomerular endothelium by HG-triggered glomerular production of inflammatory mediators of adhesion molecules and integrins. In the in vivo study employing db/db mice PCA retarded glomerulosclerosis with morphological changes, mesangial expansion, and monocyte/macrophage infiltration. PCA diminished abnormal angiogenesis by disturbing the angiopoietin-Tie-2 ligand-receptor system linked to renal VEGF receptor 2 signaling pathway. Furthermore, chrysin blocked hyperglycemic induction of EMT in renal tubular epithelial cells and in db/db mice. Chrysin dampened renal tubulointerstitial fibrosis through deterring the production of collagen IV in tubular cells and the deposition of collagen fibers in mouse kidneys. Therefore, these natural compounds may be potential renoprotective agents antagonizing diabetes-associated glomerulosclerosis and tubulointerstitial fibrosis leading to DN and end-stage renal diseases.

Characterization and Functional Properties of Bovine Serum Albumin-fucoidan Conjugates Prepared through the Maillard Reaction

Do-Yeong Kim

Hanyang University, Korea

Bovine serum albumin (BSA)-fucoidan conjugates were prepared by the Maillard reaction and then identified by sodium dodecyl sulphate-polyacrylamide gel electrophoresis (SDS-PAGE) and size-exclusion chromatography (SEC). SDS-PAGE patterns provided evidence for the covalent bonding between BSA and fucoidan. SEC profiles showed that about 1.5-2.0 mol of fucoidan were covalently linked to 1 mol of BSA, resulting in high-molecular-weight compositions (conjugates). Molecular characteristics of the BSA-fucoidan conjugates were investigated using atomic force microscopy (AFM), dynamic light scattering (DLS), fluorescence spectroscopy, and circular dichroism spectroscopy. AFM images and DLS results indicated that most particles in the conjugates were nanostructured and more spherical than those of a regular BSA-fucoidan mixture. The fluorescence intensity and maximum emission wavelength of the conjugates together revealed that the BSA molecules had converted from an ordered conformation into a partially folded molten globule state. On the basis of characterization of BSA-fucoidan conjugate, the solubility, thermal stability, surface activity, and emulsifying properties of BSA-fucoidan conjugate were assessed and compared to native BSA, heat-treated BSA, and BSA-fucoidan mixture. Covalent linkage of BSA with fucoidan resulted in significant (p<0.05) high solubility after heated at 90°C for 15 min, particularly at pH 5. The BSA-fucoidan conjugate had a high melting temperature (97.09±1.45°C) as scanned by differential scanning calorimetry (DSC), indicating strong heat stability and high resistance to denaturation. Although the attachment of fucoidan, a non-surface active hydrophilic polysaccharide, gave no change in the surface activity, the emulsifying activity and the emulsion stability of the conjugate at pH 5 were superior to native BSA, heat-treated BSA, and the BSA-fucoidan mixture. Conclusively, fucoidan attachment enhanced the solubility, thermal stability and emulsifying properties of the protein molecules with negative charge distribution and steric stabilization.
Development of Consumer Context-specific Sensory Acceptance Methodology

Min-A Kim

Department of Food Science & Engineering, Ewha Womans University, Korea

Affective sensory evaluation should be predictive of consumers’ real behavioral preference/choice; only then can it be effective for guiding product development in the fast moving consumer goods (FMCG) industry including food and non-food products. This means that sensory tests have to be designed adequately. To increase predictive validity, in this study, I aimed to make the consumer sensory acceptance test more context-specific, i.e. incorporate the consumer personal context of purchase, usage and evaluation into the measurement methods. As a first step to developing such a consumer context-specific sensory acceptance test, I tested the feasibility of inducing a consumer's natural context of evaluation using a cognitive manipulation, rather than a simulation of the physical consumption environment, as is sometimes attempted with Virtual Reality approaches. For this, a cognitive warm-up procedure (CWU) was devised to be performed before the hedonic ratings. The effects of such methodological interventions were investigated in terms of the robustness of the affective product discriminations. As hypothesized, the CWU had a stabilizing effect on the consumer evaluative criteria, resulting in more robust product discrimination. But, even with the CWU, the perceptual contrast effects seem to be inevitable for hedonic perception, resulting in a shift in evaluation criteria rendering the hedonic ratings inherently relative, rather than absolute. Consequently, an in-direct rating procedure using the CWU was further developed and compared to the direct hedonic scaling. The novel in-direct scaling in conjunction with the CWU generated repeatable product discrimination results across experimental contexts demonstrating a stabilization of the evaluative criteria. It suggests that such test modifications are useful developments for consumer research and should be further applied and investigated.

Effects of Standardized Siegesbeckia orientalis L. Extract and Kirenol on Anti-obesity and Exercise Capacity

Mi-Bo Kim

Jeju Wellbeing Vegetables RIS System, Jeju National University, Korea

Kirenol is a natural diterpenoid compound isolated from Siegesbeckia orientalis L., has been reported to possess anti-oxidant, anti-allergic, and anti-arthritic activities. This study evaluated the effects of kirenol and standardized S. orientalis ethanol extract (SOE) on anti-obesity and exercise capacity in vitro and in vivo. Kirenol prevented lipid accumulation by down-regulating key adipogenesis transcription factors and lipid biosynthesis-related enzymes as well as adipocytokines in 3T3-L1 adipocytes. Kirenol effectively activated the Wnt/β-catenin signaling pathway by up-regulating the expression of disheveled 2 (DVL2), β-catenin, and cyclin D1 (CCND1) which down-regulates the major genes of the adipogenesis pathway. In addition, kirenol activated the exercise signaling pathway by up-regulating the expression of AMP-activated protein kinase (AMPK), peroxisome proliferator-activated receptor γ coactivator-1α (PGC-1α), and PPARδ in L6 skeletal muscle cell. Kirenol also increased mitochondrial activity through stimulating the expression of mitochondrial biogenesis markers, such as PGC-1α, estrogen-related receptor α (ERRα), nuclear respiratory factor-1 (NRF-1), and mitochondrial transcription factor A (Tfam). The effects of standardized SOE on anti-obesity and exercise capacity were also investigated in C57BL/6J mice. SOE administration (250 mg/kg/day for 6 weeks) significantly decreased body weight gain and gross appearance without affecting food intake. Elevations in levels of total cholesterol, low-density lipoprotein cholesterol, and triglyceride in serum were suppressed by SOE administration. SOE decreased fat pad mass by reducing adipocyte size and suppressed the development of the fatty liver by decreasing liver fat accumulation. SOE also inhibited the expression of adipogenic transcription factors by activating the Wnt/β-catenin signaling pathway in adipose tissue. Furthermore, SOE significantly increased running distance in normal and high-fat diet (HFD)-induced obese mice. In the muscle tissue, the expression of mitochondrial biogenesis markers and exercise signaling pathway related markers were increased by SOE supplement. Based on these results, kirenol and SOE could be used as natural agents for treatment or prevention of obesity and for improvement of exercise capacity.
Metabolic Engineering of Yeast *Saccharomyces cerevisiae* for Production of Food Ingredients

Soo Rin Kim
*Kyungpook National University, Korea*

*Saccharomyces cerevisiae* is one of the most important industrial hosts. Its application widely ranges from making wine and beer to producing biofuels and bio-based chemicals. In addition to its GRAS status, well-established genetic engineering tools and fermentation techniques of *S. cerevisiae* provide opportunities for food scientists to engineer this microorganism for production of various food ingredients. In this presentation, progress and perspective in metabolic engineering of *S. cerevisiae* for production of sugar alternatives and food additives will be discussed. As one of the most recent advances, a Cas9-based marker-free genome editing technique will be highlighted.

Rewiring of Metabolic Pathways in Microbial Cells to Produce Food Materials

Hyo Jin Kim
*Research Group of Gut Microbiome, Division of Nutrition and Metabolism Research, Korea Food Research Institute, Korea*

Microbial factories utilizing the rational and combinatorial metabolic engineering are powerful resources for producing functional biomolecules. Recently, cutting-edge methods based on systems and synthetic biology have enabled microbial factories to compete with conventional processes for producing chemicals and functional molecules. The microbial cell factories are capable to produce target molecules with minimal amounts of unwanted byproducts. The high product specificity renders easier and safer purification processes, as compared to chemical processes that are probably difficult to control the production of toxic intermediates or byproducts. This high product specificity of microbial cell factories may be attractive for producing high-value products such as nutraceuticals and therapeutics. This presentation will show potential applications of microbial cell factories implementing emerging technologies to rewire metabolic circuits for the production of food materials.
Gas Chromatography/Mass Spectrometry-based Metabolomics: Applications to Plant, Microbial, and Human Systems

Sooah Kim*, Kyoung Heon Kim
Department of Biotechnology, Korea University Graduate School, Korea

Metabolomics, one of the omics technologies, is a study of global change of metabolome of living organism. Metabolome is the complete of small molecule metabolites including intermediates and end products of regulatory metabolic pathway. The metabolome directly reflects the physiological status of an organism. Therefore, metabolomic data provide valuable information such as physiological state and reflect specific biochemical processes in plant, microbial, mammalian, and environmental system. Recently, plant, microbial, and human metabolomics has received increased attention for increasing the productivity of functional secondary metabolites and alcoholic beverage and discovering disease biomarkers. In this study, metabolomics was used for i) elucidation stress mechanisms for increased production of flavonoids in Melissa officinalis, ii) optimization of metabolome sample preparation and investigation of stress mechanism for increased production of alcoholic beverage and fuels in microbial system, and iii) identification of potential biomarkers of rheumatoid arthritis and behcet's disease in human system. To accomplish this, gas chromatography/mass spectrometry (GC/MS) and various statistical analyses such as principal component analysis (PCA) and hierarchical clustering analysis (HCA) was used. These results demonstrated metabolomics can be a useful and powerful tool for studying the metabolism and physiological status in plant, microbial, and human systems.

Effect of Gamma Irradiation on Physico-Chemical and Sensory Characteristics of Pomegranate Fruit (Punica granatum L.) and Its ESR- and Luminescence-based Detection

Hafiz Shahbaz
Department of Biotechnology, Yonsei University, Korea

Food irradiation has been endorsed by a number of international regulatory bodies such as IAEA, WHO, IFT, the Codex Alimentarius etc., for multiple purposes. Considering the commercial use of food irradiation and the prevalence of international trade of irradiated food and fresh agricultural commodities, fresh pomegranate fruits originating from US were irradiated with Co-60 γ-rays (0.4, 1, and 2 kGy), as quarantine treatment, at Korea Atomic Energy Research Institute. In addition, investigation of radiation-induced free radicals and luminescence properties for effective and reliable detection of irradiated fruits was performed to conform compliance against strict labelling requirements particularly at international entry ports. Total soluble solids, titratable acidity, and pH values of juice from fruits remained unaffected up to 1 kGy treatment. In contrast, total anthocyanin content decreased with an increase in irradiation dosage. Total phenolics content and ABTS radical scavenging capacity of juice were slightly affected upon irradiation. The juice from fruit treated with low and medium radiation doses was liked more by sensory panelists than that from untreated (control) fruits. Photo-stimulated luminescence (PSL), as a screening approach, showed less sensitivity for samples treated with low and medium irradiation doses. This PSL behavior can be ascribed to the insufficient amount of contaminating minerals on fruit surfaces. Radiation-induced cellulose radicals were detected only in the relatively hard parts of fruit (seed and peel) using electron spin resonance spectroscopy (ESR) after different sample pretreatments such as freeze-drying and alcoholic extraction. Inorganic minerals separated from irradiated pomegranate fruit surfaces showed well-defined irradiation-specific thermoluminescence (TL) glow curves with maximum peaks in the temperature range of 150-200°C at all dose levels. TL results were further confirmed by calculating TL ratios (first glow curve/ second glow curve). SEM-EDX (scanning electron microscopy - energy-dispersive X-ray spectroscopy) showed that feldspar and quartz minerals were the main source for the typical radiation-specific luminescence properties. These research-oriented scientific facts about irradiated pomegranate would be useful to boost the international marketing and consumer acceptability of fruits.
YSL2-5

**Synergistic Proteins for the Promoted Saccharification of Lignocellulose by Cellulolytic Enzymes**

In Jung Kim*†, Kyoung Heon Kim  
Department of Biotechnology, Korea University Graduate School, Korea

Enzymatic hydrolysis has remained a key challenging process in lignocellulose-based biorefinery industries due to the inherently crystalline and complex structure of lignocellulose. For this reason, disruption of the recalcitrant lignocellulose is a prerequisite for an enhanced accessibility of cellulose to cellulases. Incorporating synergistic proteins into a cellulase mixture as the cellulase-enhancing agent can be one promising strategy. Synergistic proteins provide an accessibility of cellulose to cellulase through a non-hydrolytic disruption of glycosidic bonds on cellulose, resulting in the enhanced saccharification of lignocellulose. Therefore, understanding and application of synergistic proteins during hydrolysis is important for more viable process. In this talk, we will briefly introduce general features of synergistic proteins in enzymatic hydrolysis of cellulose including their functions, mechanisms, and industrial applications. Then, functional characteristics of two kinds of synergistic proteins we have investigated for several years will be presented with emphases on their molecular interactions with lignocellulosic substrates and synergistic activities in the saccharification process. First, the binding interactions of a bacterial expansin from *Bacillus subtilis* (BsEXLX1) with microcrystalline cellulose and pretreated lignocellulose were investigated. As a result, BsEXLX1 was found to follow the binding behaviors of Type A carbohydrate-binding module (CBM), and show a preferential binding to lignin. In the second part, synergistic activity of an AA9 (Auxiliary Activities family 9, previously known as GH61 or LPMO) from *Chaetomium globosum* CBS148.51 (CgAA9) were studied. The fungal CgAA9 was actively expressed in the bacterial host for the first time in this study, and the recombinant CgAA9 showed synergistic activities on pure cellulose in the presence of sodium azide, which was used as the reducing cofactor. The study conducted here will be helpful not only for the application of synergistic proteins as cellulase-enhancing agents in the industrial lignocellulose hydrolysis but also for the better understanding of mechanism by which synergistic proteins facilitate celluase activity.

YSL2-6

**Prebiotic Effects of Novel Oligosaccharides: Sialyllactoses and Arabinooligosaccharides**

Jin Seok Moon*, Nam Soo Han  
Brain Korea 21 Center for Bio-Resource Development, Division of Animal, Horticultural, and Food Sciences, Chungbuk National University, Korea

In nutritional sciences there is much interest in dietary modulation of the human gut. The objective of this study was to analyze prebiotics effects of sialyllactoses and debranched arabinolo-oligosaccharides on (LAOS) gut microbiota. Firstly, prebiotic effects of sialyllactoses (SL) that are dominant components of human milk oligosaccharides (HMOs) investigated by using pH-controlled *in vitro* batch fermenter with infant fecal samples. During the fermentation, changes in the fecal microbial communities and short chain fatty acids (SCFAs) contents were analyzed for 24 h by quantitative real-time PCR and HPLC, respectively. As results, both 3′-SL and 6′-SL significantly increased the population of the population of bifidobacteria that compared well with the commercial prebiotic fructo-oligosaccharides (FOS). Bifidobacteria efficiently consumed SL and produced abundant lactate and SCFAs resulting insignificant pH reduction. Pathogenic bacteria did not utilize appreciable HMOs. Secondly, prebiotic effect of LAOS and debranched arabinan (LARS) was investigated by non-digestibility test in GI environment and by fermentability test in adult colon condition. LAOS were prepared from LAR by enzymatic hydrolysis with endo-arabinanase from *Bacillus licheniformis*, followed by removal of the arabinose fraction by incubation with resting cells of *Leuconostoc mesenteroides*. The resulting LAOS contained DP2 (4.44 mg/mL), DP3 (7.73 mg/mL), DP4 (3.12 mg/mL), and DP5 (0.18 mg/mL). A standardized digestibility test showed that LAOS and LAR were not digestible in artificial salivary, gastric, and small intestinal fluids. Individual cultures of 24 strains of gastrointestinal bacteria showed that LAOS and LAR stimulated growth of *Lactobacillus brevis* ATCC 14069, *Bifidobacterium longum* ATCC 15707, and *Bacteroides fragilis* ATCC 25282. *In vitro* batch fermentation using human fecal samples showed that LAOS had higher bifidogenic properties than LAR; LAOS increased the population of bifidobacteria, which produced SCFAs. Compared to FOS, LAOS was fermented slowly, and this may permit SCFAs production in the distal colon. Conclusively, SL and LAOS are considered as potential prebiotics giving beneficial effect for human health.
Synergistic Bactericidal Effects and Mechanisms of Action of a Novel Inactivation Method Using Medium Chain Fatty Acids in Combination with Organic Acids

Sun Ae Kim1,2

1Department of Food Bioscience & Technology, College of Life Sciences & Biotechnology, Korea University, Korea,
2School of Life Sciences and Biotechnology for BK21 PLUS, Korea University, Korea

Microbiological safety is a major concern for both consumers and industry, and a wide range of antimicrobial treatments have been developed to eliminate pathogens. The words “chemical compound” provoke a negative reaction from consumers. Consumer demands are also focused on minimally invasive treatments that prevent significant losses of product quality. Thus, there is considerable interest in developing combined treatments with synergistic effects to achieve more effective microbial reduction. A novel inactivation method was developed based on the synergistic effects of a combination of natural borne antimicrobials: medium chain fatty acids (capric, caprylic, and lauric acid) and organic acids (acetic, lactic, malic, and citric acid). Combined treatments produced higher log reductions compared with the sum of the reductions obtained using individual treatments. For example, caprylic acid (1.0 mM) and citric acid (1.0 mM) alone produced only negligible bactericidal effects against E. coli O157:H7, whereas a marked synergistic effect (complete destruction, 7.51 log reduction) was obtained when the two were combined. The mechanism that underlies the antimicrobial effects of the combined treatment may involve membrane disruption by medium chain fatty acids or organic acids, which accelerates the uptake of active antimicrobial compounds from the extracellular environment, particularly hydrogen ions, thereby causing the cells to undergo morphological changes and cell death. To examine the effectiveness in practical applications, the bactericidal effects of the caprylic acid + citric acid treatment were tested against E. coli O157:H7 in fresh carrot juice and natural flora. When carrot juice samples were treated with individual treatments (5.0 mM caprylic acid or 5.0 mM citric acid at 50°C for 5 min), there was no noticeable reduction. However, E. coli O157:H7 and natural flora were reduced by 7.46 log CFU/mL (undetectable levels) and 3.07 log CFU/mL, respectively, using the combined treatment. The main advantages of using the combined treatment at very low concentrations is that it is very cost-effective and uses natural antimicrobial compounds, which means that it could be applied as a food additive. This approach may also be an alternative to conventional antimicrobial treatments, such as those currently used in public health and medical centers.

Discovery of a Novel Metabolic Pathway by Integrating Transcriptome and Metabolome Analyses

Eun Ju Yun*, Saeyoung Lee, In-Geol Choi, Kyoung Heon Kim

Department of Biotechnology, Korea University Graduate School, Korea

Red macroalgae (Rhodophyta) are being actively investigated as a renewable biomass source because of their advantageous characteristics such as abundant carbohydrate contents, low lignin contents, and the absence of conflicts with food production. The main carbohydrate in red macroalgae (e.g., Gelidium amansii) is agarose, which is composed of d-galactose and 3,6-anhydro-l-galactose (AHG). Although agarose is considered a valuable source of fermentable sugar, the catabolic fate of AHG was completely unknown in any organisms. AHG is not catabolized by ordinary fermentative microorganisms, and it hampers the utilization of red macroalgal biomass as renewable biomass for biofuel and chemical production. Due to the high abundance of AHG in red macroalgal biomass, the inability of fermenting AHG impedes the overall utilization red macroalgal biomass as a sustainable resource for bio-based products. We have recently discovered the novel metabolic pathway of AHG using a marine microorganism catabolizing AHG as a sole carbon source by the integrated analyses of metabolome and transcriptome. The revealed catabolic pathway of AHG begins with the oxidation of the aldehyde group of AHG, which is composed of 3,6-anhydro-l-galactose (AHG). Although agarose is considered a valuable source of fermentable sugar, the catabolic fate of AHG was completely unknown in any organisms. AHG is not catabolized by ordinary fermentative microorganisms, and it hampers the utilization of red macroalgal biomass as renewable biomass for biofuel and chemical production. Due to the high abundance of AHG in red macroalgal biomass, the inability of fermenting AHG impedes the overall utilization red macroalgal biomass as a sustainable resource for bio-based products. We have recently discovered the novel metabolic pathway of AHG using a marine microorganism catabolizing AHG as a sole carbon source by the integrated analyses of metabolome and transcriptome. The revealed catabolic pathway of AHG begins with the oxidation of the aldehyde group of AHG, resulting in the conversion of AHG to 3,6-anhydrogalactonate (AHGA) by AHG dehydrogenase. The resulting AHGA is then isomerized by AHGA cycloisomerase to 2-keto-3-deoxy-galactonate, a common metabolic intermediate found in the DeLey-Doudoroff pathway. This newly discovered metabolic route was verified in vivo by demonstrating the growth of E. coli harbouring the genes of these two enzymes on AHG as a sole carbon source. These findings provide not only insights for the evolutionary adaptation of a central metabolic pathway to utilize uncommon substrates in microbes but also a metabolic design principle for bioconversion of red macroalgal biomass into bio-based products.
Comparative Study of Isoflavone and Carbohydrate Profiles in Soybean Depending on Acetic Acid Treatment Periods

Department of Applied Bioscience, Konkuk University, Korea

Acetic acid treatment changes the physical, chemical, and physiological properties of soybean into beneficial and effective forms. In this study, we investigated the changes in isoflavone and carbohydrate profiles in four soybean cultivars subjected to different treatment durations with acetic acid. The sum of total isoflavones (pickled soybean and pickled solution) was increased by 30 to 93% after acetic acid treatment for 30 days. In all pickled soybeans, malonyl and acetyl glucosides were decreased by 17 to 41%, whereas glucosides and aglucones were increased by 54 to 160%. Following acetic acid treatment, the total amount of carbohydrates in the pickled soybeans was 38-66% less than that of untreated soybeans. In particular, the contents of oligosaccharides and sucrose in pickled soybean declined significantly (>50%) within the first 24 h. In the pickled solutions, carbohydrates accounted for approximately 12% of the total amount of carbohydrates present in untreated soybeans. These results may be useful to develop or improve soybean-based functional foods containing more bioactive compounds.

Analysis of Selected Nutraceuticals in Promising Legume Genetic Resources for Breeding Database

Ill-Min Chung*, Taek-Jun Lee, Yong-Taek Oh, Jae-Yeon Yoon, Jin-Hee Yang, Jin-Young Oh, Prabakaran Mayakrishnan, Seung-Hyun Kim
Department of Applied Bioscience, Konkuk University, Korea

Among various legume genetic resources, the study on kidney bean and red bean has been limitedly reported so far. In this study, we examined the profile of selected nutraceuticals (23 phenolic compounds, soyasapogenol A&B, and 12 isoflavones) in 200 kidney beans and 134 red beans. The average content of total 23 phenolic compounds in kidney beans was 1006.3 μg/g. Myricitin (636.2 μg/g) was the most abundant compound, followed by gentisic acid (212.6 μg/g). However, other 7 compounds including formononetin content was found at level of <1.0 μg/g. For red beans, the average content of total 23 phenolic compounds was 498.9 μg/g. Gentisic acid (271.1 μg/g) content was the highest, followed by myricitin (141.6 μg/g). However, other 11 including syringic acid content was less than 1.0 μg/g. Soyasapogenol A was not detected in both legume resources. The average content of soyasapogenol B was 255.6 μg/g and 62.8 μg/g in kidney beans and red beans, respectively. Lastly, we confirmed that isoflavones were not detected or present in the trace level (<LOD) in both legume resources.

Effects of Milk Type, Production Month, and Brand on Its Fatty Acid Composition: A Case Study in Korea

Department of Applied Bioscience, Konkuk University, Korea

The aim of this study was to examine the difference in fatty acid (FA) composition and contents of organic and conventional milk at the retail market level in Korea for different milk production months and brands. The essential FA contents of the milk vary significantly under the combined effects of milk type, production month, and brand. Chemometric analysis reveals a greater difference between milk types than between production months and identifies significantly different levels of nutritionally desirable FAs—notably C18:3n-3, C16:0, C12:0, and C18:0-in the organic and conventional milks. Notwithstanding the limited sampling size and period, the results from this study may provide a better understanding of the nutritional quality of organic milk to consumers who are interested in organic milk intake.

Determination of the Geographical Origin of Rice (Oryza sativa L.) Based on Analysis of δ¹³C, δ¹⁵N, δ¹⁸O, and δ³⁴S: A Case Study in Korea, China, and Philippine

Department of Applied Bioscience, Konkuk University, Korea

The abundance of C, N, O, and S natural stable isotopes is unique to each living creature, because of the various physical, chemical, and biological fractionation processes in nature. Therefore, the analysis of C, N, O, and S stable isotope ratios in rice provides a feasible method for determining the authenticity of rice geographical origin. This study determined the geographical origin of rice by using isotope ratio mass spectrometry and chemometrics. The δ¹³C, δ¹⁵N, and δ¹⁸O values of brown rice were more markedly influenced by geographical origin than was the δ³⁴S value. In particular, the combination of δ¹⁸O and δ³⁴S more efficiently discriminated rice geographical origin than did the remaining combinations. Principal component analysis revealed a clear discrimination between different rice geographical origins but not between rice genotypes. Our findings may provide a valuable insight into the control of improper or fraudulent labeling regarding the geographical origin of rice worldwide.
Antioxidant Compounds and Radical Scavenging Activity on the Sorghum according to Variety

Koan Sik Woo*, Jae Yeon Ko, Jae Saeng Lee, Seuk Bo Song, Myeong Eun Choe, Tae Wook Jung
National Institute of Crop Science, Rural Development Administration, Korea

The purpose of this study was to evaluate the antioxidant compounds and activities of the sorghum (Sorghum bicolor L. Moench) according to varieties. The production years were 2014, and the cultivated varieties were Nampungchial (NPC), Hwanggeum (HG), Milyang 6 (MY6), Milyang 8 (MY8), Milyang 9 (MY9), and Milyang 10 (MY10). The total polyphenol, flavonoid, and tannin contents with varieties 3.07-17.74 mg gallic acid equivalent (GAE)/g sample, 2.26-3.73 mg catechin equivalent (CE)/g sample, and 1.48-9.33 μg tannic acid equivalent (TAE)/g, respectively. The highest total polyphenol, flavonoid, and tannin contents were 17.74±1.91 mg GAE/g sample, 3.73±0.16 mg CE/g sample, and 9.33±1.04 mg TAE/g sample in the NPC. The DPPH and ABTS radical scavenging activities were 0.62-17.05 and 1.98-22.57 mg Trolox equivalent antioxidant capacity (TE)/g sample, respectively. The highest DPPH and ABTS radical scavenging activities were 17.05±1.79 and 22.57±1.49 mg TE/g sample in the NPC. The results of this study show that notable antioxidant compounds and activity in sorghum are considered to have significant health benefits.

Physicochemical Properties Comparison of Red Pepper Cultivated Gyeongsang and Jeolla Province in South Korea

Sang Seop Kim*, Kyung A Lee, Eun Jeong Choi, Kyung Hyung Ku
Korea Food Research Institute, Korea

The aim of this study was to provide useful information about the effect of cultivation province in the physicochemical properties of Korean red pepper (Capsicum annuum L. Kangrukdatong, cultivated for 3 years). The total free sugar of Gyeongsang province (GP) and Jeolla province (JP) samples was a range of 24.25-31.52%, 24.14-29.37%, respectively. The ASTA value of samples was 98.86-129.51 of GP red pepper and 119.52-154.99 of JP red pepper. The capsaicinoids content related hot taste of GP and JP red pepper showed 27.76-82.50 mg%/ (4,104-12,375 SHU) and 80.83-180.82 mg% (12,124-27,123 SHU), respectively. The seed ratio, firmness, size and ascorbic acid of red pepper samples were not significant value according to cultivation province. And cultivation province was positively correlated with ASTA and capsaicinoids content in this experiment samples. Generally, Jeolla province samples showed higher capsaicinoids content and ASTA value than Gyeongsang province samples. In the principal component analysis, the first (PC1) and second principal components (PC2) accounted for 59.06% of the total variances (36.67%, 22.39%, respectively).

Masking Effect by Treating of Deodorant Material in Off-flavor of Gugija (Lycium chinese Miller)

Sung-Hee Choi*, Sook-Kyung Hyun
Department of Food and Nutrition, Dangeui-University, Korea

Gugija (Lycium chinese Miller) is traditionally consumed as a Chinese medicinal material in food, tea, or alcoholic beverages. Gugija has beneficial healthy components, but it produces an off-flavor during storage. This study compared the volatile components of dried gugija (sample A), stale dried gugija (sample B) and suppression gugija (sample C) of off-flavor. The volatile compounds in samples were collected by simultaneous distillation and extraction method using a Likens and Nickerson's extraction apparatus. The concentrated extracts were analyzed and identified by GC and GC-MS. The main volatile components of dried gugija were 2-methyl butanal, furfural having sweet odor, and hexanal having grass odor, and phenyl acetaldehyde having floral, and tetra methyl pyrazine having nutty odor. The main volatile components of sample A decreased in sample B. Isovaleric acid, which has a disagreeable odor were found newly in sample B. The GC chromatogram of sample C was similar pattern as sample A, because sample C was recovered as natural flavor in original sample by treating with deodorant material.

Masking Effect by Treating of Deodorant Material in Off-flavor of Safflower (Carthamus tinctorius L.)

Sung-Hee Choi*, Sook-Kyung Hyun
Department of Food and Nutrition, Dangeui-University, Korea

Safflower (Carthamus tinctorius L.) is used as a chinese medicinal material, but it is not a good smell because of off-flavor. This study compared the volatile components of natural safflower (sample A) having off-flavor. The volatile compounds in samples were collected by simultaneous distillation and extraction method using a Likens and Nickerson's extraction apparatus. The concentrated extracts were analyzed and identified by GC and GC-MS. The main volatile components of sample A were ethyl hexanoate, γ-terpinene, pentyl pentanoate having herbal odor, and phenyl acetaldehyde, nonanal having floral odor. And also isovaleric acid was found in sample A, which has a disagreeable odor. Because threshold value of isovaleric acid is very low, it has an influences on off-flavor. After sample A was treated with deodorant material, off-flavor disappeared. The main volatile compounds of sample B treated with deodorant material were remained almost all, isovaleric acid causing off-flavor in safflower did not found in sample B.
Survey on the Statue of Total Sugar and Artificial Sweetener Contents in Drinks Circulated in Busan Area

Sungah Park*, Byeongjun Kim, Hocheol Yun, Jaehun Jeong, Chanhee Kim, Jungmi Kang
Busan Metropolitan City Institute of Health & Environment, Korea

This study was conducted to figure out the statue of total sugar and artificial sweetener contents on a total of 81 drinks, including 45 processed drinks, which were made in food factories, and 36 commercial drinks, which were made and served at restaurants, circulated in Busan Metropolitan City. The average calorie content of processed drinks was 67.8 kcal and the average sugar content was 16.8 g. Of the 45 processed drinks tested, two types of artificial sugar, aspartame and acesulfame-K, were detected in only one soda drink at levels below the standard guidelines. The average sugar content of commercial drinks was 12.6% and the average calorie content showed 126 kcal based on the assumption of a 250 mL serving size, suggesting that the sugar content of commercial drinks was relatively higher than that of the processed drinks. Of the 36 commercial drinks tested, sodium saccharin was not detected while aspartame was identified in 14 cases of samples and potassium acesulfame in 4 cases of samples. The average content of both aspartame and acesulfame-K was 0.3 g/kg, which is below standard guidelines.

Free Radical-scavenging and Antitumor Activities in Various Fractions of Fruit and Leave Extracts from Prunus mume

Gyeong-Ji Kim*, Kyu-A Rho, Hyun-A Ji, JeungHee An
Konkuk University, Korea

This study investigated the free radical-scavenger and antitumor activities of the hot water, water, acetone, ethanol, ethyl acetate, chloroform and hexane extracts from fruit and leave in Prunus mume. The various extracts are being evaluated for its total polyphenol, flavonoid and tannin contents, scavenger activities by the DPPH and ABTS analysis, reducing power, protective effects against oxidative stress on L-132 cells, and antitumor activities against A549, HeLa, U87 cancer cells. The ethanol extract of fruit and leave showed the highest total polyphenol content, 336.41 and 523 mg GAE/100 g, respectively. DPPH radical-scavenging activity ethanol extracts from the leave was 65.48% at a 200 μg/mL concentration. All extract factions of leave were observed high the ABTS radical-scavenger activities. All extract of leave performed better than the extracts of fruit for protective effects against oxidative stress on L-132 cells. Anticancer activity of the ethyl acetate, chloroform, hexane, ethanol extracts of fruit and leave showed against A549, HeLa, and U87 cancer cell. However, the ethanol extracts of fruit and leave showed not toxicity in normal cells (BNLCL2).

Comparison of Analytical Methods for the Simultaneous Determination of Gallates (propyl-, octyl-, dodecyl-) and 2,4,5-3-hydroxybutyrophenone

Jae-Min Kim*, Young-Hyun Kim, Jin-Sol Lee, Gi-Hae Shin, Ji-Won Oh, Jin-Ha Lee, Myoung-Lae Cho, Hye-Won Kim1, Seong-ran Gang1, Hyang Sook Chun2, Chan Lee2, Jae-Wook Shin3, Ok-Hwan Lee
Department of Food Science and Biotechnology, Kangwon National University, Korea, 1Food Safety Research Institute Analytical Laboratory, S-Food Guardians Co., Ltd., Korea, 2Department of Food Science and Technology, Chung-Ang University, Korea, 3Korean Advanced Food Research Institute, Korea

Synthetic antioxidants such as propyl gallate (PG), octyl gallate (OG), dodecyl gallate (DG) and 2,4,5-trihydroxybutyrophenone (THBP) have been used to prevent oxidative degradation in edible oils and fats. These antioxidants in USA, EU and other countries can be added singly or together up to the final concentration of 200 mg/kg. Although the PG is an antioxidant authorized as a food additive in Korea, the OG, DG, and THBP are unauthorized. Therefore, Simultaneous analytical methods is needed to detect. The present study was conducted to compare the different methods including AOAC (Association of Official Analytical Chemists) and AOCS (American Oil Chemists’ Society) and AOCS (American Oil Chemists’ Society) of analysis for simultaneously determining the four antioxidants. The results showed that AOCS official method is more suitable for the simultaneous determination of PG, OG, DG and THBP compared to other methods. The LOD and LOQ of PG, OG, DG and THBP were in the range from 0.06 to 0.17 mg/kg and 0.19 to 0.52 mg/kg, respectively. The AOCS method has been successfully applied to edible oils and fats.

Taste Profiles of Some Processed Foods in Relation to Sodium Reduction

Min-young Heo*, Ha-yull Chung
Department of Food Science & Biotechnology, Hankyong National University, Korea

Sodium is an important component which takes various parts such as osmotic pressure, maintaining physical body balance, and absorption of nutrition. However, in case of over ingestion, it causes osteoporosis, high blood pressure, cardiac diseases, stomach cancer, chronic renal failure and etc. According to ‘Korea National Health and Nutrition Examination Survey’ of 2010, the average daily sodium intake of Koreans was over three times higher than the recommended level of sodium in Korean Dietary Reference Intakes. Although salty taste is known to relate sodium, we examined the association of sodium contents with five different kind of taste using the taste sensor. According to the experiment with sodium chloride solution, sodium content showed a proportional relationship with saltiness and sourness but inversely proportioned with umami, bitterness and astringency. In this study, we tried to monitor taste profile of some processed foods such as oriental dressing, kimchi stew, pickled cucumber and cooked rice containing sauce topping chicken with different levels of sodium in order to understand the pattern of taste properties.
Identification of Gelatin Capsule Sources by Species-specific PCR: Bovine, Porcine, Tilapia and Plant Materials

Tae Sun Kang*, Mi-ra Kim, Yong-Sang Kim, Jin Ha Lee, Kisung Kwon
New Hazardous Substance Team, National Institute of Food and Drug Safety Evaluation, Ministry of Food and Drug Safety, Korea

The aim of this study was to develop detection methods for capsule materials, including bovine, porcine, tilapia, and plant sources. As a genetic marker, 16 srRNA and rbcL gene was selected, species-specific and universal primer sets were developed, and PCR conditions were optimized. Under optimized conditions, the PCR products of bovine, porcine, tilapia, and plant were 131, 136, 167, and 255 bp, respectively, and cross-contamination was not detected among these four species. Gelatin capsules of 28 dietary supplements were analyzed by our detection method. Twenty-five capsules originated from bovine material, including 13 blending capsules (bovine and porcine) that was also detected by the porcine-specific primer set, and only two samples used either tilapia or plant material. Our result is consistent with the gelatin information labeled by the manufacturers. However, we detected bovine DNA from one capsule labeled with tilapia gelatin. Our method can offer an opportunity to screen the authenticity of capsules from various dietary supplements.

Development of UHPLC Method for Analysis of 24 Anti-obesity Drugs in Dietary Supplement and Medicinal Herbs

Ji Hyun Lee*, Jung Yeon Kim, Hyoung Joon Park, Jung-Ah Do, Seok Heo, Jeong-Hwa Cho, Chang-Yong Yoon, Seong Kwan Park, Sooyeul Cho, Sun Young Baek
Advanced Analysis Team, National Institute of Food and Drug Safety Evaluation, Ministry of Food and Drug Safety, Korea

Recently, the number of the cases in which slimming functional foods have been sold with adulterants has increased, as awareness of the problems of obesity grows. In this study, we developed a simultaneous analysis method to rapidly and accurately identify ingredients illegally mixed with dietary supplements. Twenty-four anti-obesity drugs in dietary supplements were determined by newly developed ultrahigh performance liquid chromatography (UHPLC) methods. The UHPLC chromatographic separation was carried out on a C18 reversed-phase column using UV detection at 210 nm. The limits of detection and quantification (LOD and LOQ, respectively) were in the ranges 0.05-3.0 and 0.2-10.0 μg/mL, respectively. The determination coefficient was over 0.999. The precision was <6.2%, and the accuracy was 82.8-102.1%. The mean recoveries of the targeted compounds ranged from 80.3 to 109.3%. The relative standard deviation (RSD) of stability was less than 2.1%. Sixty-eight samples were tested with the developed methods, and twenty were found to be adulterated.

Analytical methods for 12 non-opioid analgesics in dietary supplements by HPLC and LC-MS/MS have been developed in this study. The HPLC chromatogram separation was carried out a C18 reversed-phase column using UV detection at 230 nm. The LODs and LOQs ranged from 0.3-1.0 μg/mL and from 0.5-2.5 μg/mL, respectively. The mean recoveries of targeted compounds ranged from 99.1% to 108.48%. Determination of 12 non-opioid analgesics was accomplished by electrospray ionization LC-MS/MS using DRM. The chromatogram separation was performed on the HSS T3 reversed-phase column, using a gradient of solvent A: 10 mM ammonium acetate in DW and solvent B: acetonitrile. The LC-MS/MS method was validated for linearity (r^2>0.99), The LODs and LOQs ranged from 0.125-25 ng/mL and from 0.25-100 ng/mL, respectively. Sixteen dietary supplements were tested with the developed methods. Seventy-one food and dietary supplements were tested using this method, and were found to be 13 adulterated samples.

Analysis of Volatile Compounds in Seasoned Red-pepper Sauce by SPME-GC/MS

Heeyoung Lee*, Sungbak Hong, Wonil Jung, Hyekyung Ryu, Hyunju An, Jebin Park, Dongyoung Ko
Central Customs Laboratory & Scientific Service, Korea

Customs Service (KCS), Korea

The KCS established standard for applying tariff classifications under the customs act. Detailed Criteria, contents of moisture, presence of seasoning substances etc., are applied to seasoned red-pepper sauce (Mixed seasoning, tariff no. 2103. 90). In this study, we were analyzed volatile compounds of imported red-pepper sauce in order to verify whether garlic and onion were contained or not. Volatile compounds of 4 samples, 2 raw materials and 2 red-pepper sauce (imported and made of raw materials submitted by importer), were analyzed by SPME-GC/MS. The identification of volatiles was based on comparing their RI and mass spectra. Identified components were quantified as relative peak area%. A total of 75 compounds were identified from 4 samples, composed of sulfur-containing compounds (22), terpenes (15), aldehydes (8), alcohols (7), miscellaneous compounds (23). In garlic, the proportion of sulfur-containing compounds was 92.6%. Among them diallyl disulfide, diallyl trisulfide were composed 53.7% and 17.0%, respectively. In onion, 3,4-dimethyl thiophene, Dipropyl trisulfide were detected. The main volatile compounds of raw material were consistently detected in seasoned red-pepper sauces.
Analysis of Adulteration of Red Ginseng Concentrate by Electronic Nose
Hyun Jung Han1,*, Suwon Park1, Hyemin Dong1, Ji Young Moon1,2, Kyong-Hwan Bang1, Jin Young Choi1, Bong Soo Nob1
1Department of Food Science and Technology, Seoul Women’s University, Korea, 2National Agricultural Products Quality Management Service, Experiment Research Institute, Korea

Domestic red ginseng and bellflower root and Codonopsis lanceolata concentrate were diluted to 10°Bx. There sample was mixed in a ratio of 10% with red ginseng concentrate. Corn syrup, rice syrup, high fructose corn syrup were mixed in a ratio of 10% with red ginseng concentrate. The samples were analyzed by electronic nose, and discriminant function analysis (DFA) was used for discriminating of adulteration. Discriminant first score (DF1) was much higher than that of discriminant function second score (DF2), indicating that discrimination was mainly affected by DF1. Furthermore, mixing ratio highly correlated to DF1 value. This technique could be used to efficiently detect the adulteration of red ginseng concentrate.

Simultaneous Determination of Synthetic Food Colorants in Emulsified Food
Yoon Jung Yoo*, Byeong Hyeon So, Jae Sung Kim, Kwang Sik Jung, Hyun Mi Koo, Ji Won Lee, Jang-Hyuk Ahn, Sang Ra G Lee, Young Ryul Kim
KOTITI Testing and Research Institute, Korea

Simultaneous quantitative analytical method for 9 synthetic food colorants was developed by using alkali hydrolysis sample pre-treatment and HPLC-PDA (High Performance Liquid Chromatography-Photodiode Array Detector). Colorant validated for the method included tartrazine (Y4), sunset yellow FCF (Y5), amaranth (R2), erythrosine (R3), allura red AC (R40), ponceau 4R (R102), brilliant blue FCF (B1), indigo carmine (B2) and fast green FCF (G3). Since quantitative analytical method for the 9 colorants in emulsified food was not published officially yet, this research was performed with the aim of official method. For the sample pre-treatment, alkali hydrolysis was performed using 25 mL 4% ammoniacal methanol and defatted process was performed using petroleum ether layer. Proteins removal was performed by centrifugation. Some amount of supernatant was evaporated and the residual was dissolved in 10 mL of 10 mM ammonium acetate. Reversed-phase C18 column to separate colorants within 20 minutes was used with 10 mM ammonium acetate and acetonitrile. Almost all of colorants showed good linearity with 0.9999 regression coefficients and the recovery ranged from 97.2% to 103.9%.

Effects of Hydroxycinnamic Acids on the Formation of Furan in Canned-coffee Model Systems
Li Wei Zheng*, Hyun Chung, Young-Suk Kim
Department of Food Science and Engineering, Ewha Womans University, Korea

The effects of hydroxycinnamic acids (HCAs), including cinnamic acid, p-coumaric acid, caffeic acid, and chlorogenic acid, on the reduction of furan level in canned-coffee model systems (CMS) containing dicarbonyls [glyoxal (GO) or methylglyoxal (MGO)], as precursors of furan formation, were investigated using GC-MS combined by solid phase micro-extraction. Caffeic acid and chlorogenic acid could significantly reduce the furan formation in CMS with MGO by 23.0 and 31.2, respectively, whereas those could decrease the furan formation in CMS with GO by 19.4 and 31.2, respectively, whereas those could decrease the furan level (%) in model system by 41.2 and 48.1, respectively (p<0.05). In conclusion, HCAs with two OH groups such as caffeic acid and chlorogenic acid were observed to be more effective on the furan reduction compared to those with less OH group such as cinnamic acid and p-coumaric acid. The assumption could be supported by the result that higher OH groups in HCAs could trap more dicarbonyls such as GO and MGO.
Quantitative Determination of trans- and cis-Vitamin K\textsubscript{1} in Infant Formula by Isotope Dilution-liquid Chromatography/Mass Spectrometry

Hyeyoung Lee*, Joonhee Lee, Byungjoo Kim
Division of Metrology for Quality of Life, Korea Research Institute of Standards and Science, Korea

A method based on isotope dilution-liquid chromatography/tandem mass spectrometry (ID-LC/MS/MS) has been developed as a method for the accurate determination of vitamin K\textsubscript{1} in infant formula. A generally adopted method based on lipase digestion, protein denaturation with potassium carbonate, pH adjustment and alcohol, and hexane partitioning was followed but with modification and further optimization for accurate and non-biased measurement. A deuterium-labelled standard (Vitamin K\textsubscript{1}-d\textsubscript{3}) was used as an internal standard. Trans- and cis-vitamin K\textsubscript{1} were separated on C\textsubscript{30} column and the ratio was determined by a quantitative NMR and HPLC-UV. The repeatability and reproducibility were tested for the validation of the developed method. Additionally, the developed analytical method was applied to determine trans- and cis-vitamin K\textsubscript{1} in homogenized infant formula.

Comparison in Anti-obesity, Anti-diabetic Effects and Physiological Activities of Several Food Materials

Hyejin Park*, Jungmi Park, Jongok Jeon, Jaeho Park, Sidong Kim, Euisook Park, Hyang-sik Yoon
Wine Research Institute, Chungbuk Agricultural Research and Extension Services, Korea, \textsuperscript{1}food Co., Ltd., Korea

This study was aimed to investigate the biological activity of several fruit and vegetable extracts by the fermentation of Lactobacillus paracasei KB28 and Saccharomyces cerevisiae. Fermented extracts of six different food materials, such as red pepper, Campbell Early, Muscat Bailey A (MBA), wild grape (Vitis coignetiae), blueberry and aronia (Aronia melanocarpa) were investigated for antioxidant effect, pancreatic lipase and α-glucosidase inhibitory activities by using in vitro assays. The results of this study have shown that fermented extracts with lactic acid bacteria were showed strongest inhibition against pancreatic lipase. The inhibitory activity was in the order of red pepper > blueberry > Campbell Early > aronia. α-Glucosidase inhibitory activity was in the order of aronia > MBA and Campbell Early > blueberry > red pepper > wild grape. Especially, the aronia extract showed the highest α-glucosidase inhibitory activity, total polyphenol contents and DPPH radical scavenging activities compared with other samples. These results suggest that the food materials can be useful as a potential functional wine for improving various disorders.

Volatile Flavor Compounds in Petal Tea of Pueraia thumbergiana by Manufacturing Process

An-Hong Choi*, Min-Wook Kim, Se-Yeong Lim, Tai-Sun Shin
Division of Food and Nutrition, Chonnam National University, Korea

Pueraia thumbergiana is native to Korea, China, and Japan. P. thumbergiana has hairy dark brown stems up to 15 m long. Flowers are pea-like, pink to purple with yellow centers, highly fragrant and borne in long hanging panicles. There has been a traditional use of the flower as petal tea which has not only mild flavor and sweet taste, but also beneficial properties to reduce a hangover effect. However, the flower of P. thumbergiana has not been widely used on a commercial scale. This study is to improve the taste and aroma of the petal tea of P. thumbergiana for extensively use as a functional food. The petal tea was prepared by roasting, steaming, and blanching flower with various times at 150, 100, and 100°C, respectively. Headspace solid phase micro-extraction (SPME) coupled to fast gas chromatography-mass spectrometry (GC-MS) was applied to identify volatile flavor compounds present in the headspace of petal tea samples. The major volatile compounds of raw flower were hexanol, 2-ethylhexanol, 3-hexenol, nonanal, 3-octanol, linalool, Butyl acetate, 2,3-butanediol, hexanal, hexanol, 1-octen-3-ol, and nonanal were identified in roasted flower.

Contents of Sargachromanol, Sargaquinoic Acid, and Sargahydroquinoic Acid in Sargassum on the South Coast of Korea

An-Hong Choi*, Min-Wook Kim, Se-Yeong Lim, Tai-Sun Shin
Division of Food and Nutrition, Chonnam National University, Korea

For several centuries, there has been a traditional use of seaweeds as food in China, Japan, and Korea. Sargassum is a genus of brown macroalgae found throughout the tropical and subtropical regions. The brown algae produces the some metabolites of structural classes such as chromanols, chromenes, plastoquinones, phlorotannins, and phlorethols. The sargachromanol E significantly reduced the inflammatory response in LPS induced macrophages, decreasing LPS-induced transcription factor of pro-inflammatory cyclooxygenase-2. Also, sargaquinoic acid and sargahydroquinoic acid in Sargassum showed some beneficial result for reducing insulin resistance through regulation of adipogenesis. However, there are scarce information on the contents of sargachromanol, sargaquinoic acid, and sargahydroquinoic acid in Sargassum. This study collected Sargassum such as Sargassum yamadae, Sargassum serratifolium, Sargassum horneri, Myagropsis myagroides and analyzed the contents of sargachromanol, sargaquinoic acid, and sargahydroquinoic acid in Sargassum by HPLC. Sargassum serratifolium had high amount of sargachromanol, sargaquinoic acid, and sargahydroquinoic acid compared with the others.
Volatile Flavor Compounds of Korean Fried Kamaboko with Allium hookeri

Min-wook Kim*, An-Hong Choi, Se-Yeong Lim, Ha-neul Kim, Hee-Jeong Jeong, Bok-Mi Jung, Tai-Sun Shin
Division of Food and Nutrition, Chonnam National University, Korea

Kamaboko is a type of cured surimi in which various white fish such as pollack, white croaker, or pollack are used, combined with additives such as MSG, sugar, and NaCl, molded into various shapes, and then fried. The fried kamaboko has a peculiar flavor caused from fishes used as a raw material and heating. Garlic, leeks, onion powder, etc. are used to remove the off-flavor. The plant contains high amount of sulfur (0.6%) containing compounds which might remove some off-flavors. This study prepared Korean fried kamaboko with Allium hookeri (0, 0.5, 1.0, and 1.5%). Headspace solid phase micro-extraction (SPME) coupled with gas chromatography and mass spectrometry has been used to identify volatile organic compounds present in the headspace of Korean fried kamaboko. Sixty-three volatile compounds were identified in the headspace of Korean fried kamaboko with Allium hookeri. The presence of compounds such as hexanal, propyl disulfide, ethylbenzene, heptanal, 1-octen-3-ol, octanal, terpinen-4-ol, and decanal. Addition of Allium hookeri to fish paste slightly decreased the fishy smell compounds such as hexanal, heptanal, and pentenal.

Development and Application of an Analytical Method for Quantification of Biogenic Amines in Fermented Soybean Paste (Doenjang)

Yong Gun Kim*, Jae Young Her, Jun Young Lee, Kwang Geun Lee
Department of Food Science and Biotechnology, Dongguk University, Korea

Biogenic amines (BAs) are toxic nitrogenous compounds and formed by the microbial decarboxylation of amino acids during fermentation. BAs can cause several toxicological problems such as nausea, respiratory distress and hypoxia or hypertension. In this study, development of analytical method to quantify the BAs was presented in fermented soybean paste (doenjang) model. Seven doenjang samples were selected for validation of this method, and each was manufactured in a traditional method. The matrix effect was considered for validation. The linearity values from current method were higher than 0.99, and recovery efficiencies ranged from 97.0% to 107.2%, respectively. The method detection limit (MDL) ranged from 0.37 to 2.50 μg/g and the limit of quantitation (LOQ) ranged from 1.23 to 8.35 μg/g. The inter-day precision of BAs ranged from 0.84 to 8.91% and the intra-day precision of BAs ranged from 0.43 to 6.98%, respectively. The mean values of biogenic amines including tryptamine, β-phenylethylamine, putrescine, cadaverine, histamine, tyramine, spermidine and spermine found in commercial doenjang samples were 55.0, 49.0, 263.2, 9.0, 229.0, 72.5, 29.5, and 10.6 μg/g, respectively.

Establishment of the Detection Methods for Newly Approved GM Events

Eden Jeong*, Ye-Seul Jo, Min Ki Shin, Guim Moon, Yu Jihn Kwon*, Jeong Yun Cho*, So Young Chung*, Sun Ok Choi*, In Gyun Hwang
Food Safety Risk Assessment Division, National Institute of Food & Drug Safety Evaluation, Ministry of Food and Drug Safety, Korea, "Hazardous Substances Analysis Team, Gyeongin Regional Food and Drug Administration, Korea

In this study, we validated event specific qualitative and quantitative detection methods for the newly developed genetically modified (GM) crops in order to strengthen the label management for GM foods. Three GM events [one soybean (DAS-81419-2), two maize (MON87741, VCO-01981-5)] were selected for the qualitative detection methods and one GM event [one soybean (DAS-68416-4)] was selected for the quantitative detection method. For the validation of a qualitative detection method, polymerase chain reaction (PCR) was tested for specificity, sensitivity and repeatability. As a result, the limit of detection (LOD) of qualitative detection methods for DAS-81419-2, MON87741, and VCO-01981-5 were ranged from 0.005 to 0.05% and showed specificity to other crops or other GM events. Quantitative detection method of DAS-68416-4 was validated according to the CODEX guideline and satisfied the performance requirements. This study may imply that detection methods can be established in the GMO analysis.

Determination of Coenzyme Q10 in Health Functional Foods

Jin Hee Lee*, Hee Jung Kwak, Hwa Jung Lee, Il Won Seo, Jae Myoung Oh, Yong Woon Shin, Seul Gi Kim, Tae Seok Kang
Nutrition and Functional Food Research Team, National Institute of Food and Drug Safety Evaluation, Korea

Coenzyme Q10 (CoQ10), also known as ubiquinone or ubidecarenone is a biologically active compound similar in chemical structure to vitamin K and E. CoQ10 has functional effects such as antioxidant and lowering blood pressure like vitamin K and E. For this reason, a significant number of CoQ10 products are currently on the market as health functional foods. It is of paramount importance to the health functional foods industry that any CoQ10 product be safe and efficacious. A new method has been developed for the enhancement of the CoQ10 recovery rate in single and composite products. The CoQ10 is dissolved in a mixture of hexane : anhydrous ethanol (5:2) and finally is analyzed by reverse-phase high-performance liquid chromatography with a UV detector. Detection and quantification were achieved at 280 nm. The linearity was established in the range 0.14-185.12 μg/mL with a determination coefficient, r² of 0.9998. Accuracy and selectivity of the method were demonstrated.
**Use of Chromatography for Perchlorate Levels in Agriculture Water**

Jae-Min An*, Young-Jin Song, Ji-Hye Kim, Chae-Hyun Jung, Kyong-Suk Hong, Sung-Youn Kim, Dong-Ho Kim, Byung-Chyoun Kim, Jae-Hwon Lee
National Agricultural Products Quality Management Service, Korea

Perchlorate was separated by the anion column and detected by electrical conductivity detector method. The running buffer solutions contained 12 mM sodium carbonate, 20% acetone in ultrapure water and 100 mM sulfuric acid. Stock standard solution (1,000 mg/L) purchased as certified solutions and made stock solution (10 mg/L). Five calibration solutions (0.01, 0.1, 0.5, 1.0, and 2.0 mg/L) were prepared with ultra pure water. Recovery analysis was repeated 3 times. The result and relative standard deviation (RSD) was 103.0% (0.803%). Aliquots of standard solutions from 0.1 mg/L were analyzed to determine the limit of detection (LOD, SD*3) and limit of quantification (LOQ, SD*10) (n=7). The Limit of detection for perchlorate was 0.002 mg/L, while the Limit of Quantification was 0.008 mg/L. In conclusion, this method may cover the determination of perchlorate in surface water, ground water, agriculture water, and finished drinking water.

**Optimizing Conditions for Cycloalliin Formation from Garlic Cloves Using Response Surface Methodology**

Sun-young Kim*, Sanghee Lee, Dongbin Shin, Mıyoung Yoo
Food Analysis Center, Korea Food Research Institute, Korea

The optimizing conditions for cycloalliin formation were determined using response surface methodology. The three independent variable were temperature (°C, X1), humidity (% X2) and storage time (day, X3), and two dependent variables which were cycloalliin contents from garlic clove harvested in 2013 (Y1) and garlic clove harvested in 2014 (Y2). The central composite design consisted of 17 experimental points including three replications at the center point. Data were analyzed by statistical system software. Regression analysis showed more than 88% of the variation was explained by the model. Canonical analysis revealed the stationary point mental values of Y1 and Y2 were 22.62 mg/g, dry base, 7.30 mg/g respectively. Under optimum condition, the predicted responses value for Y1 and Y2 were 21.33 mg/g, dry base, 7.32 mg/g, dry base, respectively. The experimental data agree with predicted, thus indicating suitability of the model and the success of RSM in optimizing condition for cycloalliin formation.

**Evaluation of Natural Food Preservatives in Domestic and Imported Cheese**

Sun-young Park*, Sang-Dong Lim, Noori Han, Sun-young Kim, Mi-young Yoo, Hyun-Dong Paik
Korea Food Research Institute, Korea, 1Konkuk University, Korea

We investigated the production of natural food preservatives (sorbic acid (SA), benzoic acid (BA), propionic acid (PA), nitrite and nitrate) contents of domestic and imported cheeses. 11 kinds of domestic and 26 kinds of imported cheeses were collected. The content of natural food preservatives in domestic cheese was investigated depending on cheese aging and storage period. Each domestic cheese was aged for suitable months and stored for one or two months at 5°C and 10°C. HPLC-PDA analysis was used for detection of BA and SA. GC-FID, HPLC-UV and spectrophotometric analysis were used for detection of PA, nitrite and nitrate, respectively. All kinds of preservatives were not detected in domestic soft and fresh cheeses, except cream cheese. In case of semi-hard cheeses, BA was detected after one or two months of aging. It was 2-5 mg/kg. In imported cheeses, PA and BA were only detected. The averages of BA and PA contents in semi-cheese were 8.73 mg/kg and 18.78 mg/kg, respectively. Also, the contents were 2.81 mg/kg and 6.60 mg/kg in soft cheese, 3.27 mg/kg and 2.84 mg/kg in fresh cheese, 1.87 mg/kg and N.D. in hard cheese, 2.07 mg/kg and 182.26 mg/kg in blended process cheese, respectively.
**Effect of Various Food Additives and Caramel Colorant on the Reduction of Carcinogenic 4(5)-Methylimidazole in Soy Sauce Model System**

Sumin Lee*, Min-chul Jung, Kwang-geun Lee  
Department of Food Science and Biotechnology, Dongguk University, Korea

Recently, 4(5)-methylimidazole (4(5)-MI) received much attention from the government regulatory agencies due to its carcinogenicity. The aim of the present study was to develop a reduction for carcinogenic 4(5)-MI in soy sauce model system using food additive approaches. In addition, the correlation between 4(5)-MI and caramel colorant as an index, was determined. The effect of food additives such as metal ions (Fe²⁺, Zn²⁺, and Mg²⁺) and organic acid (citric acid, gallic acid, and ascorbic acid) on the formation of 4(5)-MI was investigated using soy sauce model system. The level of 4(5)-MI in soy sauce model system with 5% (v/v) caramel colorant III was 1,404 μg/L. The degree of reduction was at the greatest with addition of 0.1M iron sulfate (81%). The correlation between physicochemical properties of soy sauce such as caramel colorant amount, pH value, color differences and 4(5)-MI levels was determined. The amount of caramel color and pH values with level of 4(5)-MI in soy sauce showed the higher correlation ($r^2=0.9712$, $r^2=0.9378$). The level of caramel colorants in eight commercial soy sauces were estimated ranging from 0.01-1.34% (v/v).

**Validation and Analysis of Furan in Commercial Tea Products Using SPME-GC/MS**

Yun-Jeong Seok*, Min Yeop Kim, Soo Young Jeong, Jae-Young Her, Kwang-Geun Lee  
Department of Food Science and Biotechnology, Dongguk University, Korea

Furan is a heterocyclic volatile compound formed during the 137 maillard reaction and was recently classified as a possibly human carcinogen (group 2B) by the International Agency for Research on Cancer. It has been reported to occur in various foods that undergo thermal treatment. In this study, validation of analytical method for furan were carried out using solid phase microextraction-gas chromatography/mass spectrometry (SPME-GC/MS) to analyse the amounts of furan in commercial tea products. The linearity values were obtained higher than 0.99 and recovery efficiencies were ranged from 80.58% to 108.94%. The limit of detection (LOD) was 0.36 ng/g and the limit of quantification (LOQ) was 1.09 ng/g. The inter-day precision of furan ranged from 5.13 to 14.04% and the intra-day precision of furan ranged from 4.68 to 13.48%. Furan in 36 commercial tea products was ranged from 2.96 to 1,840.45 ng/g.

**Effect of Different Cooking Methods on Vitamin Contents in Vegetables**

Seongeung Lee*, Yeaji Park, Heemang Jeon, Youngmin Choi1, Junsoo Lee  
Brain Korea 21 Center for Bio-Resource Development, Division of Animal, Horticultural, and Food Sciences, Chungbuk National University, Korea, 1Department of Agrofood Resources, National Academy of Agricultural Science, Rural Development Administration, Korea

This study evaluated the effect of different cooking methods including blanching, boiling, microwaving and steaming on the contents of vitamins such as vitamin C (ascorbic acid), vitamin E (tocopherol), vitamin K (phytolquinone) and β-carotene. True retention was assessed using paired samples and a formula that compensated for loss or gain of moisture and soluble solids. The retention of vitamin C ranged from 0.0% to 91.1% for all cooked samples. Generally, higher retention of vitamin C was observed in microwave cooked vegetables whereas the lowest retention was characteristic of boiled vegetables. Retention of higher than 100% was observed for vitamin E and β-carotene in cooked vegetables. Microwave cooking caused the most loss of vitamin K in crown daisy and mellow samples. On the other hand, microwave cooking caused the least loss of vitamin K in spinach and chard, tested in our study. Smoking may cause change of vitamin contents, and it depends on the vegetables and the heating process. Further research is needed to optimize cooking procedures to enhance retention of vitamins.

**Analysis of Vitamin K₁ in Some Commonly Consumed Foods in Korea**

Seongeung Lee*, Youngmin Chui1, Seungwoo Noh, Kyeongmin Lee, Junsoo Lee  
Brain Korea 21 Center for Bio-Resource Development, Division of Animal, Horticultural, and Food Sciences, Chungbuk National University, Korea, 1Department of Agrofood Resources, National Academy of Agricultural Science, Rural Development Administration, Korea

Vitamin K₁ (phytolquinone) contents of commonly consumed foods in Korea were determined by solvent extraction followed by reverse phase liquid chromatography using post-column derivatization and fluorescence detection. The samples in this study included 46 vegetables, 14 fruits, and 6 legumes. The relatively higher amount of vitamin K₁ was found in sweet potato leaves, green kiwi, and mung beans from vegetables, fruits, and legumes, respectively. The contents of vitamin K₁ in vegetables ranged from non-detectable (ND) to 1,292.59 μg/100 g. The contents of vitamin K₁ in fruits ranged from ND to 25 μg/100 g. The contents of vitamin K₁ in legumes ranging from 1.69 to 63.35 μg/100 g. In addition, the analytical method validation parameters including recovery, reproducibility, repeatability, peak purity, and linearity were calculated to ensure the method’s validity. Generally, the results of validation parameters were reliable and satisfactory. This study provided reliable vitamin K₁ analytical data in commonly consumed foods in Korea for the nutritional information and food composition database.
Effects of Adsorbents on the Contents of Benzo(a)pyrene, Sesamol and Sesamolin, and the Profiles of Volatile Components in Sesame Oil

Bo Ram Shin*, Seung-Ok Yang, Young-Suk Kim, Hye Won Song1, Myung-Sub Chung2
Department of Food Science and Engineering, Ewha Womans University, Korea, 1Peakman SP Company, Korea, 2Department of Food Science and Engineering, Chung-Ang University, Korea

The aim of current study is to determine the effects of treatment with adsorbents used for the reduction of benzo(a)pyrene (BaP) on volatiles profile and antioxidants (sesamol and sesamolin) contents in sesame oil. Charcoal-based activated carbons with different mesh sizes and celite were used as adsorbents. The addition of activated carbons to sesame oil led to a significant reduction in the BaP content. Also, the removal of BaP could be affected by the particle sizes of activated carbons. However, there was no significant difference in BaP content between control and sesame oil added with celite. Whereas the volatiles profile in sesame oil was not considerably influenced by the addition of any of the adsorbents, the contents of both sesamol and sesamolin in sesame oil treated with adsorbents were significantly lower than those of control without them.

P01-037

Volatile Compounds in Fermented and Distilled Liquors Using Different Types of Fermentation Starters

Seung-Joo Lee*, Kwang-Jin Shin
Department of Culinary and Food Service Management, Sejong University, Korea

This study was conducted to investigate changes of the volatile compounds of fermented and distilled liquors during the process of alcohol fermentation and distillation. Yakju was prepared using different types of fermentation starters such as nuruk, ipguk, and crude amylolytic enzyme. Total 15 samples were extracted using solid phase micro extraction (SPME), and extracts were analyzed by GC and GC-MS. A total of 63 volatile compounds, including 46 esters, 15 alcohols, 5 acids, 8 ketones, 1 aldehyde, and 8 miscellaneous components, were identified. Esters, and alcohols were the largest groups among the quantified volatiles. Principal component analyses (PCA) was applied to differentiate fermented liquors and Korean distilled liquors samples by volatile compounds. Five samples (D-NU1, D-NU2, D-CR, D-IP1, D-IP2) made by reduced pressure showed similar volatile patterns as shown in PCA 1 (52.62% of variance), and volatile compounds showed a different patterns depending on commercial fermentation starters by PCA 2 (13.97% of variance).

P01-038

Development and Validation of Analytical Method of Benzo(a)anthracene, Chrysene, Benzo(b)fluoranthene, and Benzo(a)pyrene in Two Different Types of Food Matrices Using GC/MS

Shinwoong Park*, Junhyun Jeong, Jae-Young Her, Kwang-Geun Lee
Department of Food Science and Biotechnology, Dongguk University, Korea

PAHs are hydrocarbons-organic compounds containing only carbon and hydrogen formed during the imperfect combustion and was recently classified as group 2B (Benzo(a)pyrene) and group 2B (Benzo(a)anthracene, chrysene, Benzo(b)fluoranthene) by the International Agency for Research on Cancer. They have been reported to occur in various foods that undergo heat treatment. In this study, development and validation of analytical method of PAHs were carried out using gas chromatography/mass spectrometry. To minimize the matrix effect, two different types of food matrices such as apple juice (non-fatty group) and sausage (fatty group) were selected for validation. The linearity values were obtained higher than 0.99 and recovery efficiencies were ranged from 81.73% to 113.11%. The limit of detection was ranged from 0.01 to 0.03 ng/g and the limit of quantification ranged from 0.04 to 0.10 ng/g. The inter-day precision of PAHs ranged from 2.96 to 13.89% and the intra-day precision of PAHs ranged from 0.52 to 15.77%.

P01-039

Reduction of Roasting Energy by New Coffee Manufacturing Process Using Green Coffee Bean Grinder

Su Jeong Lee*, Ha Yan Song, Jae-Young Her, Kwang-Geun Lee
Department of Food Science and Biotechnology, Dongguk University, Korea

Coffee consumption has been increasing steadily. Therefore using of coffee roaster has significantly increased and subsequent energy consumption associated with coffee production received attention as important issue. The objective of current study was to reduce for roasting energy by new coffee grinder and roaster. Coffee samples such as conventional Bolivian coffee bean (control), roasted coffee bean powder crushed by new grinder (RCBP-NG) and roasted coffee bean powder crushed by conventional grinder (RCBP-CC). The color of Bolivian coffee was used as an index for time and temperature in roasted coffee. Physicochemical analyses such as color, moisture content, pH and trigonelline content of control and experiment group were carried out. The trigonelline content of RCBP-NG was significantly higher than the content of control group (p≤0.05). The color, moisture content and pH of three samples were not significantly difference (p>0.05). The amount of total volatile compounds in control and RCBP-NG were not different. The roasting energy consumption of RCBP group at different grinder such as conventional and new grinder were reduced by 20 and 28%, respectively, compared with control group.
**P01-041**

Determination of Antioxidants in Oils by High Performance Liquid Chromatography

Su Yeon Lee*, Jae Yeon Lee, Cheong Tae Kim, Soo Hyun Park  
Food Safety Research Institute, NONGSHIM Co., Ltd., Korea

A HPLC method for simultaneous determination of antioxidants butylated hydroxyanisole (BHA), butylated hydroxytoluene (BHT), and propyl gallate (PG) in oil was validated through CRM (Certified Reference Material) and international proficiency test (FAPAS proficiency test 20105). A C18 column was applied as the stationary phase, acetonitrile/methanol (1:1, v/v) and acetic acid (5%) is used as the mobile phase of gradient elution. The UV detector was set at 280 nm. The samples were extracted using acetonitrile, 2-propanol and ethanol mixture (2:1:1, v/v) by ultrasonic treatment for 10 min. After precipitation in a freezer (1 h), the sample solution was filtered and then a supernatant was analyzed by HPLC. The result of BHA in oil was 83.97 mg/kg, compared with the assigned value of 84.2 mg/kg from FAPAS, 0.0 of z-score was obtained. Additionally, BHT in oil was 49.2 mg/kg with -0.9 of the z-score compared with the assigned value of 52.2 mg/kg. The result of PG in oil was 39.21 mg/kg with -1.7 of the z-score compared with the assigned value of 47.2 mg/kg. It was verified that analytical method was accurate and reliable to determine antioxidants BHA, BHT, and PG in oil by HPLC.

**P01-042**

Characterization of Photo-degradation of Different Formazans by Porphyrin Derivatives

Bo Hee Choi*, Mi-Ri Kim, Snee Kang, Yu Na Jung, JooHyoun Kim, Jungil Hong  
Department of Food Science and Technology, College of Natural Science, Seoul Women’s University, Korea

Tetrazolium-based colorimetric assay is widely used to assess cell viability. In this study, photo-degradation properties of MTT and other water-soluble formazans induced by zinc protoporphyrin, protoporphyrin IX, and zinc phthalocyanine were investigated. They rapidly degraded MTT formazan under various light sources. Photo-degradation of MTT formazan by the porphyrins was more pronounced under UV at 365 nm rather than 254 nm; light absorption at 365 nm by the porphyrins was more efficient than at 254 nm. Photosensitizing properties of the porphyrins were also verified through enhancing fluorescence of 2',7'-dichlorofluorescein under light. The porphyrins did not affect color stability of water-soluble formazans that need an electron coupling reagent for their color development. An electron coupling reagent (e.g. menadione) also delayed degradation of MTT formazan by the porphyrins. The results suggest that certain porphyrin compounds induce rapid degradation of MTT formazan due to their photosensitizing properties, but do not alter color response of water-soluble formazans using electron coupling reagents.

**P01-043**

Formation and Reduction of Furan in a Soy Sauce Model System according to the Time of Addition of Food Additives

Min Yeop Kim*, Jae-Young Her, Kwang-Geun Lee  
Dongguk University, Korea

The aim of this study was to understand the formation of furan in soy sauce according to the time of addition of food additives. Soy sauce was produced to a standard manufacturing procedure method using koji (Aspergillus oryzae) fermentation. A level of furan was determined. Soy sauce was treated with Headspace-Solid phase microextraction (SPME) followed by Gas chromatography-Mass Spectrometry (GC-MS), every 5 days up to 30 days. Five food additives (magnesium sulfate, calcium sulfate, sodium sulfite, dibutyl hydroxytoluene (BHT), and butylated hydroxyanisole (BHA)) were added to the soy sauce model system under two different conditions (simultaneous fermentation and with food additives prior to sterilization) in order to determine the effect of food additives on reduction of furan. The addition of magnesium sulfate, calcium sulfate, BHT and BHA to soy sauce showed a significant reduction of furan level both two conditions, compared to control samples (p<0.05). However, sodium sulfite under simultaneous fermentation showed effective reduction ratio of furan levels compared to when processing this additive prior to sterilization.

**P01-044**

A Study on Physicochemical and Functional Properties of Korean Dioscorea spp. by High Hydrostatic Pressure

Kyung Mi Kim*, Moon Kyung Kang, Jin Sook Kim, Gi Chang Kim, Song Yi Choi  
National Academy of Agricultural Science, RDA, Korea

This study was carried out to investigate the changes of physicochemical properties and antidiabetic activities from Dioscorea spp. treated with high hydrostatic pressure. Korean Dioscorea spp. was treated at 100-400 MPa for 3, 5, and 10 min, respectively. The samples were extracted with 70% ethanol and analyzed by the free sugars, organic acids were analyzed, and crude saponin, water binding, oil absorption and α-glucosidase inhibitory activity were measured in the study. The free sugar and organic acid was increased as the high hydrostatic pressure individually. The crude saponin content was higher samples treated with high hydrostatic pressure than the control. α-Glucosidase inhibitory activities of samples treated at 100 and 300 MPa were significantly higher than acarbose. The water binding and oil absorption capacity showed that high hydrostatic pressure treatment decreased. The present results suggest that high hydrostatic pressure treatment would improve the functional compound and antidiabetic activity of Dioscorea spp.
Comparison of the Quality Characteristics and the Organic Acids in the Sweet Wines Produced on the Yeongdong Farmhouse Wineries

Jung-Mi Park*, Hyejin Park, Hyang-sik Yoon, Jaeho Park, Jongok Jeon, Sidong Kim
Wine Research Institute, Chungbuk Agricultural Research and Extension Services, Korea

This study was conducted to compare the organic acids of the sweet wines produced on the Yeongdong farmhouse wineries. Sample wines were analyzed for ethanol, pH, total acidity, sugar content, color intensity, hue, organic acid, and total phenolic content. The various wines contained from 9.0-15.6% (v/v) ethanol depend on the various wine types. The pH of the sweet wines ranged from 3.29 to 4.0 and the total acidity of wines ranged from 0.4-1.0% (w/v). It has shown that the quality of wines differed greatly from wineries and grape types. In the case of sweet wine among the various wines, the Bx values ranged from 10.3-21.3. Also, the reducing sugar analysis was similar to result of the oBx values. The total polyphenol content of wines showed 94.6-173.1 mg% (w/v) and the organic acids of wines, such as citric acid, tartaric acid, malic acid, lactic acid, formic acid, and acetic acid were detected by HPLC. Significant differences in the color analysis (color intensity and hue values) were found to depend on processing procedures and kinds of wineries. As a result, it may be applicable to the manufactures of the sweet wines for the good quality.

HPLC/DAD Methods for Determination of Patulin in Apple Juice

Seung Lim Baek*, Dong Sik Jeong, Cheong Tae Kim, Soo Hyun Park
Food Safety Research Institute, NONGSHIM Co., Ltd., Korea

Patulin, a mycotoxin mainly produced by Penicillium and Aspergillus sp., is found in apple fruits and juices. In the present, a maximum acceptable level for patulin has been established at 50 μg/kg in apple juices in Korea. For analysis, apple juice sample was extracted with acetoniitrile and cleaned-up through solid-phase filtration column. The extract solution was evaporated to dryness under nitrogen followed by re-dissolving. Patulin was separated on a chromatographic column(C18, 250×4 mm, 5 μm) using a mobile phase of 0.8% THF prior to measure at 276 nm by UV diode array detector (DAD). The analysis method was confirmed and validated through the international proficiency test using juice sample contains patulin, which was provided by Food Analysis Performance Assessment Scheme (UK). As a result, 35.4 μg/kg of patulin was quantified with -0.3 of z-score compared with the assigned value of 37.6 μg/kg by FAPAS. It was verified that applied analysis method to determine patulin in apple juice by HPLC/DAD is accurate and reliable.

Optimization of Microwave-assisted Extraction for Antioxidant Activities and Polysaccharide Content from Coriolus versicolor Mushroom Using Response Surface Methodology

Jeong-Hwan Maeng*, Joong-Ho Kwon
Kyungpook National University, Korea

Coriolus versicolor mushroom is also termed as ‘YunZhi’, and it belongs to family Polyporaceae in Basidiomycetes division. Also, it is listed in the Korean Food Standards Codex as an ingredient of processed mushroom. Particularly, polysaccharides of C. versicolor were reported to exhibit pharmacological properties. Microwave-assisted extraction (MAE) is a method that can extract target compounds with improved efficiency by reducing consumption of energy within shorter extraction time as compared to reflux extraction (RE). The optimum extraction condition range was expressed to be 3.4-4.4 min extraction time, 30-45% ethanol concentration and 120-170 W microwave power, and its random point was estimated to be 3.9 min extraction time, 37.5% ethanol concentration and 145 W microwave power. Furthermore, comparative results with RE regarding total yield, total phenolics content and total polysaccharide content were found to be higher in MAE extracts than those obtained by RE. But, antioxidant activities of extracts by both methods were found to be statistically insignificant. MAE was found to be more efficient than RE, because MAE has shorter extraction time than RE.

Determination of Pb, Cd, As, Al, and Hg in Beef from South Korea

Eun Yeong Nho*, Ji Yeon Choi, Sang Yeol Oh, Yun Mi Dang, Kyung Su Park1, Min Ga Jo2, Hea Jung Yoon2, Kyong Su Kim
Department of Food and Nutrition, Chosun University, Korea, 1Advanced Analysis Center, Korea Institute of Science and Technology, Korea, 2Food Contaminants Division, Food Safety Evaluation Department, Ministry of Food and Drug Safety, Korea

This study aimed at determining the content of heavy metals including Pb, Cd, As, Al, and Hg in Beef. A total of 2,884 samples containing rib bone (30) and each part of beef (chuck, ribloin & top ribloin, rib, top round, foreslish, hindshank) collected from super markets all over South Korea. Inductively coupled plasma-mass spectrometry (ICP-MS) was used for determination of Pb, Cd, As and Al, while Hg was analyzed by direct mercury analyzer (DMA). The applied analytical method were validated by linearity, detection limits, precision, accuracy and recovery experiments. Results indicated the presence of considerable amounts of toxic heavy metals in the rib bone and beef analyzed. The average concentration of all analyte metals were found bigger in the rib bone than each part of the beef. The anlyte metal in decreasing order of (mg/kg): Al>As>Pb>Hg>Cd. In general the levels of all analyzed toxic metals were very low as compared to recommended standards from WHO/IECFA and MSDF. The overall contribution of the studied toxic metals intake for consumers from the beef was found very small and therefore would not pose any health concern under normal conditions.
Storage Stability and Quality Attributes of Valencia Oranges during Storage at Different Temperatures

Namhyeok Chung*, Yaping Gao, Yunhee Jo, Jeong-Hwan Maeng, Joong-Ho Kwon
Kyungpook National University, Korea

Quality characteristics of imported Valencia oranges were studied during storage at low (4°C) and room temperature (20°C) for 30 days. The fruit weight and peel thickness decreased significantly when the oranges were stored at 20°C. The hardness of flesh also decreased more at 20°C than 4°C. Hunter’s L and a values showed no difference at both temperatures, but Hunter’s b value (yellowness) decreased significantly from the 10th day of storage. Consequently, overall color difference was changed more when stored at 20°C. As total soluble solid (TSS) decreased significantly and total acidity (TA) maintained constant value, TSS/TA ratio decreased regardless of the storage temperature. Vitamin C content decreased on the 10th day of storage and maintained the content during 30 days. In the sensory evaluation, scores on color, flavor, sweetness, sourness, and overall acceptability decreased with storage time. TSS, TA, TSS/TA ratio, and reducing sugar content were significantly related to the sensory properties (p<0.05). These results suggest that storage conditions at 4°C for 20 days were suitable for keeping the physicochemical and sensory qualities of Valencia oranges.

Characterization of Traditional Korea Unifloral Honey Based on Mono-, Di- and Trisaccharides

Eun Sook Jang*, In Suk Kim, Hyun-Sun Seo, Hee-Jin Lee, Jong-Bae Kim
Food Analysis Division, Institute of Health and Environment, Daegu Metropolitan, Korea

Sugar profiles of 45 honey samples, which are commercially available in Korean markets, were analyzed by GC/MS through the TMS-oxime and TMS-methoxime derivatization. The mean content of total invert sugar in honey samples from acacia, multi-floral, chestnut and artificial honeys were 69.3±2.86, 66.4±3.28, 62.4±2.24, and 68.0±2.32%, respectively. Fourteen disaccharides were detected from those honey samples and the content of major disaccharides was higher in order of turanose, maltulose, maltose, trehalulose, kojibiose, isomaltose and nigerose. However, the disaccharides, such as sucrose, α-trehalose, β-trehalose, laminaribiose, palatinose and gentiobiose, were detected in trace amounts in foral honeys. The mean content of total disaccharides, consisted of maltulose, turanose and trehalulose, was the highest in chestnut and the lowest in acacia. Seven different kinds of trisaccharides were detected from the samples. Amount of trisaccharides was the highest in artificial honeys, which showed high in erlose content. The total amount of the disaccharides and the trisaccharides was the highest in chestnut that showed the lowest content of monosaccharides.

Determination of Quality Index Components in High-acidity Cider Vinegar Produced by Two-stage Fermentation

Yunji Park*, Hye-Jin Lee, Yunhee Jo, Namhyeok Chung, Soo-Hwan Yeo1, Yong-Jin Jeong2, Joong-Ho Kwon
School of Food Science and Biotechnology, Kyungpook National University, Korea, 1Fermentation and Food Processing Division, Department of Agrofood Resources, NASS, RDA, Korea, 2Department and Food Science and Technology, Keimyung University, Korea

High-acidity cider vinegar (HACV) was produced by alcohol and acetic acid fermentation of apple concentrate without any nutrients and then the optimum alcohol concentration was determined through quality study. HACV was fermented with the different initial alcohol concentrations (6-9%) in the process of acetic acid fermentation. Reducing sugar, organic acids, and free amino acids showed the highest content at 6% of initial alcohol concentration. Total phenol content and radical scavenging activity showed the highest value at 7-8% of initial alcohol concentration. Approximately 20 types of volatile compounds were identified by SPME/GC-MS. Total volatile content showed the highest at 6% of initial alcohol concentration, and the acids showed the lowest at 9%. The qualities of HACV using a two-stage fermentation showed better results compared with three kinds of commercial HACV, presenting the highest value at 6% of initial alcohol concentration. Based on the correlation between physicochemical properties and sensory attributes of HACV, malic acid, aspartic acid, and hexyl acetate were selected as quality index component of high acidity cider vinegar by two-stage fermentation.

First Evaluation of Antioxidant Potential of Regrowth Velvet Antler by Means of Multiple Biochemical Assays

Sangho Moon*, Yujiao Tang, Heeri Choi, Eunju Choi, Eunkyung Kim
Konkuk University, Korea

In this paper, we investigated the antioxidant activity of regrowth velvet antler. For this research, the antler was divided into three segments: top, middle, and basis, and subjected to the extraction process using boiling water at 100°C and 70% ethanol solution. The antioxidant activity was determined by means of DPPH, ABTS, hydrogen peroxide, and hydroxyl radical scavenging activities. In addition, we performed ORAC and FRAP assays. The top section exhibited higher antioxidant potential than middle and base, and the activity was dose-dependent manner. The water extract of the top section showed the strongest antioxidant capacity in the DPPH, hydrogen peroxide scavenging activity, and FRAP assay, and the TE values were 53.441, 17.283, and 59.250 μM at 1 mg/mL, respectively. Meanwhile, the ABTS, hydrogen peroxide scavenging activities, and ORAC of the ethanol extract of the top section were higher than others, and the TE values were 37.367 and 27.982 μM at 1 mg/mL, and 121.58 μM at 20 μg/mL, respectively. These results indicate the antioxidant activity of the antler depends on their segments and extraction methods.
**P01 -053**

**Comparison on Quality Characteristics of High Amylose Rice Cookies**

Eun-yeong Sim*, Chun Woo Lee, Byung Joo Kim, Yu Young Lee, Ji-young Park, Yook Han Kim  
National Institute of Crop Science, Rural Development Administration, Korea

With increasing interest in health and beauty, indigestable substances such as total dietary fiber (TDF), resistant starch (RS) were being focused. Minmyeon, Dodamsaal, Saegoami were identified as high-amylose rice cultivars except Ilmibyeo. As the contents of amylose were higher, the contents of RS were higher. The purpose of this study was to develop a method for making rice cookies (100, 70, and 50%) with upper cultivars and recommend the best rice cultivars for a rice cookie. We investigated the characteristics of the material (raw rice, dough, cookies) and the rice cookies (physico-chemical, physical, sensory). Raw rice contained TDF between 4.42-10.34 g/100 g. The TDF contents of brown Dodamssal were the highest. The contents of amylose and resistant starch of white Dodamssal were the highest, 38.7% and 9.54%, respectively. Moreover, a cookie made of white Dodamssal contained the highest amylose and RS contents, 23.88% and 3.7%, respectively. These showed no significant difference between a cookie of white and brown Dodamssal. Finally, according to the sensory evaluation, a cookie of brown Dodamssal was the most popular among them. It means that brown Dodamssal would be an appropriate cultivars for a cookie.

**P01 -055**

**Improvement of HPLC Method for 14 Sugars and 7 Sugar Alcohols in Foods Using NQAD and RID**

Joo-Hee Lee*, Choong-In Yoon, Young-Jun Kim  
Food Safety Center, Ottogi Corporation, Korea

There are various methods for detecting sugars and sugar alcohols such as evaporating light scattering detector (ELSD) and refractive index detector (RID). In this research, a method was newly developed for the determination of 14 sugars (fructose, glucose, sucrose, lactose, maltose, ribose, rhamnose, arabinose, mannose, galactose, trehalose, melibiose, raffinose, xylose) and 7 sugar alcohols (erythritol, xylitol, sorbitol, mannitol, inositol, maltitol, dulcitol) by HPLC with nano quantity analyte detector (NQAD). Mobile phase was 77% acetonitrile with a flow rate of 1.0 mL/min. Sugars and sugar alcohols were resolved within 30 min and quadratic calibration curves of each content were obtained with a correlation coefficient (R²) of over 0.999. The limits of detection (LOD) of the method ranged from 0.002 mg/100 g to 0.70 mg/100 g. The NQAD results were then compared against the results using other detectors. The LOD of the method using ELSD ranged from 0.01 mg/100 g to 5 mg/100 g and the results using the RID method ranged from 8 mg/100 g to 27 mg/100 g. The NQAD method had the lowest LOD and the resolutions of 21 peaks were higher than ELSD and RID methods.

**P01 -054**

**A Rapid and Accurate Method for the Determination of Underivatized Amino Acids in Various Foods Using HPLC-ESI-MS/MS**

Choong-In Yoon*, Joo-Hee Lee, Young-Jun Kim  
Food Safety Center, Ottogi Corporation, Korea

The nutritional value of proteins is one of the most important components of the human diet. This depends mainly on the amino acid composition and most critically, the eight essential amino acids. In addition, free amino acids such as glutamic acid, glycine, and alanine contribute to food flavor and taste. The current method of amino acid determination requires expensive sample preparation and extended analysis times using reversed-phase-HPLC pre-column derivatization with various reagents such as o-phthalaldehyde. To resolve these issues, a new and improved method for the simultaneous determination of the 26 amino acids has been developed and validated using HPLC-ESI-MS/MS without derivatization. The total running time was 15 min per sample including re-equilibration. Moreover, an evaluation and comparison of the differences between using HPLC pre-column derivatization method and that using HPLC-ESI-MS/MS minus derivatization method has been carried out. The newly proposed method is simple, rapid, economical, sensitive, and selective without derivatization and represents an improvement over other methods currently available.

**P01 -056**

**Chemical Composition and Antioxidant Activities of Berry Fruits Produced in Korea**

Yongcheol Lee1,2*, Jib-Ho Lee2, Sung-Dan Kim2, Min-Su Chang2, In-Soon Jo2, Si-joong Kim2, Keum Taek Hwang3, Han-Bin Jo2, Jung-Hun Kim2  
1Department of Food and Nutrition, and Research Institute of Human Ecology, Seoul National University, Korea, 2Seoul Metropolitan Government Research Institute of Public Health and Environment, Korea

Berry fruits are rich in phytochemicals including polyphenols, anthocyanins, phenolic acids, and organic acids, which are known to have positive effects on health. The aim of this study was to investigate chemical composition, functional constituents, and antioxidant activities of mulberry, black raspberry, raspberry, and blueberry cultivated in Korea. Activity of the four berries ranged from 0.27% to 1.10%, and pH ranged from 3.3 to 5.2. Total mineral contents of the four berries ranged from 92.9 mg/100 g to 256.0 mg/100 g. Mulberry among the berries had the most abundant total sugars, and glucose and fructose were the major sugars. Mulberry contained GABA five or more times more than the other berries. Blueberry contained the highest free phenolic acids than the other berries; especially chlorogenic acids were the major free phenolic acids in blueberry. Black raspberry had the most abundant polyphenols, anthocyanins, and flavonoids among the berries and showed the highest antioxidant activity.
Volatiles in Buckwheat (*Fagopyrum esculentum*) Sok sungjang according to Aging Periods

In Hee Cho*, Min-Kyung Park¹, Hye-Sun Choi², Bo Ram Shin¹, Young-Suk Kim³

Wonkwang University, Korea, ¹Ewha Womans University, Korea, ²National Academy of Agricultural Science, Korea

Sok sungjang is one of traditional soybean pastes in Korea. In particular, it is made with soybean and another main ingredient (a source of cereals), whereas doenjang is prepared with soybean. In this study, volatile profiles in buckwheat (*Fagopyrum esculentum*) sok sungjang were investigated and compared according to its aging periods. Buckwheat sok sungjang was made by soaking, steaming, molding, and fermenting buckwheat and soybean (7:3) and then aged with *Aspergillus oryzae* and *Bacillus subtilis* (1:1) starters in a humid space maintained at a warm temperature in this study. A total of 95 volatiles, including 59 acids and esters, 15 alcohols, 11 carbonyls, 5 pyrazines, and 5 miscellaneous, were found in buckwheat sok sungjang. As aging proceeded, the levels of most acids and esters which could be described as sweet and sour notes increase during the early stage of aging (two weeks), but decreased in the later part of aging. On the other hand, amounts of pyrazines, responsible for the roasted note, increase as aging proceeded.

Inhibition Effect of Medicinal Herbs on Warmed-over Flavor Development of Duck Baeksuk

Su Yeon Kim*, Na Ri Lim, Bo Sik Kang, Hyun Jin Park

School of Life Science and Biotechnology, Korea University, Korea

To evaluate inhibition effect on medicinal herbs on warmed-over flavor (WOF) development of duck baeksuk, the WOF of sample was monitored simultaneously by colorimetric sensor array system and by thiobarbituric acid reactive substances (TBARS) assay during refrigerated storage. Duck baeksuk was prepared either with a mixture of medicinal herbs (TS) or without it (CS). The sensor array, which consisted of dyes to sensitive the WOF, was exposed to odor of sample and its image was captured by digital camera. A unique color pattern for each sample was obtained by differentiating the image of array before and after exposure to odor. TBARS values of all samples were increased depending on storage period. TBARS values of TS were generally lower than those of CS during storage. To predict TBARS values by colorimetric sensor array system, partial least square (PLS) regression was used. There were strong correlation between data of colorimetric sensor array system and TBARS values. These results suggested that not only medicinal herbs can inhibit the WOF of duck baeksuk but also colorimetric sensor array system may be a useful tool for analysis of the WOF in meat products.

Quality Characteristics and Volatile Compounds of Welsh Onion by Processing Pre-treatment

Bong-Yun Oh*, Gyeong-Suk Jo, Min-Ji Kim, Yeo-Jin Lee, Jong-Whan Rhim¹, Hae-Yeong Seo², You-Seok Lee, Jeong-Hwa Kang, Kyung-Ju Jung

Jeollanamdo Agricultural Research and Extension Services, Korea, ¹Department of Food Engineering, Mokpo National University, Korea, ²World Institute of Kimchi, Korea

There will be a difference in quality and flavor of welsh onion (*Allium fistulosum* L.) by pre-treatment process as a flavoring vegetables. To take advantage of those in industry were processed welsh onions, fresh, frozen, freeze-dried, and hot air drying, we analyzed color, flavor intensity, sensory evaluation and volatile compounds. The color L value of stem was higher in freeze-dried, fresh, hot air and freeze sequence. a-Value of leaf was high fresh, frozen, air dried, and freeze-drying. Flavor intensity and quality was higher in frozen, fresh, hot air drying, and freeze-drying. In sensory evaluation of fresh, freeze-dried, and freeze, which showed a significantly higher acceptability by hot air drying. GC-MS chromatogram pattern was different between in flavor components by pre-treatment process, 38 kinds of those were identified of 35 in fresh onions, a key compound dipropyl trisulfide, 3,5-diethyl-1,2,4-trithiolane, (E)-propenyl propyl disulfide, accounted for 56.5% of the total with dipropyl disulfide. 46 in frozen, 37 in freeze-dried and 38 in hot air drying was identified.

Quality Characteristics and Volatile Compounds of Garlic by Processing Pre-treatment

Bong-Yun Oh*, Gyeong-Suk Jo, Min-Ji Kim, Yeo-Jin Lee, Jong-Whan Rhim¹, Hae- Yeong Seo², You-Seok Lee, Jeong-Hwa Kang, Kyung-Ju Jung

Jeollanamdo Agricultural Research and Extension Services, Korea, ¹Department of Food Engineering, Mokpo National University, Korea, ²World Institute of Kimchi, Korea

There will be a difference in quality and flavor of garlic (*Allium sativum* L.) by pre-treatment process as a flavoring vegetables. To take advantage of those for commercialization in industry garlic were processed fresh, frozen, freeze-dried, and hot air drying by pre-processed, we analyzed color, flavor intensity, sensory evaluation, and volatile organic sulfur compounds. The color L value of garlic was higher in freeze-dried, fresh, frozen, and freeze-drying sequence. Flavor intensity and quality was high in frozen, fresh, freeze-drying, and hot air drying. In sensory evaluation of fresh, freeze-dried, freeze, which showed a significantly higher acceptability by hot air drying. GC-MS chromatogram pattern was different between fresh, freeze-dried, freeze-drying, and freeze drying. Flavor intensity and quality was higher in frozen, fresh, hot air drying, and freeze-drying. In sensory evaluation of fresh, freeze-dried, and freeze, which showed a significantly higher acceptability by hot air drying. GC-MS chromatogram pattern was different between in flavor components by pre-treatment process, 38 kinds of those were identified of 35 in fresh onions, a key compound dipropyl trisulfide, 3,5-diethyl-1,2,4-trithiolane, (E)-propenyl propyl disulfide, accounted for 56.5% of the total with dipropyl disulfide. 46 in frozen, 37 in freeze-dried and 38 in hot air drying was identified.
Quality Characteristics of Mini Sweet Pumpkin (Suppress Cultivation, Fall Planting) at Different Harvesting and Ripening Period

Bong-Yun Oh*, Gyeong-Suk Jo, Min-Ji Kim, Yeo-Jin Lee, You-Soon Lee, Jeong-Hwa Kang, Kyung-Ju Jung
Jeollanamdo Agricultural Research and Extension Services, Korea

Mini sweet pumpkin (Var. Bouchang) is known as a healthy food, increasing in demand. This study was conducted to evaluate the quality characteristics of that at different harvesting and ripening periods. After fertilization treatment, half-forcing cultured pumpkin was harvested at the 45th, 50th, 55th, 60th, and 65th day and were investigated their weight, length and width, flesh color, hardness, and soluble solids. During every 5th days ripening intervals at room temperature, they were determined their moisture loss, color, hardness, and sensory evaluation. Until 55-60th days after pollination, pumpkin had 309-384 g of fruit weights, 91-98 mm of fruit length, 56-62 mm of fruit width, 21.5/10.5-26.4/11.5 mm of fruit thickness. There were no significant differences in color, weight, water soluble solids, and hardness of pumpkin. On 60th days, pumpkin showed more weight loss, hardness, soluble solids, and a and b color value. Sensory evaluation showed that pumpkins harvested at the 55th, 60th, and 65th days are needed ripening period for 25 days, 20 days, 15 days, respectively for optimum product quality.

A Study on Multiresidue Method for the Analysis of Polar Pesticides by Mass Spectrometer

YoungHwan Kim*, Jongsung Ahn, Hyo-Young Kim, Eun-ggu Lee, Chae-Uk Lim, Byung-Chyoun Kim, Jae-Hwon Lee
National Agriculture Products Quality Management Service, Korea

Polar pesticides (Log $P_{ow} < 0$), such as Glyphosate, Glufosinate, Ethephon and so on, cannot be amenable to simultaneous multiresidue analysis method. To analyse these polar pesticides, long-time disproportionate effort and derivatizations are needed for preprocessing. Since these polar pesticides are completely water-soluble, it is essential to employ derivatization process analysed by GC and HPLC in order to obtain lower LOD and use reversed-phase column. We newly developed the multi-residue method for 6 compounds of polar pesticides which should be analysed individually only by a single-residue method, because such pesticides need to be derivatized and involved complicated preprocessing. The method we developed enables the compounds to be analysed without evaporation step by LC/MS/MS. The method showed good linearity in a concentration range of 5-200 μg/kg ($R^2 = 0.9981-0.9999$). The average recovery was found to be 56.66-93.2% (RSD (n=9)<2.78-9.72%).

Optimal Extract Solvent and Temperature of Anthocyanin Pigment for Application of Food Materials

Ji-Young Park*, Chun Woo Lee, Byeong Ju Kim, Yuyoung Lee, Eun-Youeng Sim, Sang-Ik Han, Yook Han Kim
Department of Functional Crop, NICS, RDA, Korea

Coloured rice, particularly black rice, is of great interesting because of the health benefits with anthocyanins which are the largest group of water-soluble pigments in the plant kingdom, known as flavonoids. The application of anthocyanins has been limited since their stability and extraction percentages were relatively low. Eighty percent MeOH solvent added 0.1% HCl have been used to extract anthocyanin pigment for quantitation by high-performance liquid chromatography (HPLC). This study aims to investigate extract condition which is suitable for use anthocyanin pigment as food materials. To extract pigment effectively as high content of anthocyanin, 2 varieties of black rice, Heugjinjubyeo and Shinrongheugchal, were extracted using commercially available solvents such as water, fermented alcohol, and n-hexane for 24 h. At the 80% fermented alcohol process, it showed the highest level of anthocyanin content in both varieties. As a result of extract among the degree level of 20, 30, 40, 50, and 60 using 80% fermented alcohol, the each content of anthocyanin is 122, 115, 108, 106, and 98 mg/100 g, respectively, in Heugjinjubyeo.

Physicochemical Characteristics of Multi-grain Noodles Using Ferment Cultured with Pediococcus pentosaseus

Bo-Young Lee*, Sang-Jun Kim, Ye-Won Kim*, Ji-Young Yoon
Jeonju Biomaterial Institute, Korea, ¹Sinsundle, Korea

This study investigated the effects of multi-grain noodle by using ferment cultured with Pediococcus pentosaseus, specifically with regard to the physicochemical characteristics of noodles. The basic formula was as follows: tetrastichum barley 44%, unpolished rice 42%, green-kerneled rice 10%, and multi-grainof seventeen 4%. The suitable dough containing based on moisture content of 33%, salt of 1%, and multi-grain or multi-grain by using ferment cultured with Pediococcus pentosaseus during noodle manufacturing was investigated. Nutritional Components of Multi-Grain noodles was carbohydrate 61.96 g/100 g, protein 7.00 g/100 g, fat 0.26 g/100 g, and 278.18 kcal. As a result, physicochemical analysis of multi-grain noodle was pH 6.05, total chromaticity L-values 50.57, a-values 27.80, b-values 16.80, whereas fermentation noodle was pH 4.49, L-values 42.87, a-values 10.13, b-values 13.13 of total chromaticity. The results showed that the addition of ferment to Multi-Grain during noodle preparation reduced the pH and L-value in total chromaticity values of the noodles.
Comparison of the Mineral Contents in Brussels sprouts by Yield Ability, Size of Bulblet and the Attachment Part upon Harvests in Entirety

Jeong Seon Kim*, Sun Bo Ko, Ae Kyoung Moon, Young Taek Yang, Tea Sin Ko
Jeju Special Self-governing Province Agricultural Research & Extension Services, Korea

Brussels sprouts have recently earned recognition and popularity as a functional cash crop. However, this crop has several drawbacks, including a low yield per area, low degree of uniformity when harvested in entirety in a bid to save labor, posing a lot of difficulty in extending cultivation. In a bid to address these issues, this study has conducted comparative analysis of mineral contents depending on the size of bulblets and the attachment parts while identifying the yield ability associated with the number of harvests. The study has found that the yield ability per unit area was higher if harvested three times at intervals of one month during the period between December to February than the harvest in entirety in February and that there were no significant differences in content of mineral contents, including P, K, Ca, and Mg depending on the size and attachment parts. It is noted that fruits located on top are likely to have more nitrogen. In consideration of these findings, it is deemed better to harvest in entirety in specific time rather than splitting the harvest into multiple occasions in order to maximize expected return.

Absorption of Polycyclic Aromatic Hydrocarbons Using by Cellulose Based Absorbents from Red Ginseng Products

Seo-Yun Kim*, Han-Seung Shin
Department of Food Science and Biotechnology and Food and Bio Safety Research Center, Dongguk University, Korea

The cellulose based absorbents were evaluated on elimination of polycyclic aromatic hydrocarbons (PAHs) from red ginseng products. The cellulose based absorbents were consist of Eulalia and three different solvents. The Eulaia based absorbents were be applied to dried red ginseng. In order to confirm the adsorptive effects of the adsorbents, examined the eliminative concentration of benzo[a]pyrene from dried red ginseng treated under different drying temperature. It was analyzed using liquid-liquid extraction and followed by HPLC. According to the results, Eulaia based absorbent with a LiBr solvent was the most effective in reducing BaP. This study was examined the eliminative concentration of 4 PAHs (benzo[a]anthracene, chrysene, benzo[b]fluoranthen and benzo[a]pyrene) in red ginseng products. As a result of the adoption, 4 PAHs were tended to reduce in red ginseng products except in the case of samples treated Eulaia based adsorbent with a NaOH/urea solvent. Therefore, based on these experiments, it is expected that cellulose based adsorbent will be utilized for reduction of PAHs in the food industry.

A Static Headspace Gas Chromatography Method for Determination of Residual Solvents in Food

Mi Hyun Ka*, Na In Chang, Soo Jung Lee, Heung Youl Lim, Cheon Hoe Kim
Korea Health Supplement Association Sub. Korea Health Supplement Institute, Korea

A simultaneous determination method of methanol and isopropanol based on gas chromatography was developed with a static headspace. Indeed, although solvents are essential to extract the certain functional compounds from food, they may cause a health hazard such as toxicity. Until now, the residual solvents in functional foods could be analyzed only based on the method for the oleoresin paprika according to Korea Food Additive code which is time-consuming procedure during preparation of samples. Therefore, an effective analytical method is required to rapidly screen over the commercial products. Various sample diluents such as dimethyl-sulfoxide, N,N-dimethyl-formamide, N,N-dimethyl-acetamide, 1,3-dimethyl-2-imidazolidinone, benzyl alcohol, and water were examined so as to increase the sensitivity of the proposed method. The method was optimized and validated regarding precision, detection and quantification limits, linearity, and recovery. Furthermore, this method was applied to determination of residual solvent in the commercial foods.

Physicochemical Properties and Oxidation Stabilities of Mealworm (Tenebrio molitor) Oils under Different Roasting Conditions

Yu-Ho Jeon*, Yang-Ju Son, Soo-Young Choi, Ji-Won Lee, Eun-Young Yun1, Soo-Hee Kim2, In-Kyeong Hwang
Department of Food and Nutrition, Seoul National University, Korea, 1Department of Agricultural Biology, National Academy of Agricultural Science, RDA, Korea, 2Department of Culinary Arts, Kyungmin University, Korea

This study was to investigate the effect of roasting on physicochemical properties and oxidation stabilities of mealworm (Tenebrio molitor) oils. Oils were extracted with n-hexane from mealworm roasted at 200°C for 0-15 min and were stored at 50°C up to 50 days. The specific gravity and the viscosity of unroasted oil were 0.893 and 306.67 cp each and were the lowest in oil roasted for 10 min showing 0.857 and 246.67 cp each. The L values were decreased and a values were increased with roasting time. The primary fatty acids of unroasted sample were oleic (39.87%), linoleic (29.90%), palmitic (17.74%), and stearic (3.17%) acid and roasting were increased with roasting time. The primary fatty acids of unroasted sample were oleic (39.87%), linoleic (29.90%), palmitic (17.74%), and stearic (3.17%) acid and the viscosity of oils was significantly increased. The peroxide value of roasted oils showed only slight increases, whereas that of unroasted oil exhibited the largest increase from 19.01 to 183.52 meq/kg. The acid value of oils was significantly increased during the first 10 days of storage but showed fluctuations thereafter.
Changes of the Antioxidant Activity and Content of Dark Chocolate according to Different Conching Conditions

Soo-Young Choi\textsuperscript{a}, Yang-Ju Son, So-Young Kim, Yu-Ho Jeon, Kyung-Mi Yoo\textsuperscript{1}, Ki-Won Lee\textsuperscript{2}, In-Kyeong Hwang

Department of Food and Nutrition \textsuperscript{3} Research Institute of Human Ecology, Seoul National University, Korea, 1Department of Food and Nutrition, SoongEul Women’s College, Korea, 2WCU Biomodulation Major, Department of Agricultural Biotechnology, Seoul National University, Korea

The objective of this study was to provide information on the effects of conching temperatures (50 and 60°C), conching times (24, 48, and 72 h), and cacao mass content (CMC, 60 and 70%) in dark chocolate. We conducted total phenol content (TPC), total flavonoid content (TFC), ABTS, DPPH, and HPLC analysis to determine the antioxidant activity and investigate antioxidant compounds. Generally, the ABTS, DPPH, and TFC values were increased as the conching time increased, but the result of TPC was decreased. In HPLC, procyanidin B\textsubscript{2}, catechin, and epicatechin were significantly decreased as conching time increased to 48 h, but it was not significant except for CMC 70% chocolate conched at 60°C. The contents of procyanidin B\textsubscript{2}, catechin, and epicatechin were significantly increased to 48 h and decreased at 72 h ($p<0.05$) except for CMC 60% chocolate conched at 50°C. As conching temperature was high, antioxidant compounds were efficiently measured by the smaller particle size of cacao mass, but negatively caused by conching time above 48 h. Overall results suggested that CMC 70% chocolate conched at 60°C for 48 h is the best condition to produce dark chocolate.

Analytical Method for Silicone Dioxide (SiO\textsubscript{2})

Content from Food Additives and Health Functional Foods Using ICP-OES

Mi Hyun Ka\textsuperscript{a}, Yesung Hur, Heung Youl Lim, Cheon Hoe Kim

Korea Health Supplement Association Sub. Korea Health Supplement Institute, Korea

An analytical method has been developed for the detection of silicone dioxide used in food additives using inductively coupled plasma optical emission spectrometry (ICP-OES). Analysis method for silicone dioxide was evaluated and validated. Silicone dioxide was dissolved into hydrofluoric acid and hydrolyzed in boric acid as a test solution for ICP. The recovery ratio of food additives and health functional food was 94.4% and 90.22-94.14%, respectively. The limit of detection and quantification was 0.007 mg/L and 0.02 mg/L, respectively. The analysis result of silicone dioxide was 0.02-1.80% detected in health functional foods. This method proved accurate, reproducible, and rapid of determining silicone dioxide in food additives and health functional foods.

A Study of Leaf and Stem of Bakbunja (Rubus coreanus Miq.) to Review the Possibility of Its Use as Food Material

Youna Song\textsuperscript{a}, Shinhye Kwak, Aessom Om, Geonmin Nah\textsuperscript{b}, Jeongsook Choe\textsuperscript{c}, Haengran Kim\textsuperscript{c}

Lab. of Food Safety & Toxicology, Department of Food Science & Nutrition, College of Human Ecology, Hanyang University, Korea, 1Functional Food & Nutrition Division, Department of Agrofood Resources, National Academy of Agricultural Science, Korea

To evaluate the possibility of leaf and stem of Rubus coreanus miquel (RCM) as food material, this study was carried out to investigate proximate composition, fatty acid composition, minerals and vitamins composition. The proximate analysis revealed the values of moisture, carbohydrate, crude protein, crude fat, crude ash, and sugars contents present to be 5.75%, 76.81% (including 66.42% dietary fiber), 10.07%, 2.20%, 5.17%, and 18.57 mg/g, respectively. The major composition of fatty acids were 30.48% of α-linolenic acid, 23.68% of palmitic acid, and 15.51% of linolenic acid. The major composition of minerals were 1,463.96 mg/100 g of K, 263.28 mg/100 g of Mg, and 810 mg/100 g of Ca. Among 7 vitamins detected, the highest composition of vitamins were 0.14-0.66 μg/100 g of vitamin A, then 7.93 mg α-TE/100 g of vitamin K, 0.51 mg NE/100 g of niacin and 0.16 mg/100 g of vitamin B\textsubscript{6} were followed. Also, crude protein, crude ash, Ca, Fe, K and fibers in leaf and stem of RCM was higher than fruits of RCM. These results suggested that leaf and stem of RCM have nutritional benefits for human health and could be used as a good food material.

Evaluation of Chemical Analysis Method for Polycyclic Aromatic Hydrocarbons from Cooked Meat Products

Young-Ok Kang\textsuperscript{a}, Jae-Hyung Koh, Han-Seung Shin

Department of Food Science and Biotechnology and Food and Bio Safety Research Center, Dongguk University, Korea

Polycyclic aromatic hydrocarbons (PAHs) are classified as carcinogens to humans. PAHs can be formed from a variety of combustion and pyrolysis processes and thus their natural or anthropogenic sources are numerous, however food seems to be the major route of exposition. PAHs are formed during cooking by burning some food materials. And the meat products have high level of risk PAHs in Korea. PAHs were extracted with solid-phase extraction (SPE), purified with Sep-Pak Silica cartridges and determined by GC/MS (Gas Chromatography-Mass Spectrophotometry). Method validation proceeded on a matrix which is fatty solid (Cooked beef meat). The limit of detection (LOD) was 0.10-0.22 μg/kg, and the limit of quantification (LOQ) was 0.31-0.66 μg/kg. The recovery values measured using the peak area of chrysene-deuterium12 (CRY-d12) and benzo[α]pyrene-deuterium12 (BaP-d12) were 80.30-99.40% and the relative standard deviation was 0.04-3.54%. The accuracies of intraday and interday evaluation generally varied in the range 86.30-119.96% and 94.67-119.96%, respectively. The precision of intraday and interday evaluation generally varied in the range 10.23% and 10.23%.
Study of Formation and Inhibition of Polycyclic Aromatic Hydrocarbons in Meat Model System

Sae-Rom Min*, Ae-Hee Lim, Han-Seung Shin
Department of Food Science and Biotechnology and Food and Bio Safety Research Center, Dongguk University, Korea

Polycyclic aromatic hydrocarbons (PAHs) are a class of well-known carcinogenic compounds originating from incomplete combustion of organic compounds and geochemical processes. In this study, the influence of heating conditions, lipid precursors, and antioxidants on the formation of PAHs, and its formation kinetics were evaluated in a meat model system. The effects of different treatments in both dry and wet conditions were studied. The lyophilized beef meat was heated at temperatures ranging between 80 and 200°C for times ranging from 15 to 30 min. Four lipid precursor (methyl stearate, methyl oleate, methyl linoleate, and methyl linoleate) and five antioxidants (BHT, BHA, α-tocopherol, EGCG, and sesamol) were added to the meat model system and their effect was evaluated from meat model systems heated at 200°C for 30 min. Concentrations of PAHs including benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, dibenzo(a,h)anthracene, benzo(g,h,i)perylene and indeno(1,2,3-c,d)pyrene were evaluated by GC-MS.

Sodium Content Analysis of Retorts in Processed Foods

Da-Un Jeong*, Hye-Seung Shin1, Hye-Im Woo, Ae-Son Om
Lab. of Food Safety, Department of Food & Nutrition, College of Human Ecology, Hanyang University, Korea, 1Seoul Pharma Laboratories, Korea

This study was to investigate whether providing consumers with reliable information about sodium content of retorts in the processed foods. Total 119 retorts of curry (21), black-bean-sauce (16), rice porridge (33), source (17), soup (16), and meat (16) were analyzed using the specified method of Food Code. This study confirmed to the validity of the analysis test results through the In-house control sample as well. Sodium content of collected retorts showed that all 119 cases complied with the Nutrition Facts Label (NFL) regulation and was applied with the Nutrition Facts Label (NFL) regulation and was confirmed to provide consumers with the reliability of NFL by analyzing sodium contents in the collected retorts. Hence, this study might be considered that consumers can utilize NFL to purchase suitable and healthy foods.

Evaluation of Chemical Analysis Method and Determination of Polycyclic Aromatic Hydrocarbons Content from Bakery, Confectionary, and Seasoning Food Products

So-Young Lee*, Min-Cheol Seo, Han-Seung Shin
Department of Food Science and Biotechnology and Food and Bio Safety Research Center, Dongguk University, Korea

This study was carried out to investigate contents of 8 polycyclic aromatic hydrocarbons (PAHs) from frequently consumed bakery, confectionary, and seasoning food products. Samples were collected from markets of 9 cities in Korea chosen as the population reference for PAHs analysis. The methodology involved saponification, ultrasonic extraction with n-hexane, clean-up on Sep-Pak silica cartridges and determined by GC/MS (gas chromatograph-mass spectrometry). Validation proceeded on 3 matrices including non-fatty solid, fatty solid, and non-fatty liquid. Recoveries for eight PAHs ranged from 79.32 to 99.40%. The limit of detection (LOD) was 0.08-0.25 μg/kg, and the limit of quantification (LOQ) was 0.24-0.75 μg/kg. The mean concentration of BaP was 0.23 μg/kg from bakery products, 0.13 μg/kg from confectionary products and not detected from seasoning products. The total PAH concentration was 0.60 μg/kg in bakery products, 0.53 μg/kg in confectionary products and 0.21 μg/kg in seasoning products.

Evaluation of Chemical Analysis Method and Determination for Polycyclic Aromatic Hydrocarbons from Meats, Fruits, Vegetables, Edible Oils, Fats, and Their Products

Jeong-Sook Kim*, Min-Ji Kim, Han-Seung Shin
Department of Food Science and Biotechnology and Food and Bio Safety Research Center, Dongguk University, Korea

Contents of polycyclic aromatic hydrocarbons (PAHs) collected from 9 cities in Korea for total diet study (TDS) were analyzed. Foods selected representing the same food category were aggregated into three main different food groups: meats, fruits, and vegetables edible oils, fats, and bakery, confectionary, and seasoning food products. Samples were collected from markets of 9 cities in Korea chosen as the population reference for PAHs analysis. The methodology involved saponification, ultrasonic extraction with n-hexane, clean-up on Sep-Pak silica cartridges and determined by GC/MS (gas chromatograph-mass spectrometry). Validation proceeded on 3 matrices which are fatty solid, non-fatty solid, and fatty liquid. Recoveries for eight PAHs ranged from 79.32 to 99.40%. The limit of detection (LOD) was 0.08-0.25 μg/kg, and the limit of quantification (LOQ) was 0.24-0.75 μg/kg. The mean concentration of BaP was 0.23 μg/kg from bakery products, 0.13 μg/kg from confectionary products and not detected from seasoning products. The total PAH concentration was 0.60 μg/kg in bakery products, 0.53 μg/kg in confectionary products and 0.21 μg/kg in seasoning products.
Influence of Coagulant on Haze Formation from Beer Fermentation Process

Bo-Na Kim*, Hae-Na Chun, Han-Seung Shin
Department of Food Science and Biotechnology and Food and Bio Safety Research Center, Dongguk University, Korea

Beer haze is generally formed through complexation of protein and polyphenolic ingredients. The problem of reducing susceptibility of beer haze formation can be done either by lowering protein and polyphenol levels, or by minimizing the molecular size of protein and polyphenols. In experimental part of this work the shelf life of destabilized beer is being compared with beer stabilized with various standard products, such as PVPP and silica xerogel. This study is an experiment for removing polyphenols and proteins in beer causing haze shape. Beer coagulant including PVPP and silica xerogel were evaluated. The method of saccharification for obtaining the wort is followed the EBC congress mash. The fraction containing identification and relative quantification of procyanidins is eluted, then quantitatively analyzed by combined high performance liquid chromatography and fluorescence detector. Protein quantitative measurement was evaluated by Kjeldahl. Quality of beer including alcohol content, bitterness, foam, haze, and color were also evaluated.

Development of Analytical Method of Carbonyl Compounds for No-smoking Aid Products

Jong-Hoon Lee*, Sang-Yup Kim, Han-Seung Shin
Department of Food Science and Biotechnology and Food and Bio Safety Research Center, Dongguk University, Korea

Carbonyl compounds are a group of carcinogens that are contain in electronic cigarette refill cartridge. Acetaldehyde, formaldehyde, acetone, acrolein, propionaldehyde, and crotonaldehyde are the most common carbonyl compounds in electronic cigarette and refill cartridge. Propionaldehyde and crotonaldehyde are a weak carcinogen, and acrolein lacks activity, but acetaldehyde and formaldehyde have been evaluated by IARC (International Agency for Research on Cancers) the most carcinogenic compounds to humans. In this study, we collect carbonyl compounds in electronic cigarette refill cartridges. Each products are derived by 2,4-dinitrophenylhydrazine solution for preprocessing. The fraction containing carbonyl compounds is eluted, then quantitatively analyzed by combined high performance liquid chromatography-fluorescence detector.

Evaluation of Freshness Indicator (FI) for Quality of Skate (Raja kenojei) during Storage

Ga-Young Lee*, Gyu-Tae Han, Han-Seung Shin
Department of Food Science and Biotechnology and Food and Bio Safety Research Center, Dongguk University, Korea

There is much interest in the fishery industry in developing freshness indicator which can reflect the storage history of the products and their quality. Freshness is one of the main attributes for fishery industry and consumption. In this study, we developed prototype of the freshness indicator of fish products. The release of amines especially ammonia from decomposing fish is concentrated in headspace and they can be detected by pH-sensitive sensor. The sensor was organized with polymer matrix solution which contains pH-sensitive dye to monitor visible color changes that contribute to quantity of volatile amines. We investigated sensor formulation which respond to the TVB-N especially ammonia. In particular, the color change of the sensor was investigated as well as the selection of proper sample weight and packaging material for the suitable sensor. We also evaluated ammonia content during the fish storage using HS-SPME and GC-FID. In addition, the kinetic modeling of the sensor based on its chromaticity will be assessed to determine the suitability of the sensor formulation for intelligent packaging application.

Comparison of Nutrition Labeling of Fat Contents in Mandoo

June Im*, Ji-Hye Choi, Shin-Hye Gwak, Yeo-Jin Lee, Ae-Son Om
Lab. of Food Safety, Department of Food & Nutrition, College of Human Ecology, Hanyang University, Korea

This study compared the difference between the nutrition label and the value of the analyzed nutrients in mandoo. Crude fat, saturated fat, and trans fat contents of 60 products were analyzed following the specified method of the Food Code. Reference Material (RM) and In-House Quality Control Sample were used to ensure the accuracy and reproducibility of the data from all test. Then, the results were reviewed with label and confirmed the compliance of the Nutrition Facts. The results of analysis of the fat contents; crude fat, saturated fat, and trans fat were 36-110%, 51-119%, and 80%, respectively, when compared to the sample's value of nutrition label. Nutrition Facts are found to comply with the tolerance of the indicated value of less than 120% compared to 60 mandoo cases. Therefore, the result showed that the fat contents in nutrition label of mandoo is reliable.
Study of Effect of Processing Parameters on DNA Degradation in Food

Kyung-Suk Ryu*, Byeong-Keun Kim, Cheong-Tae Kim, Soo-Hyun Park
Food Safety Research Institute, NONGSHIM Co., Ltd., Korea

Many genetically modified crops have been approved in the world and process for food. DNA-based methods using PCR are widely used for GMO detection. The applicability of DNA-based method depends on the quality and quantity of the DNA. DNA quality is a significant parameter for detecting target gene. In general, food processes involving mechanical stress, high temperature, pH variations, enzymatic activities, and fermentations affect the degradation of DNA. The DNA degradation should be occurred during the processing, so the detection of maize gene in processed food with corn should be difficult caused by gene degradation. In this study, we conducted the degree of maize DNA degradation was checked by N corn snack manufacturing processes flow through DNA concentration and visualized by PCR (quantitative polymerase chain reaction). The data shows that, a lot of industrial process cause the degradation of DNA fragments. In the case of rolling corn snack, high temperature drying steps were shown as the strongest effect on DNA degradation, the target DNA was disrupted by about 13%.

Method and Proficiency Test (FAPAS) for Analysis of Cholesterol in the Mixed Fat Spread Test Material by GC

Jae-Yeon Lee*, Hyun-Jung Jung, Cheong-Tae Kim, Soo-Hyun Park
Food Safety Research Institute, NONGSHIM Co., Ltd., Korea

Cholesterol is a sterol, a lipid molecule and is biosynthesized by all animal cells. And animal fats are complex mixtures of triglycerides, with less amounts of phospholipids and cholesterol. As a consequence, all foods containing animal fat contain cholesterol to varying extents. Major dietary sources of cholesterol include cheese, egg yolks, beef, pork, poultry, fish, and shrimp. The analysis method of cholesterol in the mixed fat spread include cheese, egg yolks, beef, pork, poultry, which is a flavouring agent and used in soy sauce production. The analytical method of cholesterol in soy sauce was confirmed and validated through quality control materials (QCM) and the international proficiency tests. The check samples were prepared for the GC-MS/MS analysis using the optimized sample preparation procedure and for evaluating the suitability as a quality control method. Data acquisition was in selected reaction monitoring mode (SRM) using four transition reactions for cholesterol (m/z 196→147, 196→147) and d3-cholesterol (m/z 201→150). Linear calibration curves were obtained over concentrations range of 1-250 μg/kg for cholesterol. The analytical result of 3-MCPD in soy sauce was shown 48 μg/kg. We got a satisfied result which z-score was -0.1 from FAPAS®. The assigned value of a given sample was 49.6 μg/kg.

Comparison of Volatile Flavor Components of Ginseng Extract, Red-ginseng Extract and Cultured Wild Ginseng Extract

Seung Kyung Chung*, Kyung Hoon Jun, Dae Eung Kim, Mina Jo, Hyun Bong Yang, Hyun Ah Bae, Hye In Jeong, Byung Suck Hurk, Sun Young Kim¹, Hyung Hee Baek¹
Sempio Fermentation Research Center, Sempio Foods Company, Korea, ¹Department of Food Engineering, Dankook University, Korea

The objective of this study was to investigate the volatile flavor components of ginseng extract (GE), red-ginseng extract (RGE) and cultured wild ginseng extract (CWGE). Volatiles were extracted by solid phase microextraction (SPME) and solvent-assisted flavor evaporation (SAFE) and analyzed by gas chromatography-mass spectrometry (GC-MS). β-Selinene, β-panasinsene, and α-neoclovene in GE, piperidine and 2-furanmethanol in RGE, and 2-nonanone and 6-(5-methyl furan-2-yl)-hexan-2-one in CWGE were found to be the most abundant volatile components obtained from SPME. 2-Acetylpyrrole and maltol in GE, 2-furanmethanol and maltol in RGE, and 2-nonanone and 2-acetylpyrrole in CWGE were found to be the most abundant volatile components obtained from SAFE. Aroma-active components from GE, RGE, and CWGE were analyzed by gas chromatography-olfactometry (GC-O). 2-Acetylpyrrole (slightly coffee-like) and 2-hydroxy-3-methyl-2-cyclopenten-1-one (sweet) in GE, 2(5H)-furanone (fatty) in RGE, and 2-acetylpyrazine (nutty) and guaiacol (medicinal) in CWGE were considered to be the characteristic aroma-active components.
Measurement of Ethanol Contents in Alcohol-free Beverages to the Implementation of New Food Label System
Sang-Mok Lee*, Seung-Hyun Kim, Jaehyeon Park, Ji-Yoon Jeong, Gyuseek Rhee
Pesticide and Veterinary Drug Residues Division, Department of Food Safety Evaluation, National Institute of Food and Drug Safety Evaluation, Ministry of Food and Drug Safety, Korea

Recently, some Koreans without alcohol break-down enzymes are trying to find alcohol-free beverages and Halal certificate system requires alcohol-free beverages. There are some official methods for the analytical methods of alcohol-free in ASBC, AOAC, OIV, OIML, and the Korean official method of National Tax Service (NTS Liquors License Aid Center). All of the official methods do not specify details of GC conditions etc. Therefore, we have studied to find an official method for Korean Food Code in cooperation to Korean labeling standard. We have compared the electronic densimetry and GC-FID toward alcohol-free beverages which are circulated in Korean food markets. Additionally, we have validated the method in conventional beverages to extend the scope of samples for Halal certificate. In the Republic of Korea, beverages containing over 1% ethanol are under control with National Tax Law. The alcohol-free beverages should have below 0.5% ethanol. Therefore, the method performance should be fully validated between 0.1-2% ethanol concentrations. The two methods showed enough performance to meet the requirement of Korean Food Code.

Physiochemical Properties of Processed Salt Using Various Subtropical Vegetable Leaves
Jeong-Hwa Kang*, You-Seok Lee, Song-Yi Choi1, Bong-Yun Oh, Jin-Young Kang, Kyung-Ju Jung
Food and Farm Management Research Institute, Jellanamdo Agricultural Research and Extension Services, Korea, 1Department of Agrofood Resources, RDA, Korea

Since rapid climate change over the world is progressing by global warming, many subtropical vegetables in Korea are tried to introduce as the counter measure for global warming. Especially, Jeonnam region introduced two subtropical vegetables like Indian spinach and Molokhia (Corchorus olitorius). In this study, hot water extractable concentrates of Indian spinach and Molokhia were produced by extraction at 120°C for 5-7 h. The subtropical vegetables extraction (3-12%) were applied to manufacture salts and analyzed physiochemical properties of their product. The pH of salts was 5.61-8.00 and decreased by higher amount of subtropical vegetables extraction. L and b value of Hunter color the higher with Indian spinach salt than Molokhia salt. As the result of sensory evaluation, 7% Indian spinach salt and Molokhia salt preferred the most. Indian spinach (7% extraction) and Molokhia salts (7% extraction) had 93.2-93.8% NaCl were lower than 97.9% NaCl of solar salt. Indian spinach salt had 6,390 mg/kg magnesium content compared to 3,669 mg/kg of solar salt.

Effects of Packing Material on the Keeping Quality of Indian Spinach Salt
Jeong-Hwa Kang*, Song-Yi Choi1, You-Seok Lee, Sun-Kyung Lee, Su-Hwa Jung
Food and Farm Management Research Institute, Jellanamdo Agricultural Research and Extension Services, Korea, 1Department of Agrofood Resources, RDA, Korea

Indian spinach, the subtropical vegetable has high amount of vitamins and minerals. It is rapidly promoted at southern areas in south Korea. The functional vegetable with Indian spinach is acutely required to meet Korean consumer’s need. This study was performed to determine the storage method for the keeping quality with various packing film (PET, HDPE, and PE) and storage temperature (5, 25, and 35°C) of Indian Spinach Salt. The rate of weight loss packed with PET film was 3.11%, but HDPE film was 2.60% after 30 days at 35°C. The browning degree of Indian Spinach Salt with PE and HDPE film were higher than PET film after 30 days at 35°C. As the storage temperature, browning of Indian Spinach Salt with PET, HDPE, and PE were slightly increased, while water activity was decreased. These results suggest that packing film and storage temperature affect the quality of Indian Spinach Salt. As the result of quality evaluation, the best storage temperature was 5°C with PET film.

Physiochemical Properties of Korean Figs (Ficus carica L.) on Pretreatment Conditions
Jeong-Hwa Kang*, You-Seok Lee, Gyeong-Suk Jo, Eun-Sil Lee
Food and Farm Management Research Institute, Jellanamdo Agricultural Research and Extension Services, Korea

Korean figs (Ficus carica L.) have a enriched dietary fiber, mineral, polyphenol, and phytosterol and those are to have cholesterol reduction effects. We analyzed the total phenolics, dietary fiber, and antioxidant activities of Korean figs (variety : Dauphine, Horaish) on their cultivars and pretreatment conditions. Horaish showed the more total phenolic compounds than dauphin (95.7 mg/100 g vs 88.6 mg/100 g). Horaish showed higher total phenolics and dietary fiber contents than Dauphine. The pectinase addition treatment had a 61.4-68.0% yields, which is higher than of non-treatment and blanching treatment with 45.0-59.0% and 39.2-51.4%, respectively. The total polyphenol contents and antioxidant activity of Korean figs were increased by blanching treatment. The blanching treatment (95°C for 50 s) of Horaish had 21.7% dietary fiber contents which was higher than that of Horaish non-treatment. The blanching treatment of Horaish showed the highest DPPH radical scavenging activity with 16.7%.
Physiochemical Properties of Dropwort (Oenanthe javanica DC.) Harvested in Different Culture Regions

Food and Farm Management Research Institute, Jeollanamdo Agricultural Research and Extension Services, Korea

Dropwort (Oenanthe javanica) is a perennial herb and cultivated in marshy areas of Asia and Australia and is used as a salad or as a seasoning in soups and stews in Korea. Recent studies have provided evidence that it may possess liver-protective, anti-neurotoxic, and anti-alcoholic effect. But dropwort does not have a fixed breed. We collected 10 dropwort genetic resources (A, B, C, D, E, F, G, H, I, J) from 4 provinces (Jeonnam, Jeonbuk, Gyeongnam, Gyeongbuk) in Korea and investigated the physiochemical properties to choose the good breed and to be fix. Jeonnam (D) and Gyeongnam (H) showed higher hardness (3.3 kg vs 1.2-1.8) and hunter a good breed and to be fix. Jeonnam (J) and Gyeongnam (H) showed the more quercetin (10.2 ppm vs 4.7-9.2 ppm). Specifics, Gyeongbuk (J) region showed the highest contents of isohamnetin (21.71 ppm vs 2.50-12.46 ppm). Those results could be applicable for the scientific basis and selection source to fix excellent breed.

Current State and Physicochemical Characteristics of Sigumjang in Gyeongsang-do Area

Jyeong Yoon*, Hojeong Jeong, Sangdon Lee, Gidong Han, Joongho Kwon
School of Food Science and Biotechnology, Kyungpook National University, Korea, 1Department of Food Science and Technology, College of Natural Resources, Yeungnam University, Korea

Sigumjang made with barley bran is a traditional fermented food in Gyeongsang-do area. Appearance, tastes, and flavors of sigumjang differ from doenjang (traditional fermented soy-bean paste). Manufacturing method of sigumjang is not standardized so far because it is made so differently by region. The aim of this research is to suggest the basic information for standardization of sigumjang through investigating characteristics of sigumjang. Nineteen kinds of sigumjang and 26 kinds of sigumjang meju (S-meju), which is a doughnut of dried fermented barley bran and serves as the basis of sigumjang, is collected from Daegu and Gyeongsang-do area. S-meju is made differently by region from baking directly the dough of barley bran or after steaming the dough. Additional ingredients for sigumjang are various by region and east side of Gyeongsang-do showed a tendency to add various additional ingredients to sigumjang. Physicochemical properties of S-meju and sigumjang were investigated. pH, moisture, crude protein, crude fat, and crude ash contents of S-meju were 5.49-6.48, 8.19, 6.14, 31-47, and 3-10%, respectively and sigumjang were 4.37-5.99, 42-72, 0-12, 20-56, and 2-9%, respectively.

Functional Characterization of Dropwort (Oenanthe javanica DC.) Harvested in Different Culture Regions

You-Seok Lee*, Seong-Ja Lim, Min-Kyeong Ju, Jeong-Hwa Kang, Jin-Woo Lee, Bong-Yun Oh, Kyung-Ju Jung
Food and Farm Management Research Institute, Jeollanamdo Agricultural Research and Extension Services, Korea

Dropwort (Oenanthe javanica) is one of most important perennial herb known for its flavor. It is generally used as a salad or as a seasoning in soups and stews in Korea. Recent studies have provided evidence that it may possess liver-protective, anti-neurotoxic, and anti-alcoholic effect. But dropwort does not have a fixed breed. The aim of study is to evaluate 10 dropwort harvested from Jeonnam, Jeonbuk, Gyeongnam, or Gyeongbuk with respect to functional composition. Jeonnam province (E) and Gyeongbuk (J) showed the more quercetin (10.2 ppm vs 4.7-9.2 ppm). Specialy, Gyeongbuk (J) region exhibited the highest contents of isohamnetin (21.71 ppm vs 2.50-12.46 ppm). Those results could be applicable for the scientific basis and selection source to fix excellent breed.

Characterization of the Functional Active Compounds in Maillard Reacted Milk Proteins with Different Sugars

Nam Su Oh*, Ji Young Lee, Yong Kook Shin
ReD Center, Seoul Dairy Cooperative, Korea

Previously, we confirmed that Maillard Reaction Products (MRPs) from milk proteins reacted with sugars possess effective antioxidant activity and have a protective ability against oxidative damage. In this study, we examined the characteristics of MRPs from milk proteins with sugars. The MRPs were obtained from milk protein, i.e., whey protein concentrates (WPC) and sodium caseinate (SC), using two types of sugars, i.e., lactose (Lac) and glucose (Glc), by heating the mixture at 55°C for seven days. Changes in chemical modification of milk protein were monitored by measuring the protein bound carbonyls and SDS-PAGE protein profiles. The results showed that the amount of protein bound carbonyls increased after MR. Also, SDS-PAGE analysis indicated that formation of high molecular weight complexes via the MR. The attachment of lactose and glucose to milk protein was confirmed by MALDI-TOF/MS analysis of MRPs. With increasing reaction time, the lactose and glucose adducts of milk protein were more produced than intact milk protein. Therefore, our results show that MRPs from milk proteins could be a potentially new compound for use as functional dairy ingredients in the food industry.
Analysis of Off-flavor Generated from PET Water Bottle and Cap Using Electronic Nose

Hyun Jung Han*, Su Won Park, Hye Yoan Jung, Jung Sun Kim, Hyemin Dong, Ji Eun Park, Bong Soo Noh
Department of Food Science and Technology, Seoul Women's University, Korea

Off-flavor generated from PET water bottle was investigated by mass spectrometry-based electronic nose. The obtained ion fragments data from electronic nose were used for discriminant function analysis (DFA). When concentrations of the contaminated water increased, off-flavor pattern depended upon the discriminant function second score instead of the discriminant function first score. To find out cause of off-flavor in PET bottled water, cap of bottle and PET bottle were also analyzed by DFA. DFA showed that the cap generated more volatile compounds than bottle or water parts did. Off-flavor material might be predicted as 4-di-tert-butylphenol (2,4-DTBP), nonanal, and decanal when main peak of mass spectrum was compared with major ion fragments of electronic nose. Therefore, it could find out not only whether PET water bottle was contaminated or not but also off-flavor by contamination resulted from.

Analysis of Korean Commercial Distilled Soju Using Electronic Tongue

Jung Sun Kim*, Hyo Yeon Jung, Hae Nim Park, Bong Su Noh
Department of Food Science and Technology, Seoul Women's University, Korea

The purpose of this study is to analyze the flavor characteristics of the domestic market distilled soju using an electronic tongue (e-tongue). Fourteen kinds of domestic distilled soju and 7 kinds of domestic diluted soju, 5 kinds of imported spirits were selected for analysis. Five flavor sensors (bitterness, sweetness, saltiness, sourness, umami) get the sensitivity value to analyze the characteristics of soju by using e-tongue. As a result, distilled soju and diluted soju were clearly identified through a discriminant function analysis and it is also possible to distinguish between imported and domestic distilled spirits. Compared with the sensitivity value of each flavor sensor, saltiness, and umami of the diluted soju was stronger than distilled soju. In addition, it was found that the imported spirits was a little sweeter than the domestic spirits. Umami and saltiness of the imported spirits were stronger than the domestic one. But, There were no significant difference in the bitterness. On the other hands, the distilled soju during aging in the oak barrels or pottery and the distilled soju without aging were not separated.

Physiochemical Characteristics of Raw and Dried Jerusalem Artichoke Pickle

Songe Choi*, Kyoungkyu Kang, Jinsook Kim, Gichang Kim, Kyungmi Kim
Agro-food Resources, National Academy of Agricultural Science, Rural Development Administration, Korea

Jerusalem artichoke is difficult to store outside the soil because of the short storability. For this reason, Jerusalem artichoke is mainly distributed in the market in the form of dried materials. In order to improve the utilization of the dried Jerusalem artichoke, we made a pickle and compared the physiochemical characteristics with a raw Jerusalem artichoke pickle. The raw Jerusalem artichoke were sliced in 7 mm and dried in hot air. After aging, we compared pH, hardness, salinity, sugar content, water activity, and fructan content of the both. In the case of raw Jerusalem artichoke, hardness showed the tendency to decline relatively, the hardness of dried Jerusalem artichoke measured consistently. The salinity and sugar content of dried material were higher 0.87%, 8.14°Bx respectively and content of fructan was lower 2.56% than raw material. As a result of comparison, the texture of dried Jerusalem artichoke pickle is expected to be similar to the texture of raw Jerusalem artichoke pickle.
**Assessing the Permitted Use Level of a Non-nutritive Sweetener, Saccharin, in Food Products**

Wisbowotomo Budi¹, Jong-II Rhee¹, Jong-Bang Eun

Department of Food Science and Technology and Functional Food Research Center, Chonnam National University, Korea, ¹School of Applied Chemical Engineering, Research Center for Biophotonics, Chonnam National University, Korea

As a non-nutritive sweetener, saccharin, has been approved for usage in food with the permitted level around 100-1,200 mg/kg. We investigated the saccharin content in (a) different food categories collected from local market, and (b) 3 types of food model (soft drink, pudding, steamed-bread) spiked by 500 and 1,000 mg/kg of each. After ethanol extraction, calculated concentration was determined by HPLC and then compared with labeled value to obtain recovery rate. Results showed that saccharin contents in food sweetener, food in brine, and popped-grain are under permitted level with recovery rate of 92.34, 110.86, and 107.69%, respectively, by comparison with labeled value of 50,000, 500, and 500, respectively. But crackers and carbonated drinks have no significant recovery rate due to the minus calculated concentration and lack of labeled value, respectively. Alcoholic beverage exhibited non-detected saccharin peak area. Among food categories collected from local market, followed by soft drink (97.92-110.13%) and steamed-bread has the most accurate recovery rate exhibited non-detected saccharin peak area. Overall, the observed labeled-food products have saccharin content less than permitted usage level.

**Physicochemical and Sensory Characteristics of Beef-bone Broths Prepared under Atmospheric Pressure and Overpressure Conditions**

Sang Ha Moon¹, Keum Taek Hwang, Yong Bum Cha³

Department of Food and Nutrition, and Research Institute of Human Ecology, Seoul National University, Korea, ¹Woo Hyang Woo Foods Corporation, Korea, ³Korean German Institute of Technology, Korea

This study was to compare physicochemical and sensory characteristics of beef-bone broths prepared under atmospheric pressure (BBAP) and overpressure (BBOP) conditions. Beef bone (0.5 kg) was boiled in water (1.5 L each) 7 times for 2 h each, and all the extracts were gathered to prepare the BBAP. Beef bone (0.5 kg) was boiled in water (1.5 L each) 7 times for 1 h each using an autoclave (121°C, 1.25 atm), and all the extracts were gathered to prepare the BBOP. The BBOP had significantly more solid (p<0.05), protein (p<0.01), ash (p<0.001), and collagen (p<0.001) than the BBAP but chondroitin sulfate content was not significantly different. Lightness (L value) of the BBAP was significantly higher (p<0.001), and its redness (a value) (p<0.001) and yellowness (b value) (p<0.001) were significantly lower than the BBOP. In sensory evaluation, the BBAP had significantly stronger meaty off-flavor (p<0.001) and greasy flavor (p<0.001) than the BBOP, although there were no significant differences in umami and sesame taste. The BBAP was significantly preferred to the BBOP in flavor, taste, color, and overall preference (p<0.001).

**Stability Verification Analysis of DNA Reference Materials (RMs) for Genetically Modified (GM) Maize MON810**

Hyong-Ha Kim¹, Young-Hye Seo, Su-Kyung Lee, Woo Jeong Kim², Jung-Keum Sub³,²

Korea Research Institute of Standards and Science, Korea, ¹BIONSYSTEMS, Korea, ²Korean German Institute of Technology, Korea

Food labeling policies in Korea have a 3% threshold level, and GMO analysis methods are established according to the Korean Food Standards Codex (KFSC). Among various GMO analysis methods, real-time PCR is used for quantifying GM content. We have reported that plasmid DNA samples have shown long-term stability after 12 months of storage at -20°C and -70°C. The ratio of transgenic gene and endogenous gene was calculated using Ct values. This study reports additional long-term stability after analyzing the plasmid DNA samples which were stored at -20°C and -70°C for 24 months. The samples have already shown long term stability after 12 months of storage at these temperatures and the results of 24 month-long-term stability tests were similar to the earlier tests and very close to the gene ratio of 1:1, showing stability of the developed materials for up to 24 months at temperatures lower than -20°C. We therefore report the development of an MON810 maize plasmid DNA RM with long-term stability which can be used for qualitative/quantitative analyses to determine the presence or the mixture ratio of GM maize.

**Analysis of Long-term Stability of DNA Reference Materials (RM) for Genetically Modified (GM) Maize MON863**

Hyong-Ha Kim¹, Young-Hye Seo, Su-Kyung Lee, Woo Jeong Kim², Jung-Keum Sub³,²

Korea Research Institute of Standards and Science, Korea, ¹BIONSYSTEMS, Korea, ²Korean German Institute of Technology, Korea

Korean food labeling policies for GM food have a 3% threshold level, and GMO analysis methods are established according to the Korean Food Standards Codex (KFSC). Real-time PCR is used for quantifying the GM. This study reports plasmid DNA RMs developed for qualitative/quantitative analyses of GM maize MON863. We have cloned one copy of the MON863 transgenic gene along with one copy of endogenous ssIIb in one plasmid DNA molecule to provide the most suitable calibrator for the KFSC GM tests. Previous tests showed homogeneity and short-term stability at various temperatures. Long-term stability was tested with samples stored at -20°C and -70°C for 6 months in this study. The results were similar to the homogeneity and short-term stability tests, verifying stability for up to 6 months at temperatures lower than -20°C. We report development of an MON863 maize RM with long-term stability which can be used for qualitative/quantitative analyses to determine the presence or the mixture ratio of GM maize. We plan to analyze the sample for up to 24 months.
Validation of an Analytical Method and Estimation of Uncertainty for Valifenalate in Vegetables
Ji Young Kim*, Hee Jung Kim¹, Eun Heui Park, Myoung Jin Go, Moon Ik Chang², Gyu Seok Rhe³, Jong Kwon Lee Hazardous Substances Analysis Division, Gwang-Ju Besional Food and Drug Administration, MFDS, Korea, ¹Pesticide and Veterinary Drug Residues Division, National Institute of Food and Drug Safety Evaluation, MFDS, Korea

Valifenalate is an acylamino acid fungicide. It interferes with the cell-wall synthesis thus affecting the growth stages of the pathogens controlled, both outside or inside the plant. In this study, validation of analytical method of valifenalate were carried out using HPLC/MS-MS. We demonstrated to estimate the measurement uncertainty of valifenalate. The sources of measurement uncertainty (i.e. sample weight, final volume, standard weight, purity, standard solution, calibration curve, recovery, and repeatability) in associated with the analysis of valifenalate were evaluated. Prior to measure of uncertainty, the analytical method was validated for linearity, limit of detection (LOD, 0.002 mg/kg), limit of quantification (LOQ, 0.01 mg/kg), and precision and accuracy (less than a relative standard deviation of 7.9%). The content of fortified valifenalate from vegetables was estimated at a 95% confidence level. The results of the recovery test was 72.5-98.3%. These validation results demonstrated that the valifenalate method is suitable for the determination of vegetables and satisfied the performance requirements of CODEX guideline.

Charantin Level from Sixteen Varieties of Bitter Melon (Momordica charantia L.) Grown in Korea
Kyu-won Hwang*, Joon-Kwan Moon, Dong Mo Son¹
Department of Plant Life and Environment Science, Hankyong National University, Korea, ¹Jeonnam Agricultural Research & Extension Services, Korea

Charantin is a chemical substance obtained from Asian bitter melon (Momordica charantia L.), reputed to be responsible for hypoglycemic properties. Sixteen different varieties of bitter melon fruit samples from two different harvest times from Naju, Jeonnam were selected for the analysis of charantin content. Methanolic extracts from frozen dried bitter melon fruit (0.2 g) were analyzed for charantin content by HPLC-DAD using Brownlee SPP C18 column (4.6×100 mm, 2.7 μm) after filtration through PVDF membrane syringe filters (13 mm, 0.45 μm). Charantin was monitored at the wavelength of 210 nm. The charantin content of the group 1 was ranged 5.3 to 13.4 mg/g whereas the group 2 from 5.3 to 14.9 mg/g. Among the 16 cultivars, the highest amount of charantin was found in the cultivar of dragon (13.4 mg/g) and super dragon (14.9 mg/g), respectively. Otherwise the lowest charantin content cultivar was the Baekdolli (5.3 mg/g). This study has shown an important phytochemicals content in different cultivars of bitter melon collected from different seasons.

Inspection of Radioactive Contamination in the Food Distribution Industry
Byungjun Kim*, Sungah Park, Hocheol Yun, Jaehun Jeong, Chanhee Kim, Jungmi Kang Busan Metropolitan City Institute of Health & Environment, Korea

Since the Fukushima nuclear accident in 2011, Busan Metropolitan Institute of Health and Environment has been inspecting a radioactive contamination in food products since 2012. The food products inspected are seafood, processed food, and fresh produce. The total tested items are 1,135-148 in 2012, 446 in 2013, and 539 in 2014 by year - including 371 imported food products. Radioactivity was not detected in the test results. The inspection items are Iodine-131, Cesium-134, and Cesium-137. The measuring equipment is High Purity Germanium Gamma Ray Spectrometer, and the measurement time is 10,000 s according to the Korean Food Standards Codex. The inspection criteria of Iodine-131 is lower than 300 Bq per kg and the sum of Cesium-134 and Cesium-137 is lower than 100 Bq per kg based on the Korean Food Standards Codex. The inspection of radioactive contamination, which has been carried out since 2015, will be subdivided into the radioactivity inspection of the Japanese nuclear power plant, the agricultural and fishery producing around Kori Nuclear Power Plant, and radiation test of school meals ingredients.

Rapid Detection and Enumeration of Lactobacillus kefiranfaciens in Kefir Grain and Kefir Milk Using Real-time PCR
Dong-Hyeon Kim*, Jung-Whan Chon, Hong-Seok Kim, Jin-Hyeok Yim, Il-Byeong Kang, Young-Ji Kim, Jong-Soo Lim¹, Kwang-young Song¹, Kun-Ho Seo¹
KU Center for Food Safety, College of Veterinary Medicine, Konkuk University, Korea, ¹Sensorgen Inc., Konkuk University, Korea

Lactobacillus kefiranfaciens is an indicator microorganism of kefir and a key factor in kefir grain formation and kefiran production. We designed a novel real-time PCR primer/probe set, LKF_KU504 for the rapid detection and enumeration of Lactobacillus kefiranfaciens. In inclusivity and exclusivity tests, only 14 L. kefiranfaciens strains were positive among 61 microorganisms, indicating 100% sensitivity and specificity. LKF_KU504 set also differentiated kefir milk from 30 commercial non-kefir yogurts. In the enumeration of L. kefiranfaciens in kefir grain and milk, there was significant difference in the number of L. kefiranfaciens in kefir grain and kefir milk, indicating L. kefiranfaciens was more concentrated in kefir grain than kefir milk. The newly developed real-time PCR assay could be boon to kefir industry because it could provide an accurate and fast tool for detection and enumeration of L. kefiranfaciens in kefir grain and milk to monitor the quality of kefir probiotics.
Validation of Analytical Method for the Determination of Antioxidants in Food

Young-Hyun Kim*, So-Young Jang, Jung-Bok Kim, Jae-Wook Shin
Korea Advanced Food Research Institute, Korea

Butylate hydroxy anisole (BHA), butylate hydroxy toluene (BHT), tert-butyldihydroquinone (TBHQ), propyl gallate (PG), erythorbic acid, ascorbyl stearate (AS), ascorbyl palmitate (AP), and disodium & calcium disodium ethylenediaminetetraacetate (EDTA) are synthetic antioxidants authorised as a food additive in the Korea. Antioxidants play a significant role in retarding the lipid oxidation reactions in food products, since oils and fats, essential to our diets, tend to encounter problems of oxidation and rancidity, which affect food quality and may endanger our health. To prevent food peroxidation, manufacturers prefer to use antioxidants for the control of these oxidative reaction. However, the safety of these antioxidants was questioned due to their potential risk. Therefore, necessity of broad scale monitoring and supply of estimated daily intake data have been raised to acquire safety of food. The purpose of this study was to provide analytical method validation for monitoring and supply of estimated daily intake data of antioxidants. We have validated the present HPLC method based on Korean Food Codex and The Analytical Methods of Food Additives in Foods.

Optimization of Capsanthin Extraction from Red Paprika Using ASE by Response Surface Methodology

Ji-Sun Kim*, Suna Kim
Food and Nutrition in Home Economics, College of Natural Sciences, Korea National Open University, Korea

In this study, we extracted capsanthin (CST) from red paprika using accelerated solvent extraction (ASE) by Box-Behnken Design (BBD) of response surface methodology (RSM). Three independent variables including temperature (°C, X1), static time (min, X2), and ratios of acetone and ethanol (%v, X3) were studied. CST contents as response variable was determined by ultra-performance liquid chromatography (UPLC). The data fitting revealed coefficient of determination (R2) for the total model was 80.20% (p<0.001), and no lack-of-fit could be verified (p>0.05). A mathematical relationship, Y=32.58+7.30X1+2.00X2+2.50X3−2.36X12+4.10X22+3.71X32−2.89X1X2+0.02X1X3−5.09X2X3, was obtained to explain the effect of all factors. The optimal extraction condition was found to be 100°C, 5 min, and 50% acetone, respectively. Under these conditions, the mean extraction yield of CST was 26.12 μg/100 g dry weight (dw), which was in good agreement with the predicted model value. The experimental values under optimal conditions were in good consistent with predicted values, which suggested that ASE is very efficient process comparing to conventional solvent extraction.

Method Development of Biphenyl Analysis in Food

So-Young Jang*, Young-Hyun Kim, Jung-Bok Kim, Jae-Wook Shin
Korea Advanced Food Research Institute, Korea

Biphenyl is used as an intermediate in the production of crop protection products, a solvent in pharmaceutical production, and in the preservation of citrus fruits in many countries. It has been said that long-term or repeated exposure of biphenyl may have effects on the liver and nervous system, resulting in impaired functions. In Japan, biphenyl is used as food additives for anti-molding agents. It is restricted to maximum limits of 0.070 g/kg for use. However, Biphenyl is not authorized for use and also does not have standards and specifications in Korea. National and imported food products are likely to contain it. Therefore, control and management of these products is required. Existing analytical methods, e.g. AOAC Official Method, pesticide residue analysis of Korean Food Standards Codex, migration testing in woods of Korean Food Additives Codex, and analysis methods of papers, are not effective. These methods also showed low recoveries. This study aims to establish the new analysis method of biphenyl in food by modifying existing analysis methods.

Antimicrobial Properties of Yeast Isolated from Kefir against Salmonella Enteritidis and Listeria monocytogenes

Il-Byeong Kang*, Jung-Whan Chon, Dong-Hyeon Kim, Hong-Seek Kim, Jin-Hyeok Yim, Dasom Choi, Young-Ji Kim, Jong-Soo Yim1, Kwang-young Song1, Kun-Ho Seo1
KU Center for Food Safety, College of Veterinary Medicine, Konkuk University, Korea, 2 Sensorgen Inc., Konkuk University, Korea

Kefir is a fermented milk product, which consists of lactic acid bacteria, yeasts, and possibly other microorganisms. Although the probiotic properties of lactic acid bacteria in kefir have been studied for decades, these of yeast were not addressed yet. The objectives of this study were to isolate yeast strains from kefir and investigate their antimicrobial properties. Kefir was directly streaked onto potato dextrose agar, yeast extract-peptone-dextrose agar, and yeast extract glucose chloramphenicol agar. Single colonies on the agar plates were isolated and identified by internal transcribed spacer sequencing. Salmonella Enteritidis (SE) isolated from sprout and Listeria monocytogenes (LM) ATCC51776 were employed for investigating the antimicrobial activity of yeast culture. A total of 46 Candida kefyr, 16 Saccharomyces unisporus, and 2 unidentified yeasts were isolated from kefir milk. A total of 19 C. kefyr and 10 S. unisporus strains inhibited the growth of SE. A total of 19 C. kefyr and 4 S. unisporus strains inhibited the growth of LM. In addition, a total of 18 C. kefyr and 3 S. unisporus strains inhibited the growth of both SE and LM.
Quality Characteristics of Commercial Wasabi for Extended Shelf Life

Hyo-Kyung Lee*, Do-Hee Kim, Eun-Jeong Jeong, Yong-Suk Kim
Department of Food Science & Technology, Chonbuk National University, Korea

In order to extend the shelf life of commercial cold storage Wasabi, the quality characteristics of two kinds of commercial cold storage Wasabi (CSW) and four kinds of commercial room temperature storage Wasabi (RSW) were determined. The pH of CSW and RSW were confirmed as the ranges of 4.34-4.43 and 4.12-4.90, respectively. The total acidity and soluble solid contents of CSW were 0.55-0.71% and 1.87-2.20%, respectively, and RSW were indicated in the ranges of 0.21-0.58% and 1.74-2.27%, respectively. The salinity of the RSW were indicated in the ranges of 4.27-7.53%, which were higher than CSW (2.20-3.60%). The color values (L, a, b) of CSW showed higher than RSW. In RSW, contents of the citric acid and sorbitol were determined in the ranges of 0.02-0.06% and 0.19-0.36%, respectively, which were higher than CSW (0.03-0.05% and 0.01-0.16%). The microbial analysis of all commercial Wasabi were evaluated by the aerobic bacteria, yeasts, and molds. Therefore, to extend the shelf life of commercial cold storage Wasabi, it is necessary to add an additives or reduce the salinity.

Sowing Time Limitation and Total Polyphenol Contents of Sorghum in Central Region of Korea

Gun Ho Jung*, Sun Lim Kim1, Mi Jung Kim2, Yu Young Lee2, Sung Kook Kim, Jeong Hwa Park, Chung GuK Kim, Sung Gi Heu
Cultural Environment Research Division, Department of Central Area, Crop Sci., National Institute of Crop Science, Korea, 2Crop Foundation Research Division, Crop Sci., National Institute of Crop Science, Korea, 3Crop Post-harvest Technology Research Division, Department of Central Area, Crop Sci., National Institute of Crop Science, Korea

The climate changes such as high temperature, cold weather damage, flooding, drought stresses, and other disasters were reported that cause to reduce productivity of upland crops. One of the climate changes, flooding is severe environment factor. In general, sorghum is grown at summer period in Korea. The moisture stress at early growth stage of sorghum is causing a large decrease in yield. Two sorghum cultivars, Donganmae and Hwanggeumchal were planted in the experimental field of NICS, RDA, Suwon, Korea. Donganmae and Hwanggeumchal were sown at May 27, June 7, 17, 27 and July 7 in 2013, and 2014, respectively. Planting density was 70×25 cm, and the major agronomic characteristics such as flowering dates, harvest, and production of sorghum seed were tested. Growth period of Donganmae, Hwanggeumchal cultivar is about 110-120 days. Total polyphenol contents of Donganme and Hwanggeumchal sorghum were 293.9, 209.8, 240.3, 370.8, and 416.2 mg/g and 318.7, 373.7, 355.6, 301.0, and 414.3 mg/g sample, respectively. For stable production of sorghum in the central region of Korea, sowing time limitation of Donganmae and Hwanggeumchal cultivars is June 27, respectively.

Optimization for the Lactic Acid Fermentation of Pleurotus ostreatus Water Extracts

Hyo-Kyung Lee*, Ab-Young Lee, Eun-Jeong Jeong, Yong-Suk Kim
Department of Food Science & Technology, Chonbuk National University, Korea

The optimum fermentation condition of Pleurotus ostreatus (PO) water extracts for the production of lactic acid fermented beverage were determined. In order to select the strain, seven kinds of commercial lactic acid bacteria strains (LPBA, YO-MIX™101, YO-MIX™401, YO-MIX™495, YO-MIX™496, YO-MIX™863, and JOG331A) were evaluated by the contents of ergothioneine, total phenolic compounds, and lactic acid. Also, the optimum conditions of pH (2.0, 4.0, 5.0, 6.0, and 8.0), carbon sources (glucose, sucrose, fructose, and lactose), and their concentrations (0, 2, 4, 6, and 8%) were determined. In the strains, lactic acid content of YO-MIX™496 strain fermented on 36 h showed the highest 3.11±0.02 mg/g. However, ergothioneine and total phenolic compounds contents showed the highest 2.54±0.02 mg/g and 8.94±0.43 mg/g, respectively, in YO-MIX™101 strain based on same condition. Therefore, YO-MIX™101 strain that contained the highest contents of ergothioneine which contained high antioxidant activity was selected for lactic acid fermented beverage. Optimal conditions of pH, carbon source, and the concentration for fermentation of PO water extracts showed pH 5.0 to 6.0, fructose, and 2.0%, respectively.

Comparison of Nutrition Labeling of Fatty Acid Content in the Distribution Food

Yoon-Jin Park1,2*, Cheon-Hoe Kim1, Bo-Ram Jang2, Eun-Hee Kim2, Young-Kyoung Kim2, Heung-Youl Lim1, Joo-Hong Yang2, Ae-Son Om2
1Korea Health Supplement Association Sub. Korea Health Supplement Institute, Korea, 2Lab. of Food Safety, Department of Food & Nutrition, College of Human Ecology, Hanyang University, Korea

This study was carried out to provide reliable indication of the fatty acid (saturated fatty acids, trans fatty acids) about the retort food in commercial food. It was classified curry, black-bean-sauce, porridge-rice, soup, sauces, meat as a retort food depending on the contents. This study analyzed 119 cases of retort food (curry 21 cases, black-bean-sauce 16 cases, rice porridge-33 cases, soup 16 cases, source 17 cases, meat 16 cases). Fatty acids were analyzed by Korean Food Standards Codex provided by Korea Food & Drug Administration. Also, the in-house-control-sample analyzed together for the validity of the analysis result. As a result, all 119 cases complied with the labeling of saturated fat and trans fat (The product label in the Nutrition Facts panel was less than 120%). Saturated fat per 100 g in meat was 2.16±2.64 g high, and trans fatty acids per 100 g curvy was 0.17±0.11 g high than other types. Finally, this study was able to ensure the reliability of nutrition content labeling by measuring saturated fat and trans fat.
Antioxidant Activity and Biological Activity of Korean Barley and Barley Bran

Mi Ja Lee*, Woo Duck Seo, Kyung Hye Seo, Song Min Oh, Kwang Sik Lee, Hyeon Jung Kang, Sun Lim Kim
Crop Foundation Division, National Institute of Crop Science, Korea

Numerous studies have demonstrated that whole grains that are high in soluble fiber, such as oats and barley, are more effective in lowering blood cholesterol than grains in which fibers are predominantly insoluble, such as wheat or rice. Cereals such as wheat, rice, corn and barley in addition to being primary sources of carbohydrates, also provide trace minerals, dietary fiber and bioactive compounds. Evaluation of abundantly available by-products for their bioactive compounds and biological activities is beneficial in particular for the food and pharmaceutical industries. In this study, whole barley grains of Korean cultivars and barley bran were investigated for the antioxidant, xanthine oxidase and tyrosinase inhibitory activities. The 1,1-diphenyl-2-picrylhydrazyl (DPPH) radical scavenging activities of waxy type whole barley and bran were higher than that of non-waxy barley type barley. Barley bran had higher DPPH than whole grains. Inhibition rates (%) of the mushroom tyrosinase didn’t show significant difference between whole barley grain and bran. The samples showed an inhibition effect of xanthin oxidase and angiotensin converting enzyme.

Quality Characteristics and Antioxidant Activity of Yogurt Added with Pleurotus ostreatus Water Extracts

Hyo-Kyung Lee*, Ji-Yoon Park, Eun-Jeong Jeong, Yong-Suk Kim
Department of Food Science & Technology, Chonbuk National University, Korea

To use Pleurotus ostreatus water extracts (PWE) as yogurt base, quality characteristics and antioxidant activity of yogurt added with PWE were investigated. According to fermentation hours (0, 2, 4, 6, 8, and 10 h) and concentrations (0, 10, 30, 50, and 70%) of PWE, yogurts were determined by pH, titratable acidity, contents of soluble solid, and lactic acid bacteria. Organic acid, antioxidant activity, and sensory evaluation were evaluated by the concentrations of PWE after 10 hours of fermentation. Soluble solid contents and pH were decreased and titratable acidities was increased during fermentation time. Lactic acid bacteria was detected 10.02-10.14 log CFU/mL in yogurt fermented on 10 h and they were no significant difference. As the ratio of the PWE increase, the contents of lactic acid and tartaric acid were increased in a dose-dependent manner. Also, polyphenols and 1,1-diphenyl-2-picrylhydrazyl (DPPH) radical scavenging activity were increased. However, this study showed that the yogurt added with 10% PWE were considered the best due to overall acceptability of the yogurt added with 10% PWE was found to be considerably better than other groups.

Analysis of Flavor Patterns of Korean Commercial Distilled Soju Using Electronic Nose

Hyo Yeon Jung*, Jung Sun Kim, Jin Young Choi
Department of Food Science and Technology, Seoul Women's University, Korea, 1Division of Food Science and Culinary Arts, Shinhan University, Korea

Flavor patterns of 14 types of Korean commercial distilled soju and 7 types of diluted soju was analyzed by electronic nose based on mass spectrometer. In the results, the flavor pattern of samples was separated according to types (distilled, diluted) by the discriminant function analysis (DFA). The data showed that distilled soju have more volatile compounds and various flavors in comparison with diluted soju. However the pattern of distilled soju that aged in oak barrels were not significantly different with general distilled soju. The aged distilled soju have more volatile compound rather than non-aged distilled soju. Flavor is one of the most important factors for determining distilled soju characteristics and quality. Electronic nose could be successfully used for quality evaluation and new product development of distilled soju.

Reduction of Off-flavors for Steamed Crab Meat by Dairy Products

Hyo Yeon Jung*, Jung Sun Kim, Seo Young Oh
Department of Food Science and Technology, Seoul Women’s University, Korea

The objective of this study was to determine the effect of dairy products on reduction of fishy odor in steamed crab meat using the mass spectrometer based electronic nose. The steamed crab meat was soaked in three different dairy products (whole milk, soymilk, and yogurt) and the pattern changes of volatile components were analyzed by discrimination function analysis. The discriminant function first score (DF1) was significantly moved from negative position to positive direction with increase of soaking time. It suggested that the intensity of fishy odor became weaker as soaking time increased. The effect of whole milk on the reduction of fishy odor was better than that of yogurt. The results of this study demonstrate that reduction of off-flavors using dairy products was possible.
Determination of Quorum Sensing Molecules in Makgeolli by Dispersive Liquid-Liquid Microextraction Coupled with Gas Chromatography and Mass Spectrometry (GC/MSD)

Jangho Lee1,2*, Haewon Jang1, Jaeho Ha1

1Food Analysis Center, Korea Food Research Institute, Korea;
2Department of Food Biotechnology, Korea University of Science and Technology, Korea

Makgeolli is the Korean traditional alcoholic beverage, which is commonly made from rice. During makgeolli fermentation, various metabolites are made by some microorganisms, Candida albicans and Saccharomyces cerevisiae. These yeasts produce quorum sensing molecules (QSMs), including Farnesol, Tyrosol, Phenylethanol, and Tryptophol in the fermentation process. Quorum sensing (QS) is a mechanism of cell-to-cell communication that regulates microbiological functions. Previously, Tyrosol, Tryptophol, Phenylethanol and Farnesol in makgeolli were identified or determined by solvent-fractionation and stir-bar sorptive extraction with GC/MSD. However, those extraction methods were not simultaneous determinations and also dispersive liquid-liquid microextraction (DLLME) for the simultaneous analysis of the QSMs in makgeolli has not been yet reported. Therefore, we determined QSMs in makgeolli by DLLME coupled with GC-MSD. In this study, chloroform and methanol were selected as the optimal extraction and dispersive solvents, respectively. Response surface methodology was used to find the optimal condition of DLLME.

Ultrafast Analysis for the Simultaneous Identification and Quantification of the Multi-target Gingerol-related Compounds in Ginger Products by UPLC-MS/MS with a Multiple Reaction Monitoring Mode

Su Yeon Park*, Mun Yhung Jung

Department of Food and Biotechnology, Gradate School, Woosuk University, Korea

Ultrafast analytical method for the simultaneous separation, identification, and quantification of gingerol-related compounds in ginger products was developed with a system of ultrahigh pressure liquid chromatography coupled with a tandem mass spectrometer in a multiple reaction monitoring mode using a core shell C18 column. The established LC-TOF/MS method achieved exceptionally high fast separation, identification and quantification of 10 target ginerol-related compounds in the samples within 1 min running time. The established method showed a satisfactory linearity \( r^2 > 0.990 \) in a wide range, extremely low limit of detection (LOD) and limit of quantification (LOQ), and high precision, inter- and intra-day repeatability, high recovery and no matrix effects. The established method was successfully validated and applied to measure the quantities of 10 target ginerol related compounds in fresh gingers, dried gingers, and supplements. The present established analytical method provided the fastest analysis of the multi-gingerol compounds ever reported. This newly developed UPLC-MS/MS analytical method was 60 times faster than the conventional HPLC-DAD method.

Volatile Flavor Components of Black Raspberry Wine Fermented with Traditional Yeast

Ji Hye Jung*, Hae Hoon Yoon, Rak Ho Son

Berry & Biofood Research Institute, Korea

We investigated black raspberry (Rubus occidentalis) wine made using traditional yeast (Saccharomyces cerevisiae G3, BRG) and S. cerevisiae Femavin (BRF) which is widely used in wine manufacturing. Flavor constituents of the two fermented wines were analyzed by gas chromatography and mass spectrometry. Thirty-nine compounds from the sample were separated and identified as fourteen alcohols, thirteen esters, four hydrocarbons, three aldehydes, two ketones and an acid. The major compound of black raspberry wine was ethyl benzonate of sweet and fruity flavor and the content of the in BRG were more than in BRF. Phenethyl alcohol of lilac and rose flavor was four times more abundant in BRG than in BRF. Several ester components (ethyl butanoate, ethyl hexanoate, ethyl octanoate) were about two times more abundant in BRG than in BRF. The sensory evaluation revealed that BRG showed excellent flavor, taste, and overall acceptability compared with BRF. In conclusion, S. cerevisiae G3 was contributes to improved black raspberry wine production with high quality.

Analytical Method Validation of Caffeic Acid and Chlorogenic Acid in Extract of Pear Pomace and Extraction Conditions

Eun-Jung Cho*, Mi-Ae Bang1, Jung-Eun Kim, Seung-Sik Cho

Department of Pharmacy, College of Pharmacy, Mokpo National University, Korea, 1Department Jeonnam Bioindustry Foundation, Food Research Institute, Korea

This study has been conducted to establish the HPLC analysis method for the determination of marker compound as a part of the materials standardization for the development of cosmetic materials from pear pomace. It showed a high linearity in the calibration curve as coefficient of correlation (R2) of 0.9999, and the limit of detection (LOD) and limit of quantification (LOQ) were 1.14-1.61 μg/mL and 3.5-4.9 μg/mL, respectively. RSD values of data from intra- and inter-day precision were less than 3.1% and 4.0%, respectively. Recovery rate test with caffeic acid and chlorogenic acid concentration of 12.5, 25, and 50 μg/mL was revealed in the range of 93.66-106.32% and 97.33-105.68%. An optimized method of extraction for caffeic acid and chlorogenic acid in PPE was established through conditions of diverse extraction and the validation result indicated that the method is very useful for the evaluation of marker compound in PPE to develop the cosmetic material.
A Large-Scale Production Technique of Oxyresveratrol from Ethanol Extract of Morus Root Bark by Enzymic Conversion

Young-Hee Jeon*†, Dong-Hee Lee, Sang-Won Choi
Department of Food Science and Nutrition, Catholic University of Daegu, Korea

The bioconversion process has been developed for the large scale production of oxyresveratrol aglycone from the Morus root barks including oxyresveratrol glycosides using a commercial enzyme. The ethanol extract of the short-cutted dried root barks was solubilized in 20% ethanol (EtOH) and reacted with commercial enzyme solution for 6 h at 40-45°C, cooled and then partitioned with double amount of ethylacetate (EtOAc). The EtOAc fraction was evaporated under reduced pressure, redissolved, and passed onto Diaion HP-20 column with 40% EtOH to obtain oxyresveratrol. The method developed allowed the reuse of the recovered solvents and the chromatographic columns. The high purified and recovered oxyresveratrol was produced by enzymic conversion, solvent fractionation and column chromatography.

Analysis of Flavor Patterns in Baechu and Chonggak Kimchi at Fermentation Periods by GC/FID-based Electronic Nose

Ye-Seul Hwang*, Won-Bo Shim, Su-Ji Kim, In-Min Hwang, Ji-Su Yang, B. Jae Lee†, Sung Hyun Kim
World Institute of Kimchi, Korea, †Scitec Lab Center, Korea

This study was comparison the flavor compounds and investigation the physico-chemical properties during kimchi fermentation. Baechu and chonggak kimchi were fermented at 4°C for 3 months. Each sample of pH, acidity, salinity, reducing sugar were measured. Flavor pattern of the fermented kimchi was obtained by electronic nose system with gas chromatograph/flame ionization detection (GC/FID). The kimchi fermentation induced a gradual reduction in pH and an increase in acidity from 0.33% (initial) to 1.11% (3rd month). The reducing sugar contents in baechu and chonggak kimchi were slowly decreased as storage period passes. The salinity was not significantly affected by fermentation. Electronic nose analysis could differentiate the flavor profiles of kimchi according to the fermentation periods, making different groups in the principal component analysis (PCA) plot.

Comparison of Biological Activities of Resveratrol and Oxyresveratrol

Young-Hee Jeon*, Dong-Hee Lee, Eun-Jeong Kim, Jin-Kyung Kim†, Sang-Won Choi
Department of Food Science and Nutrition, Korea, †Department of Biology, Catholic University of Daegu, Korea

Biological activities of resveratrol and oxyresveratrol were compared with several in vitro and cell assays. Oxyresveratrol showed higher 1,1-diphenyl-2-picrylhydrazyl (DPPH) radical scavenging, α-glucosidase, lipoxygenase, and tyrosinase inhibitory activities than resveratrol. In particular, oxyresveratrol with lower cytotoxicity exhibited stronger inhibition on iNOS and COX-2 expression, and on NO and IL-6 production in a dose-dependent manner than resveratrol. Meanwhile, the hypoglycemic activity of two stilbenes was evaluated after its oral administration to STZ-induced diabetic rats. Diabetes was induced by injection of 60 mg/kg of STZ at five times i.p. The administration of oxyresveratrol for 10 days (600 mg/kg/day) significantly reduced a plasma glucose level from control level (162.20±8.32 mg/dL) to a lower level (80.20±7.46 mg/dL). Thus, these results suggest that oxyresveratrol, a major stilbene compound of Morus root barks, may be useful as a potential therapeutic agent for treatment of pathological disorders.

Isolation and Identification on Phytochemicals from Nigella sativa L.

Ga-Hee Jang*, Heon-Wong Kim, Jung-Bong Kim, Min-Ki Lee, Jae-Hyeong Shin, Dong-Jin Lee†
National Academy of Agricultural Science, Rural Development Administration, Korea, †Department of Crop Science and Biotechnology, Dankook University, Korea

Seeds of Nigella sativa are used as a spice in cooking and in a wide traditional medicinal uses. Most pharmacological properties are mainly attributed to phytochemicals in N. sativa seed. Various bioactive compounds have been isolated such as alkaloids, steroids, cycloartenol, fatty acids, sugars, flavonoids of trigillin quercetin-3-glucoside and an isohenzofuranone derivatives. This study is to investigate N. sativa secondary and primary metabolism. Profiling of phytochemicals was evaluated by using UPLC-DAD-QTOF/MS. The database of information about 16 different alkaloids, 9 different saponins and 11 different flavonols, built by alkaloids, saponins and flavonols library. As a result, 8 components of hederagenin glycosides and 3 components of flavonol glycosides separated in n-butanol fraction. The hederagenin glycosides major component was nigella A and hederasaponin C. And new hederagenin saponin glycoside isolated in Nigella genus compared with previous studies. In the flavonol glycosides, nigelanol A, B and C revealed from the n-butanol fraction. The total contents of hederagenin and flavonol glycosides was determined 481.27 and 3.25 mg/g DW, respectively.
Validation of Oxyresveratrol as Marker Compound for Standardization of Ethanol Extract of Mulberry (Morus alba L.) Twig as Functional Ingredient

Young-Hee Jeon*, Dong-Hee Lee, Eun-Jeong Kim, Jin-Kyung Kim¹, Sang-Won Choi¹
Department of Food Science and Nutrition, Catholic University of Daegu, Korea, ¹Department of Biology, Catholic University of Daegu, Korea

Validation of oxyresveratrol for the standardization of mulberry twig as a functional ingredient and health food was carried out by HPLC analysis. HPLC method was validated according to specificity, linearity, accuracy, precision test, and recovery test. Specificity was confirmed with identical retention time, and calibration curves of oxyresveratrol showed good linear regression \((R^2>0.998)\). Relative standard deviations (RSD) of data from the intra- and inter-day experiments were less than 2.30% and 2.75%, except low limit of quality control (LLOQ, 1 \(\mu\)g/mL). Recovery ranged from 90.12% to 98.23% with RSD values from 0.05 to 0.12%. Therefore, oxyresveratrol as a marker compound in mulberry twig extract was quantified by HPLC. Level of oxyresveratrol in mulberry twig was about 0.39±0.01 g/100 g (0.39%) by the validated method. These results suggest that the developed HPLC method is simple, efficient, and could contribute to the quality control of mulberry twig extract as a functional ingredient.

Evaluation of 13 Flavonols Glycosides from Bulbs of White and Purple Onions (Allium cepa L.) Using UPLC-DAD-QTOF/MS

Min-Ki Lee*, Heon-Woong Kim, Jae-Hyeong Shin, Ga-Hee Jang, Sung-Hyeon Lee, Hwan-Hee Jang, Jeong-Sook Choe, Jung-Bong Kim
National Academy of Agricultural Science, RDA, Korea

The chemical informs of 33 individual flavonoid derivatives were constructed from bulbs (inner and outer scales), flowers and whole plants of species related onion (Allium cepa L.) based on literature sources. Simultaneously, a total of thirteen flavonoids including quercetin 3,7,4’-tri-O-glucoside were evaluated of which, quercetin 4’-O-glucoside (spiraeoside) and quercetin 3,4-di-O-glucoside were identified as the major components in bulbs of white and purple onions using UPLC-DAD-QTOF/MS on the basis of constructed library and internal standard (galangin). Especially, a minor component, taxifolin 4’-O-glucoside was detected only in purple onion sample and showed structure of dihydroflavonol class. In total flavonols content, white (raw), white (blanching) and purple (raw) onions showed 785.1±39.2, 222.0±7.8, 1,679.2±60.0 mg/100 g (dried weight), respectively. Among these concentrations, especially, spiraeoside (338.3±16.0, 455.4±4.0 mg/100 g) and quercetin 3,4-di-O-glucoside (327.9±17.1, 1,104.4±56.7 mg/100 g) showed great importance as about 90% of total content in white and purple onions.

Separation and Characterization of Antioxidants from Peucedanum japonicum Thunberg

Seong Hwa Song*, Gwang-Ju Jang, Eun-Ji Gu, Dong Wook Kim, Sang Bong Lee, Jae-In Lee, Hyun-Jin Kim
Division of Applied Life Science (BK21 Plus), Gyeongsang National University, Korea

We investigated the antioxidant properties of the essential oil and 80% methanol extracts from Peucedanum japonicum Thunberg having a unique taste and flavor, which is used as a spice in Korea. The essential oil and methanol extracts showed antioxidant activity of 2.13 ug trolox equivalent (TE)/mg sample. Antioxidants in the essential oil extracted using simultaneous distillation extraction (SDE) were separated by a silica gel column and identified by a GC/MS. Limonene, sabinene, terpinene, terpinolene, pinocarveol, and cadinol were identified as major antioxidants from essential oil and their characteristics were investigated. Moreover, antioxidants from 80% methanol extracts were separated by solvent-solvent extraction, Sephadex LH-20 column, C₈-Sep-pak column, and C₁₈-HPLC. Antioxidants from the water fraction showing strong antioxidant activities were identified by UPLC-Q-TOF MS and their characteristics were investigated.

Estimations of Flavonoid Contents and Compositions on Domestic Agri-products Using UPLC

Jae-Hyeong Shin*, Heon-Woong Kim, Min-Ki Lee, Ga-Hee Jang, Jung-Bong Kim
National Academy of Agricultural Science, Rural Development Administration, Korea

This experiment was investigated to agri-food for the expansion at the fundamental flavonoid compounds data as contents and compositions. Extractions and mobile phases were used methanol, distilled water, and formic acid. Twenty three types of flavonoid compounds were analyzed with same kind of external standard and one kind of internal standard (galangin) for quantification. Standard calibration curve presented linearity with the correlation coefficient \(R^2>0.97\), analyzed from 1 to 60 ppm concentration. Quantitative values were calculated to use the Excel and multivariate statistics data from Simca-P11. In the results, there are great differences in the contents and compositions of the flavonoid compounds for each sample. The raspberry (Rubus coreanus Miq) has largest total amount (141.4 mg/100 g) of flavonoid in analyzed samples and also Ailanthus leaf, Water parsley, Water parsley (wild), and Mung bean sprouts had included over 50 mg/100 g of flavonoid compounds. Depending on the types and contents of flavonoid has clearly difference between vegetables group and non-vegetable group in the results of multivariate statistics analysis.
To investigate the change in metabolite profile of soybean sprouts according to the sprouting period (0, 1, 2, 3, and 4 days), methanolic extracts of the sprouts and soybean soaked in water (0 day) were analyzed using UPLC-Q-TOF MS. The mass data were statistically analyzed and visualized by partial least squares-discriminant analysis (PLS-DA). Five groups were significantly separated on the PLS-DA scores plot. Four amino acids (methionine, phenylalanine, tyrosine, and tryptophan), 11 soyasaponins, 12 isoflavones, and phosphatidylcholine were identified as major metabolites contributing to the separation. Especially, phenylalanine, epicatechin, group B soyasaponins, and isoflavone aglycones including daidzein, glycitein, and genistein were increased with an increase of sprouting time, while isoflavone glucosides and DDMP soyasaponins were decreased. These data suggested that sprouting is a good processing to improve the nutritional quality of soybean and metabolomic analysis is a very useful technology to more understanding the nutritional change during soybean sprouting.

The nutritional quality of rice (*Oryza sativa* L.) can be affected by various storage conditions including time, temperature, moisture content, and microbial contamination. However, the change of whole metabolites, especially volatile metabolites from rice according to storage time has been not studied to estimate its quality. In this study, therefore, the profiles of volatile metabolites from fresh and old rices were analyzed using Headspace SPME-GC-MS. The mass data were analyzed and visualized by partial least squares-discriminant analysis (PLS-DA). Significant separation between each other was observed on the PLS-DA scores plot. The major volatile metabolites from fresh rice were identified as hexanal, 2-pentylfuran, styrene, nonanal, and 1-octen-3-ol, while hexanal, 2-pentylfuran, nonanal and 1-octen-3-ol were analyzed from old rice. In particular, the contents of hexanal, 2-pentylfuran, nonanal, and 1-octen-3-ol in old rice were higher than those in fresh rice. These metabolites can be used as biomarkers for estimating the quality of rice. Moreover, metabolomic analysis can be helpful for better understanding of the quality change of rice during storage.
Icariin Levels Using HPLC of Horny Goat Weed (Epimedium koreanum) Wine

Duksoon Women's University, Plant Resources Research Institute, Korea

Horny goat weed wine made of Epimedium koreanum soaked in 25, 30, and 35% alcohol. In this study, HGWW was analyzed for icariin using HPLC/DAD. The higher alcohol content (%) is higher icariin contents were dependent on the actual concentration of icariin. Icariin not detected of horny goat weed wine made using 25% alcohol. Over soaking time, it reduced the icariin content of horny goat weed wine for three weeks. (at one week - 30% alcohol; 37.66 μg/mL and 35% alcohol; 62.43 μg/mL, at two weeks - 30% alcohol; 13.87 μg/mL and 35% alcohol; 23.70 μg/mL and at three weeks - 30% alcohol; 8.23 μg/mL and 35% alcohol; 16.95 μg/mL).

Analysis of Aromatic Compounds from Leaves, Stems, and Sap of Dendropanax morbifera LEV

Seun-Ah Yang*, Min Ju Kim
Department of Food Science and Technology, Keimyung University, Korea

Dendropanax morbifera LEV. is a well known tree that produces a resinous sap. Although D. morbifera is used in Korean traditional medicine for a variety of diseases, the biological activities and the aromatic compounds of essential oil and sap are poorly understood. In the present study, aromatic compounds in essential oils of leaves and stems and also in sap from D. morbifera were analyzed by using GC-MS. Moreover, essential oils were extracted by distillation and supercritical fluid extraction (SFE) to compare the major aromatic compounds, extraction yields, and the flavor quality. For GC-MS analysis, ethanol extracts, four different kinds of essential oils (leaves, stems, SFE-leaves, SFE-stems), and sap were derivatized using N,O-bis (trimethylsilyl) trifluoracetamide (BSTFA). As results, the amounts of the major aromatic substances (β-caryophyllene, humuleneoxide, β-selinene, caryophyllene, etc.) were quantified and optimum extraction condition for high quality essential oil from D. morbifera.

Comparative Analysis of Useful β-Glucan and in the Mycoleptodonoides aitchisonii Extracts

Bo-Ram Jeong*, Bo-Yeon Shin, Gong-Gi Jeong, Mi-Ae Bang
Jeonnam Bioindustry Foundation Jeonnam Bio Food Technology Center, Korea

This study was carried out to compare the medicinal effects of Mycoleptodonoides aitchisonii extract. β-Glucan and polyphenol, flavonoid are useful ingredient in mushrooms and they were known to have antioxidant activity. We analyzed β-glucan and polyphenol contents of M. aitchisonii extract. Most extracts exhibited β-glucan contents of 15 to 95%. M. aitchisonii extract showed the highest β-glucan level of 95%. Interestingly, thirteen extracts of M. aitchisonii extract showed excellent antioxidant activity.
**P01-137**

Metabolomic Analysis of Mugwort (*Artemisia argyi* H.) Grown under Salt Stress

Eun-Ji Gu1*, Bomin Kim2, Dong Wook Kim3, Seong Hwa Song1, Gwang-Ju Jang1, Jae-In Lee1, Sang Bong Lee3, Hyun-Jin Kim1,2
1Division of Applied Life Science (BK21 Plus), Gyeongsang National University, Korea, 2Department of Food Science and Technology, Gyeongsang National University, Korea

The influence of salt stress on the growth, appearance, and nutritional quality of mugwort (*Artemisia argyi* H.) cultivated with various NaCl solutions (0, 50, 100, and 200 mM) was investigated and especially, MS-based metabolomics technology has been employed to find metabolites affected by salt stress. Weight and height of mugworts were significantly decreased by 100 mM and 200 mM NaCl treatments, while there was no any appearance change between control and 50 mM NaCl treatment. Especially, partial least squares-discriminant analysis of GC/MS data of volatile metabolites extracted by MTBE and HPLC data of antioxidants released that mugworts were significantly separated by the NaCl concentration on the scores plot. The levels of β-tocopherol, hentriacontane, stigmasterol and pytol were declined with high salt stress. Weight and height of mugworts were significantly decreased by 100 mM and 200 mM NaCl treatments, while there was no any appearance change between control and 50 mM NaCl treatment. Especially, partial least squares-discriminant analysis of GC/MS data of volatile metabolites extracted by MTBE and HPLC data of antioxidants released that mugworts were significantly separated by the NaCl concentration on the scores plot. The levels of β-tocopherol, hentriacontane, stigmasterol and pytol were declined with high salt stress.

**P01-139**

Supplementation of Food Waste to Grow-finishing Pigs Enhanced Peroxidation via Increasing Linoleic Acid

Haeun Kim*
Department of Food and Nutrition, Kookmin University, Korea

Supplementation of food waste (FW) to pig is common practice in many countries including Korea. However, nutrients in FW were chemically unstable, resulting in stimulation of oxidation. Therefore, we tested if feeding FW to pigs would increase the concentration of unsaturated fatty acids, followed by enhanced lipid peroxidation. Twenty pigs were aligned either normal corn based diet or FW containing diet. Longissimus dorsi muscle was collected for thiobarbituric acid reaction (TBAR) and GC was applied for fatty acid analysis. The TBA value of FW fed group was significantly higher than control (p<0.01). In 14 days, the difference of TBA value was the greatest indicating feeding FW to pig drastically stimulates lipid peroxidation in a time-dependent manner. Feeding FW to pig altered the fatty acid profiles decreasing the proportion of saturated fatty acids and monounsaturated fatty acids, increasing that of polyunsaturated fatty acids (PUFA) (p<0.05). Among the PUFA, linoleic acid was strikingly increased in FW fed pigs (p<0.001). Therefore, FW fed pigs have greater contents of PUFA and were more susceptible to lipid peroxidation.

**P01-138**

Comparison of the Volatiles in 'Fuji' Apple by Solid Phase Microextraction at Different Temperatures Coupled with Gas Chromatography Time-of-flight Mass Spectrometry

Heeyong Jung*, Moon Cheol Jeong, Jeong Ho Lim, Kee Jai Park
Korea Food Research Institute, Korea

Volatile compounds in 'Fuji' apples were extracted by SPME fiber and detected using GC-TOF MS spectrometry. Apples were separated with flesh and peel, and volatile extraction by SPME fiber was performed at two temperature of 35 and 60°C. Extraction temperature of 35°C was related to sensory analysis near to human perception, and 60°C was tested to enhance volatility and absorption into SPME fiber of compounds. The intensity of high molecular weight compounds after retention time of 15 min was detected more quantitatively by extraction at high temperature of 60°C than at 35°C. In the only extraction of 60°C, detectable volatiles were minor compounds of nonanal, (E)-2-octenal, hexyl butanoate, pentyl hexanoate, hexyl hexanoate and so on. Especially, the terpenes with 15 carbon (α-Phthachelene, α-Zingiberene, (Z,E)-α-Farnesene, α-Curcumene, α-β-Cadinene, L-Calamenene) were detected 2 or 3 times quantitatively in extraction at 60°C.

**P01-140**

Novel Chitosan Extraction from Larvae, Adult, Superworm Stage of Mealworm Beetle (*Tenebrio molitor; Zophobas morio*) with Alkali Treatment

Chae Shim Shin*, Weon-Sun Shin
Laboratory of Food Chemistry, Department of Food & Nutrition, Hanyang University, Korea

Recently, insects come into the spotlight in the global level as new alternative potential functional food resources in the future. For diet, insects could be consumed in the forms of eggs, larvae, pupa and adults in their life stages. In this study, chitin and chitosan were isolated from larvae, adult, and superworm of mealworm beetles. First, insect chitin was isolated by deproteinization, decolorization and defat by treatment with 10% (w/v) NaOH (95%) all at once and by demineralization with 7% (v/v) HCl (36%) from larvae, adult and superworm of mealworm beetles. The yield of chitin from them was 4.6, 8.4, and 3.9% respectively. Subsequently, insect chitosan was extracted and deacetylated from chitin (0.6g) by treatment with 55% (w/v) NaOH (95%). The yield of chitosan was 80.0, 78.3, and 83.3%, respectively. The FTIR and XRD showed the same structural characteristics of insect chitosan as the commercial shrimp chitosan. This result indicated that insect chitosan could be a good chitosan source as functional ingredient instead of crustacea.
Method Validation for Determination of Polycyclic Aromatic Hydrocarbons in Tea Using GC-MS

Joon Goo Lee*, Sheen Hee Kim, Jung Sik Moon, Hae Jung Yoon

Food Contaminants Division, National Institute of Food & Drug Safety Evaluation, Ministry of Food and Drug Safety, Korea

Polycyclic aromatic hydrocarbons (PAHs), produced naturally in food as a result of pyrolytic processes, particularly incomplete combustion of organic matter are genotoxic and carcinogenic. Many methods for determination of PAHs are proposed for tea, such as HPLC-FLD, GC-MS and GPC. However it needs to develop a method for determining 4 PAHs for food. To make a simple and efficient method, saponification followed by Liquid-liquid extraction, Solid-phase extraction for purification and gas chromatography-mass spectrometry (GC-MS) for detection of 4 PAHs are used. Two isotope labelled PAHs are used as internal standards. A method validation is also carried out for testing of selectivity, linearity, detection limit, recovery and uncertainty. To identify 4 PAHs, 228, 229, and 226 m/z ions for Benz(a)Anthracene and Chrysene, 232, 253, and 250 m/z ions for benzo(a)pyrene and benzo(b)Fluoranthene, 240, 241, and 236 m/z ions for Chrysene-d12, 264, 265, and 260 m/z ions for benzo(a)pyrene-d12 are monitored by SIM mode of GC-MS.

Distribution of Escherichia coli and Listeria monocytogenes in Domestic and Imported Seafood at Retails

Hye Soo Lee*, Seung Ho Choi, Hee Yoon Kim1, Il Shik Jin

Department of Marine Food Science and Technology, Gangneung-Wonju National University, Korea, 1Department of Foodservice Management, Woosong University, Korea

Recently, consumption of seafood is continuously increasing because seafood is low-fat, high-protein, and has physiological activity. However, seafood has higher risk for food poisoning than other foods because of a simple structure, high moisture content, and alkalic pH of the muscle. This study was carried to investigate detection ratio of Escherichia coli and Listeria monocytogenes in domestic and imported seafood in retails. E. coli was detected from 3 (scallop, sandfish and oyster) of 7 domestic seafoods and 3 (seasoned squid, webfoot octopus and sea mussel) of 5 imported seafoods. L. monocytogenes was detected from 2 (sand launce and oyster) of 6 domestic seafoods and 3 (webfoot octopus, sea mussel and smoked salmon) of 5 imported seafoods. E. coli and L. monocytogenes should not be detected from seafood by Korean food standards codex. Therefore, seafood needs to be enhanced through the good sanitation management to improve their safety.

Immunomodulatory Activity of Squid (Todarodes pacificus) Skin Collagen Peptide

Sang Moo Kim*, Ladawan Nakchum

Department of Marine Food Science and Technology, Gangneung-Wonju National University, Korea

The squid skin collagen peptide is a value-added compound manufactured from a squid processing by-product. In this study, the immunomodulatory activity of squid skin collagen peptide with molecular weight of 3.4-10 kDa (F3) was investigated using RAW 264.7 mouse macrophage cells. F3 stimulated RAW 264.7 cells resulting in the increase in the production of nitric oxide (NO) and prostaglandin E2 (PGE2) by 48.61 mM and 3.40 µg/mL at 8 µg/mL, respectively. In addition, F3 also stimulated mRNA expression of iNOS, COX-2, IL-1β, IL-10, IL-6 and TNF-α. Moreover, F3 effectively activated NF-κB pathway via the induction of the IκB and PI3K/Akt degradation. Therefore, the squid skin collagen peptide with immunostimulatory activity can be used as a food supplement peptide.

Total Mercury Concentrations of Antarctic Toothfish (Dissostichus mawsoni) from Antarctic Sea

Woo-Seok Choi*, Kwang-Tae Son, Ji-Young Kwon, Mi-Ra Jo, Minchul Yoon, Ki-Cheol Song1, Ji-Hoe Kim2, Tae Seek Lee

Food Safety Research Division, National Fisheries Research & Development Institute, Korea, 1West Sea Fisheries Research Institute, National Fisheries Research & Development Institute, Korea, 2Research and Development Planning Division, National Fisheries Research & Development Institute, Korea

Total mercury has been one of the elements of special concern in human health. Measurement of total mercury levels in fish to assess risk has been considered. In this study, Antarctic toothfish (Dissostichus mawsoni) was evaluated as potential safe seafood source through measurement of total mercury analysis. The total mercury concentration of Antarctic toothfish ranged from 0.101±0.047 mg/kg to 0.139±0.075 mg/kg. The total mercury concentration was significantly correlated with macroscopic values including total fish length, weight, gonadosomatic index, and maturity (p<0.01 or 0.05). Furthermore, according to risk assessment, the total mercury body exposure rate of Antarctic toothfish was shown ranged from 2.125 to 2.847% of the Provisional Tolerable Weekly Intake. Therefore, Antarctic toothfish could be used for potential safe seafood source.
Heavy Metal Decontamination of Oysters Farmed Metal-enrich Area by Translocation

Minchul Yoon*, Kwang-Tae Son, Mi-Ra Jo, Ji-Young Kwon, Woo-Seok Choi, Ki-Cheol Song1, Eun-Gyoun Oh2, Ji-Hoe Kim3, Tae Seek Lee

Food Safety Research Division, National Fisheries Research & Development Institute, Korea, 1West Sea Fisheries Research Institute, National Fisheries Research & Development Institute, Korea, 2Southwest Sea Fisheries Research Institute, National Fisheries Research & Development Institute, Korea, 3Research and Development Planning Division, National Fisheries Research & Development Institute, Korea

In oysters Crassostrea gigas trans-located from a metal-enriched farms (Daeijack Is., West Sea, Korea) to a comparatively clean site, the Tongyeong (South Sea, Korea), Cd, Pb, Hg, Ag, Cr, Cu, Ni, Zn, and As concentrations were determined bi-weekly for four months in the whole soft tissues. In this result, the concentrations of all of the five metals decreased markedly. The half-lives were always shortest for Hg (4 weeks), while other metals were shown in 6 weeks (Cd, Cr), 8 weeks (Ni), and 10 weeks (Cu). After 4 weeks, the Cd concentration in soft tissue shown in below 2 mg/kg (the Korean threshold). Consequently, after 10 weeks, it had become not significantly different from the threshold of European regulation (1 mg/kg). In addition, the concentrations of Cd on sea water, sediment and other organisms were compared. In these results, there was no significant difference between these sites. Thus, it suggests that the self-cleaning might be caused by change the farming or their feeding conditions. In this study, the decontamination of this oyster by trans location to clean site is conformed, and it can provide a useful help for consumer health and improvement of health standard.

Profiles of PUFAs (Polyunsaturated Fatty Acids) in Organs of Halocynthia aurantium, Korean East Seaside Sea Squirt and Their Potentials for the Functional Materials

Chul Woo Park*, Seok Hyun Ko, Sang Mi Lee, Chan Hee Chun, So Hyun Lee, Woo Jung Park

Department of Marine Food Science and Technology, Gangneung-Wonju National University, Korea

PUFAs (Polyunsaturated fatty acid) of DHA (22:6n-3), EPA (20:5n-3), ARA (20:4n-6), and DGLA (20:3n-6) are critical nutrients for human development and health. They have been reported to be related to diverse chronic diseases such as cardiovascular disease (CVS), cancers, and diabetes and especially DHA has been thought to be important for brain and eye development. In addition, Eicosanoids derived from twenty-carbon PUFA are signaling molecules in inflammation, consisting prostaglandins, prostacyclins, thromboxanes, and leukotrenes. ARA is a precursor of pro-inflammatory eicosanoids, whereas EPA and DGLA are precursors of anti-inflammatory eicosanoids. Halocynthia aurantium, Korean East seaside sea squirt, is called golden sea squirt and has been considered as a potential source for functional materials. Even though diverse tunicates have been researched over the world, this organism has not been studied well. Most of all, no study showed PUFA profiles according to the organ of golden sea squirt, which show that PUFA composition is different depending on organs, indicating as a potential functional lipid source.

Development of Seaweed Snack Sauce with Improved Stickiness by Using Modified Starch

Ki Myong Kim*
Honam University, Korea

Market scale of seaweed snack is estimated to be worth almost 9,300 million dollar in Thailand. Main process for production of seaweed snack employs coating the sauce on the surface of seaweed, topping materials, attaching seaweed pieces into one, and toasting the snack. The problem of snack is lack of stickiness in sauce, which snack is easily detached into two pieces. To develop thickness agent, several candidates (sticky rice powder, modified starch, and dextran) were estimated its rheological properties when it was dissolved in water with various concentrations (2.5, 5, and 7.5%) and after coating on the seaweed with various thickness. Higher viscosity of solution and hardness of snack were achieved by adding the modified starch. Consequently simulated condition, which base of sauce containing high amount of soy sauce and sugar was applied. Rheological properties were examined by changing the amount of soy sauce and sugar with different concentrations. The highest hardness of snack was achieved at the 15% addition of modified starch with soy sauce and sugar base solution and stickiness was improved.

Development of Nondestructive Detection method for Artificial Water-injected Octopus Minor in Cold Storage

Sangdai Lee*, Jung-Seok Lee, Seunghwan Yang, Youngjoo Kim, Ki-Bok Kim1, Sang-Mok Lee2

Korea Institute of Industrial Technology, Korea, 1Korea Research Institute of Standards and Science, Korea, 2Ministry of Food and Drug Safety, Korea

As consumption of fishery products is increasing, its importation also is growing from year to year. Specially, shrimp, crab, and octopus are greatly increasing. Import traders or distribution dealers use the artificial water injection and water-coating methods to increase the weight of fishery products. The artificial water-injected products using chemical agents such as caustic soda and sodium polyphosphate has become a social issue. Because there is no scientific way to sorting the water-injected products, sensory evaluation method is still used. This method consumes a huge amount of time, is not on all inspection, and is difficult to obtain objective information. The objective of this study is to develop the nondestructive sorting method of artificial water-injected octopus minor using ultrasound and microwave techniques. It is possible to sorting the water-injected octopus minor using time-of-flight of transmitted ultrasound signal and gain value of reflected microwave signal.
Relationship between Moisture Sorption, Mechanical Properties and Thermal Stability of Yuba Film

Jisuk Kim*, Siran Zhang, Yookyung Kim
Department of Human Ecology, Graduate School, Korea University, Korea

Yuba is the surface film of protein-lipid network formed during heating of soymilk. This study was conducted to characterize yuba as an edible film by analyzing sorption properties of films collected at different times of heating (3rd, 7th, 11th). Moisture affinities of films were affected by hydrophilicity of its chemical composition and their ratios. 11th film (high carbohydrate) exhibited higher equilibrium moisture. Moisture of films increased as protein to lipid ratio increased. The earlier the films were collected, the higher the elongation. At 5% moisture, light transmittance of films was low and almost opaque. As moisture increased to 28%, transmittances of films increased rapidly and nearly transparent. At 39 and 87% RH, film presented Tg at 182°C and 175°C. Peaks of high water content group were much sharper than the peaks of films with low water content, and denaturation enthalpy (ΔH) values ranged from 315 to 493 J/g in 87% RH compared to in the 39% RH (113 to 203 J/g). Higher ΔH values suggested lower thermal stability and more hydrophobic/hydrophilic interactions.

Development of a Protein and Fiber Enhanced Jeungpyun with Added Okara

Yetong Ren*, SooHee Jang, Yookyung Kim
Department of Human Ecology, Graduate School, Korea University, Korea

The aim of this study was to improve the nutritional quality of jeungpyun by adding okara, a by product of tofu manufacturing. Okara is rich in protein and fiber and may provide good quality to jeungpyun as a fermentation agent. For developing the okara added jeungpyun (O), 10% okara was replaced with rice flour. 0.3% HPMC was added O dough for improving the texture of jeungpyun (OH). The quality of jeungpyun was measured by dough pH and volume and by finished product volume, appearance and texture over 5 day storage at 20°C. After 2.5 h fermentation, O dough (20 mL) had more increase of volume compared to control (18 mL). However, after baking, O jeungpyun (47 mL) had less volume than control (50 mL) but increased to 51 mL with HPMC. O jeungpyun had increased pore size, with smaller and uniform with greater symmetry (0.65) and uniformity (0.50) compared to control. The addition of okara increased the hardness of jeungpyun (control: 250, O: 532, OH: 382 g), but decreased the rate of hardening at 5 day storage (control: 842, O: 760, OH: 517 g). The addition of HPMC results in greater loaf volume and improved structure in O jeungpyun.

High-pressure Enzymatic Hydrolysis of Soybean Residue Insoluble Dietary Fraction

Anette Wennlid1,2,3*, Weon-Sun Shin2
1Erasmus Mundus Master in Food Innovation and Product Design (FIPDes), 2Laboratory of Food Chemistry, Department of Food and Nutrition, Hanyang University, Korea, 3Department of Agriculture, University of Naples Federico II, Italy

One of the big challenges for the plant food processing industries is disposal of by-products. Soybean residue contains full worthy protein and over 50% dietary fiber, but the high portion of insoluble dietary fiber limits application in food products. In this study, high-pressure enzymatic hydrolysis was applied to dietary fiber-rich lyophilized soybean residue (Biji) to evaluate how this would change the content of insoluble versus soluble dietary fiber, which can be suitable for further processing and food product incorporation. Water-binding capacity, water- and oil-holding capacity, swelling capacity, bulk density, solubility, and viscosity of the untreated, lyophilized soybean residue and the treated, hydrolyzed, and lyophilized soybean reside were measured and compared. Furthermore, the total phenolic contents were measured to evaluate the potential utility as a functional ingredient. The result suggested that the enzymatic treatment under high pressure increased the content of soluble dietary fiber and significantly improved the hydration properties in the wide range of pH.

Physicochemical Properties and Sensory Characteristics of Carrot (Daucus carota L.) according to Cultivation Method

Eun Jeong Choi*, Sang Seop Kim, Jeong Hee Choi, Kyung Hyung Ku
Korea Food Research Institute, Korea

This study was conducted to investigate the physicochemical properties and sensory characteristics of order to provide basic data for quality grade establishment of environment-friendly cultivation in Carrot. Carrot samples were collected to soil organic cultivation, sand organic cultivation and conventional cultivation method in Jeju Island. The physicochemical properties such as carrot pH, total acidity and soluble solid content of samples were no significant difference from depending on the cultivation methods. The sensory descriptive analysis of carrot was performed by the 12 trained panels. The sensory lexicons attributes developed were 4 appearance of sample without removing the skin (degree of orange, degree of horizontal, degree of gloss, and extent of injuries), 3 appearance of sample removed the skin (intensity of orange color, degree of yellow in the wick, and degree of moisture in the surface), 3 odors (unique carrot, sweet, and off-odor), 6 flavors (unique carrot, sweet, bitter, sour, astrin- gent, and off-flavor), 4 textures (hardness, toughness, crunchiness, juiciness, remaining material in mouth) and 3 after-taste (sweet, astringent, and bitter) attributes.
Influence of Test Method on the Consumer Acceptability: Central Location Test (CLT) vs. Home Usage Test (HUT)

Jung-Seo Park*, Kwang-Geun Lee, Mina K. Kim
Department of Food Science and Biotechnology, Dongguk University-BMC Campus, Korea

The objective of current study was to determine the influence of testing methods (CLT vs. HUT) on consumer acceptability of 4 doenjang products with representative sensory characteristics. A total of 240 consumers were recruited for the consumer acceptability testing for CLT and HUT, and each were strategically recruited from different demographic segments and consumption pattern. Three different types of cooking methods were utilized on four doenjang samples for both CLT and HUT methods, with suggested cooking recipes provided to the participants of HUT. Univariate and multivariate statistical analyses were conducted. Overall consumer acceptability of all doenjang samples was elevated when tested at home with consumer’s own recipe than when tested under CLT conditions (p<0.05). Variables other than sensory characteristics, such as recipe, number of people eating together at a meal, and meal times, influenced the result obtained from HUT test setting, suggesting introduction of extrinsic factors on consumer liking. Finding from current work can practically guide the food ingredient manufacturers by providing the guideline of optimal consumer test method.

Sensory and Physio-chemical Properties of Commercial Distilled Spirits

Seung-Joo Lee*, Jung-Min Hong
Department of Culinary and Food Service Management, Sejong University, Korea

Physio-chemical components and sensory properties of commercial distilled liquors were investigated by instrumental and sensory descriptive analysis method. Sample liquors were analyzed for titratable acidity, ethanol content, pH, amino acid level and total reducing sugars. A bench test by 10 panel members was carried out and 12 commercial distilled spirits were selected. After five training sessions to develop sensory vocabularies, 10 terms for aroma, 6 terms for texture/mouth feeling were selected. From the correlation analysis of total acid levels and sensory terms, positive and significant relations with nuruk aroma and bleach aroma, and a negative and significant relation with fruit aroma were observed. Amino acid levels showed a negative significant relation with astringent taste, and a reduced sugar level showed a positive significant relation with brandy aroma.

Influence of Cooking Method on the Consumer Acceptability: Fermented Soybean Paste (Doenjang) Model

Jung-Seo Park*, So-yeon Lee, Se-Wook Oh, Jaehhee Hong
Kookmin University, Korea

The objective of the study was to determine how the cooking method affects the consumer acceptability of doenjang products. Four different doenjang samples were used based on the sensory characteristics. Each was presented to consumers (N=180) in three different cooking methods (as a soup, a thick soup, and a condiment) in 3 days. Two-way Analysis of Variance (ANOVA) followed by Tukey’s multiple comparison tests was conducted. Different cooking methods influenced the overall likings of 4 doenjang products in a differing degree (p<0.05). Doenjang served as a soup negatively influenced the overall liking of all doenjang samples, regardless of doenjang types (p<0.05). Doenjang served to consumers as a sauce, favored 2 doenjang products with certain sensory characteristics. Doenjang cooked in a thick soup were the optimum cooking method for future consumer testing of doenjang products. Current study demonstrated the importance of cooking recipe in the consumer testing, and can practically guide the future consumer test method development.

Sensory Drivers of Sliced Raw Fish: A Case Study of Flounder (Paralichthys olivaceus) and Rockfish (Sebastes schlegli)

Jeongmin Ko*, So-yeon Lee, Se-Wook Oh, Jaehhee Hong
Kookmin University, Korea

This study was conducted to investigate sensory characteristics and consumer acceptance of sliced raw fish. Two most popular varieties, olive flounder (Paralichthys olivaceus) and black rockfish (Sebastes schlegli), were used. Samples of each variety were prepared as follows to create perceptible sensory differences consistently: fresh (served within 2 h after killing), aged (stored for 24 h at 1°C), frozen (frozen at -20°C for 23 h and defrosted for 1 h), and water-immersed (immersed in water at 1°C for 24 h). Sensory profiles of the samples were determined by 10 trained panelists. Acceptability of the samples was assessed by 47 consumers. The samples were described with the terms such as gloss, brightness, fresh raw fish flavor, fishy flavor, crunchiness (applied to only rockfish), hardness, cohesiveness, springiness, wetness, and juiciness. The result suggests that textural attributes were main factors affecting consumer liking. For both fish varieties, consumers generally preferred fresh to the others, for their cohesiveness and springiness. However, it was also observed that 40% (flounder) and 50% (rockfish) of the respondents preferred aged and frozen to fresh for their tenderness.
Effect of Fermentation on the Sensory Characteristics of Kimchi Varying in Sodium Level

Hyun-jee Kim*, Mi-ran Kim, Seo-jin Chung
Department of Nutritional Science & Food Management, Ewha Womans University, Korea

Present study investigated the changes in sensory characteristics of kimchi during fermentation. Four commercial kimchi products varying in sodium content were selected as samples. Samples were divided into fresh kimchi (FR, -1°C, no storage) and fermented kimchi (FRM, 5°C, stored two weeks). Generic descriptive analysis was performed on a total of 8 samples. Nine female descriptive panelists participated. General linear model was applied to analyze the data. A total of 20 sensory attributes consisting of 2 appearance, 4 odor, 11 taste and 3 texture attributes were developed. When ANOVA was conducted to evaluate the fermentation effect, 14 attributes showed significant differences. FRM samples showed high intensities in overall flavor, saltiness, sourness and sour odor. Considering the effect of sodium, degree of red, aging and off odor-flavor were attributes that showed difference among samples. The intensities of these attributes were rated higher among low-sodium kimchi. Saltiness intensity increased when kimchi had undergone fermentation. Based on the results, it is recommended to optimally ferment low sodium kimchi to improve the flavor.

Effect of Sample Presenting Types in Sensory Characteristics of Chilled Buckwheat Noodle Soup (Naeng-myeon)

Hyun-jee Kim*, Jung-eun Go, Seo-jin Chung
Department of Nutritional Science & Food Management, Ewha Womans University, Korea

The objective of this study was to investigate the effect of sample presenting types in sensory properties of Naeng-myeon. Generic descriptive analysis was performed for evaluating only stock (system 1) and stock with noodle (system 2). Eight Naeng-myeon products were samples of interest. Ten female descriptive panelists participated. ANOVA and regression analysis were used for data analysis. In the training sessions, ten sensory properties were developed for system 1, four were additionally established for noodle. In each system, the 8 products showed significantly different intensities in almost all sensory attributes like sweetness, saltiness. When integrating the two systems, sample presenting types showed significant difference for the seven sensory attributes, especially saltiness, sourness, beef flavor tended to be rated more strongly in system 1. As a result of the regression analysis of salty intensity and sodium contents shown on the Nutrition facts label, The correlation coefficient of the system 2 (R²=0.867) was higher than the system 1 (R²=0.738). That is, evaluating the stock with noodle as a general intake method proved to assess more accurately the salty intensity.

Sensory and Emotional Drivers of Liking for Soy Sauce

Han-byol Jeon*, Ryu-ri Song, Seo-jin Chung
Department of Nutritional Science & Food Management, Ewha Womans University, Korea

The present study investigated the relationships between sensory characteristics and consumer preference for soy sauce using descriptive analysis (DA) and consumer taste test (CT). Additionally, the drivers of (dis)liking affecting the acceptance were explored by analyzing check-all-that-apply (CATA). Eight types of soy sauces were evaluated by eleven trained panelists in DA. The panelists evaluated the intensity of 20 sensory attributes. In CT, seventy-one housewives (age 40-57) were offered 6 types of soy sauces applied to seaweed soup system. The subjects evaluated the samples on five liking categories (overall, appearance, odor, flavor, and texture). MFA was conducted on the sensory data and the liking data to understand the relationship between them. The sample characterized as sweet, MSG (umami), meju flavor (soy paste flavor) was rated highest in all of the liking categories. The CATA attributes such as mildness, familiar, umami were correlated positively with the overall liking rating. However, the sample characterized as fermented, fish sauce flavor (akkejoot flavor) was rated lowest in most of the liking categories. This sample was perceived beany and musty among consumers.
Investigation of Japanese Acceptability of *Panax ginseng* Drinks by Exploratory Multivariate Analysis of Survey Data

Yuri Kim*, Hyun-Soon Lee¹, Dong-Chool Kim

Mimi Research Laboratory, DCK Consulting Co., Ltd., Korea
¹Agency for Korea National Food Cluster, Korea

This study aimed to evaluate the acceptability of commercially available *Panax ginseng* drinks by questioning 80 Japanese with regard to the taste, odor, color and feeling of healthiness. Four drinks were chosen for the survey. Control product (100% red ginseng extract), product-1 (41 mg ginseng extract in 50 mL), product-2 (0 mg ginseng extract in 250 mL) and product-3 (130 mg ginseng extract in 100 mL). The survey results were analyzed by RStudio using FactoMineR package. The evaluation scores of control product were lowest in taste, odor, color, sweetness compared to the other products. When the tested drinks were analyzed for the sweetness, bitterness, saltiness, and umami by the taste sensing system (Intelligent Technology, Japan), the control product showed the lowest value of sweetness and the highest value of bitterness. This study clearly showed the taste and odor of *P. ginseng* drinks are the critical factors for the acceptability by Japanese population.

Consumer and Descriptive Sensory Analysis of a Fried Cookie System Containing Waxy Rice Flour

Kyongae Lee*, Jinsook Park, Malshick Shin¹, Eunok Choe²

Soongchunhyang University, Korea, ¹Chonnam National University, Korea, ²Inha University, Korea

A fried cookie absorbs substantial amounts of oil during frying. The oil absorption of fried food may increase caloric intake causing health problems and hence limit the consumption. Incorporation of rice flour into a fried cookie could give health benefits and may result in an increased consumption. In this study, the sensory effects of rice flour substitution in a fried cookie system were investigated along with consumer liking evaluation. A Korean fried cookie, *yakgwa*, was used as a model system to investigate the effects of waxy rice flour on the fried cookie quality. *Yakgwa* was prepared by replacing 0, 50, and 75% of wheat flour with waxy rice flour. The panelists generated 4 appearance (exterior & interior brown, glossy, and cracking), 4 odor (sweet, roasted, sesame oil, and soybean oil), 5 flavor (sweet, roasted, greasy, sesame oil, and soybean oil) and 5 texture (hardness, moistness, cohesiveness, crispness, and oiliness) attributes. There was no significant difference in appearance and odor liking between the control and *yakgwa* with 50 or 75% waxy rice flour. *Yakgwa* with 50 or 75% waxy rice flour had a significantly higher overall acceptability than the control.

Sensory Evaluation of Steamed Egg Using Salicornia Plant-driven Salt Substitute

Da young Hong*, Jeong Eun Jo, Young Kyu Yang, Deuk-Hoi Kim

Phyto Corporation, Korea

The purpose of this study is to investigate the sodium reduction effect of the *Salicornia herbacea*-derived Salt Substitute (*PhytoSalt*). *PhytoSalt* contains not only NaCl but also various kinds of other salts that give off a salty taste, including KCl, CaCl₂, and NH₄Cl. Also, *PhytoSalt* contains glutamic acid, a salt enhancer. Therefore *PhytoSalt* has a strong salty taste with less sodium content. For this experiment, three steamed eggs were prepared with three different types of salt-a refined salt (control), *PhytoSalt* A and B. The saltiness of each steamed egg was compared through a sensory evaluation. The experimental results through the sensory evaluation of said steamed eggs showed that *PhytoSalt* A with 22% less NaCl, and *PhytoSalt* B with 18% less NaCl, tasted similar to the saltiness of the refined salt. Also, the steamed eggs prepared using *PhytoSalt* A and B contained a more savory flavor than the steamed egg prepared using the refined salt. Considering the above-mentioned experiment results, we can draw the conclusion that *PhytoSalt* has an approximately 20% NaCl reduction effect. Therefore, *PhytoSalt* is useful as a sodium reduction salt substitute and a savory taste enhancer.
Quality Characteristics of Sulgidduk Added with Moringa oleifera Water Extracts

Yujiao Tang1,2, Eun-Ju Choi3, Heeui Choi3, Eun-Kyung Kim1,2
1Division of Food Bio Science, College of Biomedical and Health Sciences, Korea, 2Korea Nokyong Research Center, Konkuk University, Korea, 3Division of Sport Science, College of Science and Technology, Konkuk University, Korea

The aim of this investigation was to examine the quality characteristics of a Korean steamed-rice cake, sulgidduk added with Moringa oleifera (M. oleifera) water extracts. M. oleifera water extracts were added to rice powder at rations of 0.1, 1.0, and 10.0%. The quality characteristics were measured by proximate composition, color, texture profile analysis, and sensory evaluations. On the texture profile analysis, the control groups showed significantly higher values for hardness and adhesiveness as compared with the M. oleifera water extract-added groups (p<0.05). On the contrary, in the M. oleifera water extract-added groups, cohesiveness, springiness, and chewiness exhibited significantly lower values than the control groups (p<0.05). For the sensory evaluation, the sample containing 0.1% of M. oleifera extract obtained better results in overall preference. From the results, we suggest that M. oleifera possess a potential as a good ingredient for enhancing consumer preference of sulgidduk.

Studies on Organoleptic Properties of Selected Dried Radish Leaves Products according to Proximate Analysis

Na-Jeong Kim*, Bo Ram Park, Gui-Jung Han, Ha Yun Kim, Hye Min Han
Department of Agrofood Resources, National Academy of Agricultural Science, RDA, Korea

The aim of this study was to investigate the organoleptic properties of commercial dried radish leaves (CDRL) purchased in on-line markets. The proximate compositions (moisture, crude protein, crude lipid, and dietary fiber) of 21 CDRL products were evaluated and analyzed via principal component analysis (PCA). The result of the PCA was presented as biplots and the data revealed that 86.8% of the variability was accounted for by the first two principal components, moisture (55.2%) and dietary fiber (31.7%). Consequently, we selected representative 4 CDRL; AD, JD, DS, and OG. The AD sample had a high moisture, whereas the JD was a product with a low moisture content. Also, the DS had a high dietary fiber and the OG was classified as a low dietary fiber. Subsequently, they were evaluated in terms of sensory intensity properties and preference of flavor, odor, taste, color and softness. As a results of intensity, the values of the high moisture samples were significantly higher than those of others (p<0.05).

Sensory Characteristics and Consumer Acceptability of Seafood Kimchi

Jiyun Yang*, Jeehyun Lee, Yeong-Ok Song, Mi-Soon Jang1, Ji-Sook Han
Department of Food Science & Nutrition and Kimchi Research Institute, Pusan National University, Korea, 1Food and Safety Research Center, National Fishers Research & Development Institute, Korea

Kimchi is one of the most famous Korean traditional foods. To enhance the unique flavor of kimchi, seafood may be added. The purposes of this study were to develop flavor lexicon and evaluate flavor characteristics of seafood kimchi and to evaluate consumers’ acceptability. Six seafood kimchi samples (4 Chinese cabbage kimchi (no seafood added for control, gamttae kimchi, abalone kimchi, and octopus kimchi) and 2 radish kimchi (no seafood added for control, and small octopus kimchi)) were used for this study. Nine trained panelists participated in descriptive analysis. They developed lexicons and conducted descriptive analysis of seafood kimchi. One hundred consumers participated in consumer acceptance test. And nine-point hedonic scale was used for liking scores. As a result, a total of 20 attributes were developed for seafood kimchi lexicon. In consumer acceptance, there were two consumer clusters which one group liked kimchi considerably but another did not. Overall, consumers tended to like abalone kimchi and small octopus radish kimchi. The most but there were no significant difference among seafood kimchi.

Effect of Sample Conditions for Acceptability of Apple with Various Sizes

Hee-yeon Jung*, Hoon Kim, Sang-sook Kim
Korea Food Research Institute, Korea

The effect of two sample conditions (A and B) on importance of appearance, odor, flavor and texture for overall acceptability of fuji apple with six different sizes (3D:30-39, 4D:40-49, 5D:50-59, 6D:60-69, 7D:70-79, 8D:80-89 apples/15 kg) was investigated. Total 100 consumers evaluated apples for appearance, odor, flavor, texture and overall acceptability on 9 point hedonic scale under two sample conditions. In condition A, whole apple was presented for acceptability of appearance and identical size of peeled apple was present for odor, flavor, texture and overall acceptability. In condition B, two pieces of 1/8 unpeeled apple were presented for appearance, odor, flavor, texture and overall acceptability. Also weigh, volume, specific volume, color (L, a, and b), hardness, pH, acidity and °Bx were measured as physicochemical characteristics of apples. The results showed no difference between two methods in acceptability. Regression analysis showed overall acceptability in both conditions was highly affected by taste, followed by texture, appearance and odor. The result of this study suggested condition B for acceptability of apple with various sizes considering time and convenience.
Effect of Moisture Content on Some Physical Properties of Wheat

Eun-Jung Choi*, Hoon Kim, Sang-Sook Kim, Oui-Woung Kim
Korea Food Research Institute, Korea

Physical properties of wheat kernels were determined as a function of moisture content to optimize the designing equipment for post-harvest management. Several properties included length, width, thickness, area, dynamic repose angle, one thousand kernel weight, bulk density and specific gravity of two wheat cultivars (Backjung: B and Jokeung: J) were studied in the moisture range from about 9 to 30% dry basis. In the different moisture range, length from 6.42 to 7.20 mm (B), 8.71 to 9.15 mm (J), width from 2.90 to 3.49 mm (B), 4.12 to 4.43 mm (J), thickness from 2.67 to 2.84 mm (B), 3.00 to 3.26 mm (J) and area from 14.13 to 19.44 mm² (B), 27.75 to 31.25 mm² (J) increased linearly, respectively. Besides, dynamic repose angle and one thousand kernel weight increased linearly from 46.3 to 54.0° (B), 46.3 to 54.5° (J) and 32.26 to 41.51 g (B), 45.30 to 63.07 g (J) each with the increase of moisture content. For the experimental determinations it could be observed that only the bulk density and specific gravity decreased from 754.0 to 664.1 kgm⁻³ (B), 776.1 to 8.71 to 9.15 mm (J), width from 2.90 to 3.49 mm (B), 4.12 to 4.43 mm (J), thickness from 2.67 to 2.84 mm (B), 3.00 to 3.26 mm (J) and area from 14.13 to 19.44 mm² (B), 27.75 to 31.25 mm² (J) increased linearly, respectively. Besides, dynamic repose angle and one thousand kernel weight increased linearly from 46.3 to 54.0° (B), 46.3 to 54.5° (J) and 32.26 to 41.51 g (B), 45.30 to 63.07 g (J) each with the increase of moisture content. For the experimental determinations it could be observed that only the bulk density and specific gravity decreased from 754.0 to 664.1 kgm⁻³ (B), 776.1 to 660.0 kgm⁻³ (J) and 1.2950 to 1.2265 (B), 1.3379 to 1.2671 (J) each in the range of moisture content.

Effect of Moisture Content on Terminal Velocity of Wheat Kernel and Foreign Materials

Eun-Jung Choi*, Hoon Kim, Sang-Sook Kim, Oui-Woung Kim
Korea Food Research Institute, Korea

This research was carried out to identify aerodynamic property as a function of moisture content for designing equipment such as post-harvest management. Terminal velocity of two wheat cultivars (Backjung: B and Jokeung: J) selected sound, damaged kernel and foreign materials (stick and straw) were measured with a designed vertical wind column at Korea Food Research Institute, Korea.

This research was identified the perceptions of school-age children for current 5 kinds of rice snacks which sold in Korea (BBC_Kr, HSR_Kr), Japan (KMD_Jp), China (WW_Cn), Vietnam (BDM_Vi), and analyzes the characteristics that affect consumer acceptability. Descriptive analysis was performed on 8 samples; 4 types of patty style soy-meat samples (Soy-meat Patty; SP) which made by "ddukgali" recipe (YSP, VSP, LSP, and SSP) and 4 types of bulgogi recipe (YSB, VSB, LSB, and SSB). Forty attributes were generated by panelists and thirty seven attribute were significantly different across products (p<0.05). This was found that the SB group was characterized by beef taste, leek taste, garlic taste, wetness, denseness, slipperiness, chewiness and pepper after taste. In case of VSB sample, it had significant high rate on brown, appearance wetness and beef taste attribute (p<0.05). Consumer acceptability test showed that VSB sample had the highest score on favorable of appearance, flavor, texture, and overall characteristics. Further cross-cultural consumer acceptance testing would enable to identify for the drivers of liking/disliking of soy-meat products by panels of different countries in the context of increasing food product exports to other countries.
Correlation between Quality Index and Consumer Acceptance in Environment-friendly ‘Campbell Early’ Grape

Da Uhm Lee*, Jeong Mi Bae, Kyung Hyung Ku, Jeong Hee Choi
Korea Food Research Institute, Korea

This study investigated correlation between quality index and consumer acceptance in environment-friendly ‘Campbell early’ grape. Grapes were divided into three parts horizontally and only the middle portion was used for the examination. As a result of quality index, positive correlation was found between soluble solids content and ratio of CIE a* to b* value, and negative correlation was found between soluble solids content and titratable acidity. As a result of consumer acceptance, positive correlation was found between sweetness and texture preference. Whereas, sweetness showed negative correlation with sourness. Overall preference score increased by more sweetness and lower sourness. Correlation between quality index and consumer showed positive correlation of sourness with CIE L* value. Sweetness was mostly related with hardness among other quality index factors. Overall preference, the most important sensory evaluation, showed the most strong correlation with hardness (r=0.860), followed by SSC/pH (r=0.591).

Evaluation of Crab Extracts Treated with Various UHT Conditions

Xiaojia Hu*, Jeehyun Lee, Tai-Sun Shin1, Jeong-Ae Heo, Bongyeon Kim2, Heseob Lee
Department of Food Science and Nutrition, Pusan National University, Korea, 1Department of Nutrition and Food Science, Chonnam National University, Korea, 2MSBio, Korea

Nowadays a lot of seafood-related foods are exploited. Crab extract is an essential ingredient for imitation crab products. Our purposes were to investigate if UHT treatment conditions will influence the flavor of crab extracts and to determine flavor and liking of imitation crab products flavored with the crab extracts. We evaluated 4 crab extract samples with or without UHT treatment at different pressures. First, we created a lexicon for crab extract and evaluated intensity of diluted crab extracts. A total of 9 panelists participated and established a lexicon for crab extract and evaluated intensity of diluted crab extracts. Without UHT treatment at different pressures. First, we created a lexicon for crab extract and evaluated intensity of diluted crab extracts. A total of 9 panelists participated and established a lexicon for crab extract and evaluated intensity of diluted crab extracts. Overall liking showed that 4 samples did not have significant differences.

Evaluation of 52 Korean Emotion Terms Using Two Instant Cup Noodles with the Big Liking Difference

Juyoung Kim*, Hyeri Kim, Jeehyun Lee
Ewha Womans University, Korea

‘How do real consumers perceive and use the product?’ is the main concern for the food industries from the product development stage. Emotions evoked when purchasing or consuming products may be helpful. Well known emotion term ‘EsSense Profile™’ is the emotion term list developed in English. This profile has been used as itself or translated into different languages. However, for Korean consumers, it did not fully describe their emotions, ending up developing Korean emotion terminology in our previous study. Using instant cup noodle from the market as samples, we developed 52 Korean emotion terms. Along with the emotion term test, consumers were asked to score the liking of the products and ranking score of the products. Two samples (yukejang and Nagasaki Ramen) showed the big difference between liking and ranking score. Using these two samples, we evaluated the efficiency of the developed 52 Korean emotion terms. As a result, yukejang showed higher score for liking and ranking score than Nagasaki Ramen. Among the emotions, yukejang product had higher score for ‘nostalgic’ and ‘glad’ while Nagasaki Ramen showed higher score for ‘attractive’ and ‘pleasant surprise’.

Measurement of Consumer Acceptance: Consumer Rejection Threshold (CRjT) and Hybrid Satisfaction Scaling with Sensory and Cognitive Warm-up (HSS/SCWU)

Hyo-Jin Kim*, So-Yub Lee, Min-A Kim, Hye-Seong Lee
Ewha Womans University, Korea

It is important in food industry to reduce salt, sugar and fat from food in order to make healthier products, while maintaining consumer acceptance/satisfaction of products. To achieve successful food reformulations of those ingredients, thus it is required to accurately measure consumers’ sensory acceptance taking account for the consumers’ natural decision strategy as well as inter-consumers differences. To solve this problem, two different consumer acceptance test methods based on signal detection approach methods were studied using soup stimuli varying salt levels: 1) consumer rejection threshold (CRjT) using a paired preference test; 2) hybrid satisfaction scaling following sensory and cognitive warm-up (HSS/SCWU). Two equivalent groups were formed from 190 consumers and used to test these two methods independently. Differences in acceptance between the reference and test stimuli were analyzed in d' values. Two methods were compared and their pros and cons were discussed to find out which method is more appropriate to measure the meaningful changes of consumer acceptance that can be used to determine an optimal reformulation level of salt, sugar and fat ingredients.
Salty Taste Enhancement Effect of Animal and Vegetable Hydrolysate by Intensity Evaluation

So Jung Youn1,2*, Jin Seon Kim1,2, Han-Sul Park2, Hee-Ju Kim1,2, Juan Park1, Hyung-Yong Cho3, Seok Hoon Lee4, Jung-Kue Shin5
1Department of Traditional Food Industry, JeonJu University, Korea, 2Food Industry Research Institute, JeonJu University, Korea, 3Lab. of Bioguided Processing and Food Engineering CHA University, Korea, 4BiO Center, Biovan Ltd., Korea, 5Department of Korean Cuisine, JeonJu University, Korea

Recently, a number of research are being carried out for sodium intake reduction as the problem of excessive intake of sodium is raised. The various research one of salt replacement or salty taste enhancer research and development is being carried out for sodium reduction of the a way. In this study, the salty taste enhancer created by using animal materials are anchovy and vegetable materials are bean. This is to carried out salt intensity evaluation in order to confirm salty taste enhance effect using ranking test method. Panels are a total of 22 people, evaluation was repeated three times. The panelists was assessed each evaluation standard solutions to prepare model broth and NaCl solution. On the base of NaCl 30, 40, and 50 mmol concentration was evaluated animal and vegetable hydrolysate salty taste intensity. The results of the research, hydrolyzed animal protein (eHAP) and hydrolyzed vegetable protein (eHVP) of aqueous evaluation standard solutions containing 30, 40, and 50 mmol/L NaCl with an amount of protein 2%, respectively. The panelists was assessed evaluation standard solution containing 30, 40, and 50 mmol/L NaCl at eHAP is 40, 53, and 66 mmol/L NaCl, eHVP is 39, 50, and 64 mmol/L.

Gender Differences in the Dietary Habits and Consumption Patterns of Sodium

Yoojin Jung*, Heera Na, A Young Kim, Seul Ki Lee, Chang Geun Kwak1, Min-A Lee
Department of Food and Nutrition, Kookmin University, Korea, 1Korea Food Research Institute, Korea

The purpose of this study was to investigate dietary habits and consumption patterns of sodium intake. A survey was conducted from Oct 2014 to Nov 2014. Collected data were evaluated by gender using frequency analysis, descriptive analysis, paired samples t-test, and Chi-square test utilizing SPSS 22.0. 689 people participated, of whom 407 (59.1%) respondents were aged 20-29 years. The main source of sodium was salt from eating out (Women, 49.8%) and protein (eHAP) and hydrolyzed vegetable protein (eHVP) of aqueous evaluation standard solutions containing 30, 40, and 50 mmol/L NaCl with an amount of protein 2%, respectively. The panelists was assessed evaluation standard solution containing 30, 40, and 50 mmol/L NaCl at eHAP is 40, 53, and 66 mmol/L NaCl, eHVP is 39, 50, and 64 mmol/L.

Fed-batch Fermentation for Production of 7,10-Dihydoxy-8(E)-octadecanoic acid (DOD) from Pseudomonas aeruginosa KNU-2B

Se-Rin Kim*, Hye-Ran Sohn, Hak-Ryu Kim
School of Food Science and Biotechnology, Kyungpook National University, Korea

Hydroxy fatty acid (HFA) are known to have special properties such as high viscosity and reactivity. These special properties augmented high industrial potentials in a wide range of applications. Among those HFAs, 7,10-dihydroxy-8(E)-octadecanoic acid (DOD) from Pseudomonas aeruginosa PR3 was well studied in terms of production and antimicrobial activities. However, for industrial applications of HFA, there are still problems remained to be solved, such as economical production and enhancement of biological properties. In this study, we used fed-batch fermentation for efficient production of DOD from P. aeruginosa KNU-2B, which is a newly developed strain. DOD was efficiently produced from KNN-2B by fed-batch fermentation. The maximum DOD production from batch fermentation and fed-batch fermentation was 137.5 mg/50 mL, 326.7 mg/50 mL, respectively, representing that fed-batch fermentation produced 2.3-fold more DOD than the batch fermentation. Results from this study demonstrated that whey powder could be used as efficient carbon source for DOD production from strain KNU-2B and fed-batch fermentation could be used to increase the maximum DOD production in this system.
Production and Functional Study of a Novel Amide Derivative of 7,10-Epoxyoctadeca-7,9-dienoic Acid

Janice Averilla Nullan*, Chakradhar Dasagrandhi, Hak-Ryul Kim
School of Food Science and Biotechnology, Kyungpook National University, Korea

For the extended industrial applications of fatty acids, researchers have been focused on derivatization of fatty acid molecules. Recent studies showed successful derivatization of fatty acids using lipases to produce fatty esters such as monoglycerides and amides. In our research group, a novel furan fatty acid (7,10-epoxyoctadeca-7,9-dienoic acid, EODA) was successfully produced from 7,10-dihydroxy-8(E)-octadecanoic acid (DOD) using an one-step heat treatment reaction, which enabled the discovery of a new valuable bioactive compound for biomedical and pharmaceutical applications. In the continuous attempts to augment its industrial applicabilities, this study tried to attach an ethanolamine group at the carboxyl end of EODA using lipase to produce a secondary fatty amide, EZAM. The production was carried out at 60°C with stirring at 160 rpm for 24 h in the presence of immobilized Candida antarctica lipase B (Novozym-435), N-methylethanolamine as substrate, and 2-methyl-2-butanol as solvent. Its structure was elucidated by GCMS, NMR, and FTIR analyses.

Comparison of Physical and Chemical Properties between Camellia and Soybean Oils

Ho-Jeong Lim*, Jae-Kyeom Kim1, Sun-Wi Oh, Mi So Kim, Da Som Kim, Hye Jeong Jeong, Eui-Cheol Shin
Department of Food Science, Gyeongnam National University of Science and Technology, Korea, 1Department of Food Science and Nutrition, University of Minnesota, USA

This study compared the physical and chemical properties between Camellia and soybean oils as frying oil. Camellia and soybean oils were thermally oxidized at 80°C for 12 day. Physical properties in Camellia oil were evaluated by the ratio of polar compounds, color, and viscosity. For Camellia oil, the ratio of polar compounds, color (lightness), and viscosity in fresh and thermally oxidized oils were 2.4±0.1 & 3.3±0.1, 32.8±0.1 & 32.9±0.2, and 2.4±0.1 & 3.3±0.1, respectively. Moreover physical properties in fresh and thermally oxidized soybean oils were 8.5±0.1 & 20.5±0.2, 20.5±0.4 & 24.1±0.2, and 1.2±0.1 & 1.5±0.1, respectively. Chemical properties in Camellia oil were evaluated by peroxide value (POV) and para-anisidine value (p-AV). For Camellia oil, POV and p-AV in fresh and thermally oxidized oils were 0.7±0.1 & 233.5±4.7 and 8.2±0.1 & 31.5±0.3, respectively. Moreover chemical properties in fresh and thermally oxidized soybean oils were 15.3±1.1 & 146.7±3.7 and 15.7±0.2 & 58.9±4.2, respectively. On the basis of physical and chemical properties, Camellia oil has a potential as edible oil.

Comparison of Sensory Properties between Camellia and Soybean Oils during a Repetitive Frying

Sun-Wi Oh*, Ho-Jeong Lim, Jae-Kyeom Kim1, Mi So Kim, Hye Jeong Jeong, Da Som Kim, Eui-Cheol Shin
Department of Food Science, Gyeongnam National University of Science and Technology, Korea, 1Department of Food Science and Nutrition, University of Minnesota, USA

This study investigated the induction period and odor profiles of thermally oxidized Camellia oils by a rancimat and an electronic-nose (E-nose). The determination of induction time was used by a rancimat at 120°C. Camellia oil was fried at 170°C for the thermal oxidation. Through five repetitive frying of Camellia oil, induction times of Camellia oils were 4.22, 3.94, 3.45, 4.00, and 3.52 h, respectively. For the reference in edible oil, commercial soybean oil was also fried. Through repetitive frying, induction times of soybean oils were 3.06, 3.06, 3.42, 3.39, and 3.06 h, respectively. For odor profiles, fragrance, strength, ammonia, and hydrogen sulfide of raw and thermally oxidized Camellia oils were 49±1 & 39±3, 1072±64 & 2156±208, 112±4 & 73±18, 274±29 & 653±163, respectively. For the reference, fragrance, strength, ammonia, and hydrogen sulfide of raw and thermally oxidized commercial soybean oïls were 61±1 & 45±3, 1365±97 & 1788±242, 69±7 & 72±14, 506±47 & 601±122, respectively. Camellia oil can be used for commercial frying oil based on the thermal oxidative stability.
Effects of Nordihydroguaiaretic Acid on Photooxidation of α-Terpinene and Soybean Oil

YunSeo Choi*, Mun Yhung Jung
Department of Food and Biotechnology, Graduate School, Woosuk University, Korea

The antiphotooxidative activity of α-terpinene in methanol containing methylene blue during light illumination was studied. NDGA showed strong protective activity on the photochemical oxidation of α-terpinene in methanol in a dose dependent manner. The protective activity of NDGA was comparable to that of BHA, but greatly higher than BHT, sodium azide, and DABCO. Total singlet oxygen quenching activity of NDGA was determined by using a Stern-Volmer plot. The total singlet oxygen quenching activity of NDGA was 0.981 × 10^6 M^-1s^-1. NDGA also showed protective activity on the soybean oil oxidation during light illumination. Light greatly induced the hydroperoxide formation and conjugated dienoic fatty acid (CDFA) contents. The added NDGA decreased effectively the hydroperoxide and CDFA formations in soybean oil during light illumination. The protective activity of NDGA was greater than BHA, which is a well-known synthetic antioxidant.

Effects of Emulsifier Charges on the Oxidative Stability in Oil-in-water Emulsions under Riboflavin Photosensitization

BoRa Yi*, Sumi Oh, Hye Jung Ka, Joo Hyoeok Park, Jinyeong Jung, Juhee Song, Chankyu Lee, Seo Young Gim, JaeHwan Lee
Department of Food Science and Biotechnology, Sungkyunkwan University, Korea

Various factors affect oxidative stability in oil-in-water (O/W) emulsions. Effects of emulsifiers charge, presence of iron, and addition of metal chelators on the oxidative stability in O/W emulsions were investigated under riboflavin (RF) photosensitization. Sodium dodecyl sulfate (SDS), Tween 20, and cetyltrimethylammonium bromide (CTAB) were selected as anionic, neutral, and cationic emulsifiers, respectively. Oxidative stability of the O/W emulsion was determined by analyzing headspace oxygen content and lipid hydroperoxides. The O/W emulsions containing CTAB had lower oxidative stability than those with anionic and neutral emulsifiers. Addition of metal chelator increased the oxidative stability in O/W emulsions irrespective of emulsifier charges. Oxidative stability in Tween 20-stabilized emulsions decreased with concentration dependent manner of FeCl3 and FeCl2. However, oxidative stability in samples containing CTAB increased up to 0.5 mM of FeCl3 and FeCl2, and then decreased, which implies CTAB act differently during lipid oxidation compared to anionic or neutral emulsifiers. Cationic transition metals may act antioxidantly in O/W emulsions with CTAB.

Evaluation of Antioxidant Properties of Roasted Hullled Barley (Hordeum vulgare L.) in Bulk Oil and Oil-in-water Emulsion Systems

Sumi Oh*, Hye Jung Ka, BoRa Yi, Joo Hyoeok Park, Jinyeong Jung, Juhee Song, Chankyu Lee, Seo Yeong Gim, JaeHwan Lee
Department of Food Science and Biotechnology, Sungkyunkwan University, Korea

Barley (Hordeum vulgare L.) possesses high antioxidant properties partly due to the presence of phenolics. The objective of this study was to determine antioxidant properties of aqueous extract of roasted hulled barley (AERB) in corn oil heated at 60, 100, and 180°C or oil-in-water (O/W) emulsion under riboflavin (RF) photosensitization. Aqueous extracts of hulled barley, roasted at 210°C for 20 min were put in bulk oil and O/W emulsion (0-1.0%, w/w). Content of phenolics were analyzed by HPLC and in vitro antioxidant assays were also determined. Major phenolics of AERB were p-coumaric and ferulic acids. Depending on the concentration and temperature AERB had antioxidant or prooxidant properties in bulk oil. At 60°C, 0.5% AERB acted as prooxidants while 1.0% AERB were antioxidants. At 100°C, AERB acted as antioxidants irrespective of concentration. In 180°C conditions, AERB with 0.5% were prooxidants whereas others acted as antioxidants. AERB showed antioxidant properties in O/W emulsions, irrespective of concentration. Thus, antioxidant properties of natural compounds should be tested in different food matrix although in vitro assays show high antioxidant property.
Overall, antioxidant properties of glutamic acid and MSG in O/W emulsions were different depending on the charges of emulsifiers. Antioxidant properties of glutamic acids decreased as pH increased while those of MSG were not observed in samples with SDS. Antioxidants in those with Tween 20, however, such as glutamic acid, showed different antioxidant properties. MSG acted as a prooxidant in O/W emulsions with CTAB whereas those with Tween 20. However, such properties were not observed in samples with SDS. Antioxidant properties of glutamic acids decreased as pH increased from 4.0 to 8.5 while those of MSG were not observed. Overall, antioxidant properties of glutamic acid and MSG in O/W emulsions are different depending on the charges of emulsifier and pHs.

Deep frying is one of the most common unit operations in food preparation. During frying process, a wide variety of chemical reactions result in the formation of compounds with high molecular weight and polarity. The objectives of this study were to determine correlation of acid value (AV), total polar materials (TPM), and other physicochemical properties in frying oils and to suggest level of TPM for setting the criteria for discard the used frying oil. Mixture of soybean and palm olein was used for the production of French fries and fried chicken at 180°C for 3 and 5 min, respectively. AV, TPM, 2,2-diphenyl-1-picrylhydrazyl (DPPH) in isooctane and methanol, conjugated diene acid (CDA), p-anisidine value (p-AV), and degree of color were analyzed. AV, TPM, CDA, and p-AV in frying oils increased while antioxidant properties decreased with increased frying number. The degree of oxidation in frying oils from chicken was greater than that from French fries, which could be due to the moisture content. Changes of TPM had high correlation with AV in frying oils from both fried samples. This study can help to set the TPM level for discarding used frying oils in Korea instead of AV.

Amino acids are prooxidant or antioxidant in oil-in-water (O/W) emulsions. Light irradiation in the presence of photosensitizers decreases oxidative stability in foods and influences the quality and flavor attributes. The objective of this study was to determine the antioxidative or prooxidative properties of glutamic acid and monosodium glutamate (MSG) in O/W emulsion made of different emulsifiers charge or pH conditions under riboflavin sensitization. The oxidative stability was determined by analyzing headspace oxygen content, conjugated dienes, and lipid hydroperoxides. Generally, addition of glutamic acids decreased the rates of lipid oxidation in O/W emulsions with CTAB and Tween 20 whereas those properties were not observed in SDS stabilized emulsions. MSG acted as a prooxidant in O/W emulsions with CTAB while antioxidants in those with Tween 20. However, such properties were not observed in samples with SDS. Antioxidant properties of glutamic acids decreased as pH increased from 4.0 to 8.5 while those of MSG were not observed. Overall, antioxidant properties of glutamic acid and MSG in O/W emulsions are different depending on the charges of emulsifier and pHs.

This study aimed to investigate the effects of repeated retrogradation (RR) on the structural characteristics and digestibility of amylosucrase (AS)-treated waxy corn starches. AS-treated waxy corn starch (20,000 U/30 ml suspension, 24 h) was fully gelatinized and stored at 4°C for 1 or 5 days. This process was performed 1 to 3 times to prepare single-retrograded (SR), dual-retrograded (DR) and triple-retrograded (TR) samples. AS control starch underwent the same procedure for comparison. The melting enthalpy of control and AS-treated samples increased from 1.70 to 6.35 J/g and from 3.76 to 7.15 J/g, respectively. All samples showed a B-type X-ray diffraction pattern. Relative crystallinity increased with RR in control and AS-treated samples, showing the highest value in 5 d-TR samples. The SDS contents of control and AS-treated samples decreased with RR, whereas the RS contents increased with RR. Also, the RS contents of AS-treated starches greatly increased compared with those of control starches after RR. This indicates that RR accelerated double helix formation between extended chains of AS-treated starches and formation of ordered or crystalline state.
Physicochemical Properties of Hydroxypropylated Corn Starches Prepared by Conventional Method with High Hydrostatic Pressure (HHP)

El-Hyun Chun*, Chang-Nam Kim†, Sung-Won Choi‡, Nam-Yoon Hur§, Byung-Yong Kim, Moo-Yeol Baik
Department of Food Science and Biotechnology, Kyung Hee University, Korea; †Department of Hotel Baking Technology, Hyejeon College, Korea; ‡Department of Food and Culinary Arts, Osan University, Korea

Hydroxypropylated corn starches were prepared by conventional method with pre-, post- and no-high hydrostatic pressure (HHP) treatment. Conventional hydroxypropylation of starch was performed at 45°C for 5, 10, 15, 20, and 24 h. Effect of HHP on hydroxypropylation of starch was investigated by applying HHP (at 400 MPa for 15 min) before (HHP-Con) or after (Con-HHP) conventional method. Degree of substitution (DS) of samples was increased with increasing reaction time up to 20 h and then maintained thereafter. HHP reactions before and after conventional method did not greatly influence the DS at each reaction time. On the other hand, significantly different RVA pasting properties were observed. Con-HHP group revealed slightly lower pasting temperature and higher peak viscosity than HHP-Con and Con groups. Lower pasting temperature and higher viscosity of Con-HHP group than other groups may be caused by leaching of hydrophilic HP group by post-HHP treatment. Although HHP treatment did not influence the DS, it influenced the RVA pasting properties of hydroxypropylated starches. Hydroxypropylation with HHP treatment can be used as valuable dual-modification for food industry.

Preparation and Characterization of Curcumin Encapsulated Starch Nanoparticles for Increasing Its Water Solubility and Stability

Jinglei Li*, Han Sol Doh, Hyun Jin Park
Graduate School of Life Science and Biotechnology, Korea University, Korea

Starch nano-particles loaded with curcumin was prepared using a facile solution mixing method. Different amount of curcumin was loaded and our results suggested that 3 wt% of curcumin achieved highest encapsulation ability and efficiency. The obtained curcumin loaded starch (cur@star) was yellowish colored and well dispersed in water. Morphology properties were observed via transmission electron microscopy which revealed the particles were spherical shaped and unified distributed. Differential scanning calorimetry and X-ray diffraction were conducted to probe the crystallization state of curcumin in the starch matrix. Moreover, Fourier transform infrared spectroscopy result showed that H bonding may be responsible for the interaction between curcumin and starch. Cur@star easily released curcumin in the DPPH assay which showed similar radical scavenging ability with pure curcumin. At last, the release profile of cur@star was determined by in vitro digestion test. Due to the simple preparation procedures and low priced material used, curcumin starch nano-composite fabricated here is promising to widen the applications of curcumin in the food industry.

Enzymatic Hydrolysis and Recrystallization for Starch Nanoparticle Preparation

Dong-Jin Lee*, Seung-Taik Lim
School of Life Sciences and Biotechnology, Korea University, Korea

Waxy maize starch nanoparticles were manufactured using enzymatic hydrolysis and recrystallization after gelatinization. The starch nanoparticles were prepared under different conditions in enzyme concentration (0.5-3%) and recrystallization process (4°C or at cycles of 4°C and 30°C at each for 10 days). Characteristics and morphology of starch nanoparticles were determined by differential scanning calorimeter (DSC), nanoparticle size analyzer, X-ray diffraction (XRD) analyzer and transmission electron microscopy (TEM). The recovery yield of starch nanoparticles after the hydrolysis and recrystallization was greater than 80%. The particle diameters was decreased less than 460 nm and the crystal pattern changed from A-type to B-type by nanoparticle preparation. The melting enthalpy of starch nanoparticles was increased as enzyme concentration increased from 0.5 to 3%. The manufactured waxy maize starch nanoparticles could be used in foods and industrial products as a novel ingredient.

Effect of Pregelatinization and Dry Heating for Physical Modification of Indica Rice Starch

Yu-Jin Yang*, Joo Yeon Hong, Seung-Taik Lim
Graduate School of Life Sciences and Biotechnology, Korea University, Korea

Normal Indica rice (IR) starch was physically modified by pregelatinization and dry heating, and the pasting properties of the physically modified rice starches were investigated. Pregelatinized starch was conducted by pasting a starch dispersion (10% solids) at 100°C for 10 min and heat treatment was applied in the dry starch at 130°C for 1, 2, or 3 h, and the effects of the physical modifications on paste viscosity (RVA) were examined. The pregelatinization with IR starch showed substantial changes in peak viscosity and pasting temperature, but not much in breakdown and setback. The dual modification with IR (pregelatinization and dry heating) resulted in more significant changes in pasting viscosity as compared to the corresponding unmodified and pregelatinized starch. The results revealed the apparent changes on paste viscosity of rice starch may be controlled by using both modification processes. The physically modified rice starches may provide new pasting reaching adaptable for industrial utilization.
Preparation of Slowly Digestible and Resistant Starches with Enhanced Thermal Stability and Their In vitro Digestibility

Inmyoung Park*, Hyun-Hee Lee, Cheon-Seok Park1, Young-Su Seo
Department of Microbiology, Pusan National University, Korea, 1Graduate School of Biotechnology, and Institute of Life Science and Resources, Kyung Hee University, Korea

The aim of the present work is to investigate the preparation, characterization and in vitro digestibility study of calcium alginate-starch-entrapped microspheres, in observance of the possibility to control the starch digestibility within the human gastrointestinal tract. Native and amylomaltase (AS)-treated waxy corn starches (5,000 U, 20,000 U, and control) were used to encapsulate with three different ratios of sodium alginate (0.5, 0.7, and 1.0%). With increasing sodium alginate concentration, the percent of starch in dried microspheres decreased from 82.7 to 76.6%, amounts of calcium alginate were opposite, from 11.3 to 17.4% and shown more rounded shapes microspheres. The SDS and enzyme resistant starch (RS) fractions of the encapsulated starch showed 57.49 to 97.67%, respectively. After cooking, these fractions remained 2.9 to 48.3% depending on the type of starch and concentration of sodium alginate. These encapsulated microspheres with improved thermal stability that contain high amounts of SDS and RS may prove useful in slowing glucose release and controlling the metabolic regulation.

Rheological Properties of Arabinogalactan Solutions Relate to Composition of Carbohydrates of Different Legumes

Kyeongyee Kim*, Osvaldo Campanella1, Bruce Hamaker2, Sridihar Sathe3
Department of Food Science and Biotechnology, Seoul University, Korea, 1Whistler Center for Carbohydrate Research, Purdue University, USA, 2Whistler Center for Carbohydrate Research, Purdue University, USA, 3Department of Nutrition, Food & Exercise Sciences, Florida State University, USA

Most legumes contain arabinogalactans (AGS) which are classified as dietary fiber and have good functional properties in foods. The carbohydrate/monosaccharide composition of AGS of a variety of legumes were analyzed by gas chromatography (GC). AGS solutions in a range of concentrations of 1.0 to 5.0% (w/v) exhibited both shear thinning and Newtonian flow behavior. At higher concentrations some AGS solutions showed plastic behavior and significant yield stress. Rheological flow curves obtained using cycles of increasing and decreasing shear rates showed that AGS may exhibit both thixotropic and rheopectic flow behavior. That behavior was observed especially for solutions of AGS depending on the concentration. Viscoelastic properties of these solutions were examined by using small strain oscillatory tests. Some concentrated solutions showed the presence of a gel network. The ratio of arabinose/galactose influenced rheological properties of these materials and seems to be related to structural differences among the AGS of the different 22 legume varieties studied.

Process Optimization for Making Starch Nanoparticles Using Acid Hydrolysis and Ultra-Sonication

Hoon Namkung*, Hee-Young Kim1, Hyeong-Jong Kim, Seung-Taik Lim
Graduate School of Life Sciences and Biotechnology, Korea University, Korea, 1Department of Food & Human Nutrition, Iowa State University, Korea

Starch nanoparticles can utilize in various purposes such as paper coating agent and food ingredient. Starch nanoparticles were made by sonication after acid hydrolysis under various conditions (hydrolysis time, ethanol treatment, and sonication time). We hydrolyzed waxy maize starch in an aqueous sulfuric acid solution (3.16 M) for 6, 12, 18, and 24 h. Hydrolyzed starches were neutralized with 1M NaOH and washed with water. Then, starch hydrolyzates were re-dispersed into water and homogenized before sonication. The hydrolyzed starches were fragmented to nanoparticles by cavitation effect of sonicator. Finally, the hydrolyzates obtained from the sonication were recovered by centrifugation. The obtained results suggest that the yield of starch decreased as acid hydrolysis time increased but crystallinity of starch was slightly increased in the peak intensity from the XRD pattern. The use of ethanol solution could increase the yield of starch nanoparticles from 67.3 to 39.2%, but had an effect on crystallinity. As increasing sonication time, transmittance increased and size of starch particle decreased. But, starch nanoparticles were easily aggregated after sonication.

Physicochemical Properties of Chemically Modified Japonica and Indica Rice Starches

So-Jin Lee1,2*, Joo Yeon Hong1, Eun-Jung Lee2, Young Hee Choi1, Hyun-Jung Chung3, Seung-Taik Lim3
1Graduate School of Life Sciences and Biotechnology, Korea University, Korea, 2Suseong College, Korea, 3Department of Bio-food Analysis, Bio Campus Korea Polytechnics, Korea, 4Division of Food and Nutrition, Chonnam National University, Korea

The effects of chemical modifications with acetylation, hydroxypropylation, cross-linking and dual modification of the japonica (JR) and indica (IR) rice starches on the physicochemical properties were investigated. JR had a greater substitution degree of acetyl or hydroxypropyl groups than IR. The dual-modified JR showed broader gelatinization temperature range than corresponding single-modified starches, but narrow in IR. The dual-modified JR and IR showed higher pasting temperatures and lower breakdown than their corresponding single-modified starches. The dual modification with JR and IR induced significant increase in gel hardness as compared to the corresponding unmodified and single-modified starches and the dual-modified JR had a greater hardness, gumminess, and chewiness than the dual-modified IR. The different impact of single and dual modification with JR and IR on the physicochemical properties could be due to the differences in the location and distribution of substituent groups on the starch molecules. The dual modification of rice starches provided desirable changes in the functional properties and could facilitate a wide range of applications.
**P06 -011**

**Preparation and Characterization of OSA Potato Dextrin by Ultrasound**

**Yu-Jin Han*, Jin Shu Bai, Shun Ji Li, Jung-Ah Han**

*Department of Foodservice Management and Nutrition, Sangmyung University, Korea*

Potato starch esterified by 1-octenyl succinic anhydride (OSA) was dextrinized by ultrasound treatment (UT) at four different conditions (at 25°C for 30 min or 60 min, and at 50°C for 30 min or 60 min), and the physico-chemical properties were analyzed. By UT, significant decrease in pasting temperature and peak viscosity of dextrins was observed, especially for those treated at higher temperature with longer time. The onset temperature and enthalpy of dextrins measured by DSC were also decreased, showing same tendency with RVA results. However, the dextrin prepared at 50°C for 60 min showed the highest pasting temperature and setback values among ultrasound treated samples, indicating some chain association during UT. For the result of chain profile of dextrins after debranching measured by HPSEC, the amount of short chain (DP 11-24) significantly increased after UT at 25°C, regardless of treatment time, indicating chain degradation by UT. For the dextrin prepared at 50°C for 60 min, the amount of short chains (DP 19-24) decreased and longer chains increased, which could prove the same chain association by UT.

**P06 -012**

**Effect of Acid-hydrolysis under Limited Moisture Content on Physicochemical Properties of Maize Starch Depending on Amylose Content**

**Dae Han Park*, Min Jung Kim, Jong-Yea Kim**

*Department of Food Science and Biotechnology, Kangwon National University, Korea*

Maize starches with various amylose contents (approximately <1, 25, or 55 %) was dispersed in an aqueous solution (15 g in 150 mL) comprising varying acidic solution contents (0.1 M HCl; 2, 4, or 6 mL), the recovered starches were subjected to a hydrothermal treatment (120°C, 3 h, 20% moisture content). All treated maize starches exhibited significantly reduced overall paste viscosities and granular swelling characteristics relative to their native starches, as well as enhanced levels of thermo-stable resistant starch. High amylose maize starch, which has B-type crystalline structure, exhibited most obvious changes in enhancement of thermo-stable RS content after the acid-hydrolysis. Acidic conditions under 20% moisture content mainly promoted limited hydrolysis of amylose and/or amylopectin long chains of high amylose maize starch, which like enhancing mobility and interaction of starch chains, and these conditions appeared to promote generation of thermal transition at around 130-160°C in treated high amylose maize starch.

**P06 -013**

**Solubility and Characterization of the Inclusion Complex of β-Carotene with Cycloamylose of DP26 (CA26)**

**Shin-Joung Rho*, Saehun Mun, Sun Chu, Kyeongseon Joo, Yong-Ro Kim**

*Center for Food and Bioconvergence, Department of Biosystems and Biomaterials Science and Engineering, Seoul National University, Korea*

The objective of this work was to investigate the capability of cycloamylose of DP26 (CA26) to form an inclusion complex with β-carotene to improve solubility in comparison with cycloamylose mixture (CA) and cycloextrin (CD). Chromatographically-separated CA26 from CA was reacted with β-carotene and the inclusion complexes were analyzed using scanning electron microscopy (SEM), fourier transform infrared (FT-IR) spectroscopy, and 1H nuclear magnetic resonance (NMR) spectroscopy. Aqueous solubility of β-carotene was enhanced up to about 8 and 6-fold in the presence of 15 mM of CA26 and CA, respectively, compared to that of pure β-carotene. The electron micrograph revealed that inclusion complex of β-carotene and CA26 showed a dramatic change in morphology compared to that of the β-carotene particles, which suggested an apparent interaction between β-carotene and CA26. Further characterization of inclusion complexes between CA26 and β-carotene using the FT-IR and NMR suggested that the stable inclusion complex was formed with the olefinic region of β-carotene interacting with the hydrophobic cavity of CA26.

**P06 -014**

**Effects of Gums on Rheological Properties of Rice Starch-based Gel**

**Shinjae Park*, Saehun Mun, Yongro Kim**

*Department of Biosystems & Biomaterials Science and Engineering, Seoul National University, Korea*

Recently, the effects of gums on rheological properties of starch were studied by several researchers. However, due to the complex interaction between gums and starch, there still remain many uncertainties especially for the effects of gums on the starch gel network formation. Therefore, the main objective of this research is to clarify the effects of different types of gums [Guar gum/Xanthan gum/-Carrageenan] on rheological properties of rice starch based hydrogels. Starch-gum mixtures (total solids concentration 7%, w/w) were prepared by mixing starch dispersion in 5 mM phosphate buffer and gums of different levels (0, 0.1, 0.5, 1.0, 1.5, and 2.0%, w/w). Each mixture heated at 95°C for 10 min with mild agitation (gelatinization). Then, Frequency sweep test was conducted over the range of 0.63-62.8 o at 1% strain (gap size=1 mm, 25°C). From dynamic rheological data, it was found that guar and xanthan gum made gel more viscous compared to normal starch gel. However, the high concentration of -carrageenan made it more elastic and solid-like. Such rheological properties could find potential applications in related fields like food structuring and food processing.
Yield of Bacterial Cellulose by Response Surface Optimization of Culture Conditions to Produce High Cellulose Production

Jiwoon Park*, Yong-Ro Kim
Department of Biosystems and Biomaterials Science and Engineering, Seoul National University, Korea

Several cryoprotectants have been used to protect probiotics in the freeze-drying process such as sugars, peptides, and proteins, however, the finding of more effective cryoprotectants is still required. Therefore, this study examined the combined effects of several sugars as cryoprotectant on viability of probiotics during freeze-drying process. Three types of sugars [glucose, trehalose, and sucrose] at the concentration of 0.5 M and three types of combinations [glucose (50%) + trehalose (50%), glucose (50%) + sucrose (50%), and trehalose (50%) + sucrose (50%)] were used as cryoprotectants in this study and effect was compared. As a result of comparisons, ‘trehalose + sucrose’ showed the highest viability (61%) in Lactobacillus rhamnosus GG and ‘trehalose + glucose’ had the highest viability (65%) in Lactobacillus plantarum. These results indicated that the combination of sugars could be used as more effective cryoprotectant than the single sugar to improve viability of probiotics during freeze-drying process.

Optimization of Culture Conditions to Produce High Yield of Bacterial Cellulose by Response Surface Methodology

Hyeseung Chung*, Yongro Kim
Department of Biosystems and Biomaterials Science and Engineering, Seoul National University, Korea

Bacterial cellulose (BC) is produced by Acetobacter and other species. BC exhibits unique properties; high tensile strength, water holding capacity, and biodegradability. The objective of this research was the optimization of parameters for maximum cellulose production by RSM. Three experimental factors, fructose (X1), agar (X2), agitation speed (X3) were chosen for optimization. Central composite design and response surface methodology (RSM) of three factors at three levels were adopted. The regression equation between factor and response methodology (RSM) of three factors at three levels were adopted. The regression equation between factor and response was obtained; BC = 15.69 + 1.19X1 - 1.31X2 - 6.32X3 - 1.49 X1 * X1 + 5.22 X1 * X2 - 7.54 X1 * X3 - 0.93 X2 * X3 - 2.38 X1 * X2 * X3 - 0.60 X2 * X3. The adjusted R²=0.6992 suggests that the model may explain 69.92% of the total variation in response. X1, X2, X3, X1X2, X1X3, X2X3 of model are significant. The optimum operating conditions obtained from RSM to achieve maximum cellulose production were fructose concentration 90 g/L, agar concentration 45 w/v, agitation speed 169 rpm and the predicted BC yield was 25.70 g/L.

Effect of Superheated Steam Treatment on Physicochemical Properties and Gel Texture of Waxy and Non-waxy Rice Flours as Affected by Heat Temperature

Ahna Kim*, Sung-Gil Choi
Division of Applied Life Science, Graduate School, Institute of Agriculture and Life Sciences Gyeongsang National University, Korea

The objective of this study was to determine difference between waxy (WRF) and non-waxy rice flour (NRF) in physicochemical such as swelling power, solubility properties and water binding capacity and gel texture such as hardness, adhesiveness, gumminess and cohesiveness at different heat temperatures and as the effect of superheated steam (SHS). SHS treatment was conducted at steam and oven temperature of 250°C and 150°C and steam flow of 7.8 m³/h for 10 min. Swelling power, solubility properties and water binding capacity of all the samples was increased with increasing heat temperature. Swelling and water binding capacity mostly decreased as treated by SHS and WRF has higher swelling power above 50°C and water binding capacity above 60°C than NRF. Rising temperature tend to increase hardness, adhesiveness and gumminess, whereas opposite tendency was observed in cohesiveness. Generally, hardness, adhesiveness, and gumminess of NRF has higher than WRF. Hardness, adhesiveness, and cohesiveness of samples treated by SHS was decreased in comparison with untreated by SHS. Therefore, SHS and heat temperature, when applied to WRF and NRF affect physicochemical properties and gel texture.

Preparation of Nano Sized Starch Particulates Using an Emulsion Cross-linking Process

Jun-Kyu Park*, Jae-Kwon Lee
Department of Food Science and Biotechnology, College of Natural Science, Kyonggi University, Korea

Nano sized starch particulates from rice, corn and potato starch were prepared using an emulsion cross-linking process with POCl3 as a cross-linking reagent. To produce an emulsion, alkali solubilized starch solution containing POCl3 was dispersed in cyclohexane with the mixture of Span 80 and Tween 80. Then the resultant w/o emulsion was high pressure homogenized using a Microfluidizer at different levels of pressure (30, 50, and 70 MPa) and pass number (1, 3, and 5). Particle size analysis revealed that starch particulates vary in size and distribution pattern depending on the botanical origins, resulting the different size and distribution range of each starch particulates. The recovery yield of starch particulates from rice, potato and corn starch were about 40, 60, and 70% respectively for emulsion cross linking process. The X-ray diffractometric and DSC analysis of starch particulates showed that the crystallinity of starch was reduced significantly through the emulsion cross linking process. However, the pressure as well as pass numbers of high pressure homogenization do not affect the characteristics of starch particulates prepared through the emulsion cross linking process.
High Pressure Treatment of Native Corn Starch Powder Affects Initial Hydrolysis Rate by α-Amylase

Jung-Guy Jun*, Yu-Jung Jung, Jae Chel Kim, Myo-Jeong Kim
Department of Food and Life Science, Inje University, Korea

To facilitate native starch hydrolysis at starch saccharification process without gelatinization of starch for eco-friendly starch industry, native corn starch powder was treated under high hydrostatic pressure at various conditions and its hydrolysis rate was determined in the presence of α-amylase (BAN480L, Novozymes). The initial hydrolysis rate was dramatically jumped more than 2 times after high pressure treatment at 2,000 atm. The hydrolysis rate was increased as the pressure increased up to 2,000 atm and the processing time increased up to 10 min. Also, the hydrolysis rate was accelerated by drying starch powder, which means lower water content of starch granule was affected greatly under the high pressure. The high pressure treatment seems to make damage on the surface of starch granule which helps the enzymatic attack toward starch granule leading the increased hydrolysis rate. The 3 factors affecting hydrolysis rate was investigated in detail using response surface methodology (RSM) with a central composite design (CCD). The high pressure treatment of native starch may be useful for reduction of process time at native starch saccharification step.

Physicochemical Properties of Potato and Sweet Potato Starches as Affected by Heating Temperature

Seul-Ah So*, Sung-Gil Choi
Division of Applied Life Science, Graduate School, Institute of Agriculture and Life Sciences, Gyeongsang National University, Korea

The objective of this studies were comparison of potato and sweet potato starches, such as swelling power (SP), solubility, water binding capacity (WBC), gel texture profile attribute (TPA) (hardness, gumminess, springiness, cohesiveness) at different heat temperatures (30°C to 90°C). Oil absorption capacity (OAC) was measured after heat treatment with different temperatures (100, 140, and 180°C). Solubility of their starches was increased at heated temperature. SP and WBC of potato starches were increased range of from 50°C to 70°C; however decreased at 80°C. Also, sweet potato starches were similarly showed that increased at 50°C to 80°C and decreased 90°C. TPA of gel such as hardness and gumminess result appeared that potato starches nearly higher than sweet potato starches. Also, springiness and cohesiveness showed same result. OAC of their starches were increased with heated temperature. Especially, OAC of potato starches were higher than sweet potato starches. Consequently, physicochemical properties of potato and sweet potato starches were affected by heated temperature.

Effects of Enzymatically Produced Resistant Starch Substitution on Physicochemical Properties of Rice and Corn Starch Gels

Ha Xuyen Nguyen Doan*, Yang Kim, Kieu-Tien Nguyen, Dong-Joo Han, Byung-Hak Youn, Hye-Jin Kim, Sang-Ho Yoo
Department of Food Science & Technology, BK21+ Project Team, and Carbohydrate Bioproduct Research Center, Sejong University, Korea

Resistant starch (RS) has been well recognized for health benefits. However, application of RS often causes disadvantages in terms of texture. By applying amylosucrase, high RS products can be obtained via elongation of amylopectin and amylose. In this study, modified rice starches with high RS fractions were produced using amylosucrase from Neisseria polysaccharea (NpAS) and their effects on physicochemical properties of rice and corn starch gels were investigated at 10 or 20% substitution. Gels were prepared with 15% starch dispersions upon heating and cooling. Hardness of NpAS-treated starch substituted gels were significantly increased and this effect was greater in rice compared to corn starch gel (p<0.05). Less syneresis after 7-day storage compared to commercial RS in rice starch gel manifested that substitution of NpAS-treated starch effectively stabilized gel network. NpAS-treated starch even enhanced RS fraction after storage and increased crystalline region due to elongated chain length might be the explanation. The results suggested NpAS-treated starches have a potential to be utilized as a texture enhancer as well as a functional ingredient to starch-based gel food.

Optimizing Reaction Conditions of Turanose Production by Using Amylosucrase from Neisseria polysaccharea

Yang Kim*, Min-Oh Park, Yi-Seul Jung, Sang-Ho Yoo
Department of Food Science & Technology and Carbohydrate Bioproduct Research Center, Sejong University, Korea

Turanose (3-O-a-D-glucopyranosyl-D-fructose) is a sucrose isomer and has a potential as functional sweetener. Recently, turanose was synthesized utilizing a recombinant amylosucrase from Neisseria polysaccharea (NpAS). NpAS catalyzes synthesis of linear α-(1,4)-glucan from sucrose, however, synthesizes turanose by glucosyl transfer onto released fructose. In this study, concentrations of substrate sucrose and co-substrate fructose, and reaction time were optimized to maximize yield of turanose by RSM. All factors significantly contributed to the yield (p<0.01). Major transglycosylating pathway of NpAS shifted from α-glucan synthesis to turanose production by increasing sucrose. Meanwhile, turanose synthesis was retarded at higher and lower fructose. R² of mole turanose and % yield were 0.994 and 0.988, respectively, and lack of fit was insignificant (p>0.05). Yield of turanose maximally reached to 66.8% with 1.97 M sucrose and 0.58 M fructose after 70.8 h reaction and the yield under predicted optimum displayed a good agreement verifying adequacy of the model. The markedly increased yield of turanose suggested the feasibility for industrial production as a novel sucrose substitute.
Development of Fat-free Dressing Using Rice Resistant Starches and Its Rheological Stability during Storage

Junhee No*, Jiyoung Song¹, Malshick Shin
Department of Food and Nutrition, Chonnam National University, Korea

A fat-free dressing composed of vinegar, sugar, and xanthan gum was developed by using the various types of resistant starch (RS) which were prepared from non-waxy and waxy rice starches. The retrograded RS3 was prepared by using autoclaving-cooling cycle with 0.1% vinegar and 0.1% ascorbic acid (RS3V). The three kinds of cross-linked RS4 were made by cross-linking with STMP after preheating (PRS4), cross-linking after annealing (AnRS4), and heating after cross-linking (HRS4), respectively. The morphological changes of RS granules and the stabilities of viscosity on fat-free dressing during storage were investigated. The RS levels of RS3 and RS3V were 8.40 and 11.58% in non-waxy rice, and 2.90 and 3.36% in waxy rice starches, respectively. Those of RS4, PRS4, AnRS4, and HRS4 were 19.03, 41.64, 22.07, and 21.46% in non-waxy and 15.36, 45.81, 26.01, and 26.67% in waxy rice starches, respectively. The dressing added with RS3V from waxy rice starch showed higher viscosity and had good stability during storage. The HRS4 added dressing maintained rheological stability for 1 month storage, regardless of non-waxy or waxy rice starches.

Physicochemical Properties of Waxy Rice Flours Prepared from Rice Grains with Different Soaking Time

Sara Park*, Huina Yoon, Onbit Jeong, Malshick Shin
Department of Food and Nutrition, Chonnam National University, Korea

The waxy rice flours (WRF) which were prepared from dried wet rice grains during soaking for 15 days by dry milling method, were investigated for their physicochemical and morphological properties. The pH of soaking water decreased rapidly at first from 7.18 to 4.43 at second day of storage after that slightly decreased from 4.43 to 4.02 at 15th day. The moisture contents of WRFs were ranged 8.11-9.26% and their water binding capacities were ranged 136.7-159.85%. The pasting behaviors of WRFs were significantly different with soaking times. The initial pasting temperature was ranged from 75.10°C to 77.85°C. Peak viscosity of WRFs during soaking for 0 day was showed 185.83 RVU. The peak viscosity of WRFs was increased during 10 days storage (197.08-253.75 RVU) and decreased in WRF soaked for 15 days (75.66 RVU). Breakdown viscosity of WRFs was showed the similar result to the peak viscosity. Each viscosity was showed lowest in WRFs soaked for 15 day, so it was suggested that WRF soaked for 15 days could be changed their molecular.

Structural and Physicochemical Properties of Starches from Hydrothermally Treated Brown Rices

Linlin Bian*, Hyun-Jung Chung
Department of Food and Nutrition, Chonnam National University, Korea

Brown rice (Dasan cultivars) flour were heat-moisture treated at 110°C (30% moisture) for 4 h and annealed at 50°C (70% moisture) for 24 h. The brown rice flours were also modified by combination of annealing (ANN) and heat-moisture treatment (HMT). Impact of hydrothermal treatment on morphology, in vitro digestibility, and physicochemical properties of starches from hydrothermally treated rice flours were investigated. The apparent amylose content was the highest in starch from annealed brown rice flour (BRS-ANN) and the lowest in annealed rice starch subjected to heat-moisture treatment (BRS-ANN-HMT). The pasting temperature increased and peak viscosity and final viscosity substantially decreased during BRS-ANN-HMT. The starch digestibility substantially decreased after HMT and ANN, showing 8.1% decrease in RDS content and 4.9% increase in RS content by HMT and 1.9% decrease in RDS content and 1.7% increase in RS content by ANN. In gelatinized starches, ANN and HMT decreased RDS level and increased SDS and RS levels. The changes in amounts of RDS, SDS, and RS after ANN, HMT and dual treatment could be attributed to alteration in the crystalline and molecular structures.

Textural and Structural Properties of Sweet Potato Starch Gels Made from Korean Varieties during Storage

Hyunjin Kim*, Junhee No, Sara Park, Malshick Shin
Department of Food and Nutrition, Chonnam National University, Korea

The textural and structural properties of sweet potato starch gels (SPSGs) were investigated to compare the difference between types and varieties of Korean sweet potatoes, such as purple-fleshed Shinjami and Borami, orange-fleshed Juwhangmi and Shinwhangmi, and white/cream-fleshed Shinyulmi, Shinchunmi, Yeowhangmi, and Jeungmi. The gels with different varieties were significantly different and increased lightness, greenness, and blueness during storage. Textural properties of SPSGs showed significant difference however hardness and gumminess were increased, but springiness, cohesiveness, and resilience were decreased during storage. Juwhangmi and Shinwhangmi gels were kept the initial texture during stored at 4°C for 10 days. The crystallinity of SPS gels was changed from V type to B type after 10 day storage.
Newly Produced Slowly Digestible Starch by Heat Treatment in Rice Powder

Yi Zhang1,2,3*, Weon-Sun Shin2
1Erasmus Mundus Master in Food Innovation and Product Design(FIPDes), 2Laboratory of Food Chemistry, Department of Food and Nutrition, Hanyang University, Korea, 3Department of Food Science, AgroParisTech, France

Slowly digestible starch (SDS), considered as healthy resource of food, refers to starch material with a moderated rate, hydrolyzed to glucose, during its transit through the human small intestine. Changes to the chemical structures of starch molecules or changes that make the molecules or granules more crystalline tend to reduce the rate of starch digestion. Dual heat treatment and retrogradation was applied to produce more SDS in rice powder. Three different particle sized rice powders showed different changes in enthalphy, indicating that the fine particles released the larger surface area, and then gave more opportunity to absorb the energy for starch to be gelatinized. In order to produce SDS from the dry-milled rice flour, the gelatinized rice slurries were stored at 4°C with time course. Subsequently, to make dual retrograded starch sample, the stored samples were re-gelatinized and then stored again under the same condition. The maximum SDS content point appeared when stored for 36th, suggesting a simple and efficient way to produce slowly digestible starch.

Impact of Ultrasound and Heat-moisture Treatments on the Structures and In vitro Digestibility of Starch from Germinated Waxy Brown Rice

Min Ji Kim*, Hyun-Jung Chung
Department of Food and Nutrition, Chonnam National University, Korea

The in vitro digestibility as well as the molecular and crystalline structures of waxy rice starches isolated from brown rice, germinated brown rice (GBR), ultrasonicated GBR, and heat-moisture treated GBR were investigated. The GBRs had lower average molecular weight and higher proportion of DP 6-12 in amylpectin than BRS. The relative crystallinity, 1047/1022, gelatinization temperature and pasting temperature were reduced by germination. The ultrasonication and heat-moisture treatment of GBRs increased the relative crystallinity and gelatinization temperature. The digestibility of BRS was increased by germination. The rapidly digestible starch (RDS), slowly digestible starch (SDS) and resistant starch (RS) contents were 50.5, 42.4, and 7.1% in BRS, and 69.0, 27.9, and 3.1% in GBRs, respectively. The ultrasonication and heat-moisture treatment of GBRs reduced RDS content and increased RS content in raw and gelatinized starches. The decrease in starch digestibility of cooked GBR was more pronounced after heat-moisture treatment than after ultrasonication.

Structural and Physicochemical Characteristics of Rice Starches with Varying Processing Adaptabilities

Seul Lee*, Hyun-Jung Chung
Department of Food and Nutrition, Chonnam National University, Korea

Molecular structure, physicochemical properties and in vitro digestibility of rice starches from cultivars for three major processing applications of rice (cooked rice, brewing and rice cake) in Korea were investigated. Rice starches isolated from selected 10 different rice varieties (4, 2, and 4 varieties for cooked rice, brewing, and rice cake, respectively). The apparent amylase contents of rice starches for cooked rice, brewing and rice cake were 21.1-22.4, 22.9-24.6, and 20.1-22.0%, respectively. Rice starches for rice cake had higher gelatinization temperature and enthalpy than did those for cooked rice and brewing. The relative crystallinity of rice starches measured by X-ray diffractometry did not show significant difference among three processing applications. Peak viscosity of rice starches for cooked rice was substantially higher than that for brewing and cooked rice. Rice starches for brewing had higher rapidly digestible starch (RDS) content and lower resistant starch (RS) content than did those for cooked rice and rice cake.

Effect of Curcumin in Breast Cancer Cells of Chemotherapy Strategy

Eunmi Park*
Department of Food and Nutrition, Hannam University, Korea

The strategy of homologous recombination pathway regulation has been applied for cancer therapy. Chemical inhibitors of poly (ADP-ribose) polymerase (PARP) induce BRCA-deficient tumors via blocking HR pathway showing a synthetic lethality. In the present study, we demonstrated that combined treatment of curcumin and ABT-888 reduced a colony formation in HR-proficient-breast cancer cells. Curcumin had hypersensitivity in MDA-MB 231 and MCF-7 breast cancer cells when co-treated with PARP inhibitor, compared with the breast cancer cells treated alone with PARP inhibitor. The data indicates that curcumin may be used with PARP inhibitor as a combination therapy. Finally, we examined the effect of curcumin in combination with PARP inhibitor in a xenograft model. Combined curcumin and PARP inhibitor treatment delayed breast tumor formation in the xenograft model. Taken together, our study in vitro and in vivo described provided new data that curcumin regulates HR-dependent repair, including RAD 51 foci formation and it hypersensitizes breast cancer cells to PARP inhibitor as a combined chemotherapy reagent.
Physicochemical Properties, Minerals and β-Glucan Contents of Korean Oat (Avena sativa L.) Cultivars

Yu Young Lee*, Sun Lim Kim1, Mi-Jung Kim, Yu-Ho Kim2, Ji-Young Park, Eun-yeong Sim, Byung Joo Kim, Choounwoo Lee, So Young Kim, Yurim Son, Wook-Hwan Kim

Crop Post-harvest Technology Research Division, Department of Central Area, Crop Sci., National Institute of Crop Science, Korea, 1Crop Foundation Research Division, Crop Sci., National Institute of Crop Science, Korea, 2Highland Agriculture Research Institute, Crop Sci., National Institute of Crop Science, Korea

Oat (Avena sativa L.) has received considerable attention for their content of dietary fibers and functional compounds. Consumption of oat-based food is rapidly increasing due to consumer preference for functional foods, it is therefore important to know functional compound and nutritional values in Korean oat cultivars. This study examined the physicochemical properties, minerals, and functional compounds of nine Korean oat cultivars (five hullness and four covered oat cultivars). Findings showed that the ash, potassium, calcium, and dietary fiber of covered oat cultivars were higher than the hullness oat. The phosphorus content was highest in Daeyang (DY, 481.5 mg/100 g) and Sunyang (SY, 491.68 mg/100 g). Samhan (SH, 11.43 and 486.2 mg/100 g) was highest content of Iron and potassium. All β-Glucan contents of hullness oat cultivars were higher than covered oat cultivars. Total β-Glucan contents ranged from 3.4% to 4.1% in oat flours. The Daeyang (DY, 4.10%), Jopung (JP, 4.09%), and Highspeed (HS, 4.07%), showed high levels of β-Glucan contents. Findings of the study will provide useful information in extending the use of oat.

Leuconostoc mesenteroides 815 Cell Extract Inhibits Adipogenesis in 3T3-L1 Adipocytes

Jieun Lee*, Ja-Young Jang, Young-Jun Oh, Seul Ki Lim, Min-Sung Kwon, Hyun Ju Kim, Hak-Jong Choi

World Institute of Kimchi, Korea

This study investigated the inhibitory effect of the cell extracts of Leuconostoc mesenteroides 815 (815-CE) isolated from kimchi (Korean traditional fermented food) on cellular lipid accumulation in preadipocyte 3T3-L1 cells. 815-CE was obtained by lysing Leu. mesenteroides 815 suspended in PBS at 10^7 colony-forming unit/mL and then used to treat 3T3-L1 preadipocytes during adipogenic phase. AdipoRed assay revealed that 815-CE treatment significantly decreased lipid accumulation in maturing 3T3-L1 preadipocytes in a dose-dependent manner. Oil red O staining demonstrated that 815-CE reduced the number of lipid-containing rounded cells. 815-CE down-regulated the mRNA expression of six adipocyte-specific genes: peroxisome proliferator-activated receptor-γ, CCAAT/enhancer binding protein-α, sterol regulatory element binding protein-1c, fatty acid synthase, activator protein-2a and glucose transporter type 4. These results suggest that the 815-CE inhibits lipid accumulation in the differentiating adipocyte through down-regulating the expression of adipogenic transcription factors involved in lipid metabolism.
Correlation of Dietary Intake with Emotional Status in Healthy Korean Children and Adolescents

Jin Young Kim1,2, Hye Lim Kang3, Dae-Keu Kim1,2, Daesok Han3, Yoo Kyoun Park4,5, Seung Wan Kang1,2,3
1The Research Institute of Nursing Science, Seoul National University, Korea, 2College of Nursing, Seoul National University, Korea, 3National Standard Reference Data Center for Korean EEG, Korea, 4Department of Medical Nutrition, Graduate School of East-West Medical Science, Kyung Hee University, Korea, 5Research Institute of Medical Nutrition, Kyung Hee University, Korea

The aim of the study was to explore the association between dietary intake and emotional status. 318 healthy children and adolescents who haven’t been diagnosed of neurologic or psychiatric disorder were evaluated (age of 11.8±3.6 years). Analysis indicators were dietary intake checklist for children’s nutrition quotient (NQ), food frequency questionnaire, child depression inventory (CDI), state trait anxiety inventory (STAI-S, STAI-T), electroencephalographic theta/beta ratio and heart rate variability (HRV). The subjects were divided into 4 quartiles depending on NQ total scores. Fourth quartile group had the most high NQ total score and showed the best dietary intake. Standard deviation of R-R intervals of HRV was significantly higher in the 4th than the 1st (p<0.05). The score of CDI, STAI-S and STAI-T were significantly lower in the 4th than the 1st (p<0.001). Artificial sweeteners had positive correlations with Fz theta/beta ratio and Cz theta/beta ratio (p<0.05). Emotional status was generally healthier in best dietary intake group than worst group. These results suggest that diet is closely related to emotions even in healthy children and adolescents.

A Study on Nutrition Facts Label: Comparison of Foreign and Domestic and Consumer Awareness Survey

Da-Un Jeong*, Yu-Jeong Cho, Ae-son Om
Lab. of Food Safety, Department of Food & Nutrition, College of Human Ecology, Hanyang University, Korea

To determine the need for improvement of Korea’s Nutrition Facts Label (NFL), this study was investigated the difference of NFL between foreign and domestic and surveyed 199 consumers aged through 20-40 on April 2015, on consumer awareness about NFL. Korea’s NFL is indicated calories, carbohydrates, sugars, protein, fats, and sodium in this order, while NFL of the United States, Germany, Australia, Thailand is displayed calories, fats, sodium, and carbohydrates, respectively. According to the survey, when consumers purchase food, they checked NFL (64.32%). The first reading nutrient was calories (74.87%), followed by fats such as saturated fat, trans fat, cholesterol (41.71%) and sodium (23.62%). On the other hand, the lowest reading nutrient was minerals like calcium, zinc, iron (53.27%). Regarding convenience of NFL utilization, the highest response was ‘uncomfortable’ and ‘not interested’ with 67.84%. Therefore, further study on NFL may be needed to increase satisfaction and availability.

Metabolomic Analysis of Fecal Bile Acids from Rats Fed Red Ginseng

Dong wook Kim*, Eun-Ji Gu, Gwang-Ju Jang, Seong-Hwa Song, Jae-In Lee, Sang bong Lee, Young Kyung Rhee1, Young-Chul Lee1, Hyun-Jin Kim
Division of Applied Life Science (BK21 Plus), Gyeongsang National University, Korea, 1Korea Food Research Institute, Korea

Many studies on functional properties of red ginseng suggested that red ginseng is positively correlated with health benefits such as immune enhancement, anti-oxidant, and anti-hyperlipidemia, however, the mechanism is still not fully understood. Recently, metabolomics technology is used to more understanding of the mechanism, but the correlation between red ginseng and bile acids has not been studied. In this study, therefore, we investigated that bile acids in feces from red ginseng-fed rats were analyzed by Ultra Performance Liquid Chromatography–Quadrupole-Time of Flight-Mass Spectroscopy (UPLC-Q-TOF-MS). Bile acid metabolites extracted from fecal of rats fed red ginseng (100 and 200 mg/kg of red ginseng) and water (sham control) for four weeks were comparatively analyzed using multivariate statistical analysis. PLS-DA scores plots and heat maps were used to visualize the separation among samples and major bile acid metabolites contributing to the separation were identified.

A Study of Dietary Habits, Consumption of Convenience Food of University Students

Hyun-Young Jung*, Hyun-Ah Kim1
Department of Food and Nutrition, Mokpo National University, Korea, 1Department of Food and Nutritional Sciences, Kyungnam University, Korea

This study investigated the actual conditions of Dietary Habits and Consumption of Convenience foods by 600 college students in Jeonnam area. Of these 315 lived at home, 122 lived in boarding houses, 140 were self-boarding, and 23 had different living arrangements. 85.1% of the students answered that they don’t eat proper breakfast. Some of the students go to convenience stores for light meals instead of proper meals (62.3%). Instant noodles, kimbab, and other kinds of snack foods were the meals of choice at convenience stores. Despite this, 62.9% of the respondents said that what needs improvement which they eat. Dietary habits of University students is believed to be strongly related to consumption present in our society. It’s because students want to save time on eating. Given that poor eating habits are common in students, nutritional education for university students is needed so as to improve their health and dietary habits. Nutritional education program should be developed and qualitative development of convenience food are required in order to improve the consuming attitude of consumers and their preference for convenience food.
Comprehensive Analysis of Urinary Steroids from Rats Fed Red Ginseng by UPLC-Q-TOF-MS

Gwang-Ju Jang*, Eun-Ji Gu, Dong Wook Kim, Seonghwa Song, Sang Bong Lee, Jae-In Lee, Young Kyung Rhee 1, Young-Chul Lee 1, Hyun-Jin Kim
Division of Applied Life Science (BK21 Plus), Gyeongsang National University, Korea, 1Korea Food Research Institute, Korea

To more understanding of the health benefits of red ginseng, metabolic profile of urinary steroids in rats fed red ginseng was analyzed using liquid chromatography-quadrupole-time of flight-mass spectrometry (UPLC-Q-TOF-MS). Rats were given oral doses of red ginseng water extraction (100 and 200 mg/kg) every day for 4 weeks and rats with oral administration of water was used as a control. Steroids extracted from urine using 80% methanol were hydrolyzed by β-glucuronidase/arylsulfatase to remove sulfuric acid and glucronic acid. Steroids purified by solid phase extraction (SPE) were analyzed using UPLC-Q-TOF-MS and the mass data were statically analyzed by partial least-squares-discriminant analysis (PLS-DA). The study of steroid hormone profiles affected by oral administration of red ginseng is very important to understanding the mechanism of the steroid hormone-related diseases. Moreover, steroid analysis is used for diagnosis of congenital steroid enzyme deficiency, hypertension, and stress. Therefore, analysis of urinary steroid profiling may be useful to understanding various health benefits of red ginseng.

Metabolomic Analysis of Liver, Serum, and Urine from Rats Fed Red Ginseng

Sangbong Lee*, Eun-ji Gu, Dong-Wook Kim, Seong-Hwa Song, Gwang-Ju Jang, Jae-In Lee, Hyun-Jin Kim, Young-Chul Lee 1, Young Kyung Rhee 1
Division of Applied Life Science (BK21 Plus), Gyeongsang National University, Korea, 1Korea Food Research Institute, Korea

We investigated the effect of oral administration of red ginseng on the change of global metabolomic profiles of liver, serum, and urine from rat to better understanding the health benefits of red ginseng. Hepatic, blood, urinary metabolites from rats fed red ginseng (100 and 200 mg/kg of body weight) and water as a control were analyzed via GC/MS and the mass data were statistically analyzed by PLS-DA. Sample groups were significantly separated each other on a PLS-DA scores plot and 18 metabolites from plasma and urine and 25 metabolites from liver were identified as major metabolites contributing to the separation. Red ginseng increased amino acid levels in plasma and urine and hepatic sugar level as compared to control group. Although more studies will be needed, these data suggested that metabolomic analysis can be useful technology to more understanding of the biological effect of red ginseng.

Study on Mineral Contents of Yeonsan Ogye Meat and Broth

Jung Hun Shin*, Eun Jung Kim, Hyun Jin Ko, Ki Nam Kim
Department of Food Science and Nutrition, Daejeon University, Korea

Yeonsan Ogye, a natural monument is a Korean Native Chicken with black bones and skin. From old times, Ogye had been used as a medicament for Women’s diseases, diabetes mellitus, and stroke. This study was performed to evaluate the mineral contents of Ogye meat and broth compared to common chicken. Inductively Coupled Plasma-Optical Emission Spectrophotometer was used for analysis of mineral contents in digested samples by Microwave Digestion System. Zinc and iron contents of Ogye meat were higher than those of common chicken meat. A significant amount of minerals were extracted into broth from chicken. The yield ratio of calcium came to 44.6%. Calcium and magnesium contents of broth from by-products including the head, neck, bones, various organs and skin were similar to the level of whole Ogye broth. These results suggest that Ogye has higher zinc and iron concentrations than common chicken, and that broth from by-product of Ogye’s could be used as an ingredient for commercial product development.

Current Topics in Active and Intelligent Food Packaging for Preservation of Fresh Foods

Seung Yuan Lee*, Seung Jae Lee, Sun Jin Hur
Chung-Ang University, Korea

The purpose of this review is to provide an overview of current packaging systems, e.g., active packaging (AP) and intelligent packaging (IP), for various foods. AP extends shelf life of fresh produce, provides a high-quality product as well as reduced economic losses. Nevertheless, AP was affected by several features, such as temperature control and different gas formulations with product types and microorganisms. AP refers to the incorporation of additive agents into packaging materials with the purpose of maintaining or extending food product quality and shelf life. IP is emerging as a potential advantage in food processing and is an especially useful tool for tracking product information and monitoring product conditions as well as facilitating data access and information exchange by altering conditions of the inside or outside packaging and product. In spite of these advantages, few of these packaging systems are commercialized because of high cost, strict safety and hygiene regulations, or limited consumer acceptance. Therefore, more research is needed to develop cheaper, more easily applicable or effective packaging systems for various foods.
Plasticization of Defatted Soybean Meal-based Edible Films

Si Hyeon Roh*, Young Sun You¹, Soo Yeon Kim, Ji Hyeon Ahn, Sea Cheol Min
Seoul Women’s University, Korea, ¹Biopolymer Corporation, Korea

Applications of novel food grade plasticizers and cold plasma (CP) have been evaluated as the methods for improving plasticity of defatted soybean meal-based films (DSM films). The tensile properties and glass transition temperature ($T_g$) of a basic DSM film, prepared by thermally pressing the mixture of DSM (56.5-80.6%, w/w), plasticizer (5.0-7.5%), and water (35%) at 90°C and 30 MPa for 4 min. were compared with those of the DSM film treated with the CP generated by argon, oxygen, or dry air at 650 W and 667 Pa or those of the DSM films prepared by glycerol, triacetin (TA) (5.0, 5.5, or 6.5%) or triethyl citrate (TEC) (5.5, 6.5, and 7.5%). The CP treatment with argon and oxygen increased the TS of the DSM film (p<0.05). Nonetheless, the %E was not increased of the film. As the concentration of TA, TEC, or glycerol increased, the %E of the film increased (p<0.05) and the $T_g$ of the film decreased, implying improvement of plasticity by the incorporation of the plasticizers. The incorporation of the novel food grade plasticizers demonstrated potential for improving plasticity of the DSM film and potentially other biopolymer films made of agricultural process byproducts.

Quality Change during Storage for Semi-dried Persimmons according to Storage Temperature and Transportation Container that Applies Thermoelectric Elements

Ki-hyun Kwon*, Byoung-sam Kim, Ji-young Kim, So-hee Kim
Korea Food Research Institute, Korea

In this study, in order to suppress the deterioration of the quality of dried persimmons, quality change of semi-dried persimmons was examined through storage methods according to storage temperature and transportation container applying thermoelectric elements. The storage temperature of the 25 L transportation container was set as -5°C (T-5), -10°C (T-10), and the storage temperature of the 250 L transportation container was set as -15°C (T-15). EPS box (T0) was used as the control group and -20°C general freezer (T-20) was used as the test group. The soluble solid content was found to increase in value for all treated groups regardless of the storage period, and this is judged to be related with weight decrease. Upon analyzing browning, it was found that all treated groups excluding T-20 increased with the passage of storage time, and it is evident that the higher the storage temperature, the more browning increased. Therefore, it is judged that for long-term storage of semi-dried persimmon, the storage temperature should be set at under -10°C and that it would require thermoelectric element transportation containers that can control up to ±0.1°C developed in this study.

Quality Changes of Astringent Persimmon in Astringency Removal Pre-processing Conditions for Development of Processed Foods

Ki-hyun Kwon*, Byoung-sam Kim, Ji-young Kim, So-hee Kim
Korea Food Research Institute, Korea

In this study, astringency removal effects using microwave and steam to investigate the astringency pre-processing methods, which is the previous stage for development of processed foods to raise the additional value of astringent persimmons. For microwave, after treating for 5 min, testing was conducted at 0°C (M0) and room temperature (MR), and steam was tested at 0°C (S0) and room temperature (SR) after treating for 20 min. For the control, untreated astringent persimmons were tested at 0°C (CT-0) and room temperature (CT-R). Change of soluble solid contents according to astringency removal was 13.20-13.60°Bx when not treated, 14.80-15.07°Bx when steam treated, and 14.13-14.27 after microwave treating. The L value of non-treated persimmon was measured as 37.74-39.18, it was measured as 37.68-40.71 after microwave treating, and 46.33-47.82 after steam treating. Using the above results, it was judged that the optimal conditions for astringency removal that minimizes changes of color and quality of astringent persimmons would be to treat in microwave for five minutes and store for four days at room temperature.

Improvement of Storage Stability of Smoked Salmon Using Defatted Soybean Meal-based Films Treated with Cold Plasma

Si Hyeon Roh*, Yoon Ah Oh, Sea Cheol Min
Seoul Women’s University, Korea

The effects of packaging smoked salmon in a sachet, made of cold plasma (CP)-treated biopolymer films of defatted soybean meal (DSM) on the physicochemical properties of smoked salmon have been investigated in this study. Biopolymer films were formed by casting film-forming solutions (DSM-glycerol of 10:3), prepared by high-pressure homogenization at 172 MPa. The DSM film was treated with CP for 15 min, generated with argon as a plasma-forming gas at 400 W. Smoked salmon was packaged with sachets of the DSM films with (CP-S) or without the CP treatment (NCP-S), and the physicochemical properties of the salmon samples were compared together with unpackaged salmon samples during storage for 21 days at 4°C. The hardness of CP-S was 17.6 N on day 21, which was higher than the other samples (p<0.05). The level of lipid oxidation on day 21 was lowest with CP-S (p<0.05). Biodegradation of the smoked salmon packaged with DSM films was accelerated by the CP treatment. The results have demonstrated the potential of applying cold plasma treatment to extend shelf life of smoked salmon and increase biodegradation levels of biopolymer films as well as the food packaged with the films.
Effect of Different Packaging Types on Shelf-life of Pork Sausages during Refrigerated Storage

Hyeong Sang Kim*, Sang Keun Jin1, Koo Bok Chin
Department of Animal Science and Functional Food Research Center, Chonnam National University, Korea, 1Department of Animal Resources Technology, Gyeongnam National University of Science and Technology, Korea

This study was performed to determine shelf-life of pork sausages as affected by different packaging types (air vs vacuum) and storage temperatures (4 vs 10°C). Physicochemical characteristics, antioxidant activities and microbial counts of pork sausages were measured during refrigerated storage at two different temperatures. Among the parameters analyzed, pH value of vacuum packaged sausage at 10°C was gradually decreased from 28 day, but others were not. No differences in Hunter color values were observed among the treatments during storage. To reach the microbial counts of 6 log CFU/g in sausages was the maximum storage day and this value was equivalent to 15 meq/kg of peroxide value (POV) and 10 mg% of volatile basic nitrogen (VBN). The average days of shelf-life of three parameters were: 50 days for 4°C-air, 52 days for 4°C-vacuum, 41 days for 10°C-air, 45 days for 10°C-vacuum. Thus, 4°C-vacuum combination showed longer shelf-life than other combinations. These results indicated that TPC, POV and VBN would be good parameters to determine the shelf-life of pork sausage during refrigerated storage.

Postharvest Treatment to Produce High Quality Paprika for Export

Ji Hoon Kang*, Shin Min Park, Hyun Gyu Kim, Hyun Jung Son, Kyoung Ju Song1, Miee Cho1, Jong Rak Kim1, Jeong Yong Lee2, Kyung Bin Song
Department of Food Science and Technology, Chungnam National University, Korea, 1Purgofarm, Korea, 2Foundation of Agri. Tech. Commercialization & Transfer, Korea

To maintain high quality and microbiological safety of paprika during storage for export, the paprika samples after harvest were treated with 75 ppmv chlorine dioxide (ClO₂) gas and stored at 8°C, which is the optimal storage temperature, for 30 days. The ClO₂ gas treatment reduced the initial populations of total aerobic bacteria and yeast and molds in the samples by 1.62 and 1.45 log CFU/g, respectively, compared to those of the control. During storage, weight loss of all samples increased, and the samples treated with ClO₂ gas had lower weight loss than that of the control. In addition, total soluble solid and total phenolic contents were not significantly different between the samples during storage, whereas Vitamin C content and hardness of all samples decreased. The Hunter L, a, and b values of the paprika samples were not significantly different between the treatments. These results suggest that the chlorine dioxide gas treatment can be effective for improving microbiological safety and maintaining high quality of paprika during storage.

Preparation of Perilla Seed Meal Protein Composite Films and Their Application in Sausage Packaging

Nak-Bum Song*, Ji-Hyun Lee, Kyung Bin Song
Department of Food Science and Technology, Chungnam National University, Korea

Perilla seed meal protein (PSMP) composite films were developed using different amounts of red algae (RA). With the addition of RA, tensile strength (TS) of the PSMP film increased, while water vapor permeability (WVP) of the film decreased. In particular, the PSMP composite film with 3% RA had the highest TS (11.52 MPa) and the lowest WVP (1.62×10⁻⁸ g m/m² s Pa). Incorporation of essential oils such as rosemary, clove, and lemongrass resulted in the enhancement of the antimicrobial property of the film. The PSMP/RA composite film with 1.2% clove oil had the highest antimicrobial activity against Listeria monocytogenes. Packaging of pork sausage with the composite films containing essential oils showed antimicrobial and antioxidative activities during storage at 4°C for 12 days. The composite film with 1.2% clove oil reduced the microbial growth by 1.24 log CFU/g, and thiobarbituric acid and peroxide values were reduced by 40 and 37%, respectively, compared to the control.

Characterization of a Corn Fiber Protein Film Containing Green Tea Extract

Hyun-Ju Yang*, Ji-Hyeon Lee, Kyung Bin Song
Department of Food Science and Technology, Chungnam National University, Korea

Corn fiber protein (CFP) films containing various plasticizers and cross-linking agents were prepared and their mechanical properties were determined. Among the plasticizers and cross-linking agents used in this study, the CFP film containing 2 g fructose and 0.03% cinnamaldehyde had the most appropriate physical property. In addition, the CFP films containing green tea extract (GTE) were prepared by incorporating different amounts (0, 0.5, 1.0, and 1.5%) of GTE into the film-forming solution. Tensile strength (TS), film solubility, and opacity of the CFP films increased with the addition of GTE, whereas elongation (E) and water vapor permeability (WVP) of the CFP/GTE films decreased compared to those of the control. The antioxidant activity of the CFP/GTE film was determined in terms of 2,2-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging activity. As a result, antioxidant activity of the films increased with increasing GTE concentration. Furthermore, antimicrobial activity against pathogenic bacteria increased with increasing GTE concentration. These results indicate that the incorporation of GTE could enhance antioxidant and antimicrobial activities of the CFP films.
Non-thermal Treatment of Strawberry and Its Freezing

Ji Hoon Kang*, Kyung Bin Song
Department of Food Science and Technology, Chungnam National University, Korea

To secure the microbial safety of frozen strawberries, they were treated with the combination of aqueous chlorine dioxide (ClO₂) and acetic acid prior to freezing and the effects of different freezing methods (at -20°C in a freezer, at -70°C in a gas nitrogen convection chamber, and at -196°C in liquid nitrogen) on the quality changes of strawberries were examined. Regarding the color of frozen strawberries, there were negligible changes among freezing treatments. In contrast, vitamin C content and sensory evaluation scores of strawberries frozen at -70°C were the highest and drip loss of same freezing condition was the lowest among the samples. In addition, the effects of combination of 50 ppm ClO₂ and 1% acetic acid on the microbial growth in frozen strawberries were investigated, and the populations of preexisting microorganisms in the frozen strawberries were not detected by the combined pre-treatment. These results suggest that rapid freezing at -70°C is an appropriate freezing method for preserving quality of strawberries, and the combined treatment of ClO₂ and acetic acid can be effective for improving microbiological safety of frozen strawberries.

Preparation of a Makgeolli Lees Protein Film Containing Wasabi Extract

Ji-Hyeon Lee*, HyunJu Yang, Kyung Bin Song
Department of Food Science and Technology, Chungnam National University, Korea

Makgeolli residue protein (MRP) was extracted from byproduct of makgeolli processing, and the MRP films containing various plasticizers were prepared. Among the plasticizers used in this study, the MRP film having glycerol-sorbitol (1:2) had the most desirable mechanical properties. In addition, the MRP films containing wasabi extract (WE) were prepared by incorporating different amounts (0.8, 1.0, and 1.2%) of WE into the film-forming solution. Tensile strength, elongation at break, and moisture content of the MRP films decreased with the addition of WE, compared with the control. However, the MRP films having WE had antimicrobial activities against E. coli O157:H7 and L. monocytogenes. Application of the MRP film containing 1.0% WE to packaging of beef decreased the populations of pathogens after storage at 4°C for 8 days by 0.41-1.1 log CFU/g, compared with those of the control. In addition, the peroxide value and 2-thiobarbituric acid reactive substance value were decreased by 53 and 56%, respectively, compared to the control. Therefore, these results suggest that the MRP film containing WE can be used to improve the quality of beef during storage.

Essential Oils

Preparation of a Chicken Feet Protein Film Containing Essential Oils

Ji-Hyun Lee*, Jiyeon Lee, Kyung Bin Song
Department of Food Science and Technology, Chungnam National University, Korea

To prepare an edible film, after extraction of protein from chicken feet, chicken feet protein (CP) films were prepared using various types of plasticizers, and their physical properties were evaluated. Incorporating more sorbitol than glycerol as a plasticizer in the CP film made the film more rigid, and a 3:2 ratio (w/w) of glycerol-sorbitol was optimal. To render the film antimicrobial and antioxidative, marjoram (MA), coriander (CO), and clove bud oil (CL) were incorporated. The type of essential oil affected the mechanical properties of the CP film, and the film containing CL had the most desirable physical properties: a tensile strength of 6.49 MPa, an elongation at break of 20.91%, and a Young’s modulus of 313.49 MPa. The antimicrobial and antioxidant activity was the highest for the film containing CL. When applying the CP film during food packaging, sliced cheddar cheese was wrapped with a CP film containing CL. Consequently, using a CP film containing CL inhibited microbial growth and delayed lipid oxidation in the sliced cheddar cheese during storage. Therefore, a CP film containing CL can be used in antimicrobial and antioxidative packaging for food products.
Quality Changes in the Lotus Root Frozen under Different Conditions

Seongjung Park*, Ji Hoon Kang, Kyung Bin Song
Department of Food Science and Technology, Chungnam National University, Korea

To optimize the preparation of frozen lotus root, an optimal blanching condition at 100°C for 5 min was established, based on the results of microbial growth, texture, total phe-nolic content (TPC), and sensory evaluation. Blanched samples were then frozen under various freezing conditions such as -20°C in a freezer for 2 h, -70°C in gas nitrogen convection chamber for 7 min, and -196°C in liquid nitrogen for 20 s, and their qualities after thawing were determined. Scanning electron microscopic analysis indicated that the microstructure of the sample frozen at -70°C was similar to that of the control, compared with other freezing conditions. The antioxidant activity of frozen samples decreased compared to the control, but there was no significant difference among treatments. In terms of TPC, the samples frozen at -70 and -196°C had higher values than that of the sample frozen at -20°C. In addition, drip loss of the sample frozen at -20°C was higher than those of other frozen samples. Therefore, these results suggest that freezing at -70°C can be an optimal freezing method to produce high-quality frozen lotus root.

Quality Change of ‘Delaware’ Grapes Treated with Chitosan during Storage

Su Jin Yum*, Ji Hoon Kang, Kyung Bin Song
Department of Food Science and Technology, Chungnam National University, Korea

To maintain the quality of ‘Delaware’ grape during storage, the grape samples were treated with 0.1% chitosan dissolved in 0.5% acetic acid, packaged with low density polyethylene (LDPE) film, and stored at 4 or 20°C for 12 days. The chitosan treatment reduced the initial populations of yeast and molds in the grapes by 1.86 log CFU/g, compared to that of the control. During storage, oxygen content in the packages of the samples decreased, but carbon dioxide content increased. In addition, regardless of storage temperature, the changes in oxygen and carbon dioxide concentration of the grapes treated with chitosan were lower than those of the control. Hardness of the samples decreased and Hunter L, a, b values were not significantly different among treatments. Regarding pH and total soluble content, the grapes stored at 4°C maintained pH and had more total soluble content than those stored at 20°C. These results suggest that chitosan treatment and low temperature storage can be useful for maintaining microbiological safety and quality of Delaware' grapes during storage.

Chemical Properties and Quality Characteristics of Saute and Dried Radish by Refrigeration Storage Period

Ji-Na Kim*, Young-Hee Park, Yun-Young Noh, Young Kim
Department of Agrofood Resources, National Academy of Agricultural Science, RDA, Korea

For development of Jong-ga (Jeonju Hakindang) recipe, this study investigated chemical properties, quality characteristics and microbiology of the saute and dried radish during storage period (0, 4, 8, and 12 weeks) at 4°C. Sliced radish samples with two different thickness of 3.5 mm or 7.0 mm were dried using hot air drying in 45°C or sun drying. Regarding their proximate compositions, the water contents of the sun dried radish in 3.5 mm, sun dried radish in 7.0 mm, hot air dried radish in 3.5 mm and hot air dried radish in 7.0 mm were 17.1, 18.6, 15.2, and 21.8%, respectively. Total polyphenol compounds and ABTS value of hot air dried radish were higher than those of sun dried radish than the radish sliced at 3.5 mm in both drying methods. The radish slices at 7.0 mm showed relatively high antioxidant activities. Chemical qualities, the pH, salinity, sugar content and Browning Degree, did not significantly change from initial state during the storage period of 12 weeks.

Sustained Release of Thyme Essential Oil from Halloysite Nanotubes for Antioxidant Food Packaging

Min Hyeock Lee*, Hyun Jin Park
School of Life Science and Biotechnology, Korea University, Korea

Thyme essential oils extracted from Thymus vulgaris L. was used for natural food preservatives. The major constituent of thyme oil is thymol that has antibacterial, antioxidant and anti-insect activities. However, the limitation of using thyme oil as active agents is their high volatility. Halloysite nanotube (HNT), Al₂Si₂O₅(OH)₄·2H₂O, is a aluminosilicate clay with hollow tubular structure. HNT is inexpensive, environment-friendly and naturally abundant in countries such as China, USA, and Korea. In this study, thyme oil was encapsulated into HNTs using a vacuum process in order to solidify the active agent from a liquid state and to sustain the release rate of thyme oil. Furthermore, the thyme oil-loaded HNTs were coated with Eudragit® EPO which is positive charged polymer to avoid initial burst release. The amount of thyme oil loaded into HNTs was determined using GC/FID. The morphology of the prepared samples was observed using FE-SEM and TEM. Eudragit® EPO coating was monitored by zeta-potential measurement. The release of thyme oil was sustained until 100 h with the HNTs at room temperature. The antioxidant activity of the prepared samples was evaluated using a DPPH assay.
**P08 -018**

Postharvest Quality Changes of Winter Kimchi Cabbage 'Woldong Janggun' by Pressure Cooling Treatment

Ae-Ri Han*, Ho Hyun Chun, Jungeun Cho, Young-Bae Chung

*World Institute of Kimchi, Korea*

This study was investigated to evaluate influence of precooling on postharvest physicochemical quality of kimchi cabbage (*Brassica campestris* var. *perkinensis* cv. 'Woldong janggun'). Kimchi cabbage was cultivated in Haenam and harvested in Feb., then packaged with plastic containers. Kimchi cabbage was applied with pressure cooling throughout the storage period (PP1) and pressure cooling for 10 days (PP2) to estimate the effect of postharvest treatment on physicochemical qualities during 5 week storage at 0.5°C. Weight loss in the Kimchi cabbage treated with pressure cooling was lower than control after 5 week of storage. Titratable acidity was slowly increased from 0.06% to 0.1% without oxygenation. Great antioxidant activity of the films was verified by DPPH radical scavenging assay. Existence of cross-links by the oxidized phenolics and the decrease in free amino groups in the films were verified by FTIR and TNBS assay, respectively. The degree of cross-linking increased with increasing concentration of the phenolics, resulting in higher tensile strength, lower elongation-at-break (%), water vapor permeability, water solubility and swelling property of the films. Increase in the phase transition temperature was confirmed by DSC. Among all the phenolic compounds, caffeic acid exhibited the highest cross-linking degree and improved mechanical, thermal and barrier properties in the composite film.

**P08 -019**

Effect of Vacuum-shrink Packaging and Natural Disinfectant Solution on the Shelf-life Extension of *Abay-sundae* during Chilled Storage

Ki Chang Song*, Jin Ho Lee, Endy Triyannanto, Keun Taik Lee

*Department of Food Processing and Distribution, Gangneung-Wonju National University, Korea*

The effects of vacuum-shrink packaging and natural disinfectant solution on the shelf-life extension of *abai-sundae* were examined during storage at 10°C for 28 days. The treatments were as follows: vacuum packaging with a polyamide/polyethylene film (PA/PE) (C), vacuum packaging with a polylvinylidene chloride and ethylene vinyl acetate copolymer film followed by heat shrinking at 85°C for 3 min in a water bath (T1), and spraying with a natural disinfectant solution followed by vacuum packaging with a PA/PE film (T2). T2 samples exhibited significantly lower pH and CIE a* and b* values and higher CIE L* values than those of C and T1 samples. Volatile basic nitrogen values did not differ significantly among samples. After 7 days of storage, the 2-thiobarbituric acid reactive substance levels were highest in C samples, followed by T2 and T1 samples. The T1 and T2 treatments significantly reduced the total aerobe counts, including those of *Lactobacillus* and coliforms. At day 28, sensory scores for the off-odour and flavour of T2 samples were the highest among the treatments. In conclusion, T1 and T2 treatments are recommended for extending *abai-sundae* shelf-life during chilled storage.

**P08 -020**

Influence of Different Phenolic Substances on Protein Cross-linking and Properties of Turmeric-gelatin Composite Film

Sang Eun Lee*, Soo Hyun Sung, Jaejoon Han

*Department of Food Bioscience and Technology, Korea University, Korea*

We investigated the cross-linking effect and properties of phenolic compounds (tannic acid and caffeic acid) and phe- nolic-rich substance (green tea extract) on the biodegradable composite films made of turmeric (*Curcuma longa*) and gelatin. Film-forming solution (FFS) was prepared by combining gelatin and turmeric flour suspension homogenized at pH 9 and 88°C for 4 h. The phenolic substances at various concentrations (1, 2, and 3%) were incorporated into FFS with/without oxygenation. Great antioxidant activity of the films was verified by DPPH radical scavenging assay. Existence of cross-links by the oxidized phenolics and the decrease in free amino groups in the films were verified by FTIR and TNBS assay, respectively. The degree of cross-linking increased with increasing concentration of the phenolics, resulting in higher tensile strength, lower elongation-at-break (%), water vapor permeability, water solubility and swelling property of the films. Increase in the phase transition temperature was confirmed by DSC. Among all the phenolic compounds, caffeic acid exhibited the highest cross-linking degree and improved mechanical, thermal and barrier properties in the composite film.

**P08 -021**

Development of Colorimetric pH Indicator Using Agar/Potato Starch Film with Anthocyanin

Inyoung Choi*, Kyungmo Kang, Jaejoon Han

*Department of Food Bioscience and Technology, Korea University, Korea*

Colorimetric pH indicator can be used for the intelligent food packaging system to detect the quality changes of food product. The aim of this study was to develop a novel pH indicator using agar/potato starch film incorporated with anthocyanin extracted from sweet potato, *Ipomoea batatas*. The anthocyanin, which changes the color from pink to green in the pH range 2.0-9.0, was immobilized in potato starch and agar solution as a natural pH dye. The film-forming solution was casted to make a dried indicator film. The pH sensitivity of the anthocyanin and indicator film was verified using a UV-vis spectrometer and colorimeter respectively after exposure to various pH ranges. Interaction between agar/potato starch and anthocyanin was observed using a fourier transform infrared spectroscopy (FT-IR). The pH-sensing film was applied to food packaging system. As a result, the color of pH indicator changed from pink to green because of the pH increase under improper storage condition. The result implied that the developed indicator film can be applied to intelligent food packaging system as a food spoilage indicator.
**Development of Non-metallic Oxygen Scavenger Using Sodium L-Ascorbate and Diatomite**

**Jung-Soo Lee**, Sang Eun Lee, Jaejoon Han  
*Department of Food Bioscience and Technology, Korea University, Korea*

Oxygen is a major cause of oxidative deterioration of foods. In order to prevent this problem, oxygen scavengers are efficiently used in food packaging industry. In general, however, oxygen scavengers are made of iron powder. These are sensed by the metal detector and prohibited from using microwave oven. Non-metallic materials do not have such disadvantages. The aim of this study was to make the non-metallic oxygen scavenger using sodium L-ascorbate and diatomite, and then evaluate its efficiency. In this oxygen scavenger formulation, sodium L-ascorbate reacts as an oxygen scavenging agent, the latter works as a carrier. To determine the optimum formulation of oxygen scavenger components, the oxygen scavengers with different mixing ratios of each component were prepared and measured their oxygen scavenging capacity. The quality attributes of foods packaged with oxygen scavenger were compared with the control samples without oxygen scavenger. Storage stability of experimental groups were superior to control groups. This result suggests that the developed oxygen scavengers can be effectively utilized in food packaging industry.

**Development of Natural Insect Repellent-loaded Halloysite Nanotubes against *Plodia interpunctella***

**Jeong-heon Kim**, Jaejoon Han  
*Department of Food Bioscience and Technology, Korea University, Korea*

*Plodia interpunctella* causes serious damages on grains by penetrating through packaging materials. Eugenol, a major compound of clove essential oil, was chosen as a bioactive compound due to the repellent activity against *Plodia interpunctella*. Since eugenol is volatile, halloysite nanotubes, which are clay mineral, were used for stabilizing eugenol to control the release rate for continuous repellent activity. Eugenol was loaded into halloysite nanotubes and halloysite nanotubes were coated with chitosan. Characteristics of halloysite nanotubes were observed using a FT-IR and zeta potential analyzer. Insect repellent tests were performed to evaluate the repellent activities of eugenol-loaded halloysite nanotube depending on chitosan coating. Thermal stability of eugenol-loaded halloysite nanotubes was verified using a DSC. In conclusion, eugenol was successfully loaded into halloysite nanotubes. The encapsulated eugenol with chitosan coating showed a prolonged repellent activity and higher thermal stability than encapsulated eugenol without chitosan coating. The developed insect repellent-loaded halloysite nanotubes could be applied to packaging materials for stored products.

**Effects of Storage Temperature on Quality of Wheat with Time**

**Eun Young Joo**, Tae Jong Kim, Sang Min Jin, Yang Il Kim, Jong Sik Park, Sang Yup Lee, Young Chul Hwang, Da Eun Lee, Sang Sook Kim  
*CJ Cheiljedang Corp., Korea, Korea Food Research Institute, Korea*

This study was performed to investigate changes in physico-chemical characteristics (moisture, ash, protein, falling number, and thousand kernel weight) of domestic wheat grain stored in different temperature levels: 10, 20, 30, and 40°C, and such characteristics of wheat grain were observed and analyzed for 12 months with 4 month interval. The results of this study showed that moisture, ash, and protein contents were generally constant regardless of storage temperature. However, falling number of the wheat grain stored at 30°C and 40°C was gradually increased with time implying decrease of wheat quality. In addition, weight of thousand kernel stored at 30°C was significantly decreased after 8 months and showed contamination caused by *Oryzaephilus surinamensis* (sawtoothed grain beetle). According to these result, storing the domestic wheat grain above 30°C is too risky to secure its quality; hence, storing at temperature lower than 20°C is the most ideal way to ensure its best quality.

**Application of Chitosan Based Carbon Dioxide Indicators to Monitoring Commercial Rice Wine Products**

**Xiangpeng Meng**, Sanghoon Ko  
*Department of Food Science and Technology, Sejong Uniesity, Korea*

Chitosan based carbon dioxide indicators that are placed inside sealed food packages will give consumers an easier way to find microbial spoilage of food. Based on the principle of changes in visual appearance of chitosan solution with pH, the generation of CO₂ from food products dissolve into chitosan indicator solution. To fabricate a carbon dioxide (CO₂) gas indicator, 0.3% brilliant blue R-250 dye (BB) was incorporated into the chitosan dissolved in 0.1 M HCl aqueous solution. The commercial *makgeolli* products were re-packed with the indicators attaching, then, parameter variation was observed at the storage condition of 26°C and 16°C in 7 days at 24 h interval, respectively. With *makgeolli* fermentation, the pH decrease from 7.0 to about 5.3 caused by CO₂ accumulation, the transparency increased from 46.1% to 64.8% both at room temperature (26°C) or 16°C. A higher temperature leded to a faster indicating reaction but the reaction is too fast and sensitive, it is needed that a re-test at a lower storage (10°C or 4°C) in the future study.
Change of Quality and Nutrient Value in Fresh-cut ‘Romaine’ Lettuce by Heat Treatment Condition

Jeong Mi Bae*, Moon Cheol Jeong, Da Uhm Lee, Jeong Hee Choi

Korea Food Research Institute, Korea

This study investigated the effect of heat treatments on the quality and nutrient value of fresh-cut Romaine lettuce by treating in hot water (45, 50, and 55°C) for 2 min. Sensory properties, microbial growth, browning, respiration, ethylene production, total phenolics (TP), chlorophyll (CHL), vitamin C, and antioxidant properties (DPPH, ABTS, and FRAP assays) of samples were evaluated after 5 days at 5°C. The 50°C heat treatments exhibited the best quality index including texture, color, microbial growth and browning. Heat treatments did not affect the change in TP but increased CHL a and b content after storage. The 50°C heat treatment was the most effective in promoting CHL a and b content. The influence of heat treatments on antioxidant properties was very contradictory depending on treatment temperatures. Only 50°C treatment showed significant increase in vitamin C content and antioxidant activity of fresh-cut Romaine lettuce after storage.

Fabrication of Cholecalciferol (Vitamin D3)-loaded Nanostructured Lipid Carriers (NLCs)

Sung Jin Park*, Eun Ju Baek, Hyun Jin Park¹, Jun Tae Kim

Department of Food Science & Technology, Keimyung University, Korea, ¹College of Life Sciences & Biotechnology, Korea University, Korea

Nanostructured lipid carriers (NLCs) containing cholecalciferol (Vit-D) were fabricated and their processing conditions were optimized for potential application in delivery system and improvement of their stability. NLCs consist of both solid lipid and liquid lipid while emulsions consist of only liquid lipid. The highest solubility of Vit-D was obtained in oleic acid (OA) by oil screening method. For the solid lipid screening, a new method was developed based on the principle of drug encapsulation rate on solid lipid and glycerol mono-stearate (GMS) was selected as a solid lipid for Vit-D. The ratio of OA and GMS was optimized by Vit-D concentration in oil phase. Tween 80 was used as a good surfactant for Vit-D-loaded NLCs. Mean particle sizes of NLCs were 118.9 nm and 132.0 nm, respectively, when the surfactant contents were 3.3% and 6.6% (w/v). Particle size of NLCs was significantly decreased by homogenization and ultrasonication. The toxicity of NLCs was evaluated by particle size of NLCs.

Antioxidative Activity, Vitamin C, Anthocyanins of Apple Cultivated at Different Local Area

Hyo Jin Kim*, Jeong Ho Lim, Kee Jai Park, Moon Cheol Jeong

Korea Food Research Institute, Korea

Antioxidative activity and the contents of vitamin C and anthocyanins were compared with ‘Fuji’ apples cultivated at A, B, C, D (Muju, Andong, Chungju, Yesan) in 2014. Vitamin C and antioxidative activities (total phenolics, FRAF, DPPH radical scavenging activity, ABTS radical scavenging, flavonoids content) were much higher in peel than flesh of the apple. Especially, the more total phenolics were, the higher antioxidative activity were in the apples. In total phenolics and FRAP were high in peel of apple A and B among the groups. Vitamin C of peel was highest, 7.76 mg/100 g FW in apple D. Dehydroascorbic acid was the dominant component of vitamin C in apple C, while the other apples were mostly coexisted in the form of dehydroascorbic acid and ascorbic acid. There were a strongly positive correlation between the content of vitamin C and flavonoids. The major anthocyanin of apple was identified as the cyanidin form and the contents in the peel were higher as shown by antioxidative activity and the content of vitamin C.

Migration of Silver from AgNPs-applied Food Packages and Their Antimicrobial Test

Yu Mi Jo*, Jae Yeol Lee, Seung Hwan Kim, Jun Tae Kim

Department of Food Science & Technology, Keimyung University, Korea

Silver nanoparticles (AgNPs) have been widely used in many food packages due to their recognized antimicrobial properties. However, many consumers have concerned about their potential toxicity and harmful effects. Commercially available AgNPs-applied baby bottle was chosen to migration test of silver. Total Ag content in the sample was about 1.34 μg/g which was obtained using ICP-MS after calcination of 1 g sample at 600°C. Migration of AgNPs has been tested using four food simulants such as distilled water, 3% acetic acid, 10% ethanol, and n-heptane at 25, 40, and 60°C for 5, 10, and 20 days. Total amount of silver migrated from the baby bottle was determined by ICP-MS directly from the migration solutions. Migration of Ag was only observed in distilled water and 3% acetic acid while no migration was found in 10% ethanol and n-heptane. For 3% acetic acid, Ag migration was detected over all conditions and increased with migration time and temperature. Maximum migration of Ag was 2.27 μg/L which was obtained in 3% acetic acid migrated at 60°C for 20 day. Antimicrobial test AgNPs-applied baby bottle was carried out using disc-diffusion and grows activity of E. coli.
Preparation of Nanoemulsion (NE) and Their Potential as a Tumeric Extract (TE) Delivery Carrier

Su Bi Lee*, Su Jung Hong, Jun Tae Kim
Department of Food Science & Technology, Keimyung University, Korea

Curcumin is a major component of the plant *Tumeric*. It is traditionally used as a spice and coloring in foods and is an important ingredient in curry. Although curcumin has a lot of biological activities such as antioxidant, antimicrobial, anticancer, anti-inflammatory, its application has been limited due to its low solubility and bioavailability in the body. Among the various delivery formulations for water insoluble curcumin, nanoemulsion (NE) has been considered as one of the good candidates for the application to commercial products such as functional beverages and powders. *Tumeric* extract-loaded nanoemulsion (TE-NE) was fabricated with various ratios of oil, surfactant and distilled water using ultrasonication (US). Physicochemical properties of TE-NE such as particle size and zeta potential were characterized using particle size analyzer (ELSZ-2000). MCT oil was used because of the highest solubility of TE in MCT oil by oil screening test. The mean droplet sizes of TE-NE were ranged from 112.6 nm to 614.9 nm and its zeta potentials were ranged -22.36 mV from -8.85 mV.

Changes of Volatile Components on Vegetable Oils depending on Various Storage Conditions

Hyemin Dong*, Jin-Young Choi¹, Bong Soo Noh
Department of Food Science and Technology, Seoul Women’s University, Korea, ¹Division of Food Science and Culinary Arts, Shinhan University, Korea

The objective of this study is to analyze volatile components from vegetable oils under various LEDs irradiation during 4 weeks with various storage conditions. The pattern changes of volatile components were analyzed by electronic nose based on mass spectrometer. It was observed that vegetable oils affected by storage containers. Polyethylene (PE) bottle showed the most changes in volatile components rather than transparent glass bottle. And volatile components of vegetable oils with 5 PE pieces were more changed rather than without PE pieces. The most change was shown in vegetable oils with 5 PE pieces under fluorescent light during 4 weeks. When samples were heated, as temperature increased higher, change of volatile components more decreased. After heat treatment, change of volatile components on vegetable oils increased once again under various LEDs and fluorescent light irradiation. Volatile components of vegetable oils were most influenced under fluorescent light rather than any other LED irradiation. In case of light intensity, the higher light intensity was provided, the more volatile components were changed.

Preparation and Characterization of Jellyfish Protein Films

Ji-Hyun Lee*, Ji-Hyeon Lee, Hyun-Ju Yang, Kyung Bin Song
Department of Food Science and Technology, Chungnam National University, Korea

The jellyfish is widely distributed in the Yellow Sea, but it has toxins that can harm fishery resources. However, jellyfish is rich in collagenous protein that can be converted into gelatin. In this study, the physical, optical, antimicrobial, and antioxidant properties of jellyfish protein (JFP) films with added transglutaminase (TGase) and wasabi extract (WE) were studied. The optimal physical properties of the JFP films were obtained when 15 U TGase/g JFP was added. The incorporation of WE affected the physical properties of the JFP films. The tensile strength (21.68 to 35.25 MPa), elongation at break (10.85 to 13.23%), and Young’s modulus (920.18 to 1278.9 MPa) of the films increased as WE concentration increased from 0.5 to 1.5%. The thermal gravimetric analysis results revealed that the thermal stability of the JFP films increased with increasing concentrations of WE. The inhibition zones against *Escherichia coli* O157:H7 and *Listeria monocytogenes* and antioxidant activity also increased as the concentration of WE increased. Thus, antimicrobial and antioxidant JFP films could be prepared by the addition of WE.

Effect of Ascorbic Acid Content on Browning and Physicochemical Properties in Ripened Persimmon (*Diospyros kaki*. cv. Daebong) Puree during Freeze-thaw Cycles

Ji-Hyun Min*, Chang-Gon Lee, Jong-Bang Eun
Department of Food Science and Technology and Functional Food Research Center, Chonnam National University, Korea

The physicochemical changes of ripened persimmon puree (RPP) added with different levels of ascorbic acid (AA) were investigated during freeze-thaw cycles (0-5). The AA 0.6% (AA1), 0.8% (AA2), and 1.0% (AA3) (w/w) was added to the RPP. In color, L and b values during 0-3 freeze-thaw cycles decreased and there was no significant difference during 3-5 cycles, while control decreased with increasing freeze-thaw cycle numbers. Polyphenol oxidase (PPO) activities of AA2 and AA3 during 3-5 freeze-thaw cycles were inhibited at 49.18 and 49.62%. There was no significant difference in pH of AA3 while control decreased with increasing cycle numbers. Vitamin C content of all samples was not significantly different during 3-5 freeze-thaw cycles while it decreased during 0-3 freeze-thaw cycles. In conclusion, number of freeze-thaw cycles of RPP added with AA affected color value, PPO activity and pH and 1.0% AA addition showed the highest inhibition browning in RPP. Sensory evaluation and microbiological characteristics of the RPP will be conducted in the future.
**Effects of the Combined Treatment of Aqueous Chlorine Dioxide and Organic Acids on the Microbial Reduction in *Aster scaber***

Ji Hoon Kang*, Shin Min Park, Hyun Gyu Kim, Hyun Jung Son, Ka Yeon Lee, Jong-Tae Park, Kyung Bin Song

Department of Food Science and Technology, Chungnam National University, Korea

Consumption of wild edible greens increases because of well-being trend. However, there are health risks associated with contamination by microorganisms in wild edible greens. In this study, to control the initial populations of microorganisms in *Aster scaber*, the effects of the combined treatment of aqueous chlorine dioxide (ClO₂) and organic acids on the microbial reduction in *Aster scaber* were examined. The samples were treated with 50 or 100 ppm of ClO₂, 0.3 or 0.5% of citric acid or fumaric acid, as well as a combination of 50 ppm of ClO₂ and 0.5% of citric acid or fumaric acid. The populations of total aerobic bacteria in *Aster scaber* decreased by 2.21-3.03 log CFU/g after treatment with ClO₂ or organic acids alone, and those of yeast and molds decreased by 0.60-1.39 log CFU/g. On the contrary, the combined treatment of ClO₂ and citric acid or fumaric acid reduced the initial populations of total aerobic bacteria and yeast and molds by 3.59-3.93 and 2.39-2.63 log CFU/g, respectively. These results suggest that the combined treatment of ClO₂ and organic acid can be more effective than any single treatment to control the initial microbial populations in *Aster scaber.*

**Usefulness of Smartphone-based Compact Refrigerator Monitoring System Coupled with Built-in Camera and Sensors**

Do-Youn Im*, Kyoung-In Lee¹

Division of Liberal Arts and Teacher Training, Kwangju Women's University, Korea, ¹Biotechnology Industrialization Center, Dongshin University, Korea

Nowadays, more home appliances such as refrigerator for one person or two people have been released. Also, the transforming trend can be attributed such as more working women and men in common home raising the demand for time-saving products that help to manage a family and a career. In addition, people sometimes litter their foods in refrigerator after they pass the “best before date”. In the meantime, the spread of Wi-Fi and online applications makes it easy to accomplish many tasks on the go with handheld devices. Therefore, we suggest smartphone-based compact refrigerator monitoring system under the conditions of Wi-Fi coupled with built-in camera and sensors in this project. The finished product has a built-in camera and sensors, and a Wi-Fi antenna. The latest picture was taken by built-in camera before a closing the refrigerator door. The camera image and information is sent to the monitoring device such as smartphone via Wi-Fi. These transmission can be connected with a specially developed smartphone app.

**Combination Effect of Microbubble and Hot Water Washing for Freshness Prolongation of Organic Perilla Leaf**

Ji Young Lee*, Eun Young Jo, Kee Jai Park, Jeong Ho Lim, Moon Cheol Jeong

Korea Food Research Institute, Korea

This study was carried out to investigate the freshness prolongation effects of organic perilla leaf by various washing system. The samples were divided into bubble washing group (Control), bubble-micro bubble-hot water washing group (CHM), hot water-micro bubble washing group (HM), micro bubble-hot water washing group (MH), and combined micro bubble and hot water washing group (M+H). Then samples were packaged with PP film and stored to 20°C. All samples were treated for 2 min in the washing system, and hot water washing system was treated for 2 min under 40°C. Respiratory rate, ethylene production, electric conductivity, hardness, color, microorganism and decay rate were measured during 8 days. For the respiratory rate and ethylene production, M+H group showed the lowest among the treatment. M+H showed 3 times lower date in outflow rate compared to other treatment in electric conductivity. M+H group reduced 3.0 log cycle in the total viable cell count while HM, MH and M+H reduced 2.0 log cycle in the mold count more than control at 8 days. Also, M+H group showed two times lower in decay rate compare to control and this approves that it is effective way to extend the freshness.

**Effect of Hot Water Micro-bubble Washing Treatment on Freshness Prolongation and Microorganism Control of Organic Green Leaf Lettuce**

Eun Young Jo*, Ji Young Lee, Kee Jai Park, Dong Man Kim, Moon Cheol Jeong

Korea Food Research Institute, Korea

This study was aimed to compare the effect of washing treatments by micro-bubble (MB), city-water macro-bubble (WB), hot-water macro-bubble (HB), and hot-water micro-bubble (HMB) on freshness prolongation and microorganism control of organic green leaf lettuce. The time for all the treatment was two minutes, respectively and hot water temperature was 45°C. The treated samples were wrapped with PP film after dewatering, and then stored at 5°C. Foreign materials were remained in WB treatment group after washing, but almost all the materials were removed by HB, MB, and HMB treatments. HMB had the effect of extending freshness about two times or more through suppressing the highest rate of respiration, ethylene production, browning, and tissue damage rate compared to other treatment groups. In reduction of aerobic bacteria immediately after washing, HMB treatment group showed the lowest level of approximately 3 log CFU compared to the control group. In case of the level of mold, the groups treated by HB, MB, and HMB showed approximately 2.2-2.4 log CFU lower than the control group after 9 days storage.
**Quality and Antioxidant Activities of Korean Oat Cultivar During Storage**

Mi Ja Lee*, Song Min Oh, Woo Duck Seo, Kyung Hye Seo, Hyeon Jung Kang, Sun Lim Kim  
Crop Foundation Division, National Institute of Crop Science, Korea

Oat grains (*Avena sativa* L.) are rich in lipids with a high content of unsaturated fatty acids. They also contain various compounds with anti-oxidative activities that protect the lipids from oxidation and are important for the storage stability of various oat products. In this study, we stored Korean oat cultivar in different temperature chamber and sampled every 15 days. Protein, starch, β-glucan, and total phenol contents were investigated. During the storage, the protein content didn't change significantly. Starch content was investigated during storage. There was no significant change at room temperature (RT). However, the content increased steadily in samples stored at 4°C and 15°C. β-Glucan content of oat stored at 4°C didn't change significantly. However, content of samples stored at 15°C and RT significantly decreased. DPPH activity and total phenol content were decreased.

**Changes in Physicochemical and Microbiological Properties and Estimation of Shelf-life of Beef Sirloin under Different Freezing Temperature**

Jeong Ah Park*, So Young Joo, Hyun Jung Hwang, Ye Seul Na, Seo Jin Kim, Jeong In Choi, Joo Young Ha†, Mi Sook Cho  
Department of Nutritional Science & Food Management, Ewha Womans University, Korea, †Samsung Electronics, Korea

This study was conducted to estimate shelf-life of beef sirloin through investigating the changes in pH, Volatile Basic Nitrogen (VBN), Thibarbituric acid (TBA) values, a* (redness), shearing force and microbiological evaluation (total plate count) and establish its shelf-life during freezing storage at -1, -5, and -20°C for 21 days. Total plate count (TPC) as an effective quality indicator was used to estimate shelf-life with Regression Analysis. Changes of pH, TBA values and the number of TPC were significantly increased with storage periods at -1°C and -5°C. β-Glucan content of samples stored at 15°C and RT significantly decreased. DPPH activity and total phenol content were decreased.

**Antimicrobial Activity of Essential Oil-incorporated Chitosan-based Film**

Enkhbolor Buyanbadrakh*, Jun-Hyun Oh  
Department of Plant and Food Sciences, Sangmyung University, Korea

This research aims to investigate the antimicrobial effects of chitosan-based film containing essential oil (origanum oil, OG). Chitosan-based films were fabricated with selected concentrations of OG (0.01-0.1%). The mechanical properties such as tensile strength and elongation were determined and the antimicrobial activity was determined using disc diffusion method. The pathogens include *Staphylococcus aureus*, *Salmonella enterica*, *Escherichia coli*, and *Propionibacterium acnes*. The optimum concentrations of chitosan and glycerol were 2.5% (w/v) and 25% (v/v), respectively. The incorporation of OG into chitosan-based film did not alter the mechanical properties significantly. The greatest antimicrobial activity of the film was obtained against *S. aureus*, exhibiting a diameter of clear zone of 17 mm at 0.2% OG. The diameters of clear zones of the film against *P. acnes* and *E. coli* were 11 mm at 0.5% OG and 14 mm at 0.7% OG, respectively. There is no clear zone observed against *S. enterica* from the tested concentration. This research suggests that the chitosan-based film containing OG could be used for natural wound dressing material against skin pathogens.

**Quality Changes and Estimation of Shelf-life of Mackerel Fish Fillet under Different Freezing Storage Temperature**

So Young Joo*, Jeong Ah Park, Hyun Jung Hwang, Ye Seul Na, Seo Jin Kim, Jeong In Choi, Joo Young Ha†, Mi Sook Cho  
Department of Nutritional Science & Food Management, Ewha Womans University, Korea, †Samsung Electronics, Korea

The purpose of this study is to evaluate changes in the quality characteristics of a mackerel fish fillet under freezing storage conditions. This study investigated the quality changes in pH, Volatile Basic Nitrogen (VBN), Thibarbituric acid (TBA) values, L* (lightness), a* (redness), b* (yellowness) value, shearing force and microbiological evaluation (Total Plate Count) of products and establish its shelf-life while storage for 21 days at -20, -5, and -1°C. The results of TBA values were significantly increased and also VBN measurements were increased with storage periods at -1°C and -5°C (p<0.05). Changes of hunter value L*, a*, and b* and the number of total plate count (TPC) were increased during storage periods at every temperature (p<0.05). The TPC showed significant relationships with the temperatures at -1°C (r = 0.944), -5°C (r = 0.925) and -20°C (r = 0.666). Therefore, our results suggest that the estimated shelf-life was 27 days at -1°C, 52 days at -5°C and 84 days at -20°C.
Novel Chitosan Films with S. chinensis Extract for Anti-microbial Packaging Application

Vita Jarolimková1,2,3*, Weon-Sun Shin2
1Erasmus Mundus Master in Food Innovation and Product Design (FIPDes), 2Laboratory of Food Chemistry, Department of Food and Nutrition, Hanyang University, Korea, 3Department of Packaging Logistics, Lund University, Sweden

Chitosan films for food packaging applications were prepared from shrimp and insect chitosan, enriched with S. chinensis extract. Physicochemical and antibacterial properties of the films were studied and compared with similar natural polymers. Chitosan is a biodegradable polymer, mostly harvested from shells of crustaceans, which has been studied for packaging applications, as it can improve shelf life of products, especially when enriched with antibacterial and antioxidant compounds. The addition of these substances, such as herbal extracts, influences the physicochemical properties of the film, which are important parameters for characterization of packaging material, as it is necessary to assess its ability to fulfill the necessary requirements. The originality of the work lies in the use of extract from S. chinensis, which has not been used in films before and which demonstrated antibacterial effect on Gram-positive bacteria, and in harvesting chitosan from insects (G. bimaculatus), as all previous experiments with chitosan films have been done with shrimp chitosan. Moreover, during the extraction of insect chitosan, novel and effective decolorization method was discovered.

Effects of the Brine Containing Calcium Chloride and Magnesium Chloride on Qualities and Texture of Salted Kimchi Cabbage

Hye-Yeon Song1, Seung Ran Yoo, Sang-Un Park, Young-Bae Chung
World Institute of Kimchi, Korea

This study was conducted to evaluate the influence of the brine containing calcium chloride and magnesium chloride on qualities and texture of salted kimchi cabbage. Kimchi cabbages were salted in the various brines containing calcium chloride (0.02 and 0.4%), magnesium chloride (0.1 and 2.0%) and mixed calcium chloride and magnesium chloride and then stored at 0°C for 15 days. The pH, titratable acidity, hardness, chewiness, springiness and microbial analysis were analyzed during the storage period. The titratable acidity of the salted kimchi cabbage was 0.14-0.17% during storage. The hardness of kimchi cabbage salted with the brine containing calcium chloride/magnesium chloride was higher than control during 9 days, but after 12 days there was no significant difference among treatment. The initial population of lactic acid in salted kimchi cabbage was 0.14-0.17% during storage.

Effects of Buckwheat and Fermented Buckwheat on the Physicochemical and Textural Properties of Pork Patties

Min-Gu Ju*, Ji-Han Kim, Jin-Ju Bae, Min-Young Jeon, Na-Youn Lee, Woo Joon Park, Chi-Ho Lee
Department of Food Science and Biotechnology of Animal Resources, Konkuk University, Korea

This study was investigated to assess the effects of buckwheat (BW) and fermented buckwheat (FBW) on the proximate compositions, pH change, cooking quality, lipid oxidation, and textural properties, and sensory characteristics of pork patties. Pork patties treated with BW and FBW were divided into six groups: Control, non-treated patties; T0, reduced fat patties; T1 and T2, addition of 1% and 3% BW; FT1 and FT2, addition of 1% and 3% FBW. FBW showed significantly higher antioxidant activity and the total phenolic contents than BW (p<0.05). FT2 had significantly lower the level of lipid oxidation than other groups (p<0.05). BW and FBW significantly reduced expressible drip and cooking loss (p<0.05). Pork patties prepared with BW and FBW exhibited higher redness value of uncooked and cooked patties. Texture profile analysis of patties revealed that the addition of BW and FBW significantly decreased the hardness and increased tenderness. The 1% BW (T1) and FBW (FT1) appeared to be the most effective means of improving the overall properties of pork patties when they were used for meat products such as patties.

The prepared kimchi sauce was made for easy making kimchi with “Do-It Yourself: DIY” concept. For making prepared kimchi sauce, focus group interview was performed with eight Korean married young women. The kimchi made with prepared kimchi sauce was performed consumer acceptance test to 110 consumers. As the consumer acceptance analysis on the just making kimchi (gut-jeul-i) with prepared kimchi sauce, the percentage marked “very like” and “like” were 25% and 68%, respectively. The percentage of that on the fermented kimchi were similar with the just making kimchi. The percentages of the consumer acceptance for prepared kimchi sauce marked “very like” and “like” were 12% and 76%, respectively. The percentage of purchase intend for prepared kimchi sauce marked “very like purchase” and “like purchase” were 10% and 79%, respectively. As a conclusion, Korean consumer likes the kimchi made with prepared kimchi sauce and they want to buy the prepared kimchi sauce.
Sensory Analysis for China Foreign Student of Prepared Kimchi-sauce for Globalization of Kimchi

Myung-Woo Byun1,*, Sung-Seo Myung1, Da-Eun Beak1, Seung-Yeon Shin1, Myung-Gon Shin1, Peng Peng2, Hyun-A Kang3, Hyea-Mi Nam5, Gyu-Hee Lee5,6,7  
1School of Culinary Nutrition, Woosong University, Korea, 2Department of Foodservice Management, Woosong University, Korea, 3IC Food Co. Ltd., 4Culinary Science Research Center, Woosong University, Korea

For globalization of kimchi for China, eight persons of China foreign students were participated as a focus group interview. They were developed prepared kimchi sauce with “Do-It Yourself: DIY” concept. The kimchi made with prepared kimchi sauce was performed consumer acceptance test to 107 China foreign students. The consumer acceptance analysis results, 99% of China foreign student had been experienced kimchi and 90% of them has been eaten the kimchi at Korea. Forty eight percent of them are eating the kimchi over one time per one day. On the just making kimchi (gut-jeul-i) with prepared kimchi sauce, the percentage marked “very like”, “like”, “so so” were 13, 33, and 47%, respectively. The percentages of the consumer acceptance for fermented kimchi made with prepared kimchi sauce marked “very like”, “like”, “so so” were 5, 27, and 48%, respectively. The percentages of the consumer acceptance for prepared kimchi sauce marked “very like”, “like”, “so so” were 8, 34, and 51%, respectively. The percentage of purchase intend for prepared kimchi sauce marked “very like purchase”, “like purchase”, and “so so” were 6, 26, and 53%, respectively.

Sensory Analysis for Vietnam Foreign Student of Prepared Kimchi-sauce for Globalization of Kimchi

Myung-Woo Byun1,*, Kyung-Hee Cho1, Eun-Ji Kang1, Myung-Gon Shin1, Hyun-A Kang2, Hyea-Mi Nam2, Gyu-Hee Lee2,4  
1School of Culinary Nutrition, Woosong University, Korea, 2IC Food Co. Ltd., Korea, 3Culinary Science Research Center, Woosong University, Korea

The kimchi made with prepared kimchi sauce was performed consumer acceptance test to 106 Vietnam foreign students. As the result, they want to put the coriander leaf in Gut-Jeul-I. As the consumer acceptance analysis results, 97% of Vietnam foreign student had been experienced kimchi and 60% of them has been eaten the kimchi at Korea, others has experienced at Vietnam. A hundred percent of them are eating the kimchi over one time per two days. On the just making kimchi (gut-jeul-i) with prepared kimchi sauce, the percentage marked “very like”, “like”, “so so” were 10, 44, and 33%, respectively. The percentages of the consumer acceptance for fermented kimchi made with prepared kimchi sauce marked “very like”, “like”, “so so” were 5, 27, and 48%, respectively. The percentages of the consumer acceptance for prepared kimchi sauce marked “very like”, “like”, “so so” were 10, 47, and 40%, respectively. The percentage of purchase intend for prepared kimchi sauce marked “very like purchase”, “like purchase”, and “so so” were 3, 23, and 67%, respectively.

Physicochemical Properties of the Prepared Kimchi Sauce

Myung-Woo Byun1,*, You-Rhim Park1, Seung-Yeon Seo1, Ji-Su Shin1, Kyung-Hee Cho1, Myung-Gon Shin1, Hyun-A Kang1, Hyea-Mi Nam2, Gyu-Hee Lee1,4  
1School of Culinary Nutrition, Woosong University, Korea, 2IC Food Co. Ltd., Korea, 3Culinary Science Research Center, Woosong University, Korea

The physicochemical properties of prepared kimchi sauce were analyzed for confirming of its storage stability. The prepared kimchi was made with mixture of fish sauce, salt, apple extract, capsicum extract, vegetable extract, yeast extract (Hyomoro) and gum. These mixtures were sterilized at 90°C for 30 min. As the physicochemical properties, viscosity, color, emulsion separation, pH, titrable acidity, and general bacteria count were analyzed per each weeks during 8 weeks at 5, 25, and 45°C with 75% relative humidity. Viscosity were getting lower trend according to storage periods at each temperature. Viscosity changes have shown the less value the higher storage temperature. However, that at 5°C storage has not shown any changes. In color changes, L, a, and b values were not changed at 5°C storage during storage periods. At 25°C storage, a and b values were not changed during storage, but L values were little less. The values of pH and titrable acidity were not changed during storage except stored at 45°C for 7 weeks. The bacterial count was not shown during storage period.

Comparison of General Fermented Kimchi and the Fermented Kimchi Made with Prepared Kimchi Sauce

Myung-Woo Byun1,*, Myung-Sung Seo1, Da-Eun Beak1, Jin-Woo Kim1, Myung-Gon Shin1, Hyun-A Kang2, Hyea-Mi Nam2, Gyu-Hee Lee1,4  
1School of Culinary Nutrition, Woosong University, Korea, 2IC Food Co. Ltd., Korea, 3Culinary Science Research Center, Woosong University, Korea

The kimchi made with the prepared kimchi sauce were compared with generally made kimchi. Comparisons were done through analysis of pH, titrable acidity, salt content, color, texture and microbial count store during 8 weeks at 4°C. For analysis of pH, titrable acidity, salt content and color, samples were prepared after mixing of 50 g kimchi stem part and 25 mL kimchi soup part filtering by using gauze. Analysis of texture was performed pressure and cutting strength of stem part of middle leaf by using Rheometer. As the result, the value of pH and salt content were getting lowered and titrable acidity were getting increased during storage, however, the values between treatments were not shown statistical differences. In analysis of rheological properties, the trends of strength change were getting increased and then decreased. That of cutting strength was getting increased. However, the differences between treatments were not shown. In color, the values of L, a, and b were increased and then decreased, however the differences between treatment were not shown. In microbial count, the count general and Lactobacilli bacteria were increased and then decreased.
Quality Properties of Dried Noodles Added Defatted Rice Bran Powder

Lan Hee Jung*, Bock Hee Park1, Eun Raye Jeon, Da Hee Joo
Department of Home Economics Education, Human Ecology Research Institute, Chonnam National University, Korea

This study investigated the quality characteristics of noodles added defatted rice bran powder (DRBP). Noodles were prepared at concentration of 0, 5, 10, 15, and 20% based on flour weight. Proximate composition of defatted rice bran powder were moisture 12.50%, ash 10.70%, crude fat 5.80%, crude protein 16.20%, carbohydrate 54.80%. Water binding capacity, solubility and swelling power of defatted rice bran powder were higher than that of wheat flour. Gelatinization points of the composite DRBP-wheat flour by amylograph increased with increasing concentration of DRBP. In case of maximum viscosity decreased from 234 B.U. in control to 181 B.U. in 20% noodles added DRBP. For Hunter’s color values of noodles, L and a values decreased with increasing concentration of DRBP whereas b value increased. Cooking characteristics of noodles increased with increasing concentration of DRBP such as weight, volume, and water absorption. In the sensory test, noodles containing 10% DRBP were the most preferred in color, taste, and overall preference. In conclusion, the results of this study were suggested that the addition of 10% DRBP was optimum for improving quality of noodles.

Effect of β-Glucan-enriched Pleurotus eryngii Mushroom Powder on Quality Characteristics of Common Wheat Pasta

Tong Li*, Sun-Hee Kim, Jihyun Park, Bo-Ra Kim, So-Hee Yoon, Tong Li, Jo-Won Lee, BoKyung Moon
Department of Food and Nutrition, Chung-Ang University, Korea

In this study, we aimed to produce the pasta with common wheat flour adding β-glucan-enriched Pleurotus eryngii mushroom powder (BGPM) and to evaluate the effect of BGPM on the quality and cooking properties of pasta. All pasting properties were reduced with the added amount of BGPM except for breakdown viscosity. Replacement of the common wheat flour with BGPM caused reddish brown color with lower L* value and higher a* value than common wheat flour. The common wheat pastas containing up to 4% BGPM did not show any significant difference with semolina pasta on cooking loss (p<0.05). There were no significant differences of swelling index and water absorption between semolina pasta and common wheat pasta containing up to 2% BGPM. The results in this study showed that substitution with BGPM for common wheat flour showed a possibility to produce a new type of pasta with improved quality characteristics as well as compatible texture properties to semolina pasta.

Development of Radish Tea Beverage with Antioxidant Activity

Seulki Kim*, Mijeong Kim, Koeun Jung1, Yeong Ok Song
Department of Food Science and Nutrition, and Kimchi Research Institute, Pusan National University, Korea; 1Department of Food and Nutrition, Chung-Ang University, Korea

To develop carbonated low calorie radish tea beverage with antioxidant activity, radish was sliced, dried and then roasted with pressure. Barley and cassia seeds were selected as a main ingredient to increase antioxidant activity of tea. To make low calorie with sweet taste beverage, sugar was replaced by invert sugar syrup, stevia, or scFOS. CO2 was added to increase the freshness of beverage. Radish tea was prepared as follows: hot water extracts of roasted radish, barley, and cassia seed were mixed (3:1:1/v:v:v) and then citric acid (0.01%) and Vt C (0.05%) were added to it. Mixture of invert sugar syrup (54.4 g/L), stevia (0.73 g/L), and scFOS (17 g/L) were added. Radish tea of 700 mL was put in a 1 L gas jar and CO2 was injected. Total calorie and sweetness of the final beverage were 19.1 kcal/100 mL and 6.5°Bx, respectively. Consumer’s preference test of radish tea beverage were performed with 60 volunteers by comparing 4 other beverage commercially available on the market. Willingness to purchase the radish tea beverage developed in this study was significantly higher than carbonated barley tea beverage on the market (4.9 vs 3.9 points, p<0.05).

Quality Characteristics of Spread with Pleurotus eryngii Mushroom Powder

Jo-Won Lee*, Jihyun Park, Bo-Ra Kim, So-Hee Yoon, Tong Li, BoKyung Moon
Department of Food and Nutrition, Chung-Ang University, Korea

Mushrooms have been widely used as food or food ingredients in various food products. Also, because of unique flavor of mushrooms, they have been used in the form of powders as additives in functional foods. The objectives of this study were to evaluate the effect of mushroom in spread on the quality and sensory characteristics of it. In this study, we screened umami flavor of mushrooms and select a proper one to produce a mushroom spread. Base on a screening test, Pleurotus eryngii mushroom was selected for spread production. Spread was prepared with different levels of Pleurotus eryngii mushroom powder (PEMP: 0, 3, 5, 7, and 10%). Saliency of spread with PEMP was significantly lower than control. Sugar content and pH increased significantly by the addition of PEMP (p<0.05). L* value of spread decreased with the addition of mushroom powder, whereas a* and b* values increased. Base on a result of sensory evaluation, a spread with 5% of mushroom powder was considered as the best one.
Quality Characteristics of Korean Wheat Bread with Mulberry Leaf Powder

Beom-An Kim*, Hye-Jin Kim, Inhwa Han, Byung-Geon Park
Department of Food and Nutrition, Kwangju Women’s University, Korea

This study examined the quality characteristics of bread made from Korean wheat with dried mulberry leaf powder in various content. Dried mulberry leaf powder was added into bread in 0, 2, 4, 6, and 8%, and the breads were examined in moisture content, bread volume, and texture for 4 days of storage. Moisture content increased with the amount of mulberry to 4% but there was no significant difference in 6% and 8% bread. Bread volume was decreased as the addition of mulberry powder increased. Hardness was increased with the storage time and 4% bread exhibited larger increase than the others. Gumminess, chewiness, and adhesiveness are generally increased with the storage time. Springiness decreased in 0% bread but increased in the bread with mulberry. Meanwhile cohesiveness decreased in the bread with mulberry but increased in 0% bread after 3 days of storage. Overall the quality of bread was acceptable in the bread with mulberry to 4% but the addition of mulberry higher than 6% exhibited loss of quality.

Sensory Flavor Characteristics of Roasted Barley Extract and Development of Barley Beverage

Soong-Nyong Shin*, You-Rhee Lee
Korea Tourism College, Korea

As the barley contains β-glucan (beta-glucan), a kind of dietary fiber that has been known to aid in digestion and diet, it has been given the recent popularity as health food. In these days demand of barley product, such as barley sikhye, barley ddudek, barley bread, drinks and a variety of products to market is steadily increasing. In this study, the pretreatment method of manufacturing conditions were investigated in order to produce roasted barley drink, by rotating time, temperature and optimal extraction conditions with the sensory characteristics. Roasted barley prepared under optimum conditions for barley extract was introduced in the liquid beverage to reflect the preliminary taste evaluation results for optimum dose of the barley extract. Barley washed, immersed for 30 min, drained for 1 h and roasted in a pre-heated to 250°C roaster for 145 min showed savory flavor and no fishy smell. Hot water extraction of roasted barley showed less fishy flavor and a bit of a bitter taste, when 10 kg of roasted barley were extracted with 25 kg of water and concentrated to 20 kg. However, the extract was most appropriate to beverage for strong nutty flavor.

Quality Characteristics of Gochujang Added Agastache rugosa

JuHee Heo*, Seongyep Jeong, Eulhwa Jo
Microbial Institute for Fermentation Industry, Korea, 1Oriental Medicine of Wonkwang University, Korea

This study aims to determine the sensory acceptability of gochujang added Agastache rugosa. To achieve this, gochujang was blended with different concentrations of Agastache rugosa (0, 0.5, and 1%). We checked the character in quality by checking the product with the interval of 0, 15, 30, 45, and 60 days in terms of tests such as general (water content, amino-nitrogen, salt, pH, and activity), and free amino-acid. Additionally, subjective sensory evaluation by age were investigated the preference degree. Represents the good smell of hot pepper were symbols from 40-50, were also added to the feel of a small amount of concentrated flavor. This eliminates the distinctive smell meju traditional sauces are thought to help improve gonna flavor.

Preparation of Sparkling Wine Using Astringent Persimmon

Mun-gyeong Cho*, Ji-hyong Cho, Doo-hyun Cho, Se-jong Kim
Sangju Persimmon Experiment Station, Korea, 1Gyeongsangbuk-do Agricultural Research & Extension Services, Korea

Processing of fruits into high value products like brewing of persimmon into wine is a value adding process that could increase the income of persimmon farmers. The aim of this study was to find the optimum conditions out for preparing quality astringent persimmon sparkling wine. Persimmon wines were prepared by fermenting raw materials for 2 months in two steps. In the first step the ripe persimmon fruits were crushed and fermented with adding yeast for 28 days to prepare base wine. Three different proportions of fruit and water (10:0, 6.6:3.4, and 5:5 kg w/w, respectively) were mixed for fermentation. In the second step of fermentation three strains of yeast (S. bayanus, S. carlsbergensis, and S. cerevisiae) were added to the base wines separately using two different inoculation methods i.e., culture yeast and non-culture yeast. The results showed that the wine prepared by fermenting persimmon fruits without adding additional water in the first step of fermentation and thus prepared base wine inoculated with the culture yeast of S. bayanus in the second step was found to be the optimum conditions for quality sparkling wine with the best alcohol flavor and overall taste.
Quality Characteristics and Antioxidant Activity of Sulgidduk by the Addition of Aronia Powder (Aronia melanocarpa)

Young-ran Hwang*, Eun-Sun Hwang
Hankyong National University, Korea

Aronia, deciduous shrub belonging to the Rosaceae family, has high quantities of phenolic compounds than other fruits. The study was conducted to investigate rheological and sensory characteristics of sulgidduk added with aronia powder. The moisture content of sulgidduk ranged from 40.86% to 44.40% and the addition of aronia powder in the sulgidduk tended to decrease the moisture content. In chromaticity determination, L and b values decreased but a value increased with the increasing level of aronia powder. The total polyphenol, total flavonoid and total anthocyanin contents increased with the increasing levels of aronia powder. The antioxidant activity measured by DPPH and ABTS radical scavenging activities were significantly higher than the control, and it proportionally increased as the amount of aronia powder increased. Total aerobic colony and coliform content ranged from 40.86% to 44.40% added with aronia powder. The addition of 5% aronia powder had the best score in color, taste and overall acceptance. This result suggest that adding 5% aronia powder could be applied for making sulgidduk.

Quality Characteristics of Jujube Paste Made by Steam-cooking Treatment

Soo hyung Lee*, Sangwook Kim, Hojeong Jeong, Sangdon Lee, Hyojin Song, Gi Dong Han
Department of Food Science and Food Service Industry, Yeungnam University, Korea

The jujube paste (BJP) used to be conventionally made by boiling it down in water, which result in off flavor and bad texture of the paste. In order to improve these flaws, steam-cooking technology was tried for making high quality jujube paste, and the steamed jujube paste (SJP) compared Boiled jujube paste (BJP) on overall quality characteristics. The °Bx and color of SJP was significantly higher than those of BJP and no differences on pH in the two groups. In a sensory evaluation, SJP showed a significantly higher score for color, sweetness, texture, overall acceptability than BJP. We also analyzed sensory quality after seasoning both of them for commercialization. SJP showed a significantly higher score for color, texture, overall acceptability. Based on these results, application of steam-cooking method could be effective for improving the quality of Jujube paste.

Production and Quality Properties of Anti-obesity Quark Cheese Using Lactobacillus plantarum A Isolated from Kimchi

Jong-Hyuk Park*, Hye-Jung Moon, Joo-Hee Lee, Hee-Young Choi, Eun-Ha Park, Kwan-Sub Jang, Chang-Hyun Lee*, Sang-Cheon Lee
Insil Research Institute of Cheese Science, Korea, 1Department of Anatomy, College of Oriental Medicine, Woosuk University, Korea

Quark cheese is one of fresh cheese and similar to Ricotta cheese. But the biggest difference is that Quark cheese is made by lactic acid produced from lactic acid bacteria. In this study, we isolated lactic acid bacteria from kimchi then investigated anti-obesity effects in animal study. And then Quark cheese was selected to increase the utilization of isolated strain and consumption of fresh cheese, and it was confirmed quality characteristics. Isolated and identified strain named L. plantarum A and is deposited in Korean Culture Center of Microorganisms (deposited number:KFCC 11611P). L. plantarum A was orally administered to animal model at a concentration of 2,000 mg/kg. L. plantarum A showed a lower body weight, total visceral fat and serum lipid level than control group. The values of pH was 4.6 for 8 h at 37°C during the fermentation of milk to manufacture Quark cheese using L. plantarum A. Quark cheeses produced on a commercial starter and L. plantarum A were analyzed for quality properties after cold fermentation for 18 h. There were no significant differences between the two products. Therefore, the commercial possibility of L. plantarum A was considered to be high.

Development of Anti-obesity Symbiotics Containing Lactobacillus acidophilus C, Red Ginseng and Black Raspberry

Insil Research Institute of Cheese Science, Korea, 1Department of Anatomy, College of Oriental Medicine, Woosuk University, Korea

Symbiotics are a product made to be consumed with probiotics and prebiotics. Probiotics are a live microbial feed supplement which beneficially affects the host, and mostly lactic acid bacteria. Prebiotics are indigestible food ingredients which help the growth of probiotics in the intestines. In this study, we isolated probiotics from kimchi then prepared symbiotics by mixed fermentation and its anti-obesity effects were investigated in animal model. We selected Lactobacillus acidophilus which was likely to be probiotics among isolated lactic acid bacteria from kimchi. Anti-obesity effects were examined with fermented mixture as symbiotics that was produced by added with 10% skim milk, 1% red ginseng extract and 1% immature black raspberry powder fermented by L. acidophilus C at 40°C for 24 h. To measure the anti-obesity effects, C57BL/6j mice were orally administrated at 2,000 mg/kg dose for 4 weeks. The symbiotic intake group was significantly decreased in body weight, total visceral fat, glucose concentration and serum leptin concentration compared to the control group. In conclusion, the results showed a high potential as symbiotics with the anti-obesity effects.
Characteristics of Vegetables and Fruits by Pectinase

Heejeon Park*, Sohee Jeong, Ji-Young Song
Berry & Biofood Research Institute, Korea

The object of this study is to investigate the characteristics, colors, viscosities and dietary fibers of vegetables and fruits by enzyme treatments. Colors, viscosities, and dietary fibers of samples such as cabbage, sweet-pumpkin, mandarine, red grape, apple, and tomato were compared after grinding and pectinase treatment (2 h). L, a, b values of vegetables and fruits were 32.32±0.00-2483.47±322.37 cP. Viscosities of theirs also were changed by pectinase treatments. The L values of mandarin, tomato, red grape, apple, cabbage and sweet-pumpkin were decreased after pectinase treatment. The a values of tomato and cabbage were decreased and its of mandarin, red grape, apple, sweet-pumpkin increased. The b value mandarin, apple and cabbage was decreased and its of tomato, red grape and sweet-pumpkin increased. Viscosities of vegetables and fruits were measured using the different spindles and were 6.00±1.70-2483.47±322.37 cP. Viscosities of theirs also were changed by pectinase treatments. The L values of mandarin, tomato, red grape, apple, cabbage and sweet-pumpkin were decreased and its of tomato increased. The a values of mandarin were decreased and its of tomato increased. The b value mandarin was decreased and its of tomato increased. Viscosities of vegetables and fruits were measured using the different spindles and were 12.00±0.00-1439.70 cP. Viscosities of theirs also were changed by ultrasonication, and apple, mandarin, and red grape were decreased after sonication.

Characteristics of Vegetables and Fruits by Ultrasonication

Sohee Jeong*, Heejeon Park, Ji-Young Song
Berry & Biofood Research Institute, Korea

The object of this study is to investigate the characteristics, colors, viscosities, and dietary fibers of vegetables and fruits by ultrasonication. Colors, viscosities, and dietary fibers of samples such as cabbage, sweet-pumpkin, mandarine, red grape, apple and tomato were compared after grinding and ultrasonic treatment (30 min and 1 h). L, a, b values of vegetables and fruits were 29.73±0.12-47.76±0.52, -2.18±0.05-7.67±0.56, and -0.69±0.09-34.01±0.71, respectively. Color values of theirs were changed by pectinase treatments. The L values of mandarin, tomato, red grape, apple, cabbage and sweet-pumpkin were decreased after pectinase treatment. The a values of tomato and cabbage were decreased and its of mandarin, red grape, apple, sweet-pumpkin increased. The b value mandarin, apple and cabbage was decreased and its of tomato, red grape and sweet-pumpkin increased. Viscosities of vegetables and fruits were measured using the different spindles and were 6.00±1.70-2483.47±322.37 cP. Viscosities of theirs also were changed by pectinase treatments. The L values of mandarin, tomato, red grape, apple, cabbage and sweet-pumpkin were decreased and its of tomato increased. The a values of mandarin were decreased and its of tomato increased. The b value mandarin was decreased and its of tomato increased. Viscosities of vegetables and fruits were measured using the different spindles and were 12.00±0.00-1439.70 cP. Viscosities of theirs also were changed by ultrasonication, and apple, mandarin, and red grape were decreased after sonication.

Extraction Process Optimization of Phyllodulcin as a Glycoside from Sweet Hydrangea macrophylla

Min-Soo Kim*, Yang Kim, Seong-Won Choi, Seung-Min Lee, Hae-Kwon Kang, Sang-Ho Yoo
Department of Food Science & Technology, BK21+Project Team and Carbohydrate Bioproduct Research Center, Sejong University, Korea

Phyllodulcin, a potential high-intensity sweetener, exists as glycoside forms in Hydrangea macrophylla. Due to low solubility, phyllodulcin may have limited range of application. Phyllodulcin glycoside is expected to have greater solubility than its aglycone, but there is no information about its characteristics. The objectives of this study were to establish optimal extraction conditions of glycoside form of phyllodulcin from hydrangea leaves and to collect it for evaluation of its properties. Phyllodulcin glycoside was extracted from leaf powder by applying various solvents. Phyllodulcin glycoside was most efficiently extracted with 70% of methanol and ethanol, which was distinguished from its aglycone being maximally extracted with 100% methanol. The solubility profiles indicated glycoside form could be more stable in aqueous environment than aglycone form. LC/MS spectra of preparative HPLC elution fractions displayed the molecular ion peak of phyllodulcin glycoside at m/z=447.1[M-H] along with m/z=285.1[phyllodulcin-H], m/z=181.3[hexose+H], and m/z=492.8[M+2Na]. The identified phyllodulcin glycoside was highly purified and its content was quantified as ca. 25 mg/g leaf.

Quality Characteristics of Kimchi Seasoning Prepared with Different Amounts of Black Raspberry Juice Powder

Ji Hye Jung*, Eun Hye Ryu, Hae Hoon Yoon, Kyu Seo Chae, Min Jung Lee
Berry & Bio Food Research Institute, Korea

This study was carried out to investigate the quality characteristics of kimchi seasoning containing 0, 5, 10, and 20% of freeze dried black raspberry juice powder (BP). The pH was slightly lower in kimchi seasoning added with BP than in the control (0%), and the acidity increased with increasing BP content. Salinity showed a range of 1.22-1.43% and sugar contents showed a range of 21.6-22.4°Bx. The color (L, a, and b values) of BP kimchi seasoning decreased with increasing BP content. The DPPH radical scavenging activity and ABTS radical scavenging activities of 20% BP added kimchi seasoning showed the highest values among groups. Reducing power increased as the concentration of the BP increased. Also, levels of cholesterol decreased in the 5-10% BP added group compared with control group.
A Study on the Thermal Stability of SDP GS-L200 at High Temperature

Young Jin Jang*, Hae Jin Jang, Won Suk Kim
Re&D Center, SDBNI Co., Ltd., Korea

SDP GS-L200 has a powerful effect on food preservation derived from the synergy of a variety antimicrobial activities consist of natural extracts and phosphates. And, this helps to maintain natural flavor and taste of food owned and not to give any effects on the texture, appearance, flavor and taste of foods. There are many different types of heat treatments in processed foods and it affects to the function of the ingredients contains in processed foods with some other factors such as pH, pressure, etc. The purpose of this study is to investigate the thermal stability of SDP GS-L200 when processed at high temperatures. According to the experiment by plate assay, antimicrobial activity of SDP GS-L200 was not decreased against KCTC 1039 Escherichia coli in the manufacturing process for 60 min at high temperatures. In case of stir-fried process at 250°C for 30 min, SDP GS-L200 was shown more excellent antimicrobial activities on the process of fried seaweed than potassium sorbate which is widely used in processed foods. Therefore, our conclusion is that SDP GS-L200 could be replaced harmful synthetic preservatives such as potassium sorbate, benzoic acid and etc for processed foods.

A Study on Extraction Solvents Settings for the Industrialization of Natural Pigment Purple Sweet Potato

Woo Young Choi*, Hae Jin Jang, Won Suk Kim
Re&D Center, SDBNI Co., Ltd., Korea

For import substitution of natural pigment and enhancement of national competitiveness, we have worked to extract anthocyanin from purple sweet potato cultivated domestically and we have studied to select a suitable extraction solvent by comparison of extraction efficiency according to the dosage amount of water or ethanol solvent and acidic sodium metaphosphate adopted by acidity regulator. All extraction process had been fixed and treated by 60°C for 20 h and extracted while shaking with 200 rpm to increase the extraction efficiency of anthocyanin. The result was that the higher content of acidic sodium metaphosphate is used, the more the extraction efficiency of anthocyanin is tended to increase generally. And, it showed extremely at 3% and we found that the higher content of acidity regulator is used when we extract with ethanol, the more the extraction efficiency is tended to increase. And, we found there’s not much correlation between the content of ethanol and the extraction efficiency. Finally, we made a conclusion that the most suitable extraction solvent was water solution with 3% of acidic sodium metaphosphate does not contain ethanol and this solvent showed approximately 7 times higher extraction efficiency when compared to control.

Quality Evaluation of Gamma-irradiated Freeze-dried Fruits for Patient’s Food

Eui-Baek Byun*, Jae-Nam Park, Hye-Min Kim, Beom-Su Jang, Sang-Hyun Park
Advanced Radiation Technology Institute, Korea Atomic Energy Research Institute, Korea

This study examined the microbiological and organoleptic qualities of gamma-irradiated dried apples, pears, strawberries, pineapples, and grapes, and evaluated the organoleptic acceptability of the sterilized dried fruits for hospitalized patients. The dried fruits were gamma-irradiated at 0 to 15 kGy, and their quality was evaluated. Microorganisms were not detected in apples after 1 kGy, in strawberries and pears after 4 kGy, in pineapples after 5 kGy, and in grapes after 12 kGy of gamma irradiation. The overall acceptance score, of the irradiated dried fruits on a 7-point scale at the sterilization doses was 5.5, 4.2, 4.0, 4.1, and 5.1 points for apples, strawberries, pears, pineapples, and grapes, respectively. The sensory survey of the hospitalized cancer patients (N=102) resulted in scores of 3.8, 3.7, 3.9, 3.9, and 3.7 on a 5-point scale for the gamma-irradiated dried apples, strawberries, pears, pineapples, and grapes, respectively. The results suggest that dried fruits can be sterilized with a dose of 5 kGy, except for grapes, which require a dose of 12 kGy, and that the organoleptic quality of the fruits is acceptable to immunocompromised patients.

Studies on Manufacturing of Ganjiang-Gejang (Korean Traditional Marinated Raw Crab in Soybean Sauce) Edible in Patients by Gamma Irradiation

Eui-Baek Byun*, Jae-Nam Park, Hye-Min Kim, Sang-Hyun Park, Beom-Su Jang
Advanced Radiation Technology Institute, Korea Atomic Energy Research Institute, Korea

This study was conducted to confirm quality properties of sterilized ganjiang-gejang with Korean soy sauce using by gamma irradiation. The ganjiang-gejang was irradiated at dose of 3 to 15 kGy by gamma irradiation and it was evaluated in microbiological, physicochemical, and sensory properties. Total aerobic bacteria and fungi contents of non-irradiated samples were about 6 and 4 log CFU/g level, respectively. Gamma-irradiated samples at above 9 kGy did not contain aerobic bacteria or fungi at detection limit less then 2 log CFU/g, but sensory scores were significantly decreased depending on the irradiation dose. To improve the sensory qualities of gamma-irradiated ganjiang-gejang, the temperature was adjusted during sample irradiation. When samples were irradiated under freezing temperatures, especially on dry ice, the TBARS and the deterioration of sensory qualities of ganjiang-gejang were reduced. Different odor patterns were observed among samples, as observed using electronic nose analysis system. The results of this study indicated that treatment with irradiation under low temperatures may help to preparing high-quality ganjiang-gejang.
Rapid Detection and Quantification of Shigella boydii Using Bacteriophage Amplification Assay

La-Seung Jung*, Geun-Pyo Choe, Juhee Ahn
Department of Medical Biomaterials Engineering, Kangwon National University, Korea, 1Department of Food Processing and Bakery, Gangwon Provincial College, Korea

This study was designed to investigate the possibility of using bacteriophage for detecting viable Shigella boydii in food. The Shigella bacteriophage belonging to a member of the Siphoviridae family was isolated from swine fecal sample. The free bacteriophages were highly stable against pH 4.0 to 9.0 and temperature change (z-value=17.1°C). The bacteriophage amplification assay could selectively detect S. boydii in the bacterial mixture of Escherichia coli O157:H7, Listeria monocytogenes, and Salmonella Typhimurium. The number of S. boydii bacteriophages enumerated by the bacteriophage amplification assay was highly corresponding to the number of viable S. boydii in single (r=0.987) and mixed (r=0.969) cultures. The bacteriophage-based detection of S. boydii was highly reproducible in lettuce (6.3 log CFU/mL and 4.9 log PFU/mL) and cooked chicken breasts (6.1 log CFU/mL and 6.0 log PFU/mL). These results suggest that the bacteriophage amplification assay can be used as an alternative for rapid, selective, and cost-effective detection of S. boydii in food. This provides useful information for designing a quick and simple detection kit.

Development of an Immuno-selective Filtration Method for the Rapid Detection of Vibrio parahaemolyticus Using Magnetic Nanoparticle-antibody Composites

Chae Won Lee1*, Song Yi Koo2, Sang-Gon Park2, Myeong Jin Jeong3, Jeong-Sook Kim3, Sung-Jo Kang3, Duck-Hwa Chung1,2
1Department of Food Science Technology, Gyeongsang National University, Korea, 2Department of Food Science and Technology, Gyeongsang National University, Korea

The objective of this study was the development of immuno-selective filtration method for the rapid detection of Vibrio parahaemolyticus. The Magnetic nanoparticle-antibody composites (MNP-MAb) bound or unbound to V. parahaemolyticus after isolated on a magnet were directly passed through a nitrocellulose filter membrane by vacuum pressure. The color signals from remained MNP-MAb conjugate-bacteria on the membrane could be measured by reflecting the amount of bacteria in a sample. MNP-MAb conjugates was diluted solution of PBS containing 1% BSA (MNP-MAb : Solution = 1 : 9). The most reactive conditions were the incubation for 30 min at 37°C. The detection limit of the immuno-selective filtration method was 10^3 cell/mL. The method could be completed within 1 h, the results could be get for similar analysis time with recently reported antibody-immobilized MNP-based methods without additional steps. In conclusion, these results indicated that immuno-selective filtration method could provide an easy, convenient and rapid method for a wide range of pathogens.

Microbiological Hazard Analysis of Chestnut for the Application of the Good Agricultural Practices (GAP)

Sang-Gon Park1*, Song-Yi Koo1, Chae-Won Lee2, Myeong-Jin Jeong2, Jeong-Sook Kim2, Sung-Jo Kang2, Duck-Hwa Chung1,2
1Division of Applied Life Science, Graduate School of Gyeongsang National University, Korea, 2Department of Food Science and Technology, Gyeongsang National University, Korea

The objective of this study was to analysis microbiological hazard of chestnut for the good agricultural practices (GAP). Samples were collected from crops (chestnuts and leaves), cultivation environment (soil and air), personal hygiene (hands, gloves and clothes), farming utensil (protective gloves, tongs and gummy sacks). The collected samples were tested for microbiological hazard; sanitary indicative bacteria (total bacteria, coliform, Escherichia coli), foodborne pathogens (Bacillus cereus, Staphylococcus aureus, E. coli O157:H7, Listeria monocytogenes, and Salmonella spp.) and fungi. As a result, sanitary indicative bacteria, total bacteria, and coliform were detected at the level of ND-6.1 and ND-4.7 log CFU/g, mL, hand or 100 cm², but E. coli was not detected in all samples. In pathogens, B. cereus and S. aureus were detected at the levels of ND-3.7 and ND-3.8 log CFU/g, hand or 100 cm² respectively, while E. coli O157:H7, L. monocytogenes, Salmonella spp. were not detected in all samples. Fungi was detected at the level of ND-4.8 CFU/g, mL, hand or 100 cm².

Development and Application of Immunoassays for the Detection of Salmonella Typhimurium

Songyi Koo1*, Sang-Gon Park1, Chae-Won Lee2, Myeong-Jin Jeong2, Jeong-Sook Kim2, Sung-Jo Kang2, Duck-Hwa Chung1,2
1Division of Applied Life Science, Graduate School of Gyeongsang National University, Korea, 2Department of Food Science and Technology, Gyeongsang National University, Korea

The objective of this study was the development of immuno-chromatography (ICG) for the rapid and simple detection of Salmonella Typhimurium. Monoclonal antibodies (MAb) were conjugated with 40 nm colloidal gold particles. The colloidal gold-MAb conjugate was used as the detection reagent in the ICG. The ICG was composed of three pads (sample, conjugate, and absorbance pads) and one nitrocellulose membrane. The colloidal gold-MAb conjugate applied to the conjugate pad and the test line and control line on the membrane were treated with MAb (FKST 4H3-6) and anti-mouse IgG, respectively. The detection limit of the ICG was cell/mL and it showed little cross-reactivity to S. aureus, Sal. enterica Enteritidis. The developed ICG applied to fork, beef, perilla leaf and lettuce samples. All the inoculated meat samples and vegetable samples gave positive results after enrichment for 10 h and 12 h, respectively. These results strongly support that the developed ICG could be used as rapid, simple and effective methods for primary screening of S. Typhimurium in various foods.
**P10-007**

**Effect of Electron Beam Irradiation on Pathogens of Pork Byproducts in Different Packaging**

Hyun-Joo Kim*, Hae In Yong, Hyun Jung Lee, Haeilim Lee, Ki Chang Nam1, Cheorun Jo
Department Agricultural Biotechnology, Seoul National University, Korea, 1Department of Animal Science and Technology, Sunchon National University, Korea

Pork byproducts are inexpensive and have distinct sensory and nutritional characteristics. However, unhygienic slaughtering and processing conditions may contaminate pork byproducts with spoilage as well as pathogenic microorganisms. The objective of study was to investigate the effect of electron beam irradiation on foodborne pathogens (Escherichia coli O157:H7 and Listeria monocytogenes) inoculated on pork byproducts (heart, large intestine, liver, and small intestine). Electron beam irradiation significantly reduced the numbers of foodborne pathogens on pork byproducts. No viable cells were detected in vacuum-packaged samples at irradiation dose of 4 kGy while a dose of 3 kGy was effective for aerobically packed samples. Pork byproducts packed under vacuum had higher D10 value than aerobically packed samples, but no significant differences were observed between the D10 values of E. coli O157:H7 and L. monocytogenes. These results indicated that foodborne pathogens on pork byproducts can be effectively reduced to acceptable level by low dose (4 kGy or less) of electron beam irradiation.

**P10-008**

**Assessment of Microbial Population on Commercial Duck Meat and Its Products**

Hyun Jung Lee*, Hae In Yong, Hyun-Joo Kim, Haeilim Lee, Kang Nyeong Heo1, Cheorun Jo
Department of Agricultural Biotechnology, Seoul National University, Korea, 1Department of Poultry Science, National Institute of Animal Science, RDA, Korea

To assess microbial population on commercially-available duck meat and its products (whole or sliced, raw or smoked, and chilled or frozen), samples were purchased from different markets. In chilled condition, raw whole and sliced duck meat showed 3.53-4.40 and 4.56-5.75 log CFU/g, respectively, while smoked whole and sliced duck meat have the microbial load of 3.62-6.84 and 4.55-6.85 log CFU/g, respectively. The population of microorganisms in frozen whole duck meat were 4.97-5.39 log CFU/g while frozen sliced duck meat were 4.12-6.19 log CFU/g. The identified species from the different duck meat products available in market were Acinetobacter spp., Pseudomonas spp., Enterobacter spp., and Lactococcus lactis. Although the microbial population identified microorganisms were varied depending on processing and storage conditions, microbial contamination should be controlled to have safer duck meat and its products.

**P10-009**

**Specific and Rapid Detection of Pathogenic B. cereus Using Endolysins and Their Cell Wall Binding Domains (CBDs)**

Ji-Sang Hong*, Min Suk Kong1, Sangryeol Ryu1, Ju-Hoon Lee
Department of Food Science and Biotechnology, Graduate School of Biotechnology, Kyung Hee University, Korea, 1Department of Food and Animal Biotechnology, Research Institute for Agriculture and Life Sciences, Seoul National University, Korea

Bacteriophage is a specific bacterial virus with the host lysis and specificity activities. Endolysins and their cell wall binding domains (CBDs) are generally responsible for these activities, suggesting that they may be good candidates for specific and rapid detection of food-borne pathogens. To obtain phage endolysins genes and their CBDs, two B. cereus-infesting phages, PBC5 and PBC10, were isolated and their genes and CBDs were obtained using specific PCR. After cloning into E. coli expression vector and expression, two endolysins (LysPBC5 and LysPBC10) and two CBDs containing EGFP (EGFP-PBC5_CBD and EGFP-PBC10_CBD) were obtained. Interestingly, the host range test of two endolysins and their CBDs showed that host ranges of CBDs are narrower than those of endolysins, suggesting higher host specificity. Furthermore, the mixture of the EGFP-CBDs to B. cereus culture showed specific and rapid detection of B. cereus cells, suggesting that CBD would be useful for pathogen detection. This study would be useful for specific and rapid detection of B. cereus pathogens in various environments and they may replace the expensive antibodies for bacterial detection.

**P10-010**

**Isolation and Characterization of Broad Host Range Bacteriophages Simultaneously Inhibiting Food-borne Pathogens**

Eun-Ah Park*, Jeong-Hyun Kim, Sangryeol Ryu1, Ju-Hoon Lee
Department of Food Science and Biotechnology, Graduate School of Biotechnology, Kyung Hee University, Korea, 1Department of Food and Animal Biotechnology, Research Institute for Agriculture and Life Sciences, Seoul National University, Korea

Klebsiella sp. is a well-known opportunistic human pathogen, causing diabetes mellitus and chronic pulmonary obstruction. To control this pathogen, several Klebsiella-infecting phages were isolated from various environmental samples. Among them, two distinct phages, K. pneumoniae phage PKP126 and K. oxytoca phage PKO111 were selected. Interestingly, their host range analysis revealed that they infect K. pneumoniae, K. oxytoca, and even Cronobacter sakazakii, suggesting their broad host range specificity. TEM morphology showed that PKP126 belongs to the family Siphoviridae and PKO111 to the family Myoviridae. Stability test showed that they are stable under various temperature (~20 to 65°C) and pH (3 to 11). Challenge assay showed that PKP126 and PKO111 inhibit their host strains in 3 log and 2 log reductions, respectively. Their complete genome sequences revealed that PKP126 genome has 50,934-bp DNA length with GC content of 50.37% containing 85 ORFs and no tRNA gene, and PKO111 genome has 168,758-bp DNA length with GC content of 39.39% containing 291 ORFs and 16 tRNA gene. These phases would be useful for development of novel biocontrol agents against Klebsiella pathogens.
**P10-011**

Characterization and Genome Analysis of Bacteriophage HY01 Infecting *Escherichia coli O157:H7* and *Shigella flexneri*

Heyn Lee†, Jae-Hyun Cho, Sunggi Heu‡, Sangryeol Ryu‡, Ju-Hoon Lee

Department of Food Science and Biotechnology, Graduate School of Biotechnology, Kyung Hee University, Korea, †Microbial Safety Division, National Academy of Agricultural Science, Rural Development Administration, Korea, ‡Department of Food and Animal Biotechnology, Research Institute for Agriculture and Life Sciences, Seoul National University, Korea

*Escherichia coli* O157:H7 is a food-borne pathogen causing food-borne illnesses. To control this food-borne pathogen in food, bacteriophage treatment could be a good alternative approach. *E. coli* O157:H7-infecting phage HY01 was newly isolated from a swine fecal sample. TEM morphology observation showed that it belong to *Myoviridae* family. The host range test revealed that it inhibits efficiently *E. coli* O157:H7 and *Shigella flexneri*. Antibacterial activity is stable under various pH (4-11) and temperature (20-65°C). One-step growth curve analysis showed short eclipse/latent periods (5/25 min) and large burst size (>100). In addition, bacterial challenge test showed 4 log reduction in 1 h. Food applications of HY01 showed 3 log reduction of clinical isolate (ATCC 43890) and 2 log reduction of food isolate (ATCC 43895). Complete genome sequence revealed 166,977-bp DNA with an overall G+C content of 35.5%, 258 open reading frames (ORFs), and 9 tRNA genes. In conclusion, this phage HY01 would be useful for development of a novel biocontrol agent against *E. coli* O157:H7 and *Shigella*.

**P10-013**

Investigation of Irradiated Foods Using Photostimulated Luminescence and Thermoluminescence

Eun Sun Yun*, Na young Kim, Young suk Hwang, Su-jeong Choi, Hye-ran Yang, Dong-gyu Kim, Jung hun Kim

Seoul Metropolitan Government Research Institute of Public Health and Environment, Korea

This study was carried to determine whether the commercial foods in Seoul were irradiated or unirradiated. Three hundred and eleven foods were investigated by photostimulated luminescence (PSL) and thermoluminescence (TL) method. PSL is used for the detection of irradiated foods by measuring the photon counts. The photon counts of non-irradiated samples were lower than 700, while those of irradiated samples were higher than 5,000. Seventeen samples showed photon counts of more than 5,000 or intermediated counts (700-5,000). For TL analysis, the silicate minerals were obtained by density separation. TL glow curves of irradiated samples showed a higher peak at 150-250°C. TL ratio (TLr/TLs) was obtained by the first glow curve area (TLr) and the second glow curve area (TLs) of re-irradiation at 1 kGy. TL ratio was found to be less than 0.1 for unirradiated samples and higher than 0.1 for irradiated samples. The results showed four food products were confirmed to be irradiated. Of these, hot barbecue source, red ginseng tablet and red ginseng powder were not indicated labeling for irradiation. Only another red ginseng powder was complied with indicated standard for irradiated.

**P10-012**

Affinity Maturation of Single-chain Variable Fragment Specific for Aflatoxin B1 Using Yeast Surface Display

Ji-Na Kim*, Won-Ki Min, Jung-Hyun Jo, Woong Heo, Hee-Jin Sim, Kyoung-Muk Lee, Tae-Young Lee, Sung-Gun Kim†, Jin-Ho Seo

Department of Agricultural Biotechnology and Center for Food and Bioconvergence, Seoul National University, Korea, †Department of Biomedical Science, Youngdong University, Korea

For in vitro affinity maturation of the single-chain variable fragment against aflatoxin B1, yeast surface display technique combined with fluorescence-activated cell sorting was applied. A randomly mutated scFv library was subjected to 4 rounds of fluorescence activated cell sorting, resulting in isolation of 5 scFv variants showing an affinity improvement compared to the parental wild type scFv. The best scFv with a 9-fold improvement in affinity for aflatoxin B1 exhibited similar specificity to the monoclonal antibody 2C12 in competitive indirect enzyme linked immunosorbent assay with other aflatoxins. Most of mutations in scFv-M37 were located outside of the canonical antigen-contact loops, suggesting that its affinity improvement might be driven by an allosteric effect inducing scFv-M37 to form a more favorable binding pocket for aflatoxin B1 than the wild type scFv.

**P10-014**

Effect of Milk Fat Content on Ohmic Heating for Inactivation of Food-borne Pathogens

Sang-Soon Kim*, Dong-Hyun Kang

Department of Food and Animal Biotechnology, Department of Agricultural Biotechnology, Center for Food and Bioconvergence, and Research Institute for Agricultural and Life Sciences, Seoul National University, Korea, and Institutes of Green Bio Science & Technology, Seoul National University, Korea

The effect of milk fat content on ohmic heating compared to conventional heating for inactivation of food-borne pathogens was investigated. For each heating method, (1) the effect of milk fat on temperature increase and (2) the protective effect of milk fat on food-borne pathogens were researched. While temperatures at each time were not significantly different regardless of fat content for conventional heating, temperature increased more rapidly with lower fat content for ohmic heating due to higher electrical conductivity. Although pathogens were partially affected, mostly the protective effect was not observed for conventional heating. In contrast to conventional heating, the protective effect of milk fat on *E. coli* O157:H7 and *L. monocytogenes* was observed in samples subjected to ohmic heating. Non-uniform heat generation of non-homogeneous fat-containing samples were verified using a thermal infrared camera. These results indicate that food-borne pathogens can survive in the non-homogeneous fat-containing food subjected to ohmic heating. Therefore, more attention is needed to ohmic heating than conventional heating for pasteurizing fat-containing food.
P10 -015
Comparative Effect of pH on Ohmic Heating and Conventional Heating for Inactivation of Food-borne Pathogens in Orange Juice
Sang-Soon Kim*, Dong-Hyun Kang
Department of Food and Animal Biotechnology, Department of Agricultural Biotechnology, Center for Food and Bioconvergence, and Research Institute for Agricultural and Life Sciences, Seoul National University, Korea, and Institutes of Green Bio Science & Technology, Seoul National University, of Korea

Due to lack of information about the effect of pH on ohmic heating, the influence of acidity on ohmic heating for inactivation of food-borne pathogens in orange juice was investigated. For conventional heating, the heating rate was not significantly different regardless of pH and pathogens were inactivated more effectively at lower pH. However, different patterns were observed for ohmic heating. Although temperature and electrical conductivity were not greatly affected by lowering pH, temperature increased more rapidly with increasing pH due to higher electrical conductivity. Also, the inactivation patterns were different from conventional heating. While Salmonella Typhimurium was inactivated most rapidly at pH 2.5, Escherichia coli O157:H7 and Listeria monocytogenes were inactivated most rapidly at pH 4.5. Non-thermal effects of ohmic heating were not observed in this study. Also, the overall quality of orange juice subjected to ohmic heating was not greatly affected at any pH level. The different characteristics of ohmic heating compared to conventional heating indicate the necessity of a new approach.

P10 -016
Effect of pH on Inactivation of Escherichia coli O157:H7, Salmonella Typhimurium and Listeria monocytogenes in Apple Juice by Ozone Treatment
Won-Jae Song*, Joo-Yeon Shin, Dong-Hyun Kang
Department of Food and Animal Biotechnology, Department of Agricultural Biotechnology, Center for Food and Bioconvergence, and Research Institute for Agricultural and Life Sciences, Seoul National University, Korea Institutes of Green Bio Science & Technology, Seoul National University, Yeongchung-gu, Korea

We investigated the effect pH on inactivation of Salmonella Typhimurium, Escherichia coli O157:H7, and Listeria monocytogenes in apple juice by ozone. Apple juice (pH 3.0, 4.0 and 5.0) inoculated with the three pathogens were treated with gaseous ozone (3.0 L/min and 2.0-3.0 g/m3) for up to 4 min. Gaseous ozone treatment for 1 to 4 min of pH 3.0 apple juice resulted in 0.24 to >5.23 log CFU/mL reductions of S. Typhimurium, respectively. Ozone treatment of pH 4.0 apple juice for 1 to 4 min reduced this pathogen by 0.12 to 4.71 log CFU/mL, respectively. In pH 5.0 apple juice, ozone treatment reduced S. Typhimurium by 0.12 to 1.30 log CFU/mL, respectively. E. coli O157:H7 and L. monocytogenes in apple juice showed a reduction trend similar to S. Typhimurium during ozone treatment. There were no significant changes of color values after ozone treatment, except for b values. Among all ozone treated samples, the browning index was reduced and there were no significant differences in total phenolic contents. In conclusion, gaseous ozone treatment of low pH apple juice was significantly effective in inactivation of food-borne pathogens while maintaining acceptable apple juice quality.

P10 -017
Inactivation of Escherichia coli O157:H7, Salmonella Typhimurium, and Listeria monocytogenes in Ready-to-bake Cookie Dough by Gamma and Electron Beam Irradiation
Seul-Gi Jeong*, Dong-Hyun Kang
Department of Food and Animal Biotechnology, Department of Agricultural Biotechnology, Center for Food and Bioconvergence, and Research Institute for Agricultural and Life Sciences, Seoul National University and Institutes of Green Bio Science & Technology, Seoul National University, Korea

This study was conducted to investigate the efficacy of gamma and electron beam irradiation to inactivate foodborne pathogens in ready-to-bake cookie dough and to determine the effect on quality by measuring color and texture changes. Cookie dough inoculated with Escherichia coli O157:H7, Salmonella Typhimurium, and Listeria monocytogenes was subjected to gamma and electron beam irradiation, with doses ranging from 0 to 3 kGy. As the radiation dose increased, the inactivation effect increased among all tested pathogens. After 3.0 kGy of both types of irradiation, numbers of pathogens were reduced to below the detection limit (1 log CFU/g). The D0-values of inoculated pathogens in cookie dough treated with gamma rays were similar to those treated electron beam. Based on the D0-value of pathogens in cookie dough, L. monocytogenes showed more resistance to both treatments than did E. coli O157:H7 and S. Typhimurium. Color and textural characteristics of irradiated cookie dough were not significantly (p>0.05) different from the control. These results suggest that irradiation can be applied to control pathogens in ready-to-bake cookie dough products without affecting quality.

P10 -018
Radio-frequency Heating to Control Cronobacter sakazakii in Powdered Infant Formula
Seul-Gi Jeong*, Dong-Hyun Kang
Department of Food and Animal Biotechnology, Department of Agricultural Biotechnology, Center for Food and Bioconvergence, and Research Institute for Agricultural and Life Sciences, Seoul National University and Institutes of Green Bio Science & Technology, Seoul National University, Korea

The aim of this study was to investigate the bactericidal effects of RF heating against Cronobacter sakazakii in powdered infant formula and to determine the effect on product quality. A cocktail of C. sakazakii strains was inoculated into powdered infant formula, followed by RF treatments using electrode gaps of 8, 10, and 12 cm. The heating rate of the sample increased with decreasing electrode gap. RF heating for the treatment time required to reach 90°C achieved 2.85-, 2.17-, and 2.08-log reductions of C. sakazakii without generating heat-injured cells at the electrode gaps of 8, 10, and 12 cm, respectively. The color values, moisture contents, and sulfhydryl activities of infant formula powder subjected to RF treatment with the electrode gap of 8 cm were not significantly (p>0.05) different from those of nontreated samples. However, these qualities significantly (p<0.05) changed at prolonged treatment time as the electrode gap increased. These results suggest that RF heating under optimized conditions could reduce foodborne pathogens without adversely affecting quality properties of powdered weaning foods.
Applying Vacuum Impregnation to Organic Acid Washing for Enhancing Its Effect

Jun-Won Kang*, Dong-Hyun Kang

Department of Food and Animal Biotechnology, Department of Agricultural Biotechnology, Center for Food and Bioconvergence, and Research Institute for Agricultural and Life Sciences, Seoul National University and Institutes of Green Bio Science & Technology, Seoul National University, Korea

Inoculated broccoli was treated with a simple dipping washing process or with vacuum impregnation in 2% malic acid. Continuous and intermittent treatment was applied to the vacuum impregnation. With the dipping washing process, increasing treatment times after 5 min could not achieve significant additional reductions. With continuous treatment, there were significant additional reductions with increasing vacuum levels. With increasing treatment time, however, there were no significant additional reductions with 61.3 kPa and the significant differences of 21.3 kPa treatment was inefficient due to its low reduction compared with treatment time. With intermittent treatment, there were additional reductions with increasing treatment time for both 61.3 and 21.3 kPa from 5 min to 10 min and 30 min, respectively. Broccoli surfaces were visualized by scanning electron microscopy and showed that bacteria tend to attach to or become entrapped in protective sites after dipping washing. However, most bacteria were washed out of protective sites after intermittent treatment. Color and texture values were not significantly different from those of untreated samples.

Analysis of Polycyclic Aromatic Hydrocarbons Using MS Ultra Inert Column Installed GC/MS

Yongmin Lee*, Min-Seok Baek, Changmin Lee, Sanghoon Ko

Department of Food Science and Technology, Sejong University, Korea

Polycyclic aromatic hydrocarbons (PAHs) can be produced during high temperature cooking, which are usually contaminated at a low concentration in the cooked food. The objective of this study was to evaluate the performance of MS ultra inert column (UI column) and MS column which were used to analyze PAHs concentrations in the samples by GC/MS. Standard materials of the PAHs used in this study were benzo[a]anthracene (BaA), chrysene (CHY), benzo[b]fluoranthene (BbF), and benzo[a]pyrene (BaP). The standard materials were dissolved in dichloromethane (100 ppm). Injection temperature and volume were 320°C and 1 μL, respectively. As a result, by using UI column, retention time and volume were 320°C and 1 μL, respectively. AUC values of BaA, CHY, BbF, and BaP were 1.94×10^8, 1.85×10^8, 2.28×10^8, and 1.96×10^8 for the MS column installed GC/MS, while they were 2.83×10^8, 2.75×10^8, 2.75×10^8, and 2.11×10^8, respectively, for the UI column installed one. AUC values of UI column installed GC/MS were 30.54% in average higher than those of MS column installed one. In conclusion, UI column can be a good candidate for analyzing low concentration of PAHs in food.
P10 -023

Evaluating Effectiveness of Detaching Microorganism from Fresh Vegetables by 4-Section Spindle and Stomacher

Do-Kyun Kim*, Soo-Ji Kim, Dong-Hyun Kang
Department of Food and Animal Biotechnology, Department of Agricultural Biotechnology, Center for Food and Bioconvergence, and Research Institute for Agricultural and Life Sciences, Seoul National University and Institutes of Green Bio Science & Technology, Seoul National University, Korea

This study was undertaken to compare the effect of the 4-section Spindle and Stomacher for detaching microorganisms from fresh vegetables. When processed with the Spindle, food samples were barely disrupted, and the diluent was clear. The 4-section Spindle consists of 4 sample bag containers to economize time and effort by simultaneously processing 4 samples. The aerobic plate counts (APC) of 50 fresh vegetable samples were measured following Spindle and Stomacher treatment. Correlations between the two methods were very high (R²>0.90). Inoculated 3 foodborne pathogens ratios of Spindle-to-Stomacher enumerations were close to 1 between every section of the Spindle and Stomacher. Four uncut whole samples which were inappropriate to be treated by Stomacher were processed by the Spindle and by hand massaging by 2 min. The APC and recovery of 3 pathogens were assayed, and the difference between each section of the Spindle and hand massaging was not significant (p>0.05). This study demonstrated that the Spindle apparatus can be an alternative device for detaching microorganisms from all fresh vegetable samples for microbiological analysis by the food processing industry.

P10 -024

Improved Selective Medium for the Detection of Shigella spp.

Ji-Yeon Lee*, Dong-Hyun Kang
Department of Food and Animal Biotechnology, Department of Agricultural Biotechnology, Center for Food and Bioconvergence, and Research Institute for Agricultural and Life Sciences, Seoul National University and Institutes of Green Bio Science & Technology, Seoul National University, Korea

We developed an improved selective medium (HEX) for the detection of Shigella spp. from foods. Conventional culture media for Shigella are neither specific nor sensitive. HEX medium contains D-xylene, lactose, salicin, and saccharose as a differentiation marker. The concentration of selective agent was reduced which completely inhibits tested gram positive pathogens. All Shigella spp. tested produced green colonies on HEX medium, while Hafnia alvei, found to be false positive for Shigella on HE agar, appeared as differentiable orange colonies on HEX medium. HEX medium supported a higher recovery of heat- or acid- injured Shigella than conventional media. A total of 300 food samples were used to evaluate the specificity and sensitivity of HEX medium. The specificity was 13.5, 38.5, and 83.5 (%) on MacConkey agar, HE agar, and HEX medium, respectively. The sensitivity was 76.0, and 84.0 (%) for S. flexneri and 80.0, and 92.0 (%) for S. sonnei on HE agar and HEX medium, respectively. HEX medium had superior specificity and sensitivity than HE agar. Therefore HEX medium can be an appropriate selective and differential medium for detection of Shigella spp. from foods.

P10 -025

Fabrication and Characterization of a Salmonella-loaded Hydrogel System Suitable for Multiple Applications

Youngjae Cho*, So-Yeon Park, Quang Lam Truong, Bokyoung Park, Kiju Kim, Tae-Wook Hahn
College of Veterinary Medicine and Institute of Veterinary Science, Kangwon National University, Korea

This study was focused on developing an efficient Salmonella-loaded microsphere using a biodegradable material. Alginate was used to encapsulate Salmonella Typhimurium (ST) by the emulsion method. Alginate has been frequently used to encapsulate bacteria, because it is a natural material and degradable biopolymer. Its microstructure can interact easily with other charged polymers. First, green fluorescent protein (GFP) in the expression plasmid (pIIBR: GFP) was inserted into ST by electroporation. After 3 day incubation, fluorescent colonies were observed on Tryptic soy agar. To encapsulate ST, 10³ CFU of ST was mixed with 2% of alginate solution and dropped into mineral oil added with span 80. Homogenizer was used to achieve right size of microspheres at appropriate speed for 10 min. Calcium chloride was then mixed slowly with the solution for 3 h. The bacterial presence inside the capsule and sphere morphology were observed by fluorescence microscopy. Our findings suggest that efficient and economic method to encapsulate Salmonella for the therapeutic use. Our current experiments are designed to elucidate the role of microspheres in antigen presentation.

P10 -026

Identification of Foreign Materials in Food by Physicochemical Analyses: Non-edible Fragments of Fishery Products

Jae-Hwang Lee*, Young-Eun Park, Byung-Chul Lim, Tae-Sun Kang, Cheon-Ho Jo, Yoo-Kyung Jung, Jin-Ha Lee, Jang-Duck Choi, Ki-Sung Kwon
New Hazardous Substance Team, National Institute of Food & Drug Safety Evaluation, Ministry of Food and Drug Safety, Korea

Foreign materials with a variety of types and sizes are found in food; thus, extraordinary efforts and various analytical methods are required to identify the types of foreign materials and to find out accurate causes of how they unintentionally enter into food. In this study, fish-bones, otoliths, and seashells were chosen as three types of foreign materials. We morphologically analyzed them using stereoscopic, optical and scanning electron microscopes, showing differences in each type. In addition, X-ray fluorescence spectrometer was used to analysis chemical compositions (¹¹Na-⁹²U, Mass%) of the three types of materials. As a result, we observed that (1) fish-bones were mainly composed of calcium, phosphorous and sulfur, (2) in otoliths and seashells, calcium was a major element. Organic compounds of samples were further analyzed by fourier transform infrared spectroscopy (FT-IR) that can compare spectra of given materials; however, this method did not show significant differences mostly due to low levels of organic compounds in the samples. In this study, we suggest a rapid method for the identification of the causes and types of foreign materials in food.
Identification of Inhibitors for Escherichia coli O157:H7 Infections

Seung Min Kim*, Hyun Jung Kim
Research Group of Food Safety, Korea Food Research Institute, Korea

Enterohemorrhagic Escherichia coli O157:H7 is the most common foodborne pathogen. The locus of enterocyte effacement (LEE) pathogenicity island in E. coli O157:H7 is known to be activated by Ler. Therefore, identification of small molecules which inhibit the activity of Ler is important to combat E. coli O157:H7 infections along the food chain. A high throughput screening of natural small molecule libraries was performed to identify inhibitors of the LEE expression. Using a reporter strain P_{lacC}:luxCDABE whose activity entirely depends on Ler, we identified a small molecule named inhibitor A. Inhibitor A suppresses the expression of virulence genes encoded within the LEE. E. coli O157:H7 treated with inhibitor A was significantly diminished in adherence to Caco-2 epithelial cells in vitro. Attenuated cytotoxic activity was also observed after treating E. coli O157:H7 with the chemical. These results indicated that inhibitor A plays an important role in preventing E. coli O157:H7 pathogenesis. Since inhibitor A specifically inhibits the Ler activity without affecting bacterial growth, this molecule can be a novel anti-infective agent that is different from conventional antibiotics.

A Simple Method for the Simultaneous Determination of Natural Preservatives in Fruits

Sang-Soon Yun*, Do-Yeon Lim, Sang-Jin Lee, Gunyoung Lee, Meephye Kim
Food Additives and Packaging Division, Ministry of Food and Drug Safety, Korea

A simple and practical method for determination of natural preservatives (benzoic acid and sorbic acid) in fruits was developed. Ground sample was weighed and put into a volumetric flask with 50 mL of ethanol. After sonication and centrifugation, the solution was then filtered using a 0.45 µm membrane filter for injection into high performance liquid chromatography (HPLC). The HPLC analysis was performed using a C18 column on UV detector at 235 nm. The method was validated for linearity, recovery, limit of detection (LOD), and limit of quantification (LOQ). Recovery rates obtained were 99.1-104.3% for benzoic acid and 98.9-105.0% for sorbic acid. The correlation coefficient of each standard varied from 0.9997 to 1.0000. The proposed method seems to be a suitable method for the broad scale monitoring of natural preservatives in fruits.

Contamination Degree Measurement of Coliform Bacteria in the Refrigerator Tops

Sanggil Lee*, Chung Hee Lee, Jieun Lee, Saerom Eom, Dong-Sub Kim
Uijeongbu Center for Children’s Foodservice Management, Korea, 1Hotel Culinary Arts Major in Division of Food Science & Culinary Arts, ShinHan University, Korea

Purpose of this study is to determine the refrigerator coliform contamination degree by measuring the refrigerator tops. Refrigerator is for preservation of both uncooked and cooked foods and ingredients as packed and also cooked foods are in and out from refrigerator very often. As the preservation place for various foods, it is maintained by low temperature for the prevention of reproduction of microorganisms but it happens that it’s room temperature can cause food poisoning microorganisms to multiply exponentially. As the measurement of coliform bacteria in the refrigerator tops by using ATP luminescence and petri film, among the whole 86 nursery schools, 15 places (17.4%) showed no detection of coliform bacteria and 178 RLU in average ATP, 62 places (72.1%) showed 10^5 CFU/mL and 980 RLU in ATP, and 9 places (10.5%) showed TNC (too numerous to count) of coliform bacteria and 2810 RLU in ATP and the high risk of detection of foodborne microorganisms, including pathogenic microorganisms. These results show the higher probability of occurrence of cross-contamination of food poisoning caused in the microorganisms.

Characteristics of Lactic Acid Bacteria Including Biofilm Formation, Slime Production, Colony Spreading, and Antibiotic Susceptibility, and Their Correlation

Hana Song*, Young-Min Bae, Jae-Hyun Yoon, Sun-Young Lee
Department of Food Science and Technology, Chung-Ang University, Korea

This study was conducted to investigated characteristics of lactic acid bacteria including biofilm formation, slime production, and antibiotic susceptibility. Also their correlations were evaluated. Biofilm formation and slime production were measured by staining method with crystal violet and Congo-Red method, respectively. Agar disc diffusion method was used for determining antibiotic susceptibility for 19 antibiotics. High levels of biofilm formation were found in 8 strain of LAB tested. Among LAB, higher numbers of strong biofilm formation strains showed higher levels of antibiotic resistance against vancomycin, sulfamethoxazole-trimethoprim, levofloxacin, and cefoxitin compared than other groups. While, lower levels of resistance against penicillin were observed in strains of strong biofilm formation group. Only 4 strains (25%) showed positive results on slime production and there was no any correlation between biofilm formation and other characteristics. Therefore, biofilm formation properties of LAB might be not related with the resistance to antibiotics.
Analysis of Food Microbial Pathogen in Air Solution Products and Control of the Microbial Contaminants for Preventing Cross-contamination

Seung-Mok Yeom*, Young-Mog Kim, Myung-Suk Lee
Department of Food Science and Technology, Pukyong National University, Korea, 1Department of Microbiology, Pukyong National University, Korea

Atmospheric pollutants including microorganisms can cause food spoilage and food poisoning by cross-contamination. As a result, air purification was now recognized as an important issue. Therefore, improved sterilization and disinfection technologies are constantly being investigated by food-processing and air-conditioning industries. This study was conducted to analyze food microbial pathogen in air solution and to develop an effective control method of microbial contaminants in air for preventing cross-contamination by air. Firstly, analysis the profiles of microbial contaminants present in air and air solution used in home, office, and industry was conducted. We analyzed four air solution including two dehumidifiers and two air washer. Eleven types of microorganisms were detected in air and air solution; six different species of fungi, one species of yeast, and four species of bacteria. Among them, three genera related with food spoilage and food poisoning was identified: Penicillium sp., Staphylococcus sp., and Bacillus sp.. Thus, these results suggest that the control of microbial contaminants in air solution is important for clean air supply and prevention of cross-contamination.

Monitoring of the Contamination Levels of Norovirus in Ground Water Used at Postharvest Facilities in Korea

Sung-Youn Kim*, Dong-Ho Kim, Kyong-Suk Hong, Jae-Min An, Young-jin Song, Ji-Hye Kim, Chae-Hyun Jung, Byung-Chyoun Kim, Jae-Hwon Lee
Division of Safety Analysis, Experiment & Research Institute, National Agriculture Products Quality Management Service, Korea

Norovirus is an RNA virus of Caliciviridae family and is classified into five genogroups (GI-GV) according to the polymerase and capsid protein sequences. Norovirus is a leading cause of acute gastroenteritis and is often spread via ground water contamination. The quality of the water used in postharvest washing should be controlled and monitored to minimize the potential of cross-contaminating fresh fruits and vegetables. This study was performed to investigate the contamination levels of norovirus in ground water used at agricultural products processing center and postharvest facilities in Korea. The ground water samples from 30 facilities were collected and tested for norovirus genogroups I (GGI) and II (GGII), respectively. Virus particles were concentrated using centrifugation, viral RNA was subsequently extracted, and transformed into cDNA by reverse transcription. The temperature, turbidity, pH, residual chlorine concentration, nitrate nitrogen of ground water were also analysed. Among the 30 facilities, norovirus was not detected during this period. However, in order to ensure food safety and quality it is required of norovirus surveillance on ground water.

Survey and Risk Assessment of Cadmium and Lead Levels of Dried Fruits and Vegetables in Korea

Young-jin Song*, Jae-Min An, Ji-Hye Kim, Chae-Hyun Jung, Sung-Youn Kim, Kyong-Suk Hong, Dong-Ho Kim, Byung-Chyoun Kim, Jae-Hwon Lee
Division of Safety Analysis, Experiment & Research Institute, National Agriculture Products Quality Management Service, Korea

This study was performed to investigate heavy metals of dried fruits and vegetables were determined by ICP. The average levels of Cd in µg/kg were 1.5 for imported Apricot Dried, 4.0 for imported Cranberry Dried, 12.5 for imported Fig Raw, 2.6 for imported Grape Raisin, 2.1 for imported Mango Dried, 1.5 for imported papaya Dried, 1.8 for Persimmon Dried, 8.1 for Sweet Potato Steamed and Dried. The average levels of Pb in µg/kg were 42.5 for imported Apricot Dried, 29.0 for imported Cranberry Dried, 43.7 for imported Fig Raw, 51.1 for imported Grape Raisin, 56.1 for imported Mango Dried, 57.6 for imported papaya Dried, 46.3 for Persimmon Dried, 65.9 for Sweet Potato Steamed and Dried. For risk assessment of Cd, probable daily intake was estimated and compared with provisional tolerable weekly intake established by JECFA. The dietary exposures of Cd through usual weekly intake were 0.002 µg/kg bw week taking 0.03% of PTWI respectively And risk assessment of Pb, probable daily intake was estimated and compared with provisional tolerable weekly intake established by JECFA. The dietary exposures of Pb through usual intake were 0.025 µg/kg bw week taking 0.1% of PTWI.

Validation for Analytical Method of Polycyclic Aromatic Hydrocarbons (PAHs) in Herbal Medicinal Plants

Seung Yi Hong*, Young-Suk Kim
Department of Food Science and Engineering, Ewha Womans University, Korea

This study was performed to develop a quantitative analytical method for the simultaneous determination of 8 polycyclic aromatic hydrocarbons (PAHs) in herbal medicinal matrices. 8 PAHs were benzo[a]anthracene, chrysene, benzo[b]fluoranthene, benzo[k]fluoranthene, benzo[a]pyrene, indeno(1,2,3-cd) pyrene, dibenzo[a,h]anthracene, and benzo[g,h,i]perylene. Validation was carried out in herbal medicinal matrix, a root of Saposhnikovia, on the base of LOD, LOQ, precision, recovery, and accuracy using GC-MS. LOD values for B[a]A, Chry, B(b)F, B(k)F, B(a)P, I(cd)P, D(ah)A, and B(g,h,i)P were 0.19, 0.44, 0.45, 0.24, 0.54, 0.27, 0.28, and 0.93 µg/kg, respectively, whereas LOQ levels were 0.57, 1.34, 1.36, 0.73, 1.63, 0.81, 0.84, and 2.82 µg/kg, respectively. Intra-day precisions (RSD, %) of 1-10 µg/kg concentrations were below 30%, which could satisfy the validation criteria of CODEX (2003), and those of 10-100 µg/kg concentrations were below 20%, respectively. Recovery was in the range of 82-111%, whereas accuracy was in the range of 82-110%.
This study was carried out to update the current specifications of Korea Food Code for hygiene indicator microorganisms and food poisoning bacteria in foods: Ready-to Eat, marine products and processed extract food. Total of 80 samples were collected from a number of grocery stores and markets. Aerobic viable bacteria, coliforms and *E. coli* as hygiene indicator microorganisms were tested with the method of ‘Dry sheet medium culture plate’ and ‘MPN’ specified in the Korea Food Code. *Staphylococcus aureus, Bacillus cereus, Clostridium perfringens, Vibrio parahaemolyticus* as food poisoning bacteria were analyzed with methods specified in the Korea Food Code. Each sample was tested five times according to ICMSF (International Commission on Microbiological Specifications for Foods) standard.

**Response Surface Modeling for the Inactivation of**

*Escherichia coli* O157:H7 on Radish Seeds by Heat and Relative Humidity

**Jae Jun Jang**, Hye Won Kim, Min Kyung Song, Min Suk Rhee

*Department of Food Bioscience & Technology, College of Life Sciences & Biotechnology, Korea University, Korea*

Our previous study for the combined treatment of heat and relative humidity (RH) reported a significant reduction of *Escherichia coli* O157:H7 on radish seeds. In the present study, the response surface methodology was used to determine a predictive model for *E. coli* O157:H7 reduction based on three factors: temperature (55, 60, and 65°C), RH (40, 60, and 80%), and time (8, 15, and 22 h). The predictive model was satisfied with a high regression coefficient (R²=0.9683) and verified with validation data (R²=0.9175). Among three independent variables, temperature was the most effective factor for bacterial reduction (p<0.0001). Considering both microbial reduction and germination rate, 65°C, 40% RH, and 8 h was selected by desirability function (6.6 log reduction; 94.4% germination). The advantages of this technique are simple and clean resulting remarkable bactericidal effects with very low detrimental changes of the seeds. The predictive model developed in this study could be practically used in real industry for sprout production.
Low-Shear Modeled Microgravity Affects the Gene Expression and Protein Levels of the Stationary Phase Sigma Factor RpoS in Escherichia coli O157:H7

Hye Won Kim*, Min Suk Rhee
Department of Food Bioscience & Technology, College of Life Sciences & Biotechnology, Korea University, Korea

The sigma factor RpoS (σ) has been described as a general stress response regulator which confers increased resistance to various stresses in gram-negative bacteria. To elucidate the effects of microgravity on the rpoS expression and RpoS levels in Escherichia coli O157:H7, stationary phase bacterial cultures under Low-Shear Modeled Microgravity (LSMMG: space condition) and Normal Gravity (NG: Earth condition) were prepared. Amounts of total RNA of LSMMG culture (0.46-0.55 μg/μL) was twice that of NG culture (0.18-0.26 μg/μL). Using real time RT-PCR analysis, we found that the relative expression levels of rpoS increased approximately twice under LSMMG condition when normalized by housekeeping gene, GAPDH. In accordance with the up-regulation of rpoS, RpoS levels increased maximum 1.46 times compared to NG condition when measured by Western blot. Our results indicate that, under the microgravity conditions, up-regulated rpoS induces the increased RpoS levels which may accompany the higher resistance of E. coli O157:H7 during the spaceflight.

Bactericidal Effects of Caprylic Acid in Combination with Citric Acid for the Reduction of Escherichia coli O157:H7 and Aerobic Bacteria in Carrot Juice

Sun Ae Kim1,2*, Min Suk Rhee1
1Department of Food Bioscience & Technology, College of Life Sciences & Biotechnology, Korea University, Korea; 2School of Life Sciences and Biotechnology for BK21 PLUS, Korea University, Korea

The microbiological safety of fresh vegetable juice is of great concern to the food industry. The aim of this study was to examine the bactericidal effects of caprylic acid combined with citric acid (both agents are natural borne antimicrobials) against the virulent pathogen E. coli O157:H7 and the endogenous microflora in unpasteurized fresh carrot juice. Carrot juice was treated with either caprylic acid, citric acid, or a combination of caprylic acid + citric acid at mild heating temperature (45°C or 50°C). The color of the treated carrot juice was also examined over time. The use of these inhibitors as separate treatments resulted in negligible inhibitory activity. In contrast, combined treatment with low concentrations effectively inhibited bacteria; combined treatment (each at 5.0 mM) at 50°C for 5 min resulted in 7.46 and 3.07 log CFU/mL reductions in the E. coli O157:H7, and endogenous microflora populations, respectively. Combined treatment also resulted in perceived improvements in the color of the juice. The present results may prove valuable in settings in which contamination by pathogenic bacteria is a concern.

Application of Citric Acid to Drying Step for Controlling Inherent Bacteria in a Dried Laver

Eun Soo Kwak*, Sun Ae Kim, Min Suk Rhee
Department of Food Bioscience & Technology, College of Life Sciences & Biotechnology, Korea University, Korea

While consumption of the dried laver continues to increase in many countries, there is a concern for their microbiological quality. According to our previous study, a raw laver had abundant ocean-derived bacteria and aerobic plate count (APC), in a laver slurry (a mixture of water and raw laver) was highly increased during drying step, reaching about 5-6 log CFU/g in final product (dried laver). The purpose of this study was to develop a novel method which can applicable to drying step using citric acid. Laver slurry was treated with citric acid (2.5, 5, and 10 mM) and then immediately dried at 45°C for 10, 20, 40, and 80 min. After drying for 80 min, a dried laver without citric acid treatment had 6.2 log CFU/g of APC while no APC was observed in a dried laver treated with 10 mM citric acid. The present study highlights the utility of citric acid as a natural antibacterial agent that can control inherent bacteria in a dried laver and it is applicable to real processing step in plant. This method could be a cost-effective treatment for other dried products to retain their microbial quality.

Phytic Acid Permiabilizes Acid Resistant Escherichia coli O157:H7 and Shows Obvious Synergistic Antimicrobial Interaction with Sodium Chloride

Nam Hee Kim*, Min Suk Rhee
Department of Food Bioscience & Technology, College of Life Sciences & Biotechnology, Korea University, Korea

Antimicrobial potential of phytic acid (PA), natural by-product of rice industry, has been merely investigated. This study examined antimicrobial spectrum of the PA and also investigated its interaction with sodium chloride (NaCl), the most common food preservative. The PA showed higher bactericidal effect to acid resistant Escherichia coli O157:H7 than other organic acids, but acid-adapted cells showed higher resistance than non-adapted cells (p<0.05). In ranges that PA or NaCl alone showed negligible effect (p>0.05), combinations of PA + NaCl generated a great synergistic bactericidal effect. PA + 3-4% NaCl completely inactivated acid-resistant E. coli O157:H7 within 5 min without recovery (> 7 log CFU/mL of reduction). A flow cytometry confirmed that the PA alone disrupts cell membrane even the injured cells retained colony forming capacity. When combined with NaCl, however, the cells lost viability by clear disintegration of the membrane. PA has a good potential to be an effective outer membrane permeabilizer which facilitates entry of charged ions into the cytoplasm and combination of PA + NaCl can be a promising alternative to conventional chemical disinfectant.
Identification of Fungal Strains Isolated from Berries

Song Hee Ryu*, Ah-Hyun Choi, Hye-Young Kim, Se-Ri Kim, Won-Il Kim, Hwang-Yong Kim, Ryu Jae-Gee
Microbial Safety Team, Department of Agri-Food Safety, National Academy of Agricultural Science, Rural Development Administration, Korea

This study was conducted to investigate occurrence of toxicogenic fungi on berries such as mulberry, Korean raspberry, and blueberry. Frozen berry samples were collected from 6 mulberry farms, 3 Korean raspberry farms, and 3 blueberry farms. Ten gram of samples were placed on Rose-Bengal chloramphenicol agar using the spreading plating technique to enumerate viable microorganisms. Colonies that appeared on plates were counted after 7 days of incubation at 25°C. A colony that looks different from the colonies was subcultured on potato dextrose agar and identified using a molecular biological methods. Cladosporium sp., Alternaria sp., Phoma sp. were isolated on mulberry and Cladosporium sp., Botrytis sp. were isolated on Korean raspberry. For blueberry, Alternaria sp., Phoma sp., Pestalotiopsis sp. was isolated. In this study, toxicogenic fungi such as Alternaria sp., Aspergillus sp., Penicillium sp. and Fusarium sp. was isolated on all kinds of berry samples although frequency of identification was relatively low. Therefore, it is necessary to identify mycotoxin production of isolated fungi and contaminant of fermented juice made by berries.

Effects of Inland Pollution Sources on the Bacteriological Water Quality after Rainfall Events in Southern Area of Gangneung, Korea

Jun Su Go*, Won Hee Jeong, Jin Kyung Choi1, Il Shik Shin
Department of Marine Food Science and Technology, Gangneung-Wonju National University, Korea, 1Department of Foodservice Management, Woosong University, Korea

Rainfall is a factor affects to the bacteriological quality of seawater. Suspended solid and various pollutants scattered around river basin flow into sea by rainfall, and then contamination level of fecal coliform increase. The purpose of this study is to evaluate the effects of inland pollution sources on bacteriological quality of seawater after rainfall at 20 stations (W1-W20) in Southern area of Gangneung, Korea. The fecal coliform levels at 20 stations were <1.8 MPN/100 mL without rainfall. The range of fecal coliform level of seawater at station W1-W20 was 2.0-13,000 MPN/100 mL at 24 h after rainfall with 46.5 mm precipitation. Among 20 stations, the fecal coliform levels of seawater at station W5 (13,000 MPN/100 mL) was highest. The 11,000 MPN/100 mL of fecal coliform was detected at station W2 17.5 km distant from inland pollution sources. The bacteriological quality of seawater at all station except station W2 were naturally recovered to normal level at 72 h after rainfall.
Effect of Electron Beam Irradiation on Microbial Reduction and Antibacterial Activities in Frozen Crushed Garlics

Hyun-Gyu Lee*, Yunhee Jo, Joong-Ho Kwon
Kyungpook National University, Korea

Garlic is widely used around the world as a seasoning or condiment for its pungent flavor. As demand for frozen crushed garlic (FCG) has been recently increasing for its convenience, electron beam irradiation can be used to control the microorganisms of the frozen foods (IAEA, 2014). This study was designed to determine the effect of electron beam irradiation (0-7 kGy) on microbial decontamination, allin content, and antimicrobial activities of Korean and Chinese FCG. The microbial counts (total bacteria, yeasts & molds, and coliforms) of FCG were reduced from log 3-4 CFU/g to non-detectable levels by irradiation at 4 kGy. HPLC analysis showed that allicin content was not changed at 4 kGy, which dose induced insignificant changes in antibacterial activities of FCG samples on pathogenic bacteria including S. enteritidis, B. subtilis, S. aureus, V. parahaemolyticus, Y. enterocolitica (p<0.05). E-beam irradiation less than 4 kGy can be a suitable means to improve the microbial quality of FCG without changes in biological activities of frozen garlics.

Distribution of Hazardous Microorganisms in Traditional Dried Persimmon Farms

Se-Ri Kim*, Hyo-Sup Lee, Su-Ji Kim, Yu-Mi Jo, Hyun-Mi An, Eun-Sun Lee, Won-II Kim, Song Hee Ryu, Jae-Gee Ryu, Hwang-Yong Kim
Microbial Safety Team, Department of Crop Life Safety, NAAS, RDA, Korea

To investigate the prevalence and frequency of occurrence of food-borne pathogens in perilla cultivation area, a total of 270 samples were collected from 5 farms. The collected samples were assessed on sanitary indicative bacteria (total aerobic bacteria, coliform, and Escherichia coli) and pathogenic bacteria (Escherichia coli O157:H7, Salmonella spp., Staphylococcus aureus, Listeria monocytogenes, Bacillus cereus). The APC level of environment of the 5 traditional dried persimmon farms were 1.41-4.27 log CFU/hand or 100 cm². The mean levels of APC in dried persimmon were decreased by 0.92-1.60 log CFU/g in the process of drying for 3 weeks. For B. cereus, although the mean log10 values in dried persimmon were increased by 0.69-1.66 log within 3 weeks, the mean levels of B. cereus were decreased by 0.5-1.66 log CFU/g in the process of drying after 3 weeks. S. aureus were detected on a glove and dried persimmon, while E. coli O157:H7, Salmonella spp., and L. monocytogenes were not detected. In conclusion, these results clearly demonstrated that safety management system should be introduced to the farms producing traditional dried persimmon to enhance the safety of product.
Antimicrobial Activity of Ethanol Leaf Extract of *Dendropanax morbiferus* Lev.

Su-geyeong Lee*, Soyeon Kim, Eun-Jin Park  
Department of Food Bioengineering, Jeju National University, Korea

In this study, the antimicrobial activities of ethanol leaf extract of *Dendropanax morbiferus* Lev. growing in Jeju Island were investigated. Among 14 strains of 12 species microorganisms, antimicrobial activity was observed against seven Gram-positive bacteria of four species, but not against six Gram-negative bacteria and the yeast strain. By the disc diffusion assay, a diameter of inhibition zone was increased with the extract concentration in all the strains, and the highest growth inhibition was exhibited against *S. aureus* KCTC 1916 at 5 mg/mL. The minimal inhibitory concentration by turbidity were 2.5 and 15 mg/mL against *B. cereus* KACC 12672 and *E. faecalis* KCTC 3206, respectively. The minimum bacterial concentration values defined as 99.9% reduction in viable cells against the tested strains was higher than its MIC values. Time killing curves with the determined MIC were performed on seven strains after 48 h. The growth of *B. cereus* KACC 12672 was detected after 12 h, and no significant growth was showed in the others after 48 h (*p* < 0.05). These results indicate that leaf extract of *D. morbiferus* Lev. could be utilized as a natural preservative.

Effect of Polysaccharide Gel Matrix Containing Chlorine Dioxide in Reducing *Listeria monocytogenes* on Green Pepper

A-Ra Ryu*, Junyong Kim, Taehwan Oh, Jeong-Mok Kim  
Department of Food Engineering, Mokpo National University, Korea

This study was undertaken to evaluate the effects of slow releasing ClO$_2$ gas from polysaccharide gel matrix (agar, gellan gum, and carrageenan) in reducing *Listeria monocytogenes*. Green peppers inoculated with $10^5$ CFU/g of *Listeria monocytogenes* were treated with different gelling matrix, concentrations, and treatment times of ClO$_2$ releasing gel. Green peppers inoculated with $10^5$ CFU/g of *Listeria monocytogenes* were exposed on gaseous ClO$_2$ released by agar, gellan gum and carrageenan for 60 min. The population of *Listeria monocytogenes* in green pepper was reduced by 6.0 and 4.7 log CFU/g after treatment with 1% agar and 1% gellan gum containing ClO$_2$, respectively. The 2% carrageenan showed the 5.0 log CFU/g reduction for 60 min. Reduction in *Listeria monocytogenes* population was significantly correlated with gelling agents and treatment time of exposure ClO$_2$. Residual concentration of ClO$_2$ on green pepper was less than 0.5 ppm, and gaseous ClO$_2$ treatment did not affect the color. These results indicated that gaseous ClO$_2$ emitted slowly from polysaccharide gel matrix were useful in improving the microbial safety and quality of green pepper.

Detection of Norovirus and Indicator Microorganisms in Agricultural Products and Environmental Samples

Ji Hyun Kang*, Hye Mee Shim, Myeong Kyo Jeong, Kwang Yup Kim  
Department of Food Science and Biotechnology, Chungbuk National University, Korea

Norovirus has been causing epidemic viral gastroenteritis in recent years. Team for the control of noroviral foodborne outbreaks (NOROTECL) is tracing the cause of norovirus contamination in agricultural products and environmental samples to reduce, prevent and control norovirus outbreaks in Korea. Between Jan. 16 to April 3 in 2015, we investigated the contaminations of norovirus, MSC (male specific coliphage) and sanitary indicative bacteria in 34 agricultural products, 34 soil, 34 feces and 68 water samples, respectively. Through semi-nested RT-PCR and DNA sequencing, 9 genus group I and 1 genus group II noroviruses were identified in total 9 samples. They were also validated using real time PCR. In IDEXX results, coliform bacteria and *E. coli* were detected in vegetables (60%, 0.49%), water (85%,17%), feces (38%, 0%) and soils (91%, 8.8%). MSC result showed 1 positive sample. We are continuously monitoring these samples and expecting more data.

Monitoring of Heavy Metal Contents of Children's Preferred Food in Korea

Hyun Ah Lee*, Ji Hyun Lee  
SPC Food Safety Center, Korea

This study was conducted to estimate the contents of heavy metals in children's preferred food sold in Korea. The levels of heavy metals were determined using ICP-OES. The contents of Pb; cookies 0.0-0.044 (0.003) mg/kg, candies 0.0-0.0 (0.0) mg/kg, bread 0.0-0.072 (0.007) mg/kg, chocolate 0.0-0.01 (0.001) mg/kg, fruit and vegetable juice 0.0-0.0 (0.0) mg/kg. The contents of Cd; cookies 0.0-0.024 (0.004) mg/kg, candies 0.0-0.0 (0.0) mg/kg, bread 0.0-0.005 (0.001) mg/kg, chocolate 0.0-0.060 (0.021) mg/kg, fruit and vegetable juice 0.0-0.0 (0.0) mg/kg. The contents of As; cookies 0.0-0.009 (0.001) mg/kg, candies 0.0-0.005 (0.002) mg/kg, bread 0.0-0.019 (0.002) mg/kg, chocolate 0.0-0.00 (0.0) mg/kg, fruit and vegetable juice 0.0-0.0 (0.0) mg/kg. The average weekly intake of lead, cadmium and arsenic in children's preferred food sold in Korea is 0.04-0.09% PTWI (Provisional Tolerable Weekly Intakes), a range determined as safe by FAO/WHO Joint Food Additive and Contaminants Committee.
**P10 -055**

Induction of Inflammatory Mediators in Pathogen-infected Chicken Macrophages Treated with Bacteriophages

Lae-Seung Jung*, Geun-Pyo Choi1, Debabrata Biswas2, Juhee Ahn

Department of Medical Biomaterials Engineering, Kangwon National University, Korea, 1Department of Food Processing and Bakery, Gangwon Provincial College, Korea, 2Department of Animal and Avian Sciences, University of Maryland, USA

Recently, the bacteriophage control has received much attention as a potential treatment approach for bacterial infections. The objective of this study was to characterize the role of bacteriophage in Salmonella-infected chicken macrophage cells. The production of inflammatory mediators was determined at 0 and 24 hpi. The survival rates of intracellular S. Typhimurium were effectively reduced in Salmonella-infected macrophages treated with bacteriophages at 24 hpi. The secretion of inflammatory mediators varied with infection period and bacteriophage treatment. The reduction of intracellular S. Typhimurium was highly correlated with the enhanced production of nitric oxide. The results suggest that bacteriophage can be used to control the intracellular pathogens. This study would provide useful information on the bacteriophage-host interactions and open the door for designing an effective and safe bacteriophage therapeutic system.

**P10 -056**

Biofilm Formation and Other Physiological Characteristics of Bacteria Isolated from Food Service Facilities

Eun Seob Lim*, Ok Kyung Koo1,2

1Food Biotechnology, University of Science and Technology, Korea, 2Food Safety Research Center, Korea Food Research Institute, Korea

Biofilm formed pathogenic bacteria have shown despite of disinfectant treatment which may become a cause of foodborne illnesses due to cross-contamination. In this study, biofilm-formation and susceptibility to disinfectant of foodborne pathogens and bacteria isolated from foodservice facilities were evaluated. A total of 23 areas in a cafeteria kitchen were selected for bacterial isolation and identification. Ability of biofilm formation was tested by crystal violet assay and disinfectant susceptibility test was performed by agar well diffusion assay. Most isolated genera were Bacillus (33%), Acinetobacter (17%), Kocuria (12%) and Staphylococcus (5%) among 182 isolates. The genus Bacillus were resulted in highest ratio of biofilm formation that 80% of isolates were over 1.5 of absorbance (OD595) in most isolates. Other genus showed distinctive absorbance values. A wide range of susceptibility on disinfectant such as sodium hypochlorite, hydrogen peroxide, quaternary ammonium compounds and others was observed on the pathogens and isolates. Overall, this study will be a great resource of selection and use of disinfectants for hygienic practices in foodservice facilities.

**P10 -057**

A Comparative Evaluation of the TEMPO®BC and MYP Medium for the Enumeration of Bacillus cereus

Hae-Jin Wang*, Da-Yeon Lee, Hee-eun Kim, Yong Sun Cho

Korea Food Research Institute, Food Analysis Center, Korea

In this study, automated most-probable-number (MPN) system (TEMPO, bioMérieux, Marcy l’Etoile, France) for enumeration of Bacillus cereus was compared with plating method Man-nitol-egg yolk-polymyxin agar (MYP). A total of 225 food samples (sunsik, bibimbap, bibimnongmyeon, gimbap, salad and sushi) collected in supermarket. Samples of 25 g were homogenized with phosphate buffer tested by the TEMPO BC Method and MYP plate method. The results of the two methods were compared to each other. The statistical analysis of the results showed good agreement between the two enumeration methods (p<0.002). TEMPO BC is a practical and reliable alternative to the current standard plate method for the enumeration of Bacillus cereus in foods.

**P10 -058**

Prevalence and Characterization of Clostridium difficile Isolated in Raw Meats

Da-Yeon Lee*, Joo-young Lee, Hae-Jin Wang, Hee-eun Kim, Yong Sun Cho

Korea Food Research Institute, Food Analysis Center, Korea

The aim of the present study was to determine the prevalence of Clostridium difficile in raw meats and to investigate toxin, antimicrobial resistant profiles, and genetic diversity of the isolated strains. C. difficile is an important cause of infection diarrhea that usually develops in patients after hospitalization and antibiotic treatment. Recently studies have isolated C. difficile from retail foods intended for human consumption in the United States, Canada, and Europe. C. difficile was isolated 45 strains (10.8%) from 415 raw meat samples collected in nationwide markets in Korea from 2012 to 2013. September is the highest prevalence rate of the year (28.6%) and detected in Chicken (16.4%), pork (8.3%) and beef (6.8%). According to antibiotic resistance test, resistance to clindamycin was the most common finding. The genetic similarity of ribotype O78, O27 and strains isolated from raw meat was compared to identify the sources of contamination Rep-PCR. Isolated strains presented different patterns from ribotype, with low similarity. We confirmed that 3 strains have toxin A and toxin B by the ELISA reaction and they were high genetic similarity.
Application of Underwater Dielectric Barrier Discharge as a Washing System to Inactivate Salmonella Typhimurium on Perilla Leaves

Eun-Jung Lee*, Joo-Sung Kim, Yun-Ji Kim
Korea Food Research Institute, Korea

An underwater dielectric barrier discharge (DBD) system was applied to inactivate Salmonella Typhimurium. Reduction of S. Typhimurium ATCC 14028 in water suspension was 4.3 log after treatment with underwater DBD system for 1 min. Scanning electron microscope observation showed membrane destruction in S. Typhimurium by underwater DBD treatment, and amount of genomic DNA from cytoplasm was decreased by the underwater DBD treatment. These results reflected that DNA might be released from cytoplasm by membrane damage induced by underwater DBD. And reduction of S. Typhimurium ATCC 14028 on perilla leaves by underwater DBD treatment for 1 min was 1.8 log. Consequently, the underwater DBD could potentially be used in washing step to reduce pathogen such as S. Typhimurium on perilla leaves. Further study on the reduction effects by various types of electrodes and operation conditions were needed for efficiency improvement in microbial reduction on perilla leaves.

Screening for Androgenic Activity of Pesticides by Androgen Receptor Transactivation Assay Using 22Rv1-MMTV-E4 Cells

Hee-Seok Lee*, Eun-Jung Park, Songyi Han, Gyeong-Yong Oh, Min-Hee Kim, Kwang-Soo Lee, Myung-Sil Hwang, Guim Moon, In-Gyun Hwang
Food Safety Risk Assessment Division, National Institute of Food and Drug Safety Evaluation, Ministry of Food and Drug Safety, Korea

Endocrine disruptors are exogenous chemicals which exert adverse effect on endocrine system in mammals. They mimic or block hormone action by binding hormone receptors such as androgen receptor. Indeed, some pesticides are considered as endocrine disruptors. In this study, we selected five pesticides (kepone, procymidone, sodium azide, 2,4,5-T, and procloraz) as the test materials to evaluate androgenic activity or block hormone action by binding hormone receptors such as androgen receptor. Indeed, some pesticides are considered as endocrine disruptors. In this study, we selected five pesticides (kepone, procymidone, sodium azide, 2,4,5-T, and procloraz) as the test materials to evaluate androgenic activity through androgen receptor transcriptional activation (ARTA) assay using the stable cell line, 22Rv1-MMTV-E4 cells. We found all of test pesticides are positive androgen receptor antagonists. The rank of the anti-androgenic activities was procymidone > kepone > procloaza > sodium azide > 2,4,5-T. These IC50 values had 2.53×10-7, 1.46×10-5, 1.16×10-4, 1.39×10-5, and 3.83×10-4 M, respectively. These activities were around 0.64-, 40-, 300-, 980-fold less than positive agonist, DHT/bicalutamide (IC50=3.93×10-7 M). In the case of agonist test, all pesticides were not shown any activity. Moreover, ARTA assay using the stable cell line, 22Rv1-MMTV-E4 cells might be useful as a screening tool for the androgenic and the anti-androgenic activity.

Identification of Small Molecules Inhibiting Exotoxin Production in Vibrio vulnificus

Chang Uk Choi*, Su Jin Yum, Hee-Gon Jeong
Department of Food Science and Technology, College of Agriculture and Life Sciences, Chungnam National University, Korea

Vibrio vulnificus is a gram-negative pathogenic bacterium which causes severe food-borne disease and life-threatening septicemia. Among numerous virulence factors, the Multifunctional Auto-processing RTX toxin (MARTXVv) is one of the most important exotoxins produced by V. vulnificus. In this study, we carried out a high-throughput screening (HTS) to identify inhibitors of MARTXv production using natural single-compounds library. rtxA1 was modified to encode protein with an in-frame β-lactamase (Bla) fusion and nitrocefin was used for colorimetric determination of Bla activity representing MARTXv expression. 4 small molecules (MI (MARTXv-inhibitor)-19, MI-42, MI-50 and MI-71) were identified using a cell-based Bla/nitrocefin system. All these molecules reduced production of extracellular Bla, but didn't show a bactericidal activity against V. vulnificus. Transcription analysis confirmed that identified molecules inhibited rtxA1 transcription, but only MI-19 down-regulated hlyU transcription known as a de-repressor of rtxA1. Therefore, these results suggest that identified molecules in this study can lead to the development of putative anti-V. vulnificus infection agent.
Antimicrobial Effect of Castanea crenata Inner Shell Extracts against Campylobacter jejuni in Chicken Breast

Byeong Su Jung*, Na-Kyoung Lee, Hwan Hee Yu, Da Som Na, Joo-Sung Kim1, Hyun-Dong Paik
Department of Food Science and Biotechnology of Animal Resources, Konkuk University, Korea, 1Division of Convergence Technology, Korea Food Research Institute, Korea

Campylobacter species are very common microorganisms present in humans worldwide. In developing countries, Campylobacter species are an important cause of childhood morbidity caused by diarrheal illness. The aim of the present study was to investigate antimicrobial effects of chestnut inner shell extract (CISE) against Campylobacter jejuni grown in laboratory media and chicken breast were investigated. CISE inhibited the growth and adhesion of C. jejuni to the intestine by reducing aggregation and increasing hydrophobicity (p<0.05). The antimicrobial effects of CISE were tested at 3 different inoculum densities (3, 5, and 7 log CFU per mL or per g) and 2 temperatures (4°C and 42°C). The antimicrobial effect of CISE was higher in laboratory media than in chicken breast, and low temperature storage (4°C) prolonged the survival of C. jejuni. CISE at 1 and 2 mg/mL completely eliminated 3 and 5 log CFU/mL of C. jejuni in laboratory medium, respectively. In fact, just 2 mg/mL of CISE completely eliminated 7 log CFU/mL of C. jejuni. In chicken breast, 1 mg/g of CISE completely eliminated 3 log CFU/g of C. jejuni when stored at 4°C for 7 days.

Analysis of Phenolic Antioxidants Migrated from Polyethylene and Polypropylene Food Packaging Materials into Food Simulants

Heeju Choi*, Jae-Chun Choi, Inae Bae, Hyun Kim, Meehye Kim
Food Additives and Packaging Division, Ministry of Food and Drug Safety, Korea

Phenolic antioxidants are used in the manufacturing of commercial food packages made of plastic such as polyolefin for the purpose to delay the oxidation reaction of the polymer. The analytical method has been developed for the quantitative determination of specific migration levels of phenolic antioxidants such as Irganox 1010, 1076, and 1330 in the food simulants. Specific migration levels of antioxidants were determined by reversed-phase high-performance liquid chromatography (HPLC) after solid-phase extraction (SPE) for aqueous food simulants and dilution with isopropanol (IPA) for fatty food simulant. The SPE step with a silica C18 cartridge was optimized to obtain good recoveries for all three compounds. The analytical method showed good linearity, precision and accuracy. This method would be used as a routine method to analyze antioxidants migrated from polyethylene and polypropylene into food simulants.

Migration of As, Pb, and Cd from Polycarbonate and Rubber Food Packaging Materials

Se-Jong Park*, So-Ra Park, Jae-Chun Choi, Meehye Kim
Food additives and Packaging Division, Ministry of Food and Drug Safety, Korea

The aim of this study was to determine arsenic (As), lead (Pb), and cadmium (Cd) from polycarbonate (PC) and rubber food packaging materials. PC is used in the production of food containers because it is a clear, strong and rigid thermoplastic. Rubber is widely used in food packaging materials such as teats, molds, spoons and spatulas. They may contain trace amounts of additives, residual chemical, catalytic residues and contaminants during the manufacturing process. That could be migrated into the food when PC and rubber food packaging materials are used for cooking, heating and washing. For the reason, we collected PC and rubber food packaging materials from retailed market in Korea and analyzed As, Pb, and Cd by inductively coupled plasma mass spectrometry (ICP-MS). All the samples were filled with food simulants for 30 min at 70 and 100°C under the Korea regulation. The analytical method was validated by examining the limit of detection (LOD), limit of quantification (LOQ), linearity and recovery. The migration results of As, Pb, and Cd would be used as a scientific basis for the safety management of food packaging materials.

Rapid and Simple Method for Direct Determination of Propylene Glycol and Ethylene Glycol in Foods by GC-FID

Ho Soo Lim*, Jung Im Kim, Ju Young Hwang, Meehye Kim
Food Additives and Packaging Division, Ministry of Food and Drug Safety, Korea

A rapid and simple method was developed for the simultaneous determination of propylene glycol (PG) and ethylene glycol (EG) in foods using gas chromatography with flame ionization detector (GC-FID). PG and EG in foods were extracted with acetone, followed by centrifugation and dehydration. The resulting solution was filtered using 0.45 μm membrane syringe filter and injected into GC. The separation of PG and EG was carried out on HP-5 capillary column. The calibration curves of PG and EG were linear in the range of 1.0 to 100 μg/mL, with good correlation coefficients (r² >0.999). Recoveries were more than 90% for spiking levels of 2.0, 40, and 100 mg/kg PG and EG in PG, EG-free samples. The limit of detections (LOD) and limit of quantifications (LOQ) for PG and EG were 0.33 and 0.26, 1.0 and 0.8 μg/mL, respectively. This rapid and simple method is the first method for direct determination of PG and EG in foods by GC-FID.
Effects of Three Different Domains of UV Irradiation with and without TiO$_2$ Photocatalysis on E. coli K12

Dasel Park*, Mijin Lee, Sun-Hyoung Kim, So Young Chun, Jinho Cho, Hafiz Shabbaz, Jiyong Park
Department of Biotechnology, Yonsei University, Korea

Titanium dioxide (TiO$_2$) photocatalytic reaction is an oxidizing process that leads to the creation of hydroxyl radicals when illuminated under UV light. Disinfection properties of TiO$_2$-UV photocatalysis (TUVP) have been well demonstrated. In this study, we evaluated the effect of TUVP treatment on E. coli K12 under different domains of UV light (A, B, and C). The hydroxyl radical concentration, lipid membrane peroxidation, intracellular protein release, DNA strand breakage and morphological changes of cell were comparatively examined. The hydroxyl radical concentrations of TUVP system were found to be as 1.17×10$^{-14}$, 3.50×10$^{-14}$, and 9.83×10$^{-14}$ M when treated with UV-A, -B, and -C, respectively. TUVP reduced E. coli K12 more effectively than UV irradiation alone irrespective of the applied UV domain. E. coli K12 was completely inactivated under TiO$_2$-UV treatment within 2 min. Results showed that TUVP promoted membrane peroxidation and increased the permeability, resulting in the release of intracellular proteins; it caused severe damage to DNA and cell structure. The TiO$_2$-UV photocatalysis can be an effective method to inactivate E. coli K12.

Fabrication of a Sensitive Nanoporous Anodic Aluminium Oxide Sensor

School of Food Science and Biotechnology, College of Agriculture and Life Sciences Kyungpook National University, Korea; 1School of Electronics Engineering, College of IT Engineering, Kyungpook National University, Korea

This study aims to develop a sensitive nanoporous anodic aluminium oxide (NAA) sensor for the employment of biosensor method. The NAA sensor was fabricated by two-step anodizing method. Then, the structural characteristics of fabricated NAA sensor were observed by using FE-SEM. From the FE-SEM images, the diameter, inter-pore distance, wall thickness, and length of pore were 49.6±1.23 nm, 99.7±4.13 nm, 72.8±1.53 nm, and 1.01±0.01 μm, respectively. The fringe characteristic of NAA sensor coated with gold showed clearer and greater reflectance that of bare NAA. The sensitivity of NAA sensor was determined to be 700 nm/RIU, which was greater than that of the previously studies. Therefore, this study showed that NAA sensor was fabricated with an excellent sensitivity and it will be applied for foodborne pathogen detection.

Isolation and Characterization of Novel Bacteriophages Specific for Aeromonas hydrophila

Sung Hyeok Park*, In Young Choi, You Jin Kim, Joo Hyeon Park, Kwang-Pyo Kim*, Mi-Kyung Park
School of Food Science and Biotechnology, Kyungpook National University, Korea; 1Department of Food Science and Technology, College of Agriculture and Life Sciences, Chonbuk National University, Korea

Aeromonas have recently gained more attention due to the increasing outbreaks in food. The development of rapid and practical biosensor method for Aeromonas detection is essentially required for the prevention of its outbreaks. Thus, a lytic and specific bacteriophage was isolated and purified as a new bio-recognition element. Aeromonas-specific phage was isolated from waste water in poultry plant using a spot-on-lawn assay. Lytic property and specificity of purified phage were investigated against 10 non-Aeromonas species and 11 Aeromonas strains using a dot assay. The morphological characteristic of the purified phage was confirmed by using TEM. The purified phage showed an excellent lytic property against A. hydrophila JUNAH and A. hydrophila A9 among 11 Aeromonas stains. The purified phage showed the specificity against A. hydrophila among other 20 bacteria. The TEM images revealed that the purified phage consisted of icosahedral head and long contractile tail with the size of 78±4 nm and 157±6 nm, respectively. Taken together, the purified phage demonstrated an excellent potential for its employment to biosensor methods as the new bio-recognition element.

Simple Biosensor System for Detecting Food-poisoning Bacteria Using Label-free Aptamers with Magnetic Nanoparticles

Ji Young Park*, Moon Il Kim*, Tae Jung Park
Department of Chemistry, Chung-Ang University, Korea; 1Department of BioNano Technology, Gachon University, Korea

Because people have a great attention to well-being food, food-poisoning bacteria is becoming a serious threat to human health. So far, techniques for detecting food-poisoning bacteria take a long time and laborious. To overcome such challenges, platform biosensor system to detect Salmonella Typhimurium was developed. Our colorimetric strategies for the detection of Salmonella are attractive because they enable rapid sensing with naked eyes without the need for sophisticated instruments and long analysis time. We just use magnetic nanoparticles (MNPs), specific aptamers and TMB. Because MNPs have enzyme-like activity, they can lead to color change with hydrogen peroxide. In this system, MNPs were first incubated with aptamers which specifically interact with Salmonella species, thereby reduce the peroxidase activity of MNP by the DNA-mediated shielding of the catalytic activity. After adding of Salmonella cells into the solution, specific aptamers on the MNP interact with Salmonella, which consequently enhance the peroxidase activity of MNP. Considering the inexpensive cost, easy to separation, easy to synthesis and modification, MNP would be applied to various detection systems.
Collecting Food-poisoning Bacteria with Lectin-Fc Fusion Protein Coupled with Magnetic Nanoparticles

Minyoung Joo*, Seon Ah Cheon, Tae Jung Park
Department of Chemistry, Chung-Ang University, Korea

Just low level of food-poisoning bacteria such as Salmonella Typhimurium can cause serious food poisoning. Therefore, specific and sensitive detection tools are required for lower the detection limit of such harmful bacteria. Here, we developed lectin-Fc fusion protein conjugated magnetic nanoparticles (Lectin-Fc@MNPs) to capture and collect food-poisoning bacteria. First, we produced recombinant human MBL2-Fc and PGRP-Fc fusion proteins from Escherichia coli. Human mannos binding lectin (MBL2) or peptidoglycan binding protein (PGRP) plays a major role in recognition of mannos or peptidoglycanic residues at the surface of pathogens, respectively. Fc region of human IgG1 is used as a fusion partner of lectin against challenging pathogens to facilitate those interaction. MBL2-Fc and PGRP-Fc fusion proteins were immobilized at the amine group functionalized MNPs by forming peptide bonds and the resulting MNPs were withdrawn by an external magnet. This lectin-Fc coupled MNPs may improve the limit of detection by concentrating the bacteria with MNPs from real food samples and be an efficient tool for quick diagnosis of food-poisoning in real life.

Effect of Gamma Irradiation on Cochineal Extracts

Allergenicity

Jae-Kyung Kim*, Jong-Heum Park, Beom-Seok Song, Dong-Ho Kim
Advanced Radiation Technology Institute, Korea Atomic Energy Research Institute, Korea

Cochineal extract and Carmine is a natural red dye extracted from the dried female body of cochinell insect (Dactylopiun coccus costa) and widely used as food, cosmetic and pharmaceutical coloring agent. However, carmine is known to induce food allergy. Consequently, reducing technologies of allergenicity of carmine or cochineal extract are required. In the present study, cochineal extract was gamma irradiated with 0, 10, 30, and 50 kGy and contents of the carminic acid which is a major component of cochineal extract and the Hunter color values were measured. Carminic acid level of gamma irradiated cochineal extracts were significantly reduced as irradiation dose increased. Nevertheless, Hunter color values of gamma irradiated cochineal extract decreased which indicates gamma irradiation can improve the efficiency of pigment. Allergenicity of cochineal extracts was evaluated by competitive ELISA cross-react with polyclonal antibody to carmine. Gamma irradiation significantly reduced allergenicity of cochineal extract gradually as irradiation dose increased. In conclusion, gamma irradiation is possible to reduce allergenicity of cochineal extracts with improving its color.

Analysis of 2-Tetradecylcyclobutanone in Irradiated Beef Packaged with Air, Vacuum and Nitrogen Gas

Seon-Min Go1,2, Beom-Seok Song1, Jae-Kyung Kim1, Jong-Heum Park1, Jong-Bang Eun1, Dong-Ho Kim1
1Advanced Radiation Technology Institute, Korea Atomic Energy Research Institute, Korea, 2Department of Food Science and Technology, Chonnam National University, Korea

2-Alkylcyclobutanones (2-ACBs) are considered as Unique Radiolytic Product (URP) of fat-containing foods with irradiation treatment. 2-Tetradecylcyclobutanone (2-tDCB) is one of the most useful 2-ACBs since it is formed from stearic acid which is usually the most abundant in foods. This study was performed to determine 2-ACBs induced by gamma irradiation in beef sirloin at different irradiation doses with different gas packages. Beef sirloin was irradiated at 2, 4, 6, 8, and 10 kGy under air, vacuum and nitrogen gas packages, and irradiated samples were then analyzed using EN 1785 which was accepted as a standard method of measurement of 2-ACBs. The result showed that the production of 2-tDCB in irradiated beef under air, vacuum and nitrogen gas packages was 0.07, 0.15, and 0.16 μg/g lipid per 1 kGy, respectively. The production yields in vacuum and nitrogen gas packaged samples were more than those of air packaged samples, while 2-tDCB was not detected in non-irradiated samples. The detected amount of 2-tDCB showed a linear relationship with respect to the absorbed dose.

Effect of Gamma-ray, Electron-beam, and X-ray Irradiation on Radio-sensitivity of Escherichia coli and Listeria monocytogenes

Beom-Seok Song1*, Koo Jung1, Byeong-Geum Moon1,2, Seon-Min Go1,2, Jae-Kyung Kim1, Jong-Heum Park1, Dong-Ho Kim1
1Advanced Radiation Technology Institute, Korea Atomic Energy Research Institute, Korea, 2Department of Food Science and Technology, Chonnam National University, Korea

The aim of this research was to compare the bacteriocidal effects of gamma, electron-beam (e-beam), and X-ray irradiation on Escherichia coli and Listeria monocytogenes. The cell suspensions of E. coli and L. monocytogenes were prepared with approximate 8 log CFU/mL, and an aliquot of 1 mL was inoculated into ground beef, respectively, followed by treatment with 0, 200, 400, 600, 800, and 1,000 Gy of gamma rays, e-beams, and X-rays. The decimal reduction values (D10 values) of suspended E. coli by gamma, e-beam, and X-ray irradiation were 74.28, 149.45, and 287.92 Gy, respectively, revealing an extreme sensitivity to gamma rays. In contrast, L. monocytogenes was more sensitive to e-beams. In the inoculated meat sample, the radio-sensitivity of both E. coli and L. monocytogenes were significantly higher to gamma rays than e-beams and X-rays. In conclusion, the suspended bacterial cultures tested exhibited different radio-sensitivity to gamma rays, e-beams, and X-rays, whereas gamma irradiation was found to be the most effective process to inactivate bacteria in ground beef.
Prevalence and Characterization of \textit{Salmonella} and \textit{Campylobacter} from Pork and Chicken By-products in South Korea

Jungwhan Chon*, Haein Jung, Min Kuk, Kunho Seo¹, Sooki Kim
Department of Animal Science and Technology, Konkuk University, Korea. ¹Department of Food Science and Technology, Konkuk University, Korea.

We evaluated the microbiological risk of pork and chicken by-products by identifying the pathogens \textit{Campylobacter} and \textit{Salmonella}. Pork (n=95) and chicken (n=64) by-products were collected from 10 processing plants. \textit{Salmonella} were detected in 3 of 95 and 6 of 64 pork and chicken by-products, respectively; all strains from pork were serovar Typhimurium, and those from chickens in order of the frequency of isolation were serovar Virchow, Typhimurium, and Hadar. \textit{Campylobacter} species were present in pork (5 of 95) and chicken (3 of 64). \textit{Campylobacter} from pork were identified as \textit{C. coli} (3 strains) or \textit{C. jejuni} (2 strains), and all chicken isolates were \textit{C. jejuni}. Seven of nine \textit{Salmonella} isolates were resistant to at least three antibiotics, and four isolates produced extended-spectrum \text{ ß-} lactamase. Most \textit{Campylobacter} isolates were resistant to tetracycline and quinolones. Molecular subtyping was performed using automated rep-PCR. The similarity of rep-PCR patterns of \textit{Salmonella} isolates was more closely associated with serotype than with the sampling plant and meat source. However, the rep-PCR patterns of \textit{Campylobacter} isolates were specific to the processing plant.

Effects of Food Sanitation and Safety Support of Center for Children’s Foodservice Management on Children’s Foodservice Facilities in Guri Area

Ye-Ji Jeong*, Eun-Zoo Kang, Hye-Soo Kim, Hye-Min Yoon, Ae-Son Om²
Guri-si Center for Children Foodservice Management, Korea. ²Department of Food & Nutrition, Hanyang University, Korea.

This study was conducted by Center for Children’s Foodservice Management (CCFSM) to evaluate the effects of the sanitation and safety support on children’s foodservice facilities in Guri city, Gyeonggido, Korea. We investigated the sanitation conditions of 90 facilities by using a food safety checklist from September, 2014 to March, 2015. The checklist consisted of 5 categories: personal hygiene, ingredient management, cooking process management, service management, and sanitation management. We provided sanitation products (e.g. ‘apron’, ‘refrigerator thermometer’, etc.) and provided educations for the registered facilities. As a result, the practice rate of each checklist item (first-supporting/second-supporting) was 78.0%/90.0% for ‘Wearing an apron’, 65.5%/80.0% for ‘Checking on refrigerator (0-5°C) temperature’, 6.0%/55.6% for ‘No bare hand contact with food’. However, both ‘No wearing an accessories during cooking process’, and ‘Checking on freezer (below -18°C) temperature’ are the two items needed to be under further scrutiny. The data shows that the sanitation and safety support by CCFSM had positive effects on the condition of the foodservice facilities.

Estimation of Dietary Exposures of Several Pesticide Residues Using Food Commodity Intakes Calculated by KFCIC Software

Min-Seek Baek*, Jaehyo Choe, Yohan Yoon¹, Sanghoon Ko
Department of Food Science and Technology, Sejong University, Korea. ¹Department of Food and Nutrition, SooMyung Women’s University, Korea.

Estimation of the food commodity intake is not easy since normal diets are composed of not only commodity-type foods but also mixed and processed foods. Herein, the Korean Food Commodity Intake Calculation (KFCIC) software to estimate the food commodity intake using database of the Korea National Health and Nutrition Examination Survey (KNHANES) has been developed. The purpose of this research was to evaluate pesticide residues in exposure assessment using the food commodity intake data calculated by the KFCIC software. Several representative food commodities such as rice, potato, apple, peach, cucumber, tomato and perilla leaf were selected to determine their exposure to pesticide residues. The calculated items were the average values in the database of KNHANES in 2008-2012. The average daily intakes of rice, potato, apple, peach, cucumber, tomato and perilla leaf were 217.72, 19.74, 32.05, 9.28, 11.80, 16.80, and 3.20 g, respectively; which were utilized to determine their exposure to several pesticide residues. As a result, the amounts of pesticide residues were ranged between 0.021 and 1.898% of hazard index (%ADI).

Development of a Single-step Enrichment Medium for Non-chromogenic Detection of \textit{Salmonella} spp. in Fresh Vegetables

Hong-Seek Kim*, Dasom Choi, Jung-Whan Chon¹, Dong-Hyeon Kim, Jin-Hyeok Yim, Young-Ji Kim, Il-Byeong Kang, Kun-Ho Seo
KU Center for Food Safety, College of Veterinary Medicine, Konkuk University, Korea. ¹Department of Animal Science and Technology, Konkuk University, Korea.

Culture-based detection of non-typhoid \textit{Salmonella} spp. in foods requires at least four working days; therefore, new detection methods that shorten the test time are needed. In this study, we developed a novel single-step \textit{Salmonella} enrichment broth, SSE-1, and compared its detection capacity with that of commercial single-step ONE-broth \textit{Salmonella} (OBS) medium and a conventional two-step enrichment method using buffered Peptone Water and Kappaport-Vassiliadis Soy broth (BPW-RVS). Minimally processed lettuce samples were artificially inoculated with low levels of \textit{Salmonella} enteritidis (10³ or 10⁴ CFU/g), incubated in OBS, BPW-RVS, and SSE-1 broths, and streaked on xylose lysine deoxycholate (XLD) agar. \textit{Salmonella} recoverability was significantly higher in BPW-RVS (87.5%) and SSE-1 (79.2%) compared to OBS (33.3%) (p<0.05). Our data suggest that the SSE-1 single-step enrichment broth could completely replace two-step enrichment, performing better than commercial single-step enrichment medium in the conventional non-chromogenic \textit{Salmonella} detection, thus saving time, labor, and cost.
Rapid Detection of Pathogenic Bacteria Using an Antibody-based Carbon Nanotube Biosensor

Hyun Kyoung Choi1*, Jinyoung Lee, Jun-Hyun Oh
Department of Plant and Food Sciences, Sangmyung University, Korea

Rapid, selective and sensitive detection methods for pathogenic bacteria in foods are crucial tools to ensure food safety. The objective of this research is to develop a carbon nanotube biosensor to detect foodborne pathogens in foods as a rapid detection method. Single-walled carbon nanotubes (SWCNT) were cast on the surface of a gold sputtered silicon wafer. An anti-Staphylococcus aureus polyclonal antibody (pAb) as an acceptor was self-assembled onto the SWCNT bundles connected between electrodes after applying linker. The linear sweep voltammetry for each step was measured using a potentiostat. The detection of bacteria onto the biosensor was also confirmed using a scanning electron microscope. The binding of pAb with S. aureus significantly increased the resistance (AR). The increase in the resistance of the bacterial culture was proportional to the concentrations of the S. aureus culture up to 10^8 CFU/mL without further increase beyond 10^9 CFU/mL. The linear detection range up to 10^9 CFU/mL was successfully obtained using electrical properties the SWCNTs. The SEM images also confirmed the binding of S. aureus with the SWCNT-based biosensor.

Study on Decontamination of Escherichia coli, Listeria monocytogenes, and Salmonella spp. Using Cabinet X-ray System

Byeong-Geum Moon1,2*, Koo Jung1, Jong-Heum Park1, Beom-Seek Song1, Jae-Kyung Kim1, Jong-Bang Eun1, Dong-Ho Kim1
1Team for Radiation Food Science & Biotechnology, Advanced Radiation Technology Institute, Korea, 2Department of Food Science and Technology, Chonnam National University, Korea

Efficient cabinet X-ray system has successfully been used for sterilization in sectors such as medical supplies and foods. This study evaluated the inactivation effects of cabinet X-ray system on decontamination of E. coli, L. monocytogenes, and Salmonella spp., which is a known as a major pathogen for food poisoning. The samples were irradiated using a cabinet X-ray system (Model 43855F, Faxitron X-ray LLC., USA). The E. coli, L. monocytogenes, and Salmonella spp. population was significantly reduced with increasing radiation doses (p<0.05). The initial population of L. monocytogenes and Salmonella spp. were 8.94 and 8.98 log CFU/g respectively, whereas the microbes in samples irradiated with X-rays was significantly reduced by 3 log values at a dose of 600 Gy (p<0.05). The initial population of E. coli (8.46 CFU/g) was also significantly reduced by 6 log values at a dose of 600 Gy (p<0.05). The D10 value for the E. coli was 92 Gy and those for L. monocytogenes and Salmonella spp. were 174 and 196 Gy, respectively. These results indicate that X-rays generated from Cabinet X-ray system were effective for the reduction of food pathogens.

Improvement of Karmali Agar by Supplementation with Tazobactam Sodium Salt for Detecting Campylobacter from Chicken Carcass Rinse

Young-Ji Kim*, Hong-Seek Kim, Kwang-Yeo Kim, Kun-Ho Seo
KU Center for Good Safety, College of Veterinary Medicine, Konkuk University, Korea

Tazobactam, ESBL inhibitor, was added to karmali agar and investigated for improving the selectivity and specificity of commercial karmali agar. Normal karmali agar and modified karmali agar (T-karmali agar) were evaluated with 120 whole chicken samples. All samples were rinsed with 400 mL buffered peptone water by gentle shaking for 1 min and then this rinse fluid samples were enriched with 2x Bolton enrichment broth at 42°C for 48 h under microaerobic condition. After incubation, a loopful of enrichment broth was streaked onto unmodified and modified karmali agar, followed by incubation at same condition as described above. The isolation ability of T-karmali agar was higher than unmodified normal karmali agar (T-karmali, 16 out of 120; karmali, 10 out of 120). Furthermore, the selectivity of the T-karmali agar was significantly higher than that of karmali agar (16 out of 120; 99 out of 120) and growth index of background flora (T-karmali, 0.18; Karmali, 2.43) was also better than normal karmali agar. We concluded that karmali agar supplemented with tazobactam can effectively inhibit competing flora, allowing to isolate Campylobacter spp. successfully from chicken carcass.
Detection of Norovirus and F+ Coliphage at Farming Environments

Won Jung Park*, Seo Yeon Park, So Jung Kim, Jong Hyun Park
Department of Food Science and Biotechnology, Gachon University, Korea

Norovirus has accounted to the high percentage of food poisoning in our country. However, the detection is not easy to predict the contamination of norovirus. In order to analyze the viral contamination at the farming environments, the detection of coliform, E. coli, and F+ coliphage with norovirus were conducted. To analyze the relation, total 136 agricultural products of vegetable, strawberry, perilla leaf, cucumber, cabbage, white radish, chives, and tomato collected from 136 farm sites. Also, 136 samples of the soil, agricultural water and river water in the farming environment were collected. Norovirus were detected mostly from the 15 samples of the river water and their norovirus were the mean level of 4×10^6 copies/mL. Two types of Genogroup norovirus at five samples and seven types of GenogroupII norovirus at ten samples of the river were detected. Mainly the detection of norovirus has been detected at the samples of winter and the river water. Four F+ coliphages were in the river water. Compared to environment samples, coliform and E. coli were relatively much more detected in the river water. To find a contamination source and correlation, further research is needed.

Virulence Factors and Starch Hydrolysis of Bacillus cereus in Powdered Infant Formulas and Ready-to-eat Foods

Jae-Hyung Park*, Ji-Yeon Hwang, Jong-Hyun Park
Department of Food Science and Biotechnology, Gachon University, Korea

The potential virulence factors and starch-hydrolyzing properties of B. cereus isolated from ready-to-eat (RTE) foods and powdered infant formulas (PIF) were analyzed. A total of 347 B. cereus strains were isolated and identified from 687 samples. Half of the strains had all three enterotoxin genes were detected in 50% of the B. cereus isolates from RTE, 14% of the isolates were identified from PIF. RTE harbored higher cytK, hceT, and hbl genes than PIF 83% of the isolates were positive and 17% were negative for starch hydrolysis. Over 90% of the RTE food isolates and only 35% of PIF isolates were positive for starch hydrolysis. All the strains possessed nhe, but their harboring patterns of hbl and cytK were significantly different. Most starch-hydrolyzing strains possessed hbl and very low non-starch hydrolyzing strains harbored cytK. Most non-starch-hydrolyzing isolates showed high lecinthinase and strong hemolysis activities, and very low hbl and cytK harboring. Therefore, most PIF isolates showed stronger hemolysis and higher lecinthinase activities with lower frequency of harboring hbl and cytK and lower starch hydrolysis than RTE isolates.

Survey of Lead, Cadmium, and Foreign Matter in Agricultural Products and Kimchi from Kimchi Industry

Ji-Su Yang*, In Min Hwang, Ye-Seul Hwang, Su-Yeon You, Sung Hyun Kim
World Institute of Kimchi, Korea

This study was carried out as a survey on the contents of lead, cadmium, and foreign matter in agricultural products and kimchi. The samples (51 vegetables and 18 kimchi) were collected from eleven kimchi industry in Korea, and most vegetable samples were divided into the before and after washing. Vegetable after washing generally showed with slightly lower contents of lead and cadmium compared to those before washing. The average levels of lead in mg/kg (wet weight basis) were 0.009 for leaf vegetables, 0.007 for leaf and stem vegetables, 0.009 for root vegetables, and 0.009 for kimchi. The average levels of cadmium in mg/kg (wet weight basis) were 0.008 for leaf vegetables, 0.011 for leaf and stem vegetables, 0.007 for root vegetable, and 0.012 for kimchi. Foreign matter was not detected in any of the samples. The present results of this study showed that lead and cadmium contents in the whole samples were less than the maximum residual levels of the KFDA standard. The data from this research will be valuable source for database construction for science-based safety control and management for the metal and foreign matter contamination in kimchi.
Anti-norovirus Activity of Natural Plant Extracts Using a Norovirus Surrogate System

Ye Won Kim*, Bomi Kim, Do Kyung Kim, Yeon-Ji Kim, Moon Jung Song1, Sung-Junoon Lee
Division of Food Bioscience and Technology, College of Life Science and Biotechnology, Korea University, Korea, 1Department of Biosystems and Biotechnology, College of Life Science and Biotechnology, Korea University, Korea

Noroviruses have been identified as a major cause of acute gastroenteritis epidemics. In this study, the antiviral activity of natural plant extracts against murine norovirus-1 (MNV-1), a surrogate of human norovirus were investigated using plaque assay. Plants extracts (1 mg/mL) were individually mixed with MNV at titers of ~5 log10 PFU/mL and incubated for 72 h at 4°C. The infectivity of the recovered virus after treatment was evaluated by a number of plaque. Among the 53 of tested plant extracts, three plant extracts exhibited a significant reduction of MNV plaque formation: FSB A; FSB B; FSB C (patent pending). MNV-1 plaque formation was decreased >50% with FSB A (64.93%); <50% with FSB B (21.38%) and FSB C (39.73%). The inhibition concentrations for 50% reduction (IC50) of MNV-1 were 1.381 mg/mL, 3.315 mg/mL, 4.044 mg/mL in FSB A, FSB B, FSB C, respectively. In addition, three plant extracts exhibited significant reduction of the MNV plaque formation in a time-dependent manner at 25°C and 37°C. Our results suggest that plant extracts may directly have an impact on MNV capsid proteins.

Antiviral Effect of Phytochemicals on Murine Norovirus as Surrogates for Human Norovirus

Ye Won Kim*, Bomi Kim, Do Kyung Kim, Yeon-Ji Kim, Moon Jung Song1, Sung-Junoon Lee
Division of Food Bioscience and Technology, College of Life Science and Biotechnology, Korea University, Korea, 1Department of Biosystems and Biotechnology, College of Life Science and Biotechnology, Korea University, Korea

In this study, the effect of phytochemicals was investigated on the infectivity of murine norovirus-1 (MNV-1), a surrogate of human norovirus (huNoV) using plaque assay. MNV-1 at titers of ~5 log10 PFU/mL was mixed with phytochemicals (1 mg/mL or 0.2% v/v) and incubated for 72 h at 4°C. The infectivity of the recovered virus after treatment was evaluated by a number of plaque formations. Among the 47 of tested phytochemicals, three phytochemicals exhibited a significant reduction of MNV plaque formation: FSB D (80.17%); FSB E (75.49%); FSB F (75.49%). The inhibition concentrations for 50% reduction of MNV-1 were 4.058 mg/mL, 0.3061 mg/mL and 0.1537% v/v in FSB D, FSB E and FSB F, respectively. Furthermore, three phytochemicals exhibited significant reduction of the MNV plaque formation in a time-dependent manner at 25°C and 37°C. In an attempt to identify active components with antiviral activities, 6 components derived from FSB F were examined, and components C reduced the plaque formation to 26.09% at a concentration of 2% v/v. Our results suggest these phytochemicals may help to directly inactivate norovirus particles.

The FDA Food Safety Modernization Act (FSMA) - The Current Status of Preventive Controls for Human Food

Yoonkyung Roh*, Boyoun Lee, Chaeyoon Lee, Dongeun Sung, Sangsuk Oh
Department of Food Science and Technology, College of Engineering, Ewha Womans University, Korea

Rules of food safety on preventive controls (PC) are a major issue in recent development of food safety regulation in the US. The FDA published the original proposed PC for Human Food on January 16, 2013. In FSMA, PC for Human Food is based on current good manufacturing practice (CGMP). CGMP includes personnel, building, equipment, process, sanitation and recall plan. Hazard analysis and risk-based preventive controls is the updated rule of HACCP. This rule is for facilities that manufacture, process, pack or hold for human food. FDA received comments on PC for human food from September 29, 2014 to December 15, 2014. The supplemental proposal provisions of PC for Human Food were revised definition of farm, definition of business size, proposed requirements for product testing, environmental monitoring and supplier verification, and proposed requirements for a hazard analysis to address economically motivated adulteration. These revisions will be reflected in the final rule on August 30, 2015. Through these changes, rule will affect to prevent problems that can cause foodborne illness and to deal with regulation more flexibly.

Monitoring on Microbiological Contamination of Agricultural Products and Kimchi in Korea

Ji-Hyun Lee*, Won-Bo Shim, Su Ji Kim, Hae-Won Lee, Sung Hyun Kim
World Institute of Kimchi, Korea

Over the past years, the outbreaks from food poisoning have been continuously increasing on agricultural products and Kimchi. This study was conducted to investigate the microbiological contamination of agricultural products washed and non-washed and kimchi. A collection of 150 samples of agricultural products and kimchi was obtained in Korea. Samples were subjected for total aerobic bacteria, coliforms, Enterichthia coli, and major food pathogens (Bacillus cereus, Entetohemorrhagic, E. coli, C. perfringens, C. jejuni/coli, S. aureus, S. spp., V. parahaemolyticus, L. monocytogenes, and Y. enterocolitica). Among the agricultural products, total aerobic bacteria ranged between 1.0 and 8.7 log CFU/g. Total aerobic bacteria with the largest contamination level was detected on the ginger non-washed. However the significant reduction of microbial contamination level by washing was confirmed on radish (ranged 2.0 CFU/g). B. cereus 18.5% and S. aureus 1.0% and most food pathogens were not detected in any of the samples. In conclusion, The HACCP system should be introduced to the kimchi industry to improve the microbial quality of the kimchi products in Korea.
The FDA Food Safety Modernization Act (FSMA) - The Current Status of Produce Safety

Kyungmin Lee*, Jiyee Yang, Chaeyoon Lee, Dongeun Sung, Sangsuk Oh
Department of Food Science and Technology, College of Engineering, Ewha Womans University, Korea

Four rules proposed in 2013 of the US Food and Drug Administration were changes of food safety regulation to implement the FDA Food Safety Modernization Act. Produce safety is science- and risk-based preventive controls focusing on identified routes of microbial contamination. The standards of food safety cover a)Domesticated and wild animals, b)Equipment, tools, buildings and sanitation, c)Worker health and hygiene, d)Agricultural water, e)Growing, harvesting, packing and holding activities, f)Biological soil amendments of animal origin and g)Specific requirements for sprouts. The FDA was proposing more flexible in many ways of produce safety on 5 following key provisions: a)Water directly applied to the growing of produce, b)Extensive studies of the safe use of fertilizer, c)The better definition of “farm”, d)Withdrawal and reinstatement of qualified exemptions process and e)Well defined provisions in wild animals. Based on these comments on the FSMA Proposed Supplemental Rule on December 15, 2014, final rule will be released in near future. This study will focus on updates of produce safety regulation of the FSMA that the FDA has recently been developing to ensure food safety.

The FDA Food Safety Modernization Act (FSMA) - The Current Status of Preventive Controls for Food for Animals

Jiyee Yang*, Kyungmin Lee, Chaeyoon Lee, Dongeun Sung, Sangsuk Oh
Department of Food Science and Technology, College of Engineering, Ewha Womans University, Korea

In 2013, US FDA published Hazard Analysis and Risk-based Preventive Controls for Food for Animals to implement FSMA. Preventive controls (PC) for food for animals would apply to domestic and imported animal food, including pet food, animal feed, and raw materials and ingredients. PC for food for animals based on CGMP is similar to that for human food, however, PC for food for animals include nutrient imbalances. This rule includes CGMP regarding personnel, plants, sanitary operations, processes, equipment as well as recall plan. Allergens are not included in PC for animal food. The FDA received comments on risk-based PC for food for animals from September 29, 2014 to December 15, 2014. The proposed supplemental rules include a)additional CGMP regulations, b)definition of very small business of animal food, c)withdrawal of exemptions, d)potential regulatory language, e)economically motivated adulteration language, and f)feed mills associated with farms. These revision will be reflected in the final rule which will be published on August 30, 2015. These multiple revisions and a substantial strengthening will provide greater assurance of food safety for all animals, including pets.
A New Simplified Method for Detecting and Quantification of Antimicrobial Resistant *Escherichia coli* with the IDEXX Colilert and IDEXX Quanti-Tray® Method

Min-Hyeok Cha*, Jeong-Tae Kim, Kyeong-Won Kim, Gun-Jo Woo
Laboratory of Food Safety and Evaluation, Department of Biotechnology, Korea University, Korea

These days, simple and rapid detecting method for microorganism is very important. For detecting antimicrobial resistant bacteria, general methods for detecting that from food samples and environment samples should be established in the isolating bacteria from samples and testing antimicrobial resistance with methods of disk-diffusion and MIC (Minimum Inhibitory Concentration). By using mixture of IDEXX Colilert® and additional antimicrobial, substances simple and rapid detection and quantification for antimicrobial resistant *Escherichia coli* is possible. This new method shorten the detecting time to 18 h.

Development of the Analysis and Pretreatment Method of Brown FK in Foods by HPLC

Yeon-Seong Jeong*, Hee-Min Noh, Hee-Jae Suh1, Ok-Hwan Lee2, Hyang-Sook Chun, Chan Lee
Chung-Ang University, Korea, 1Sunmmon University, Korea, 2Kangwon National University, Korea

Brown FK is consisted of six mono-, di- and tri-azo-dye which is permitted in EU as a food colorant, but not in Korea. In our study, three different analysis methods of Brown FK by high-performance liquid chromatography (HPLC) with diode array detection (DAD) were compared. Modified JECA method, which was performed with isocratic gradient of 0.075 M sodium acetate (pH 7) with methanol (2:3) at 254 nm, showed the best linearity (R²=1) with good resolution and selectivity. And the method showed the best limit of detection and limit of quantification. LC-MS/MS was applied to confirm Brown FK. To analyze the Brown FK in three foods (processed fishery, oriental noodle, and cooked ham), sample pretreatment and preparation were optimized as described by AOAC and MHLW methods and the recoveries among these methods were compared.

Evaluation of Various Dilution Buffers and Media to Enumerate *Vibrio* spp.

Jae-Hyun Yoon*, Young-Min Bae, Hana Song, Sun-Young Lee
Department of Food Science and Technology, Chung-Ang University, Korea

The number of *Vibrio* spp. in foods would be underestimated, depending on the type of dilution buffers and media. In the present study, effects of dilution buffers and media on enumeration of a total of 14 *Vibrio* spp. in TCBS and TSA with 3% NaCl (TSAN3) was compared before and after storage at 4°C for 3 days. Among dilution buffers and media, PBS showed significantly (p<0.05) lower effects on enumerating the number of *V. paraenemolyticus* 1 in TSAN3 and *V. parahaemolyticus* 1 in TSAN3 and PBS showed efficacies of less than or equal to the others for enumeration of *Vibrio* spp..
Diversity of Fluoroquinolone Resistant and Virulent Enterococci Isolated from Fresh Produce and Farm Samples in South Korea

Siti Zuhaidah Hamzah*, Kimberly Gongora, Moo-Kyung Kim, Min-Hyeok Cha, Gun-Jo Woo
Laboratory of Food Safety and Evaluation, Department of Biotechnology, Korea University, Korea

To date, only few studies were done on the characterization of Enterococci isolated from vegetables. Hence in this study, fluoroquinolone resistant Enterococci from vegetable and farm samples were analyzed. 66 (59 E. faecalis, 7 E. faecium) isolates were collected from 28 fresh vegetables and 38 farm samples. Fluoroquinolone resistance was tested by Disc Diffusion and Minimal Inhibitory Concentration as well as Polymerase Chain Reaction. 32 E. faecalis isolates showed resistance but not E. faecium. In Multi-locus sequence typing, we found 17 STs, six CCs and 10 singletons. In conclusion Enterococci strains are diverse and it is important to know the diversity of E. faecalis and E. faecium in fresh produce farming and its environment.

Gammar Radiation Induces Change of Molecular Structure and Physiological Properties of Resveratrol by Gamma Irradiation

Eui-Baek Byun*, Jae-Nam Park, Mi-So Yang¹, Nak-Yun Sung², Sang-Hyun Park, Beom-Su Jang, Eui-Hong Byun³
Advanced Radiation Technology Institute, Korea Atomic Energy Research Institute, Korea, ¹Department of Microbiology, Infection Signaling Network Research Center, College of Medicine, Chungnam National University, Korea, ²Department of Food Science and Technology, Konju National University, Korea

The aim of the present work was to gain further insight into the molecular mechanisms of gamma-irradiated resveratrol as an anti-inflammatory agent. Resveratrol was irradiated at various doses of 15 to 70 kGy. Structural modification of gamma-irradiated resveratrol was measured by HPLC, which induced the decrease in the resveratrol peak and the appearance of several new peaks up to 70 kGy. Gamma-irradiated resveratrol did not exert cytotoxicity to macrophages in dose ranges from 30 to 70 kGy; therefore, 70 kGy gamma-irradiated resveratrol was used as the maximum dose throughout subsequent experiments. Treatment of LPS-stimulated macrophages with 70 kGy gamma-irradiated resveratrol resulted in a dose-dependent decrease in iNOS-mediated NO, PGE2, and pro-inflammatory cytokines level, such as TNF-α, IL-6 and IL-1β. These findings may be closely mediated with the radiolysis products of resveratrol transformed by gamma-irradiation. From these findings, it seems likely that gamma irradiation can be an effective tool for a reduction of the toxicity and play a potent role in the treatment of inflammatory disease.

Improvement of Anti-inflammatory Action through the Structural Modification of Gamma-irradiated Chrysins in Macrophages

Eui-Baek Byun*, Jae-Nam Park, Beom-Su Jang, Sang-Hyun Park
Advanced Radiation Technology Institute, Korea Atomic Energy Research Institute, Korea

We focused on the role of gamma irradiation on the physiological properties of chrysins as an anti-inflammatory agent. Chrysins were irradiated at various doses of 15, 30, and 50 kGy for the development of anti-inflammatory action through modification of the structural properties. We observed that the decrease in the chrysin peak after gamma irradiation was concomitant with the appearance of several new peaks increased up to 50 kGy. Both gamma-irradiated chrysin (15 to 50 kGy) and intact-chrysin (0 kGy) did not exert cytotoxicity to macrophages at concentrations ranging from 0 to 25 μM. Treatment of LPS-stimulated macrophages with 50 kGy gamma-irradiated chrysin resulted in a dose-dependent decrease in pro-inflammatory mediators, such as NO and PGE2, as well as pro-inflammatory cytokines compared to the same concentration of the intact-chrysin treated group. From these findings, the anti-inflammatory action may be closely mediated with the radiolysis products induced by the structural modification of chrysin. It seems likely that gamma irradiation can be an effective tool for the treatment of inflammatory-related disease.

Anti-inflammatory Action of Gamma-irradiated Resveratrol through Toll-like Receptor 4 Signaling in Lipopolysaccharide-stimulated Macrophages

Eui-Baek Byun*, Jae-Nam Park, Mi-So Yang¹, Eui-Hong Byun³, Nak-Yun Sung², Beom-Su Jang, Sang-Hyun Park
Advanced Radiation Technology Institute, Korea Atomic Energy Research Institute, Korea, ¹Department of Microbiology, Infection Signaling Network Research Center, College of Medicine, Chungnam National University, Korea, ³Department of Food Science and Technology, Konju National University, Korea

The present study was to evaluate the effects of gamma irradiation on the physiological activities of resveratrol in terms of anti-inflammatory action. Resveratrol was irradiated at various doses of 15, 30, 50, and 70 kGy. Gamma irradiation effectively reduced the cell cytotoxicity induced by a high dose of resveratrol treatment. For this reason, 70 kGy gamma-irradiated resveratrol showing a non-cytotoxic effect was used in all of the subsequent experiments. 70 kGy gamma-irradiated resveratrol significantly inhibited cyclooxygenase-2 levels, as well as the expression of cell surface molecules, such as CD80 and CD86, in LPS-induced macrophages. Furthermore, the inhibitory action of these pro-inflammatory mediators occurred through an inhibition of MAPKs (ERK1/2, p38 and JNK) and NF-κB signaling pathways based on a toll-like receptor 4 in macrophages. This anti-inflammatory action might be closely mediated with the structural modification of resveratrol induced by gamma irradiation. Further study is needed, however, for formulation of changed resveratrol form and clarification of upstream signaling pathways involved in the anti-inflammatory action.
**Eupatorium makinoi** Suppresses Toll-like Receptor Signaling Pathways

Sang-Il Ahn1,*, Ji-Soo Kim1, Chea-Yeon Hong2, Hyeon-Myeong Shin2, Hyung-Sun Youn1,2

1Departments of Medical Science, College of Medical Sciences, SoonChunHyang University, Korea, 2Department of Biomedical Laboratory Science, College of Medical Sciences, SoonChunHyang University, Korea

Toll-like receptors (TLRs) recognize microbial molecules that are widely presented by pathogens and initiate innate immune system. TLR signaling is divided into two different signaling pathways, the myeloid differential factor 88 (MyD88)- and Toll-interleukin-1 receptor domain-containing adapter inducing interferon-b (TRIF)-dependent pathways. *Eupatorium makinoi*, a plant species in Asteraceae, is used for medicinal purposes in China, Korea, and Japan. We investigated the effect of an ethanol extract of *E. makinoi* (EEM) on TLRs signaling pathways. EEM suppresses NF-κB activation and iNOS and COX-2 expression induced by TLR2 or TLR4 agonists. Also, EEM suppressed the activation of IRF3 induced by TLR3 or TLR4 agonists. All results indicated that EEM suppressed MyD88- and TRIF-dependent signaling pathways of TLRs and the expression of target genes derived from the activation of TLRs.

**Bioactive of Pueraria radix after Juice Extract**

Beom-Seok Ryu1,*, Dong-Hyun Jeong1, Jae-Hyun Jeong1,2

1Department of Food Science and Technology, Korea National University of Transportation, Korea 2Bio-Food School-Based Enterprise, Korea National University of Transportation, Korea

The aim of this study was to evaluate the antioxidant activity and protective effect of extracts from *Pueraria radix* after juice extract. For total polyphenol and flavonoid substances of extracts, RP (W 66.84±0.79 mg/g; EtOH 77.87±0.53 mg/g) was higher than P (W 42.11±0.38 mg/g; EtOH 32.36±0.45 in total polyphenol contents), however, flavonoid was not detected. Antioxidant activities in the extracts were determined for various radical scavenging activities including FRAP, ABTS radical scavenging activity. DP showed a good scavenging effect of DPPH radical (IC50 PW 0.16; PE 0.13; RPW 0.07 mg/mL; RPE 0.05 mg/mL), alkyl radical (IC50 PW 0.07; PE 0.08; RPW 0.05 mg/mL; RPE 0.03 mg/mL), and hydroxyl radical (IC50 PW 7.11; PE 4.83; RPW 5.92 mg/mL; RPE 5.94 mg/mL). Cell toxicity was determined by MTT assay on RAW264.7 macrophages. We evaluated the anti-inflammatory effects of extracts by measuring nitric oxide. Ethanol extracts (0.125, 0.25, and 0.5 mg/mL) significantly suppressed LPS-stimulated production of NO. The present results show that ethanol extract has anti-inflammatory effects on RAW264.7 macrophages. Therefore, extract of RP may be utilized as a good source of functional foods.

**Curcumin Suppresses Cholera Toxin-induced ER Stress and Anti-inflammatory Response in Human Epithelial Cells**

Eunmi Park*

Department of Food and Nutrition, Hannam University, Korea

The intestine consists of the small intestine and the large intestine, which is the major location of nutrient absorption as well as contact with pathogens/bacteria or their secreted toxins. The intestinal epithelial cell barrier is the first location of defense for innate immunity. The present study showed that treatment with curcumin resulted in a reduction of BIP mRNA levels and IL-8 mRNA levels after choldra intoxication. Curcumin also reduced ER stress induction by thapsigargin or cholera toxin and thereby lead to reduction in inflammatory response. In addition, the study indicates that curcumin can also reduce the toxicity of pathogen. Using the electrophysiology assay, it was shown that curcumin treatment can reduce and delay the toxicity of wild-type cholera. Finally, our data suggest that long-term or consistent intake of curcumin-containing food might prevent early bacterial or virus infection into the lumen of the intestine or reduce the degree of the infection by inhibiting the inflammatory response and an ER stress response from the intestinal epithelial barriers.
Ferulic Acid Hypersensitizes to Poly (ADP-ribose) Polymerase Inhibitor Breast Cancer Cells as Combination Chemotherapy

Eunmi Park*
Department of Food and Nutrition, Hannam University, Korea

Inhibition of DNA damage repair pathway is a common mechanism by which conventional cancer therapies kill cancer cells. Chemical inhibitors of poly (ADP-ribose) polymerase (PARP) are efficient in inducing sensitivity to BRCA-deficient tumors through synthetic lethality by targeting base-excision repair (BER) in HR-deficient tumors. Ferulic acid has been shown its therapeutic effects against cancer. Here, we hypothesized that ferulic acid impedes HR-dependent repair and therefore, ferulic acid in combination with PARP inhibitor, make cancer cells more hypersensitive. In the present study, ferulic acid reduces HR repair, inhibits RAD 51 foci formation, which is a crucial protein in HR repair and reduces HR-dependent repair. Moreover ferulic acid results in accumulation of γ-H2AX, a hallmark of DNA damage. Finally, we demonstrated that combined treatment of ferulic acid and PARP inhibitor reduces colony formation in HR-proficient breast cancer cells. Taken together, our study provides new data that ferulic acid regulates HR-dependent-repair, including RAD 51 foci formation, and it hypersensitizes breast cancer cells to PARP inhibitor when combined as a chemotherapy reagent.

Gomisin J Inhibits Oleic Acid-induced Hepatic Lipogenesis by Activation of the AMPK Dependent Pathway and Inhibition of the Hepatokine Fetuin-A in HepG2 Cells

Myungsuk Kim*, Ahmad Randy, Eui Jeong Nam, Chu Won Nho
Natural Product Research Center, Korea Institute of Science and Technology (KIST) Gungneung Institute, Korea

The aim of our study is to investigate the molecular mechanism of gomisin J from Schisandra chinensis on the oleic acid (OA)-induced lipid accumulation in HepG2 cells. Triglyceride (TG) assays, and Oil red O staining were used to determine lipid accumulation in the HepG2 cells. Gomisin J attenuated lipid accumulation in OA-induced HepG2 cells. It also suppressed the expression of lipogenic enzymes and inflammatory mediators and increased the expression of lipolytic enzymes in OA-induced HepG2 cells. Furthermore, the use of specific inhibitors and fetuin-A-siRNA and liver kinase B1 (LKB1)-siRNA transfected cells demonstrated that gomisin J regulated lipogenesis and lipolysis via inhibition of fetuin-A and activation of an AMP-activated protein kinase (AMPK)-dependent pathway in HepG2 cells. Our results showed that gomisin J suppressed lipid accumulation by regulating the expression of lipogenic and lipolytic enzymes and inflammatory molecules through activation of AMPK, LKB1, and Ca2+/calmodulin-dependent protein kinase II and inhibition of fetuin-A in HepG2 cells. It suggested that gomisin J has potential benefits in preventing and treating nonalcoholic fatty liver disease.

Effect of Quercetin Post-treatment against γ-Irradiation-induced Hematopoietic Damage and Cellular Toxicity in Mice

Jung Ae Kang1,2, Seon Hye Yoon1,3, Jong Kook Rho4, Dae Seong Choi1, Beom-Su Jang3, Sang Hyun Park5
1Advanced Radiation Technology Institute, Korea Atomic Energy Research Institute, Korea, 2Department of Food and Nutrition, Chungnam National University, Korea, 3Department of Radiation Biotechnology and Applied Radioisotope Science, Korea 4Research Division, Kwangmyungdang Pharmaceutical Co. Ltd.

This study was designed to evaluate the protective effect of quercetin against radiation-induced hematopoietic damage and cellular toxicity in BALB/c mice. Quercetin (25, 50 mg/kg, b.w.) was given to female BALB/c mice, via oral administration for 7 consecutive days after whole body exposure to 6 Gy of γ-radiation. Radiation-induced significantly elevated hepatocellular damage markers, including AST (aspartate aminotransferase) and ALT (alanine aminotransferase), as well as depleted spleen index, thymus index, and the number of white blood cells. In addition, lipid peroxidation was significantly increased, whereas levels of antioxidant enzyme activities, including SOD (superoxide dismutase), catalase, and GPx (glutathione peroxidase) were significantly depleted in γ-irradiated mice. However, post-treatment with quercetin resulted in a significant recovery and protection of all of these parameters. These results suggest that quercetin to be an effective radioprotector against radiation-induced cellular damage in mice.

Antioxidant and Anti-diabetes Activities of Spatholobus suberectus Extracts

Peijun Zhao*, Md Badrul Alam, Hyeong-U Son, Sang-Han Lee
School of Food Science and Biotechnology, Kyungpook National University, Korea

Type 2 diabetes is common type of diabetes over the world. The stem of the Spatholobus suberectus has been widely used as a traditional Chinese herbal medicine against several diseases. Total phenolic content and total flavonoid content of the Spatholobus suberectus aqueous extracts (SA) and ethanol extracts (SE) were 185.65±0.54, 298.20±1.12 GAE mg/g and 185.59±0.64, 271.30±19.61 CE mg/g, respectively. We also investigated whether these extracts had antioxidant activities through a series of experiments including DPPH and ABTS radical-scavenging activities, FRAP assay, CUPRAC assay, and ORAC assay. The extracts showed high anti-oxidant potential. Furthermore, we determined in vitro α-glucosidase inhibitory activity of SA and SE with an inhibition of 70% and 90% at the concentration of 10 (μg/mL), respectively. Moreover, the glucose uptake was also increased upon SA and SE treatment in C2C12 cells. Taken together, our results suggest that Spatholobus suberectus might be a potential herbal plant for the treatment of type 2 diabetes.

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**P11 -012**

**In vivo Study on Radioprotective Effect of Rutin**

Seon Hye Yoon 1,2*, Jung Ae Kang 1,3, Jong Kook Rho 3, Yoonsung Jung 4, Beom Su Jang 1,2, Sang Hyun Park 1,2

1 Advanced Radiation Technology Institute, Korea Atomic Energy Research Institute, Korea, 2 Department of Radiation Biotechnology and Applied Radioisotope Science, Korea, 3 Department of Food and Nutrition, Chungnam National University, Korea, 4 Kwangmyungdang Pharmaceutical Co., Ltd, Korea

The radioprotective effect of rutin was studied in BALB/c mice exposed to γ-irradiation. Young BALB/c mice were divided into four groups and then exposed to 6 Gy of γ-irradiation to investigate mice hematopoiesis, lipid peroxidation of liver and antioxidant enzymes of liver. After 1 h, mice were orally administered rutin (50, 100 mg/kg, b.w.). Exposure to γ-irradiation resulted in elevation of serum AST (aspartate aminotransferase) and ALT (alanine aminotransferase) levels as well as reduction of spleen index, thymus index, and the number of white blood cell. Moreover, γ-irradiation gave rise to significant increase of lipid peroxidation and depletion of antioxidant enzymes such as SOD (superoxide dismutase), catalase, and GPX (gluthathione peroxidase) in liver. However, present study found that treatment of rutin substantially attenuated radiation-mediated injury. These findings demonstrate that post-treatment with rutin could prevent hepatocellular and hematopoietic system damage from γ-irradiation.

**P11 -014**

**Effect of Black Ginger Extract on Skin Hydration in Human Epidermal Keratinocytes and Hairless Mice**

Changhee Kim 1,*, Seon Wook Woo 1, Dongbin Rhim 2, Jae-Kwan Hwang 1,2

1 Department of Biotechnology, College of Life Science and Biotechnology, Yonsei University, Korea, 2 Department of Biomaterials Science and Engineering, Yonsei University, Korea

Black ginger (*Kaempferia parviflora* Wall. ex. Baker) has been reported to possess anti-inflammatory, anti-cancer, and gastroprotective activities. In this study, the effect of *K. parviflora* ethanol extract (KPE) on skin hydration was investigated with human epidermal keratinocytes (HaCaT) and hairless mice (SKH-1). KPE increased cornified envelope (CE) formation by enhancing the expression of keratinocyte differentiation markers such as loricrin (LOR), involucrin (INV), and transglutaminase (TGM) which were closely related with peroxisome proliferator-activated receptor alpha (PPARα) for skin hydration. KPE also stimulated the generation of natural moisturizing factors by upregulating the expression of matriptase (MTSP), prostasin (PRSS), filaggrin (FLG) and caspase 14 (CASP14). KPE (200 mg/kg/day for 24 weeks) showed skin hydration and barrier function by preventing transepidermal water loss (TEWL) and elevating keratinocyte differentiation markers in intrinsic aged mice. Overall, *K. parviflora* could be used as a potential cosmeceutical material for improving skin hydration.

**P11 -013**

**Enhancement of Antioxidant Effects of Naringin after Atmospheric Pressure Dielectric Barrier Discharge Plasma Treatment**

Tae Hoon Kim *, Hyun-Joo Kim 1, Hae In Yong 3, Haeilim Lee 1, Wonho Choe 1*, Cheorun Jo 1

Department of Food Science and Biotechnology, Daeug University, Korea, 1 Department of Agricultural Biotechnology, Seoul National University, Korea, 2 Department of Physics, Korea Advanced Institute of Science and Technology, Korea

Naringin is the natural chief bitter flavonoid found in Citrus species. Naringin was treated by atmospheric pressure dielectric barrier discharge plasma to enhance bioactivity and resulted in two new flavonoids, narinplasmins A (2) and B (3), along with the known compound, 2R-naringin. The structures of the two new naringin derivatives were elucidated on the basis of spectroscopic methods. The antioxidant activity of all isolates were evaluated based on 1,1-diphenyl-2-picryl-hydrazyl and peroxynitrite (ONOO-) scavenging assays. The new flavanone glycoside 2 containing a methoxyalkyl group exhibited significantly improved antioxidant properties in these assays relative to the parent naringin.

**P11 -015**

**Anti-photoaging Effect of β-Sitosterol, an Activator of PPARα, on UV-induced Human Dermal Fibroblasts**

Changhee Kim 1,*, Jae-Hong Jeong 1, Dongbin Rhim 2, Jae-Kwan Hwang 1,2

1 Department of Biotechnology, College of Life Science and Biotechnology, Yonsei University, Korea, 2 Department of Biomaterials Science and Engineering, Yonsei University, Korea

Chronic exposure to ultraviolet (UV) irradiation causes photoaging in skin through inflammatory responses and reactive oxygen species (ROS). The present study was performed to evaluate the inhibitory effect of β-sitosterol on UVB-induced photoaging in HS68 human dermal fibroblasts. β-Sitosterol activated antioxidant enzymes such as catalase and superoxide dismutase (SOD), having an antioxidant activity through decrease in UVB-induced ROS production. Also, mitogen-activated protein kinases (MAPKs) and activator protein-1 (AP-1) singling pathways, activated by ROS, were suppressed by β-sitosterol. It was also found that β-sitosterol decreased UVB-induced matrix metalloproteases (MMPs) expression with reduction in inflammatory responses and increased collagen expression and secretion. Additionally, β-sitosterol directly activated peroxisome proliferator-activated receptor-alpha (PPARα) which has an anti-inflammatory effect. Overall, β-sitosterol, an activator of PPARα, could be a substantial natural anti-photoaging agent in the skin.
Formulation Optimization of Vegetable Powders Using Experimental Mixture Design

Mi-Bo Kim¹*, Jeong-Yeon Ko², Mi-Ok Ko², Sang-Bin Lim¹,²
¹Jeju Wellbeing Vegetables RIS System, Jeju National University, Korea, ²Department of Food Bioengineering, Jeju National University, Korea

This study optimized the mixing ratio of broccoli (BroMP), cabbage (CabMP), and carrot-mixed powders (CarMP) for the development of juice powders containing high total phenolic content (TPC), high antioxidant activities, and preferable sensory properties using a mixture design. TPC and antioxidant activities of juice powders were increased with a higher proportion of BroMP and lower proportions of CabMP and CarMP. However, the overall acceptance was increased with a higher CarMP proportion and lower BroMP and CabMP proportions. The optimal mixing ratio obtained from the numerical and graphical optimizations was 67.4% BroMP, 16.7% CabMP, and 15.9% CarMP. At this ratio, the predicted response values of TPC, ABTS radical scavenging activity (IC₅₀), FRAP activity, and overall acceptance were 9.51 mg GA/g dry extract, 5.35 µM FSE/g dry extract, and 4.62, respectively. Desirability at this optimal point was calculated as 0.658. The optimized mixing ratio enhanced both the functionality and sensory properties of vegetable juice powders.

Effects of Panax ginseng with Different Steaming Time on Thermoregulation in Rats

Hyung Taek Cho*, Jun Ho Kim, Young Jun Kim
Korea University, Korea

It has been shown that protopanaxatriol-ginsenosides (PPT-G) promotes microcirculation and activates NOS pathway; however, it is still unclear whether PPT-G controls body temperature. We here investigated the acute and chronic effects of white ginseng (WG) and steamed ginseng (SG) with different levels of PPT-G and propanaxadiol-ginsenosides (PPD-G) on body temperature, blood pressure, and heart rate in rats. The total ginsenosides and PPD-G/PPT-G ratio of SG was higher than those of WG and was increased with the steaming time (3, 6, and 9 h). All extracts were administered orally to mice for single day (200 mg extract/kg) or once daily for 3 weeks (10 mg ginsenosides/kg). Our results showed that the administration of WG extract, which has the highest PPT-G content, did not affect body temperature, blood pressure and heart rate in rats after single or daily administration. There were no significant differences in the observed parameters among all tested groups. These results suggest that the WG extract has no adverse effects on thermoregulation in rat.

Effect of Gallus domesticus (Yeonsan ogolgye) Extracts on Osteoblast Differentiation and Osteoclast Formation

Han Seok Yoo*, Kang-Hyun Chung, Jeung Hee An¹
Department of Food Science and Technology, Seoul National University of Science & Technology, Korea, ¹Division of Food Bioscience, Konkuk University, Korea

The principal objective of this study was effects of Gallus domesticus (Yeonsan ogolgye) extract on osteoblasts differentiation and osteoclasts formation at the cellular level. Gallus domesticus (Yeonsan ogolgye) extract was prepared using ethanol and water solution. In order to observe the effects on osteoblasts differentiation, we measured cell viability and alkaline phosphatase activity against MG-63 and RAW 264.7 cell. In the MG-63 cells, water extract from GD showed a more than 83% of viability at all concentrations, and the ethanol extract was showed 64% to 89% at a 250 mg/mL concentration. The water extract was not toxicity, but the ethanol extract showed the toxicity all the range concentration in the raw 264.7 cell. Our result observed that the water extract from flesh of 1 years cock showed high the alkaline phosphatase activity 140.6% at 1.000 mg/mL. Our result demonstrate that the water extract of GD increase the proliferation and bone-forming activity of osteoblasts, and inhibit the activity of bone-resorbing osteoclasts.

St. John’s Wort (Hepericum Perforatum) Induces Apoptosis of MCF-7 Human Breast Cancer Cells

Hyeon-A Kim*, Mi-Kyoung You, Hwa-Jin Kim
Department of Food & Nutrition/Research Institute of Human Ecology, Mokpo National University, Korea

In this study, we examined the effect of St. John’s Wort extract (SJW) on the apoptosis of the estrogen receptor positive (ER+) MCF-7 human breast cancer cells. Cells were grown in Dulbecco’s modified Eagle’s medium (DMEM) supplemented with 3.0 g/L glucose, 3.7 g/L sodium bicarbonate and 10% fetal bovine and were incubated in a humidified incubator at 37°C and 5% CO₂. Cells were cultured in the presence 10, 25, or 50 µg/mL SJW. SJW significantly induced apoptosis of MCF-7 cells in a dose-dependent manner. The expression of Bcl-2, an apoptotic suppressor gene, was significantly decreased, whereas, the expression of Bax, a proapoptotic gene, was increased by SJW. The ratio of Bcl-2/Bax protein expressions, which is considered to be an important indicator of apoptosis, significantly decreased in a dose-dependent manner. Furthermore, SJW increased activation of caspase-3/7 compared to control. Taken together, these findings suggest that SJW may be a potential chemotherapeutic agent for the control of human breast cancer cells.
Optimization of Processing Time and Temperature for Brown Rice Noodle

Ju Hwan Hyun*, Chang-Nam Kim¹, Sung-Won Choi², Nam-Yoon Hur², Byung-Young Kim, Moo-Young Baik
Department of Food Science and Biotechnology, Kyung Hee University, Korea, ¹Department of Hotel Baking Technology, Hyejeon College, Korea, ²Department of Food and Culinary Arts, Osaka University, Japan

Based on the processing condition of rice noodle (80-85°C and 20-40 min), optimum BR noodle processing conditions were investigated to maximize antioxidant activity, digestibility and gelatinization using the response surface methodology (RSM). The experiments were designed according to the central composite design, which included two independent variables (temperature and time), and six dependent variables (total phenolic contents (TPC), total flavonoid contents (TFC), DPPH and ABTS radical scavenging activities, digestibility, gelatinization). As expected, antioxidant activities were decreased but digestibility and gelatinization were increased with increasing temperature and time. All dependent variables are suggested quadratic model but probability of TPC and TFC were not applicable (0.1505 and 0.6965). Therefore, other four dependent variables were applied to the 3D response surface. Three optimum conditions have been proposed; 1) for antioxidant activity (70°C, 22.95 min, 0.720), 2) for digestibility and gelatinization (88.18°C, 34.89 min, 0.688), and 3) for both (88.50°C, 40 min, 0.690). These results show the optimum processing conditions for BR in rice noodle processing.

Study on the Biological Activities of Flavonols from Fruits of Opuntia ficus-indica Grown in Korea via Enzymatic Hydrolysis

Hyesoo Jeong*, Byoung Ha An¹, Wemniei Zhou, Jeong Yoon Shin¹, Xiuyan Liu, Johann Sohn², Hye-Jin Park², Na-Hye Sung², Minsoo Chang³
Graduate School of Life Systems Science, Sookmyung Women’s University, Korea, ¹Department of Food and Nutrition, Sookmyung Women’s University, Korea, ²Natural F&B Corp., Korea, ³Department of Medical and Pharmaceutical Science, College of Science, Sookmyung Women’s University, Korea

Opuntia ficus-indica (OFI) is the plant generally grown in South America and East Asia. Especially, OFI grown in Korea is composed of high amount narcissin (isorhamnetin-3-O-rutinoside). Flavonol aglycones such as quercetin, kaempferol and isorhamnetin comprise the phytochemicals present in OFI. In particular, both kaempferol and isorhamnetin have ERα subtype selectivity with ERβ preference. In this study, we investigated the appropriate enzymatic hydrolysis conditions to obtain isorhamnetin from narcissin present in freeze-dried OFI fruits. HPLC and LC-ESI-MS/MS analyses were utilized to identify the enzymatic reaction, which lead to increase of isorhamnetin concentration by fold compared to no enzymatic hydrolysis. The ER-mediated transcription assays revealed that the estrogen signaling with ERβ-mediated mechanism was increased in the samples subject to enzymatic hydrolysis. Our results demonstrate that enzymatic hydrolysis may add a high value to develop OFI extracts as functional food product for postmenopausal women’s health through increase in ERβ-selective estrogenic activities.

Anti-inflammatory, α-Glucosidase and Pancreatic Lipase Inhibitory, and DPPH Radical Scavenging Activity of Daraesoon Affected by Blanching and Drying

Jeongha Kim*, Haecheon Ahn, Jihee Kim, Eunok Choe
Inha University, Korea

Daraesoon (shoot of Siberian gooseberry tree, Actinidia arguta Planchon) contains high amount of antioxidative compounds which can contribute to the human health. Daraesoon is usually air-dried after collection, which may cause chemical changes of these compounds and subsequent changes in health functionality. This study evaluated the effect of blanching and drying on anti-inflammatory, α-glucosidase and pancreatic lipase inhibitory, and DPPH radical scavenging activity of daraesoon. Fresh daraesoon was blanched in boiling water for 50 s and dried in the dark and under light. Fresh daraesoon showed 65.35, 64.36, 35.73, and 83.99% of anti-inflammatory, glucosidase and lipase inhibitory, and radical scavenging activity, respectively. Blanching did not affect all activities, and drying significantly decreased only the anti-inflammatory nitrite scavenging activity to 54.90% and 54.15% after drying under light for 10 days and in the dark for 13 days, respectively. The results suggest that drying of daraesoon after blanching hardly affect the anti-inflammatory, α-glucosidase and pancreatic lipase inhibitory, and DPPH radical scavenging activities regardless of light presence.

Modulating Effect of Beneficial Microorganisms on the Production of Th1 and Th2 Cytokines induced by Concanavalin A

Jae Yoon Baek*, Sun Young Lim
Division of Marine Bioscience, Korea Maritime & Ocean University, Korea

We investigated the effect of beneficial microorganisms (BM) on the production of cytokines in C57BL/6 mice. The culture supernatants of splenocytes exposed to 85% aqueous methanol (85%aq. MeOH) fraction from BM plus concanavalin A (Con A) were harvested to determine the production of Th1 (IFN-γ, TNF-α, IL-2, IL-17A) and Th2 [IL-4, IL-5, IL-6, IL-10, IL-12/IL-23[p40]] cytokines. Co-administration of the 85%aq. MeOH fraction from Con A resulted in a significantly higher IFN-γ expression than that observed with Con A alone (p<0.01), but significantly decreased TNF-α and IL-17A expression (p<0.05). Treatment with 85%aq. MeOH fraction plus Con A also significantly decreased the expression of Th2 [IL-4, IL-5, IL-12/IL-23[p40]] cytokines (p<0.01). These findings demonstrate that 85%aq. MeOH fraction from BM downregulates the immediate hypersensitivity reaction induced by Con A. These results also suggest that 85%aq. MeOH fraction from BM may have potential application in preventive or adjunct anti-inflammatory therapy, wherein it acts by modulating the production of cytokines.
**P11-024**

**Aurantio-obtusin isolated from *Cassia tora* Inhibits UVB-induced MMP Expression and Promotes Type-1 Procollagen Production through Estrogen Receptor Activation in HaCaT Cells and Human Dermal Fibroblasts**

Eui Jeong Nam*, Ahmad Randy, Myungsuk Kim, Young Gyun Park, Chu Won Nho  
Natural Product Research Center, Korea Institute of Science and Technology, Korea

Aurantio-obtusin, which is isolated from *Cassia tora*, have been reported to possess antioxidant and anticancer activities; however, its effects on photaging are unknown. This study assessed the effects of aurantio-obtusin and extract of *Cassia tora* (CTE) on photaging and investigated its mechanisms of action in UVB-irradiated immortalized human keratinocytes (HaCaT) and human dermal fibroblast (HDF) by enzyme-linked immunosorbent assay, reverse transcription-polymerase chain reaction, Western blot analysis and 2,7′-dichlorofluorescin diacetate assay. Our results showed that aurantio-obtusin and CTE attenuated UVB-induced MMP and inflammatory cytokine expression by deactivating mitogen-activated protein kinases (MAPKs) induced by reactive oxygen species. Aurantio-obtusin and CTE also increased type-I procollagen and antioxidant enzyme expression by activating estrogen response element (ERE). Taken together, aurantio-obtusin and CTE regulates the expression of MMPs and type-I procollagen in UVB-irradiated HaCaT cells and HDF by regulating MAPK and ERE, suggesting it as a potential candidate for prevention and treatment of skin aging.

**P11-026**

**Rosa hybrida Extract Suppresses Vascular Smooth Muscle Cells Responses via the Targeting of Signaling Pathways, Cell-cycle Regulation, and Matrix Metalloproteinase-9 Expression**

Sung Lyea Park*, Se-Jung Lee, Se Yeon Won, Jun-Hui Song, Dae-Hwa Noh, Hong-Man Kim, Chang Shik Yin, Wun-Jae Kim, Sung-Kwon Moon  
Department of Food and Nutrition, Chung-Ang University, Korea, 1Acupuncture Meridian Science Research Center, College of Korean Medicine, Kyung Hee University, Korea, 2Department of Urology, Chungbuk National University College of Medicine, Korea

The pharmacological effects of *Rosa hybrida* are well established in the cosmetics industry. However, the role of *Rosa hybrida* in cardiovascular biology has not yet been investigated. The goal of this study was to elucidate the effect of the water extract of *Rosa hybrida* (WERH) on platelet-derived growth factor (PDGF)-induced vascular smooth muscle cells (VSMCs). VSMCs proliferation by PDGF was inhibited in a non-toxicological manner by WERH, which also diminished the phosphorylation of ERK1/2 and AKT. WERH also induced G1-phase cell-cycle arrest, which was due to the reduction of cyclins and CDKs and the stimulation of p21WAF1 expression in PDGF-treated VSMCs. Moreover, WERH suppressed the PDGF-induced migration and invasion of VSMCs. WERH abolished the expression of matrix metalloproteinase (MMP)-9 and decreased the binding activities of the nuclear factor kappaB (NF-kB), activator protein-1 (AP-1), and specificity protein1 (Sp-1) motifs in PDGF-stimulated VSMCs. These results provide new insight into the development of a new agent for preventing and/or treating vascular diseases.

**P11-025**

**Inhibitory Effects of *Sphallerocarpus gracilis* on IgE-Induced Degranulation in Rat Basophilic Leukemia Mast Cells and TNF-α- and IFN-γ-induced Expression of Chemokines and Cytokines in Human Keratinocytes**

Myungsuk Kim*, Eui Jeong Nam, Ahmad Randy, Sue Ji Lim, Chu Won Nho  
Natural Product Research Center, Korea Institute of Science and Technology, Korea

*Sphallerocarpus gracilis* from Mongol is a little-investigated edible and medicinal plant. In the present study, the effects of *Sphallerocarpus gracilis* extract (SGE) on activation and degranulation of rat basophilic leukemia (RBL-2H3) mast cells and expression of chemokines and cytokines in HaCaT cells were investigated. To evaluate the effects of SGE on allergy and atopic dermatitis, we determined its effects on degranulation, and inflammatory mediators in IgE-stimulated RBL-2H3 cells and production and expression of chemokines and cytokines in TNF-α and IFN-γ-stimulated HaCaT cells. SGE inhibited secretion of β-hexosaminidase and histamine, production of prostaglandin E2, and the mRNA expression of IL-4, and TNF-α in-stimulated RBL-2H3 cells. SGE attenuated phosphorylation of the mitogen-activated protein kinases extracellular signal-regulated kinase, p38, and c-Jun N-terminal kinase expression. Furthermore, SGE also inhibited productions and expressions of TARC, MDC, and IL-6 in TNF-α and IFN-γ-stimulated HaCaT cells. These results indicate that SGE might be useful as an agent against immediate-type hypersensitivity and atopic dermatitis.

**P11-027**

**Biological Activities of Lipid Soluble Extracts and Brown Rice in Black Waxy Rice with Giant Embryo**

Sang-Ik Han*, Woo Duck Seo, Ji-Eun Ra, Ji-Young Park, Eun-Young Sim, Dong-Soo Park, You-Chun Song, Min-Hee Nam, Young-Up Kwon  
National Institute of Crop Science, Korea

Bioactive components in rice vary depending on the variety and growing condition. Fat-soluble components such as γ-oryzanol, tocopherols, tocoferolins, carotenoids, and fatty acids were analyzed in brown, sugary brown, red, and black rice varieties using established high-performance liquid chromatography (HPLC) and GC methodologies. The highest content of tocopherols (α-, 1.5; γ-, 0.5 mg/100 g) and carotenoids (lutein 244; trans-β-carotene 25 µg/100 g) were observed in BGE (black rice with giant embryo, “Nunkeunheukchal”. To determine the beneficial effect of BGE and its bioactive constituents on metabolic risk factors in overweight/obese people with central adiposity. A randomized, placebo controlled, 2-way crossover pilot feasibility study was conducted to determine the effect of BGE on metabolic risk factors. The effect of brown rice on blood pressure, gluco-regulation and lipid profile was null. For a case study in plasma insulin levels dropped drastically after the BGE phase (21.1 U/mL) compared to baseline (58.9 U/mL). These improvements suggest that BGE may have the potential to modestly reduce several important risk factors for diabetes and cardiovascular disease.
Protective Effects of *Trapa japonica* Pericarp against t-BHP Induced Oxidative Stress *In vitro* and *In vivo*

Yon-Suk Kim*, Seong-Eun Kim, Bo-Im You, Nam-Joo Jeon, Xin Dong, Pyo-Jam Park
Department of Biotechnology, Konkuk University, Korea

In this study, the hepatic protective effects of the *Trapa japonica* pericarp ethanolic extract were evaluated. The ethyl acetate fraction showed protective effects against tert-butyl-hydroperoxide-induced oxidative damage *in vitro* and *in vivo*. *In vitro* experimental results showed that the EF suppressed t-BHP-induced damage in Chang cells by inhibiting reactive oxygen species generation and regulating the mitochondrial membrane potential. Furthermore, western blot analysis showed that the EF effectively inhibited t-BHP-induced apoptosis by suppressing caspase-3, caspase-7, caspase-8, and caspase-9. *In vivo* study, the EF significantly prevented serum increases in glutamate oxaloacetate transaminase and glutamate pyruvate transaminase and hepatic malondialdehyde levels caused by t-BHP. Furthermore, the EF markedly increased hepatic superoxide dismutase, catalase, and glutathione levels. Histopathological examinations further confirmed that the EF could protect the liver from t-BHP-induced oxidative injury. These findings indicate that the EF could be developed as a medicinal plant for the therapy and prevention of hepatic injury.

Alnus japonica Extracts Induce Caspase-dependent Apoptosis in AGS Human Gastric Carcinoma Cells

Seong-Eun Kim*, Yon-Suk Kim, Bo-Im You, Nam-Joo Jeon, Xin Dong, Pyo-Jam Park
Department of Biotechnology, Konkuk University, Korea

*Alnus japonica* has been used as a traditional oriental medicine for many diseases such as fever, hemorrhage, diarrhea, and alcoholism. In this study, *A. japonica* extracts were evaluated for their *in vitro* antioxidant potential and anticancer effects in AGS human gastric carcinoma cell lines. The antioxidant properties of *A. japonica* extracts were evaluated by several biochemical assays, including FRAP (ferric reducing antioxidant power) assay, ABTS (2,2′-azino-bis(3-ethylbenzothiazoline-6-sulphonic acid), DPPH (2,2-diphenyl-1-picyril-hydrazyl), alkyl and hydroxyl radical scavenging activities. These results show that ethanol extracts of *A. japonica* (AJE) have greater antioxidant activity than water extracts of *A. japonica* (AJW). AJE extracts inhibited cell growth and induced cell death by increasing reactive oxygen species (ROS) production in AGS cells. Moreover, AJE extracts specifically triggered apoptosis when caspase-8, 7, 3, and poly ADP ribose polymerase (PARP) were activated. These results suggest that treatment with AJE extracts could be a new promising strategy for clinical chemotherapy.

Combination Effects of *Boswellia serrata*, Grape Seed and Juniper Berry Extracts on the Prevention of Rheumatoid Arthritis in Mice

Keon Woong Park*, Hyung Min Kim, Jun Ho Kim, Young Jun Kim
Department of Food and Biotechnology, Korea University, Korea

This study was designed to investigate the combination effects of *Boswellia serrata* extract (BSE), grape seed extract (GSE), and juniper berry extract (JBE) for the prevention of rheumatoid arthritis. All three extracts inhibited the production of nitric oxide and PGE2 in LPS-stimulated RAW 264.7 cells, and the BSE exhibited the strongest inhibitory effects. The optimal blend of extracts at the ratio of 2:1:1 (BSE:GSE:JBE, w/w) were selected from the *in vitro* assay and used for further determination in mouse models of collagen-induced arthritis (CIA). The daily oral administration of mixed extracts (100 or 200 mg/kg) and BSE (200 mg/kg) significantly attenuated arthritic incidence and reduced serum inflammatory mediators in CIA animals. Histological observations revealed that mixed extracts improved synovial hyperplasia and inflammatory infiltration in a dose-dependent manner. Importantly, the observed preventive effects of mixed extracts against rheumatoid arthritis were stronger than the effects of BSE alone at a same dose. The current results showed that the appropriate combination of GSE and JBE could enhance the preventive effects of BSE against rheumatoid arthritis in mice.

Anticancer Activity of Thymol Though the Apoptosis Pathway on AGS Cell Lines

Nam-Joo Jeon*, Yon-Suk Kim, Jin-Woo Hwang, Seong-Eun Kim, Bo-Im You, Xin Dong, Pyo-Jam Park
Department of Biotechnology, Konkuk University, Korea

Thymol, a phenolic compound found in a variety of plants, has been reported to have antioxidant, antimicrobial, antibacterial, anti-inflammatory, and anticancer effects. However, the effects of thymol on gastric cancer cells are poorly understood. In this study, we discovered that thymol exerts anticancer effects by suppressing cell growth, inducing apoptosis, producing intracellular reactive oxygen species (ROS), depolarizing mitochondrial membrane potential (MMP), and activating prosapoptotic mitochondrial proteins Bax, cysteine aspartases (caspases), and poly ADP ribose polymerase (PARP) in AGS human gastric carcinoma cells. The results showed that thymol induced apoptosis through the intrinsic (mitochondria-mediated) pathway in AGS cells. Thus, thymol can be utilized as a therapeutic anticancer drug.
Antioxidant Activity of the Anthocyanin Oligomers

Bo-Im You*, Jin-Woo Hwang, Yon-Suk Kim, Nam-Joo Jeon, Xin Dong, Pyo-Jam Park
Department of Biotechnology, Konkuk University, Korea

In this study, the free-radical-scavenging properties of anthocyanin oligomers for 1,1-diphenyl-2-picrylhydrazyl (DPPH) radical, alkyl radical, and hydroxyl radical were evaluated using electron spin resonance (ESR) spectroscopy. The DPPH radical, alkyl radical, and hydroxyl radical scavenging activity of anthocyanin oligomers increased in a dose-dependent manner, with the 50% inhibitory concentration (IC50) value of 3.0, 13.6, and 448 μg/mL, respectively. In addition, 0.5 mg/mL of anthocyanin oligomers has confirmed that there is no cytotoxicity and inhibited the H2O2-induced G2/M phase arrest in ARPE-19 cells. Taken together, the present results demonstrate that anthocyanin oligomers have high antioxidant activity.

Synergistic Effect of Natural Plant Extracts Mixture on Anti-Alzheimer’s Disease

Cho R. Kim*, Soo J. Choi1, Hong Y. Cho, Dong H. Shin
Department of Food and Biotechnology, Korea University, Korea
Department of Food and Biotechnology, Konkuk University, Korea

One possible pharmacological strategy available for Alzheimer’s disease (AD) is the restoration of the level of acetylcholine through the inhibition of acetylcholinesterase (AChE) with reversible inhibitors. Many natural plants are an important source of AChE inhibitors, sample C and R have been claimed to be effective for the improvement of brain function. In this research, sample C extract was blended with sample R extract for the synergistic effect. To determine the optimal mixing ratio of C and R, the mixtures were tested for AChE inhibitory activity. The mixing ratio of 70:30 showed significant effect against inhibition reaction. And then Y-maze and passive avoidance tests were performed to confirm the memory enhancing effect of 70:30 mixture. The results represented that administration of 70:30 mixture (50 mg/kg body weight) significantly improved memory deficits in TMT-treated mice. In conclusion, the 70:30 mixture of sample C and R might be useful for the development of functional food material for the prevention of AD.

Isolation of Activation Compound against Acetylcholinesterase from Natural Edible Plants

Hoi S. Kim*, Hong Y. Cho, Dong H. Shin, Soo J. Choi1
Department of Food and Biotechnology, Korea University, Korea

Alzheimer’s disease (AD), most common single cause of dementia in our aging society. It is a chronic neurodegenerative disease that commonly starts slowly. Because the characteristics of AD is decline in acetylcholine (ACh), an effective treatment for modulating cholinergic activity has been used of inhibitors of acetylcholinesterase (AChE), responsible for the metabolic hydrolysis of ACh. This study was performed to identify more effective AChE inhibitors (AChEIs) in the treatment of AD. In order to search for AChEIs, many natural edible plants (110) were screened using the colorimetric determination method. As a result, the ethanol extract of sample R showed significant inhibitory effect against AChE in vitro. In order to refine sample R using several solvent, solvent partition, open column chromatography and thin-layer chromatography were sequentially performed. Then, purification and structural analysis of the most active fraction will be carried out. On the basis of the result of this research, it can be concluded that the sample R might help to develop prevention and treatment of AD.

Isolation of a Bioactive Agent from Sample W Ethanol Extract by H2O2-induced Cell Death

Yoon K. Kwon*, Soo J. Choi1, Hye K. Kim2, Hong Y. Cho, Dong H. Shin
Department of Food and Biotechnology, Korea University, Korea
Department of Food and Biotechnology, Konkuk University, Korea

This study investigated the ethanol extract from the sample W for possible neuro-protective effects against neurotoxicity by H2O2-induced cell death in PC 12 cell. Alzheimer’s disease (AD) is the most common chronic neuro-degenerative disorder and is characterized by loss of cognition as well as behavioral and occupational instability in old age. Major pathological characteristics of AD include extensive neuronal loss, extracellular insoluble senile amyloid β peptide plaques accumulation and intracellular neurofibrillary tangles. To isolate the active compound from sample W, silica-gel column chromatography was performed. The column was eluted with a stepwise gradient of chloroform and ethanol (100:0, 90:10, 80:20, 70:30, 60:40, 50:50, 40:60, 30:70, 20:80, 10:90, and 0:100, v/v; repeated 3 times, respectively). Protective effects of the ethanol extract of sample W against oxidative stress in PC12 cells were measured by DCF-DA and MTT assays. The 5th and 6th fractions (the fractions of chloroform: ethanol = 90:10 2nd and 3rd) showed positive activity in both the DCF-DA (240-292%) and the MTT reduction assays (63-68%).
Purification of Novel Acetylcholinesterase Inhibitor from Natural Korean Traditional Plant

Sang I. Lee*, Soo J. Choi1, Hong Y. Cho, Dong H. Shin
Department of Food and Biotechnology, Korea University, Korea, 1Graduate School of Life Science and Biotechnology, Korea University, Korea

Alzheimer's disease (AD) is one of the most common neurodegenerative disorders. In AD patients, acetylcholine (ACh) which is neurotransmitter on the end of synapses is reduced by acetylcholinesterase (AChE). Principal role of AChE is the termination of nerve impulse transmission at the cholinergic synapses by rapid hydrolysis of ACh. Accordingly, inhibition of AChE serves as a strategy for the treatment of AD. In order to discover a new acetylcholinesterase inhibitor (AChEI), the ethanol extract of sample C which exhibited the highest AChE inhibitory activity was selected. Sample C was pre-extracted with ethanol. Sample C was stirred with ethanol for 24 h. The sample C was filtered and almost dehydrated under vacuum. Then, sample C was separated by solvent partition, which was examined using silica-gel open column chromatography. In results, the thirteenth fraction (chloroform : ethanol = 60:40) represented significant neuro-protective activity.

Purification of the Protective Constituent against Hydrogen Peroxide-induced Neurotoxicity for Alzheimer's Disease

Chan K. Park*, Min K. Hong, Soo J. Choi1, Hong Y. Cho, Dong H. Shin
Department of Food and Biotechnology, Korea University, Korea, 1Graduate School of Life Science and Biotechnology, Korea University, Korea

Alzheimer's disease (AD) is a neurodegenerative disorder characterized by loss of memory and progressive decline of cognitive ability. Many researchers regard that AD is closely related to oxidative stress. In this study, in order to inspect protective effect of screened plant extract against hydrogen peroxide in PC12 cells, cell survival was measured by 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide (MTT) assay and intracellular reactive oxygen species (ROS) were tested by 2',7'-dichlorofluorescin diacetate (DCF-DA) assay. To purify the neuro-protective compound, the ethanol extract H which exhibited the highest protective effect was partitioned with hexane, chloroform and ethyl acetate, three times, respectively. After solvent partition, the sample was isolated by silica-gel open column chromatography. In results, the thirteenth fraction (chloroform : ethanol = 60:40) represented significant neuro-protective activity.

Ameliorative Effect of Plant Extract against Trimethyltin-induced Memory Impairment in Mice

Kyu S. Lee*, Dong H. Shin, Hong Y. Cho, Soo J. Choi1
Department of Food and Biotechnology, Korea University, Korea, 1Graduate School of Life Science and Biotechnology, Korea University, Korea

Alzheimer’s disease (AD), which is the most common neurodegenerative disease, is one of the critical diseases in the near future. AD is featured by memory loss, learning disability and cognitive malfunction. The basic symptoms of AD are due to impaired nicotinic cholinergic neurotransmission. AD patient’s brain exhibited loss of neurons and synapses in hippocampus of the central nervous system and reduced levels of acetylcholine. Acetylcholinesterase (AChE) serves as the key enzyme in cholinergic transmission, as it hydrolyzes the ester bond of the neurotransmitter acetylcholine in cholinergic synapses. A variety of natural edible plants were screened for inhibitory effect against AChE in vitro. Sample B represented the highest inhibitory effect against AChE. Thus, the effect of sample B against trimethyltin-induced memory impairment in mice was examined using Y-maze and passive avoid tests.
Hair loss (alopecia) is a loss of hair from the head or body. It can be the result of heredity, hormonal changes, medical conditions or medications, indicating that anyone can experience hair loss. In the present study, we have determined the most effective combination of herbal extracts (Cymanchum wilfordii and 7 others) and developed an exclusive methodology on the hair growth promotion. Two formulations (fermented: FMNG and non-fermented: MNG) were developed for oral administration and one was prepared for spray treatment. Our results demonstrated that FMNG showed comprehensive effects on male and female C57BL/6 mouse model, whereas spray type promoted the hair growth faster than that of FMNG and MNG, in female mice group. These findings were supported by the increase of Wnt gene (Wnt 3 and Wnt 10a) expression, which triggers new hair follicle formation and the development of hair, respectively. In conclusion, our findings suggest that the combination of eight herbal extracts and new methodology may be the promising novel candidate for non-chemical hair growth treatment.
Radical Scavenging Activity and Antioxidative Effect of Acer okamotoanum
Soo Yeon Choi*, Ah Young Lee, Yu Ra Bueon, Sanghyun Lee1, Eun Ju Cho
Department of Food Science and Nutrition, Pusan National University, Korea, 1Department of Integrative Plant Science, Chung-Ang University, Korea

This study was focused on the evaluation of antioxidative effect of Acer okamotoanum. It was extracted with methanol (MeOH) and then fractionated into 4 different fractions, n-butanol, ethyl acetate (EtOAc), methylene chloride (MC) and n-hexane. We investigated the protective effect of Acer okamotoanum against oxidative stress under in vitro and cellular system using C6 glial cells. The MeOH extract and 4 fractions at 100 μg/mL showed over 70% scavenging effect against 1,1-diphenyl-2-picrylhydrazyl (DPPH) and ·OH radical. In particular, EtOAc fraction exerted the strongest scavenging activity from DPPH and NO among other extract and fractions. The treatment of H2O2 to C6 cell led to the cellular loss, but MeOH extract and 4 fractions increased the cell viability significantly as concentration-dependent manner. Among the all fractions, EtOAc fraction demonstrated the highest inhibitory activity against production of reactive oxygen species. The present results suggest that Acer okamotoanum would play the protective effect from oxidative stress and EtOAc fraction would be mainly responsible for the protective role.

Antioxidative and Pancreatic Lipase Inhibitory Activities of Steamed Soybean and Fermented Form of Steamed Soybean
Hye Rin Seo*, Young A Lee1, Ah Young Lee, Kye Man Cho2, Hyun Young Kim3, Eun Ju Cho
Department of Food Science and Nutrition, Pusan National University, Korea, 1Department of Food Science and Nutrition, Catholic University of Daegu, Korea, 2Department of Food Science, Gyeongnam National University of Science and Technology, Korea

This study was focused on antioxidant and pancreatic lipase inhibitory activities of ethanol extract from steamed soybean (SS) and fermented SS (FSS) for 60 h. The radical scavenging effect was evaluated against 1,1-diphenyl-2-picrylhydrazyl (DPPH), hydroxyl radical (-OH), and nitric oxide (NO). In all these three assays, radical scavenging activities of SS and FSS increased as concentration-dependent manner. In particular, extract of FSS showed higher radical scavenging activity than that of SS. At the concentration of 10 μg/mL, SS and FSS, 81.51% and 82.46% of OH scavenging activities were observed, respectively. In addition, the anti-obesity possibility of SS and FSS was investigated under porcine pancreatic lipase inhibitory assay. The IC50 values, indicator of inhibitory activity of pancreatic lipase, of SS and FSS were 0.08 μg/mL and 0.07 μg/mL, respectively. These results indicate that SS and FSS, in particular FSS, potentially be considered as a new source of natural antioxidant and anti-obesity agents.

Anti-cancer and the Anti-oxidant Activity of Novel Facility-based Cultivated Panax ginseng Extract on B16F10 Melanoma Cells
Hye-Jin Park*, Woo-Ri Jo
Department of Food Science and Biotechnology, College of BioNano Technology, Gachon University, Korea

Panax ginseng has been widely used as a traditional herbal medicine to treat various diseases, including cancer in East Asia. This study is to investigate the anticancer and anti-oxidant activity of P. ginseng extract (GE) against B16F10 melanoma cells. We found that anti-oxidant activity of GE was higher than P.ginseng, using 1,1-diphenyl-2-picrylhydrazyl (DPPH) assay. Next, the effect of GE on B16F10 cell viability was evaluated by Cell-counting kit (CCK-8) assays. GE showed stronger inhibitory effect than P.ginseng on B16F10 melanoma cell viability. To validate the anti-proliferative activity of GE, we observed that B16F10 melanoma population and cell migration under the microscope. GE inhibited B16F10 cell proliferation as well as cell migration. To demonstrate its mechanism of action against B16F10 melanoma cells, we checked the level of phosphorylated MAPKs and β-catenin proteins. GE significantly suppressed phosphorylation of extracellular signal-regulated kinase (ERK) and the level of β-catenin. GE might exert anticancer activity through suppressing the Wnt/β-catenin and MAPK signaling pathway. This study presents the potential use of GE as an anti-cancer agent.

Effects of Tarak on Immunity, Melanin Synthesis, and Lipid Metabolism
Soyoung Kim*, Hyunguen Yoon
Department of Food and Nutrition, Sungshin Women’s University, Korea

Tarak is Korean traditional fermented milk, which is made by adding makgeolli to milk. The purpose of this study was to investigate effects of each tarak made with different starters on immunity enhancing, melanin synthesis inhibition, and anti-obesity. Tarak made with Lactobacillus paracasei ssp. paracasei M13-65-3 increased T lymphocyte Jurkat clone E6-1 cells proliferation (p<0.05). Each tarak, which is made L. paracasei ssp. paracasei MKRL5-8, M13-65-3, or M13-67-1, inhibited tyrosinase activities and α-melanocyte stimulating hormone-induced melanin synthesis of B16-F10 at concentration of 100 μg/mL (p<0.05). Each tarak made with L. paracasei ssp. paracasei MKRL5-8 or MKRL71-2 significantly decreased lipid accumulation comparing with milk (p<0.05). And they had effect on anti-obesity, especially C57BL/6j mice intaking high fat diet + 10% tarak made with L. paracasei ssp. paracasei MKRL71-2 significantly decreased weights of body, kidney, and epididymal fat and levels of blood cholesterol and LDL-cholesterol (p<0.05). These results suggest that tarak might have functionalities on immunity enhancing, inhibition of melanin synthesis, and anti-obesity.
Flavonoid Characterization and Anti-oxidative Activities Evaluation of Citrus platymamma Hort. et Tanaka (Byungkyool)

Hyeong Min Kim*, Ju Mi Hyun, Suk Hyun Yun, Hyun Joo An, Kyung Jin Park, Young Hun Choi, Sang Suk Kim
Citrus Research Institute, National Institute of Horticulture and Herbal Science, RDA, Korea

This study aims to evaluate the changes of flavonoid contents and antioxidative activity of Jeju native citrus fruit, Citrus platymamma Hort. et Tanaka (Byungkyool) according to the harvest season (Sep. 2014, Dec. 2014, and Feb. 2015). Peel was contained higher amounts of total flavonoids, 17.5 (Sep.), 7.2 (Dec.), and 5.5 mg (Feb.) of quercetin/g dry weight, than flesh extracts. Flavonoid contents were the highest on immature fruit and decreased rapidly while its ripening. In the antioxidant activity test, using DPPH, ABTS and FRAP assay. The highest DPPH radical scavenging effect was observed in peel (Sep.) with IC50= 0.48 mg/mL and lowest was observed in flesh (Feb.) with IC50=1.2 mg/mL. The value of IC50 was the lowest at the highest amount of flavonoid. Because major antioxidant materials are flavonoids, those contents of extracts were analyzed by HPLC. Major components of ‘Byungkyool’ was narirutin, rutin, and hesperidin. In addition, neohesperidin, nobiletin, tangeretin, and auraptene were detected as minor components on peels. The result indicated that ‘Byungkyool’ was the good natural sources of antioxidants for the functional ingredients in the food and cosmetics industry.

Enhancement of Phenolic Compounds in Rice Bran Treated by Commercial Carbohydrases

Sung-Min Kim*, Hoon Namkung, Seung-Taik Lim
Graduate School of Life Sciences and Biotechnology, Korea University, Korea

Rice bran was treated with different commercial carbohydrases (Viscozyme, Termamyl, Celluclast, AMG, Ultraflo, and Pentopan) at pH 4.5-6.0, 50°C for 12 h, and then phenolic compounds were extracted in an aqueous alcohol solution (50% ethanol) for the analyses of their composition and antioxidant activities. Among the enzymes tested, Celluclast, Ultraflo, and Pentopan appeared most effective in increasing the total phenolic content (TPC) as well as radical scavenging activity. All the carbohydrases tested, however, induced significant decreases in ferrous reducing powers (1.5-3.3 times). Celluclast, Ultraflo, and Pentopan increased the amount of extractable phenolic acids by 2.5 to 3.0 times, especially for ferulic, p-coumaric, vanillic, and p-hydroxybenzoic acids. Ultraflo and Pentopan contained esterase, which may assist the release of phenolic acids from the cell wall. Overall results proved that the carbohydrases could be used to improve the extraction of phenolics from rice bran as well as the antioxidant activity of such extracts.
Diallyl Trisulfide Inhibits Proliferation, Migration and Invasion in Bladder Cancer EJ Cells: The Role of G2/M Cell Cycle Arrest, ERK1/2 Signaling, and MMP Expression

Jun-Hwi Song*, Sung Lyea Park, Se Yeon Won, Dae-Hwa Noh, Wun-Jae Kim1, Sung-Kwon Moon
School of Food Science and Technology, Chung-Ang University, Korea, 1Department of Urology, Chungbuk National University, Korea

Diallyl trisulfide (DATS) is a garlic-derived organosulfur compound, and has been shown to inhibit the proliferation of various cancer cells. However, the anti-cancer mechanism in human bladder cancer is not fully identified. In this study, DATS treatment showed inhibition of proliferation that caused by G2/M phase cell cycle arrest via induction of p21WAF1. In addition, treatment with DATS resulted in the suppression of Cyclin A, Cyclin B1, CDC2 and CDC25C expression, which was followed by the increased expression of CDC25C inhibitor, such as CHK1-WEE1 and CHK2. Moreover, DATS induced the activation of extracellular signal-regulated kinase1/2 (ERK1/2) signaling but not c-Jun N-terminal protein kinase (JNK), p38 MAPK and AKT. Furthermore, DATS suppressed migration and invasion of EJ cells through the decreased expression of matrix metalloproteinase (MMP)-2 and MMP-9. These results suggest that DATS inhibited proliferation, migration, and invasion of bladder cancer EJ cells. Overall, these novel findings concerning the molecular mechanisms of DATS in bladder cancer cells provide a theoretical basis for therapeutic treatment of malignancies.

Antiobesity Effect of Water Soluble Fraction of Smilax china L. Leaf Ethanol Extract in 3T3-L1 Adipocyte

Kyoung Kon Kim*, Yun Hwan Kang2, Dae Jung Kim2, Myeon Choe1,2
1Department of Bio-Health Technology, College of Biomedical Science, Kangwon National University, Korea, 2Well-Being Bioproducts R&D Regional Innovation Center, Kangwon National University, Korea

In this study, we examined the mechanism underlying these antidiabetic effects by examining glucose uptake in HepG2 cells cultured with SCLE. Treatment with SCLE resulted in enhanced glucose uptake in HepG2 cells, and this effect was especially pronounced when cells were cultured in an insulin-free medium. SCLE induced an increase in expression of GLUT-2 but not GLUT-4. The increase in the levels of HNF-1α, a GLUT-2 transcription factor, in total protein extract and nuclear fraction suggest that the effects of SCLE may occur at the level of GLUT-2 transcription. In addition, by measuring the change in glucokinase activity following SCLE treatment, we confirmed that SCLE stimulates glucose utilization by direct activation of this enzyme. These results demonstrate that the potential antidiabetic activity of SCLE is due at least in part to stimulation of glucose uptake and an increase in glucokinase activity, and that SCLE-stimulated glucose uptake is mediated through enhancement of GLUT-2 expression by inducing expression of its transcription factor, HNF-1α.

Antioxidant Activity and Cytotoxicity of Black Rice Extracts

Kyoung Hee Seo*, Ji Young Lee, Trishna Debnath, Hasnat Md Abul, Beong Ou Lim
College of Biomedical & Health Science, Department of Applied Biochemistry, Konkuk University, Korea

Increased intake of whole grains has been linked to reduced risk of developing prominent chronic diseases. Little is known about the antioxidant activities and cytotoxic effects of various extracts of black rice (Oryza sativa cv. Heugjinjubyeo). In this study, water and ethanol extracts were prepared from black rice, and their in vitro antioxidant activities such as hydroxyl and superoxide radical and nitrite scavenging, reducing power (Fe3+ to Fe2+), linoleic acid oxidation inhibition, and free-radical-induced DNA damage prevention were investigated with 1,1-diphenyl-2-picrylhydrazyl and 2,2-azino-bis(3-ethyl-benzothiazoline-6-sulfonic acid) diammonium salt. The cytotoxic effects of the extracts were determined in RAW 264.7 cells. Both extracts showed strong antioxidant activities and prevented free-radical-induced DNA damage. Antioxidant activity was highly correlated with phenolic and flavonoid content. The ethanol-based extracts showed no cytotoxicity. The results of the study suggest that black rice extracts are a potent source of natural antioxidants.
**P11 -056**

**Effect of LE Extract (Medical Mushroom) on Blood Leptin Level in Sprague-Dawley Rats Fed High-fat Diet**

Inho Kim*, Taewon Han, Daeseok Han  
Korea Food Research Institute, Korea

It was investigated that LE extract affected blood serum factors including leptin hormone in animal model. The serum factors were analyzed on alanine/aspartate aminotransferases (ALT/AST), triglyceride (TG), total cholesterol (TCHO) and leptin hormone level in male high-fat diet Sprague-Dawley (SD) rats. The level of ALT and AST of LE extract group were no significant difference compare with that of control group. Moreover, the content of TCHO (67±11 mg/dL) and TG (68±11 mg/dL) were significantly decreased than that of control group (90±3, 88±17 mg/dL). In addition, the leptin concentration was stable in serum was increased by sample treatment group than that of control group. These results implicate that LE extract increases the secretion of leptin in rat serum related to control of body fat accumulation and reduce food intake without toxicity in SD rats. Besides, extract of medicinal mushroom LE was expected to prevent metabolic syndrome due to the lower level of TCHO and TG. It suggests that LE would be leptin hormone promotion on lipid metabolism from gastroenteric to brain in vivo and implicate that should be applied to preliminary materials of satiety functional food components.

**P11 -057**

**Effect of LE Extract (Medical Mushroom) on 3T3-L1 Adipocytes in Leptin Metabolic Pathway**

Inho Kim*, Taewon Han, Daeseok Han  
Korea Food Research Institute, Korea

Polysaccharide G controlled an important factor on leptin metabolism in *in vitro* and *in vivo* test. It was investigated extract from medicinal mushrooms (contained high content of polysaccharide G) regulate factors on 3T3-L1 preadipocytes in leptin metabolic pathway. Physiological assays were conducted on treatments of various conditions. We evaluated effect of LE extract on cell proliferation of 3T3-L1 preadipocytes, and glucose uptake, triglyceride (TG) accumulation and leptin level of adipocytes. The cell viability was shown compatible with control by WST-1 assay. The glucose uptake (1.5 fold, p<0.001) and level of leptin (112±5%) were significantly increased than that of control in mature 3T3-L1 adipocytes. The leptin concentration was stable on physico-chemical treatment of various pH and temperature conditions. Promotion of leptin hormone secretion suppressed of transfer signal for satiety and reduced fat against obesity. Activity of leptin secretion on various physicochemical conditions also suggested that this extract would be applied to development functional products for human health with possibility of keeping on activity during processing or digestion in our body.

**P11 -058**

**Lindera glauca Blume Root Extract Inhibits Human Colorectal Cancer HCT116 Cell Proliferation by Inducing Apoptosis**

Yeah-Un Kim*, Jung-Mi Yun  
Department of Food and Nutrition, Chonnam National University, Korea

The anti-proliferative properties and mechanism of *L. glauca* root extract were investigated. In the present study, we investigated the anti-proliferative and pro-apoptotic properties of *L. glauca* root extract in HCT116 human colon cancer cells. Apoptosis was evaluated by analysis of DNA fragmentation, caspase-3 activity, and pro-apoptotic (Bax) and anti-apoptotic (Bcl-2) protein expression. Nuclear factor (NF)-κB provides a mechanistic link between inflammation and cancer, and is a major factor regulating pre-neoplastic and malignant cell apoptosis resistance. We therefore determined the effect of *L. glauca* extract on the NF-κB signaling pathway. Our results demonstrated the extract induces DNA fragmentation and characteristic morphological changes associate with apoptosis in HCT116 cells. The extract also time- and dose-dependently upregulated the expression of the pro-apoptotic gene Bax and downregulated the expression of the anti-apoptotic gene, Bcl-2. Furthermore, the extract dose- and time-dependently enhanced caspase-3 activity. Our findings provide evidence that *L. glauca* extract may mediate its anti-proliferative effect via modulation of apoptosis.

**P11 -059**

**Apigenin Attenuates Melanoma Cell Migration by Inducing Anoikis through Integrin and Focal Adhesion Kinase Inhibition**

Md Abul Hasnat*, Mehnaz Pervin, Ji Hong Lim, Beong Ou Lim  
Department of Applied Biochemistry, College of Biomedical & Health Science, Konkuk University, Korea

Apigenin has been found to have antitumor properties and is therefore particularly relevant for the development of chemotherapeutic agents for cancers. In this study, cell viability and cytotoxicity were assessed to determine the effects of apigenin on A2058 and A375 melanoma cells. Melanoma cells were pretreated with different concentrations of apigenin and analyzed for morphological changes, anoikis induction, cell migration, and levels of proteins associated with apoptosis. Apigenin reduced integrin protein levels and inhibited the phosphorylation of focal adhesion kinase (FAK) and extra-cellular signal-regulated kinase (ERK1/2), which induce anoikis in human cutaneous melanoma cells. Apigenin exhibited dose-dependent inhibition of melanoma cell migration, unlike untreated controls. Furthermore, apigenin treatment increased apoptotic factors such as caspase-3 and cleaved poly (ADP-ribose) polymerase in a dose-dependent manner, demonstrating the metastasis of melanoma cells. Our results provide a new insight into the mechanisms by which apigenin prevents melanoma metastasis by sensitizing anoikis induced by the loss of integrin proteins in the FAK/ERK1/2 signaling pathway.
Preparation of Iron-binding Peptide from Waste Brewer's Yeast and Its Bioavailability in Anemic Rat

So Young Cho*, Minguee Jeong, Byungsun So, Song Hwan Bae1, Hyung Joo Suh
Department of Food and Nutrition, Korea University, Korea, 1Department of Food and Biotechnology, Hankyong National University, Korea

The purpose of this study was to prepare iron binding peptide (IBP) from waste brewer’s yeast and evaluate its bioavailability in anemic in rat. Waste brewer’s yeast, Saccharomyces cerevisiae, was hydrolyzed with an endopeptidase, Multifect 6 L. The hydrolysate was ultrafiltered with a 3 kDa cut-off membrane and incubated with ferric sulfate (FeSO4) solution, after which ethanol precipitation was executed to obtain IBP. Bioavailability of IBP in rats was examined in seven experimental groups; normal control group (NC), iron-deficiency anemia group (IC), heme group (Heme), inorganic iron group (FeSO4), IBP group (IBP), IBP supernatant from Hongcheon Institute of Medicinal Herb group (HC-P) and IBP precipitate from Hongcheon Institute of Medicinal Herb group (HC-P). IBP-fed groups showed significant increase in iron contents of the liver, spleen and blood compared with iron-deficient group. In addition, the levels of red blood cell, hemoglobin and hematoctrit were recovered to the level of normal control group. These results suggested that IBP can be used as a plausible source of iron with improved bioavailability.

Anti-inflammatory and Anti-osteoporotic Activity of Deer Bone Oil Extract in Monosodium Iodoacetate-induced Osteoporotic Rats

EunYoung Kim*, JiHyun Lee, HyeonSon Choi1, Kyung Soo Ra2, Hyung Joo Suh
Department of Food and Nutrition, Korea University, Korea, 1Department of Food Science and Technology, Seoul Women’s University, Korea, 2Department of Food and Nutrition, Daegu Technical University, Korea

This study was conducted to evaluate the effect of deer bone oil on immune function. Deer bone oil extract (DBOE) was partitioned by liquid-liquid extraction, using hexane and methanol (DBO-M). DBO-M significantly suppressed the levels of inflammatory cytokines such as IL-1β, TNF-α, and IL-6 in their serum. However, micro-CT analysis to evaluate 3D-morphometric parameters which include bone volume fraction (BV/TV), structure model index (SMI), trabecular number (Tb.N), trabecular thickness (Tb.Th), and trabecular separation (Tb.Sp) did not show the recovery of destruction in articular cartilage or subchondral bone structure induced by MIA injection. DBO-M could play an important role in suppressing inflammatory responses and matrix-degrading process, even if MIA-induced destructive structure in articular cartilage and subchondral bone was not significantly recovered by DBO-M. In conclusion, DBOE the possibly suppress deterioration of osteoarthritis by improving inflammatory responses.

Anti-oxidative Effects of Ginsenosides in Non-vertebrate Model

Kyungae Jo*, Hae Dun Kim, Ki-Bae Hong, Yooheon Park, Hyung Joo Suh
Department of Food and Nutrition, Korea University, Korea

Oxidative stress is involved in the development of various diseases and target of non-pharmacological treatments. Ginsenosides are regarded as important component of ginseng such as steroid glycosides and triterpene saponins. It seems obvious that, functional component of ginseng can improve the immunity to physical and biological effects, but the effect of respective saponin on oxidative stress is remained unclear. In this study, Drosophila melanogaster was utilized as a model system to confirm the pharmacological property of various ginseng extracts to protect against H2O2 induced oxidative stress. As a result, ginseng extracts modulated antioxidant enzyme SOD and CAT levels, also influenced on the SOD2 mRNA level. Furthermore, ginseng extracts regulated lifespan and behavior. Taken all the results together, various processes and their combination can be plausible methods to enhance the functionality of ginseng product.

Effects of White Habiscus syriacus L. Flower Extracts on Antioxidant Activity and Bone Resorption Inhibition

Jin Seong Kim*, Hee Jung Lee, Hyung Don Kim, Chun Geon Park, Young Sup Ahn, Sang Won Lee, Man-Seok Bang1, Chung-Hun Oh1, Chul-Tae Kim2
NIHHS, RDA, Korea, 1Dankook University, Korea, 2Konyang University, Korea

In this study, we tried to offer the possibility of white Habiscus syriacus L. flower (WHS) extracts as a preventive and improving agent of osteoporosis that bone mass reduction is induced by an decrease of osteoblast involved in bone formation and increase of bone resorption by osteoclast activity. As a results, it was found to have antioxidant activity and contain a flavonoid contents (47.74 mg/g) of the WHS. There was cytotoxicity at more than 250 μg/mL concentration of WHS extract of RANKL-induced osteoclast in RAW264.7. However, it was confirmed that it is significantly inhibited the differentiation activity of osteoclasts in 50 and 100 μg/mL concentration of cells of stability levels of WHS extracts (p<0.01). The WHS prominently inhibited RANKL-induced osteoclast differentiation activity by decreased calcinon receptor and TRAP mRNA (p<0.01). These results indicate that osteoclasts differentiation activity is inhibited by protection of oxidative stress due to the antioxidant activity of the WHS. Therefore, suggesting the WHS may be a presents the possibility as a preventive and therapeutic agents for osteoporosis.
Quality Characteristics of Kimchi with Different Mixture Ratio of *Lactobacillus paracasei* KB28 as a Starter

Jae-Gwan Noh*, Eun Young Kim, Dal-Nym Song, A Reum Lee, Hyang-Sik Yoon, Sang Hee Kim, Yee Gi Kim, Ki Yeol Lee, Hyun-Ju Eom
Chungcheongbukdo Agricultural Research and Extension Services, Korea

Here, quality characteristics and physicochemical properties of kimchi by inoculating KB28 starters of different mixture ratio were studied. The pH, acidity, texture, total cell counts, total polyphenol, antioxidant activity, reducing sugar and sensory evaluation were measured during fermentation until 50 days. The pH and acidity of kimchi fermentation period were not different among samples, but kimchi with the starter showed slightly in the acidity at the last phase of fermentation. As the fermentation progressed, the level of total cell and lactic acid bacteria (LAB) increased with or without starter inoculation. However, the control kimchi showed rapid changes in cell counts and also varied shape, size, and color of colonies on the plates. Chewiness and springiness of 1% and 4% starter kimchi were not significant during fermentation for 50 days. In the sensory evaluation, kimchi with 1% starters received higher overall acceptability scores than those of other samples. The survival of *Lb. paracasei* KB28 using the DGGE profiles is ongoing. In conclusion, *Lb. paracasei* KB28 is supposed to be useful as a function added-starter in the manufacture of lactate-fermented foods.

Nutritional Compositions and Antioxidative Activities of New Mulberry Cultivar “Cheongsu”

A Reum Lee*, Dal-Nym Song, Eun Young Oh, Jae-Gwan Noh, Yee Gi Kim, Ki Yeol Lee, Hyun-Ju Eom
Chungcheongbukdo Agricultural Research and Extension Services, Korea

Mulberry (oddi) is one of the popular functional food having many physiological component. This study was investigated and compared that nutritional compositions and antioxidative activities of four mulberry fruits from *Morus alba* L. including Cheongsuppong, Ikssuppong, Suwonppong and Cheongsuppong (new cultivar of Chungcheongbuk-do). To analyze the nutrient contents, mulberry fruits were freeze-dried. The results showed that the proximate compositions of the four mulberry cultivars were ranged from 9.6-14.1% for moisture, 8.3-11.9% for crude protein, 3.7-4.8% for crude ash, 4.3-5.5% for crude lipid and 7.5-10.8% for crude fiber. The above proximate contents of mulberry cultivars were not significantly different. But, Cheongsuppong have the highest content of reducing sugar, 74.7%. Chungsuppong and Ikssuppong showed higher the contents of total polyphenol and anthocyanin than other mulberry cultivars, while all mulberry cultivars showed high antioxidant activities. Hypoglycemic effect had a slightly higher level in Suwonppong than those of other samples.

Nutritional Compositions and Physicochemical Properties of Two Domestic Aronia (A. melanocarpa) Varieties

Hyun-Ju Eom*, Dal-nym Song, Gun-Mook Yoon¹, A Reum Lee, Seong Hun Park, Jae-Gwan Noh, Yee Gi Kim, Ki Yeol Lee
Chungcheongbukdo Agricultural Research and Extension Services, Korea, ¹Chungcheongbukdo Research Institute of Health and Environment, Korea

The nutritional compositions and physicochemical properties of two aronia varieties (Viking and Nero) cultivated in Chung-buk were investigated. The proximate compositions of two aronias powder contained 13% moisture, 0.5-0.6% ash, 0.3-0.7% crude lipid, 5-6% protein, 62-64% carbohydrate and 15-16% crude dietary fiber. The proximate contents of aronia samples were not significantly different. Among the physicochemical properties, there was also no significant change in total anthocyanin and antioxidant activity. But, Viking showed higher total polyphenol contents and α-glucosidase inhibition activity than Nero. Mineral contents of Al, Fe, Mn, Mg, Ca, Na, K, Cu, and Zn in two aronias were determined. Cu and Zn were not detected in both varieties. In case of Al, Na and K, Nero was higher than Viking, while Ca is higher Viking than Nero. From the results, Viking could be suggested as beneficial for food processing.

Preventive Effect of *Citrus unshiu* Peel Extracts on Lipid and Bone Metabolism in Ovariectomized Rats

Yun Tai Kim*, Dong Wook Lim
Research Group of Innovative Special Food, Korea Food Research Institute, Korea

Dried *Citrus unshiu* peel has been widely used for various medicinal purposes in Oriental Medicine. This study evaluated the metabolic effects of dried *C. unshiu* peel in ovariectomized (OVX) rats. The OVX rats were divided into five groups treated with distilled water, 17β-estradiol (E2 10 μg/kg, once daily, i.p.) and dried *C. unshiu* peel extracts (DCPE 30, 100, and 300 mg/kg, once daily, p.o.) for eight weeks. The treatments with high-dose DCPE significantly decreased the bone mineral density (BMD) loss in the femur, which was reflected by the decrease in alkaline phosphatase (ALP), telopeptides of collagen type I (CTx) and osteocalcin (OC) serum levels. It also inhibited the increase in lipoprotein levels compared to the OVX-control group without elevating the serum levels of estradiol, aspartate aminotransferase (AST) and alanine transaminase (ALT). Furthermore, DCPE exhibits a hepatoprotective effect in OVX-induced hepatic steatosis, indicated by reduced hepatic lipid contents. Taken together, our findings suggest that DCPE has the potential to improve both lipid and bone metabolism without influencing hormones such as estrogen in OVX rats.
**Anti-hyperlipidemic Effect of the Plant-derived Extract from Hoichoon-Tang**

Jun-Hui Choi*, Se-Eun Park, Hyo-Jung Lee, Seung Kim  
Department of Bio-Health Science, Gwangju University, Korea

Obesity is associated with a number of pathological disorders such as hyperlipidemia, hypertension, and cardiovascular disorders. The medical plant-derived extracts have been widely used in the oriental medicine for the treatment of several diseases associated with abnormalities in cardiovascular and nervous system. This study was carried out to investigate the effects of the plant-derived extracts from Hoichoon-Tang (HCT) on anti-oxidative, and anti-hyperlipidemic potential. The plant-derived extracts from HCT inhibited DPPH radical by 33.4% at 50 μg/mL. In tributryn plate assay, 10 μg of the plant-derived extracts from HCT lyzed triglyceride plate on clear zone. Also, the plant-derived extracts from HCT inhibited blood clots. We investigate whether the plant-derived extracts from HCT affects amidolytic activity on three synthetic substrates for lipase. The plant-derived extracts from HCT have amidolytic activity with 0.045-0.102 mU/min/μg, comparing to lipase amidolytic activities. These results imply that supplementation of HCT extracts may beneficially contribute to improve antioxidant potential and to decrease the lipid levels in the blood.

**Anti-thrombotic Effect of the Plant-derived Extract from Hoichoon-Tang**

Jun-Hui Choi*, Se-Eun Park, Hyo-Jung Lee, Seung Kim  
Department of Bio-Health Science, Gwangju University, Korea

Thrombosis associated with abnormal blood clotting is one of the leading causes of death worldwide. Abnormal localized vascular blood clots can develop in arterial or venous thrombosis, and arterial thrombi can also develop during the process of atherosclerosis. The active crude compound and medical plant have been broadly treated in the oriental drug for the treatment of several diseases associated with disorders in cardiovascular and nervous system. We investigated in vitro antithrombotic activity of the plant-derived extracts from HCT. Turbidity and fibrin clotting studies revealed that the plant-derived extracts from HCT reduces fibrin clot in concentration dependent manner. The plant-derived extracts from HCT were found to prolong activated partial thromboplastin time (APTT), and prothrombin time (PT). Furthermore, it decreased the activity of pro-coagulant proteins, thrombin and activated factor X. These results may be attributable to the prevention of thrombus formation and partial suppression of thrombus. Therefore, we suggest that the plant-derived extracts from HCT may be a potential antithrombotic agent for thrombosis-related and cardiovascular diseases.

**Antithrombotic Effect of Lotus Extracts from Nelumbo nucifera**

Jun-Hui Choi*, Se-Eun Park, Hyo-Jung Lee, Seung Kim  
Department of Bio-Health Science, Gwangju University, Korea

The present study was investigated on in vitro antithrombotic activity of lotus extracts from Nelumbo nucifera. We isolated the ethnicolic extracts from root, leave, flower, and seed of N. nucifera. Antithrombotic activities of different extracts were examined by turbidity assay, fibrin clot assay, and compared with the properties of the commercial urokinase like plasminogen activator. Lotus extracts inhibited the human fibrin clot. The inhibition of the fibrin clot by root (50 μg), and flower extract (50 μg) by 26, and 51% respectively. The antifibrin clot activity of lotus extracts was demonstrated by turbidity assay. Lotus extracts induced the inhibition of fibrin polymer as observed by reduction in turbidity. The inhibition of fibrin clot by lotus extract was concentration-dependent. Lotus extracts caused the inhibition (%) of fibrin clot by 89.22, 92.12, 82.76, and 80.7% at root, leave, flower, and seed extract of 30 μg, respectively. These results may be attributable to the prevention of thrombus formation and partial inhibition of thrombus. In conclusion, these results suggest that lotus may be a good candidate as a natural antithrombotic source.

**Inhibitory Effects of the Water Extract of Hizikia fusiforme on Human Bladder Cancer EJ Cells**

Se Yeon Won*, Sung Lyea Park, Jun-Hui Song, Dae-Hwa Noh, Kim Wun-Jae, Moon Sung-Kwon  
School of Food Science and Technology, Chung-Ang University, Korea, 1Personalized Tumor Engineering Research Center, Department of Urology, Chungbuk National University, Korea

The Hizikia fusiforme has been showed various pharmacological effects including antibacterial, antifungal, and anti-inflammatory effect. In this study, we investigated the effect of a water extract of *H. fusiforme* (WEHF) on bladder cancer EJ cells. WEHF treatment inhibited cell growth in EJ cells. These inhibitory effects were associated with reduced expression of cyclin D1 and CDK4 via increased expression of p21WAF1 and p27KIP1 in EJ cells. In addition, treatment with WEHF increased JNK phosphorylation without altering the phosphorylation level of ERK1/2, p38MAPK, and AKT. Moreover, WEHF treatment suppressed the migration and invasion of EJ cells. Furthermore, zymographic analyses demonstrated that WEHF treatment with EJ cells suppressed the expression of matrix metalloproteinase (MMP)-9. Collectively, these results demonstrate that WEHF reduces cyclin D1 and CDK4 expression through the induction of p21WAF1 and p27KIP1 expression, increases JNK phosphorylation, and prevents MMP9 expression in EJ cells, which led to the growth inhibition, and to the repression of migration. These results might provide a novel insight in the use of WEHF for the prevention of bladder cancer.
Clinical Study on Health Promotion Effects of *Dendropanax morifera* Leveille Extracts

Su Kyung Lee*, Mi Ran Kim
Institute of Life Science, Global Cyber University, Korea

This study was performed to investigate the health promotion effects of the *Dendropanax morifera* Leveille (DML) extracts. The DML extracts were prepared with leaves and stems of DML. The samples (30 g) were ground to weight ratio 7 : 3 of leaves and stems, boiled in 1 L of water at 70-90°C for 6 h. The supernatant (DML extracts) was taken to objects every day for a month. The objects of this study were 11 female and 4 male, aged between 30 and 50. DML extracts treatment reduced liver function index, decreased fatigue of the body and slightly decreased or increased BMI and fat mass index in all of them. Whereas in case of taking DML extracts for three month, objects significantly reduced fat mass and BMI used formula for obesity. In addition, in case of taking DML extracts one year, the object of hypertensive recovered normal blood pressure. While BMI and fat mass index were not changed because of normal range by nature, blood pressure was brought down to normal. These results described that DML could effected to maintain homeostasis to drop especially highly increased biological level in body. Also, DML extracts could improve vitality, relax tense muscles and relieve fatigue.

Analytical Method Validation of Ellagic acid and Shelf-life of Extract From Black Raspberry

Kyu Seo Chae*, Ki An Kim, Ji Wung Kwon
Berry & Biofood Research Institute, Korea

Validation of ellagic acid, as a marker compound in the standardization of black raspberry extract developed for functional health food, was attempted by a analytical method. Ellagic acid was validated for its LOD (limit of detection), LOQ (limit of quantitation), precision, accuracy, and recovery by HPLC relative to the black raspberry extract. It showed a high linearity in the calibration curve with a coefficient of correlation ($r^2$) of 0.9999. The LOD and LOQ were 0.6 μg/mL and 1.9 μg/mL, respectively. The results of the recovery test was 89-100%. The intra-day and inter-day precision in the ellagic acid for black raspberry extract was 0.28-1.96% and 0.69-2.49%, respectively. Therefore, the application of ellagic acid was validated in analytical method as a marker compound in black raspberry extract. Moisture, ellagic acid, coliform group were measured periodically at -20, 5, and 15°C for 6 months. Moisture and ellagic acid did not change during the storage period. During the storage period, coliform group were not detected.

Ellagic Acid Content and Antioxidative Activity of the *Rubus occidentalis* L. Fruit of at Different Ripening Stages

Ki An Kim*, Kyu Seo Chae, Tae Bum Lee, Hye Ran Choi, Ji Wung Kwon
Berry & Biofood Research Institute, Korea

In order to obtain the basic data that could be used to evaluate the ripening stages of *Rubus occidentalis* L. fruit (ROF), ellagic acid content and antioxidant activities of ROF were investigated. ROFs were collected at 2-4 days intervals from around 15 days after the florescence. The content of ellagic acid was the highest in 15 days after florescence regardless and then gradually decreased with the elapse of ripening stages. Change of antioxidant activity in ROFs showed correlation with the contents of DPPH radical-scavenging activity, total phenolics, total flavonoids, and ascorbic acid. The contents of DPPH radical-scavenging activity, total phenolics, total flavonoids, and ascorbic acid were higher in 15 days after florescence.

Co-treatment of Fermented Black Raspberry and Red Ginseng Improves Lipid Metabolism and Obesity in Rats Fed with a High-fat and High-cholesterol Diet

MinJung Lee*, JiEun Jang, HyeRan Choi, SuJung Lee, JiWung Kwon, Tae-Bum Lee
Berry & Bio Food Research Institute, Korea

This study investigated the effects co-treatment of fermented black raspberry (BR) and red ginseng (RG) on lipid metabolism and obesity improvement in rat fed a HFHCD (high fat/high cholesterol diet) for 12 week. Total cholesterol, LDL-cholesterol, and triglyceride were lowered and HDL-cholesterol was elevated by treatment of fermented BR and RG extracts compared with HFHCD. Fermented BR and RG extracts significantly increased expression of HMG-CoA reductase, LDL receptor, and sterol regulatory-element-binding protein-2 (SREBP-2) mRNA. Also, fermented BR and RG extracts decreased serum level of leptin and fatty acid synthase. Fermented BR and RG extracts significantly reduced the SREBP-1 mRNA expression. Moreover, supplementation with fermented BR and RG effectively increased fecal cholesterol excretion. These results suggest that fermented BR and RG extracts might be effective to prevent hypercholesterolemia and obesity.
Antioxidant Activity of Extracts from Chestnut Shells
Un-Young Youn*, Myung-Soo Shon, Gyo-Nam Kim, Seung-Cheol Lee
Kyungnam University, Korea

Chestnut is one of favorite fruits in Asian countries, and more than 60 thousand tons are annually produced in South Korea. Chestnut has been used in food industry, and lots of shells are produced after processing. However, chestnut shells are wasted or destined to under-valued uses. Currently, agricultural and industrial residues are attractive sources of natural antioxidants. In this study, methanol and water extracts of chestnut shells were prepared, and their antioxidant activity was evaluated for total phenol contents (TPC), tannin contents (TC), 1,1-diphenyl-2-picrylhydrazyl (DPPH) and 2,2’-azino-bis(3-ethylbenzthiazoline-6-sulfonic acid) (ABTS) radical-scavenging activities (RSAs), and tyrosinase inhibitory activity (TIA). TPC of the methanol extract (CSME) and water extract (CSWE) at 100 μg/mL was 20.50 and 17.31 mg GAE/g, respectively. TC of dried chestnut shell was 72.20 mg gallic acid equivalents/g. The DPPH and ABTS RSAs of CSME and CSWE at 100 μg/mL were 34.20 and 78.79%, 13.70 and 33.13%, respectively. However, TIA of CSWE was higher than CSME, where that of CSME and CSWE at 500 μg/mL was 5.58% and 16.22%, respectively.

Phytocidene Decreases LPS-induced Cyclooxygenase-2 Expression in Bovine Mammary Epithelial Cells
Su Kyung Kang*, Jae Sung Lee1, Hong Gu Lee1, Bae Yong Kim2, Sung Gu Han
Department of Food Science and Biotechnology of Animal Resources, Konkuk University, Korea, 1Department of Animal Science and Technology, Konkuk University, Korea, 2Phylus Corporation, Korea

Mastitis is an inflammatory disease which causes poor quality of milk. Phytocidene is an antioxidant and antimicrobial organic compound found in plants and trees. To investigate the effect of phytocidene, mammary alveolar epithelial cells (MAC-T) were pre-treated with phytocidene (0.17 and 0.35 mg/mL, 6 h) followed by lipopolysaccharide (LPS) treatment (1 and 25 μg/mL, 12 h). Results showed that phytocidene attenuated LPS-induced cyclooxygenase-2 (COX-2) expression. ERK, p38 and Akt were activated by LPS and that this activation was attenuated in cells treated with phytocidene. Treatment of cells with inhibitors confirmed the link of these signaling molecules to COX-2 expression. Also, phytocidene attenuated LPS-induced NF-kB activation. Moreover, LPS-induced superoxide production was decreased in cells treated with phytocidene. Our results suggest that phytocidene may prevent inflammatory responses in cow’s mammary gland by modulating cellular signaling molecules, such as COX-2, ERK, p38, Akt, NF-kB and oxidative stress.

Solid-state Fermented Taxarcosum coreanum Nakai with Mycelium of Phellinus linteus Inhibits Oxidative Stress Induced by Lipopolysaccharide in Mice
Byung-Je Cho*, Mijeong Kim1, Seulki Kim1, Yeong Ok Song1
Chedam Hospital of Korean Medicine, Korea, 1Department of Food Science and Nutrition, and Kimchi Research Institute, Pusan National University, Korea

Taxarcosum coreanum Nakai (TC) has been demonstrated protective effects against lipopolysaccharide (LPS) induced oxidative stress in mice. In this study, antioxidant property of solid-state fermented TC with mycelium of Phellinus linteus (F-TC) was investigated. TC was fermented by inoculating 10% (w/v) of cultivated liquid spawn of Phellinus linteus, and dried on the shelf at room temperature for seven days. F-TC was orally administered for two consecutive days immediately after LPS injection. Compared with LPS injected group, the level of reactive oxygen species and peroxynitrite of plasma and liver dropped significantly for both TC and F-TC fed animal groups (p<0.05). These effects of F-TC group were greater than those of TC. The protein expressions of superoxide dismutase, catalase, and glutathione peroxidase decreased in LPS groups compared with normal group, while anti-oxidative enzyme expression were elevated by F-TC administration (p<0.05). In conclusion, the beneficial effects of TC were ameliorated by fermentation with the mycelium of Phellinus linteus.

Lespedeza cuneata G. Extract Inhibits Human Colorectal HT-29 Cell Proliferation by Inducing Apoptosis
Qian Zhao*, Yeah-Un Kim1, In-Hwa Han, Jung-Mi Yun1
Department of Food & Nutrition, Kwangju Women’s University, Korea, 1Department of Food & Nutrition, Chonnam National University, Korea

We investigated the anti-proliferative properties and mechanism of L. cuneata stem extract. The ethanol extract of L. cuneata dose- and time-dependently inhibited human colon cancer cell proliferation. A 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide (MTT) assay was used to test effect of the extract on the proliferation of HT-29 colorectal cancer cells. The extract inhibited HT-29 cell proliferation with an IC50 of 554.26±8.81 μg/mL. Molecular changes were analyzed by western blot and RT-PCR. L. cuneata extract suppressed the production of pro-inflammatory cytokines (interleukin-6, tumor necrosis factor-α). Furthermore, the extract increased caspase-3 activity in cells. RT-PCR and western blot analyses were used to determine changes in the expression of mitochondria-dependent apoptosis markers (Bax and Bcl-2). Our data indicate that the extract induces apoptosis in HT-29 colon cancer cells, and that this phenomenon occurs via death receptor- and mitochondria-mediated apoptotic pathways. Our findings provide evidence that L. cuneata extract mediates its anti-proliferative effect through the modulation of apoptosis.
Effects of Pectinex Ultra SP-L Treatment on Phytochemical Concentrations and Antioxidative Properties of Mulberry Extracts

Myung Hwan Kim*, In Gyeong Lee, Hee Sun Kim¹, Gwi Jung Han¹
Department of Food Engineering, Dankook University, Korea, ¹National Academy of Agricultural Science, Rural Development Administration, Korea

The pectinase enzyme, Pectinex Ultra SP-L (PEC), was treated to mulberry extracts in order to raise phytochemical concentrations and antioxidative properties. RSM was used to obtain the optimal enzyme treatment conditions for mulberry extracts. Ranges of independent variables selected from the preliminary experiments were enzyme concentration 0.5-1.5 mL/100 L, enzyme reaction temperature and time 20-60°C and 2-8 h, respectively. PEC treatments had higher values of total polyphenol contents, total anthocyanin contents and DPPH radical scavenging activity than control. The proposed optimal PEC treatment conditions were enzyme concentration 0.52 mL/100 L, reaction temperature 25.66°C and reaction time 3.53 h, respectively. Total polyphenol contents, total anthocyanin content, DPPH radical scavenging activity and overall desirability of optimum processing condition for mulberry extracts were 5.87 mg/g, 0.67 mg/100 g, 52.53% and 0.78, respectively.

Process Optimization of Novozym 33095 Treatment for Anthocyanin Content and Bioactive Properties of Mulberry Extracts

Hee Sun Kim*, Gwi Jung Han, Myung Hwan Kim¹, Ji Eun Lim¹
National Academy of Agricultural Science, Rural Development Administration, Korea, ¹Department of Food Engineering, Dankook University, Korea

The pectinase enzyme, Novozym 33095 (Nov) was treated to mulberry extracts in order to raise anthocyanin concentration and bioactive properties. RSM was employed to obtain the optimal enzyme treatment conditions for mulberry extracts. Ranges of independent variables were enzyme concentration 0.05-0.25 mL/L, enzyme reaction temperature and time 20-60°C and 1-2 h, respectively. Nov treatments had higher values of total anthocyanin contents, DPPH radical scavenging activity and SOD-like activity than control. The optimal Nov treatment conditions were enzyme concentration 0.25 mL/L, reaction temperature 43.35°C and reaction time 61.67 min. Total anthocyanin content, DPPH radical scavenging activity and SOD-like activity of optimum processing condition for mulberry extracts were 5.15 mg/100 g, 58.25% and 20.79%, respectively.

Effects of Various Salts on Vascular Calcification in Adenine-induced Uremic Rats

Zhu Xun*, Chen Ying, Promyo Kittpong, Sun-Young Park, Jeong-yong Chao, Kyung-Sik Ham
Department of Food Biotechnology and Solar Salt Research Center, Mokpo National University, Korea

Mineral-rich solar salt and its roasted salt have been found to keep blood pressure lower compared to mineral-deficient salt when the rats were fed the same amount of NaCl. Vascular calcification is associated with cardiovascular morbidity and mortality. We investigated effects of various salts on vascular calcification in uremic rats. The rats fed with diets containing 4% (w/w) NaCl content of various salts [mineral-deficient salt (MDS), mineral-rich salt (MRS), purple bamboo salt (PBS), and white bamboo salt (WBS)] for 4 weeks after diet of 0.75% adenine. PBS rats showed the lowest level of blood pressure, vascular lumen radius and median thickness in aorta. The aortic calcium, magnesium, and phosphate (Pi) contents in PBS and WBS rats were lower than those in the MDS rats, which were consistent with the results of aortic calcification visualized by von Kossa staining. The expression levels of Runx-2, NF-κB p65, and cleaved caspase-3 in aorta were suppressed in PBS and WBS rats compared with those in the MDS rats. These results indicate that PBS and WBS gave less vascular calcification compared to MDS and MRS group, although high salt diet accelerated vascular calcification.
Octaphlorethol A, a Natural Marine Algae Product, Activates AMP-activated Protein Kinase with Beneficial Metabolic Effects in Type-2 Diabetic Mice

Seung-Hong Lee*, Sun Hee Cheong†, YuLing Ding
Division of Food Bioscience and Korea Nokyon Research Center, Konkuk University, Korea, 1Department of Biotechnology, Konkuk University, Korea

Octaphlorethol A (OPA) a type of phlorotannin, isolated from the brown algae *Ishige foliacea* has been shown to have anti-diabetic activities. However, the mechanism of action of OPA have rarely been investigated in type-2 diabetes. Here, we have investigated the antidiabetic effects and mechanism of OPA in C57BL/KsJ-db/db mice. The levels of blood glucose were significantly lower in the OPA treated db/db mice than in the control mice. OPA also significantly decreased the level of plasma insulin. OPA treatment augmented the activation of AMP-activated protein kinase (AMPK) and increased the expression of glucose transporter 4 (GLUT4) protein in skeletal muscle. In addition, OPA lowered the mRNA expression of phosphoenolpyruvate carboxykinase (PEPCK) and fatty acid synthase (FAS) in the liver. Therefore, the mechanisms of OPA may be related to suppressing gluconeogenesis by inhibiting PEPCK activity in the liver and affecting GLUT4-mediated glucose uptake in skeletal muscle through activating AMPK. These findings provided a new insight into the antidiabetic clinical applications of OPA and demonstrated the potential of OPA as a new drug candidate for type-2 diabetes.

Chemical Composition and Antioxidant Activities of Enzymatic Hydrolysates from Velvet Antler in Elk (Cervus elaphus canadensis)

Sun Hee Cheong*, Seung-Hong Lee†, Seon Gyeong Bak
Department of Biotechnology, Konkuk University, Korea, 1Division of Food Bioscience, and Korea Nokyon Research Center, Konkuk University, Korea

This study was conducted to provide the basic information to improve scientific assessment of antler’s quality by investigating in vitro antioxidant properties of enzymatic hydrolysates from elk velvet antler. The contents of uronic acid, sialic acid and glycosaminoglycan were the highest in the termamyl and protamex hydrolysates of the upper section and decreased downward to base section. The radical scavenging effects of enzymatic hydrolysates from velvet antler on 1,1-diphenyl-2-picrylhydrazyl (DPPH), hydroxyl and alkyl radical were investigated using a spin-trapping electron method. DPPH radical scavenging activity of flavovzyme hydrolysate, at the concentration inhibiting 50% of free radical generation (IC50) was 0.58 mg/mL. The IC50 values against hydroxyl radical scavenging activities was the highest in the flavourzyme hydrolysate. Alkyl radical scavenging activity was the highest in the protamex hydrolysate. These results suggest that enzymatic hydrolysates from velvet antler may be a useful radical scavenger and a potential supplement for the food, pharmaceutical and cosmetic industries because of its potent antioxidant capacities against various reactive radicals.

Biological Activity of Ethanol Extracts from Unripe Fruit of *Momordica charantia* Cultivated in Korea on the Inhibition of α-Glucosidase and Lipase

Dong-won Choi*, Nari Son, Seong-Eun Kim, Su-Young Hong, Oh-Kyung Kwon
Nutraceutical Food R&D Center, KolmarBNH Co., Ltd., Korea

To develop the functional materials food for improvement of diabetes, we examined the biological activity with *in vitro* models of ethanol extracts from unripe fruit of *Momordica charantia* cultivated in Hamyang, Korea. The extract conditions were tested by different ethanol concentrations (0, 30, 50, and 70%) and temperatures (50 and 70°C). α-Glucosidase and lipase inhibition activity of ethanol extracts were determined measuring reduction of intestinal absorption of carbohydrates and lipids. Experimental results showed that α-glucosidase inhibition activity was the highest (81.0%) at the condition of 70% and 70°C. In case of lipase inhibition, the activity was the highest (59.3%) at the condition of 70% and 70°C. Antioxidant activities were also determined by measuring the cation radical scavenging activity of hydroxyl and ABTS. The scavenging activity of hydroxyl and ABTS was 82.2%, 42.8% at the condition of 70% and 70°C respectively.

In-depth Study on Immunoregulatory Effects of Conjugated Linoleic Acid

Bitsaem Kim*, Wooki Kim
Graduate School of Biotechnology, Kyung Hee University, Korea

Numerous studies have indicated that conjugated linoleic acid (CLA, 18:2) positively influences immunomodulation. However, most of aforementioned studies compared CLA to either non-treated controls or different carbon numbered fatty acids, resulting in a vague conclusion. Furthermore, dissected studies with CLA isomers are also needed. Therefore, in the current study most abundant isomer of CLA, c9,11, and half-half mixture of c9,11 and t10,c12 isomers, were compared to common dietary lipids including linoleic acid (LA, 18:2n-6) and oleic acid (OA, 18:1 n-9) on inflammatory responses of murine macrophage RAW 264.7 cells. Phagocytosis as assessed by FACS analysis of fluorescence latex microsphere uptake was suppressed by c9,11 CLA and CLA mixture as compared to OA and LA controls. In accordance, pre-incubation of cells with c9,11 or isomer mixture showed down-regulated secretion of pro inflammatory cytokines including interleukin-1β, interleukin-6, and tumor necrosis factor-α as induced by lipopolysaccharides. This study confirmed the anti-inflammatory effects of CLA as compared to daily consumed fatty acids *in vitro*. 
DNA Protection and Antioxidant Activities of Water Extract from Hulled Barley and Phellinus linteus Grown on Hulled Barley

Ji Young Lee*, Kyoungh Hee Seo, Yong Chang Jang, Young Min Lee, Beong Ou Lim

College of Biomedical & Health Science, Department of Applied Biochemistry, Konkuk University, Korea

Hulled barley (HB) and Phellinus linteus grown on hulled barley (PLHB) was comparatively evaluated to use potential natural resources of antioxidant compound. Two water extracts were investigated in vitro by various experiments method such as 2,2-diphenyl-1-picrylhydrazyl (DPPH), 2,2-azino-bis-(3-ethylbenzothiazoline-6-sulfonic acid) (ABTS), reducing (Fe²⁺ to Fe³⁺) power and DNA protection. In conclusion, the PLHB extract showed radicals scavenging activities and reducing power better than HB extract. And the PLHB extract has a protective effect of against DNA damage induced by hydrogen peroxide (H₂O₂). Hydroxyl radical scavenging activities were measured by ESR where HB and PLHB extracts were similar activity. So, this study suggest that the PLHB extract is a potential source of natural antioxidant.

Immunological Activities of Edible Herbs and Green Coffee Bean Fermented by Solid-State Culture with Hericium erinaceum and Monascus ruber Mycelium

Eun-Hye Shin*, Hoon Kim¹, Hyun-Young Shin, Ji-Young Shin², Kwang-Won Yu

Department of Food and Nutrition, Korea National University of Transportation, Korea, ¹Department of Integrated Biomedical and Life Science, Korea University, Korea, ²Cosis Bio Corporation Ltd., Korea

Fresh edible herbs (Artemisia iwayamogi, Morus alba, and Hippophae rhamnoides) and green coffee bean were fermented with Hericium erinaceum mycelium (HE) and Monascus ruber (MR) to enhance their physiological activity for animal feed additives. When hot-water extracts (HE-AI-HW, HE-MA-HW, HE-HR-HW and MR-CB-HW) were prepared from each lyophilized ferments, HE-HR-HW showed the potent higher IL-6 production (419.6 pg/mL at 100 mg/mL) from peritoneal macrophage than any ferments (0.6-64.1 pg/mL). In addition, crude polysaccharides (HE-AI-CP, HE-MA-CP, HE-HR-CP and MR-CB-CP) were fractionated from each hot-water extracts to obtain the active macromolecules such as polysaccharide or proteoglycan. MR-CB-CP from fermented green coffee bean had the potent mitogenic activity of splenocytes (1.62-fold at 100 mg/mL) than any ferments (1.34-1.42-fold) and MR-CB-CP also showed the potent cytokine producing activity (IL-6; 1.754.1 pg/mL & IL-2 12 225.8 pg/mL respectively) from macrophage than any ferments (412.2-1,066.6 and 38.3-65.6 pg/mL). These results suggested that green coffee bean fermented with M. ruber could potentially stimulated splenocytes and macrophages activation.

Effect of Monosodium L-Glutamate on Murine Macrophage RAW264.7 Cells

Jushin Kim*, Wooki Kim

Department of Food Science and Biotechnology, Kyung Hee University, Korea

Monosodium glutamate (MSG) is one of the most common seasonings, for which public sentiment is still negative. Although numerous studies exhibited its harmlessness. Aforementioned studies focused on the toxicity of MSG by using high dose to animal models. Therefore, it is necessary to study any tentative effect of moderate dose of MSG on various physiological actions. In this study, the impact of MSG on the immune response was examined by using a cell-line model of mouse macrophage Raw264.7 cells. First, the cell viability, as assessed by MTT assay, was not affected by MSG up to 500 μM. Considering that normal concentration of plasma glutamic acid reaches 100 μM, our observation confirmed the safety of MSG on immune cells. The phagocytosis, a signature function of macrophages which initiates both innate and adaptive immune responses, was assessed following exposure of the cells to MSG up to 500 μM, and the data indicated no significant change. With respect to pro-inflammatory cytokine production following stimulation of cells by using lipopolysaccharides, TNF-α secretion was not affected by MSG treatment, whereas IL-6 was decreased at a highest concentration of MSG.
Comparison of Physiological Activities in Crude Polysaccharides from Atiso and Hovenia dulcis

Jeong-A Park*, Hoon Kim, Ki-Sun La, Yang-Ji Jo, Eun-Hye Shin, So-Young Park, Kwang-Won Yu
Department of Food and Nutrition, Korea National University of Transportation, Korea, 1Department of Integrated Biomedical and Life Science, Korea University, Korea

To develop the functional material, Atiso (Bông Atiso) and Hovenia dulcis was extracted by hot-water. Hovenia dulcis (HD-HW) showed the higher content of antioxidant component (flavonoid 0.44 mg QE and polyphenol 10.77 mg GAE/100 mg sample) and scavenging activity against ABTS and DPPH radical (6.01 and 6.92 mg AEAC/100 mg sample, respectively) than Atiso (ATS-HW). However, ATS-HW had the potent cytokine producing activity from peritoneal macrophage (TNF-α: 132.8 pg/mL, IL-6: 1.021.6 pg/mL, IL-12: 33.2 pg/mL) than HD-HW (102.6, 434.1 and 5.9 pg/mL, respectively). ATS- HW also showed anti-inflammatory activity in LPS-induced RAW-264.7 cell line. ATS-HW (TNF-α: 29.6 and IL-2: 65.2%) inhibited the production of inflammatory cytokines more than HD-HW (10.5 and 56.1%). In addition, how-water extracts were fractionated into each crude polysaccharide to enhance the physiological activity. Atiso (ATS-CP; IL-6 422.5 pg/mL and IL-12 27.9 pg/mL) showed the more potent cytokine production from macrophage than HD-CP (21.7 and 15.0 pg/mL, respectively). These results suggested that Atiso might have a potential immunomodulating agent and could be used for functional ingredients.

Lipid nano-vesicles (liposomes and niosomes) have been extensively used to increase bio-availability of physiologically active materials. Among various methods, microfluidic assembly has been garnering an attention due to its easy control of size distribution and food-grade solvent usage. In this study, mono-disperse 100 nm sized DPPC:cholesterol liposomes ([4:1, mol/mol] and Span 40:cholesterol niosomes ([1:1, mol/mol]) were produced by microfluidic assembly. Especially, liposomes were fabricated with various ionic surfactants to enhance their colloidal stability. As a result, liposomes incorporated with 20% (mol/mol) palmitate, 4% (mol/mol) dicetylphosphate, and 4% (mol/mol) hexadecanoyl showed the greatest stability in their DLS, TEM, and Zeta potential results. Moreover, food-grade biodegradable polymers (chitosan and pectin) were incorporated to endow additional physical barrier onto the lipid nano-vesicles. Branched-chain amino acids (BCAA's) were selected as model food materials for encapsulation efficiency measurement. On the basis of these results, in-depth researches on target delivery and controlled release of BCAA nano-vesicles would be conducted in the near future.

Anti-obesity Effect of Enzymatic Hydrolysate from Velvet Antler in 3T3-L1 Cells and High-fat diet-induced Obese Mice

YuLing Ding*, Seung-Hong Lee, Sun Hee Cheong
Division of Food Bioscience and Korea Nokyong Research Center, Konkuk University, Korea, 1Department of Biotechnology, Konkuk University, Korea

The purpose of this study was to evaluate anti-obesity effects of enzymatic hydrolysates from velvet antler on adipogenesis inhibition in 3T3-L1 cells and high-fat diet (HFD)-induced obese mice. The hydrolysates were prepared by enzymatic hydrolysis of velvet antler using commercial proteases such as Protamex (VAPH). The VAPH evidenced profound adipogenesis inhibitory effect. The VAPH exhibited triglyceride accumulation reduction and down-regulated the expression of the adipogenesis-related proteins such as SREBP-1, PPARγ and C/EBPα in a dose-dependent manner. In a mouse model of HFD-induced obesity, oral administration of VAPH (100 and 300 mg/kg for 13 weeks) significantly reduced the increased body weight gain induced by HFD. VAPH treatment also reduced serum glucose and triglyceride levels, while the level of HDL-C was increased. Furthermore, treatment of VAPH greatly reduced hepatic lipid droplets accumulation. Also, the size of adipocyte in VAPH-treated groups was dramatically decreased. These results demonstrated that the VAPH has anti-obesity effects. Therefore, VAPH may be an effective candidate for preventing obesity or obesity-related diseases.

Microfluidic Assembly of Lipid Nano-vesicles for Food Administration: Surface Modification of Liposome and Niosome

MinJe Jo*, Sung-Chul Hong, Kyung-Min Park, EunHye Yang, Seon-Joo Lee, Ho-Sup Jung, Keesung Kim, Pahn-Shick Chang
1Department of Agricultural Biotechnology, Seoul National University, Korea, 2Institute of Advanced Machinery and Design, School of Mechanical and Aerospace Engineering, Seoul National University, Korea, 3Center for Food and Bioconvergence, and Research Institute of Agriculture and Life Sciences, Seoul National University, Korea

Arbutin (hydroquinone β-D-glucopyranoside) is one of the main compounds contained in immature pear (Pyrus pyrifolia) fruits. It has been reported that arbutin content in immature pear fruits is predominantly higher than that in mature fruits in our previous study. In addition, skin lightening effect of arbutin by inhibition of tyrosinase is well reported. Therefore, arbutin was used as a whitening additive in cosmetic industry. Recently, simple purification method of arbutin in small scale from immature pear fruits was established in our previous study. However, this established method could not be applicable in economical aspect of bulk scale. Therefore, it was necessary to improve the established method in small scale. Immature pear fruits (100 kg fresh wt.) were extracted by hot water (120 L) instead of organic solvent. A portion (720 g/20 L) of the extract (4,320 g/120 L) was purified using a Diaion HP-20 column chromatography (H2O/EtOH, step wise, 20×120 cm) without step of concentration. Arbutin powder (44.2 g) was finally obtained from immature pear fruits (16 kg fresh wt.) and the yield of arbutin was estimated to 0.2%.

Large Scale Purification of Arbutin from Immature Pear Fruit

Mi Rim Jin*, Sang Won Lee, Jae Heon Moon, Yu Geon Lee, Jae Hak Moon
1Department of Food Science and Technology and Functional Food Research Center, Chonnam National University, Korea, 2Korea Pear Research Organization, Chonnam National University, Korea, 3Nature in Lab, Korea

Arbutin (hydroquinone β-D-glucopyranoside) is one of the main compounds contained in immature pear (Pyrus pyrifolia) fruits. It has been reported that arbutin content in immature pear fruits is predominantly higher than that in mature fruits in our previous study. In addition, skin lightening effect of arbutin by inhibition of tyrosinase is well reported. Therefore, arbutin was used as a whitening additive in cosmetic industry. Recently, simple purification method of arbutin in small scale from immature pear fruits was established in our previous study. However, this established method could not be applicable in economical aspect of bulk scale. Therefore, it was necessary to improve the established method in small scale. Immature pear fruits (100 kg fresh wt.) were extracted by hot water (120 L) instead of organic solvent. A portion (720 g/20 L) of the extract (4,320 g/120 L) was purified using a Diaion HP-20 column chromatography (H2O/EtOH, step wise, 20×120 cm) without step of concentration. Arbutin powder (44.2 g) was finally obtained from immature pear fruits (16 kg fresh wt.) and the yield of arbutin was estimated to 0.2%.
Synthesis of Thymol Glucoside and Its Absorption and Metabolism in Rat Blood Plasma

Su-A Im*, Dong-Seok Park, Hang-Yeon Jeong, Jae-Hak Moon
Department of Food Science & Technology, and Functional Food Research Center, Chonnam National University, Korea

Many aroma compounds exert various beneficial bioactivities. Alcoholic arosas mostly present as aroma precursor forms (glycoside, 97-98%) rather than aglycone (aroma, 2-3%) in plants such as flowers and tea. Nevertheless, studies on biological activity have been performed for only aglycones. Therefore, in the present study, absorption and metabolic investigations were performed for thymoyl-1-O-β-D-glucopyranoside (TG) as a precursor of thymol, which exerts various bioactivities such as antioxidant, antimicrobial, bacteriostatic, antiviral activities, in rat (Sprague-Dawley, 6 weeks old) blood plasma. Synthesized TG (yield, 57.5%) was orally administered (8.6 mmol/kg body wt.) to rat and the blood was collected from abdominal artery of rat 2 h after oral administration of TG. Then, separated plasma was analyzed by HPLC and GC. It was clarified that TG was absorbed as intact form (glucoside), not aglycone form (thymol). The pharmacokinetics experiments of TG, TG aglycone or TG metabolite(s) in rat blood plasma is in progress.

Absorption and Metabolism of 1,6-Di-O-galloyl-β-D-glucopyranoside in Rat Plasma

Hyun Jeong An*, Eun Hee Kim, Jeong-Yong Cho, Jong-Pil Kim, Hyang-Hee Lee, Eun Sun Kim, Jae-Hak Moon
Department of Food Science & Technology, and Functional Food Research Center, Chonnam National University, Korea, 1Health and Environment Research Institute of Gwangju, Korea

Sword bean (Canavalia gladiata) has been used for the treatment of purulent inflammation in Chinese herbal medicine. In our recent study on chemical constituents contained in sword bean, the presence of 1,6-di-O-galloyl-β-D-glucopyranoside (DGG) was revealed. However, the study on absorption and metabolism has not yet been fully performed. Therefore, we studied absorption and metabolism of DGG in rat plasma. Rat (Sprague-Dawley, 6 weeks old, 200 g B.W.) blood plasma after oral administration of DGG was extracted, concentrated, and subjected to ODS-HPLC analysis equipped with photodiode array. DGG was not detected from the rat plasma in intact form as well as in conjugated metabolites of gallic acid (GA), suggesting that DGG may undergo other catabolism. GA, pyrogallol (PY), and resorcinol, which may be generated by hydrolysis of ester bond and secondary metabolism from the intact compounds, were additionally analyzed by HPLC using electrochemical detector (+700 mV). Only PY was detected as free and conjugated forms. The content of total PY in plasma reached its maximum concentration 8 h after administration of DGG.

Absorption and Metabolism of an Urushiol, 3-Pentadecylcatechol, in Rat

Hang Yeon Jeong*, Jae-Hak Moon
Department of Food Science & Technology, and Functional Food Research Center, Chonnam National University, Korea

Urushiols, having catechol group coupled with a saturated or unsaturated alkyl side chain of 15 or 17 carbons, are a group of major compounds in lacquer tree (Rhus verniciflua Stokes) sap. Recently, various biological effects of urushiol such as antioxidant, antimicrobial, and anticancer activities have been reported. However, urushiols act as skin allergenic-induced factor. Nevertheless, lacquer tree has been used traditionally in Korea as a folk medicine. In this study, we evaluated absorption and metabolism of 3-pentadecylcatechol (PDC) which is one of the urushiols. PDC (50 mg/kg body wt.) in 1 mL of propylene glycol was orally administered to rat (Sprague-Dawley, 6 weeks old). Blood plasma was collected 1, 2, 4, 8, and 12 h after oral administration of PDC from aorta of rat. Urine and feces were collected for 0-24 h after oral administration of PDC. The extracts of plasma, urine, and feces were analyzed by FDA- HPLC. PDC was not detected from the rat blood plasma and urine extracts. However, PDC in high concentration was detected from the feces extract, suggesting that most of the PDC is excreted without absorption.

Absorption and Metabolism of 1,2,3,4,6-Penta-O-galloyl-β-D-glucopyranoside in Rat

Hwan Seong Choi*, Eun Hee Kim, Jeong-Yong Cho, Jong-Pil Kim, Hyang-Hee Lee, Eun Sun Kim, Jae-Hak Moon
Department of Food Science & Technology, and Functional Food Research Center, Chonnam National University, Korea, 1Health and Environment Research Institute of Gwangju, Korea

1,2,3,4,6-Penta-O-galloyl-β-D-glucopyranoside (PGG) is distributed in medicinal plants such as peony root, green alga, and moutan. It has been reported that PGG exerts various biological effects including anti-oxidative, anti-bacterial, and anti-diabetic activities. PGG was also detected from sword bean (Canavalia gladiata) based on LC-ESI-MS analysis. However, the study on absorption and metabolism of PGG has not yet been fully performed. Therefore, in this study, absorption and metabolism of PGG was investigated using a chemically synthesized PGG. After administration of PGG to rat (Sprague-Dawley, 6 weeks old, 200 g B.W.), blood plasma, urine, and feces were collected. Each extract was concentrated and subjected to HPLC analysis equipped with electrochemical detector (+700 mV) and photodiode array detector. PGG was detected from only feces. That is, PGG was not detected from the rat blood plasma and urine in intact form as well as in conjugated form of gallic acid. In addition, any other secondary metabolites such as gallic acid, pyrogallol and resorcinol were undetectable from rat plasma, urine, and feces after oral administration of PGG.
**P11 -100**

**Allergic Elimination of an Urushiol, 3-Pentadecylcatechol, by Ionization**

Hang Yeon Jeong*, Yun-Ji Lim, Jeong-Yong Cho, Jae-Hak Moon

Department of Food Science & Technology, and Functional Food Research Center, Chonnam National University, Korea

Urushiols are allergenic found in the Anacardiaceae family. Therefore, its practical use is very restricted. We attempted to eliminate the allergic property of urushiols with maintaining of the amphipathic structure. 3-Pentadecylcatechol (PDC, 200 mg), which is one of natural urushiols, was heated for 30 min with H2O containing Na2CO3. The reaction mixture was solvent fractionated by CH2Cl2 and the CH2Cl2 layer was concentrated and analyzed by ESI-MS. Ionized PDC (m/z 316.9) and complexed PDCs with Na+ of 1-3 atoms (m/z 340.8, 365.2, 380.8) were detected. PDC and ionized PDC (3 μmol/50 μL EtOH) were treated on the rear of left ear of rats (Sprague-Dawley, 6 weeks, n=6) every day for 10 days. Erythema and swelling were observed on the ear skin treated with PDC, but not in ionized PDC. Contact hypersensitivity-related biomarkers (the contents of neutrophil, eosinophil, serum IgE and histamine) in blood of rats treated with PDC were more increased than those in control (p<0.05). However, their contents in rats treated with ionized PDC were not different significantly to those of control. It was confirmed that the allergenic of urushiol, PDC, was removed by ionization.

**P11 -101**

**Structural Conversion of an Urushiol, 3-Pentadecylcatechol, by Laccase**

Ji Won Seo*, Hang-Yeon Jeong, Jeong-Yong Cho, Jae-Hak Moon

Department of Food Science & Technology, and Functional Food Research Center, Chonnam National University, Korea

3-Pentadecylcatechol (PDC, 50 mg), which is an allergenic urushiol derivative, was incubated with laccase (from Trametes versicolor) at 37°C. The incubated solution was extracted by CH2Cl2 and the CH2Cl2 layer was concentrated and analyzed by ESI-MS. The reaction product treated rat blood were similar to control. To confirm the structural change of PDC by laccase, the reaction product was purified by silica gel column chromatography. Now, structural elucidation of isolated 3 compounds is in progress.

**P11 -102**

**Absorption and Metabolism of a Gallol Lipid Derivative, 4-Pentylgallol, in Rat Plasma**

Jeong Hee Park*, Hang Yeon Jeong, Jae-Hak Moon

Department of Food Science & Technology, and Functional Food Research Center, Chonnam National University, Korea

In our previous study, nonallergenic urushiol derivatives were chemically synthesized and suggested as a potential anti-atherosclerosis factor. In order to more elevate availability as an anti-atherosclerosis factor, other amphipathic compounds containing a gallol group and a long hydrocarbon side chain in C-4 position were chemically synthesized. In this study, absorption and metabolism of a gallol lipid derivative, 4-pentylgallol (PG), as a potential anti-atherosclerosis factor was estimated. After oral administration of PG, blood plasma collected from abdominal artery of rats, urine, and feces were analyzed by HPLC. PG was not detected from the rat plasma in intact form as well as in conjugated metabolites. However, PG was detected from urine in intact form and conjugated metabolites such as sulfate and/or glucuronide. These results indicated that PG is absorbed as intact form and metabolite (glucuronide and/or sulfate) forms, although PG was not detected from plasma. Therefore, further pharmacokinetic study is in progress. In addition, PG was detected from feces as an intact form, indicating that a portion of administered PG reached large intestine.

**P11 -103**

**Absorption and Metabolism of 2,3- and 3,4-Dihydroxybenzoic Acids in Rat Blood Plasma**

Hye-Min Park*, Hang-Yeon Jeong, Jae-Hak Moon

Department of Food Science & Technology and Functional Food Research Center, Chonnam National University, Korea

2,3- and 3,4-Dihydroxybenzoic acids (2,3- and 3,4-DHBA) is widely distributed in plants and fermented foods. In vitro studies on the various physiological activities of the compounds have been reported. However, absorption and metabolism in vivo have not yet been reported. Therefore, in this study, absorption and metabolism of the compounds in rats were compared. 3,4- and 2,3-DHBA were orally administered to rats, and bloods are collected from artery. Separated plasma is analyzed using HPLC-ECD (+800 mV). Most of 3,4-DHBA was absorbed as conjugated forms. On the other hand, 2,3-DHBA was absorbed as intact form and conjugated forms. Based on combination treatment of enzymes and glucuronidase inhibitor (D-saccharic acid 1,4-lactone), it was revealed that 3,4-DHBA was absorbed as glucuronide and/or sulfate forms and 2,3-DHBA was absorbed as intact form and sulfate form. In addition, the total 3,4-DHBA (4.54±2.4 μM) and 2,3-DHBA (37.86±14.07 μM) contents reached Cmax at 0.5 h after oral administration. It was confirmed that metabolic pathway and absorption ratio of phenolic compounds could be varied by their minute structure difference.
Effect of Extract Condition on Flavonoid Content in *Opuntia ficus indica* Fruit Extracts

Seok Jin Seo*, Yeong Eun Kim, Bumsik Kim1, Sanghoo Ko
Department of Food Science and Technology, Sejong University, Korea, 1School of Food Science, Kyungil University, Korea

The purpose of this study was to find the optimum extract condition for maximizing flavonoid content in *Opuntia ficus indica* fruits. Fresh fruits were ground in a mixer. Shredded fruits were extracted twice at 70°C for 2.5 h with 75% ethanol or distilled water, or once at 121°C with distilled water for 1.5 h in a high pressure chamber. After concentrating the extracts, they were freeze-dried and subsequently powdered. The total flavonoid content of the samples was determined by measuring the absorbance at 420 nm using a spectrophotometer. Total flavonoid content of *Opuntia ficus indica* fruits was represented as quercetin equivalents (QE) in mg/10 g dry material (DM). As a result, flavonoid content was as high as 52.7±5.8 mg QE/10 g DM for the sample prepared using 75% ethanol. However, the samples extracted with distilled water under high pressure and with distilled water showed content of 32.0±3.9 mg QE/10 g DM and 41.2±7.0 mg QE/10 g DM, respectively, which were lower than that extracted with 75% ethanol. In conclusion the extract condition for maximizing flavonoid content in the extract from *Opuntia ficus indica* fruits was represented as quercetin equivalents (QE) in mg/10 g dry wt.

Further Study on Bioconversion Metabolites of Capsaicin by *Aspergillus oryzae*

Minji Lee*, Jeong-Yong Cho, Yu Geon Lee, Hyoung Jae Lee, Jae-Hak Moon
Department of Food Science and Technology, and Functional Food Research Center, Chonnam National University, Korea

In our previous study, 5 bioconverted metabolites of capsaicin were identified by *A. oryzae*, which is generally used as a starter in *gochujang* manufacturing. The isolated compounds were identified as N-vanillylcarbamoylbutyric acid (1), N-vanillyl-9-hydroxy-8-methyloctanamide (2), o-hydroxycapsaicin (3), 8-methyl-N-vanillylcarbamoyl-6(β)-octenoic acid (4), 2-methyl-N-vanillylcarbamoyl-6(Z)-octenoic acid (5). In addition, bioconversion mechanism of these compounds was proposed. In present study on metabolites of capsaicin by *A. oryzae*, 5 capsaicin metabolites were quantified in *gochujang* by LC-ESI-MS. The EIOAc fraction of *gochujang* MeOH extracts was analyzed by MRM mode. Compounds 1 (74.8±1.4 μg/100 g dry wt.), 3 (38.1±0.9 μg/100 g dry wt.), and 4 and/or 5 (5607.8±53.0 μg/100 g dry wt.) were quantified in *gochujang*. However, compound 2 was undetectable in this study. These results indicate that capsaicin metabolites 1, 3, and 4 and/or 5 are unambiguously presented in *gochujang*. Therefore, it is considered that capsaicin metabolites are produced from capsaicin during *gochujang* fermentation and the product becomes less pungency than red hot pepper.

Radical-scavenging Mechanism of a Gallol Lipid Derivative, 4-Pentylgallol, Using Fenton Reaction

Jeong Hee Park*, Hang Yeon Jeong, Jeong-Yong Cho, Jae-Hak Moon
Department of Food Science & Technology, and Functional Food Research Center, Chonnam National University, Korea

In the present study, Fenton reaction (H₂O₂ + Fe²⁺ → HO· + HO + Fe³⁺) was used to clarify radical-scavenging mechanism of 4-pentylgallol (PG) as a potential anti-atherosclerosis factor. In a different way to other approaches for clarification of radical-scavenging mechanism, Fenton reaction has advantages such as short reaction time and minimizing of refining process and by-products. Oxidation of PG (final concentration, 2.78 mM) and H₂O₂ (final concentration, 2.78 mM) mixture in MeOH was initiated by addition of FeCl₂ (final concentration, 6.5 μM) and reacted for 1.5 h at 37°C. The reaction solution was diluted in 2-fold with H₂O and partitioned with EIOAc in the same volume. EIOAc layer was concentrated and purified by ODS-HPLC of preparative scale. Two compounds were isolated and their structures were determined as 5-(3-pentyl-2',3',4'-trihydroxybenz-1'-yl)-4-pentylgallol and 6-(3-pentyl-2',3',4'-trihydroxybenz-1'-yl)-4-pentylgallol by NMR and LC-ESI-MS analyses. It is considered that the two compounds were dimerized after scavenging of radicals formed by Fenton reaction. These compounds may be used as a biofactor for in vivo study of PG.

Isolation and Identification of Secondary Metabolites Produced by *Leuconostoc mensenteroides*

Yu Geon Lee*, Jeong-Yong Cho, Jae-Hak Moon
Department of Food Science & Technology, and Functional Food Research Center, Chonnam National University, Korea

The purpose of this study was to isolate and identify secondary metabolites produced by *Leuconostoc mensenteroides*, which is one of the main microorganisms involved in early stage during fermentation of Korean traditional kimchi. *L. mensenteroides* cultivated in modified MRS broth for 2 days. The fermented medium was centrifugated at 8,000×g for 15 min at 4°C. The supernatants were extracted with same volume of ethyl acetate. EIOAc extracts was analyzed by LC-MS. The EIOAc fraction of *gochujang* MeOH extracts was analyzed by MRM mode. Compounds 1 (74.8±1.4 μg/100 g dry wt.), 3 (38.1±0.9 μg/100 g dry wt.), and 4 and/or 5 (5607.8±53.0 μg/100 g dry wt.) were quantified in *gochujang*. However, compound 2 was undetectable in this study. These results indicate that capsaicin metabolites 1, 3, and 4 and/or 5 are unambiguously presented in *gochujang*. Therefore, it is considered that capsaicin metabolites are produced from capsaicin during *gochujang* fermentation and the product becomes less pungency than red hot pepper.
Chemical Composition and Antioxidant Activity of Onion (Allium cepa L.) Cultivars

Eom-Ji Hwang*, Young-Seok Kwon¹, Cheol-Woo Kim², Young-Lok Cha, Yu Geon Lee¹, Jae-Hak Moon²

Bioenergy Crop Research Institute, National Institute of Crop Science, Rural Development Administration, Korea,¹ Vegetable Research Division, National Institute of Horticultural & Herbal Science, Rural Development Administration, Korea,² Department of Food Science & Technology, and Functional Food Research Center, Chonnam National University, Korea

In our previous study, eight phenolic compounds [3,4-dihydroxy benzoic acid (1), 4-hydroxy-3-methoxy benzoic acid (2), quercetin O-β-D-glucopyranoside (3), isorhamnetin 3-O-β-D-glucopyranoside (4), quercetin 3-O-β-D-glucopyranoside (5), quercetin (6), quercetin 7,4-O-β-D-diglucopyranoside (7), and quercetin 3,4-O-β-D-diglucopyranoside (8)] were isolated from onion (Allium cepa L. cv. Sunpower). Therefore, in this study, we compared the contents of compounds 1-8, total phenolics, total flavonoids, pyruvic acid, and sugars and antioxidant activities in ten different onion cultivars. The contents of compounds 1-8 in onion cultivars were varied from 0.01 to 53.79 mg/100 g. The average of total polyphenols and flavonoids in onion cultivars were 675.31 mg/100 g and 34.51 mg/100 g, respectively. The contents of pyruvic acid was ranged from 55.40 to 82.26 mg/100 g and total sugars was from 6.5 to 8.3 g/100 g. Cultivar 'Cheonjujeok' exhibited higher free radical-scavenging activity than other cultivars. This study may provide useful information for understanding the potential health benefits and utilization of onion cultivars.

Bioactivities of Fermented Immature Pear Powder Extracts

Sang Won Lee¹,*, Yu Geon Lee¹, Jae-Hak Moon¹²

¹Department of Food Science and Technology and Functional Food Research Center, Chonnam National University, Korea,² Korea Pear Research Organization, Chonnam National University, Korea

Pear (Pyrus pyrifolia) fruit is one of the most widely consumed fruits in the world. In cultivation process of pear, most of the immature pear fruits are generally handpicked at the early stage after florescence to harvest pear fruit of high quality. Nevertheless, the practical use of discarded immature pear fruits has not yet been prudently tried. To elevate possibility for application of immature pear fruits, immature pear fruits were fermented by A. oryzae which are usually involved in fermentation process of foods. MeOH extract of each fermented immature pear fruit was used for evaluation of various biological activities. The fermented group with L. mesenteroides showed significantly higher content of total flavonoids than those in fermented group with A. oryzae and in control. In addition, several biological activities such as scavengings of DPPH, ABTS⁺, superoxide anion radical, and hydroxyl radicals and tyrosinase inhibition, reducing power, and inhibitory effect against formation of cholesterol ester hydroperoxide in rat plasma showed that fermentation could be enhanced biological activities of immature pear fruit extracts.

Allium hookeri Inhibits Proliferation and Induces Apoptosis of Human Breast Cancer Cells

Hyeon-A Kim*, Mi-Kyoung You, Jin-Hee Kim

Department of Food & Nutrition/Research Institute of Human Ecology, Mokpo National University, Korea

In this study, the inhibitory effect of Allium hookeri water extract (AHH) on the growth of MDA-MB-231 human breast cancer cell line was determined. Cells were cultured with PBS or with 25, 50, 75, 100, or 250 µg/mL of AHH. AHH inhibited the proliferation of MDA-MB-231 cells in a dose-dependent manner. AHH also showed increase in the apoptosis of MDA-MB-231 cells in a dose-dependent manner. Western blot analysis showed that the expression of Bcl-2 (anti-apoptotic factor) decreased, whereas, the expression of Bax (pro-apoptotic factor) increased due to AHH. Therefore, the Bcl-2 protein to Bax protein expression ratio, an important indicator of apoptosis, decreased significantly. Our results shows the potential of AHH as a chemopreventive agent in clinical applications for limiting breast cancer cell proliferation.

Fallen Pear Extracts Inhibit Lipid Accumulation in 3T3-L1 Adipocytes

Hyeon-A Kim*, Mi-Kyoung You

Department of Food & Nutrition/Research Institute of Human Ecology, Mokpo National University, Korea

The goal of this study was to compare the effect of various extracts of pear on lipid accumulation of 3T3-L1 cells. We used fallen pear extracts: water (FPWM) or ethanol (FPEM) extract with fallen pears collected in May and water (FPWA) or ethanol (FPEA) extract with fallen pears collected in August. The effects of various extracts of pear on cell viability and the adipogenesis were investigated via MTT assay and Oil Red O staining respectively. FPEM, FPWA and FPEA at concentrations of 100 and 250 µg/mL showed no significant effect on cell viability after 24 h treatment. However, FPWM was cytotoxic at the concentrations of 100 and 250 µg/mL. Water extracts of pear significantly inhibited lipid accumulation in 3T3-L1 adipocytes regardless of falling time, whereas ethanol extracts increased adipocyte differentiation. These results demonstrate that FPWA treatment has an anti-adipogenic effect in 3T3-L1 adipocytes without toxicity, suggesting its potential as an anti-obesity therapeutic agent.
Antioxidant Properties and Quality Characteristics of Nine Different Fruits

Jung-Seo Park*, Min-Youp Kim, Kwang-Geun Lee, Mina K. Kim
Department of Food and Nutritional Science, Kyungnam University-BMC Campus, Korea

Fruits are known to have high levels of antioxidants. Limited studies were conducted to compare the antioxidant properties and other quality characteristics of different fruits. The objective of current study was to analyze the antioxidant properties and quality characteristics of nine well-known fruit products. Nine different types of fruit were included in this study: aronia, blueberry, cherry, cranberry, mangosteen, omija, raspberry, rambutan, and strawberry. Antioxidant properties were determined by measuring total phenolic content, total anthocyanin content, and DPPH radical scavenging activity. Other quality attributes including pH, °Bx, and vitamin C contents were analyzed. Antioxidant activities of nine different fruit products were significantly different to each other (p<0.05). The DPPH radical scavenging activities of aronia, blueberry, aronia, and raspberry were at parity (p>0.05), while aronia contained highest total phenolic contents (p<0.05). Blueberry had highest vitamin C content than other fruits (p<0.05). The findings from current work can add valuable scientific data for ingredient selection process of new fruit-based functional beverage development.

Korean Red Ginseng Extract Stimulation Cell Proliferation and Angiogenesis by Activating the MAPK Signaling Pathways in Human Umbilical Vein Endothelial Cells

Gi Dae Kim*, Jedo Oh†, Sang Kook Lee†
Department of Food and Nutrition, Kyungnam University, Korea, †College of Pharmacy, College of Pharmacy, Seoul National University, Korea

Korean red ginseng (KRG) contains numerous bioactive ginsenosides and has been traditionally used as a multi-purpose medicine for health improvement. However, the biological effects of KRG on endothelial cell proliferation and angiogenesis and the underlying mechanisms of action are yet to be elucidated. In the present study, we investigated the effects of Korean red ginseng extract (KRG) on cell proliferation and endothelial tube formation in cultured human umbilical vein endothelial cells (HUVECs). As a result, KRG in a relatively low concentration stimulated the cell proliferation of HUVECs. These effects were demonstrated to be up-regulation of the expression of proliferating cell nuclear antigen. Since endothelial cell migration and tube formation are essential step in angiogenesis, the effects of KRG on the wound-healing and tube formation of HUVECs were evaluated. One plausible mechanism of action in the stimulation of cell migration and tube formation of HUVECs by KRG was considered to be up-regulation of MAPK signaling pathways. In summary, these findings suggest that KRG might be applicable for a novel therapeutic strategy in the diseases with abnormal angiogenesis.

Physiological Properties of Fruit, Peel, and Fruit+Peel of Chopi (Zanthoxylum pipertium DC.)

Ji-su Park*, Byung-Geon Park, Inhwa Han
Department of Food and Nutrition, Kwangju Women’s University, Korea

This study investigated the physiological properties of the fruit, peel and fruit+peel of chopi (Zanthoxylum pipertium DC.). Total phenol content, total flavonoid content, and DPPH radical scavenging and ABTS radical scavenging abilities of water and 80% ethanol extracts of chopi were evaluated. Consequently, total phenol content was the highest in 80% ethanol extract of peel. The total flavonoid content was the highest in 80% ethanol extract of fruit+peel. The total phenol and total flavonoid contents were higher in 80% ethanol than water extracts of chopi. The antioxidant activities of the extracts were evaluated using DPPH (2,2-diphenyl-1-picrylhydrazyl) and ABTS (2,2’-azino-bis (3-ethylbenzothiazoline-6-sulfonic acid) radical scavenging abilities. The DPPH radical scavenging activities of fruit+peel were highest in water extract and that of peel in 80% ethanol extract. The ABTS radical scavenging activities of peel were highest in both solvent among samples. This result implies that 80% ethanol extract is more suitable solvent than water to extract functional ingredients of the fruit, peel, and fruit+peel of chopi.

Physiological Properties of Various Coffee Bean Residue

Cheoul seung Lee*, Ji-su Park, Inhwa Han
Department of Food and Nutrition, Kwangju Women’s University, Korea

This study examined the antioxidant activities of the residue of coffee beans including Ethiopia yirgacheffe (EY), Guatemalan antigua (GA), and blending of EY, GA and Colombia supremo to promote the usage of coffee bean residue. All coffee bean residues were extracted with 80% ethanol and water. Those extracts were used to evaluate total phenol and total flavonoid contents, and DPPH and ABTS radical scavenging activities. Total phenol content was higher in 80% ethanol than water extracts of all coffee bean residue and the extract of GA exhibited the highest content among 80% ethanol extracts. Total flavonoid content also exhibited the similar pattern of result except EY. Water and 80% ethanol extracts of EY did not show significant difference in the content. DPPH and ABTS radical scavenging activities also showed higher activity in 80% ethanol than water extracts and GA exhibited the highest activity without significant difference between 80% ethanol and water extracts. This result implies that the extracts of coffee bean residue could be possibly used as the source of functional ingredients.
Antioxidant Activity of Keumkang Wheat and Wheat Bran

Hye-Jin Kim*, Inhwa Han, Byung-Geon Park
Department of Food and Nutrition, Kwangju Women's University, Korea

The present study was designed to investigate antioxidant activity of Keumkang wheat and wheat bran. Keumkang wheat (Triticum aestivum L.) and wheat bran were extracted with 80% ethanol. Total phenolic content, flavonoid content and free radical scavenging activity using DPPH (2,2-diphenyl-1-picrylhydrazyl) and ABTS (2,2-azino-bis(3-ethylbenzothiazoline-6-sulfonic acid)diammonium salt) radicals were determined in diverse concentration of the extracts. Total phenolic content, flavonoid content, DPPH radical scavenging activity increased with concentration. Keumkang wheat bran showed higher antioxidant activity in total phenolic content, flavonoid content and DPPH radical scavenging activity than Keumkang wheat extract. ABTS radical scavenging activity of Keumkang wheat extract increased with concentration, meanwhile Keumkang wheat bran extract were not significantly among concentrations. Therefore, the result indicate that Keumkang wheat bran extract can used as source of natural antioxidant and production of functional foods.

Comparison on the Quality Characteristics of Korean, Chinese and Imported Wheat Flour

Hongjiao Yang*, Byung-Geon Park, Inhwa Han
Department of Food and Nutrition, Kwangju Women's University, Korea

Traditionally great quantity of imported wheat flour was used in Korea. Since research on physicochemical characteristics of Korean wheat flour is not enough, the research on those of Korean wheat flour is required. The purpose of this study is to compare the quality characteristics of Korean wheat flour with imported and Chinese wheat flours to strengthen people’s awareness on Korean wheat flour. This study examined three kinds of each Korean wheat flour, imported and Chinese wheat flours. Total of nine kinds of wheat flours were examined. All flours had similar ash content and moisture content. Chinese wheat dough had the highest gluten content and Korean wheat dough and imported wheat dough had similar gluten content. Total phenol content and antioxidant activity were examined in 80% ethanol and water extracts of all wheat flours. Korean wheat flour had the highest total phenol content, Korean wheat flour and Chinese wheat flour had higher total phenol content and antioxidant activity than imported wheat flour. Generally, Korean wheat flour's quality is better than imported wheat flour.

Distribution of Molecular Weights of Nitrogenous Compounds from Water Extracts of Traditional Korean Fermented Soybean (Cheonggukjang) and Its Angiotensin I Converting Enzyme Inhibitory Activity

Sang Hyun Lee*, Hyung Jo Lee1, Hyun Suk Jo1, Jae Cherl Kim
Department of Food and Life Science, Inje University, Korea

Nitrogenous compounds were separated from the water extract of cheonggukjang (WEC) and the distribution of molecular weight and their angiotensin I converting enzyme (ACE) inhibitory effect were investigated. Ultrafiltration system fractionated WEC into five individual groups with molecular weight of less than 1, 1 to 3, 3 to 5, 5 to 10, and more than 10 kDa. Contents of nitrogenous compounds in five fractions were 718.9 (WEC I), 565.2 (WEC II), 359.7 (WEC III), 358.2 (WEC IV) and 273.9 (WEC V) mg%, respectively. ACE-inhibitory activity was widely observed in all fractions, suggesting that many ACE-inhibitory peptides with various ranges of molecular weight were in the WEC. However, the most potent ACE inhibition was observed in the fraction of less than 1 kDa (WEC I) with an IC50 value=75.01 μg/mL. The ameliorating effect of CBL on Aβ1-42-induced learning and memory impairment were analyzed by Y-maze, passive avoidance, and Morris water maze tests. The results of behavioral tests indicated improving learning and memory function in CBL 20 mg/kg of b.w. (CBL 20) group. After the behavioral tests, the antioxidant activities (superoxide dismutase (SOD), oxidized glutathione (GSSG)/total glutathione (GSH), and malondialdehyde (MDA) levels) showed significant activity, and AChE assay also showed excellent inhibitory activity in the mice brain of CBL 20 group compared with Aβ1-42-induced group. Therefore, our studies suggest that CBL may be used as natural potential resources for ameliorating Aβ1-42-induced learning and memory impairment.
Effects of Ethyl Acetate Fraction from *Actinidia arguta* on Neuronal Cell Protection and Acetylcholinesterase Inhibition

Jeong Su Ha*, Dong Eun Jin, Seon Kyeong Park, Chang Hyeon Park, Tae Wan Seung, Tian Jiao Guo, Jin Yong Kang, Du Sang Lee, Jong Min Kim, Ho Jin Heo
Division of Applied Life Science, Institute of Agriculture and Life Science, Gyeongsang National University, Korea

We investigated the effects of ethyl acetate fraction from *Actinidia arguta* (EFAA) on acetylcholinesterase (AChE) inhibition and neuronal cell protection, and showed ameliorating effect against trimethyltin (TMT)-induced cognitive impairment. EFAA showed AChE inhibitory effect, and the IC50 value was 53 μM. Intracellular reactive oxygen species (ROS) level was performed using 2',7'-dichlorofluorescein diacetate (DCF-DA). Neuronal cell viability was carried out by (ROS) level was performed using 2',7'-dichlorofluorescein diacetate (DCF-DA). Neuronal cell viability was carried out by EFAA not only showed significant cell viability, but also showed a protective effect on cell membrane against H2O2-induced neurotoxicity. Finally, spatial working memory was examined by Y-maze test, and the results showed that EFAA in ICR mice improved TMT-induced cognitive dysfunction. Therefore, above these results suggest that EFAA as natural substances could be utilized for neurodegenerative diseases.

Study of Iodine Retention in Korean Sea Salt Fortified with Encapsulated Iodine

Da Woon Jeon*, Hyun Jin Park
School of Life Science and Biotechnology, Korea University, Korea

This research is focused on enhancing intake of iodine with Korean sea salt. Korean sea salt is known for having various minerals, but little iodine. We made iodine fortified Korean sea salt. Iodine is essential micronutrient of our body. When people are in deficiency of iodine, iodine deficiency diseases will occur to them. Iodine deficiency is prolonged critical health problem all over the world. WHO and UNICEF make plan to alleviate it. They have made iodine fortified salt which is proper vehicle to give iodine. As iodine is easy to loss during manufacturing and transporting process, we made iodine capsule to protect it. Iodine capsule was made of cross-linked calcium alginate bead, potassium iodide and filler content, HPMC AN6. We made iodine capsule which has high stability until take it. Iodine capsule was made by Ca-Alg bead method. We used elector-spray to make proper size of bead uniformly. We dried it under freeze dryer for 48 h and mixed it with Korean Sea Salt. To investigate the stability of iodine capsule in salt, we exposed it 3 different conditions (30°C RH45%, 30°C RH78%, and 37°C RH78%).

Inhibitory Effect of Epigallocatechin-3-O-gallate on Inflammatory Responses in the Interaction between Macrophages and Adipocytes

Younghwa Kim*, Youngmin Choi¹, Junsoo Lee²
School of Food Biotechnology & Nutrition, Kyungpook National University, Korea; ¹Department of Agrofood Resources, National Academy of Agricultural Science, Korea; ²Department of Food Science and Biotechnology, Chungbuk National University, Korea

In this study, we investigated the anti-inflammatory responses of epigallocatechin-3-O-gallate (EGCG) via upregulation of heme oxygenase-1 (HO-1) in cocultured macrophages and adipocytes. RAW264.7 macrophages and differentiated 3T3-L1 adipocytes were co-cultured in serum free Dulbecco’s modified Eagle’s medium with or without EGCG for 24 h. Nitric oxide (NO) and monocyte chemoattractant protein-1 (MCP-1) production was measured in co-culture supernatant. EGCG decreased the secretion of NO and MCP-1. The expression of adipogenic specific protein, C/EBPα in cocultured adipocytes and inducible nitric oxide synthase (iNOS) in cocultured macrophages was inhibited by EGCG. Also, the expression of HO-1 was induced in cocultured both cells. The silencing of HO-1 expression increased the production of NO and MCP-1 in cocultured cells in spite of the presence of EGCG. This study indicates that EGCG exhibited anti-inflammatory properties by inhibiting the production of proinflammatory cytokines in the interaction between adipocytes and macrophages through HO-1 expression. EGCG may have a potential to improve chronic inflammatory conditions in obesity.

Antioxidant and Anti-diabetic Activity of Extracts and Fractions from Leaves of *Diospyros lotus* L.

Ji-Ae Kim*, Seul-Hwa Kwak, Da-Hye Kim, Seon-Young Kim, Sang-Jun Kim, Seon-II Jung¹, Seung-II Jeong
Jeonju Biomaterials Institute, Korea; ¹ATO QeA, Korea

The object of this study was to investigate the phytochemical constituents and their *in vitro* antioxidant and anti-diabetic activities from *Diospyros lotus* L. extracts. Caffeic acid and myricetin-3-O-rhamnoside as the main compound in the leaves extracts of D. lotus L. were detected by high performance liquid chromatography. BuOH fractions among extracts of different solvents were evaluated in *vitro* antioxidant activities and alpha-glucosidase inhibition effects after the separation using silica gel of column chromatography. ABTS and DPPH assays of Fr. 3 among BuOH fractions (1-8) were presented the radical scavenging activities of 99.4% and 32.6%, respectively. Alpha-glucosidase inhibition effects for the estimation of anti-diabetic activity were tested in all BuOH fractions and showed inhibitory effects more than 98% at 10 mg/mL. These results were suggested that leaves of D. lotus L. have the potential functionalities for the development of anti-diabetic bioresources.
Obesity is one of the most serious health problems in both Westernized and developing countries. In this study, we investigated the antioxidant and anti-adipogenic activities of epigallocatechin-3-O-gallate (EGCG) in 3T3-L1 adipocytes. 3T3-L1 cells were differentiated with or without EGCG for 6 days. The activity of antioxidant enzymes including glutathione (GSH), glutathione reductase (GR), glutathione peroxidase (GPx), catalase (CAT), and superoxide dismutase (SOD) was measured in 3T3-L1 cells. EGCG suppressed the lipid accumulation and the expression of adipogenic specific proteins including peroxisome proliferator-activated receptors (PPAR-γ, C/EBP-α), CCAAT/enhancer binding protein a (C/EBPa), and adipocyte fatty acid binding protein (aP2). Also, EGCG significantly decreased intracellular reactive oxygen species production. Therefore, these results indicate that EGCG increased the activity and the expression of antioxidant enzymes and suppressed the lipid accumulation in 3T3-L1 cells.

Obesity is a serious health problem in the world and is related to metabolic diseases. Recently, foods and agricultural products that may be beneficial for improving obesity have received increasing attention. In this study, we investigated whether defatted pepper seed ethanolic extract (PSE) attenuate high-fat diet-induced obesity in mice. C57BL/6j mice were randomly divided into four groups: normal diet (ND) group, high fat diet group (HFD), 5% PSE added to high fat diet group (HLP), and 10% PSE added to high fat diet group (HHB). The regulation of protein translocation and expression in white adipose and liver tissue of each group were investigated by Immunohistochemistry. GWBR significantly downregulated the protein translocation or expression such as PPAR-γ, C/EBP-α, SREBP-1c, FABP1 and 4 and FAS related to adipogenesis, compared to the HFD group as a positive control. However, GWBR stimulated the translocation of HSL from cytosol to lipid droplets, also up-regulated the protein expression of UCP2 involved in thermogenesis, as well as HSL in lipolysis. These results might be partially mediated via regulation of the protein translocation or expression related to adipogenesis, lipogenesis, lipolysis, and thermogenesis in obese mice.

Obesity is one of the most serious health problems in both Westernized and developing countries. In this study, we investigated the antioxidant and anti-adipogenic activities of epigallocatechin-3-O-gallate (EGCG) in 3T3-L1 adipocytes. The activity and the expression of antioxidant enzymes and the expression of adipogenic specific proteins including peroxisome proliferator-activated receptors (PPAR-γ, C/EBP-α), CCAAT/enhancer binding protein a (C/EBPa), and adipocyte fatty acid binding protein (aP2). EGCG increased the activities of antioxidant enzymes and the expression of glutamate-cysteine ligase in 3T3-L1 cells. Also, EGCG significantly decreased intracellular reactive oxygen species production. Therefore, these results indicate that EGCG increased the activity and the expression of antioxidant enzymes and suppressed the lipid accumulation in 3T3-L1 cells.

In this study, we investigated the protective effects of Prunus persica (peach) hot water extracts against UVB-induced oxidative stress in human foreskin fibroblasts. Prunus persica was selected as potent candidates for skin protection agent. Unripe Chunjungdo and Hongbaekdo, two different cultivars of peach, were selected as potential candidates for skin protection agent. Unripe Chunjungdo was divided into 3 groups; whole fruit (PUW), pulp (PUP), and seed (PUS). Ripe Chunjungdo and Hongbaekdo were divided into 3 groups; pulp (PCP, PHP), seed (PCS, PHS), and seed vessel (PCV, PHV), respectively. Also, branches and leaves of Prunus persica tree were selected. These samples were extracted with hot water, filtered, and lyophilized. Inhibitory activities of intracellular ROS formation were measured by DCFH-DA assay. MMP-1 and type-1 procollagen genes expression were evaluated by RT-PCR. The PCV extract was the highest inhibitory activity on intracellular ROS formation, followed PHV and PB extracts. PUW, PCV, PHV, PL, and PB extracts showed more effects on MMP-1 down-regulation and procOL-1 up-regulation than other extracts. These results suggest that the peach extracts might be potent ingredients in cosmetics for anti-aging.
Inhibitory Effects of *Prunus persica* Extracts on Melanogenesis in B16/F10 Melanoma Cells

Hyo-Eun Lee*, Su-Hee Ahn, Jae-Hyung Mah, Hong-Yon Cho
Department of Food and Biotechnology, and Seojang Traditional Industry Promotion Project, Korea University, Korea

This study was performed to investigate the effects of *Prunus persica* extracts on melanogenesis in B16/F10 cells. Effects of the extracts were determined by mushroom tyrosinase activity assay. Also, effects of the extracts on cell viability and melamin contents were measured by cell-based assays. The results revealed that the highest inhibitory effects on melanogenesis, tyrosinase activity, followed by PCV and PCP. The PCV showed the highest inhibitory effects on melanogenesis, followed by PCS and PUP. These results revealed that the peach extracts could be potential skin-whitening agents for functional cosmetic materials.

Improvement of Immune Responses by Sweet Pumpkin

Hee-Yun Kim*, Na-Rae Kim, Sun-Young Nam, Hyung-Min Kim, Hyun-Ja Jeong
Department of Pharmacology, College of Korean Medicine, Kyung Hee University, Korea, Department of Food Technology and Biochip Research Center, Hoseo University, Korea

The immune system is regulated by the cellular or humoral-mediated responses. When immune response is weakened, various diseases such as cancer are caused by many pathogens. Sweet pumpkin (SP) includes a wealth of vitamins and minerals as well as carotenoids and has an immune-enhancing effect. However, the effects of SP in immune responses are still not completely understood. Here, we evaluated the effect of SP in immune responses. SP or β-carotene increased the proliferation of splenocytes and expression of Ki-67 mRNA. Interleukin-2 and tumor necrosis factor (TNF)-α were also increased by SP or β-carotene in splenocytes. When SP or β-carotene was used in combination with recombinant interferon (INF)-γ, there was a marked cooperative induction of TNF-α production and mRNA expression in macrophage cell line, RAW 264.7 cells. In addition, treatment of INF-γ plus SP or β-carotene induced the nuclear translocation of the nuclear factor-κB and phosphorylation of IκBα in RAW 264.7 cells. In conclusion, these data indicate that SP and β-carotene may have an immune-enhancing effect through the production of various cytokines by activation of immune cells.

Antioxidant and Liver Protective Effects in Alcoholic Liver Disease of the Extracts from IL

Sun-yeop Lee*, Keun-Hyun Yu, Hyun-Mo Yang, Young-Ahn Ham, Jung-Min Choi, Soo-Ung Lee, Yong-Jin Lee
Department of Technical Development, Chuncheon Bioindustry Foundation, Korea

This study was conducted to find out the effects of IL on the reduction of hepatotoxicity induced by ethanol. Extracts, IL water extract (ILW) and ethanol extract (ILE), examined for their potential defense against oxidative stress by measuring DPPH and ABTS radicals scavenging and SOD-like activity. ILE showed significantly higher antioxidant activity than ILW (p<0.05). HepG2 cell culture with ILW and ILE showed significantly low activities of AST and LDH, indicating an excellent protective effect against liver damage by 4% ethanol (p<0.05). Also, ILW and ILE significantly decreased the level of serum GGT, ALT and LDH activity on ethanol induced hepatotoxicity in rats with 30% ethanol 2 mL/kg BW/day for 6 weeks (p<0.05). These results indicate that IL extracts can be protective against ethanol-induced toxicity, and may be good sources for alcohol related liver disease.

Comparison for Anti-inflammatory Effect of the Mushroom PL Extracts in Domestic and Foreign Countries

Jung-Min Choi*, Keun-Hyun Yu, Hyun-Mo Yang, Young-An Ham, Soo-Ung Lee, Cheng-Bi Cui, Yong-Jin Lee
Department of Technical Development, Chuncheon Bioindustry Foundation, Korea, Center of Co-Innovation for Natural Resources of Changbai Mountain & Health Industry, Yanbian University, China

Macrophage-derived nitric oxide and Prostaglandin E2 play an important role in immune responses. Overproduction of nitric oxide and Prostaglandin E2 is known to be closely correlated with the pathology of a variety of diseases and inflammations. This study was carried out to investigate anti-inflammatory effects of collected mushroom in domestic and foreign country. Anti-inflammatory effect analysis was followed by cell viability test, nitric oxide and Prostaglandin E2 inhibition activity. Moreover, we examined the inhibitory effects of the various mushroom PL extracts on anti-inflammatory factors such as nitric oxide and Prostaglandin E2 in macrophage RAW 264.7 cells. Finally, each mushroom PL extract from the countries showed similar results, and the mushroom PL ethanol and mycelium extract had no anti-inflammatory effects.
Effect of the AA Water Extracts on the Hepatotoxicity in D-Galactosamine-Induced Rats

Keun-Hyung Yu*, Hyun-Mo Yang, Young-An Ham, Sun-Yeop Lee, Soo-Ung Lee, Yong-Jin Lee
Department of Technical Development Chuncheon Bioindustry Foundation, Korea

This study was conducted to find out the effect of AA water extracts on the reduction of hepatotoxicity induced by d-galactosamine (D-GalN) in rats. The GGT, AST, ALT, and LDH activities of D-GalN treated and AA water extracts-treated group (200 and 400 mg/kg of body weight (BW)) were significantly decreased compared with D-GalN treated group (p<0.05). HDL-cholesterol level of D-GalN treated and AA water extracts-treated group (200 and 400 mg/kg BW) was significantly increased compared with D-GalN treated group (p<0.05). The atherogenic index (AI) values in the D-GalN and AA water extracts-treated groups (200 and 400 mg/kg BW) decreased significantly compared to that in the D-GalN treated group (p<0.05), their high density lipoprotein cholesterol to total cholesterol ratio (HTR) increased significantly in these groups (p<0.05). Superoxide dismutase (SOD) activity of liver tissues were enhanced in the D-GalN and AA water extracts-treated group (400 mg/kg BW) compared to that in the D-GalN treated group, but the differences were not significant (p>0.05). Taken together, these results demonstrate that AA water extracts may improve plasma lipid profile and alleviate hepatic damage.

Establishment of the Optimal Conditions for the Vitamin D2-fortified Shiitake Mushrooms Caused by UV Irradiation

Dong Jae Won*, Cheol Ho Jang¹, Hea Suk Kang³, Jung A Ko, Hyun Jin Park
School of Life Science and Biotechnology, Korea University, Korea, ¹Keonnong, Korea

Stimulation of the bone growth and prevention of osteoporosis are well-known benefits of vitamin D. The use of mushrooms as a raw material for vitamin D enhanced food is one of the easiest way. Mushrooms have plenty of vitamin D₂ precursor named 'ergosterol' and the price is relatively low. Through the UV irradiation we can produce vitamin D₂-fortified mushrooms. The goal of our research was to establish the best production-conditions for the vitamin D₂-fortified mushroom using UV irradiation. We chose three main parameters: temperature, overall irradiation dose, and moisture content based on the several papers. The effective moisture content for vitamin D₂ production was 83.41% during UV irradiation. Vitamin D₂ content increased proportionally as the temperature increased until it reached 35°C, and after the point there was no significant increase. We also compared the vitamin D₂ production efficiency of log-grown versus sawdust-grown Shiitake mushrooms. The vitamin D₂ producing ability of log-grown Shiitake was better than that of sawdust-grown Shiitake.

Anti-amnesic Effects of Ethanolic Extract from Seomae Mugwort (Artemisia argyi H.) with Neuronal Cell Protection

Du Sang Lee*, Gi Jeong Ha¹, Seon Kyeong Park, Chang Hyun Park, Tae Wan Seung, Tianjiao Guo, Jin Yong Kang, Jeong Su Ha, Jong Min Kim, Ho Jin Heo
Division of Applied Life Science, Institute of Agriculture and Life Science, Gyeongsang National University, Korea, ¹Gyeongsangnamdo Agricultural Research & Extension Services, Korea

Anti-amnesic effects on trimethyltin (TMT)-induced learning and memory impairment and neuronal cellular protective effect against H₂O₂-induced oxidative stress of 60% ethanolic extract from seomae mugwort (Artemisia argyi H.) were performed. Behavioral tests were examined by Y-maze and passive avoidance tests, and cognitive functions of mice were improved. And in vitro neuroprotective effects against H₂O₂-induced oxidative stress were examined with (3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyl-tetrazolium-bromide} (MTT) and lactate dehydrogenase (LDH) assay. Artemisia argyi H. extract showed protective effects against H₂O₂-induced neurotoxicity, and lactate dehydrogenase (LDH) release into the medium. Finally, major phenolics of Artemisia argyi H. extract was identified by high-performance liquid chromatography (HPLC) analysis, and the results presented the eupatilin and jaceosidin. Accordingly, these results suggest that Artemisia argyi H. could be a good source of functional substances to prevent neurodegenerative diseases.

Effects of Freeze-drying Process on Total Phenolics, Total Flavonoids, and Antioxidant Capacity in Five Cultivars of Kiwifruits (Actinidia spp.)

Jeong-Seung Hwang¹,², Tae-Gyu Nam¹, Moo-Yeol Baik³, Ho Jin Heo³, Youn-Sup Cho³, Dae-Ok Kim¹,²
¹Department of Food Science and Biotechnology, Kyung Hee University, Korea, ²Skin Biotechnology Center, Kyung Hee University, Korea, ³Division of Applied Life Science, Gyeonsang National University, Korea, ⁴Fruit Research Institute, Jeollanam-do Agricultural Research and Extension Services, Korea

Oxidative stress caused by ROS contributes to many pathological conditions and diseases, including cancer, neurological disorders, atherosclerosis, and asthma. Phenolic antioxidants can reduce the oxidative stress. In this study, fresh kiwifruits were freeze-dried from -40°C to 70°C and extracted using 80% (v/v) aqueous methanol assisted with homogenization and sonication. Total phenolics, total flavonoids, and antioxidant capacity of the methanol extracts were quantitatively evaluated. Contents of total phenolics and flavonoids of freeze-dried kiwifruits ranged from 63.8 to 399.4 mg gallic acid equivalents/100 g fresh weight (FW) and from 10.1 to 39.4 mg catechin equivalents/100 g FW, respectively. Using ABTS, DPPH, and ORAC assays, freeze-dried kiwifruits had antioxidant capacity of 64.3 to 578.3, 49.5 to 560.0, and 417.0 to 1,207.9 mg vitamin C equivalents/100 g fresh weight (FW), respectively. Cv. Bidan showed the highest levels of total phenolic and flavonoids and antioxidant capacity, whereas cv. Hayward extracts had the lowest. Antioxidant capacity had higher linear correlation with total phenolics than total flavonoids.
Biological Activities of Eastern Eel (Anguilla japonica) Hydrolysates

Bethelehem Abebe*, Jun Ho Park, Sang-Eun Pyo, Ashagrie Giban, Mi-Ryung Kim
Food Biotechnology, Silla University, Korea

Fishes have been identified as one of the rich sources of bioactive peptides with valuable health benefits like antioxidant, anti-diabetic, anti-hypertensive and anti-obesity activities. This study was conducted to investigate the biological activities of Eastern Eel (Anguilla japonica) meat enzyme hydrolysates. The protein hydrolysates were prepared using enzyme Alcalase (ALH), Protamex (PRH) and Alcalase + Protamex (APH) at different hours. ALH (64.05%) had the highest DPPH free radical scavenging activity followed by APH (62.30%) and PRH (59.00%). All hydrolysates showed more than 98% ABTs scavenging power. The highest superoxide scavenging activity was recorded at 8 h for ALH (60.41%) and at 10 h for APH (64.47%) and PRH (67.00%). APH (67.95%, 6 h), PRH (55.43%, 8 h) had the highest hydroxyl and hydrogen peroxide scavenging activities, respectively. APH showed the best ACE value (80.42%) at 2 h. In addition to these, ALH showed highest PTP1B inhibition (87.12%) followed by APH (77.04%) and PRH (68.87%). The results reveal that A. japonica protein hydrolysate can be used in food systems such as meat products as a natural additive possessing different biological activities.

Ameliorative Effect of Lactic Acid-fermented Garlic Extract on Hepatic Steatosis in High Fat Diet-induced Obese Mice

Hee-Seop Lee*, Seong-Jin Lee¹, Ji-Hwi Choi¹, Seung-Hyun Lee¹, Hee-Jong Yu¹, Hong-Yon Cho
Department of Food and Biotechnology, Korea University, Korea, ¹R&D Center, Bioland Corporation, Korea

Aged garlic is difficult to standardize its quality and has time-consuming process, so we developed fermented garlic extract with lactic acid bacteria. This study was performed to investigate the ameliorative effect of lactic acid-fermented garlic extract (LAFGE, LIVERTECT™) on hepatic steatosis in high fat diet-induced obese mice. C57BL/6J mice were fed a high-fat diet (HFD) for 8 weeks to induce obesity and treated with LAFGE (500 mg/kg) orally once a day. HFD-fed mice with LAFGE supplementation significantly down-regulated lipogenic genes expression in livers and adipose tissues compared to HFD-fed mice. Moreover, LAFGE supplementation significantly decreased hepatic TG and TC compared to HFD-fed mice. These results suggested that LAFGE might be a good supplement of functional food for preventing NAFLD associated with obesity.

Lactic acid-fermented Chestnut Inner Skin Extract Prevents High Fat-Diet Induced Obesity

Hee-Seop Lee*, Hye-Seok Kang², Seung-Hyun Lee¹, Hee-Jong Yu¹, Kyung-Im Kim², Jang-Won Seo³, Hong-Yon Cho
Department of Food and Biotechnology, Korea University, Korea, ²Research and Development Center, Bioland Corporation, Korea, ³Division of Hotel Culinary Arts & Food Service, Hyejeon College, Korea

Chestnut inner skin (CIS), edible part of whole chestnut, commonly was agricultural waste because of its astrangent taste. The main objective of this study was to investigate effects of lactic acid-fermented chestnut inner skin extract (LAFCIS) in mice fed with high-fat diet (HFD). C57BL/6J mice were fed a high-fat diet (HFD, 60% calories) for 8 weeks to induce obesity and treated with LAFCIS (500 mg/kg) orally once a day. LAFCIS supplementation efficiently decreased the increased weights in body, livers, and adipose tissues in high fat-diet-fed mice. Furthermore, LAFCIS attenuated adipocyte hypertrophy, triglyceride accumulation, and the lipogenic genes and proteins expression in epididymal adipose tissue. LAFCIS supplementation significantly increased AMPK phosphorylation and attenuated HFD-induced protein expressions of lipogenic transcription factors such as PPAR-γ and SREBP-1c in livers and adipose tissues. Moreover, LAFCIS supplementation significantly down-regulated lipogenic genes expression in livers and adipose tissues compared to HFD-fed mice. These results suggested that LAFCIS might be a good supplement of functional food for preventing obesity.

Antioxidant and Skin Whitening Effects of Gastrodia elata Blume Extract

Eunjoo Song*, Jinah Hwang
Department of Food and Nutrition, College of Natural Sciences, Myongji University, Korea

Recently, ergothionine (Ergo), a strong antioxidant and free radicals scavenger in skin, was isolated in Gastrodia elata Blume (GEB). Therefore, we investigated whether GEB extracts and its bioactive compound, Ergo, had antioxidant and skin whitening activity in vitro. GEB ethanolic extract had 0.41 mg/g dried weight (DW) of Ergo. The total phenolic and flavonoid contents of GEB extract were 21.8 and 0.43 mg/g dried weight (DW), respectively. The DPPH radical scavenging activities of GEB at 5 and 10 mg/mL were 34.2% and 44%, respectively. The ABTS radical scavenging activities of GEB at 5 and 10 mg/mL were 31% and 45%, respectively. The superoxide dismutase activity of GEB at 10 mg/mL was 58%, which was dose-dependent up to 50 mg/mL. Tyrosinase inhibition activity of GEB was 73%, compared to that of positive control, arbutin. Selenium level, one of antioxidant trace minerals, was 2.44 μg/g DW. Therefore, Gastrodia elata Blume extracts have potential as functional materials for developing antioxidant and skin whitening, and skin care agents by showing the antioxidant and tyrosinase inhibition activities.
Euphorbiasteroid, a Component of Euphorbia lathyris L., Inhibits Adipogenesis of 3T3-L1 Cells via Activation of AMP-activated Protein Kinase

Su-Jin Park*, Mi-Jeong Sung, Jin-Taeck Hwang, Hyun-Jin Kim1, Myung-Sunny Kim, Jae Ho Park, Hye Jeong Yang, Anna Han2, Munkhtugs Davaatseren3, Dae Young Kwon, Haeng Jeon Hur
Korea Food Research Institute, Korea, 1Department of Food Science & Technology, Gyeongsang National University, Korea, 2Department of Nutrition, College of Education, Health & Human Science University, USA, 3Department of Bioresources and Food Science, Konkuk University, Korea

The purpose of this study is to investigate the anti-adipogenetic effects of euphorbiasteroid (component of Euphorbia lathyris L.) on 3T3-L1 pre-adipocytes, and its underlying mechanisms. Euphorbiasteroid decreased differentiation of 3T3-L1 cells via reduction of intracellular triglyceride accumulation at concentrations of 25 and 50 μM. In addition, euphorbiasteroid altered the key regulator proteins of adipogenesis in the early stage of adipocyte differentiation by increasing the phosphorylation of AMP-activated protein kinase and acetyl-CoA carboxylase. Subsequently, levels of adipogenic proteins, including fatty acid synthase, peroxisome proliferator-activated receptor-γ, and CCAAT/enhancer-binding protein α, were decreased by euphorbiasteroid treatment at the late stage of adipocyte differentiation. The anti-adipogenetic effect of euphorbiasteroid may derive from inhibition of early stage of adipocyte differentiation. Taken together, euphorbiasteroid inhibits adipogenesis of 3T3-L1 cells through activation of the AMPK pathway. Therefore, euphorbiasteroid and its source plant, Euphorbia lathyris L., could possibly be the one of the fascinating anti-obesity agent.

Effects of Hot Air Drying Process on Total Phenolics, Total Flavonoids, and Antioxidant Capacity of Actinidia arguta cv. Mansoo Kiwi Berry

ChengRi Jin*, Chi Heung Cho, Tae-Gyu Nam, Youn-Sup Cho1, Dae-Ok Kim
Department of Food Science and Biotechnology, Kyung Hee University, Korea, 1Fruit Research Institute, Jeollanam-do Agricultural Research and Extension Services, Korea

The aim of this study is to evaluate the effects of hot air drying process on total phenolics and total flavonoids contents, and antioxidant capacity of Actinidia arguta cv. Mansoo kiwi berry. Kiwi berry was air-dried at three different temperatures (35, 50, and 70°C) for 24 h. Kiwi berry dried at 70°C had the lowest total phenolic content and antioxidant capacity than the other dried kiwi berry tested in this study. Using Hunter’s colorimeter, values of L and a increased, whereas b value decreased. There were positive linear correlations between the antioxidant capacity and total phenolics and total flavonoids content, suggesting that phenolics are the major contributors to antioxidant capacity.

Antioxidant Effects of Different Parts of Epimedium koreanum Nakai Extracts

Sung-Hyun Lee*, Miran Jang, Gun-Hee Kim
Plant Resources Research Institute, Duksung Women’s University, Korea

This study was conducted to investigate antioxidant activity of 70% ethanol extracts from different parts (root, stem and leaf) of Epimedium koreanum Nakai. The ethanol extracts from three parts of Epimedium koreanum Nakai were measured to examine total phenolic content, total flavonoid content, DPPH radical scavenging activity and ONOO radical scavenging activity (using myoglobin method). Stem part showed the highest total phenolic content (13.51±0.37 mg GAE/g) and leaf part showed the highest total flavonoid content (17.72±0.38 mg QE/g). Leaf part has shown the strongest radical scavenging activities (DPPH radical: 80% and ONOO radical: 90%) at 20 mg/mL. Therefore, the results of the antioxidant activity test were correlated with total phenolic and flavonoid content values. Thus, Epimedium koreanum Nakai has great potential as a natural source for human health.

Anti-oxidant and Inhibitory Effects on Melanogenesis by Aqueous and Ethanol Leaf Extracts of Heracleum moellendorfﬁ Hance

Bum-Ju Seo*, Hyeong-U Son, Peijun Zhao, Sang-Han Lee
Department of Food Science & Biotechnology, Kyungpook National University, Korea

Heracleum moellendorfﬁ Hance leaf has been used in traditional Oriental medicine to treat skin problem and cardiovascular diseases. However, no mechanism studies have as yet been proved. Therefore we have been evaluated the anti-oxidant and anti-tyrosinase activity of Heracleum moellendorfﬁ Hance leaf Aqueous Extract (HLA) and Heracleum moellendorfﬁ Hance leaf Ethanol Extract (HLE) using various in vitro method such as DPPH radical scavenging activity, Ferric Reducing Antioxidant Power assay (FRAP), Cupric Reducing Antioxidant Capacity (CUPRAC), Oxygen radical absorption capacity (ORAC) assay and ABTS radical scavenging activity and tyrosinase inhibition activity, respectively. HLA and HLE showed strong antioxidant activity by five different assay methods. Moreover, Heracleum moellendorfﬁ Hance also showed strong mushroom tyrosinase inhibitory effect in dose-dependently. The tyrosinase activity 22% in HLA (300 μg/mL) and 25% in HLE (300 μg/mL) whereas arbutin showed 49% (1 mM) proved that both HCA and HCE have inhibitory effect on melanin synthesis compared to arbutin. Together, these results suggest that HLA and HLE may have beneficial properties as a material for cosmetics.
Antioxidant, Anti-inflammatory, and Anti-cancer Activities of *Dianthus chinensis* L. Extract *In vitro*

Joongjae Lee*1, Yeongkyo Seo, Junho Lee, Hyoyeon Kim, Kiseon Moon, Jieun Park, Sujung Lee, Jaeyeon Lee, Jiyeung Ju

Department of Food and Nutrition, Chungbuk National University, Korea

The aim of the study was to investigate *in vitro* antioxidant, anti-inflammatory, and anti-cancer activities of ethanol extract of an edible flower, *Dianthus chinensis* L. (DCE). The total polyphenol, flavonoid, and carotenoid levels of DCE were 102.2 mg gallic acid equivalent/100 g, 353.0 mg quercetin equivalent/100 g, and 12.8 mg/100 g, respectively. The radical scavenging activity and ferric reducing antioxidant power of DCE at the concentration of 1,000 μg/mL was 51-56%. In lipopolysaccharide-treated RAW 264.7 macrophages, the pre-treatment with DCE for 2 h significantly decreased nitric oxide levels (by 77-95% at the concentrations of 500 and 1,000 μg/mL). In HCT116 human colorectal carcinoma cells and H1299 human non-small cell lung carcinoma cells, treatment with DCE at the concentrations of 100, 500, and 1,000 μg/mL for 72-96 h dose-dependently inhibited the growth. DCE was also effective in inhibiting the adhesion of both HCT116 (by 60-75% at the concentrations of 100, 500, and 1,000 μg/mL) and H1299 cells (by 45% at the concentration of 1,000 μg/mL). These results suggest that PSE exerts the antioxidant, anti-inflammatory, and anti-cancer activities in *in vitro*.

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**Diospyros lotus** Leaf Extract Protects the Liver from Acetaminophen-induced Acute Injury in Mice

Byoung Ok Cho1,2*, Hong Hua Yin1, Sang Jun Kim2, Seung Il Jeong3, Seon Il Jang3,2

1Ato Q&A Corporation, Korea, 2Department of Health & Science, Jeonju University, Korea, 3Jeonju Biomaterials Institute, Korea

The aim of this study was to investigate the protective effect of *Diospyros lotus* leaf extract (DLE) against acetaminophen (APAP)-induced acute liver injury in mice. Administration of DLE significantly attenuated the levels of serum aspartate aminotransferase, alanine aminotransferase, and liver lipid peroxidation in APAP-treated mice. Histopathological examination showed that DLE treatment decreased the incidence of liver lesions in APAP-treated mice. DLE treatment markedly increased the superoxide dismutase, catalase, glutathione peroxidase activity, and glutathione levels in APAP-treated mice. Furthermore, DLE treatment significantly suppressed the production of pro-inflammatory factors such as the nitric oxide, IL-6, TNF-α, and iNOS in APAP-treated mice. These results suggest that DLE protects the liver from APAP-induced hepatic injury via antioxidant and anti-inflammatory effects.

Anti-inflammatory Activity of Myricetin from *Diospyros lotus* through Suppression of NF-κB and STAT1 Activation and Nrf2-mediated HO-1 Induction in Lipopolysaccharide-stimulated RAW 264.7 Macrophages

Byoung Ok Cho1,2*, Hong Hua Yin1, Sang Jun Kim2, Seung Il Jeong3, Seon Il Jang1,2

1Ato Q&A Corporation, Korea, 2Department of Health & Science, Jeonju University, Korea, 3Jeonju Biomaterials Institute, Korea

Myricetin is a natural flavonoid with antioxidant properties isolated from *Diospyros lotus*. However, little is known about the anti-inflammatory activity of myricetin. This study was designed to investigate the anti-inflammatory effect and underlying molecular mechanisms of myricetin in lipopolysaccharide (LPS)-stimulated RAW264.7 macrophages. Myricetin dose-dependently inhibited the production of pro-inflammatory mediators (NO, iNOS, PGE2, COX-2, and IL-6) in LPS-stimulated RAW264.7 macrophages. Myricetin suppressed the NF-κB activation by inhibiting the degradation of IκBα, nuclear translocation of p65 subunit of NF-κB, and NF-κB DNA binding activity in LPS-stimulated RAW264.7 macrophages. Moreover, myricetin attenuated the phosphorylation of STAT1 in LPS-stimulated RAW264.7 macrophages. Furthermore, myricetin induced the expression of HO-1 through Nrf2 translocation. Taken together, these results suggest that the myricetin inhibits the production of pro-inflammatory mediators through the suppression of NF-κB and STAT1 activation and induction of Nrf2-mediated HO-1 expression in LPS-stimulated RAW264.7 macrophages.

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Anti-atopic Effect of Hot Water and Supercritical Carbon Dioxide Fluid Extract of Persimmon (*Diospyros kaki* L.) Peels

Byoung Ok Cho1,2*, Hong Hua Yin1, Chong Zhou Fang2, Jae Young Shin2, Hye Ok Ha2, Sang Jun Kim2, Seung Il Jeong3, Seon Il Jang1,2

1Ato Q&A Corporation, Korea, 2Department of Health & Science, Jeonju University, Korea, 3Jeonju Biomaterials Institute, Korea

The purpose of this study was to investigate the anti-atopic effect of hot water (PPWE) and supercritical-carbon dioxide fluid extract from persimmon peels (SPPE) on atopic dermatitis (AD)-like skin lesions in hairless mice. Histological analyses demonstrated that SPPE treatment more strongly inhibited the dermal infiltration of inflammatory cells than PPWE in AD-like skin lesions. SPPE treatment more significantly decreased the dermatitis clinical score and the epidermal thickness than PPWE in hairless mice with AD. SPPE treatment showed stronger suppression of serum IgE and IL-4 production than PPWE in hairless mice with AD. Furthermore, SPPE exhibited much stronger inhibitory effects on the production of NO and PGE2 than PPWE in LPS-stimulated RAW264.7 macrophages. Moreover, SPPE treatment more strongly inhibited the production of pro-inflammatory cytokines such as IL-6 and IL-1β than PPWE in LPS-stimulated RAW264.7 macrophages. These results suggested that SPPE exhibited anti-atopic dermatitis activity via the regulation of inflammatory responses.
Anti-atopic Effect of Hot Water Extract from *Diospyros lotus* Leaves and Persimmon (*Diospyros kaki* L.) Peels and Leaves

Hong Hua Yin¹*, Byoung Ok Cho¹,², Chong Zhou Fang³, Jae Young Shin³, Hye Ok Ha³, Sang Jun Kim³, Seung Il Jeong³, Seon Il Jang¹,²
¹Ato QeA Corporation, Korea, ²Department of Health & Science, Jeonju University, Korea, ³Jeonju Biomaterials Institute, Korea

The purpose of this study was to evaluate the synergistic anti-atopic effect of hot water extract from *Diospyros lotus* leaves (DLE) and persimmon (*Diospyros kaki* L.) peels (PPE) and leaves (PLE) on atopic dermatitis (AD)-like skin lesions in hairless mice. Histological analyses demonstrated that the combination of DLE and PLE or DLE and PPE more strongly inhibited the dermal infiltration of inflammatory cells than DLE, PLE, and PPE alone in AD-like skin lesions. The combination of DLE and PLE or DLE and PPE more significantly decreased the dermal thickness score and the epidermal thickness than DLE, PLE, and PPE alone in hairless mice with AD. The combination of DLE and PLE or DLE and PPE more strongly suppressed serum IgE and IL-4 production than DLE, PLE, and PPE alone in hairless mice with AD. These results suggested that DLE and PLE or DLE and PPE in combination exhibited synergistic anti-atopic effect in hairless mice with AD-like skin lesions.

Comparison of Anti-inflammatory Activities among Ethanol Extracts and Fractions of *Glycyrrhiza uralensis* Fisch in RAW 264.7 Murine Macrophages

Jun Hyeok Choi¹*, Misun Sung, Cheol Sun Park, Sang Hoon Lee, Dong Il Park, Sung Sun Park
Research Center, Chong Kun Dang Healthcare Corporation, Korea

Inflammation is implicated in the pathogenesis of many diseases and overproduction of inflammation mediators causes many diseases such as asthma, Alzheimer’s disease and atopic dermatitis. *Glycyrrhiza uralensis* belongs to the Leguminosae family, and is used as a traditional medical herb in oriental medicine. In this study, we examined anti-inflammatory effects of EtOH extract and their fraction from *G. uralensis* Fisch (GUE) in lipopolysaccharide (LPS)-stimulated RAW264.7 murine macrophages. The ethanol extract and hexane, chloroform fractions of GUE significantly suppressed LPS-induced production of nitric oxide (NO) production, inducible NO synthase (iNOS) and cyclooxygenase 2 (COX-2) protein expression, which in turn results from the inhibition of nuclear factor kappaB (NF-kB), c-Jun N-terminal kinase (JNK) and p38 mitogen-activated protein kinase (MAPK) activities in a RAW 264.7 macrophage cell line. As a result, our study provides scientific evidence to support that a GUE extracts and their fractions may be useful in the treatment of inflammatory diseases by inhibiting inflammatory regulator responses in activated macrophages.

Anti-inflammatory Effect of Ethanol Extract from *Chrysanthemum indicum* L. May Be Involved with Suppression of MAPKs Activation in Macrophages

Misun Sung*, Jun Hyeok Choi, Cheol Sun Park, Sang Hoon Lee, Sung Cheol Lee, Sung Sun Park
Research Center, Chong Kun Dang Healthcare Corporation, Korea

The genus *Chrysanthemum indicum* L., a member of composite (Asteraceae) family, *Chrysanthemum indicum* L. has been used in traditional herbal medicine for the treatment of headache, hypertension, and respiratory diseases. In the present study, we investigated the anti-inflammatory effects of *Chrysanthemum indicum* L. 70% ethanol extract (CIE) and the underlying molecular mechanism involved in a lipopolysaccharide (LPS)-stimulated RAW264.7 macrophages. CIE inhibited nitric oxide (NO) production in LPS-stimulated RAW264.7 macrophages. The reduction of NO production was accompanied by a reduction in inducible nitric oxide synthase (iNOS) and cyclooxygenase-2 (COX-2) protein expression. Furthermore, we examined the effect of CIE on the LPS-stimulated phosphorylation of extracellular signal-regulated kinase 1/2 (ERK1/2), c-Jun NH2-terminal kinase1/2 (JNK1/2), and p38 mitogen-activated protein kinase (MAPKs) in RAW 264.7 macrophages. These results suggest that CIE inhibits the inflammatory response of RAW264.7 macrophages to LPS through inhibition of ERK1/2, JNK1/2, and p38. In conclusion, the CIE shows its anti-inflammatory activity via induction of MAPKs in RAW264.7 macrophages.

Cellular Uptake and Cytotoxicity of Auto-oxidation Products from Epigallocatechin-3-gallate in a Cell Culture System

Mi-Ri Kim*, Jungil Hong
Department of Food Science and Technology, College of Natural Science, Seoul Women’s University, Korea

Epigallocatechin-3-gallate (EGCG), a major green tea catechin, is rapidly degraded in cell culture conditions through the auto-oxidation process. In the present study, cytotoxic properties and cellular uptake of EGCG oxidation products formed in a cell culture system were investigated. The fluorescence from EGCG oxidation products of culture medium were detected after 24 h-incubation in HepG2 cells; addition of superoxide dismutase and catalase diminished the fluorescence in the medium. The fluorescence was not detected in cells treated with 24 h-incubated EGCG either. After incubation of HepG2 cells with EGCG for 1 h, residual EGCG levels in medium were less than 3%. EGCG-incubated medium for 24 h caused more potent cytotoxic effect on HepG2 cells than a medium with fresh EGCG. Cell growth was rather stimulated slightly in the medium with EGCG oxidation products after removing reactive oxygen species generated during EGCG auto-oxidation process. The present results suggest that cellular uptake of EGCG oxidation products is limited and they are not mainly involved in causing cytotoxic effects.
Anticancer Kimchi Attenuates High Fat Diet-induced Liver Dysfunction

Soon Ah Kang1,2a, Mi-Ja Kim3, Hyun-Soon Kim1,2, Kwang-Gyun Jung1,2, Tae-Soon Kim1,2, Jin-Kyung Kim1,2, Boyeon Hwang2,3, Ji-Yeon Lee4
1Department of Conversing Technology, Graduate School of Venture, Hoseo University, Korea, 2Institute of Health Industry, Hoseo University, Korea, 3College of Biotechnology & Bioengineering, Sungkyunkwan University, Korea, 4Department of Biological Science, Hoseo University, Korea

Obesity may be associated with liver disease and disease progression. Accordingly, obesity-associated fatty liver disease affects millions of individuals. This study aimed to evaluate the therapeutic effects of anticancer kimchi to improve fatty liver in high fat diet-induced obese mice. High fat diet-induced obese animals were treated with different doses of anticancer kimchi (250 and 500 mg/kg/day) for 56 days. Whole body, fat pad, and liver were weighed. Hyperlipidemia and fatty liver were further evaluated. Anticancer kimchi significantly decreased liver, epididymal fat and body weights in high fat diet-fed mice, which were associated with decreased serum levels of triglycerides, total cholesterol, LDL, alanine transaminase and aspartate transaminase. Pathological analysis revealed that anticancer kimchi dose-dependently decreased the degree of fatty liver. These data suggest that anticancer kimchi up to 500 mg/kg/day is safe and able to decrease the degree of obesity and fatty liver diseases. Therefore, anticancer kimchi may be considered for use in improve fatty liver dysfunction.

Anti-inflammatory Activity of Gastrodiae rhizoma in LPS-treated RAW 264.7 macrophage

Soon Ah Kang1,2a, Young-Ae Lee1,2, Jong-Ae Kim1,2, Hyun-Ji Oh1,2, Ji-Yeon Lee3
1Department of Conversing Technology, Graduate School of Venture, Hoseo University, Korea, 2Institute of Health Industry, Hoseo University, Korea, 3Department of Biological Science, Hoseo University, Korea

Generally processed Gastrodiae rhizoma in safe, as well as clinically applicable in diet therapy for cerebral related disease and hypertension was used. This is prescribed for anti-inflammatory effect. It has been known to act as an antioxidant which is relates to diabetes. The purpose of this study was to investigate the effects of the extracts of Gastrodiae rhizoma on the anti-oxidant and anti-inflammatory activity in lipopoly-saccharide-stimulated RAW 264.7 macrophage. Inhibition of NO production was observed when cells were cotreated with fractions of Gastrodiae rhizoma and lipopolysaccharide. High amount of nitric oxide (NO) from iNOS and high amount of PGE2 derived from COX-2 induced by many pro-inflammatory mediators including TNF-α, IL-1β, and LPS has been implicated in the pathogenesis of sepsis and inflammation. The anti-inflammatory effect of Gastrodiae rhizoma is associated with the induction of NO, PGE2, TNF-α, and IL-1β in lipopolysaccharide-stimulated RAW 264.7 macrophage.

Decreased Fat Accumulation and Increased Adiponectin Expression of Aureobasidium sp. β-Glucan in High Fat Diet-induced Obese Rats

Soon Ah Kang1,2a, Mi-Ja Kim3, Jong-Guk Park1,2, Wonil Kim1,2, Jung-Min Kim1,2, Myung-Hee Seo1,2, Jae-Hak Cha1,2, Ji-Yeon Lee4
1Department of Conversing Technology, Graduate School of Venture, Hoseo University, Korea, 2Institute of Health Industry, Hoseo University, Korea, 3College of Biotechnology & Bioengineering, Sungkyunkwan University, Korea, 4Department of Biological Science, Hoseo University, Korea

The purpose of this study was to investigate whether the addition of high and low dose of Aureobasidium sp. β-glucan diet prevent the potential adverse effects on adiposity and dyslipidemia of this diet. Aureobasidium sp. β-glucan is glucose homopolymer with β-1,3 glycosidic bond and dietary fiber with high viscosity and solubility in many mushrooms, bacteria, fungi, algae, and higher plants such as barley and oat. Potential biological activities against obesity from bacterial derived β-glucan were not reported in the literature. Supplementation with Aureobasidium sp. beta-glucan resulted in a significant reduction of body weight gain, white fat (visceral and epidydimal fat) mass. Adipocyte cell size was significantly reduced by β-glucan Serum triglyceride and leptin level was significantly reduced by beta-glucan supplementation and free fatty acid was reduced and increased the adiponectin expression. The present results suggest that β-glucan supplementation to the diet is beneficial for the suppression of diet-induced obesity and hyperlipidemia.

Effects of Prunus mume Extract and Its Biopolymer Encapsulation on a Mouse Model of Colitis

Seung Yuan Lee*, Seung-Jae Lee, Sun Jin Hur
Chung-Ang University, Korea

This study determined the effect of an aqueous Prunus mume (PM) extract in a mouse colitis model and investigated the value of biopolymer encapsulation, facilitating targeted delivery to the colon. Colitis was induced by administration of 3% dextran sulfate sodium to male BALB/c mice for 7 days prior to treatment with vehicle, 50 mg/kg PM extract or biopolymer-encapsulated PM extract, or 50 mg/kg sulfasalazine. Histological examination of the colon showed epithelial destruction and mucosal infiltration of inflammatory cells. These changes were attenuated in PM-treated mice, which had lower levels of inflammatory cytokines, cyclooxygenase 2, and immunoglobulins (IgA, IgM, and IgE), compared to the vehicle-treated colitis group. The PM extract showed concentration-dependent radical scavenging and superoxide dismutase-like activities. These results indicated that the effects of the PM extract on colitis were not influenced by biopolymer encapsulation and that this extract could be a potential therapeutic agent for irritable bowel disease.
Influence of Buckwheat Extract on Various Dietary Lipid-induced Oxidative Status of the Mice Brain

Seung Jae Lee*, Seung Yuan Lee, Sun Jin Hur
Chung-Ang University, Korea

This study was conducted to investigate the effects of various dietary lipids with buckwheat extract on the antioxidant activity of lipids in the mouse brain. Forty female mice were fed a diet containing 20% soybean oil, olive oil, and fish oil with 1% buckwheat extract for 5 weeks. The main phenolics of buckwheat extract were rutin, quercitrin and quercetin. The fatty acid composition of the mouse brain lipids was largely influenced by dietary lipids, and polyunsaturated fatty acids (PUFAs) were increased by dietary fish oil. The antioxidant activities were increased by the dietary buckwheat extract and were higher in the fish oil dietary group than in the other dietary groups. The inhibitory effect of lipid oxidation in the mouse brain lipids was also the highest in the fish oil dietary group.

Immunomodulatory Effects of Glycoprotein from Rice Bran on Immunocompromised Balb/C Mice

Ho Young Park*, Hee Don Choi, A Reum Yu
Korea Food Research Institute (KFRI), Korea

Rice bran is the outer layer of rice, which has the history of usage as an immunologic adjuvant in South Korea. In the present study, we extracted glycoprotein from rice bran (GRB) by using ammonium precipitation and purified glycoprotein by using anion-chromatography, and then examined its six glycans of GRB were verified by HPLC and MALDI-TOF MS. Immuno-enhancing effect of GRB has been examined in normal control and cyclophosphamide (Cy)-induced immunocompromised mouse model. Different doses of GRB (10, 25, and 50 mg/kg body weight) were administered for 28 day. On day 21, Cy at a dose of 100 mg/kg body weight was injected intraperitoneally. The result is that GRB affects as a functional immunomodulator by inducing the proliferation of splenic lymphocytes. Also, GRB indicated a significant restoration of spleen index and white blood cell (WBC) count in immunocompromised mice. Furthermore, GRB prevented Cy-induced damage of Th1-type immunomodulatory function through enhanced cytokine (IFN-γ and IL-12) release. Based on these data, it was concluded that GRB is a potent immunomodulator and can be developed to restore the immunity of immunocompromised individuals.

Development of Sustained Releasable Nanoparticles for Red Ginseng Extract

Han-Joo Yang*, Seok Jin Seo, Sanghoon Ko
Department of Food Science and Technology, Sejong University, Korea

The purposes of this research were to develop chitosan (CS)/denatured β-lactoglobulin (DBLG) double coated nanoparticles (DCNP) which protect and sustainedly release red ginseng extract (RGE), and to powderize them by spray drying. To fabricate CS nanoparticles (interior wall), CS (2.0 mg/mL) was mixed with RGE (2.0 mg/mL) followed by dispersing sodium tripolyphosphate (TPP, 1.0 mg/mL) into the mixture dropwise (CS:TPP:RGE = 2:1:1). For the formation of exterior wall, DBLG (1.0 mg/mL) was produced by adjusting pH of its native one to 2.4 prior to heating it (80°C, 30 min) followed by dispersing it into CS nanoparticle dispersion (CSDP) dropwise after adjusting its pH to 5.5 (CSDP:DBLG = 1:2). Between pH 2.0 and 5.0, average size, surface charge, and transmittance of DCNP ranged between 106 and 170 nm, +17 and +28 mV, 86 and 94%, respectively. Ginsenoside Rg3 was used as a standard marker to determine encapsulation efficiency and in vitro release behavior. Morphology and optimum conditions for powderization were discovered. This study would be helpful to manufacture nanosized food materials which are beneficial to improve nutritional and healthy functions of processed foods.
Effect of *Ulmus davidiana* var. *japonica* (Ulmaceae) Extract on Activation of Keratinocyte and Fibroblast

Young-Ji Choi*, Ju Kim, Su-Young Kim, In-Sun Park, Kang-Yeol Yu
Jeonju Biomaterials Institute, Korea

Wound healing is a complex process that includes inflammation, granulation tissue formation, re-epithelialization, and remodeling. We reported previously that *Ulmus davidiana* var. *japonica* activates keratinocyte and fibroblast via wound closure test and migration assay. In the scratch test, *Ulmus davidiana* var. *japonica* accelerated the closure of a monolayer wound scratch at 1 μg/mL. After treatment with *Ulmus davidiana* var. *japonica* for 9 h, keratinocytes showed the increase in migration at 59.8%, whereas the migration of fibroblast increased significantly at 95.8% of *Ulmus davidiana* var. *japonica* compared to control. The mechanism that the *Ulmus davidiana* var. *japonica* helps to promote wound healing is possibly associated with the migration of keratinocyte and fibroblast.

Molecular Identification of Chitinolytic Bacteria Isolated From Shrimp Paste

A Ustadi*, Indun Dewi Puspita, Bryan Eka Pramana
Department of Fisheries, Faculty of Agriculture, Universitas Gadjah Mada, Indonesia

The aims of this research were to isolate chitinolytic bacteria from shrimp paste and to identify the best isolate by analysed 16S rDNA sequence. Isolation and screening of the bacteria were done by evaluating the chitinolytic index using coloidal chitin agar. The 40 chitinolytic bacteria were isolated which two of them (isolate JKT 3.3 and TB 3.3) have high (>2) chitinolytic index. 16S rDNA sequence analysis of two isolates chitinolytic bacteria have been done two weeks ago. The results of analysis will presented in the seminar later.

Beauty Food Activities of Isolated Phenolic Compounds from *Pinus densiflora* Root

Eun-Ho Lee*, Young-je Cho
School of Food Science & Biotechnology/Food & Bio-Industry Research Institute, Kyungpook National University, Korea

The extracted phenolic compounds from *Pinus densiflora* root for beauty food activities were examined. The phenolic compounds which were extracted with water and 80% EtOH were 1.86±0.04 mg/g and 6.85±0.16 mg/g each. DPPH free radical scavenging activity of water and EtOH were each 86% and 85% at 100 μg/mL phenolics. ABTS radical decolorization activity were 48% in water and 68% in EtOH at 200 μg/mL. Antioxidant Protection Factor (PF) were 1.74 PF in water and 1.96 PF in EtOH at 50 μg/mL. TBARs of water and EtOH were 93% and 98% each at 100 μg/mL. Tyrosinase inhibition activity which was related to skin-whitening was observed. The tyrosinase inhibitory activity was confirmed to be 92% in EtOH at 50 μg/mL. Elastase and collagenase inhibition activity of anti-wrinkle effect showed an excellent wrinkle improvement effect, showing 61% and 78% each in ETOH contained in 200 μg/mL. Astringent activity of ETOH showed activity of 82% at 50 μg/mL. Hyaluronidase inhibition activity as anti inflammation effect of ETOH was confirmed to 94% of inhibition at 200 μg/mL. The results can be expected isolated phenolic compounds from *P. densiflora* root to use as functional beauty food resource.

Beauty Food Activities of Isolated Phenolic Compounds from *Cornus kousa* Fruit

Eun-Ho Lee*, Na-Hyeon Kim, Shin-Hyeob Hong, Bong-Jeun An¹, Young-je Cho
School of Food Science & Biotechnology/Food & Bio-Industry Research Institute, Kyungpook National University, Korea,
¹Department of Cosmeceutical, Daegu Hanny University, Korea

The extracted phenolic compounds from *Cornus kousa* fruit for beauty food activities were examined. The phenolic compounds which were extracted with water and 40% ethanol from *Cornus kousa* fruit were 7.04±0.27 mg/g and 4.47±0.18 mg/g each. The DPPH free radical scavenging activity of water and 40% ethanol extracts were each 86% and 80% at 100 μg/mL phenolics. The ABTS radical decolorization activity of water and 40% ethanol extracts were 84% and 94% each at 100 μg/mL phenolics. Antioxidant Protection Factor were 1.93 PF in water extracts and 1.82 PF in ethanol extracts at 50 μg/mL phenolics. TBARs of water and 40% ethanol extracts were 81% and 95% each at 200 μg/mL phenolics. The collagenase inhibition activity of anti-wrinkle effect showed an excellent wrinkle improvement effect. The collagenase of water and 40% ethanol extracts were 52% and 77% each at 200 μg/mL phenolics. The hyaluronidase inhibition activity as anti inflammation effect of water extracts was confirmed to 34% of inhibition at 200 μg/mL phenolic. The results can be expected isolated phenolic compounds from *C. kousa* fruit to use as functional beauty food resource.
**Anti-oxidative Activities of Extracts from Chionanthus retusus Fruits**

Mi-Sung Kim*, Eun-Ho Lee, Na-Hyeon Kim, Young-Je Cho

School of Food Science & Biotechnology/Food & Bio-Industry Research Institute, Kyungpook National University, Korea

This research was conducted to investigate the anti-oxidative activities of Chionanthus retusus fruits extract. Total phenolic compounds of water and 60% ethanol extracts were each 16.99 and 16.17 mg/g, respectively. The DPPH free radical scavenging activity of water and 60% ethanol extracts were 73.22% and 71.05% at phenolics concentration 100 μg/mL. The ABTS radical decolorization activity of water and 60% ethanol extracts were 93.26% and 79.18% at 100 μg/mL phenolics. The antioxidant protection factor (PF) of 1.86 PF in water extracts and 1.88 PF in 60% ethanol extracts at 50 μg/mL phenolics. The TBARs were 88.51% in water extracts and 91.94% in 60% ethanol extracts at 150 μg/mL phenolics. These results can be expected Chionanthus retusus fruits extracts to use as functional food.

**Beauty Food Activities of Extracts from Polygonum sachalinense**

Mi-Jeong Park*, Eun-Ho Lee, Na-Hyeon Kim, Eun-Jin Hong, Ki-Tae Park¹, Young-Je Cho

School of Food Science & Biotechnology/Food & Bio-Industry Research Institute, Kyungpook National University, Korea, ¹School of Culinary Art and Baking Technology; Dangju College University, Korea

The present study was performed to compare the antioxidative, anti-wrinkle and whitening activities of water and ethanol extracts from Polygonum sachalinense. Total phenolic content of water and 40% ethanol extracts from P. sachalinense were 75.30 mg/g and 133.08 mg/g each. The DPPH free radical scavenging activity of water and ethanol extracts were 85.34% and 90.75% at 200 μg/mL phenolic concentration. The ABTS radical decolorization activity was 83.27% in water extracts and 84.27% in ethanol extracts at 200 μg/mL phenolic concentration. The antioxidant protection factor (PF) of water and ethanol extracts were 2.33 PF in water extracts and 2.26 PF in ethanol extracts at 200 μg/mL phenolic concentration. The TBARs of water and ethanol extracts were 74.74% in water extracts and 85.02% in ethanol extracts at 200 μg/mL phenolic concentration. Elastase, collagenase and tyrosinase inhibition activities as beauty food properties of ethanol extracts were 76.23, 90.16, and 36.04% each at 200 μg/mL. These results confirmed that extracts from P. sachalinense will be useful as a functional food and functional cosmetic source.

**Comparison on Anti-arthritis Effect of Hot Water Extracts from Hericium erinaceus in Different Varieties**

Ji-Hun Seomoon*, Seong-Eun Kim, Su-Young Hong, Hyun-Kyu Kim, Oh-Kyung Kwon, Hong-Kyu Lee¹, Sang-Kyung Shin¹, Hyung-Jin Ji¹

Nutraceutical Food R&D Center, KolmarBNH Co., Ltd., Korea, ¹Laboratory Animal Research Center (LARC), Chungbuk National University, Korea

Degenerative osteoarthritis is one of degenerative diseases that appear commonly in old generation. This disease causes pain and joint mobility problems due to the loss of articular cartilage. To develop the functional food materials for joint improvement, the amounts of total polyphenols, and ergothioneine of hot water extracts from 10 varieties of Hericium erinaceus were measured. Changes of pressure pain threshold, histological changes and cytokine (TNF-α, IL-1β) expression level were also investigated with the sodium monooctoate (MIA)-induced rat model. The experimental results showed the amounts of total polyphenols and ergothioneine of different varieties were 0.32-1.47% and 0.24-1.21% respectively. There was no difference of thickness change in the knee joint of MIA-induced rat model. The 8 of varieties except KH023 and KH028 indicated reduction effects of mechanical pressure threshold reduction. KH002 and KH034 showed high value of reduction. In case of inflammatory related cytokine (TNF-α, IL-1β), KH033 showed strong inhibition of production of IL-1β. KH033 and KH034 lowered the changes in the cartilage structure.

**Comparison of Antioxidative Activities of Extracts from Non-fermented and Fermented Artemisia princeps**

Hwan-Jae Seo*, Dae-Hwan Shin, Na-Hyeon Kim, Eun-Ho Lee, Young-Je Cho

School of Food Science & Biotechnology/Food & Bio-Industry Research Institute, Kyungpook National University, Korea

This research was conducted to compare the antioxidative activities of non-fermented and fermented Artemisia princeps extracts. The phenolic contents which were extracted non-fermented and fermented Artemisia princeps were each 12.39 mg/g in non-fermented water extracts, 14.78 mg/g in non-fermented 60% ethanol extracts and 14.58 mg/g in fermented water extracts and 16.49 mg/g in fermented 60% ethanolic extracts. The DPPH free radical scavenging activity of extracts were 79%, 92% and 86%, 91% each at 50 μg/mL phenolics. The ABTS radical decolorization activity of extracts were 97%, 99% and 99%, 100% each at 50 μg/mL phenolics. The antioxidant protection factor (PF) of extracts were 1.22 PF, 1.19 PF and 1.17 PF, 1.13 PF each at 50 μg/mL phenolics. The TBARs were 95%, 95% and 92%, 91% each at 50 μg/mL phenolics. As the alcoholic fermented is created expects that the loss of antioxidants activities effect. All these results suggest that both extracts from non-fermented A. princeps and fermented A. princeps has a great potential as useful source for medicinal herbs.
Comparison of Antioxidative Activities of Extracts from Non-fermented and Fermented *Sophora flavescens*

Dae-Hwan Shin\(^*\), Hwan-Jae Seo, Eun-Ho Lee, Na-Hyeon Kim, Young-Je Cho

School of Food Science & Biotechnology/Food & Bio-Industry Research Institute, Kyungpook National University, Korea

This research was conducted to compare the antioxidant activities of non-fermented and fermented *Sophora flavescens* extracts. The phenolic compounds which were extracted with water and 60% ethanol in non-fermented and fermented *S. flavescens* were 4.93 mg/g, 7.35 mg/g and 6.44 mg/g, 9.42 mg/g each. The DPPH free radical scavenging activity of extracts in non-fermented and fermented *S. flavescens* were 68%, 77% and 91%, 92% each at 50 \(\mu\)g/mL phenolics. The ABTS radical decolorization activity of extracts in non-fermented and fermented *S. flavescens* were 76%, 78% and 98%, 59% each at 50 \(\mu\)g/mL phenolics. The antioxidant protection factor (PF) of extracts in non-fermented and fermented *S. flavescens* were 1.33 PF, 1.36 PF and 1.18 PF, 1.22 PF each at 200 \(\mu\)g/mL phenolics. The TBARs in non-fermented and fermented *S. flavescens* were 61%, 97% and 63%, 91% each at 50 \(\mu\)g/mL phenolics. All these results suggest that extracts from *S. flavescens* has a great potential as useful source for medicinal herbs.

Comparative Evaluation of Non-fermentation *Portulaca oleracea* and Fermentation *Portulaca oleracea* on Antioxidant Activities

Su-Jin Yun\(^*\), Jae-Young Park, Eun-Ho Lee, Na-Hyeon Kim, Young-Je Cho

School of Food Science & Biotechnology/Food & Bio-Industry Research Institute, Kyungpook National University, Korea

This research was to compare the antioxidant activities of the extracts of non-fermented and fermented *Portulaca oleracea*. Total phenolic compounds of water extracts from non-fermented and fermented *Portulaca oleracea* were 6.03 and 52.30 mg/g, respectively. The DPPH free radical scavenging activity of water extracts from non-fermented and fermented *P. oleracea* were 83.76% and 86.41% at 50 \(\mu\)g/mL phenolics. The ABTS radical decolorization activity of non-fermented and fermented *P. oleracea* was 73.89% and 99.53% in water extracts at 50 \(\mu\)g/mL phenolics. The antioxidant protection factor (PF) of non-fermented and fermented *P. oleracea* was 1.68 PF and 2.57 PF at 50 \(\mu\)g/mL phenolics. The TBARs inhibition rates of non-fermented and fermented *P. oleracea* was 51.45% and 79.41% in water extracts at 50 \(\mu\)g/mL phenolics. The antioxidant activities of extracts from fermented *P. oleracea* were higher than non-fermented *P. oleracea*. Thus, fermentation of plant source is thought to amplify the activities of antioxidant.

Antioxidant Activities of *Momordica charantia* by Different Processing Method

Eun-Jin Hong\(^*\), Eun-Ho Lee, Na-Hyeon Kim, Mi-Jeong Park, Sun-Ho Lee\(^1\), Young-Je Cho

School of Food Science & Biotechnology/Food & Bio-Industry Research Institute, Kyungpook National University, Korea, \(^1\)The Institute of Marine Biotechnology, Andong National University, Korea

In this study, the antioxidant activities of raw *Momordica charantia* and roasted *Momordica charantia* were compared. Total phenolic contents of water and 20% EIOH from raw *M. charantia* were 3.2 and 2.9 mg/g, respectively. The water and 40% EIOH from roasted *M. charantia* were 6.3 mg/g and 5.4 mg/g. DPPH free radical scavenging activity of water and 20% EIOH from raw *M. charantia* were 85% and 89% at 150 \(\mu\)g/mL. The water and 40% EIOH from roasted *M. charantia* were 87% and 93% at 150 \(\mu\)g/mL. ABTS radical decolorization activity of water and 20% EIOH from raw *M. charantia* were 80% and 90% at 50 \(\mu\)g/mL. The water and 40% EIOH from roasted *M. charantia* were 95% and 100% at 50 \(\mu\)g/mL phenolics. All these findings suggest that extracts from *M. charantia* has a great potential as useful source for functional food.

Antioxidant Activities of Extracts from *Sambucus sieboldiana*

Na-Hyeon Kim\(^*\), Eun-Ho Lee, Eun-Jin Hong, Dong-Ha Jeon, Young-Je Cho

Department of Food Science & Biotechnology, Kyungpook National University, Korea

This study provide antioxidant activity of water and ethanol extracts from *Sambucus sieboldiana*. The phenolic content in extracts from *S. sieboldiana* were 11.6±0.18 mg/g and 12.39±0.07 mg/g each in water and 50% ethanol extract. The DPPH free radical scavenging activity of water and 50% ethanol extracts from *S. sieboldiana* were 81.08% and 84.29% at 200 \(\mu\)g/mL phenolics. The ABTS radical decolorization activity of water and 50% ethanol extracts from *S. sieboldiana* were 97.44% and 95.85% at 200 \(\mu\)g/mL phenolics. The antioxidant protection factor (PF) of water and 50% ethanol extracts from *S. sieboldiana* were 2.13 PF and 2.11 PF at 200 \(\mu\)g/mL phenolics. The TBARs inhibition rates of water and 50% ethanol extracts from *S. sieboldiana* were 97.56% and 97.99% at 200 \(\mu\)g/mL phenolics. The antioxidant activities of *S. sieboldiana* extract was higher than BHT as positive control except TBAR inhibition activity. TBAR inhibition activity is similar to BHT. All these findings suggest that extracts from *S. sieboldiana* has a great potential as useful source for functional food.
Antioxidant Activities of Extracts from *Humulus japonicus*
Na-Hyeon Kim*, Eun-Ho Lee, Mi-Jeong Park, Dong-Ha Jeon, Young-Je Cho
Department of Food Science & Biotechnology, Kyungpook National University, Korea

This study provides antioxidative activity of water and ethanol extracts from *Humulus japonicus*. The phenolic content in extracts from *H. japonicus* were each 9.49±0.14 mg/g and 16.8±0.2 mg/g in water and 70% ethanol extracts. The DPPH free radical scavenging activity of water and 70% ethanol extracts from *H. japonicus* were 69.28% and 81.65% at 200 μg/mL phenolics. The ABTS radical decolorization activity of water and 70% ethanol extracts from *H. japonicus* showed very high activity as 99.6% and 98.47% at 200 μg/mL phenolics. The antioxidant protection factor (PF) of water and 70% ethanol extracts from *H. japonicus* were 1.14 PF and 1.11 PF at 200 μg/mL phenolics. The TBARs inhibition rates of water and 70% ethanol extracts from *H. japonicus* were 94.45% and 88.6% at 200 μg/mL phenolics. The DPPH free radical scavenging activity and the ABTS radical decolorization activity of 70% ethanol extracts were higher than water extracts and BHT as positive control. Also PF and TBAR inhibition activity of water extracts were higher than water extracts and BHT as positive control. Also PF and TBAR inhibition activity of ethanol extracts for anti-wrinkle effect were 92.45% and 88.6% at 200 μg/mL phenolics. The tyrosinase inhibitory effect was confirmed to be 35.0% and 95.6% each at 100 μg/mL phenolics. The ABTS radical decolorization activity of 92% in water and 76% in EtOH each at 100 μg/mL. Protection Factor were 1.5 PF in water and 2.1 PF in EtOH at 200 μg/mL. TBARs of water and EtOH were 84% and 99% each at 50 μg/mL. Tyrosinase inhibition activity which was related to skin-whitening was observed. The tyrosinase inhibitory activity was confirmed to be 82% in EtOH at 200 μg/mL. Elastase and collagenase inhibition activity of EtOH for anti-wrinkle effect showed an excellent wrinkle improvement effect, showing 60% and 67% each in EtOH containing in 200 μg/mL. Astringent activity of EtOH was shown activity of 32% at 200 μg/mL. Hyaluronidase inhibition activity as anti inflammation effect of EtOH was confirmed to 46% of inhibition at 200 μg/mL. The results can be expected isolated phenolic compounds from *O. undulatifolius* to use as functional beauty food resource.

Antioxidant Activity and Beauty Food Properties of Isolated Phenolic Compounds from *Tetragonia tetragonioides*
Jae-Bum Jo*, Eun-Ho Lee, Sin-Hyup Hong, Bong-Jeon An1, Young-Je Cho
School of Food Science & Biotechnology/Food & Bio-Industry Research Institute, Kyungpook National University, Korea, 1Department of Cosmeceutical, Daegu Hanny University, Korea

This study provides beauty food activity of water and ethanol extracts from *Tetragonia tetragonioides*. The phenolic compounds which were extracted with water and 50% ethanol were each 3.29 mg/g and 4.14 mg/g. DPPH free radical scavenging activity of water and ethanol extracts were each 99% and 91% at 200 μg/mL phenolic concentration. ABTS radial decolorization activity was 97.3% in water extracts and 87.8% in ethanol extracts at 100 μg/mL phenolic concentration. Antioxidant protection factor (PF) were determined to 1.77 PF in water extracts and ethanol extracts at 200 μg/mL phenolics. TBARs of water and ethanol extracts were 94.8% and 95.6% each at 100 μg/mL phenolics. Tyrosinase inhibition activity which was related to skin-whitening was observed. The tyrosinase inhibitory effect was confirmed to be 35.0% in ethanol extracts at 200 μg/mL phenolics. The elastase inhibition activity of ethanol extracts for anti-wrinkle effect showed an excellent wrinkle improvement effect, showing 78.9% in 50% ethanol extracts in 200 μg/mL phenolics. These all results can be expected *T. tetragonioides* extracts to use as a functional material for anti-oxidant and functional beauty food.

Beauty Food Activities of Isolated Phenolic Compounds from *Hypericum ascyron*
Eun-Ho Lee*, Young-Je Cho
School of Food Science & Biotechnology/Food & Bio-Industry Research Institute, Kyungpook National University, Korea

The extracted phenolic compounds from *H. ascyron* for beauty food activities were examined. Phenolic compounds which were extracted with water and 90% EtOH were 29.7±0.7 mg/g and 31.8±0.1 mg/g each. DPPH scavenging activity was confirmed to be high as over 80% in both of containing 50 μg/mL over phenolic. ABTS radical decolorization activity were 90% in water and 98% in EtOH at 100 μg/mL. Protection Factor were 2.1 PF in water and 2.2 PF in EtOH at 50 μg/mL. TBARs of water and EtOH were 82% and 94% each at 200 μg/mL. Tyrosinase inhibition activity which is related to skin-whitening was observed. Tyrosinase inhibitory activity was confirmed to be 90% in EtOH at 200 μg/mL. Elastase and collagenase inhibition activity is related to anti-wrinkle effect. Elastase of 76% in EtOH containing in 200 μg/mL. Collagenase of water and EtOH were 85% and 96% each at 200 μg/mL and 100 μg/mL. Astringent activity of EtOH showed activity of 89% at 200 μg/mL. Hyaluronidase inhibition activity as anti inflammation effect of EtOH was confirmed to 47% of inhibition at 200 μg/mL. The results can be expected isolated phenolic compounds from *H. ascyron* to use as functional beauty food resource.
Anti-oxidative Activities of Extracts from *Chionanthus retusus* Leaves

Mi-Sung Kim*, Na-Hyeon Kim, Eun-Ho Lee, Young-Je Cho
School of Food Science & Biotechnology/Food & Bio-Industry Research Institute, Kyungpook National University, Korea

This research was conducted to investigate the anti-oxidative activities of *Chionanthus retusus* leaves extract. Total phenolic compounds of water and 80% ethanol extracts were each 18.8 mg/g and 19.65 mg/g. The DPPH free radical scavenging activity of water and 80% ethanol extracts were 74.89% and 67.51% at phenolics concentration of 20 μg/mL. The ABTS radical decolorization activity of water and 80% ethanol extracts were 87.13% and 87.49% at 100 μg/mL phenolics. The antioxidant protection factor (PF) of water and 80% ethanol extracts were 87.13% and 87.49% at 100 μg/mL phenolics. The antioxidant activities of extracts from *C. retusus* leaves were higher than BHT as positive control except TBARs. These results can be expected *C. retusus* leaves extracts to use as functional food.

Pear Pomace Water Extract Reduces Fat Accumulation in High fat Diet Induced Obese Mice via Activation of AMPK Signaling

Hyeon-A Kim*, Jin Rhuy, Mi-Kyoung You
Department of Food & Nutrition/Research Institute of Human Ecology, Mokpo National University, Korea

The effect of pear pomace water extract on obesity and its underlying mechanism were investigated in C57BL/6 mice fed a high fat diet. The mice were supplemented with 200 mg/kg/day or 400 mg/kg/day of pear pomace water extract and 60% kcal fat diet. Accumulation of abdominal adipose tissue were reduced in the animals treated with pear pomace water extract. The protein expression of P-AMPK, activated form of AMPK, showed increase, while the expressions of PPAR-γ, C/EBPα, SREBP-1c and FAS showed decreases in the adipose tissue of the rats treated with pear pomace extract. Our results collectively represent that pear pomace water extract prevented fat accumulation in the mice fed a high fat diet and antiobesity effects of pear pomace may be associated with activation of the AMPK signaling.

Angiotensin-I Converting Enzyme Inhibitory Activity of Freshwater Fish, Rainbow Trout (*Onchorhynchus mykiss*) Hydrolysates

Jun-Ho Park1, Tae-Uk Kim2, Hae-Sol Kim1, Jaes-Suk Choi1,2, Mi-Ryung Kim1
1Major in Food Biotechnology, Division of Bioindustry, Silla University, Korea, 2RIS Center, Silla University, Korea

Rainbow trout (*Onchorhynchus mykiss*) have been traditionally considered as an excellent health promotion food. However, the scientific investigations as a source of health promotion food have not been explored. In this study, we tested the angiotensin converting enzyme (ACE) inhibitory activity of rainbow trout hydrolyzed with different enzymes (Alcalase, Protamex and Alcalase + Protamex) and then fractionated the rainbow trout hydrolysates via ethanol extraction, to isolate the peptides with the highest ACE inhibitory activity. Furthermore, the characterizations of fractions with the highest ACE inhibitory activity were also studied using gel permeation column chromatography (GPC) and reversed phase-high performance liquid chromatography (RP-HPLC). The degree of hydrolysis of Alcalase (TA), Protamex (TP) and Alcalase + Protamex treated hydrolysates (TAP) at 10 h of hydrolysis time, were determined 45%, 50%, and 45%, respectively. The ACE inhibitory activity of TA, TP and TAP were 73.16% (IC50 118 μg/mL), 74.5% (IC50 122 μg/mL), and 77.6% (IC50 108 μg/mL), respectively. And ethanol extracted fraction of TAP showed the 60% of ACE inhibitory activity.

Immunomodulating and Anti-inflammatory Effects of *Gardeniae Fructus* on Atopic Dermatitis-like Skin Lesions in NC/Nga Mice

Yong Chang Jang*, Tea Kyu Park, Beong Ou Lim
College of Biomedical & Health Science, Department of Applied Life Science, Konkuk University, Korea

In this study we examined the effects of *Gardeniae fructus* waster extracts (GFE) on immunoglobulin E (IgE)-mediated type-I hypersensitivity responses *in vitro*. We assessed immunomodulating and anti-inflammatory effects of GFE in a mouse (NC/Nga) model of atopic dermatitis (AD). We compared the effects of topical administration of GFE (0.2% and 1%) with those of a positive control, desonide (0.5 μg/kg), on immunoglobulin E (IgE) concentrations in serum and on the number of splenocytes of NC/Nga mice sensitized to 1-chloro-2,4-dinitrobenzene (DNCB). DNCB induced overt dermatitis in NC/Nga mice, and GFE or desonide treatment for eight weeks significantly decreased the level of IgE in serum and spleen as well as the severity of the ear thickness and inflammatory symptoms in a dose-dependent manner. Further, GFE inhibited histamine secretion, decreased the expression of COX-2 and TNF-α as well as suppressed the translocation of NF-κB. GFE suppressed the phosphorylation of Syk, p38 and Erk1/2. These observations suggest that GFE may ameliorate AD-like lesions in NC/Nga mice, likely by modulating the production of immunoglobulins involved in inflammation and skin-barrier damage.
Development of Nanostructured Lipid Carriers (NLCs) Co-loaded with EGCG and Piperine

Hye Won Kim*, Nu Ry Lee, Sanghoon Ko
Department of Food Science and Technology, Sejong University, Korea

The objective of this study was to prepare nanostructured lipid carriers (NLCs) co-loaded with EGCG and piperine and to analyze their physicochemical properties. In order to fabricate the NLCs co-loaded with EGCG and piperine, EGCG, piperine, glycerol monostearate (GMS), oleic acid and lecithin were used for lipid phase. Subsequently, Tween 80 was dissolved in water as aqueous phase. After mixing the lipid phase and the aqueous phase, the mixture was sheared homogenized. The emulsion was sonicated and then passed through a high pressure homogenizer (HPH). Subsequently, cold water (at 2°C) containing poly-vinyl alcohol (PVA) was dispersed in the emulsion. As a result, NLCs co-loaded with EGCG and piperine were formed with an average size ranging from 100-150 nm. As time elapsed, size of NLCs was gradually increased up to 200 nm. Zeta potential of NLCs co-loaded with EGCG and piperine was -40.35 ± 1.28 mV which indicated that it was stable. In conclusion, the NLCs co-loaded with EGCG and piperine can help improve stability of core materials. And this NLCs nanostructuring procedure can be used to fabricate NLCs to encapsulate with various functional ingredients for food materials.

Screening on the Biological Activity of the Trionyx sinensis

JungBeen Park*, JunHo Park, SangEun Pyo, TaeUk Kim, Bethlehem Abebe, MiRyung Kim
Major in Food Biotechnology, Division of Bioindustry, Silla University, Korea

Trionyx sinensis (TS) is known to have effects of heart diseases, stomach disorder and decreasing blood glucose level. However, few researches for evaluating these health benefits of TS have been reported. In this study, overall biological activities including the anti-oxidant, anti-diabetic, anti-hypertension and anti-inflammatory effects were tested for the hot water extract of TS meat and whole body and enzymatic hydrolysates (Alcalase, Protamex, Alcalase+Protamex). TS hydrolysates treated with Alcalase+Protamex (TAP) showed the highest DPPH free radical scavenging activity (77.69%). All enzymatic hydrolysates showed more than 99% inhibition of PTP1B activity which play important role in insulin signaling pathway. The PTP1B inhibition activity on the ethanol precipitate of TAP was 63.14%, showing the potency of an-ti-diabetic effects. The ACE inhibition activity of TAP was 55.22%, conferring the anti-hypertensive effects on the TAP. However, the hot water extracts of TS showed lower anti-oxidative, anti-diabetic or anti-hypertension activity than enzymatic hydrolysates.

Oral Administration of Moringa oleifera Extract Inhibits 2,4-Dinitrochlorobenzene-Induced Atopic Dermatitis in BALB/c Mice

Heeri Choi*, Yujiao Tang1,2, Sang-Ho Moon1,2, Eun-Kyung Kim1,2, Eun-Ju Choi
Division of Sport Science, College of Science and Technology, Konkuk University, Korea, *Division of Food Bio Science, College of Biomedical and Health Sciences, Konkuk University, Korea, Division of Sport Science, College of Science and Technology, Konkuk University, Korea

Atopic dermatitis (AD) is common allergic and inflammatory skin diseases caused by a combination of eczema, scratching, pruritus, and cutaneous sensitization with allergens. We established an atopic dermatitis model in BALB/c mice by repeated local exposure of house dust mite extract (DFE), and 2,4-dinitrochlorobenzene (DNCB) to the ears. The oral administration of Moringa oleifera (M. oleifera) over a four-week period reduced AD symptoms based on decrease skin lesions, ear thickness, epidermal thickness and histopathological analysis. In addition, M. oleifera inhibited immune cells (CD4+ cells, eosinophils, and mast cells) infiltration into the ear. Moreover, topical application of M. oleifera attenuated AD symptoms in terms of serum IgE, IgG2a, and histamine levels. Taken together, the results demonstrate that M. oleifera possess benefit to attenuate AD-like symptoms, suggesting that M. oleifera might be effective in treating allergic skin disorders.

Anti-oxidant Effects of Sulgidduck Prepared with Moringa oleifera

Yujiao Tang1,2*, Eun-Ju Choi3, Heeri Choi3, Eun-Kyung Kim1,2
1Division of Food Bio Science, College of Biomedical and Health Sciences, Korea, 2Korea Nokyong Research Center, Konkuk University, Korea, 3Division of Sport Science, College of Science and Technology, Konkuk University, Korea

This study was conducted to examine the antioxidation activity of a Korean steamed-rice cake, sulgidduck added with Moringa oleifera (M. oleifera). Sulgidduck was prepared by adding M. oleifera extract at 0.1, 1.0, and 10.0% of rice powder. For antioxidation properties, the scavenging activities of DPPH radicals, hydroxyl radicals, ABTS+ radicals, hydrogen peroxide, and ferric ion reducing antioxidant power were investigated. M. oleifera extracts significantly increased the antioxidation activities of sulgidduck in a dose dependent manner (p<0.05), and the values were 17, 15, 26, 20, and 29% on DPPH radicals, hydroxyl radicals, ABTS+ radicals, hydrogen peroxide, and ferric ion reducing antioxidant power, respectively in 10% M. oleifera extract added groups. Taken together, the results suggest that M. oleifera possess a potential for increasing the consumer acceptability and the functionality of sulgidduck.
Extract of *Moringa oleifera* Leaves Suppress the Diabetes Mellitus in *db/db* Mice

Yujiao Tang1,2*, Heeri Choi3, Eun-Ju Choi3, Sang-Ho Moon1,2, Eun-Kyung Kim1,2
1Division of Food Bio Science, College of Biomedical and Health Sciences, Konkuk University, Korea 2Korea Nokyong Research Center, Konkuk University, Korea, 3Division of Sport Science, College of Science and Technology, Konkuk University, Korea

Medicinal plants attract growing interest in the therapeutic management of diabetes mellitus. *Moringa oleifera* (*M. oleifera*) is a highly nutrient-rich plant with exceptional medicinal properties widely used to treat various health care problems. In this present study, we assessed the possible anti-diabetic effects of an ethanol extract of *M. oleifera* leaves in treating *db/db* mice. *M. oleifera* leaves were subjected to extraction process using 70% ethanol solution for 3 h, and repeated the same process three times. The extract was orally administrated with 150 mg/kg/day/mouse for 6 weeks. Fasting plasma glucose (FPG), triglyceride (TG) and insulin were monitored. *M. oleifera* treatment significantly ameliorated the altered FPG and TG compared to control levels. In addition, *M. oleifera* treatment increased the insulin value from 946±92 to 1678±268 pg/mL. These experimental findings clearly indicate the potential benefits of using the ethanol extract of *M. oleifera* leaves as a potent anti-diabetic treatment.

Inhibitory Effects of Chestnut Shell Extracts on 3T3-L1 Differentiation Are Limited in Early Stage of Adipogenesis

Myung-Soo Shon*, Ryeong-Hyeon Kim, Gyo-Nam Kim
Department of Food Science and Biotechnology, Kyungnam University, Korea

Chestnut is widely consumed in Asian countries but shells from chestnut are normally thrown away or used in low-value materials. Previous studies have been reported that chestnut shells contained beneficial phenolic and nutritional components. Therefore, we investigated that the anti-adipogenic effects and underlying molecular mechanisms of extracts from chestnut shells in 3T3-L1 cells. Here, water (CSE-W) and methanol extracts (CSE-M) from chestnut shells were prepared. The treatment up to 100 μg/mL of CSE-W and CSE-M for 24 h did not affect to the viability of 3T3-L1 cells. The treatment of CSE-W and CSE-M dose-dependently inhibited lipid accumulation of 3T3-L1 adipocytes. The concentrations of 100 μg/mL CSE-W and CSE-M suppressed 3T3-L1 adipogenesis by 71.0% and 96.5% when compared with mature adipocytes. Similar with this, mRNA levels such as CEBPα, CEBPβ, and PPARG of 3T3-L1 cells were downregulated by CSE-W and CSE-M treatment. Our study also revealed that CSE-W and CSE-M-inhibited adipogenesis are limited in the early stage of 3T3-L1 adipogenesis. These results suggest that the chestnut shells have the potential as anti-obese functional food materials.

Beneficial Effect of Fisetin in Skin Health via Regulation of Dermal Fibril Genes and Adipogenesis

Myung-Soo Shon*, Ryeong-Hyeon Kim, Gyo-Nam Kim
Department of Food Science and Biotechnology, Kyungnam University, Korea

Skin is mainly composed of multilayers such as epidermis, dermis, and hypodermis. Fisetin is a flavonol belongs to the flavonoid group of polyphenols. Although various biological functions such as anti-oxidant, anti-inflammatory, and anti-cancer were investigated, the function of fisetin in development of skin fibril and the inhibitory activity of adipogenesis in 3T3-L1 cells relatively unknown. Our study was focussed on the regulatory function of fisetin in expressions of skin fibril proteins through regulation of skin fibril-related genes and the inhibitory effects of fisetin on adipogenesis. Fisetin treatment up to 100 μM for 24 h did not affect to the viability of human skin fibroblasts and 3T3-L1 cells. We found that the fisetin treatment dose-dependently enhanced mRNA expression levels of skin fibrillar genes. Furthermore, six days after adipocytes differentiation, fisetin treatment significantly inhibited the 3T3-L1 adipogenesis. Our results also reveal a novel function of fisetin in skin health via regulation of dermal fibril genes and adipogenesis. These evidences also provide useful information for the development of nutri-cosmetics and functional foods design.

PTP1B Inhibitory Activities of *Cyprinus carpio nudus* Protein Hydrolysate

Hae-Sol Kim*, Jun-Ho Park, Tae-Uk Kim, Sang-Eun Pyo, Mi-Ryung Kim
Major in Food Biotechnology, Division of Bioindustry, Silla University, Korea

This study analyzed the anti-diabetic properties of *Cyprinus carpio nudus* (CCN) by determining the inhibition activity of PTP1B that plays an important role in insulin signaling pathways. To produce bioactive peptides, CCN was hydrolyzed by alcalase (AH), proteamex (PH), and alcalase + proteamex (APH) for 10 h at 50°C (pH 7.0), and then ethanol precipitate (EP) of CCN hydrolysates were obtained from 80% ethanol treatment for 24 h at 4°C. The AH and ethanol precipitate of APH (EPAPH) showed the PTP1B inhibition activity of 70.1 and 94.2% at same protein concentration 3.3 mg/mL, respectively. The IC_{50} (50% inhibitory concentration) of EPAPH was determined as 0.2 mg/mL, compared to positive control that usolic acid (0.017 mg/mL). The EPAPH with the highest activity was further fractionated through ultrafiltration membranes with a range of molecular weight cutoffs (MWCO) of 30, 10 and 3 kDa, respectively. The highest activity was appeared in 10-30 kDa fraction prepared with 0.06 mg/mL as 83.8% of PTP1B inhibition. This result suggests *Cyprinus carpio nudus* will be useful as a functional resource with natural anti-diabetic activities.
A Study of Water-in-Oil Nanoemulsion Systems for Topical Delivery of C-Phycocyanin

HeeJeong Jung*, JeongWon Cha¹, DongJun Kim², HyunJin Park
School of Life Sciences and Biotechnology, Korea University, Korea, ¹Sudo Girl’s High School, Korea, ²J-Creation, Korea

C-Phycocyanin (C-PC) is the major phycobiliprotein of Spirulina platensis which is blue-green algae and possesses antioxidant and anti-inflammatory effects. In recent years, there has been increasing interest in nutraceutical properties of C-PC in the fields of food, cosmetics, and medicines. However, its hydrophilic character and instability under environmental factors make it difficult for C-PC to be applied in various fields. In this study, we investigated the potential of a nanoemulsion formulation of C-PC for topical delivery. The water-in-oil nanoemulsions (NE) were prepared from caprylic/capric triglyceride, Span 80 and Tween 80 as surfactants, propylene glycol as a co-surfactant, and water by low-energy emulsification. Transparent w/o NEs were formed only at the HLB value of 9.34-11.48 and the regions of NE formation were determined by Franz diffusion cell. The selected NEs showed great potential as transdermal delivery carriers of C-PC.

Antioxidant Effect of Medicinal Herbs on Lipid Oxidation in Boiled Duck

Na Ri Lim*, Yun Ji Choi¹, Hyun Jin Park
School of Life Science and Biotechnology, Korea University, Korea, ¹Department of Culinary, Korea Culinary High School, Korea

Many spices and herbs have been studied to significantly improve quality of meat products, and are effective in delaying lipid oxidation. However, there were few studies for boiled poultry meat added with herbs or spices. We evaluated effects of medicinal herbs on lipid oxidation in boiled duck. Meat sample was prepared with duck by adding a mixture of medicinal herbs. Control sample was prepared with duck only. Antioxidant activities of medicinal herbs extract were evaluated. We used the solid phase micro-extraction (SPME) technique to extract the volatile organic compounds (VOCs) of duck and to analyze it using gas chromatography and mass spectrometry (GC-MS). The off-flavors were formed from thermal lipid oxidation of meat, thus we evaluated the major compounds among its, aldehydes. Also we analyzed 2,2-di-phenyl-1-picrylhydrazyl (DPPH) radical scavenging activity, total phenolics contents and reducing power were measured. In conclusion, we found that the medicinal herbs as effective antioxidants led to reduce the aldehydes in boiled duck caused by lipid oxidation in boiled duck.

A Study of the Lipoprotein Lipase Inhibitory Mechanism of Poncirus trifoliata Water Extracts

Kyoung Kon Kim¹*, Sung Mee Lee¹, Yun Hwan Kang², Tae Woo Kim², Myeon Choe¹²
¹Department of Bio-Health Technology, College of Biomedical Science, Kangwon National University, Korea, ²Well-Being Bioproducts R&D Regional Innovation Center, Kangwon National University, Korea

Poncirus trifoliata has been reported to have anti-inflammatory, antioxidant, and immune activities. However, its anti-obesity activity and the mechanism by which the water extract of dried, immature fruit of Poncirus trifoliata (PF-W) acts are not clear. This study suggests a potential mechanism associated with the anti-obesity activity of PF-W. The total polyphenol and flavonoid content of PF-W was 52.15±4.02 and 6.56±0.47 mg/g, respectively. PF-W treatment decreased LPL content in media to 58±5.3% of that in control adipocyte media, and increased LPL content to 117±3.5% of that in control adipocytes, but did not affect the mRNA expression of LPL. PF-W also increased the mRNA expression of sortilin-related receptor (SorLA), a receptor that induces endocytosis and intracellular trafficking of LPL, in a concentration- and time-dependent manner. Finally, cell fractionation revealed that PF-W treatment induced the expression of CEBPβ, a SorLA transcription factor, in the nuclei of 3T3-L1 adipocytes.
Process Optimization of Extraction of Ginsenosides from Ginseng Berry

Yoo-Jin Ha*, A-Yeon Kim1, Ji-Young Ho1, Yu-Rim Song1, Mee-Ree Kim, Sun-Kyun Yoo1
Department of Food and Nutrition, Chungnam National University, 1Department of Food and Biotechnology, Joongbu University, Korea

Ginseng berries have been known as reducer of blood glucose and body weight in obese mice and contain the ginsenoside Re much more than other the parts of ginseng like roots. This study was performed to investigate the optimization of extraction processes such as temperature, ratio of water to alcohol, time, and numbers of extraction based on the ginsenoside Re as a quality index component. The range of ratio water to alcohol, time, and numbers of extraction was 50 to 60°C, 0 to 90%, 2 to 5 h, and 1 to 5, respectively. The ginsenosides analysis of the extract were performed using TLC chromatography and image analyser. The concentration of ginsenoside Re was increased until the ratio water to alcohol reached 70% and was 13.67 mg/g. The optimum temperature was 80°C. As the extraction time became longer, the extraction yield was increased. At the primary extraction, about 78% of total ginsenosides was extracted. As a result, we concluded that the optimum processes of extraction of ginseng berry were 80°C of temperature, 70% of ratio of water to alcohol, 4 h of time, and 3 of numbers of extraction.

Fermentation of Ginseng Berry Extract Using Lactobacillus sp. Strain KYH Isolated from Kimchi

Yoo-Jin Ha*, A-Yeon Kim1, Ji-Young Ho1, Yu-Rim Song1, Mee-Ree Kim, Sun-Kyun Yoo1
Department of Food and Nutrition, Chungnam National University, 1Department of Food and Biotechnology, Joongbu University, Korea

Fermentation of ginseng has been known that the absorption rate of ginsenoside increased by converting higher molecular weight of glycoside ginsenoside to small molecules. This study was evaluated to isolate a probiotic microorganism capable of fermenting ginseng berry extract and to optimize fermentation parameters. The probiotic strain was isolated and identified as *Lactobacillus* sp. strain KYH. The ginseng berry extract was manufactured with conditions of 80°C temperature, 70% of ratio of water to alcohol, 4 h of time, and 3 of numbers of extraction. Fermentation was performed using a batch and fed-batch process. The fermentation temperature was ranged 20 to 40°C. Fermentation pH was ranged 3 to 7. The optimized conditions were 30°C and pH 7. In comparison with total amount of extracted ginsenoside before fermentation, that of ginsenoside after fermentation was about 20% higher. The distribution of ginsenosides after fermentation was 5.3% Rb1, 5.2% Rc, 14.3% Rd, 51.5% Re, 8.1% Rf, and 15.7% Rg1. The protopanaxatriol ginsenosides occupied about 80% of total ginsenosides.

Optimization of Enzyme Reaction Parameters for Production of Functional Peptides from Legs Meat of Yeonsan Ogae by Proteases

A-Yeon Kim*, Yu-Rim Song, Yoo-Jin Ha1, Ji-Young Ho, Sun-Kyun Yoo, Joong-Gu Ji2
Department of Food and Biotechnology, Joongbu University, Korea, 1Department of Food and Nutrition, Chungnam National University, Korea, 2Department of Oriental Healthcare, Joongbu University, Korea

Ogae as a natural monument in Korea is a kind of black-bone fowls of which meats contains biological active materials. It is known that the uncontrolled production of free radicals (superoxide, hydroxyl, singlet oxygen, and peroxy) during cellular metabolism leads to oxidative stress. This study was to evaluate the optimization process for hydrolysing the legs meat of ogae using commercial proteases and functional properties of products. Ogae was supplied from the Gisan ogae farm. Selected protease used were purchased from a commercial supplier. With finally selected protease, response surface methodology (Box-Benken) to optimize the hydrolysis of ogae protein was performed. The range of study was 40 to 60°C, 0 to 3% enzyme concentration. DH was dependent on reaction pH, temperature, and concentration of enzyme. As pH was decreased, DH was steadily increased. However, DH continued to increase as enzyme concentration increased. The defined optimization conditions were temperature of 50 to 60°C, pH 6, and 3% enzyme concentration. The molecular weight of peptides produced was less than 3,000 Da.
Effects of Cultivar and Maturity Stage at Harvest on Antioxidant Compounds and Activities of Five Korean Blueberries

Hyesung Hwang*, Sujin Lim, Youngjae Shin
Department of Environmental Horticulture, College of Bio-resources Science, Dankook University, Korea

Total phenolics and antioxidant activities were analyzed to investigate the effects of cultivar and maturity stage at harvest on five Korean blueberries such as Nelson, Duke, Bluejay, Toro, and Eliot. The fruit were harvested at 50% (unripe) and 100% (ripe) maturation stages, respectively. Total phenolics and total antioxidant activities (DPPH and ABTS) were higher in ripe fruit than unripe fruit in all cultivars. Total phenolics of unripe and ripe Nelson cultivar were 228.5 and 300.9 mg/100 g FW, respectively, which were significantly higher than other four cultivars. Total phenolic concentrations of ripe blueberries were in the following order: Nelson > Toro > Duke > Bluejay > Eliot. Total antioxidant activities of ripen Nelson blueberries using DPPH and ABTS methods were the highest, followed by Toro, Duke, Bluejay, and Eliot. The relationship of the total phenolics and total antioxidant activities (DPPH and ABTS) was very strong ($r^2=0.948$ and $r^2=0.929$, respectively). The total antioxidant activities of fruit using DPPH and ABTS methods were also highly correlated ($r^2=0.914$).

Tyrosinase Inhibitory Activity and Melanin Production Inhibitory Activity of the Dendropanax morbifera Leaf Extract Fermented by Lactobacillus plantarum

Do-Youn Im*, Kyoung-In Lee
Division of Liberal Arts and Teacher Training, Kwangju Women’s University, Korea, 1Biotechnology Industrialization Center, Dongshin University, Korea

Dendropanax morbifera is an endemic species and distributes in the south-western area of Korea. In this study, leaves of D. morbifera (DML) was obtained from Naju, Jeonnam, Korea. Distilled water extract from DML was obtained by reflux extraction device and lyophilized. Fermented DML extract were prepared by inoculation of Lactobacillus plantarum after the extraction procedure with distilled water. After fermentation for 72 h at 37°C, filtrate was lyophilized. In DPPH radical scavenging ability, SC$\frac{50}{50}$ value of the fermented DML extract was 37.9 μg/mL as a result of more effective activity in the distilled water extract (SC$\frac{50}{50}$ : 52.6 μg/mL). Moreover, tyrosinase inhibitory activity of the fermented DML extract showed higher activity than the distilled water extract. In nontoxic concentration range, the fermented DML extract showed strong melanin production inhibitory effect in a melanocyte stimulating hormone-stimulated B16F10 cell. As a result, the fermentation of distilled water extract of DML by L. plantarum could be applicable to functional materials production for skin-whitening agents.

Antioxidant Components and Antioxidant Activities of Platycodon grandiflorum Root Noodles

Chang Hyun Park*, Jeong-Seung Hwang1, Dae-Ok Kim1, Woo Jung Park
Department of Marine Food Science and Technology, Gangneung-Wonju National University, Korea, 1Department of Food Science and Biotechnology, Kyung Hee University, Korea

Platycodon grandiflorum, called doraji in Korea, belongs to the Campanulaceae family and has been used as food and traditional oriental medicine materials. It was reported that this species contains active compounds such as trierpenoid and saponin and its aqueous extract also provides health benefit toward bronchitis, asthma, and pulmonary tuberculosis, hyperlipidemia, and inflammatory diseases. Reactive oxygen species (ROS) are commonly formed in general cellular metabolism and in response to environmental stresses such as UV light, heat, and pollution. Phytochemicals such as phenolics and flavonoids identified from diverse plants show antioxidant activities against many physiological conditions associated with ROS. The aqueous extract of P. grandiflorum has also been reported to give antioxidant effects in lipid peroxidation and radical scavenging activity. In this study, noodles were manufactured using P. grandiflorum root powder and extract. According to component difference, total flavonoids and phenolics were analyzed based on ascorbic acid and DPPH, ABTS, and ORAC assays were also performed to investigate antioxidant activities.

Anti-diabetic Activity of Melania Snail (Semisulcospira coreana) Hydrolysate

Sang-Eun Pyo*, Jun-Ho Park, Tae-Uk Kim, Mi-Ryung Kim
Department of Bio Food Materials, Silla University, Korea

Semisulcospira coreana (SC) has been widely used in the treatment of various diseases as folk remedies and recently, the pharmaceutical potencies of SC were reported in several researches. This study was conducted to gather the basic data on the anti-diabetic activities of SC hydrolysates. The anti-diabetic activity was determined by testing PTP1B (protein tyrosine phosphatase 1B) inhibitory activity and the insulin secreting ability of INS-1 cells in high glucose condition (30 mM). The PTP1B inhibitory activities for the SC-hydrolysates treated with Alcalase (SCA), Protamex (SCP) and Alcalase+Protamex (SCAP) were 81.8, 95.4, and 90.1% at concentration of 1 mg/mL, respectively. To concentrate the active compound, the hydrolysates were precipitated in ethanol solution. Among them, SCP precipitate showed PTP1B-inhibitory activity of 99.72%. And the IC$50$ value of them was 7.81 μg/mL, showing the higher PTP1B-inhibitory activity than usolic acid, positive control (IC$50$=16.65 μg/mL).
**Inhibition of Lipid Accumulation and Regulation of Early Adipogenic Process by Cholecalciferol in Adipocytes and Zebrafish**

Hyeon-Son Choi*, Hyung Joo Suh1, Mi-Kyung Park2, Jungil Hong
Seoul Women’s University, Korea, 1Korea University, Korea, 2Kyungpook National University, Korea

Cholecalciferol (CCF) is a common dietary supplement for vitamin D. In this study, effect of CCF on adipogenesis in adipocytes and zebrafish was investigated. CCF inhibited lipid accumulation in both experimental models. CCF down-regulated the expressions of C/EBPα, C/EBPδ, Krueppel-like factor (KLF) 4, KLF5, while KLF2 was increased by CCF treatment. CCF inhibited cell cycle progression of adipocytes through down-regulation of cyclin A and D. p-Rb was suppressed by CCF, but p27 was up-regulated with CCF treatment. This CCF-mediated inhibition of cell cycle progression was highly correlated to the inhibitions of ERK, AKT, and mTOR. Furthermore, CCF-induced inactivation of acetyl-CoA carboxylase (ACC), a fatty acid synthetic enzyme, with the activation of AMP-activated protein kinase α (AMPKα) was also observed. Consistent with the observations in adipocytes, CCF effectively inhibited lipid accumulation with the down-regulation of adipogenic factors in zebrafish. The present study indicates that CCF shows anti-adipogenic activity in adipocytes and zebrafish, and its inhibitory effect was involved in the regulation of early adipogenic process.

**SIRT1 Suppresses Benzo[a]pyrene-induced Hepatotoxicity by Regulating the Oxidative Stress**

Yong Pil Hwang*
Department of Pharmaceutical Engineering, International University of Korea, Korea

SIRT1, which belongs to the Sir2 family of NAD-dependent enzymes, plays diverse roles in aging, metabolism, and disease biology. Benzo[a]pyrene (B[a]P) is the most studied carcinogenic, mutagenic, teratogenic, and immunosuppressant effects, which can affect both wild and farmed marine fish through the trophic chain. In this study, we verified the mechanism by which SIRT1 regulates B[a]P-induced hepatotoxicity in HepG2 cells. SIRT1 expression was down-regulated in B[a]P-induced HepG2 cell injury, accompanied by elevated oxidative stress and cell apoptosis. SIRT1 over-expression reduced B[a]P-induced HepG2 cell apoptosis with the attenuated p53 expression. SIRT1 also reduced cell apoptosis by inhibition of caspase-3/7 activation. The SIRT1 agonist resveratrol was able to prevent B[a]P-induced hepatotoxicity. Moreover, the SIRT1 inhibitor sirtinol could reverse SIRT1’s protective effect in HepG2 cells. These results support the role of SIRT1 as an important regulator of hepatocytes apoptosis during B[a]P-induced liver injury.

**Effect of Rice Bran Unsaponifiable Matter on High-fat Diet-induced Obesity in Mice**

Hyeonmi Ham*, Yu Young Lee, Ji-Young Park, Eun-Yeong Sim, Byung Joo Kim, Choonwoo Lee, Wook-Hwan Kim, Junsoo Lee1
Crop Post-Harvest Technology Research Division, Department of Central Area, Crop Sci., National Institute of Crop Science, Chungbuk National University, Korea

Rice bran unsaponifiable matter (USM) contains a variety of functional compounds, such as phytosterol, tocopherols, tocotrienols, and γ-oryzanol, which have cholesterol-lowering effects, antioxidant properties, and lipid-lowering activities. In this study, we investigate the hypolipidemic effect of rice bran USM in high-fat diet-fed mice. Mice were divided into five groups; a normal diet (ND), high-fat diet (HFD), HFD with 10, 20, and 50 mg USM/kg body weight/day group. After 6 weeks, the administration of USM at a dose of 10, 20, and 50 mg/kg reduced the body weight gain, food efficiency ratio, and size of the epididymal fat tissue compared to those in the HFD group. In addition, the serum triglyceride, total cholesterol, and LDL cholesterol level as well as the atherogenic index and cardiac risk factor also reduced in the USM fed groups compared with those in the HFD group. These findings suggest that USM may have excellent hypolipidemic potential to prevent obesity.

**Total Phenolics and Antioxidant Activity of Opuntia ficus-indica Fermented with Bacillus subtilis**

Miran Yi*, Joonho Hwang, Heejung Bu, Changhui Kang, Sangbin Lim1
Biotechnology Regional Innovation Center, Jeju National University, Korea, 1Department of Food Bioengineering, Jeju National University, Korea

Opuntia ficus-indica (OF) was fermented with Bacillus subtilis DJ-02 and their 70% ethanol extracts were measured for total phenolics and antioxidant activities. Total phenolic content was higher (35.6 mg GAE/g) in OF fermented with B. subtilis DJ-02 (OFB) than nonfermented OF (16.7 mg GAE/g) and total flavonoid content was also higher in OFB (22.6 mg GAE/g) than OF (13.3 mg GAE/g). Antioxidant activities were measured as DPPH and ABTs radical scavenging activities, and oxygen radical absorbance capacity (ORAC). OFB showed higher DPPH and ABTs radical scavenging activities with IC_{50} of 248.1 μg/mL and 520.7 μg/mL than OF (524.7 and 872.0 μg/mL, respectively). ORAC was also higher in OFB (168.4 mg TE/g) than OF (121.7 mg TE/g). Fermentation of Opuntia ficus-indica with B. subtilis improved antioxidant activities with high total phenolics and flavonoids contents.
Cytotoxic Activity of the Hydrolysates of Ovotransferrin against Human Cancer Cell Lines

Da Hee Kim*, Jae Hoon Lee, Hyuje Jin Jin, Sun Hee Moon1, Dong Uk Ahn1, Hyun-Dong Paik
Department of Food Science and Biotechnology of Animal Resources, Konkuk University, Korea, 1Department of Animal Science, Iowa State University, USA

Ovotransferrin (OTF) is a glycoprotein which accounts for about 12-13% of total egg white proteins. The purpose of this study was to investigate the cytotoxic effect of the enzyme hydrolysates of OTF (OTHS). According to the different ways of treatment, the hydrolysates were labeled ‘OTH-P (OTF treated with promod 278)’, ‘OTH-T (OTF treated with trypsin)’, ‘OTH-PT (OTF treated with promod 278 and thermolysin)’ and ‘OTH-PP (OTF treated with promod 278 and pepsin)’. The cytotoxic effects of the OTHs were evaluated by MTT (3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide) assay with various cancer cell lines including AGS, LoVo, HT-29 (human colon), MCF-7 (human breast), and HeLa (human uterine). As a result, all OTHs inhibited the growth of all the cancer cell lines in a dose-dependent manner. Among the OTHs, OTH-PT had the highest cytotoxicity showing 87.10, 90.32, 89.26, and 92.61% activities at 10 mg/mL on AGS, LoVo, HT-29, and HeLa, respectively. These results suggest that the OTHs have some potential to be used as inhibitors of human cancer cell lines.

Antioxidant and Anti-inflammatory Effects of Panax ginseng By-product Extract

Su Jin Eom*, Gi Hoon Jung, Seunho Jung1, Hyun-Dong Paik
Department of Food Science and Biotechnology of Animal Resources, Konkuk University, Korea, 1Department of Bioscience and Biotechnology, Konkuk University, Korea

Panax ginseng is an herb used in Asian medicine and has diverse activities. However, by-product of ginseng still contains biologically active compounds. The purpose of this study was to assess the antioxidant and anti-inflammatory effects of ginseng by-product extract. TLC and HPLC were using to analyze polyacetylene. The antioxidant activity of the extract was determined by measuring DPPH free radical scavenging activity and β-carotene and linoleic acid oxidation. The anti-inflammatory effect of each extract was also determined by NO production. The petroleum ether and hexane extracts resulted in similar patterns, whereas methanol was not detected at 10 mg/mL. NO production of methanol, petroleum ether, and hexane extracts was decreased by 72.96±1.29, 71.05±0.18, and 71.05±1.57%, respectively. This result suggests that the by-product of ginseng has potential for use as a functional food against free radical oxidation and NO production.

Inhibition of Tumor Progression by Dietary Nobiletin (NBT) in Mice Fed a High-fat Diet

Jae In Jung*, Hyerin Song1, Je Tae Woo1, Yuto Teruya3, Toshiki Teruya1, Jung Han Yoon Park1,2
1Department of Food Science and Nutrition, Hallym University, Korea, 2Advanced Institutes of Convergence Technology, Seoul National University, Korea, 3Okinawa Research Center Co., Ltd., Japan, 4Faculty of Education, University of the Ryukyus, Japan

Previously, we reported that adipocytes and M2-macrophages (MFs) play important roles in the stimulation of tumor growth and lymph node (LN) metastasis in C57BL/6N mice fed a high-fat diet (HFD) and injected with B16F10 melanoma cells. NBT is a polymethoxylated flavone found in certain citrus peels and was reported to exert anti-obesity activity. The present study examined whether NBT inhibits HFD-induced melanoma progression using the same mouse tumor model. NBT inhibited HFD-induced increases in body weight and body fat mass; fasting blood glucose, insulin, and HOMA-IR; solid tumor growth and LN metastasis. HFD increased the expression of proteins related to tumor cell proliferation, angiogenesis, and lymphangiogenesis in primary tissues but decreased apoptotic cells, all of which were suppressed by NBT. NBT suppressed HFD-induced increases in accumulation of lipids, F4/80+ MFs and MMR+ M2-MFs in tumor tissues and adipose tissues surrounding the LN, which were suppressed by NBT. These results indicate that the suppression of lipid and M2-MF accumulation is an important mechanism for NBT-suppressed melanoma progression and metastasis in HFD-fed mice.

Erucin Present in Cruciferous Vegetables Inhibits Tumor Angiogenesis and Lymphangiogenesis in the B16F10 Melanoma Mouse Tumor Model

Han Jin Cho*, Hyerin Song1, Ki Won Lee, Jung Han Yoon Park1
WCU Biomodulation Major, Department of Agricultural Biotechnology and Center for Food and Bioconvergence, Seoul National University, Korea, 1Department of Food Science and Nutrition, Hallym University, Korea

Epidemiological results indicate that the consumption of cruciferous vegetables is inversely associated with the risk of several cancers. Erucin, an analogue of sulforaphane, is a hydrolysis product of glucorucin. In vitro studies suggest that erucin is a new potential chemopreventive agent. In the present study, to examine whether erucin inhibits tumor progression, B16F10-luc cells were subcutaneously injected into the right flank of C57BL/6 mice and erucin (0, 10, or 20 mg/kg/day) was gavage-fed. The tumor was resected 2 weeks after the injection. The administration of erucin inhibited tumor growth, which was accompanied by decreased numbers of Ki-67+ proliferating cells and increased numbers of TUNEL+ apoptotic cells in tumor tissues. Additionally, the expression of proteins related to angiogenesis (VEGF-A and CD31) and lymphangiogenesis (VEGF-C and LYVE-1) was decreased in erucin-treated mice. Two weeks after the tumor resection, the mice evidenced lymph node metastasis, which was decreased in erucin-treated mice. We demonstrate that erucin has ability to suppress tumor angiogenesis and lymphangiogenesis leading to decreased tumor growth and lymph node metastasis in mice.
Effect of Moringa oleifera Fruits on Mitochondrial Apoptosis in HCT116 Colon Cancer Cells

Tae Eun Guon*, Ha Sook Chung
Department of Food and Nutrition, Duksung Women’s University, Korea

Moringa oleifera has been reported to inhibit several human cancer cell lines and have anti-asthmatic properties. In this study, we investigated the effects of M. oleifera on cell proliferation and apoptosis in HCT116 human colon cancer cells. Cell viability significantly decreased in a dose-dependent manner, after 72 h of incubation with various concentrations of M. oleifera, which, prompted caspase-dependent signals. This inhibition was dose-dependent and was accompanied by morphological changes indicative of apoptosis. Furthermore, flow cytometric analysis showed that M. oleifera increased the extent of apoptosis, which was confirmed by Annexin V and PI double staining. Analysis of the mechanism of these events indicated that PI double staining. Analysis of the mechanism of these events indicated that M. oleifera induced apoptosis, as accompanied by phosphorylation of the mitogen-activated protein kinase family, c-Jun N-terminal kinasep38 MAPK (p38), and extra-cellular signal-regulated kinase.

Suppressive Effects of Atractylodes Rhizome Extract on Th2 Immune Response

Young-Ji Choi*, Kang-Yeol Yu, Ju Kim
Jeonju Biomaterials Institute, Korea

Atopic dermatitis (AD) is a common chronic inflammatory skin disease caused by a variety of factors, including allergens, immunologic abnormalities and the pathogenesis and development of skin lesions. In previous study, treatment of keratinocytes with TNF-α/IFN-γ can be induced expression of thymus- and activation-regulated chemokine and macrophage-derived chemokine, which is considered to be a pivotal mediator in the inflammatory responses during the development of inflammatory skin diseases, such as AD. Although some anti-allergic activities of atractylodes rhizome (JBMI-AR) have been previously reported, the active principle for anti-allergic action is not fully elucidated and the effect of this plant material on atopic dermatitis is not known. In this study, we examined the effect of JBMI-AR extract on TNF-α/IFN-γ-induced expression of Th-2 chemokine in the human keratinocyte HaCaT cells. Consequently, pretreatment of HaCaT cells with JBMI-AR extract suppressed TNF-α/IFN-γ-induced TARC and MDC mRNA level without cytotoxicity. These results suggest that JBMI-AR can be considered as natural nutraceuticals to prevent AD and excellent sources of bioactive compounds.

Anti-inflammatory Effect of Ginger Ethanol Extract in Colonic Epithelial Cells Stimulated Proinflammatory Cytokine Mixtures

Dong Min Kim*, Min Seo Kim, Eun Min Jo, Ji Yeon Kim
Seoul National University of Science and Technology, Korea

This study was objected to compare antioxidant capacities of young and ripe fruits of Diospyros kaki/IFN-γ can be induced expression of Th-2 chemokine in the human keratinocyte HaCaT cells. Consequently, pretreatment of HaCaT cells with JBMI-AR extract suppressed TNF-α/IFN-γ-induced TARC and MDC mRNA level without cytotoxicity. These results suggest that JBMI-AR can be considered as natural nutraceuticals to prevent AD and excellent sources of bioactive compounds.

Comparative Study on Antioxidant Effects of Extracts from Young and Ripe Fruits of Diospyros kaki

Yun Young Kim*, Lee Seon Kim, Ji Yeon Kim
Seoul National University of Science and Technology, Korea

This study was objected to compare antioxidant capacities of young and ripe fruits of Diospyros kaki were extracted with DW, 70% ethanol (EIOH), acidic 70% ethanol and acidic DW, respectively. Among extracts, 70% EIOH extract of young fruit showed the highest total phenol and flavonoid contents, which were 386.42±20.14 mg/g and 106.94±1.46 mg/g, respectively. In DPPH, ABTA and FRAP assays, all extracts of young fruit showed similar higher antioxidant capacities compared to the ripe fruits extracts. In cytotoxicity treated with H2O2, acidic 70% EIOH and acidic DW extracts of young fruit showed the highest cell viability. Young fruit extracts with 70% EIOH, acidic 70% EIOH and acidic DW showed lower ROS levels compared to DW extract of young fruits. Therefore, based on these results, we could conclude that young fruit extract with 70% EIOH and acidic 70% EIOH be developed as antioxidant functional food ingredients.
Antioxidant, Anti-cancer Activity and Quality Characteristics of Wild Raspberry Cookies

KyunghwaYoon*, HaSookChung
Department of Food and Nutrition, Duksung Women's University, Korea

Raspberry (Rubus crataegifolius) is well known as an excellent antioxidant, anti-inflammatory, anti-bacterial and anti-cancer resources with bioactive components. The aim of our study is to investigate the effect of wild raspberry cookies on biological activity and quality characteristics. Raspberry cookies were prepared adding different concentrations of wild raspberry powder (0, 5, 10, 20, 30, and 50% to the flour weight). The contents of total phenols, flavonoids and anthocyanins were evaluated. Antioxidant activities through DPPH free radicals, ABTS scavenging, ferric reducing power, nitrite scavenging, metal heating effect and reducing power was determined. Anti-cancer activities on human cancer cell lines were also determined by MTT assay. The quality characteristics of raspberry cookies was accomplished by bulk density, spread factor, loss rate, leavening rate, hardness, color value, soluble solid contents and sensory properties.

Effects of Dendropanax morbifera Extract on Lipid Composition in Rats Fed High Fat and High Cholesterol Diet

HunHwanKim*, JiYunBaek, WoonYoungSoong, JeongHwaChoi
Department of Food Nutrition, International University of Korea, Korea

This study was conducted to investigate the effects of water extract from Dendropanax morbifera (DM) on lipid metabolism in rats fed high fat and cholesterol diet. Experimental rats were divided into four groups which were composed of normal diet group (N group), high fat diet group (HF group), high fat and cholesterol diet group (HFI group) and high fat, cholesterol and 5% DM diet group (DB group). The serum total-cholesterol of the HF group was significantly increased compared to the N group, while those of the DA and DB groups were decreased compared to the HF group. The serum LDL-cholesterol and AI of the HF group were significantly increased compared to the N group, while those of the DA and DB groups were decreased compared to the HF group. The serum TG of the HF group was significantly increased compared to the N group, while those of the DA and DB groups were decreased compared to the HF group. The serum HDL-cholesterol of the HF group was significantly decreased compared to the HF group. These results suggest that supplementation of DM has the potential to activate antioxidant activity.

Antioxidant Activities of Water Extracts and Ethanol Extracts from Duchesnea chrysanthae

SeungYongKang*, SungSikChun, SoJeongByeon1, JeongHwaChoi
Department of Medicinal Food, International University of Korea, Korea, 1Department of Food Nutrition, International University of Korea, Korea

This study was attempted to investigate antioxidant activities of water and ethanol extracts of Duchesnea chrysanthae (DC) by in vitro assays measuring 1,1-diphenyl-2-picrylhydrazyl (DPPH) radical, 2,2’-azino-di-2-ethyl-benzthiazoline-sulphonate (ABTS) radical, nitric oxide (NO) radical scavenging activity and reducing power activity, total phenol and total flavonoid content. The water and ethanol extracts from DC scavenged the DPPH and ABTS radical at the concentration range from 25-200 μg/mL. The total phenol content of ethanol extracts (91.60 mg/g) was higher than that of water extracts (82.33 mg/g). The total flavonoid content of water extracts (30.92 mg/g) was higher than that of ethanol extracts (27.70 mg/g). DPPH, ABTS and NO radical scavenging activities of water extracts were higher than that of ethanol extracts. IC50 of DPPH, ABTS, NO radical scavenging activities of water and ethanol extracts was 90.90, 10.12, 14.70 μg/mL and 151.6, 16.46, 235.6 μg/mL, respectively. The reducing power contents of ethanol extracts (0.16-0.45) was higher than that of water extracts (0.16-0.61). These results suggest that extracts of DC has the potential to activate antioxidant activity.

Effects of Isoflavones Supplementation on Serum Lipids and Liver Antioxidant Enzymes in Growing Rats Fed a High Fat Diet

In-SilJang*, Yun-JungJung, Mi-JaChoi
Department of Food and Nutrition, Keimyung University, Korea

Isoflavones was known that have estrogen-like activities and protect many disease such as hyperlipidemia, and cardiovascular disease. The purpose of this study was to investigate the effects of isoflavones on serum lipids and liver antioxidant enzymes in growing rats fed high fat diet. Twenty four female Sprague-Dawley rats (body wt 50-60 g) were divided into three groups, control, highfat (HF, 20% lard diet) and highfat+ isoflavone (HFI; 20% lard+0.1% isoflavones diet) for 4 weeks. Mean intake and food efficiency ratio were significantly lower in HF groups and HFI groups than in control groups. The level of serum total cholesterol, triglyceride and atherogenic index were significantly lower in HF groups than in control groups. The contents of malondialdehyde, lipid peroxidation, was significantly lower in HFI groups than HF groups. And antioxidant enzyme in liver tissue such as superoxide dismutase, glutathione peroxidase and catalase were not significantly different by isoflavones supplemented diets. In conclusion, it seems possible that isoflavones supplemented diets may produce positive effects on serum lipids and hepatic malondialdehyde.
**Effects of Onion Peel Supplementation on Serum Lipids and Liver Antioxidant Enzymes Activity in Ovariectomized Rats**

Qian-Wen Zhang*, Yun-Jun Jung, Mi-Ja Choi  
Department of Food and Nutrition, Keimyung University, Korea

Onion is a popular foodstuff that is rich in quercetin. Quercetin is a substance which has been reported to have anti-oxidative and anti-obesity properties. Onion peel contains more quercetin than onion flesh. The aim of this study was to examine the effect of onion peel on serum lipids and liver antioxidant enzymes in ovariectomized (OVX) rats. Female Sprague-Dawley rats (body wt 210-220 g) were divided into SHAM and OVX groups. These groups were divided into control and onion peel power diets (2% onion peel diet) for 6 weeks. Mean intake and food efficiency ratio were significantly higher in OVX groups than in SHAM groups. The level of serum total cholesterol (TC) was significantly lower in onion peel groups than in control groups. Contents of liver TC was significantly lower in onion peel groups than in control groups in OVX groups. Activity of superoxide dismutase and glutathione peroxidase in liver tissue of the onion peel groups were not significantly different. However, activity of catalase was significantly higher in onion peel groups than in control groups. In conclusion, effects of 2% onion peel diet were beneficial on serum and hepatic TC, and catalase in OVX rats.

**Effects of Sedum sarmentosum on Bone Metabolism in Ovariectomized Rats**

Mi-Ja Choi*, Yun-Jun Jung  
Department of Food and Nutrition, Keimyung University, Korea

*Sedum sarmentosum* (SS) contains multiple active chemical components, including quercetin,isorhamnetin, and kaempferol. The purpose of the present study was to investigate the effect of bone conserving of SS supplemented diet on bone mineral density, bone mineral content, and bone markers in OVX rats. Thirty two male Sprague-Dawley rats were divided into two groups; SHAM and OVX groups. The groups were each randomly divided into two subgroups; fed control and SS (5% Sedum sarmentosum) diets. BMD and BMC were estimated by using PIXImus in spine and femur on nine weeks after feeding. Serum Ca and P concentration, urinary Ca and P excretion was not significantly different by experimental diets among all groups. Serum concentration of ALP and urinary DPD crosslinks value was significantly lower in OVX-Sedum groups than in OVX-Control groups. Spine BMD, spine BMC and femur BMC were not significantly different by experimental diets among all groups. However, femur BMD of OVX-Sedum group was significantly higher than that of OVX-Control group. It could be concluded that SS supplemented diet positively influenced on bone metabolism in OVX rats.
Antioxidant and Antiproliferative Activities of Immature Wheat in Comparison to Mature Wheat in Korea

Mi Jeong Kim*, Oui Young Kim, Sang Sook Kim
Korea Food Research Institute, Korea

The purpose of this study was to investigate health benefits in immature wheat compared to mature wheat by measuring antioxidant and antiproliferative activities. Immature and mature wheats were harvested 35 and 45 days after heading date, respectively; steamed immature wheat was also tested. The phenolic, flavonoid, and tocopherol contents of immature and steamed immature wheat were compared with those of mature wheat. Additionally, antiproliferative activities against colon cancer cells (HT-29 and Caco-2) and cervix cancer cells (HeLa) in three samples were evaluated. The immature wheat contained higher phenolic and flavonoid contents but less tocopherol contents than mature wheat. The antioxidant property measured with oxygen radical absorbance capacity (ORAC) in immature wheat was higher than other samples. The results of the antiproliferative activity showed that immature wheat had the lowest EC50 values against HT-29 (39.31 mg/mL) and HeLa (31.39 mg/mL) cells, indicating higher antiproliferative activity.

3,4-Dihydroxytoluene Inhibits UVB-induced Wrinkle Formation by Targeting Raf-1

Ji Hye Kim*, Sang Hee Park, Eun Jung Lee, Eun Ju Lee, In Hyuk Yeo, Jae Eun Lee, Nam Joo Kang
School of Food Science and Biotechnology, Kyungpook National University, Korea

Chronic exposure to ultraviolet (UV) radiation causes skin photoaging. Many previous studies have shown that phytochemicals have anti-photoaging effects, but their direct target molecule(s) and mechanism(s) remain unclear. We found that 3,4-dihydroxytoluene (DHT), a metabolite of rutin (3-O-rhamnopyranosyl-4,7-dihydroxyflavone), inhibited wrinkle formation in mouse skin induced by UVB irradiation. DHT treatment reduced UVB-induced epidermal thickening and also suppressed UVB-induced matrix metalloproteinase-13 (MMP-13) protein expression in mouse skin. DHT strongly inhibited MMP-1 expression by suppressing UVB-induced Raf-1 kinase activity and subsequent attenuation of UVB-induced phosphorylation of MEK, ERK, and p90RSK in HaCaT cells. In vitro pull-down assays revealed that DHT bound with Raf-1 in an ATP-noncompetitive manner. Overall, these results indicate that DHT exerts potent anti-photoaging activity by regulating MMP-1 expression through the suppression of Raf-1 kinase activity.

Antioxidant Activity of Phenolic Compounds from Allium hookeri Root

Hyun-Il Jun*, Dal-Rae Ahn1, Jae-Heon Yang2, Geun-Seoup Song, Young-Soo Kim
Department of Food Science and Technology, Chonbuk National University, Korea, 1Chemical Safety Division, National Institute of Agricultural Science, Rural Development Administration, Korea, 2Center for Healthcare Technology Development, Chonbuk National University, Korea

This study was carried out to investigate the antioxidant activities and its related compound from Allium hookeri root (AHR). A methanol extract from AHR was sequentially fractionated and separated using the polarity of the solvents (methanol, ethyl acetate, and n-butanol) and the column chromatographies (Sephadex LH-20 and Kiesel gel 60), respectively. The antioxidant activity of AHR were investigated using 1,1-diphenyl-1-picrylhydrazyl radical scavenging activity (DPPH RSA), superoxide quenching activity (SQA), and superoxide radical scavenging activity (SRSA). Considering comprehensively DPPH RSA and yield of fractions, it was selected n-butanol fraction (respective 8.4-85.2% and 3.9%). There was no statistically significant difference in EC50 value for SRSA between purified compound 1 from n-butanol fraction and ascorbic acid. According to the results of mass spectrometry (MS) and nuclear magnetic resonance (NMR), the compound 1 was identified as ferulic acid-4-O-β-glucoside and isolated for the first time in AHR.
In this study, we examined the effect of cultivation adaptation and product quality of aronia (fruit of *Aronia melanocarpa*) cultivated in various domestic regions and Poland. Extracts of aronia cultivated in various domestic regions and Poland were measured total sugar contents, acidity, polyphenol contents, anthocyanin contents and antioxidant activity. As a result, it was confirmed that aronia extracts of two countries had major compound as cyanidin-3-galactoside (65.5-69.1%) in anthocyanin. Aronia cultivated in domestic C region showed the highest antioxidant activity and total phenolic contents. The extraction conditions of aronia melanocarpa were 27 kind of extraction conditions. The extraction time is 2, 4, and 6 h, ratio of the solvent 15, 20, and 25 times, temperature is in 40, 60, and 80°C. Anthocyanin contents was highest 4 h, the solvent 15 times, in 80°C with 502.61 μg/mL. These results indicated that anthocyanin contents was higher at low temperature and low solvent ratio. Polyphenol contents and antioxidant effect of DPPH and FRAP assay were significantly highest 4 h, 15 times, 80°C and 6 h, 15 times, 60°C condition. *Aronia melanocarpa* highest anthocyanin contents condition of 4 h, 15 times, 80°C and highest extraction yield condition of 6 h, 25 times, 40°C condition was compared with the control group of arbutin for DOPA oxidation inhibitory activity. These conditions significantly inhibited dose-dependent DOPA oxidation, 10 mg/mL concentration of 61.3 and 50.2%, respectively. The results of this study showed that DOPA oxidation inhibitory effect higher at high anthocyanin contents.

This experiment was determined the optimum extraction conditions of *Aronia melanocarpa* to increase the antioxidant effect and inhibit tyrosinase activity. Using a freeze-dried powder *Aronia melanocarpa* were 27 kind of extraction conditions. The extraction time is 2, 4, and 6 h, ratio of the solvent is 15, 20, and 25 times, temperature is in 40, 60, and 80°C. Anthocyanin contents was highest 4 h, the solvent 15 times, in 80°C with 502.61 μg/mL. These results indicated that anthocyanin contents was higher at low temperature and low solvent ratio. Polyphenol contents and antioxidant effect of DPPH and FRAP assay were significantly highest 4 h, 15 times, 80°C and 6 h, 15 times, 60°C condition. *Aronia melanocarpa* highest anthocyanin contents condition of 4 h, 15 times, 80°C and highest extraction yield condition of 6 h, 25 times, 40°C condition was compared with the control group of arbutin for DOPA oxidation inhibitory activity. These conditions significantly inhibited dose-dependent DOPA oxidation, 10 mg/mL concentration of 61.3 and 50.2%, respectively. The results of this study showed that DOPA oxidation inhibitory effect higher at high anthocyanin contents.

In this study, we examined the effect of cultivation adaptation and product quality of aronia (fruit of *Aronia melanocarpa*) cultivated in various domestic regions. Extracts of aronia cultivated in various domestic regions and Poland were measured total sugar contents, acidity, polyphenol contents, anthocyanin contents and antioxidant activity. As a result, it was confirmed that aronia extracts of two countries had similar activities on sugar contents, acidity, flavonoid contents and anthocyanin contents. Anthocyanin is an important functional component of *Aronia melanocarpa*. Aronia extracts of two countries had major compound as cyanidin-3-galactoside (65.5-69.1%) in anthocyanin. Aronia cultivated in domestic C region showed higher polyphenol contents of 121.5% compared to Poland Aronia. And it’s antioxidant activities measured by the DPPH (IC50) and FRAP assay showed higher than Poland aronia. Aronia cultivated in domestic C region showed the highest antioxidant activity and polyphenol content. As above results, Korean aronia had similar activities with Poland, and can be a new potential development of processed foods and high technological food.
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**Immunostimulating Activities of Ethanol and Hot Water Extract, and Crude Polysaccharide Fraction Isolated from Brussels Sprout**

Bong-Shin Kwak*, Kyoun Sook Choi1, Kwang-Soon Shin

Department of Food Science & Biotechnology, Kyonggi University, Korea, 1BK Bio Co. Ltd., Korea

In this study, we examined chemical properties of ethanol extract (BCEE), hot water extract (BSHW) and crude polysaccharide fraction (BSWP) from brussels sprout and estimated their immuno stimulating activities in vitro. Three different samples from brussels sprout did not show any cytotoxicity on murine peritoneal macrophage cells, Colon 26-M3.1 mouse colon cells and B16BL6 mouse lung cells, and had no effect on splenocyte proliferation. In an in vitro cytotoxicity using human cell lines, BCEE at a dose 10,000 μg/mL showed cytotoxicity on human colon cancer cells such as HT-29 and SW-620, and human lung cancer cells such as A549 and NCI-H460. Anti-complementary activity of BSWP was higher than that of BSHW. Peritoneal macrophages stimulated by BSWP showed enhanced production of various cytokines such as tumor necrosis factor (TNF)-α, interleukin (IL)-6 and IL-12. In an in vitro assay for intestinal immune modulating activity, BSWP also showed a higher bone marrow cell-proliferation activity through Peyer’s patch cells at 1,000 μg/mL. These results suggest that polysaccharide in the brussels sprout has a potential for enhancing macrophage functions and intestinal immune system.

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**Anti-hyperglycemic and Antioxidant Activities of Water Soluble Vitamins**

Yu-Ri Kang*, Se woon Hwang, Hwang-Yong Choi, Young-In Kwon

Department of Food and Nutrition, Hannam University, Korea

We selected 10 kinds of water soluble vitamins such as vitamins B groups and vitamin C using in-vitro enzyme inhibition assay. To evaluate anti-hyperglycemic effect of selected vitamins enzyme inhibitory activity against rat intestinal α-glucosidase (sucrase, maltase, and glucoamylase) were investigated. Oxygen radical absorbance capacity (ORAC) assay system was used for evaluating antioxidant activity of water soluble vitamins. Ascorbic acid had the α-glucosidase inhibitory activity (3.5 mg/mL of IC50) and pyridoxine (4.2 mg/mL of IC50). Furthermore, pyridoxine (2.4 TE/1 μM) had the highest peryoxyl radical absorbing activities. Based on these results, we decided to further investigate the effect of ascorbic acid and pyridoxine on reducing postprandial blood sugar levels in Sprague-Dawley rat model after sucrose loading test. In the animal trial, pyridoxine (p<0.01) had postprandial blood sugar reduction effect, when compared to control. These results pyridoxine would be helpful to manage glucose uptake and the glucose-induced increased levels of mitochondrial reactive oxygen species linked to hyperglycemia.

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**Analysis of Contents of Chlorogenic Acid and Caffeic Acid in Selected Four Roasted Coffee Bean Extracts (RCE) and Its Antioxidant and α-Glucosidase Inhibitory Activities**

Jung-Yun Lee*, Soo-In Jang, Bou-Hee Kang1, Hwang-Yong Choi, Young-In Kwon

Department of Food and Nutrition, Hannam University, Korea, 1Department of Food Science and Human Nutrition, University of Maine, USA

In the current study, we evaluated total soluble phenolics, phenolic profile and oxygen radical absorbance capacity (ORAC) of selected 4 coffee bean water extracts, with different roasting degree, such as mild (CEL), Midium (CEM), Med-dark (CEMD), and dark (CED). We also investigated inhibitory activity of RCE against porcine α-amyrase and α-glucosidase. CEMD had the highest α-glucosidase inhibitory activity, ORAC value and total phenolic content. The α-glucosidase inhibitory activity of the extracts was compared to selected specific phenolics detected in the RCE using HPLC. Chlorogenic acid and caffeic acid, a major phenolic compound in RCE had high α-glucosidase inhibitory activity. The α-glucosidase inhibitory activity of the RCE correlated to the phenolic content and antioxidant activity. These results suggest that selected RCE which has high chlorogenic acid, caffeic acid content with α-glucosidase inhibitory activity and high antioxidant activity has the potential to contribute as a useful dietary supplement for controlling postprandial hyperglycemia and oxidative stress-linked diabetes complications.
Antioxidant and α-Glucosidase Inhibitory Activities of Seven Selected Natural Food Coloring Agents

Soo-In Jang*, Jung-Yun Lee, Yu-Ri Kang, Hwang-Yong Choi, Young-In Kwon
Department of Food and Nutrition, Hannam University, Korea

Inhibition of α-amylase and α-glucosidase involved in the digestion and absorption of carbohydrates can significantly decrease the postprandial increase of blood glucose level after a mixed carbohydrate diet. In the current study, we evaluated the inhibitory activities of 7 selected natural food coloring agents, such as Monascus Color, Red beet Color, Grape skins Color, Gardenia Blue Color, Cacao color, Squid ink Color, and Red cabbage Color against α-glucosidase and α-amylase. We also investigated oxygen radical absorbance capacity (ORAC) and total phenolics content of 7 selected natural food coloring agents. All the samples had a high antioxidant and anti-hyperglycemic activities has the potential to contribute as a useful food design strategy for controlling postprandial hyperglycemia.

Essential Oil Productivity and Fragrance Characteristics of Sweet Wormwood (Artemisia annua L.) for Different Harvesting Seasons

Gyeong Suk Jo*, Hyo Joong Kim1, Bong Gi Yun1, Bong Yun Oh
Jeollanamdo Agricultural Research and Extension Service, Food & Farm Management Research Institute, Korea,
1Jeollanamdo Agricultural Research and Extension Service, Korea

Essential oil productivity and fragrance characteristics for different harvesting seasons were investigated using 10 kg of sweet wormwood (Artemisia annua L.) and water-steam distillation method in order to develop native wormwood wildly grown and cultivated in the island shore of Jeollanam-do, Korea into a food flavoring and medical ingredient. For harvest in August, total extraction time was 8 h and yield of essential oil was 2.4-2.8 mL/kg. Hydrodistillation production was 2.3 L/h. For harvest in October, total extraction time was 16-20 h and yield of essential oil was 1.8-2.2 mL/kg. Hourly hydrodistillation production was 1.5 L. In comparison to harvest in August, total extraction was increased and yield of essential oil was decreased in October. There was a difference in essential oil production according to harvesting seasons. Sweet wormwood had values as a fragrance for containing many antibiotic and aromatic components such as beta-pinene, R-alpha-pinene, limonene, eucalyptol, L(-)-borneol, caryophyllene, and bicyclo[3.1.1]heptane.

Effect of Sulforaphene and Daidzein on Invasion of Breast Cancer through Regulating Hedgehog/Gli 1 Signaling Pathway

Cheng Bao*, Minchae Kim, Hong Jin Lee
Department of Food Science and Technology, Chung-Ang University, Korea

Many studies have demonstrated that sulforaphene and daidzein possess the beneficial activities in carcinogenesis including breast cancer. However, their roles in tumor invasion, one of key events for metastasis has not been widely investigated. Recently, accumulating evidence has elucidated that the dysfunction of hedgehog (Hh) signaling enhanced the invasion in breast cancer. Here, we found that sulforaphene suppressed the invasion of SUM159 breast cancer cells expressing higher level of Gli 1 (transcription factor in Hh signaling) through inhibiting Gli 1 and its target genes MMP2 and MMP-9. In MCF10 breast cancer cells expressing lower level of Gli 1, the invasive phenotype was stimulated by tumor necrosis factor-α (TNF-α) via increasing Gli 1 transcriptional activities. Daidzein significantly inhibited TNF-α induced Hh signaling, which resulted in suppression of MMP-9 activity and cellular invasion. Taken together, sulforaphene and daidzein exerted anti-invasive effect through down-regulating Hh/Gli signaling in different breast cancer cell lines.

Effects of Cooking on Antioxidant Content and Activities of Sesame Leaves (Seasamum indicum L.)

Seoung Kim*, Jihyeung Ju
Department of Food and Nutrition, Chungbuk National University, Korea

The aim of the study was to investigate the effect of domestic cooking on antioxidant content and activities of sesame leaves (Seasamum indicum L.; SL). Raw, blanched, steamed, and roasted leaves were freeze-dried and extracted with 70% ethanol. Antioxidant content, such as total polyphenol (TP), total flavonoid (TF), carotenoid (CT), and chlorophyll (CL) levels, and antioxidant activities, such as radical-scavenging activity (RSA) and ferric reducing antioxidant power (FRAP), were determined. Blanching decreased TF levels significantly (to 27% of raw SL) and FRAP slightly (to 81% of raw SL), but it did not change TP, CT, and CL. Steaming even increased CT and CL levels (to 1.4-2.1 fold of raw SL), but it decreased TP levels (to 74% of raw SL). Roasting significantly decreased antioxidant content (in the case of TP, CT, and CL to 47-55% of raw SL) and FRAP (to 31% of raw SL), but it changed the functions of antioxidant content and activities of sesame leaves are influenced by domestic cooking, showing the most negative effects by roasting.
Change in Essential Oil Yield and Quality of Raw Garlic and Dried Garlic during Steam Distillation Extraction

Gyeong Suk Jo*, Bong Yun Oh, Jeong Hwa Kang  
Jeollanamdo Agricultural Research and Extension Service, Food & Farm Management Research Institute, Korea

Garlic (Allium schoenoprasum var. viviparum Regel) has many different uses such as spice and medicine, but it is mostly sold as raw. It is necessary to develop garlic products that can be utilized for different purposes. This experiment was conducted to secure possibility for mass production of essential oil of garlic because garlic is used as food spice and medicinal ingredient. Moisture content of raw garlic for production of essential oil was 68.2%, and moisture content of garlic dried by hot-air drying at 70°C was 16.0%. Water-steam distillation method was used for extraction of essential oil. For 10 kg of garlic, total extraction time and production of essential oil were 10 h and 0.1 mL/10 kg for raw garlic and 15 h and 14 mL/10 kg for dried garlic. Hydrosol production was 1.1 L/h for raw garlic and 0.9 L/h for dried garlic. In the sensory evaluation, natural essential oil and hydrosol of raw and dried garlics were characterized by strong garlic flavor. Mass production of garlic was evaluated as feasible, with possibility for use as food spice and ingredient.

Extract from Sasa borealis on Energy Metabolism and Antioxidant Defense System after Exhaustive Swimming

Yanghee You1, Jeongjin Park1, Ok-Kyung Kim2, Heesun Jeong2, Minseok Cha2, Jinyoung Kim2, Kyungmi Kim4, Woonjin Jun1,2  
1Human Ecology Research Institute, Chonnam National University, Korea, 2Division of Food and Nutritional Science, Chonnam National University, Korea, 3SDC Research & Development Center, Korea, 4Department of Biofood Analysis, Korea Bio Polytechnic, Korea

The aim of this study was to evaluate the effects of ethanol extract of Sasa borealis leaves (SBE) derived from Damyang region on oxidative metabolism in mice. In previous study, the SBE at a dose of 250 mg/kg/day body weight was exhibited the enhancing performance on exhaustive swimming following administration of 21 days. In the present study, we evaluated antioxidant enzyme and oxidative metabolism by mRNA expression using RT-PCR. SBE potentially enhanced mRNA expression of citrate synthase (CS), carnitine palmitoyltransferase (CPT1), and β-hydroxyacyl coenzymes A dehydrogenase (β-HAD) in skeletal muscle. The mRNA expression of catalase (CAT), glutathione peroxidase (GPX), and superoxide dismutase (SOD) were elevated in SBE administered mice. These results suggest that the SBE might be used as an effective agent to ameliorate the physical exhaustion by facilitating the energy-generating metabolic gene and enhancing endogenous antioxidants.

Productivity and Quality Characteristics of Essential Oil for Each Part of Ginger (Zingiber officinale Roscoe) Based on Steam Distillation Method

Gyeong Suk Jo*, Bong Yun Oh, You-Seek Lee, Kyung-Ju Jung  
Jeollanamdo Agricultural Research and Extension Service, Food & Farm Management Research Institute, Korea

Essential oil of ginger (Zingiber officinale Roscoe) is a natural essential oil that is widely used in the Eastern and Western world for medical purpose, aromatherapy and food flavoring to treat digestive disorders, alleviate muscular pain from physical and mental stress, prevent aging, remove migraine, and facilitate blood circulation. In this study, essential oil productivity was reviewed for each part of ginger to secure production possibility for essential oil of ginger using domestic ginger. For whole plant (stem and leaf) and root of ginger harvested in October, moisture content of each part of ginger prior to extraction was 94.3% for whole plant, 67.5% for root, and 7.8% for dry root. Essential oil production using steam distillation method was 7 mL/10 kg for whole plant, 14 mL/10 kg for root, and 33 mL/10 kg for dry root. Ginger oil had greenish yellow color, and ginger oil of dry root was a liquid of light orange-brown color. All essential oils of ginger were characterized by spicy flavor similar to ground black pepper, and this flavor was stronger in ginger root than whole plant.

Effects of Undaria pinnatifida on Ethanol-induced Liver Damage In vitro

Haneul Jo*, Heesun Jeong, Jeongmin Lee1, Kwuntaek Hwang2, Su-il Kim2, Dasom Lee, Hyunmi Lee, Woojin Jun  
Division of Food and Nutrition Science, Chonnam National University, Korea, 1Department of Medical Nutrition and Clinical Research Institute, Kyung Hee University, Korea, 2Department of Food and Nutrition, Nambu University, Korea, 3Marine Biotechnology Research Center, Korea

In the present study, we examined the free radical scavenging activities and the protective effects of hot water (UPW), 10% ethanol (UPE10), and 70% ethanol (UPE70) extracts from Undaria pinnatifida against alcoholic liver damage in HepG2 cells transfected with human CYP2E1 (HepG2/2E1). UPE70 possessed the higher contents of both total phenolic compounds and flavonoids than UPW and UPE10. Also, UPE70 exhibited relatively high free radical scavenging activities on ABTs and DPPH. UPW and UPE10 showed no cytotoxicities up to 500 μg/mL and UPE70 showed cytotoxicities up to 100 μg/mL. The extract from Undaria pinnatifida exhibited the hepatoprotective activity. Combined together, Undaria pinnatifida extract was confirmed to possess the free radical scavenging and hepatoprotective potentials.
Effect of 50% Ethanolic Extract from Canavalia gladiata DC. on Endurance Exercise Capacity in Mice

Heesun Jeong*, Yanghee You1, Kyungmi Kim2, Eunjoo Cho, Jinyoung Kim3, Minseok Cha4, Woojin Jun
Division of Food and Nutritional Sciences, Chonnam National University, Korea, 1Human Ecology Research Institute, Chonnam National University, Korea, 2Department of Biofood Analysis, Korea Bio Polytechnic, Korea, 3Division of Nutrition and Metabolism Research, Korea Food Research Institute, Korea, 4Division of Food and Nutrition, Suwon University, Korea

The objective of this study was to investigate the effect of the 50% ethanol extract from Canavalia gladiata DC. on endurance exercise capacity on swimming in mice. For the endurance exercise capacity assay, mice were divided into two groups; Exercise control + distilled water (Control) and Exercise + CGE 800 mg/kg body weight (CGE). Exhaustive swimming time in CGE group was increased 1.7 fold as compared to the Control group. Blood lactate was decreased 0.5 fold as compared to the Control group. Also, blood NEFA compared to the Control group. Blood lactate was decreased 0.8 fold as compared to the Control group. These findings suggest the endurance exercise capacity of mice administrated CGE could be enhanced by delaying the accumulation of lactate, saving glycogen, and elevating the antioxidant defense activities.

Codium fragile Extracts Suppresses Preadipocyte Differentiation and Adipogenesis through Down-regulation of PPAR and C/EBPs

Jeongjin Park1,2, Yanghee You1, Yoo-Hyun Lee3, Jeongmin Lee4, Yongjoo Kim3, Ok-Kyung Kim2, Su-il Kim4, Woojin Jun1
1Division of Food and Nutritional Sciences, Chonnam National University, Korea, 2Human Ecology Research Institute, Korea, 3Department of Food and Nutrition, Suwon University, Korea, 4Department of Medical Nutrition, Kyung Hee University, Korea

Obesity is a major risk factor associated with the development of various disease including hypertension, coronary heart disease, and type 2 diabetes. Therefore, many studies are focusing on the development of anti-obesitic agents. In this study, we found that 70% ethanol extract of Codium fragile (CFE70) reduces lipid accumulation in 3T3-L1 adipocytes. When cytotoxicities of CF extract was determined, CFE70 showed no cytotoxicity up to 200 μg/mL. The accumulation of triacylglycerol in 3T3-L1 adipocytes decreased in cells treated with CFE70 versus those in untreated cells by Oil Red O staining. In order to understand the anti-adipogenic effect of CFE70, we studied the changes in the expression of several adipokytokines of 3T3-L1 cells by CFE70. In the cells, both PPAR and C/EBPs were reduced by the treatment of extracts from CFE70. Our data indicated that the treatment of CFE70 contained the anti-adipogenic effects on 3T3-L1 cells. These results suggest that the CFE70 is expected to efficiently reduce adipogenesis in adipocytes into preadipocytes.

Baicalein Ameliorates Allergic Symptoms through Inducing Regulatory T Cells in a Mouse Model of Food Allergy

Hye-Jeong Seo*, Hee Soon Shin1, Sun Young Jung, Dea-Won Choi, Da-Ae Kwon1, So-Young Lee3, Ji-Eun Eom1, Dong-Hwa Shon
Division of Functional Food Research, Korea Food Research Institute, Korea, 1Division of Nutrition and Metabolism Research, Korea Food Research Institute, Korea

Regulatory T cells (Treg) are related to maintaining immune homeostasis and suppressing hyper immune responses. Forkhead box protein3 (Foxp3)-expressing Treg cells are able to inhibit Th1, Th2, and Th17 immune responses. Baicalein is one of the typical flavonoids in traditional herbal medicine Scutellaria baicalensis. In this study, we investigated whether baicalein induces differentiation of Treg cells and suppresses the symptoms in a OVA-induced food allergy. Baicalein significantly increased the population of Foxp3+ CD4+ T cells and mRNA expression of Treg related factors such as CTLA4, Granzyme B and AhR from naive CD4+ T cells. In the mouse food allergy model, baicalein alleviated the symptoms (diarrhea and anaphylactic reaction) and suppressed production of the total IgE, IgG1 and mCP1 in sera. Furthermore, the administration of baicalein down-regulated cytokines and transcriptional factors in mesenteric lymph nodes (mLN). However, administration of baicalein increased Foxp3 mRNA expression in mLN. Therefore, these results demonstrated that baicalein could induce differentiation of Treg cells and ameliorate allergic symptoms in a OVA induced food allergy model.

Baicalein-induced Apoptosis in HL60 Human Leukemia Cell Lines

Boohyeong Byun*, Yo-Sic Yoon1
Department of Oriental Medicine, Daegu Haany University, Korea, 1Department of College of Medicine, Chung-Ang University, Korea

Baicalein, one of the major flavonoid in Scutellaria baicalensis, has been known for its effects on cell proliferation, and apoptosis on many tumor cell lines. Most biological effects of baicalein are thought to be attributed to its antioxidant and prooxidant activities. In this report, baicalein was found to induce apoptosis in HL60 human promyelocytic leukemia cell line. Baicalein treatment induced DNA fragmentation and typical morphological features of apoptosis. To elucidate the mechanism of baicalein-induced apoptosis, the activities of the members of caspase family were measured. Interestingly caspase 2, 3, and 6 were significantly activated, whereas caspase 1, 8, and 9 were not activated, suggesting selective involvement of specific caspasess. Further, treatment with caspase inhibitors also support the involvement of caspase 2 in apoptosis process. Although it has been reported that baicalein can induce apoptosis through many caspase pathways, this is the first report that caspase 2 instead of caspase 9 pathway may be important step in apoptosis on HL60 cell line.
Comparison of Antioxidative Properties on Methanol Extracts of Asparagus cochinchinensis with Different Parts

Kyoung Yoon Koo*, So Hae Park, Won Baek Kim, Jiho Hwang, Bo Ram Kim, Minji Kim, Heeseob Lee
Pusan National University, Korea

This study was performed to compare the antioxidative activities of methanol extracts from Asparagus cochinchinensis with different parts (whole root, flesh and root bark). To evaluate the antioxidative properties of their methanol extracts, DPPH radical, nitrite scavenging, hydroxyl radical, ABTS radical scavenging activity and total flavonoid and polyphenol contents were measured. Among them, root bark showed the highest level in DPPH radical, nitrite scavenging and the ABTS radical scavenging activity, which is comparable to those of BHA and ascorbic acid, on the other hand, flesh showed the lowest level. The root bark extract had also the highest hydroxyl radical scavenging activity, which is comparable to those of trolox. Further total flavonoid and polyphenol contents of root bark extract were highest among methanol extracts. Based on these results, it is suggested that root bark of Asparagus cochinchinensis could be a good candidate for functional materials in food and pharmaceutical industries.

Efffect of Mixed Extracts Containing Houttuynia cordata on 5-Alpha Reductase Activity

Hea Mi Sung*, Ji-hyang Wee, Hyun Jung Jung, Suk Jung Kim, Eun-Jung Kim¹, Jung-Yeoil Choi², Gye-Yeop Kim¹
Jeonnam Bioindustry Foundation, Food Research Institute, Korea,¹ Department of Physical Therapy, Dongshin University, Korea

The number of men who suffer hair loss and hair thinning is increasing in accordance with changes in lifestyle and nutritional balance. Therefore, it is of great importance to develop new therapies to prevent hair loss and to enhance hair growth. Within the hair loss, testosterone (T) convert to dihydrotestosterone (DHT) by 5-alpha reductase. This study was investigated the in-vitro effect of mixtures of Houttuynia cordata extract (HCE), green tea extract (GTE) and Phyllanthus emblica extract (PEE) on 5-alpha reductase. HCE, GTE and PEE extracts were mixed according to the following ratio; HCE:GTE:PEE (2:1), HCE:GTE:PEE (2:1:1). HCE, GTE and PEE were extracted for 2 h at 60°C in 70% ethanol. Among the mixed extracts, HCE:GTE:PEE (1:1:1) significantly inhibited 5-alpha reductase type I activity by 53% at a concentration of 100 μg/mL compared with HCE:GTE (25%). These results suggest that HCE:GTE:PEE (1:1:1) has inhibiting 5-alpha reductase activity and it is a potent candidate for the prevention of hair loss.

Optimized Combination of Green Tea Catechins for Minimized Cytotoxicity and Maximized Activity in Inflammation

Minchae Kim*, Cheng Bao, Sangmun Shin¹, Hyang Sook Chun, Hong Jin Lee
Department of Food Science and Technology, Chung-Ang University, Korea,¹ Industrial & Management Systems Engineering, Dong-A University, Korea

Multicomponent of natural products are possible to possess both toxicity and beneficial effects. In this study, we employed customized statistical design to investigate interactions between green tea catechins (epigallocatechin gallate (EGCG), epigallocatechin (EGC), epicatechin gallate (EGC), epicatechin (EC), gallocatechin and catechin), and draw the optimal combination exerting minimized cytotoxicity and maximized nitric oxide (NO) inhibitory activity. The cytotoxicity of catechins against liver cells was tested using lactate dehydrogenase (LDH) assay and the inhibitory effect on NO production was determined in lipopolysaccharide-induce macrophage. According to the experimental design, 28 cases of experiments at two concentrations were performed, re-confirmed with detailed combination, and finally validated by LDH and NO assays. Based on that, we found that EGCG and gallocatechin combination out of 6 catechins significantly enhanced NO inhibitory activity and reduced cytotoxicity. To our best knowledge, it is the first report providing the platform for finding the optimized combination of food components exerting enhanced efficacy and reduced toxicity at the same time.

Baicalein from Scutellaria baicalensis Ameliorates Food Allergy by Enhancement of the Intestinal Barrier Function

Sun Young Jung*, Hee Soon Shin¹, Hye-Jeong See, Dae Woon Choi, Da-Ae Kwon¹, Jeong-Ryoung Do, Su-Yeon Back, Min-Yu Chung², Dong-Hwa Shin
Division of Functional Food Research, Korea Food Research Institute, Korea,¹ Division of Nutrition and Metabolism Research, Korea Food Research Institute, Korea

Skullcap (Scutellaria baicalensis) has been widely used as a traditional medicine. Destruction of intestinal barrier abnormally increases permeability of allergens, resulting in occurrence of food allergy. The aim of this study was to assess the effects of skullcap extract on intestinal barrier function in vitro and in vivo. We measured the transepithelial electrical resistance (TEER) and amounts of permeated ovalbumin (OVA). Treatment of skullcap increased TEER value and decreased OVA flux by increasing the mRNA expression of tight junction (TJ) proteins. We also investigated the effects of skullcap in a mouse model of food allergy. As a result, food allergic symptoms (body temperature decline and anaphylactic response) were ameliorated by oral administration of skullcap. Baicalein, baicalin and wogonin have been known as the active compounds of skullcap. Among them, baicalein enhanced barrier function, but not the others. In particular, baicalein administration recovered damaged TJ and alleviated food allergic symptoms in OVA-induced food allergy. These results demonstrated that baicalein from skullcap might ameliorate food allergy by enhancing the intestinal barrier function.
N-Acetyl-L-cysteine Protects Tight Junction against Arsenic-induced Claudin Loss in Intestinal Epithelial Cells
Chang Hee Jeong*, Haewon Kim, Jinsil Seok, Sung Gu Han
Department of Food Science and Biotechnology of Animal Resources, College of Animal Bioscience and Technology, Konkuk University, Korea

Arsenic can induce toxicity and oxidative stress in cells. Oxidative stress induces disruption of tight junction (TJ) including claudins. Studies have shown that N-acetyl-L-cysteine (NAC) reduces reactive oxygen species and increases glutathione levels in cells. Accordingly, we examined the effects of NAC in arsenic-induced TJ damage and the associated mechanisms. Human colorectal adenocarcinoma cells (HT-29) were pretreated with NAC (5 or 10 mM, 1 h), followed by arsenic trioxide exposure (40 μM, 12 h). Arsenic decreased expression of TJ proteins (i.e., claudin-1 and claudin-5), while NAC prevented arsenic-induced claudin loss. Arsenic increased activation of nuclear factor (erythroid-derived 2)-like 2 (Nrf2) and heme oxygenase-1 (HO-1) expression, compared to control. However, treatment of NAC decreased Nrf2 and HO-1 via Erk1/2. Co-treatment of NAC and arsenic also decreased Nrf2 and HO-1. Results suggest that arsenic can induce oxidative stress which results in loss of claudins and up-regulation of Nrf2 and HO-1. NAC modulates cellular redox status which leads to decrease of arsenic-induced oxidative stress and TJ damage.

Cognition-enhancing Effect of Ganjjang (Korean Soy Sauce) Supplemented with Black Garlic Extracts
Su Jin Kang*, Ji Yeon Seo, Ji Sun Oh, Gwang Rae Jo, Jin Ho Jang, Hye Lin Seo, Ga In Jeong, Sung Hee Ju, Jung-Hye Shin*, Kyung Choo, Jeong Hwan Kim*, Jong-Sang Kim
School of Food Science and Biotechnology, BK21 Plus Creative Innovation Group for Leading Future Functional Food Industry, Kyungpook National University, Korea, *Namhoo Garlic Research Institute, Korea, *Department of Food Science, Gyeongnam National University of Science and Technology, Korea, *Division of Applied Life Science BK21, Graduate School, Gyeongsang National University, Korea

Black garlic is a type of caramelized garlic and has been reported to contain various bioactive compounds. In this study, we investigated the antioxidant and cognitive enhancing activities of ganjjang supplemented with black garlic extracts. The antioxidant activity of ganjjang supplemented with black garlic extracts was assessed by 2,2-diphenyl-1-picrylhydrazyl (DPPH) free radical scavenging capacity, ferric ion reducing antioxidant power (FRAP) assay, 2,2'-azinobis-(3-ethylbenzothiazoline-6-sulfonic acid) (ABTS) cation radical scavenging activity, and oxygen radical absorbance capacity (ORAC) assays and flavonoid contents. In addition, effect of black garlic ganjjang on animal behavior was investigated by passive avoidance, Y-maze, and Morris water maze tests. The antioxidant activity of ganjjang slightly enhanced with increased concentration of black garlic extract. Ganjjang supplemented with black garlic extracts was more effective in improving the memory and cognition deficits induced by scopolamine treatment than normal ganjjang. The underlying mechanism for cognitive enhancing effect of ganjjang supplemented with black garlic extract will be discussed.

Trans-vaccenic Acid Decreases Proliferation of Vascular Smooth Muscle Cells
Haewon Kim*, Chang Hee Jeong, Sung Gu Han
Department of Food Science and Biotechnology of Animal Resources, College of Animal Bioscience and Technology, Konkuk University, Korea

Cardiovascular disease is the leading cause of human death in developed countries. Consumption of trans-fatty acids has been linked to increased risk of cardiovascular diseases, such as atherosclerosis. Although artificially hydrogenated trans-fatty acids are known to induce cardiovascular diseases, it is relatively unclear whether ruminant trans-fats, such as trans-vaccenic acid (TVA) is associated with the diseases. Therefore, we investigated the effects of TVA in vascular smooth muscle cells in comparison to elaidic acid (EA). Rat aortic vascular smooth muscle cells (VSMC) were treated with TVA, conjugated linoleic acid (CLA) and EA at 0-400 μM for 24 h. Cell proliferation was increased with the treatment of EA (10-200 μM), but this effect was not observed in cells treated with TVA and CLA. Both TVA and CLA did not alter cell migration while EA enhanced migration of cells. CDK6 expression was increased in cells treated with EA, but not with TVA. PCNA expression was decreased by treatment of TVA. Results suggest that TVA can decrease proliferation and migration of vascular smooth muscle cells via down-regulation of CDK and PCNA.

Tomato Extract Nanoemulsion and In vitro Release Properties
Saehoon Kim*, Hye Young Jo, Xiangpeng Meng, Sanghoon Ko
Department of Food Science and Technology, Sejong University, Korea

The study aimed to establish a procedure for preparation of tomato extract nanoemulsion and to investigate its effect on its physicochemical properties. In order to prepare tomato extract nanoemulsion, tomato extract (Lyco-O-Mato 6% lycope-nine), olive oil, and oleic acid were mixed at 30°C. Aqueous phase were prepared by adding Tween 80 as an emulsifier to distilled water. Subsequently tomato extract was slowly introduced to the aqueous phase. The emulsion was then sheared homogenized at 3,500 rpm for 10 min, and sonicated for 10 min. Finally the emulsion passed through a high pressure homogenizer six times at 750 MPa. Average droplet size and zeta potential value of the tomato extract nanoemulsion were in the range from 134.9±12.28 nm and -41.46±4.6 mV, respectively. The in vitro release property was determined to demonstrate applicable potential of tomato extract nanoemulsion in the simulated gastric condition. The tomato extracts was protected well from the degradation under the simulated gastric condition. This tomato extract nanoemulsion can be utilized for encapsulating various bioactive food materials and for beverage applications.
**P11 -252**

**Antioxidant and Neuroprotective Effects of Compound K: Involvement in Activation of Nrf2/Antioxidant Enzymes**

Jiyeon Seo*, Sung Hee Ju, Su Jin Kang, Gwang Rae Jo, Hye Lin Seo, Go In Jeong, Jin Ho Jang, Ji Sun Oh, Seung-Kwon Lee¹, Jong-Sang Kim

School of Food Science and Biotechnology (BK21 plus), Kyungpook National University, Korea, ¹Ginseng Research Team, Overseas Business Division, Ilhwa Co., Ltd., Korea

It has known that ginsenosides with diol present in ginseng are converted to compound K by intestinal microbiota, improving health beneficial effect. In this study we investigated protective effects of compound K against neurotoxicity induced by treatment of excess glutamate in mouse hippocampal HT22 cell line. Compound K effectively scavenged 2,2'-azinobis-(3-ethylbenzothiazoline-6-sulfonic acid (ABTS) cation radical, inhibited lipid peroxidation in mouse brain tissues, suppressed reactive oxygen species production by glutamate in HT22 cell line. In addition, it was found that compound K increased the expression of Nrf2 and its downstream antioxidant enzymes. In conclusion, the present results demonstrate that compound K protects neuronal cells from oxidative injury induced by glutamate through the induction of Nrf2 and antioxidant enzymes.

**P11 -253**

**Dual Effect of Black Rice (Oryza sativa L.) Extracts on Osteogenesis and Adipogenesis**

Byunghyun Jang*, No-Joon Song, So-Mi Kwon, Suji Kim, Seo-Hyuk Chang, Kye-Won Park

Department of Food Science and Biotechnology, Sungkyunkwan University, Korea

Osteoporosis, an age associated skeletal disease, exhibits increased adipogenesis at the expense of osteogenesis from common osteoprotic bone marrow cells. To search substances preventing osteoporosis, extracts from edible plants were treated during osteoblast differentiation of mesenchymal C3H10T1/2 cells. Oryza sativa L extracts (OSE) were identified as possible osteogenic inducers. OSE stimulated ALP activity in C3H10T1/2 and primary bone marrow cells. Similarly, OSE increased mRNA expression of ALP and osterix. Oral administration of OSE in OVX rats prevented the decrease in bone density and strength. Additionally, OSE also inhibited adipocyte differentiation of mesenchymal C3H10T1/2 cells. OSE decreased mRNA expression of PPARγ and AP2. OSE prevented increases in body weight and fat mass in high fat diet fed obese mice, further suggesting the dual effects of OSE in anti-adipogenesis and pro-osteogenesis. Taken together, these data suggest that OSE is an inducer of osteoblast differentiation and inhibitor of adipocyte differentiation. OSE can possibly be used as functional foods to protect against age related osteoporosis and diet induced obesity.

**P11 -254**

**Anti-cancer Effect of Soybean-derived Glyceollins by Induction of Phase-II Detoxifying Enzymes in Colorectal Cancer Cells**

Gwang Rae Jo*, Ji Yeon Seo, Su Jin Kang, Jin Ho Jang, Ga In Jeong, Hye Lin Seo, Sung Hee Ju, Jisun Oh, Jong-Sang Kim

School of Food Science and Biotechnology, BK21 Plus Creative Innovation Group for Leading Future Functional Food Industry, Kyungpook National University, Korea

Glyceollins, a family of phytoalexins, are de novo synthesized from daidzein in the soybean upon exposure to some types of fungus. Glyceollins have been reported to induce antioxidant and phase II detoxifying enzymes and thereby prevent some types of tumors induced by chemical carcinogens. However, it is not well established yet whether glyceollins could induce phase II detoxifying enzymes and prevent colon tumorigenesis. In this study we investigated inhibitory effects of glyceollins on the proliferation of colorectal cancer cell lines such as HCT116 (p53⁺⁻), HT29 (p53⁻), and Caco-2(p53⁺) by MTT assay and DAPI staining. In addition, we investigated whether glyceollins induce phase II detoxifying enzyme through Nrf2 signaling pathway. While glyceollins had marginal effect on the proliferation of colon cancer cells, they were found to induce phase II detoxifying enzymes in dose-dependent and cell type-specific manners, suggesting their potential preventive activity against colon tumorigenesis.

**P11 -255**

**Immunostimulating Activity and Intracellular Signaling Pathway of Pectic Polysaccharide Purified from the Fermented Brown Rices**

Dae-Young Lee*, Hye-Ryung Park¹, Kwang-Soon Shin¹

¹Department of Food Science & Biotechnology, Kyonggi University, Korea, ²Department of Integrated Biomedical and Life Science, Korea University, Korea

The present study was designed to elucidate immunostimulating function and intracellular signaling pathway for macrophage activation by a pectic polysaccharide purified from crude polysaccharide of fermented brown rices (FBR-0). FBR-4a enhanced the production of cytokines such as interleukin-6 (IL-6), tumor necrosis factor-α (TNF-α) and nitric oxide (NO) production by RAW 264.7 cell lines. Also FBR-4a augmented the mRNA expression of IL-6 and inducible nitric oxide synthase (iNOS) in a dose-dependent manner. On the other hand, FBR-4a strongly induced the phosphorylation of MAPKs (JNK, ERK, p38) and NF-κB pathways, activating macrophages through the MAPKs and NF-κB signaling pathways.
Development of Antioxidant-rich Fruit Jam Using Domestic Grapes and Various Berries

Jin Ho Jang*, Ji Yeon Seo, Su Jin Kang, Gwang Rae Jo, Sung Hee Ju, Hye Lin Seo, Ga In Jeong, Ji Sun Oh, Jae-Sik Kim1, Jong-Sang Kim
School of Food Science and Biotechnology, BK21 Plus Creative Innovation Group for Leading Future Functional Food Industry, Kyungpook National University, Korea, 1Podomaul Co., Ltd., Korea

It is necessary for food industry to satisfy consumer demand for health benefit as well as taste. In this study, we developed 13 kinds of jams using domestic grape and various berries, and determined their antioxidant properties. Including phenolic and flavonoid contents, radical scavenging activity, effect on intracellular ROS level, and thiobarbituric acid reactive substances (TBARS) inhibition assay. Jams prepared for health benefit as well as taste. In this study, we developed 13 kinds of jams using domestic grape and various berries, and determined their antioxidant properties. Including phenolic and flavonoid contents, radical scavenging activity, effect on intracellular ROS level, and thiobarbituric acid reactive substances (TBARS) inhibition assay. Jams prepared with Rubus coreanus or Vaccinium spp. (Blueberry) contained the high levels of phenolics and flavonoids. Antioxidant-rich jam (prepared in Podomaul, Inc.) and a jam made of Citrus unshiu Marcov. (Tangerine) scavenged radicals efficiently. In conclusion, jams prepared with Rubus coreanus or Vaccinium spp. (Blueberry), Citrus unshiu Marcov. (Tangerine) and antioxidant-rich jam (made in Podomaul, Inc.) showed relatively higher antioxidant activity among testsamples.

Inhibitory Effect of Ginsenoside Rg3 on Metastasis of B16F10 Melanoma Cells

Seul-gi Lee*, Ju-Ock Nam
Department of Food Engineering, Kyungpook National University, Korea

Ginsenoside Rg3 is a bioactive ginseng constituent that has been reported to have various biological effects, including anti-inflammatory and anti-metastatic activity. Metastasis is one of the most important factors related to anti-cancer therapeutic efficacy in patients with melanoma. However, the molecular mechanism underlying the anti-metastatic effects of Rg3 in malignant melanoma has not been fully elucidated. In this study, we demonstrated that Rg3 effectively inhibited metastasis of B16F10 melanoma cells. We found that Rg3 significantly suppressed B16F10 cell migration in a dose-dependent manner. We also demonstrated that Rg3 inhibited B16F10 cell colony formation in a colony formation assay. Mechanistically, we demonstrated that Rg3 suppressed B16F10 cell metastasis by inhibiting MMP-13 expression. These results showed that Rg3 suppressed metastasis of B16F10 melanoma cells through regulation of MMP-13 expression. Importantly, down-regulation of MMP-13 expression may influence the migratory capabilities of melanoma cells. Therefore, Rg3 is a potential therapeutic candidate that could be used to treat patients with metastatic melanoma.

Enhanced Hepatic Protective Effect of Fish Protein Hydrolysate Using Maillard Reaction with Ribose via Nrf2 Pathway

Sung-Yong Yang*, Min Cheol Pyo, Kwang-Won Lee
Department of Biotechnology, Major in Systems Food Biotechnology, Korea University Graduate School, Korea

Halibut (Hippoglossus hippocampus) is used in sushi and slices of raw fish in the world. Recently, several studies have reported on the utilization of fish byproduct by enzymatic hydrolysis for the recovery of various valuable components and fish protein hydrolysates have been shown to possess antioxidant activity. Also recently studies demonstrated that maillard reaction products (MRPs) play an important role in functional activities such as antioxidant. Therefore, we investigated the maillard reaction products with ribose for enhancing antioxidant activity of fish protein hydrolysate by-product. In our results, maillard reaction product of fish protein hydrolysate (MFPH) increased cell viability against t-BHP-induced oxidative stress. And 100 μg/mL of MFPH increased the glutathione content, γ-GCL and HO-1 mRNA expression compared with non-maillard reaction product in HepG2. Also, MFPH phosphorylated ERK and JNK MAPK proteins and increased nucleic translocation of Nrf2. Therefore, we concluded that MFPH, which had enrich hepatic protective activity against t-BHP-induced oxidative damage than non-Maillard reaction fish protein, can be used as a functional dietary source.

Ethanol and Hot Water Extract and Crude Polysaccharide Fraction Isolated from Red Cabbage Induce Immunostimulating Activities

Bong-Shin Kwak*, Hoon Kim1, Kwang-Soon Shin
Department of Food Science & Biotechnology, Kyonggi University, Korea, 1Department of Integrated Biomedical and Life Science, Korea University, Korea

The present study was designed to estimate immunostimulating activities in vitro of ethanol extract (RCEE), hot water extract (RCHW) and crude polysaccharide (RCWP). Three different samples did not show any cytotoxicity on murine peritoneal macrophage cells, Colon 26-M3.1 mouse colon cancer cell line and B16BL6 mouse lung cancer cell line. In an in vitro cytotoxicity using human cell lines, three different samples had no effect human colon cancer cells such as HT-29, SW-620, and human lung cancer cells such as A549, NCI-H460. RCWP showed a higher activity than other samples for lymphocyte proliferation. Anti-complementary activity of RCWP was higher than that of RCHW. Murine peritoneal macrophages stimulated by RCWP showed enhanced production of various cytokines such as tumor necrosis factor (TNF)-α, interleukin (IL)-6 and IL-12. In an in vitro assay for intestinal immune modulating activity, RCWP showed a higher bone marrow cell-proliferation activity through Peyer’s patch cells at a dose 200 μg/mL. These results indicate that crude polysaccharide fraction in red cabbage has a potential for enhancing macrophage functions, lymphocyte proliferation and intestinal immune system.
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**Polysaccharide from the Byproducts of Starch Manufacturing Industry Activates Macrophages via MAPK and NF-κB Signal Pathways**

Sue Jung Lee*, Ho Lee, Kwang-Soon Shin  
Department of Food Science and Biotechnology, Kyonggi University, Korea

To develop the new physiologically active polysaccharide from Corn steep liquor (CSL), a major by-product of the corn steeping process, crude polysaccharide (CBP-0) was isolated by controlled ethanol precipitation, and elucidated its macrophage-stimulating activity and intracellular signaling pathway for CBP-0-induced macrophage activation using RAW 264.7 cells. Component sugar analysis indicated that CBP-0 consisted of at least 9 different sugars, being characteristic of hemicellulose. CBP-0 increased the production of interleukin (IL)-6, tumor necrosis factor (TNF)-α and nitric oxide (NO) by RAW 264.7 cells, dose-dependently through the phosphorylation of MAPK and p65, a subunit of NF-κB. Also TNF-α production was largely inhibited by the treatment of SP6001, via JNK, ERK, and NF-κB pathways. These results suggest that IL-6, TNF-α and NO production by CBP-0 may be regulated through the phosphorylation of MAPK and p65, subunit of NF-κB, and especially TNF-α production is largely regulated via JNK, ERK, and NF-κB pathways.

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**Inhibitory Effect of Resveratrol on Adipocyte Differentiation through Controlling Reactive Oxygen Species via Regulation of NADPH Oxidase 4 Complex in 3T3-L1 Cell Model**

Dae-Kun Lee*, Do-Kwon Yun, Fang-Fang Wang, Ji-Eun Park, Myung-Hee Kang, Young-In Kwon, Hae-Dong Jang  
Department of Food and Nutrition, Hannam University, Korea

In some studies, nontoxic amounts reactive oxygen species (ROS) generation may play a crucial role as secondary messenger in signaling pathways of differentiation process of various cells. In this study, the suppressive effect of resveratrol on generation of ROS in adipocyte differentiation process was investigated using pre-adipocyte 3T3-L1 cells. The inhibitory effect of resveratrol on lipid accumulation dose-dependently increased between 10 and 50 μM by Oil Red O staining. The intracellular ROS generation increased to its highest level within 2 days and then declined in during adipocyte differentiation for 8 days. The suppressive effect of resveratrol on ROS generation dose-dependently increased between 10 and 50 μM via regulation of NADPH oxidase 4 (Nox4) complex in adipocyte differentiation for 2 days. These results indicate that resveratrol plays a role as an inhibitory agent on adipocyte differentiation by the decrease of ROS generation via regulation of NOX 4 complex. Therefore, we suggest that ROS may be a critical factor of inhibitory effect of resveratrol on adipocyte differentiation, further implying ROS as a prime target of obesity control.

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**Inhibitory Effect of Caffeic Acid Phenethyl Ester in RANKL-induced Osteoclast Differentiation through Controlling Reactive Oxygen Species**

Yong-Beom Kwon*, Sang-Hyun Lee, Dae-Kon Lee, Pulina Belousova, Myung-Hee Kang, Young-In Kwon, Hae-Dong Jang  
Department of Food and Nutrition, Hannam University, Korea

Caffeic acid phenethyl ester (CAPE) is a natural phenolic chemical compound, which has been found from propolis in honeybee hives, and reported the potential effect on reducing carcinogenic incidence, acute immune and inflammatory responses. The purpose of this study is to investigate the suppressive effect of CAPE in RANKL-induced osteoclast differentiation by control of ROS production. The dose-dependent inhibitory effect of CAPE on RANKL-induced osteoclast differentiation and bone resorption activity was observed using TRAP staining and bone resorption assay. In addition, CAPE dose-dependently suppressed O₂⁻ production and NADPH oxidase 1 (Nox1) activation. Furthermore, according to the measurement of mitochondrial membrane potential, the disruption of the electron transport chain system was obviously suppressed by CAPE in a dose-dependent manner. Consequently, these results indicate that the suppressive effect of CAPE in RANKL-induced osteoclast differentiation and bone resorption activity is likely to be attributed to the control of ROS production through Nox1 and mitochondria.
Black Rice (*Oryza sativa, Heukmi*) Extracts Activate Osteogenesis while Suppressing Adipogenesis in Mesenchymal C3H10T1/2 Cells

Se-Young Kim*, Yeon-Ji Kim, Young-Jae An, Sung-Joon Lee
Department of Biotechnology, Graduate School of Biotechnology, Korea University, Korea

We investigated the effects of black rice extracts (BREs) named Heukmi on osteogenic and adipogenic differentiation in C3H10T1/2 mesenchymal stem cells. BREs stimulate osteogenesis, enhancing the mRNA expression of runt-related transcription factor 2 and alkaline phosphatase (ALP), increasing ALP protein expression and cellular enzyme activity, thus elevating intracellular calcium deposition. BREs also suppressed adipogenesis by downregulating peroxisome proliferator-activated receptor-γ, CCAAT-enhancer-binding protein (C/EBP)β and C/EBPα, major regulators in adipogenesis. In cells stimulated with BREs, the rate of fatty acid synthesis was significantly decreased while there was no effect on the rate of fatty acid oxidation, resulting in reduced of intracellular lipid accumulation. This reciprocal regulation of osteogenesis and adipogenesis by BREs was achieved via regulation of Wnt signaling pathway. BREs enhanced the expression of genes in Wnt signaling pathway, including Wnt3a and β-catenin. Together, these results suggest that BREs significantly enhance osteogenic differentiation and suppress adipogenic differentiation via Wnt signaling.

Ferulic Acid Ethyl Ester Suppression LPS-induced iNOS Expression by Preventing ROS Production and Down-regulating the MAPK/NF-κB and AP-1 Signaling Pathways in RAW 264.7 Cells

Min-Ji Seo*, Sang-Hyun Lee, Fang-Fang Wang, Yong-Beom Kwon, Myung-Hee Kang, Young-In Kwon, Hae-Dong Jang
Department of Food and Nutrition, Hannam University, Korea

Ferulic acid ethyl ester (FAEE) is an ester derivative of ferulic acid and the latter is known for its anti-inflammatory properties. Previous studies have shown that ferulic acid is a phenolic compound and the treatment of disorders linked to oxidative stress and inflammation. FAEE is lipophilic and is able to easily penetrate into lipid bilayer. Therefore, the present study was designed to investigate the anti-inflammatory effects of FAEE and its underlying mechanism in RAW264.7 cells. FAEE significantly inhibited LPS-induced NO production in RAW264.7 cells concomitantly with the suppression of iNOS expression. In addition, FAEE pre-treatment attenuates reactive oxygen species accumulation. In addition, FAEE inhibited LPS-induced the activation iκB, IKK and mitogen-activated protein kinases (MAPK) including JNK, ERK and p38 by phosphorylation. Also, the activation of AP-1 in the nucleus and the translocation of NF-κB into the nucleus were abrogated by FAEE. These results suggest that FAEE exhibits anti-inflammatory activity by blocking the activation of MAPKs/IKK and transcription factors, AP-1 and NF-κB, which may be due to down-regulation of ROS production by FAEE.

Protective Effect of Chebulic Acid against Urban Particulate Matter-induced Acute Lung Injury in Alveolar-capillary In vitro Model

Kyung-Won Lee*, Won-Rak Son, Mi-Hyun Nam, Chung-Oui Hong, Kwang-Won Lee
Department of Biotechnology, Major in Systems Food Biotechnology, Korea University Graduate School, Korea

Urban Particulate Matter (SRM1648a) is atmospheric particulate matter collected in an urban area. Exposure to particulate matter (PM) is a significant risk for increased cardiopulmonary vascular morbidity and mortality. We studied the protective effect of chebulic acid against particulate matter disrupts pulmonary epithelial intercellular junction and endothelial barrier permeability through alveolar capillary barrier (blood-air barrier) in *in vitro* model. Human lung microvascular endothelial cell (MVEC) were co-cultivated with human pulmonary type II epithelial cell line on opposite sides of a permeable filter membrane. PM was suspended at medium and characterized for original, water insoluble and water soluble fractions. We verified non-cytotoxicity of PM and chebulic acid using MTT assay. And PM induced time-dependently reactive oxygen species (ROS) generation in MVEC. To analyze changes in epithelial and endothelial cell layer integrity, we use transendothelial electrical resistance measurement. In these results, we concluded that pretreatment of chebulic acid on MVEC reduced PM induced ROS production and blood-air barrier disruption.

Anti-proliferative Effect of Turmeric Fermented with *Bifidobacterium* by Down-regulating IKK/NF-κB Signaling Pathway and Up-regulating Apoptotic Effect through p21-related Cell Cycle Arrest in HCT116 Human Colorectal Cancer Cells

Ji-Eun Park*, Sang-Hyun Lee, Min-Ji Seo, Yong-Beom Kwon, Myung-Hee Kang, Young-In Kwon, Hae-Dong Jang
Department of Food and Nutrition, Hannam University, Korea

Several studies have shown that fermented turmeric (*Curcuma longa*) demonstrated its anti-carcinogenic effects on a variety of cancer models. We investigated anti-proliferative effects and apoptosis using turmeric extract fermented with *Bifidobacterium* in HCT116 cells. MTT assay showed that fermented turmeric (FT) and turmeric (T) have a similar inhibitory effect on HCT116 cells. However, FT was more potent than T as an anti-proliferative effects as indicated by suppression of TNF-α-induced NF-κB activation. According to Annexin V/PI staining, the cell cycle arrest and apoptotic effect of HCT116 cells by FT was stronger than that by T between 300-600 μg/mL. In addition, FT more strongly inhibited the expression of CDK2, CDK4, and cyclin D1 than T and markedly induced the expression of p21 compared to T. Furthermore, the treatment with FT obviously caused to enhance caspase-3 activity and cleavage of PARP compared to T. In conclusion, the fermentation with *Bifidobacterium* can contribute to the anti-proliferative effect of turmeric on HCT116 cells through down-regulation of TNF-α-induced NF-κB activation and up-regulation of apoptosis via p21-related cell cycle arrest.
Effect of Barley Sprout Extract on Ethanol-induced Hangover in Mice

Yeon-Ji Kim*, Su Hyun Hwang, Woo-Duck Seo¹
Sung-Joon Lee
Division of Food Bioscience and Technology, College of Life Sciences and Biotechnology, Korea University, Korea,
¹Department of Functional Crop, National Institute of Crop Science (NICS), Rural Development Administration (RDA),
Korea

We investigated the effect of barley sprout extract (BSE) on ethanol-induced hangover in mice. The ICR mice were orally fed low and high levels of BSE (3.3, 26.6 mg/kg of body weight) 30 min prior to the alcohol administration. Blood alcohol concentrations were decreased significantly in BSE-fed groups compared with controls. The hepatic alcohol metabolizing enzymes, aldehyde dehydrogenase activity was tended to be higher in the high BSE group compared with fed groups compared with controls. The hepatic alcohol weight) 30 min prior to the alcohol administration. Blood ethanol-induced hangover in mice. The ICR mice were orally administered with beverage A, B (19.73 mL/kg of body weight) and C (28.36 mL/kg of body weight) or BSE (102 mg/kg of body weight) before alcohol treatment. Beverage C and BSE significantly reduced blood alcohol concentrations compared with control. These results suggest that administration of BSE is effective on ethanol-induced hangover by enhancing the alcohol clearance.

Ethanol Extracts of Ramulus mori Show Antioxidant Activity and Inhibitory Effect on Adipocyte Differentiation in 3T3-L1 Cells

Seonwook Hwang¹*, Jeong-Keun Kim², Young-Hee Lim¹,³
¹Department of Public Health Science (BK21 PLUS Program), Graduate School, Korea University, Korea, ²Department of Chemical Engineering and Biotechnology, Korea Polytechnic University, Korea, ³School of Biosystem and Biomedical Science, College of Health Science, Korea University, Korea

The antioxidative and anti-obesity effects of ethanol extract of Ramulus mori containing 15.3-18.2% oxyresveratrol (ERMO) were investigated. The antioxidative activity of ERMO was determined by in vitro chemical-based and cell-based methods (DPPH, ABTS, FRAP, ORAC, β-carotene/linoleic assay, HRPO assay, Taurine test, and CAA assay). To investigate the inhibitory effect of ERMO on adipocyte differentiation, 3T3-L1 cells were treated with ERMO for 9 days. Cell viability was measured using WST assay and triglyceride (TG) accumulation in adipocytes was measured using Oil Red O staining. We examined the expression level of several adipogenesis-related genes using quantitative real-time RT-PCR analysis. ERMO showed a high antioxidant effect. ERMO also significantly suppressed adipogenesis in 3T3-L1 cells. Furthermore, intracellular lipid accumulation significantly decreased in 3T3-L1 cells treated with 100 μg/mL ERMO. The results indicate that ERMO might be developed as a health functional food for preventing obesity.

Soybean-derived Glyceollins Inhibit TNF-α-mediated Colon Cancer Cell Proliferation

Hye Lin Seo*, Ji sun Oh, Ji Yeon Seo, Su Jin Kang, Gwang Rae Jo, Sung Hee Ju, Ga In Jeong, Jong-Sang Kim
School of Food Science and Biotechnology (BK21 plus), Kyungpook National University, Korea

Glyceollins are soybean-derived phytoalexins that are accumulated in the seeds in response to various stimuli. Multiple studies have reported anti-inflammatory and anti-carcinogenic functions of glyceollins in vitro and in vivo. However, little is known about beneficial effects of glyceollins on inflammation-induced colon cancer development. This study aimed to investigate the inhibitory effect of glyceollins on colon cancer cell proliferation which may be mediated through macrophage-derived TNFα usingTHP-1 monocyte/macrophage cells. HT-29 colon adenocarcinoma cells were cultured in the absence and presence of glyceollins. TNFα production from THP-1 cells, proliferation of HT-29 cells and cell cycle-related protein levels were examined by various assays, such as ELISA, MTT, western blotting and RT-PCR. Our data showed that glyceollins suppressed TNFα-mediated proliferation of HT 29 cells.

Effects of Antioxidant Activity and Skin Whitening of Barley Sprouts by Ultra High Pressure Extraction

Mee-Kyung Kim*, Dae-Yong Kim¹, Bong-Woo Kim, Young-Duck Lee²
Cosmetic Science and Technology, Seowon University, Korea, ¹Department of Pharmaceutical Science and Engineering, Seowon University, Korea, ²Department of Food Science and Engineering, Seowon University, Korea

Health benefits of barley sprouts include relief from ulcerative colitis, prevention and treatment of cancer, strengthening of immune system and cellular damage, ability to fight addiction and regenerate damaged cells and tissues. This study was investigated the effects of the antioxidant activities and skin whitening by the ultra high pressure extracts (UHPE) of barley sprouts. To compare the extraction yields, hot water extracts, alcohol extracts, ultra sonication extracts, and UHPE were performed. Extraction yield was increased up to 2-6% by extreme process, compare to the other extraction methods. In antioxidant activities of UHPE, DPPH radical scavenging ability, and Ferric reducing antioxidant power was approximately 91.38% and 752.5 μM, respectively, and their values were higher than those of other extracting methods. As the results of skin whitening effects, the inhibition activity of tyrosinase and melanin synthesis was determined to be about 40%. These results indicate that UHPE of barley sprout might be ingredients of nutraceutical and cosmeceutical for skin whitening and antioxidant effects.
Sulfuretin, an Anti-adipogenic Compound, Prevents Obesity in High Fat Diet Induced Obese Mice

Suji Kim*, So-Mi Kwon, No-Joog Song, Seo-Hyuk Chang, Byunghyun Jang, Kye Won Park
Department of Food Science and Biotechnology, Sungkyunkwan University, Korea

Physical inactivity and excess nutrition can cause obesity and metabolic diseases. World epidemic obesity needs continuous attentions to intervene better therapeutic potentials. In this study, the effect of sulfuretin in lipid accumulation in adipocytes and high fat diet fed obese mice was investigated. Sulfuretin decreased lipid accumulation in 3T3-L1 adipocytes and mesenchymal C3H10T1/2 cells. Expression of the adipocyte markers, PPARα, fatty acid binding protein (aP2), adiponectin, and C/EBPα was inhibited by treatment of sulfuretin. Furthermore, anti-adipogenic effects were consistently observed in freshly isolated primary bone marrow cells. Intraperitoneal administration of Sulfuretin in high fat diet-induced obese mice prevented body weight gains, decreased lipid accumulation, and increased energy expenditure resulting in improved glucose tolerance. These data support the possibilities of sulfuretin as a potential bioactive compound for the prevention of obesity and its related metabolic diseases.

Inhibitory Activities of Evening Primrose Seed Oil against Lipid Accumulation in 3T3-L1 Adipocyte

Ga In Jeong*, Ji Yeon Seo, Su Jin Kang, Gwang Rae Jo, Sung Hee Ju, Hye Lin Seo, Jin Ho Kang, Ji Sun Oh, Jong-Sang Kim
School of Food Science and Biotechnology, Chung-Ang University, Korea

Evening primrose seed oil (EPSO) recently received much attention due to its bioactive functions in Korea. It has been reported that EPSO contains linoleic acid, oleic acid, tocopherols and phenolic compounds. The anti-obesity activity of EPSO was assessed by its effect on triacylglyceride (TG) accumulation and growth inhibition in differentiated 3T3-L1 adipocyte. In addition, the protein expressions of peroxisome proliferator-activated receptor (PPAR) gamma and CCAAT/ enhancer-binding protein (C/EBP) alpha were measured by Western blot analysis. Our data suggest that EPSO has the potential to improve blood lipid profile and control body fat accumulation.

Activation of PPAR-α and AMPK by Cyanidin-3-O-glucoside Regulates Hepatic Energy Metabolism by Rewiring Metabolite Profile

Yayaoa Jia*, Chunyan Wu, Yeon-Ji Kim, Yong-Suk Kim¹, Sung-Joon Lee
Department of Biotechnology, Graduate School of Biotechnology, Kyungpook National University, Korea, ¹Department of Food Science and Engineering, Ewha Women’s University, Korea

We investigated the molecular target(s) and the mode of action of cyanidin-3-O-glucoside (C3G). The surface plasmon resonance and time-resolved fluorescence resonance energy transfer analyses showed that C3G directly activated PPAR-α and increased hepatic AMP/ATP ratio, which subsequently induced AMPK. In high-fat-diet (HFD) fed C57BL/6j mice, oral administration of C3G significantly reduced hepatic and plasma triglycerides due to increased hepatic fatty acid oxidation and inhibited fatty acid synthesis. C3G improved insulin resistance, due to AMPK activation, which phosphorylated FoxO1 and CREB to suppress key genes in hepatic gluconeogenesis. Furthermore, hepatic autophagy pathway was significantly activated, via activation AMPK-mTOR axis. The hepatic metabolomics analysis showed that C3G improved glucose metabolism; combined with induced hepatic ketogenesis and reduced malonyl-CoA contents. Body fat was reduced with induced thermogenic genes in brown adipocytes and energy expenditure. Collectively, the results demonstrate that C3G may have profound metabolic roles in regulating lipid metabolism and insulin resistance via activation of PPARα and indirectly inducing AMPK.

Anticancer Effect of NeoN-methylsansalvamide on EJ Cell Xenografts in Balb/c Nude Mouse

Tae-Ran Jung*, Seong-Gwon Moon, Chan Lee
Chung-Ang University, Korea

Xenotransplantation of EJ cell in nude mice was performed to investigate the anticancer effect of NeoN-methylsansalvamide (NMSSV), a novel cyclic depsipeptide Fusarium solani KCCM90040. Different levels of NMSSV were treated every day by oral administration for 15 days and the control group was administered with correspond solution. Cisplatin was applied as positive control. There are no differences in body weight and food & water intake between treated group and control group. After 7 days, tumor size was reduced in a concentration-dependent manner between 5 and 15 mg/kg in treated group compared with those of control group except at low concentration of 1 mg/kg. Positive control, cisplatin showed a statistically similar reduction of tumor size and tumor inhibition rate at 5 mg/kg. NMSSV showed same anticancer activity compared with cisplatin at same concentration without death of animal. This result showed the possibility of NMSSV as an anticancer compound in further application.
Auraptene, a Major Compound of Supercritical Fluid Extract of Phalsak, Induces Apoptosis through the Suppression of mTOR Pathways in Human Gastric Cancer SNU-1 Cells

Jeong Yong Moon1*, Yeon Woo Song2, Ahmed Osman2, Somi Kim Cho1,2
1Subtropical Horticulture Research Institute, Jeju National University, Korea, 2Faculty of Biotechnology, College of Applied Life Sciences, Jeju National University, Korea

The supercritical extraction method is a promising process to obtain volatile and non-volatile compounds by avoiding thermal degradation and solvent residue in the extracts. In search of phytochemicals with potential therapeutic application in gastric cancer, the supercritical fluid extract (SFE) of phalsak (Citrus hassaku Hort ex Tanaka) fruits were analyzed by gas chromatography-mass spectrometry (GC-MS). Compositional analysis in comparison with the antiproliferative activities of peel and flesh of Pinus koraiensis (PK) against AD using HaCaT cells, the immunomodulatory effect of Canavalia gladiata in NC/Nga Mice, an Animal Model of Atopic Dermatitis

A Study on the Immunomodulatory Effect of Canavalia gladiata in NC/Nga Mice, an Animal Model of Atopic Dermatitis

Jee-Yun Chang*, Jeongmin Lee
Department of Medical Nutrition, Kyung Hee University, Korea

The aim of this study was to investigate the anti-inflammatory and anti-immune regulatory effect of Canavalia gladiata (CG) extract. We used NC/Nga mice induced by atopic dermatitis. Mice were divided into 4 groups as followings; Normal control, AD control, CGH (AD + dietary supplement of CG hot water extract 300 mg/kg b.w.), CG30 (AD + dietary supplement of CG 30% ethanol extract 300 mg/kg b.w.), CG80 (AD + dietary supplement of CG 80% ethanol extract 300 mg/kg b.w.). We found that the AD control caused a significant increase in the skin damage and scratching score compared with the normal control. In contrast, the groups of dietary supplement of CG significantly decreased the skin damage and scratching score compared with the AD control. The groups of dietary supplement of CG, particularly in the group of CG80, also inhibited AD-induced Th1/Th2 cytokines imbalance, decreased epidermal hydration, and productions of pro-inflammatory cytokines, IgG1, and IgE. In addition, the level of serum histamine of the NC/Nga mice with dietary supplement CG showed a significant decrease compared with the AD control. These results indicated that CG extract may be potential therapeutic candidate for AD.
Administration of Deer Antler Enhances Food Efficiency Ratio and Intestinal Health in Aged Sprague-Dawley Rats

Jisu Han*, Kyunghyun Min, Junghree Cho, Sunah Yang1, Eunkyoung Mo1, Changkeun Sung
Department of Food Science and Technology, Chungnam National University, Korea, 2Research and Development Center, DBIO Incorporation, Korea

Present study was performed to investigate the effects of deer antler on the intestinal health and food efficiency ratio in aged Sprague-Dawley rats. Tip part of deer antler was extracted with hot water for 5 h, and filtrates were used in the study. Lyophilized deer antler powder was mixed into the feed 2.5% and 5%, respectively. The experimental diets administered to 44-week rats for 28 days. Food efficiency ratios of the deer antler treated groups (DA) higher than that of the control group (CO). Small intestine thickness of the 5% DA showed the highest value. In addition, the activities of digestion related enzymes such as trypsin, chymotrypsin, and lipase were increased by the intake of deer antler.

Optimization of Complex Fermentation Conditions to Improve Antioxidant Activities in Ginseng Solution Using Lactic Acid Bacteria by Response Surface Methodology.

Ji-Eun Ryu*, Seung-Hyeon Cha, Dong-Ho Kim, Keum-Il Jang
Department of Food Science and Biotechnology, Chungbuk National University, Korea

Response surface methodology (RSM) was used to optimize the fermentation conditions of ginseng solution fermented by lactic acid bacteria (LAB) to improve antioxidant activities. A central composite design was used to investigate the effects of the independent variables of cell number of Lactobacillus delbrueckii KCTC 3034 (X1), cell number of Lactobacillus acidophilus KCTC 3145 (X2) and fermentation time (X3) on dependent variables of total acidity (TA), total polyphenol content (TPC) and DPPH radical scavenging activity (DRSA). The optimum condition of TA was 10^5.27 CFU/mL (X1), 10^7.94 CFU/mL (X2) and 51.6 h (X3). The optimum condition of TPC was 10^7.21 CFU/mL (X1), 10^6.68 CFU/mL (X2) and 50.16 h (X3). The optimum condition of DRSA was 10^7.44 CFU/mL (X1), 10^5.27 CFU/mL (X2) and 53.28 h (X3). Thus, this study established optimal fermentation conditions for LAB in ginseng solution to improve antioxidant activities using RSM.

Antioxidant Activities of Blueberry Hot Water Extracts with Different Extraction Condition

So Yae Koh*, Moa Son1, Gyeong-A Ko1, Hye Rim Kang, Ji Hee Lim3, Geun Hyung Im1, Somi Kim Cho1,2
Faculty of Advanced Convergence Technology and Science, Jeju National University, Korea, 1Faculty of Biotechnology, College of Applied Life Sciences, SABI, Jeju National University, Korea, 2Subtropical Horticulture Research Institute, Jeju National University, Korea, 3Research Institute, JeKiss Co., Ltd., Korea

Five extraction conditions (AE, autoclave extraction; OE, oven extraction; HWSE, hot water and sonication extraction; HWASE, hot water acidified with 0.5% (v/v) acetic acid and sonication extraction; BE, boiling extraction) were examined to investigate the effects of hot water extraction methods on antioxidant activities of blueberry. The extraction yields of the AE, OE, HWSE, HWASE and BE were 7.94, 8.35, 8.55, 9.15, and 8.50%, respectively. The polyphenol and flavonoid contents of AE were highest and those of OE were next. However, the total anthocyanin content of HWSE was significantly higher than the others and AE had the lowest content of anthocyanin. The order of ABTS and alkyl radical scavenging activities was AE> BE> OE> HWSE> HWASE. The antioxidant activities considerably corresponded with contents of total polyphenol and flavonoid. DPPH radical scavenging activity was quite high in HWSE, AE and BE and there was no significant difference among the five extracts in Fe^{2+} chelating activities. In conclusion, we suggest that the AE would be the most effective method for preparing blueberry hot water extracts with relatively high antioxidant activities.

Protective Effect of Maillard Reaction Products of Whey Protein Concentrate against tert-Butyl Hydroperoxide Induced Oxidative Stress in HepG2 Cells

Min Cheol Pyo*, Sung-Yong Yang, Su-Hyun Chun, Mi-Hyun Nam, Kwang-won Lee
Department of Biotechnology, Major in Systems Food Biotechnology, Korea University Graduate School, Korea

Maillard reaction is complex reaction between amino acids and amino groups of peptides or proteins with reducing sugars. This reaction occurs spontaneously in the food processing. Maillard reaction product was obtained from whey protein concentrate (WPC) and glucose (1:5 weight ratio) after heating in shaking water bath for 7 days. The purpose of this study was to investigate the hepatoprotective activity of MRPs of WPC against tert-butyl hydroperoxide (t-BHP) induced oxidative stress in human hepatoma HepG2 cells. Determination of the degree of MRPs was performed by SDS-PAGE. The result of SDS-PAGE showed the formation of high molecular weight compounds by the maillard reaction. The cytoprotect effect of MRPs were determined by the 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide (MTT) assay. MTT assay showed that the treatment of Glc-WPC had cytoprotect effect. Intracellular glutathione (GSH) level was estimated by conversion of DTNB(5,5'-dithiobis(2-nitrobenzoic acid)). The Glc-WPC MRPs increased the glutathione levels in the HepG2 cells. The results of this study suggest that Glc-WPC MRPs has a protective ability against oxidative stress caused by t-BHP.
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**Anti-obesity Effects of Korean Pine Cone (Pinus koraiensis) Supplementation in C57BL/6j Mice Fed with High Fat Diet**

Minhee Lee*, Yejin Ha, Jeeyun Chang, SeokHyung Heo¹, Tuk-Rai Jeong², Hyun-Pil Yang², Jeongmin Lee²

Department of Medical Nutrition and Research Institute of Medical Nutrition, Kyung Hee University, Korea, ¹Korea Health Supplements Association, Korea, ²Kitto Life Co., Ltd., Korea

This study investigated the anti-obesity effects of Korean pine cone (Pinus koraiensis, PC) supplementation in C57BL/6j mice fed with high fat diet (HFD). Experimental groups were treated with two different doses of PC (100 and 300 mg/kg b.w. in HFD) for 8 weeks. Weight gain and white adipose tissue weight were significantly lower in all PC groups than in the HFD alone group after 8 weeks. Serum levels of total cholesterol, triglyceride, LDL and HDL levels decreased upon treatment with PC. Leptin levels in serum were significantly reduced by PC supplement compared with the HFD alone group. These results support the expression levels of enzymes and proteins related to lipid metabolism assessed by real-time PCR. PC inhibited the expression of LPL, FAS, and lipid regulatory transcription factors such as PPAR-α, C/EBP, and SREBP in adipose tissue of the mice treated with low- and high-dose PC groups. There was a significant increase of lipid regulatory transcription factors such as PPAR-α, C/EBP, and SREBP in adipose tissue of the mice treated with low- and high-dose PC groups. These results suggest the PC is able to improve obesity-relate parameters in the serum and inhibit by down-regulating adipogenic transcription factor and genes.

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**Skin Whitening Effect of Artemisia annua L. Extracts and Artemisinin through Modulation of MITF Expression**

Dae-Yong Kim¹*, Mee-Kyung Kim¹, Young-Duck Lee², Bong-Woo Kim²

Department of Pharmaceutical Science and Engineering, Seowon University, Korea, ¹Department of Pharmaceutical Science and Engineering, Seowon University, Korea, ²Department of Food Science and Engineering, Seowon University, Korea

Artemisinin is known as a constituent of medicinal plant, Artemisia annua L. and has been used in folk medicine to treat various ailments for centuries. In studies to investigate the whitening effect of A. annua L. extracts and artemisinin as an active ingredient for whitening cosmetics, we identified the effects of A. annua L. extracts and artemisinin on melanogenesis in B16-F10 melanoma cells. In cell viability assay, A. annua L. extracts and artemisinin did not show any obvious cytotoxicity, and they also significantly reduced both tyrosinase activity and the cellular melanin content in a concentration-dependent manner. Furthermore, we found that artemisinin decreased α-MSH (melanocyte-stimulating hormone)-induced tyrosinase activity and microphthalmia associated transcription factor (MITF) protein expression. Our data indicate that A. annua L. extracts and artemisinin attenuates α-MSH-stimulated melanin synthesis by modulating MITF expression and they might be a useful therapeutic agent for treating hyperpigmentatin and an ingredient of whitening cosmetics.

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**Quercetin Reduces TNF-α-induced Atrophy in C2C12 Myotubes**

Yeo Ji Kim*, Yoonhee Kwon, Chu-sook Kim, Soeun Kang, Rina Yu

Department of Food Science and Nutrition, University of Ulsan, Korea

Inflammatory cytokine TNFα, which increases in obese condition, promotes protein degradation, and thus is implicated in obesity-related skeletal muscle atrophy and sarcopenia. Quercetin, a flavonoid, elicits anti-oxidative and anti-inflammatory activities. In this study, we investigated the effect of quercetin on TNFα-induced skeletal muscle atrophy and its potential mechanism. C2C12 myotubes were treated with TNFα or cocultured with macrophages in the presence or absence of quercetin. Levels of inflammatory cytokines and atrophic markers were measured by ELISA or RT-PCR. Quercetin suppressed TNFα expression in the cocultured myotubes/macrophages and reduced levels of MAFbx/Atrogin-1 and MuRF1 in the C2C12 myotube, and this was accompanied by an increase in myotube diameter. Quercetin upregulated heme oxygenase-1 (HO-1) in the myotubes, and the inhibitory action of quercetin on TNFα-induced atrophy was blunted by HO-1 inhibitor, ZnPP, indicating that the quercetin action is mediated by HO-1 induction. These findings suggest that quercetin may protect TNFα-induced muscle atrophy in obese condition. Quercetin may be useful for protecting obesity-induced skeletal muscle atrophy.

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**Betulinic Acid Reduced Lipid Accumulation in 3T3-L1 Differentiated Adipocytes**

Joungho Joung*

Department of Food and Nutrition, Kookmin University, Korea

Betulinic acid is a natural pentacyclic triterpene, extracted from birch bark, which has various biological activities including anti-carcinogenic and hypolipidemic effects. In particular, anti-lipogenic effect was recently emerging but its precise mechanisms are still unrevealed. Therefore, we hypothesized that supplementation of betulinic acid on 3T3-L1 would reduce its adiposity via inhibiting lipogenesis and/or adipogenesis. We applied betulinic acid (1, 2, 5, or 10 μg/mL) on differentiated 3T3-L1 adipocytes, followed by Oil red O staining and immunoblotting. As a result, lipid accumulation was decreased approximately 10% in all the betulinic acid treated groups compared to control (p<0.05). Phosphorylation of ACC1, which regulates initial step of lipogenesis, was increased. In addition, the levels of SREBP1, FAS, SCD, GPAM, and DGAT1 were significantly diminished by betulinic acid, indicating that a series of lipogenic and adiogenic enzymes were inhibited. In sum, supplementation of betulinic acid to 3T3-L1 adipocytes reduced lipid accumulation by suppressing lipogenic activity.
Flavonoid-rich Chardonnay Grape Seed Flour Supplementation Ameliorates Diet-induced Visceral Adiposity, Insulin Resistance, and Glucose Intolerance via Altered Adipose Tissue Gene Profiles

Hyunsook Kim*, Chon Chon, Seung-yeol Nah, Kunho Seo, Wallace Yokoyama
School of Veterinary Medicine, Konkuk University, Korea, 1USDA, ARS, PFR, USA

Effect of flavonoid-rich wine grape seed flour (ChrSd), a byproduct of winemaking, on global adipose tissue gene expression and obesity-induced insulin resistance was assessed in high fat (HF) diet-induced obese (DIO) mice. ChrSd diet suppressed the HF diet-induced increase in total body, liver, and adipose tissue weights with a significant decrease in feed efficiency. ChrSd intake significantly lowered the 2-h insulin and glucose areas under the curve suggesting that ChrSd improves insulin sensitivity and glucose metabolism. Gene expression profiling analysis of adipose tissue from mice fed a ChrSd diet, by exon microarray and RT-PCR, revealed a down-regulation of genes related to oxidative stress, inflammation, immune response, protein carbonylation, and fatty acid synthesis. Conversely, genes related to the scavenging of free radicals, antioxidants, insulin sensitivity, and fatty acid oxidation, were up-regulated. In conclusion, ChrSd ameliorates HF-induced obesity, insulin resistance, and glucose intolerance in DIO mice by modulating expression of genes in adipose tissue.

Antioxidant Activities of Panax ginseng C.A. Meyer Hydrolyzed by Pectinase

Sung Hee Ju*, Ji Yeon Seo, Su Jin Kang, Gwang Rae Jo, Ga In Jeong, Hye Lin Seo, Jin Ho Jang, Ji Sun Oh, Seung-Kwon Lee1, Jong-Sang Kim
School of Food Science and Biotechnology (BK21 plus), Kyungpook National University, Korea, 1Ginseng Research Team, Overseas Business Division, Ilhwa Co., Ltd., Korea

Red ginseng (Panax ginseng C.A. Meyer) contains various phytochemicals such as ginsenosides, ployacetylenes, and phenolic compounds. In this study, we examined antioxidant activities of red ginseng extracts hydrolyzed by pectinase. Red ginseng extract hydrolyzed by pectinase showed a strong ferric ion reducing power and scavenging activities of radicals including ABTS and DPPH, and effectively lowered intracellular reactive oxygen species (ROS) generated by tert-butyl hydroperoxide in HepG2 cells. Therefore, further studies including identification of factors responsible for antioxidant activity are required.

Antimicrobial Activity of the Sub Fractions from the Bark of Prunus sargentii against Staphylococcus aureus and Methicillin-resistant S. aureus

Biotechnology Industrialization Center, Dongshin University, Korea

In this study, antioxidant and antimicrobial activities of sub fractions from the Bark of Prunus sargentii were investigated by modified broth dilution assay. The P6 sub fraction showed the highest effect against S. aureus and MRSA. Minimum bactericidal concentration (MBC) value of P6 and P7 sub fractions against S. aureus were 1 mg/mL. Moreover, MBC value of P6 sub fraction against MRSA was 1 mg/mL.
Antimicrobial Effect of *Sanguisorba officinalis* Extract and Its Fraction on Foodborne Pathogens

Go-Eun Seo*, Sun-Min Kim1, Byoung-Sik Pyo1
Biotechnology Industrialization Center, Dangshin University, Korea, 1Department of Oriental Medicine Materials, Dangshin University, Korea

The purpose of this study was to investigate the antioxidative and antimicrobial activities of the methanol extract and its fraction from roots of *Sanguisorba officinalis*. The ethylacetate fraction showed higher polyphenol and flavonoid contents of 627.31 mg/g and 23.16 mg/g than other samples. Comparison of antioxidant activity was performed by the DPPH radical scavenging assay. In results, SC50 (concentration of sample for scavenging 50% of radical) of the methanol extract and all fractions except chloroform fraction were showed stronger than L-ascorbic acid used as positive control. According to result, in proportion to the total polyphenol and flavonoid contents of ethylacetate fraction was appeared. In antimicrobial activity against foodborne pathogens (*Staphylococcus aureus*, *Vibrio vulnificus*, *Bacillus cereus*) were investigated by disc diffusion assay. The ethylacetate fraction was the highest effective in antimicrobial against *S. aureus* and *B. cereus* as gram-positive pathogen. However, clear zone against *V. vulnificus* as gram-negative pathogen of the chloroform fraction was showed higher than other samples.

Antioxidant Activities of Extract from *Orostachys malacophyllus* and *Orostachys japonica*

Doo Jin Lee*, Su-in Choi, So-young Yoon, Ok-Hwan Lee, Sang Woo Han1, Jong Dai Kim
Department of Food Science and Biotechnology, Kangwon National University, Korea, 1Yangpyeong Wasong, Korea

The objective of this study was to investigate the antioxidative activities of the extracts from *Orostachys malacophyllus* (Om) and *Orostachys japonica* (Oj). Antioxidant activities were measured by different in vitro test such as DPPH, ABTS, FRAP assay, Reducing power and iron chelating ability. We also measured the total phenol and flavonoids contents in Om and Oj by using HPLC. Total phenol contents of Om and Oj extract were 6.9±0.10, 63.0±2.0 mg GAE/g respectively. Flavonoid contents of Om and Oj extract were 5.0±1.66, 13.5±0.9 mg QE/g respectively. Gallic acid in Om and Oj as 13.5±0.9 mg QE/g respectively. Gallic acid in Om and Oj as 6.9±0.10, 63.0±2.0 mg GAE/g respectively. Total phenol contents of Om and Oj extract were 127.6±0.9 mg GAE/g and 23.16 mg/g than other samples. Comparison of antioxidant activity was performed by the DPPH radical scavenging assay. In results, SC50 (concentration of sample for scavenging 50% of radical) of the methanol extract and all fractions except chloroform fraction were showed stronger than L-ascorbic acid used as positive control. According to result, in proportion to the total polyphenol and flavonoid contents of ethylacetate fraction was appeared. In antimicrobial activity against foodborne pathogens (*Staphylococcus aureus*, *Vibrio vulnificus*, *Bacillus cereus*) were investigated by disc diffusion assay. The ethylacetate fraction was the highest effective in antimicrobial against *S. aureus* and *B. cereus* as gram-positive pathogen. However, clear zone against *V. vulnificus* as gram-negative pathogen of the chloroform fraction was showed higher than other samples.

Production of a Cold-active Lipase from *Pichia petersoni* NRRL YB-3808

Eun-Chong Won*, Jae-Han Bae, Hak-Ryul Kim
School of Food Science and Biotechnology, Kyungpook National University, Korea

Lipases are class of hydrolases which catalyze the hydrolysis of triglycerides to free fatty acids, diacylglycerols, monacylglycerols and glycerol over an oil-water interface. Because lipase can catalyze numerous different reactions, they have been widely used as biocatalysts for biotechnological and industrial applications. However, lipases with abnormal functionalities such as high thermostability and optimal activity at extreme conditions gain special attentions because of their applicability in the restricted reaction conditions. In particular, cold-active lipase (CALs) have gained special attentions in various industrial fields such as washer detergent, pharmaceutical catalyst, and production of structured lipid. However, production of CAL is mostly found from psychrophilic microorganisms. In our study, we confirm that the lipase produced from a yeast strain, *Pichia petersoni* NRRL YB-3808 was cold-active lipase and we conducted both characterization and optimization study for efficient production of a cold-active lipase from YB-3808. The lipase from *P. petersoni* NRRL YB-3808 showed relatively higher activity at between 15°C and 27.5°C than over 30°C.

Characterization of a Minimal Replicon of pKW2124 from *Weissella cibaria* KLC140 and Its Application for Development of an Expression Vector, pKUCm1

Hye-Jin Ku*, Kyung-Jin Yuk, Myeong Soo Park1, Ju-Hoon Lee
Department of Food Science and Biotechnology, Institute of Life Sciences and Resources, Kyung Hee University, Korea, 1Department of Hotel Culinary Arts, Yeonsung University, Korea

Previously, a 2.1-kb plasmid pKW2124 was isolated from *Weissella cibaria* KLC140 in kimchi. To determine the minimal replicon of pKW2124, four different PCR products (MR1, ori+RBS+repA; MR2, RBS+repA; MR2’, repA; MR3, fragment of repA) were cloned into pUC19 with CAT gene, respectively (pKUCm1, pKUCm2, pKUCm2’ and pKUCm3). Their electroporation into a W. confus a ATCC 10881 showed that only pKUCm1 (1.5×10^7 CFU/μg) and pKUCm2 (1.3×10^7 CFU/μg) are replicable in the host, suggesting that putative ori, RBS and repA gene are essential. Their segregational plasmid stability revealed that pKUCm1 was stable but pKUCm2 was lost after 60 generations, suggesting that plasmid ori is indeed required. Additional host range test of pKUCm1 revealed that it has a broad host range spectrum including Weissella, Lactococcus, Leuconostoc, and even Lactobacillus. To verify pKUCm1 as an expression vector, Weissella β-galactosidase gene and its promoter were cloned in pKUCm1, resulting in pKUCgal. Expression of the β-galactosidase gene was confirmed using Blue-White screening. The small and stable pKUCm1 will be useful for gene transfer, expression, and manipulation in Weissella genome.
Complete Genome Sequence Analysis of Bacillus cereus FORC_005 from a Contaminated Food, Soy Sauce Braised Fish-cake with Quail-egg, in South Korea

Dong-Hoon Lee*, Ji-Hye Lee, Sang Ho Choi1, Ju-Hoon Lee
Department of Food Science and Biotechnology, Graduate School of Biotechnology, Kyung Hee University, Korea, 1Department of Agricultural Biotechnology, Center for Food Safety and Toxicology, Seoul National University, Korea

Bacillus cereus is one of major food-borne pathogens contaminating various foods. B. cereus FORC_005 was isolated from a contaminated Korean side dish, soy sauce braised fish-cake with quail-egg. The strain FORC_005 was completely sequenced, and analyzed using various bioinformatic tools such as GeneMarkS, RAST, BLAST, InterProScan, JSpecies, and etc. The genomic DNA contains one circular chromosome that consists of 5,349,617-bp with the G+C content of 35.29%, 5,170 open reading frames (ORFs), 106 rRNA genes, and 42 tRNA genes. Among 5,170 predicted ORFs, 3,892 ORFs (75.28%) were annotated to encode functional proteins, and 1,278 ORFs (24.72%) were annotated as hypothetical proteins. Identification of virulence factors revealed that B. cereus FORC_005 possesses toxin genes, such as cytotoxin K (cyaK), hemolysin BL (bhl), and non-hemolytic enterotoxin (nhe), but not cereulide related genes, suggesting that the strain FORC_005 can cause diarrhea but not emesis. This genome information would extend our understanding of its pathogenesis in genomic level for efficient control of its contamination in foods and further food poisoning.

Development of Species-specific PCR Primers and Polyphasic Characterization of Lactobacillus sanfranciscensis Isolated from Korean Sourdough

Young-Wook Chin*, Hyeong-Rho Lee, Hyun-Wook Baek, Kyeong-Hye Park, Eun-Ji Choi, Hae-Yong Jo, So-Yeon Shin*, Nam Soo Han1, Jin-Ho Seo
Department of Agricultural Biotechnology Center for Food and Biocconvergence, Seoul National University, Korea, 1Brain Korea 21 Center for Bio-Resource Development, Division of Animal, Horticulture and Food Sciences, Chungbuk National University, Korea

Lactobacillus sanfranciscensis is a bacterium used in sour-dough that provides desirable properties such as better flavor and texture to the sourdough bread. Here, the intra-species diversity of L. sanfranciscensis strains isolated from Korean sourdough was studied using genotypic (multiplex-RAPD-PCR: multiplex-Randomly Amplified Polymorphic DNA-polymerase chain reaction) and phenotypic (VITEK2 COMPACT system) analyses. For this, a novel species-specific set of PCR primers was developed to identify L. sanfranciscensis using the recently published genome database. The primers were able to detect L. sanfranciscensis isolated from Korean sourdough with 100% accuracy. Genotyping and phenotyping analyses at the strain level demonstrated that Korean sourdough possesses various biotypes of L. sanfranciscensis strains. These strains were clustered into 5 subtypes (genotyping) or 7 subtypes (phenotyping). In summary, this strategy to construct novel primers reduced the chance of cross amplification and was able to identify the desired strain. The various strains isolated in this study can be used to develop a sourdough starter after analysis of their fermentation characteristics.

Sesaminol Triglucoside and Antioxidative Activity of Fermented Sesame by Culturing with Lactobacillus plantarum, Lactobacillus acidophilus and Streptococcus thermophilus

Jin-Ju Bae*, Ji-Han Kim, Min-Gu Ju, Su-Jung Yeon, Go-Eun Hong, Chi-Ho Lee
Department of Food Science & Biotechnology, Konkuk University, Korea

This study investigated whether sesaminol triglucoside is changed to sesaminol by β-glucosidase in sesame fermented at 37°C for 24 h and carried out to select most competent cultures by comparing the β-glucosidase activity by culturing with lactic acid bacteria such as Lactobacillus acidophilus (LP), Lactobacillus plantarum (LA) and Streptococcus thermophilus (ST). The pH of fermented sesame was significantly (p<0.05) decreased compared with controls, due to the increases in lactic acid bacteria, and the pH of LP was significantly (p<0.05) lower than that of other groups during fermentation. The antioxidant effect of fermented sesame significantly (p<0.05) increased compared with controls during entire fermentation time. The antioxidant effect of sesame fermented by LP resulted in the most outstanding effect compared to other groups. Also sesame fermented with LP indicated significantly (p<0.05) more bioconversion of the sesaminol glycoside to aglycone, compared with other groups. The LP was best culture for production of health functional fermented sesame.

Increase of the Platycodin D Concentrations of the Balloonflower Root Extract, Caused by Fermentation and the Antibacterial Activity against Klebsiella pneumoniae

Ji-Whi Choi*, Dong-Min Yu, Du-Sung Kim, Min-Seok Kim, Hee-Jong Yu
Food R&D Center, Bioland, Korea

This study was to increase the concentrations of platycodin D, a major components of the balloonflower root extract by fermentation. The only balloonflower root extract with no appropriate bacteria. Examined the increasing of the platycodin D activity against K. pneumoniae. Saccharomyces cerevisiae cells increased from 10^1 CFU/mL to 10^6 CFU/mL of the balloonflower extract. While the unfermented balloonflower root extract contained 2.56 mg/g of platycodin D, the balloonflower root extract fermented by S. cerevisiae contained 4.33 mg/g of platycodin D. The result of antimicrobial activity against K. pneumoniae showed that bacterial growth rate fell by more than 80% at the over 3% balloonflower root extract. Besides, 80% reduction rate at the 0.05% balloonflower root extract. Highest rate of reduction (100%) was shown at the over 5% balloonflower root extract.
Cloning and Sequence Analysis of the Phosphoribosyl Anthranilate Isomerase (TRP1) Gene in Starch-utilizing Yeast *Saccharomycopsis fibuligera*

Eun-Hee Park*, Soo-Hwan Yeo1, Myoung-Dong Kim
Department of Food Science and Biotechnology, Kangwon National University, Korea; 1Fermented Food Division, Department of Agro-food Resource, NAAS, RDA, Korea

The TRP1 gene encoding phosphoribosyl anthranilate isomerase in yeast *Saccharomycopsis fibuligera* KACC93213P was determined by degenerate polymerase chain reaction and genome walking. Sequence analysis revealed the presence of an uninterrupted open-reading frame of 759 bp, encoding a 252 amino acid residue. The deduced amino acid sequence of TRP1 of *S. fibuligera* is 43.5% homologous to that of *Komatataella pastoria*. The cloned TRP1 gene complemented the trp1 null mutation in *Saccharomyces cerevisiae*, suggesting that it encodes a functional TRP1 in *S. fibuligera*. A new auxotrophic marker to engineer starch-degrading yeast *S. fibuligera* is now available. The GenBank Accession No. for SfTRP1 is KR078268.

Analysis of Genome-wide Transcriptome of Rhizopus oryzae Associated with Starch Utilization

Yeong-Hwan Choi*, Eun-Hee Park1, Pahn-Shick Chang2, Myoung-Dong Kim1
Kooksoondang Brewery Co., Ltd., Korea; 1Department of Food Science and Biotechnology, Kangwon National University, Korea; 2Department of Agricultural Biotechnology, Seoul National University, Korea

*Rhizopus oryzae* is one of the most important fungi used to make alcoholic beverages including rice wine in Korea. We utilized RNA-seq technology to explore the transcriptome of *R. oryzae* grown in glucose and starch. A total of 191,022, 262 reads was assembled into 30,832 contigs with an average contig length of 1,083 bp and an N50 of 1,686 bp. Comparison of transcriptome related to with utilization of glucose and starch showed 4,130 differentially expressed genes, of which 1,527 were up-regulated in starch while 2,603 were down-regulated.

Purification and Characterization of the Bacteriocin Produced by *Pediococcus* Isolated from Nuruk

Da Hye Song*, Jeung Hee An
Konkuk University, Korea

In this study, we evaluated the antibacterial activity about the bacterial strain isolated from traditional *nuruk*. Bacterial strains showed antibacterial activity against *Klebsiella pneumonia*, *Salmonella enteric*, *Bacillus subtilis*, *Bacillus cereus*, *Shigella flexneri* and *Escherichia coli*, and selected the S-2 and S-10 stains. By 16S rRNA nucleotide sequence analysis, the S-2 and S-10 identified *Pediococcus acidilacti* and *Pediococcus pentosaceus*, respectively. *Pediococcus acidilacti* and *Pediococcus pentosaceus* showed bacteriocin activity after various pH, temperature and enzyme treatment. This bacteriocin was sensitive to hydrolytic enzymes such as trypsin and papain. The pH range from 4.0 to 10.0 had no effect on bacteriocin activity. But the results observed that pH 4 and 5 treatments (13.67 mm±3.06 and 13.67 mm±1.15, respectively) showed the better activity than pH 9 and 10 (10.67 mm±0.58 and 11.00 mm±0, respectively) treatment groups against *Escherichia coli*. The bacteriocin was highly thermostable. The molecular weight of bacteriocin was estimated to be about 10 kDa by SDS-PAGE analysis.

Isolation, Growth and Proteomic Analysis of Lactic Acid Bacteria (LAB) Isolated from Dongchimi (Kimchi) Prepared with Different Types of Salts

Jae Min Shim*, Kang Wook Lee3, Hyun-Jin Kim1, Jeong Hwan Kim2,2
1Division of Applied Life Science (BK21Plus), Graduate School, Gyeongsang National University, Korea; 2Institute of Agriculture & Life Science, Gyeongsang National University, Korea

Three lactic acid bacteria were isolated from Dongchimi prepared with different types of salts (purified salt-SS, solar salt-BS and bamboo salt-BS). They were identified and named as *Leuconostoc citreum* BT24, *Lactobacillus sakei* BN17 and *Leuconostoc mesenteroides* P30. *Lb. sakei* BN17 and *Leu. mesenteroides* P30 grew better in SS and BS than PS. But *Leu. citreum* BT24 grew slowly in bamboo salt than purified salt. The effect of different salts on the cellular protein profiles of *Lb. sakei* BN17 and *Leu. mesenteroides* P30 were examined by 2-D gel. Protein samples were separated by IEF followed by SDS-PAGE. After electrophoresis, proteins were visualized by silver staining and scanned using a Fluor-S multimager. The intensities of the protein spots were analyzed using PDQUEST 2-D gel analysis software. Some protein spots showed different levels of production depending upon the type of salts. The possible roles of affected spots are currently under investigation.
Effects of Environmental Factors on the Growth of Yeast and Alcohol Fermentation

Hye-Young Park*, Hye-Ri Jeon, Hye-En Im1, Soo-Hwan Yeo1, Seong-Yoon Baek1, Jae Hyun Kim1, Sea-Kwan Oh, Induck Choi, Koan-Sik Woo
Crop Post-harvest Technology Division, National Institute of Crop Science, RDA, Korea, 1Fermented Food Science Division, National Academy of Agricultural Science, RDA, Korea

The objective of the present study was to investigate the effects of environmental factors on yeast growth and alcohol fermentation, in order to reduce alcohol production while manufacturing non-alcoholic beverages. There were no differences in cell counts and alcohol content when yeast cells were grown for reduced (300 mbar) and normal pressure conditions. In contrast, 5.83% of alcohol was produced under aerobic conditions and 6.90-7.13% of alcohol was produced under anaerobic conditions, showing differences in alcohol production due to changes in oxygen content. In addition, 40°C or higher temperature inhibited an increase of cell counts and alcohol production, while at 20°C or lower, though there was no difference in cell counts, alcohol production was inhibited. Overall, cell growth and alcohol fermentation of yeasts are inhibited depending on the oxygen content and temperature. Therefore, these two environmental factors (oxygen and temperature) are important and to reduce alcohol production, these factors should be considered while developing processes to manufacture non-alcoholic beverages.

Bioconversion of Ginsenosides Rb1 and Rd into F2 Using Recombinant Lactococcus lactis

Ling Li*, So-Yeon Shin, Soo Jin Lee, Nam Soo Han
Brain Korea 21 Center for Bio-Resource Development, Division of Animal, Horticultural and Food Sciences, Chungbuk National University, Korea

The aim of this study was to produce minor ginsenoside F2 from major ginsenosides Rb1 and Rd by using recombinant Lactococcus lactis expressing heterologous β-glucosidase gene. For this, the nucleotide sequence for β-glucosidase gene (BglPkm) from Pseudoalteromonas atlantica was synthesized after codon-optimization and the two genes (unoptimized and optimized) were overexpressed in L. lactis NZ9000 by using pNZ8008 plasmid (pNZBgl-unopt and pNZBgl-opt, respectively). The total activities were 0.001 unit/mL (unoptimized) and 0.017 unit/mL (optimized) and the β-glucosidase hydrolyzed outer glucose of C3 and C20 position of major ginsenoside (Rb1 and Rd) and produced the minor ginsenoside F2. When the cell lysates and permeabilized cells of recombinant L. lactis harboring pNZBgl-opt were reacted with PPD type ginsenoside mixture (PPDGM), the substrate (Rb1) was completely consumed. The bioconversion yields of whole cells, cell lysates, and permeabilized cells were 50, 91, and 74%, respectively. In addition, when the transformant was used as a starter culture for yogurt fermentation, the bioconversion yield was lower (14%) due to the decrease of pH during the fermentation.

Property Analysis of Lactic Acid Bacteria Isolated from Jeung-pyun, Korean Sourdough

Ye Won Kwon*, Sae Bom Lim, Yu Mi Son, Jin Seok Moon, Nam Soo Han
Brain Korea 21 Center for Bio-Resource Development, Division of Animal, Horticultural, and Food Sciences, Chungbuk National University, Korea

Sourdough is a dough for bread making prepared from acidic mixture of cereal flour, yeast, and lactic acid bacteria (LAB). Sourdough can improve the texture, aroma, shelf-life, nutritional value, and palatability of bread. The aims of this study were to isolate LAB from Korean rice sourdough (jeung-pyun) and evaluate their properties for suitable use as starters. For this, predominant LAB were isolated from 5 rice sourdoughs and their microbial properties were analyzed in terms of exopolysaccharide or organic acids production, cell growth rate, and volume expansion of wheat dough sponges. As results, the strains of Leuconostoc lactis and Lactobacillus brevis showed fast growth as well as the highest volume expansion of dough. Strains of Le. citreum, Le. gascomitatum, Le. lactis, and Lb. brevis produced large amount of dextran from the added 2% sucrose in wheat sourdough. Strains of Weissella confusa, Lb. curvatus, and Lb. brevis produced lower concentration of acetic acid, giving a mild sour taste of bread. These results demonstrate that the isolates have an ability to adapt to the complex environment of sourdough to produce sourdough bread with overall satisfactory quality.

Genome Sequence Analysis of Potential Probiotic Strain Leuconostoc lactis EFEL005 Isolated from Kimchi

Sharon Shiny Dhanashekaran*, Jin Seok Moon, Hye Sun Choi1, Wooha Joo, Jungsu Bang, Nam Soo Han
Brain Korea 21 Center for Bio-Resource Development, Division of Animal, Horticultural, and Food Sciences, Chungbuk National University, Korea, 1Department of Agro-food Resource, National Academy of Agricultural Science, RDA, Korea

Leuconostoc lactis EFEL005 isolated from kimchi showed promising probiotic attributes; resistance against acid and bile salts, absence of transferable genes for antibiotic resistance, broad utilization of prebiotics, and no hemolytic activity. To expand our understanding of the species, we generated a draft genome sequence of the strain and analyzed its genomic features related to the aforementioned probiotic properties. Genome assembly resulted in 35 contigs, and the draft genome has 1,688,202 base pairs with a G+C content of 43.43%, containing 1,644 protein-coding genes and 50 RNA genes. The average nucleotide identity analysis showed high homology (≥96%) to the type strain L. lactis KCTC3528, but low homology (≤95%) to L. lactis KCTC3773. Genomic analysis revealed the presence of various genes for sucrose metabolism (glucansucrases, invertases, sucrose phosphorylases) acid tolerance (F340 ATPases, cation transport ATPase, branched-chain amino acid permease, and lysine decarboxylase), vancomycin response regulator, and antibacterial peptide (Lactacin F). This report will facilitate the understanding of probiotic properties of this strain as a starter for fermented foods.
Simultaneous Production of Phenolic Acids during Cereals Fermentation by Lactic Acid Bacteria

Wooha Joo*, Na Rae Shin, Jin Seok Moon, So-Yeon Shin, Nam Soo Han
Brain Korea 21 Center for Bio-Resource Development, Division of Animal, Horticultural, and Food Sciences, Chungbuk National University, Korea

Phenolic acids, such as caffeic, p-coumaric, and ferulic acids, on bran of the cereals mainly present as bound form that are not hydrolyzed by human digestive enzymes and are mostly excreted in the feces. The aim of this study was to produce free phenolic acids from various cereals during lactic acid bacteria (LAB) fermentation to be easily absorbed into the human body. Four LAB were selected based on in silico and in vitro analysis results of ferulyl esterase (FE) activities, and four cereals were chosen based on the bound-phenolic acid contents among nine cereals. As a result, Lactobacillus acidophilus ATCC 4356 showed highest productivity as 6.72, 1.13, 1.39, and 0.12% free phenolic acid released from bound form on fermented rice bran, barley bran, corn bran and beet pulp respectively. In conclusion, this study demonstrates that fermentation of cereals by LAB having high FE activities can significantly increase the free phenolic acid content in fermented foods. Furthermore, this study proposes that the potential to develop cereal-based synbiotic product with improved bioavailability of dietary phenolic acids.

Comparison of Grape Varieties That Can Be Reduced Harmful Components of Brandy

Jae-Soon Seo*, Seon-Yi Won, Yong-Seon Lee, Dae-Hyoung Lee, Heui-Yun Kang, In-Tae Park
Gyeonggi-do Agricultural Research and Extension Services, Korea

In this study, fermentation of 10 grape varieties (24°Bx by sugar addition) was performed using Saccharomyces cerevisiae Lavin71B in 20°C. And during which the wine is distilled, we were monitored change of components such as alcohol, acetaldehyde and methanol that is the main toxic component of liquor. Alcohol contents were 10.9-14.1% (v/v) after 9 days. Produced brandy by remove the initial fraction showed methanol contents of 70-500 ppm and acetaldehyde contents of 21-197 ppm. ‘Italy’ variety had the lowest methanol contents of 70 ppm, but this cultivar has no the disadvantage of the lowest alcohol contents. ‘Muscat bailey A’ had the lowest acetaldehyde contents and third lower values of methanol contents. Also MBA has an advantage that the highest alcohol content. Thus, MBA are expected to grape variety to brandy for reduction of harmful components.

Modified Brandy with Korean Grape and Rice by Korean Alcoholic Beverage Producing Method

Heui-Yun Kang*, Jae-Soon Seo, Yong-Seon Lee, Seon-Yi Won, In-Tae Park
Gyeonggi-do Agricultural Research and Extension Services, Korea

It was carried out wine fermentation by Korean traditional method (two stage fermentation) with grape and rice (from Gyeonggi), nuruk, yeast and spring water. Wine with cheongsoo (Korean variety) showed much higher brightness value than Alexandria and Italia (Italia variety). Alcohol concentration of wine was influenced by initial concentration of sugar. Initial concentration of sugar for wine was optimized at lower than 25°Bx. During fermentation periods, sugar concentration decreased rapidly until the 10 days of fermentation, while alcohol concentration increased slowly during the same fermentation periods. In order to improve the lack of palatability, we experimented alcohol fermentation with rice-saccharized liquid under 20%, and then added herb, ginger and citrus. It was modified brandy under maturing 50% main fraction of distillate, removal 5% first fraction. Distilled alcohol was made 37.5±0.7% alcohol, from wine 15% alcohol, under condition of 40 to 75°C heating up gradually, with decompression distiller for 3 h. It is optimized distilled condition that heating temperature under 75°C, heating time less than 3 h for good taste and flavor.

The Characteristics of Fermentation for the Preparation of Beer Using Rice and Mixed Grains

Dae-Hyoung Lee*, Seon-Yi Won, Yong-Seon Lee, Jae-Soon Seo, In-Tae Park
Gyeonggi-do Agricultural Research and Extension Services, Korea

This study aimed to investigate of condition fermentation through rice and barley in order to make rice beer and to study creation of foam and beer taste using hops. For manufacturing rice beer, in case of addition ratio of rice 45% and barley 55%, alcohol was highest with 10.5%. In sensory test, rice beer showed highest points and then that with purple sweet potato and grape were added. In sensory test, rice beer showed highest points and then that with purple sweet potato and that with grape followed in order.
Quality Characteristics of Distilled Liquor Using New Ipguk (koji) Fermentation Method

Dae-Hyoung Lee*, Yong-Seon Lee, Jae-Soon Seo, Seon-Yi Won, In-Tae Park, Tae-Wan Kim¹, Jae-Ho Kim¹
Gyeonggi-do Agricultural Research and Extension Services, Korea, ¹Brewing Research Center, Korea Food Research Institute, Korea

The study was aimed at reviewing features of distilled liquor with new Ipguk (koji) fermentation by aging and through aging in both jar and stainless container. For rice type, Oh-daee-mi was used, and koji was used as ferment. Firstly, in the first stage fermentation, koji 6.92 kg, water 8.31 L, and 88-4 yeast 14 mL were fermented at 25°C for 5 days. After the first stage of fermentation, rice 23 kg and water 42.9 L were added and fermented at 25°C for 10 days. In the final fermentation stage, it was measured 16.9%. In free sugar analysis, glucose decreased from 60.23±7.5 g/L on the 5th day of the first stage of fermentation to 1.21±0.2 g/L on the 10th day of the second stage of fermentation. The remaining fructose, sucrose, and maltose were measured 0.21±0.11, 2.21±0.2, and 3.21±0.1 g/L, respectively, on the 10th day of the second stage of fermentation. For the jar container of the distilled liquor, volatile acid showed ranged in 0.27-0.8 mL in 8 distillation methods with differences.

Study on the Aging of Distilled Liquor Manufactured with a New Ipguk (koji) Fermentation Method

Dae-Hyoung Lee*, Yong-Seon Lee, Jae-Soon Seo, Seon-Yi Won, In-Tae Park, Tae-Wan Kim¹, Jae-Ho Kim¹
Gyeonggi-do Agricultural Research and Extension Services, Korea, ¹Brewing Research Center, Korea Food Research Institute, Korea

In the study about aging of distilled liquor manufactured with a new Ipguk (koji) fermentation method, alcohol content, volatile acid, pH, and acetic acid according to jar container aging period of distilled liquor were analyzed. As a result of alcohol analysis according to distillation conditions, for the condition of pressure -50 cmHg, distillation temperature 50°C, initial liquid cut 7%, and main liquid cut 50%, initial alcohol was lowest with 29.6% while the condition of pressure -50 cmHg, distillation temperature 50°C, initial liquid cut 0%, and main liquid cut 30% was highest with 59.9%. Alcohol content according to each condition until 180 days aging period decreased little by little, and it seemed to be caused by volatilization during sampling as well as natural alcohol volatilization. And after removing initial liquid 7%, main liquid cut 50% showed low pH with 4.93±0.04 and 4.99±0.12. For acetic acid content, after initial liquid cut 7%, main liquid cut 50% showed higher contents of 28.29±1.50 and 31.08±0.52 ppm. From this, acetic acid seems to be distilled mainly in later stage of main liquid.

Development of Sucrose-inducible Expression System of Leuconostoc spp.

So Ri Jeong*, Seung Kee Cho, Soo Jin Lee, Nam Soo Han
Brain Korea 21 Center for Bio-Resource Development, Division of Animal, Horticultural, and Food Sciences, Chungbuk National University, Korea

Leuconostoc constitutes a well-recognized food-grade system for the expression of recombinant proteins. The key factors that control gene expression are inducible promoter and signal peptide efficiency. Secretomic analysis of L. mesenteroides resulted in identification of levansucrase (Leum 1409, Leum 1411) genes that were up-regulated by addition of sucrose in the MRS medium. To develop an inducible expression system in L. citreum, 2 promoter sequences were fused to the promoterless β-gal gene from Lactobacillus plantarum and shuttle vectors, pEK32progal, were constructed by using pLeuCM42 as E. coli-Leuconostoc shuttle vector. The vectors were transformed into Leuconostoc spp, and the transformants were cultivated in MRS medium. The β-galactosidase activity was induced 3.3-fold in pEK32P14109gal and 2.7-fold in pEK32P1411gal after induction sucrose, respectively. pEK32P1411Amy showed high secretion activities in L. citreum, and its activity reached 0.46 unit/mL at 14 h cultivation in sucrose medium. Inducible gene expression system developed in this study might be useful as gene-delivery tools for the genetic engineering of Leuconostoc and other LAB.

Characterization of Mixed Cultures of Saccharomyces cerevisiae and Non-Saccharomyces Yeasts during Alcohol Fermentation

SeongYool Baek12*, Soo-Hwan Yeo1, Ji-Young Mun1, Dong-Jun Seo1
1Fermented Food Division, Department of Agro-food Resource, NAAS, RDA, Korea, 2Department of Food Science and Technology, Kyungpook National University, Korea

Saccharomyces and non-Saccharomyces yeasts are metabolically active during traditional Korean rice wine and fermentation, and they can contribute to the definition of the liquor. Thus use of Saccharomyces and non-Saccharomyces yeasts as mixed starter cultures for inoculation of rice wine fermentations is of increasing interest for quality enhancement and improved complexity of rice wines. We initially characterized 5 yeasts of the genera Saccharomyces, Candida, Pichia, and Hanseniaspora. And we investigated mixed cultures of non-Saccharomyces yeasts to combine with Saccharomyces in fermentation. The kinetics of growth and fermentation, and the analytical profiles of the rice wines produced indicate that these non-Saccharomyces strains can be used with S. cerevisiae starter cultures to increase titratable acidity, succinic acid, acetic acid and esters. The overall effects of the non-Saccharomyces yeasts on fermentation were dependent on the S. cerevisiae/non-Saccharomyces inoculum ratio.
Complete Genome Sequencing of *Vibrio parahaemolyticus* FORC_008, Isolated from Finespotted Flounder in South Korea

Han Young Chung*, Suyeon Kim, Jong Gyu Lim, Sang Ho Choi, Se keun Kim, Dong-Hoon Lee1, Ju-Hoon Lee1
Seoul National University, Korea, 1Kyung Hee University, Korea

*Vibrio parahaemolyticus* is a marine pathogen. In order to characterize *V. parahaemolyticus*, 10 strains of *V. parahaemolyticus* were obtained from Korean Ministry of Food and Drug Safety. They all have the genes encoding a trans-membrane protein (ToxR) involved in regulating virulence genes and a collagenase by using virulence gene-specific PCR. Afterwards, the cytotoxicity of *V. parahaemolyticus* strains was evaluated by measuring the activity of cytoplasmic and membrane protein (ToxR) involved in regulating virulence genes. Thus *V. parahaemolyticus* #332 isolated from finespotted flounder was selected for genome sequencing, and designated FORC_008. The *V. parahaemolyticus* FORC_008 genome consists of two circular chromosomes. *V. parahaemolyticus* FORC_008 has genes encoding thermolabile hemolysin (TLH) and type-3 secretion systems, and lacks genes encoding thermo-stable direct hemolysin (TDH) and TDH-related hemolysin (TRH) by using BLAST against Virulence Factor Database (VFDB). This report provides an extended understanding about *V. parahaemolyticus* and sheds insights into the future studies of rapid detection, epidemiological investigation, and prevention of food-borne outbreaks of the pathogen.

Potential Characteristics as Starter of Lactic Acid Bacteria for the Alaska Pollack *Theragra chalcogramma-Sikhae* Production

Won-Ho Choi*, Jang-Woo Park, Gun-Hyeun, Han-joon Hwang
Department of Food and Biotechnology, Korea University, Korea

The aim of this study is to select a lactic acid bacterial (LAB) strain as a starter culture for alaska pollack-sikhae fermentation and to evaluate its suitability for application in a food system. Four strains of LAB finally were selected from commercial alaska pollack-sikhae purchased at retail outlets as starter culture candidates through investigation of growth speed, safety test and functional properties such as γ-amino-butyric acid (GABA). LAB viable cell count of candidate M1 was better than the others. By candidate M1, acidity increased from 0.17% at the starting of fermentation to 0.51% in 14 day. Producing activity of histamine and tyramine of the M1 group was lower detected respectively, compared to other groups. Also, GABA producing capacity was detected from candidate M1. The sensory score of the candidate M1 batch was better than that of the other experimental batches in terms of flavor, color and overall acceptance.

Selection of Novel Starters Having Amine Oxidase Activity to Decrease Biogenic Amine Content in *Doenjang* Fermentation

Sojeong Heo*, Do-Won Jeong1, Jong-Hoon Lee
Department of Food Science and Biotechnology, Kyunggi University, Korea, 1Department of Food Science and Biotechnology, Shinansan University, Korea

Biogenic amines are basic nitrogenous compounds produced mainly by bacterial decarboxylation activity and are one of the hazard substances in *doenjang* due to their adverse health effects. Several approaches have been attempted to reduce biogenic amines in *doenjang* and physical approach such as low temperature storage has been considered effective in biogenic amine reduction. Reports of biogenic amine degrading bacteria through oxidative deamination have led us to select starter candidates having amine oxidase activities. From 126 bacilli and 400 coagulase-negative staphylococci (CNS) isolates from *doenjang*, 40 bacilli and 7 CNS strains presenting oxidase activity on tryptic soy agar supplemented with 5% sheep blood were selected. Among them, 10 bacilli and 5 CNS strains exhibiting monoamine oxidase activity were selected using a commercial amine oxidase assay kit and *Staphylococcus saprophyticus* 0AML3 exhibited the highest enzyme activity. Application of *S. saprophyticus* 0AML3 in the *doenjang* manufacturing process may contribute to decrease the biogenic amine contents in *doenjang*.

Molecular Cloning and Characterization of a *α*-Amylase from *Bifidobacterium longum* Subsp. *longum* JCM 1217

Hye-Won Lee*, Jae-Hoon Shim
Department of Food Science and Nutrition, Hallym University, Korea

For the application of amylase to the production of resistant starch, novel *α*-amylase was cloned from *Bifidobacterium longum* (BiLA). The enzyme, BiLA, exhibited an optimal activity at 20°C and pH 5.0. This enzyme specifically catalyzes hydrolysis of oligosaccharides and starch up to G5 from the non-reducing ends. According to the kinetic study, the digestibility of starch decreased after BiLA treatment, which suggests that BiLA is a potential candidate for the production of resistance starch.
Molecular Cloning and Characterization of \( \alpha \)-Amylase from *Lactobacillus plantarum* subsp. *plantarum* ST-III

Hye-Yeon Jeon*, Jae-Hoon Shim
Department of Food Science and Nutrition, Hallym University, Korea

In this study, the gene encoding an \( \alpha \)-amylase from the *Lactobacillus plantarum* subsp. *plantarum* ST-III (LBA) was cloned and expressed in *Escherichia coli* MC1061. The enzymatic properties of LBA were investigated after enzyme purification. LBA exhibited an optimal activity at 30°C and pH 3.0. The conserved sequence alignment showed that LBA belongs to glycoside hydrolase family 13 (GH13). This enzyme showed exo-type catalytic activity on \( \alpha \)-1,4 and \( \alpha \)-1,6 linked substrates such as maltopentaose, maltoheptaose, amylose, amylopectin, starch, and branched beta-cyclodextrins then produced only maltose (G2) from the non-reducing end. Compared to a commercial G2 producing enzyme, beta-amylase, LBA effectively produced G2 from starch at high purity.

Enzymatic Preparation of Maltoheptaose Using a Cyclodextrin Glucanotransferase Mutant

Ye-Seul Koo*, Jae-Hoon Shim
Department of Food Science and Nutrition, Hallym University, Korea

Cyclodextrin glucanotransferase (CGTase) (EC 2.4.1.19) mainly produces cyclodextrins using linear-maltooligosaccharides. In this study, site-directed saturation mutagenesis was performed on the +1 substrate-binding residue, H233 of CGTase from Alkalophilic *Bacillus* sp. I-5 in order to prepare specific-length oligosaccharides which are relatively expensive and receive attention as important materials recently. The obtained mutant CGTase, H233Y primarily produced maltoheptaose (G7) using b-cyclodextrin (b-CD) by hydrolysis reaction. The kinetic study of H233Y showed that the \( k_{cat}/K_m \) value of b-CD was 7 times greater than that of maltoheptaose which is the possible explanations for the accumulation of G7 during the H233Y enzyme reaction. Also, the comparison of structure of CGTases with H233Y modeling supported that the substitution of H233Y may alter the position of +1 and +2 subsites and slowed down the further hydrolysis of maltoheptaose after ring-opening reaction.

Detection and Identification of Isolates Having Tyrosine Decarboxylase Gene from *Cheonggukjang* and *Deonjang*

Hyang-Rin Kang*, Seon-Mi Shin, Yae-Lim Lee, Hyun-Hee Yu, Han-Joon Hwang
Department of Food and Biotechnology, Korea University, Korea

This study was carried out to identify tyrosine decarboxylase gene (tdc) of tyramine producing microorganisms. A total of 100 isolates from *cheonggukjang* and *deonjang* from commercial markets were identified as *Bacillus* spp. and *Enterococcus* spp. using selected media and then screened for biogenic amine contents and detected tyrosine decarboxylase gene. Twenty isolates with high tyramine-producing activity were selected by using high performance liquid chromatography. These results showed tyramine contents in the range of 1,663.25±63.94 mg/L to 3,555.74±5.68 mg/L. Among 20 high tyramine high-producing isolates, 15 strains were investigated by using a selective medium which can detect tyrosine decarboxylase activity. The selected strains were identified as *Bacillus subtilis*, *Bacillus licheniformis* and *Enterococcus faecium* based on a 16S rRNA gene sequence analysis. PCR analysis showed that the tdc gene was present in the isolated strains.

Prebiotic Effect of Gallic Acid on Human Intestinal Microbiota Analyzed by *In vitro* Fermentation

Jeongsu Bang*, Bolortsetseg Baatar, Jin Seok Moon, So-Yeon Shin, Wooha Joo, Nam Soo Han
Brain Korea 21 Center for Bio-Resource Development, Division of Animal, Horticultural, and Food Sciences, Chungbuk National University, Korea

In recent years, there has been growing interest by food scientist in the physiological relevance of polyphenol reaching the lower gut and their relationship with human intestinal bacteria. The aim of this study was to investigate the prebiotics properties of gallic acid on intestinal microbiota by using *in vitro* fermentation. Fermentation by intestinal bacteria was conducted in anaerobic and pH-controlled faecal batch vessels with gallic acid for 24 h. Fructooligosaccharide (FOS) which is a known prebiotic was used as a control. Short chain fatty acid (SCFA) was analyzed by a high-performance liquid chromatography (HPLC). Gallic acid induced the growth of total bacteria, achieving a statistical increase at 12 and 24 h of incubation compared with the control vessel. Particularly, gallic acid caused a significant increase in the growth of bacteria associated with beneficial effects such as Bifidobacteria. Furthermore, amount of SCFA increased in incubation with the gallic acid until 24 h. This study demonstrates that the gallic acid in foods give prebiotic effect modulating the composition of intestinal microbiota.
Characterization of β-Amylase in Ramie Leaves and Its Application for Rice Cake

Jin Shu Bai*, Jung-Ah Han, Kwan-Hwa Park  
Department of Foodservice Management and Nutrition, Sungmyung University, Korea

The ramie leaf was prepared into powder by freeze drying, and β-amylose activity extracted from the ammonium sulfate fractionate of the ramie leaf was analyzed. The major product of β-amylose activity was maltose, and the optimum temperature and pH of the enzyme was 45°C and pH 5.3, respectively. Rice cake was prepared with freeze-dried ramie leaf containing β-amylose activity, and the retrogradation property and chain profile after debranching were analyzed by DSC and HPAEC, respectively. The rice cake stored at 4°C after 15 h, rice cake with ramie leaf extract had significantly lower enthalpy values (0.18 mJ/mg) than control (0.35 mJ/mg). The number of shorter branch chains DP<13 of amylopectin increased, whereas the number of longer branch chains DP>14 of amylopectin decreased. The results show us β-amylose of ramie leaf can released from the non-reducing end of the longer branch chains of amylopectin to kept maltose, resulting in lower retrogradation.

Development of Red Pepper Powder Added Lactic Acid Bacteria Fermented Mix with Aging Extension Efficacy on Kimchi

Yun Sun Kim*, Do Yeon Jeong, Sung Ho Cho  
Microbial Institute for Fermentation Industry, Korea

In current research trends of our country, there have been no studies with regards to the utilization and the functionality of the pepper powder itself, and the necessity for new functional pepper powder product that leads to consumption has been rising. As a result of experimenting with different set up, different temperature (25, 10, and 4°C) and different content ratio of lactic acid fermented powder and pepper powder (0, 1, 3, 5, and 10%), Concerning the change of antibacterial activity, ordinary chili powder did not indicate antibacterial activity; however, chili powder adding lactobacillus-fermented powder showed the greatest antibacterial activity on the 4th day at 25°C, on the 12th day at 10°C, and on the 42nd day at 4°C. Among the strains of lactobacillis, Leuconostoc mesenteroides KCCM 11325 indicated the highest antibacterial activity. Because kimchi adding lactobacillus-fermented powder indicated better taste, color, flavor, sour taste, and general preference, it is expected that all kinds of products using chili powder, not just kimchi, will be positively employing lactobacillus-added chili powder afterwards.

Production of 2-Fucosyllactose by Fucosyltransferase Expressed in Lactococcus lactis

Soo Jin Lee*, A reum Lee, Seung Kee Cho, Ling Li, So-Yeon Shin, Nam Soo Han  
Chungbuk National University, Korea

2-Fucosyllactose (2-FL) is a functional oligosaccharide present in human milk. 2-FL can be synthesized through the enzymatic fucosylation of lactose by α-1,2 fucosyltransferase (FucT2) which catalyzes the fucosyl transfer from guanosine-diphosphate (GDP) to the acceptor molecules to form an α-glycosidic linkage. The aim of this study was to synthesize 2-FL from GDP-L-fucose and lactose by using recombinant Lactococcus lactis expressing FucT2 gene. For this, FucT2 from Helicobacter pylori 26695 was synthesized after codon-optimization and used for to construct pNZ-HPpet and pNZ-HPoπti, and transformed into L. lactis NZ9000. Protein expression and enzyme activity were analyzed by HPLC and TLC. At low temperature (15°C), wild type FucT2 (HPwt) and codon-optimized FucT2 (HPoπti) were expressed as active enzymes to generate 2-FL. When analyzed by HPLC, a product peak with retention time of 10.6 min was shown and it corresponded to 2-FL. These results clearly demonstrate that the recombinant fucosyltransfereases (HPwt and HPoπti) expressed in L. lactis NZ9000 have a functional activity to produce 2-FL. This is the first report about production of 2-FL by the enzyme in recombinant L. lactis.

Cloning, Purification and Characterization of Recombinant Human Pancreatic α-Amylase (AMY2B) in Pichia pastoris

Min-Gyu Kim*, Young-Wan Kim  
Department of Food and Biotechnology, Korea University, Korea

Human α-amylase (EC 3.2.1.1) genes are located in a cluster on the chromosome that includes salivary amylase genes (AMY1), two pancreatic α-amylase genes (AMY2A and AMY2B). Various studies have been conducted on the structure, mutagenesis and kinetic analysis for chemically synthesized substrate of AMY2A. However, characterization of AMY2B has received less attention. In this study, human pancreatic α-amylase (AMY2B) gene was cloned and expressed in Pichia pastoris using the methanol-induced alcohol oxidase (AOX1) promoter. After 48 hours for incubation, the activity of recombinant AMY2B in the culture supernatant reached the peak and purified by Ni-NTA affinity chromatography. The optimum temperature and pH of purified enzymes were similar to those of AMY2A. Furthermore that is consistent with the characteristics of AMY2A. Furthermore that is consistent with the characteristics of AMY2A. Furthermore that is consistent with the characteristics of AMY2A. Furthermore that is consistent with the characteristics of AMY2A. Furthermore that is consistent with the characteristics of AMY2A. Furthermee...
Production of Recombinant Lytic Polysaccharide Monoxygenases in Bacillus subtilis

Mi-Ji Yu*, Min-Gyu Kim, Sun-Hee Yoon, Young-Wan Kim
Department of Food and Biotechnology, Korea University, Korea

Lytic polysaccharide monoxygenases (LPMOs) are recently highlighted in biofuel production due to their degrading activity toward crystalline polysaccharides such as cellulose and chitin through an oxidative mechanism. Although these enzymes are extracellular enzymes, LPMOs are produced in Escherichia coli, followed by purification from the fractionation of the periplasmic proteins. In order to facilitate the production and purification, we attempted the extracellular production of LPMOs using a Bacillus subtilis system. Two genes for a chitin-active LPMO and a cellulose-active LPMO from Bacillus atrophaeus 1942 and Streptomyces coelicolar A3(2), respectively, were cloned. The amount of pure LPMOs through Ni-NTA affinity chromatography allowed to know that that the B. subtilis system is more efficient for the production of LPMOs that the traditional T7 promoter-based E. coli system.

Optimization of 4-α-Glucanotransferase-Starch Complex Formation

Sun-Hee Yoon*, Young-Wan Kim
Department of Food and Biotechnology, Korea University, Korea

Enzymatic modifications of starch structure by 4-α-glucanotransferases have been studied to develop novel functional modified starch materials. Recently we found that a thermostable 4-α-glucanotransferase from Thermus thermophiles (TTaGT) shows binding affinity toward amylose in spite of lacking a carbohydrate bonding module. Based on the specific affinity, TTaGT can be purified by mixing insoluble amylose and the enzyme, followed by centrifugation. In this work, the binding matrix was changed from amylose to starch due to its availability and low cost. Various conditions were investigated to improve binding efficiency of TTaGT toward starch. Although TTaGT did not bind to raw starch at all, the binding yield was improved to about 50% of the subjected enzyme through optimization, and the purity of TTaGT in the complex was compatible with that of TTaGT, purified by hexahistidine tag-based affinity chromatography.

Microbial Diversity of Commercial Salts from Danakil Depression of Ethiopia

Ashagrie Gibtan1-2*, Mingyeong Woo1, Yong-Jik Lee3, Dong-Woo Lee4, Jung-Kue Shin1-5, Jae Hak Sohn1-2, Sang-Jae Lee1-2, Han-Seung Lee1-2
1Major in Food Biotechnology, Silla University, Korea, 2The Research Center for Extrremophiles and Marine Microbiology, Silla University, Korea, 3School of Applied Biosciences, Kyungpook National University, Korea, 4Department of Korean Cuisine, Jeonju University, Korea, 5Food Industry Research Institute, Jeonju University, Korea

The Danakil Depression of Ethiopia, the main salt source in east Africa, is the hottest inhabited place on the planet and microbial communities were investigated from the commercial salt (rock and Lake Afdera salt) samples based on metagenomic and culture methods. Using domain-specific primers, a region of the 16S rRNA gene was amplified and the product was subsequently used to create a clone library. The metagenomic molecular phylogeny revealed the dominance of the genus Halobacterium, Halorubrum, Halobacteriaceae, Natronomonas and Halarchaeum among the archaea and Halovibrio, salinibacter, Planococcus, Bacillus and Pseudomonas from bacteria. In addition to these, cultured result showed that all sequences belonged to the Halobacteriaceae family and most of them grouped in the genera Halorubrum, Haloarcual and Halobellus. The archaea and bacteria were more diversified in lake salt and rock salt samples, respectively. Metagenomic analysis identified more than 64 archaea and 99 bacteria distinct genera and many species in comparison with the routine cultural methods.
Expression and Purification of a Biologically Active Cysteine Protease, SnuCalCp03, from Calotropis procera R. Br. in Pichia pastoris

Chang Woo Kwon1,*, Myoung-Dong Kim2, Subin Yeo1, Choong Soon Kim1, Pahn-Shick Chang1,3
1Department of Agricultural Biotechnology, Seoul National University, Korea, 2Department of Food Science and Biotechnology, Kangwon National University, Korea, 3Center for Food and Bioconvergence, and Research Institute of Agriculture and Life Sciences, Seoul National University, Korea

Cysteine proteases from Calotropis procera R. Br. may be a potential candidate for food industry due to high thermostability, broad pH optima, and milk-clotting activity. A novel cysteine protease, SnuCalCp03, was cloned, and it was successfully expressed in the heterologous Pichia pastoris KM71 with α-factor secretion signal peptide. The expression of recombinant SnuCalCp03 was induced with 0.5% methanol at pH 6.0 for 48 h at 28°C. Recombinant SnuCalCp03 was purified using gel permeation chromatography; the pure protease at pH 6.0 for 48 h at 28°C. Recombinant SnuCalCp03 was induced with 0.5% methanol.

Multilocus Sequence Typing of Pediococcus pentosaceus Strains Isolated from Vegetables

Sulhee Lee*, Hyun-Dong Paik1, Young-Seo Park
Department of Food Science and Biotechnology, Gachon University, Korea, 1Department of Food Science and Biotechnology of Animal Resources, Konkuk University, Korea

The genus Pediococcus belong to the lactic acid bacteria and include 15 species which are used in the food industry as starter and probiotic cultures. The importance of Pediococcus spp. is due to their use as starter cultures in fermented meat as well as to their presence as the natural microflora in vegetables. The availability of P. pentosaceus in the food industry increases the need for reliable molecular techniques for strain identification. To date, the reliable molecular methods for definite identification at strain level of microorganisms used in food industry has not been developed. Molecular identification based on suitable marker genes could be a promising alternative to conventional molecular typing methods such as ribotyping. In this study, the applicability of seven housekeeping genes gvrB, pyc, pgm, leuS, glmA, and dalR in combination with the psj gene in multilocus sequence typing of P. pentosaceus was assessed. Sequencing and comparative analysis of sequence data were performed on 6 strains isolated from various vegetables. These seven marker genes allowed for a clear differentiation of the strains analyzed, indicating their applicability in molecular typing.
Optimization of δ-Aminolevulinic Acid (ALA) Production Using Recombinant E. coli

Sijik Bae*, Gyu sehong Cho, Hayull Chung
Department of Food Science and Biotechnology, Hankyong National University, Korea

For the efficient production of δ-Aminolevulinic acid (ALA), an antioxidant and detoxification agent, E. coli BLR (DE3) was obtained by cloning hemA from Rhodobacter capsulatus (ATCC 11166) using pHCE-IIIB for expression. The optimum temperature and stirring speed for the fermentation were 32°C and 250 rpm. Using glucose/glycerol mix as a carbon source increased ca. 5% of δ-ALA producing yield compared to using glucose only. In addition, using yeast extract/peptone (1:1) mix as a nitrogen source helped for saving over 10% expenses compared to use yeast extract only. Succinic acid and glycine are the precursors for the biosynthesis of δ-ALA. δ-ALA yield increased as succinic acid was added and the optimum concentration of it was 25 g/L. On contrast, the addition of glycine over 20 g/L showed negative effect and 15 g/L was found to be optimum. Fermentations for δ-ALA under the suggested condition in a jar fermenter (5 L) and a scale-up fermenter (300 L) produced δ-ALA at the concentrations of 4.3 g/L and 4.2 g/L, respectively.

Screening and Characterization of Beneficial Probiotics Fermenting Germinated Grains

Sulhee Lee*, Heesoo Cho, So Hyun Kim, Young-Seo Park
Department of Food Science and Biotechnology, Gachon University, Korea

The germinated grains contain high molecular weight carbohydrates, and this makes it difficult in fermentation by beneficial probiotics, caused by lack of available carbon sources. In this study, probiotics fermenting germinated black bean, germinated brown rice, Cordyceps militaris grown on germinated soybean, and Phellinus linteus grown on germinated brown rice were screened. First, 217 strains grown on each germinated grains were selected. Among them, 32 strains showed high antioxidant activity. The highest antioxidant activity and titratable acidity was measured 99.40% and 0.32% by Pediococcus pentosaceus ON-89A and Lactobacillus pentosus SC65, respectively. Eight strains were chosen by considering the titratable acidity and sensory property. When viable cells of 8 strains grown on each germinated grains were measured, L. pentosus SC65 had the highest viability of 8.08 log CFU/mL in 9% (w/v) germinated black bean medium. Consequently, L. pentosus SC65, P. pentosaceus SP-024, ON-89A, and SP4041 were chosen as starter strains for germinated black bean, germinated brown rice, C. militaris grown on germinated soybean, and P. linteus grown on germinated brown rice, respectively.

Diversity of β-Glucosidase-producing Yeast Strains Isolated from Korean Traditional Fermented Foods

Jin-A Lee*, Sulhee Lee, Jihee Yoo, Young-Seo Park
Department of Food Science and Biotechnology, Gachon University, Korea

β-Glucosidase is involved in the hydrolysis of β-glycosidic bonds connecting carbohydrate residues in β-D-glycosides. This enzyme activity made it useful in bioconversion process of functional ingredients of foods by removing the glucose moiety. In this study, the diversity of yeast strains which producing β-glucosidase isolated from 20 different Korean traditional fermented foods was examined. Total 200 yeast strains, 10 strains from each food source, which showed black zone on YM agar plate containing esculin and ammonium ferric citrate were collected as β-glucosidase-producing strains. When the genomic DNA of these yeast strains were ran RAPD-PCR using Saccharomyces cerevisiae specific primers, only 20 strains were identified as S. cerevisiae solely isolated from Japanese arrowroot makgeolli and gingens makgeolli. S. cerevisiae strains were divided into 9 and 4 groups in Japanese arrowroot makgeolli and gingens makgeolli, respectively. The highest β-glucosidase activities of strains isolated from Japanese arrowroot makgeolli and gingens makgeolli, determined using p-nitrophenyl-β-D-glucopyranoside, were found to be 8.27 and 5.15 unit/mL, respectively.

Microbiological Quality of Salted Kimchi Cabbage Manufacturing Process

Kyungmin Park*, Eun Jeong Choi, Minseon Koo, Kyung-Hyung Ku
Korea Food Research Institute, Korea

This study was investigated the reduction effect of microorganism according to process of salting and washing on two company of different districts. Total aerobic bacteria were detected in raw material of A and B on 6.3, 4.8 log CFU/g. After salting, consecutive washing process was determined to be ineffective, lowering the microbial count by one log reduction to 5.6 log CFU/g from 6.3 log CFU/g in A. The counts of fungi, coliforms, B. cereus were not decreased after washing. Enterococcus after salting was detected to 2 folds higher than those of raw material in A but reduced to 1.4 log MPN/g from 2.2 log MPN/g after washing process in B. E. coli was detected from salted kimchi cabbage before washing, salted kimchi cabbage after primary washing and salt solution. S. aureus was detected in products after secondary washing, salt solution and third washing solution, C. perfringens was detected in salt solution. E. coli O157:H7, Salmonella spp. and L. monocytogenes were not detected in total process. To reduce microbial contamination among manufacturing process, salting and washing process should be subjected to the appropriate sanitization or sterilization processes.
Analysis of Lactic Acid Bacteria Population Dynamics of Kimchi with Bacteriocin by PCR-DGGE

Hyun Woo Ahn*, Miran Jung, Wang June Kim
Dongguk University, Korea

Effect of addition of bacteriocin on microbial dynamics during kimchi fermentation, a traditional Korean fermented food was done by polymerase chain reaction-denaturing gradient gel electrophoresis (PCR-DGGE). Crude bacteriocins (SH01, DF01, and K10) produced by lactic acid bacteria(LAB) were prepared by ammonium sulfate precipitation and added to kimchi at 20°C for 7 days, and 5 AU/mL, respectively. The amplified 16S rRNA products were analyzed with PCR-DGGE, and were compared with the control. Weissella sp., Leuconostoc sp., and Lactobacillus sp. Weissella koreensis, W. confusa and Lactobacillus sakei were predominant microorganisms existed throughout the fermentation period in each sample. Compared to the control, the intensity of L. brevis band was weak in kimchi samples with each bacteriocin, and L. plantarum was appeared 3 days later. The pH of kimchi samples with each bacteriocin was higher from day 3 to 7. The acidity % of lactic acid in bacteriocin added samples was lower than the control from day 2 to 7. Consequently, we can predict that each bacteriocin prohibited the growth of L. brevis and impeded to grow L. plantarum.

Effect of Starter Culture Which Produce Bacteriocin on Fermentation Kinetics of Beer

Minji Kim*, Wang June Kim
Dongguk University, Korea

Bacteriocin producer bacterium, Pediococcus acidilactici K10, was isolated from previous study. The strain was used as a mean of bio-acidification of mash and, also, reducing spoilage lactic acid bacteria (LAB) of beer. K10 strain had antimicrobial activity against 2 beer spoilage LAB in wort condition and did not grow in beer environment. K10 strain was inoculated before mashing step. The effect K10 as a starter culture were investigated and compared with control sample. As a result, filtration time was shortened by 17 min, alcohol contents was increased by 137%, foam stability was increased by 156%, bitterness was increased by 2 bitterness unit (BU), and there was significant difference (p<0.05) in aromatic and sour odor. This use of K10 culture in beer may represent not only effective in brewing process but also obtain safer and more stable beers in conjunction with other hurdles.

Effect of Addition of Adjuncts on Fermentation Kinetics of Beer Produced from Korean Six-row Barley

Ho Jong Han*, Wang June Kim
Dongguk University, Korea

The suitability of using Korean six-row barley, containing a relatively high protein/starch ratio, in beer production was confirmed in the previous study. Barley is partially replaced with adjuncts such as rice and wheat to provide more fermentable carbohydrates for yeast, modify beer flavor character, and reduce production cost. In this study, the effect of addition of various amount of adjuncts (10 and 20%) on fermentation kinetics of beer produced from Korean six-row barley was examined. Rice, wheat, corn and potato were used as adjuncts in flour form. The effect of addition of adjuncts was analyzed and compared with control sample made of 100% barley in terms of fermentation kinetics. The adjuncts had an effect on beer color, making it slightly lighter than the control barley beer. The reducing sugar content increased and the alcohol content was higher in proportion to the amount of adjuncts added. Consequently, the addition of adjuncts at the level of up to 20% seems to have an impact on some of quality properties of samples in terms of fermentation kinetics, but it does not significantly affect the final product characteristics.

Isolation and Some Properties of Marine Yeast from Shinan Coast

Won Sin Kim*, Kazunori Takamine
Wonkwang Research Institute for Food Industry, Division of Life Science, College of Natural Sciences, Institute of Biotechnology, Wonkwang University, Korea, *Education and Research Center for Fermentation Studies, Ruculty of Agriculture, Kagoshima University, Japan

Yeast strains were isolated from the West, South and East coast to develop an excellent quality of fragrant flavor and taste as traditional distilled soju. Four yeast strains for soju making which showed good fermentation and pellicle non-producing were selected from 276 strains of yeast-like microbes. From the result of fermentation tests using rice koji, one strain (S6) was finally selected. This strain showed a good fermentation process and higher ethanol production ability than that of a brewing yeast, Saccharomyces cerevisiae Y99-5-3 strain was isolated from nurak. Especially the S6 strain showed stable fermentation process in the laboratory scale of sweet potato soju making. This strain was identified as S. cerevisiae by genetic analysis using 18S rRNA. It was confirmed that this strain showed better sodium chloride and ethanol tolerance than those of Y99-5-3 strain. Result of this experiment suggested that the S6 strain was very useful to brewing industry.
Fermentation Characteristics of Jerusalem Artichoke Wine by Inulinase Production Yeasts

Yu-Mi Na*, Heui-Dong Park
School of Food Science and Biotechnology, Kyungpook National University, Korea

In this study, wines were made with Jerusalem artichoke containing a highly functional inulin by using the yeast strains producing the inulinsase. Raw material was used as hot-air dried Jerusalem artichoke powder to increase the carbohydrate content in the mash and storage capacity. Fermentation was carried out for 10 days at 20°C after chalalization to about 25°Bx by S. cerevisiae, P. anomala or T. delbrueckii and their mixed cells as a starter. As a result, they were verified the possibility of alcoholic beverage containing alcohol 11.4 to 14% (v/v) and residual soluble solid 9.2 to 12°Bx. In addition, they were analyzed for free sugar and organic acid composition by HPLC and qualitative properties by GC/MS after collecting the volatile compounds by Headspace-SPME method. The results might be useful as the data for the fermentation of Jerusalem artichoke alcoholic beverages.

Complete Genome Sequence of Bacillus cereus FORC_010 and Analysis of Its Virulence Factors

Jiwhan Chun1-3*, Hongjun Na1,2, Daeho Kim1,3, Hye-Jin Ku1,2, Ju-Hoon Lee3,2, Sangryeol Ryu1,3
1Department of Food and Animal Biotechnology, Department of Agricultural Biotechnology, Research Institute of Agriculture and Life Sciences, and Center for Food and Biocomvergence, Seoul National University, Korea, 2Department of Food Science and Biotechnology, Graduate School of Biotechnology, Kyung Hee University, Korea, 3Foodborne-pathogens Omics Research Center, Seoul National University, Korea

Whole genome of B. cereus FORC_010 from Korean kimchi was sequenced by hybrid of Illumina Miseq and PacBio RS II system. Genomic analysis underwent following bioinformatics tools: RBS finder and Rapid Annotation by Subsystem Technology (RAST) server. This strain has a 5,326,039-bp-long chromosome with 35.28% G+C content and 5,147 ORFs. The plasmid, pFORC10-F, is 12,252-bp-long with 34.11% G+C content including 17 ORFs. On chromosome, 106 rRNAs and 46 tRNAs were predicted. Among 5,147 ORFs on chromosome and 17 ORFs on plasmid, 1,261 and 9 ORFs encode hypothetical proteins, while 3,886 and 8 ORFs encode functional ones by prediction, respectively. Virulence factors (VFs) were identified by relevant database, VF analysis illuminated genes related to illness: capsule-forming genes for host immune evasion, phospholipase genes for host cell necrosis and calcium ion efflux, protease genes for upsetting host defense system, and toxins such as cytotoxin K, hemolytic enterotoxin (HBL) and nonhemolytic enterotoxin (NHE) for diarrhea. Revealed VFs tell that B. cereus FORC_010 may cause serious enteric illnesses, intestinal inflammation and diarrhea, by infecting human body via spoiled food.

Genome-wide Transcriptome Analysis of Enterohemorrhagic Escherichia coli (EHEC) Isolate #736 Contaminating Canola Sprout

Yeomkyung Kim1,2*, Hongjun Na1,2, Seunghye Jeong1,2, Hyunjin Yoon2,3, Sangryeol Ryu1,2
1Department of Food and Animal Biotechnology, Department of Agricultural Biotechnology, Research Institute of Agriculture and Life Sciences, and Center for Food and Biocomvergence, Seoul National University, Korea, 2Foodborne-pathogens Omics Research Center, Seoul National University, Korea, 3Department of Molecular Science and Technology, Department of Applied Chemistry and Biological Engineering, Ajou University, Korea

Enterohemorrhagic: Escherichia coli (EHEC) is a food-borne pathogen causing bloody diarrhea and hemolytic uremic syndrome (HUS) in human. Recent studies have revealed that many outbreaks were mediated by spoiled produce such as raw sprouts. To investigate how the plant-derived EHEC cells adapt to sprouts, EHEC #736 was first isolated from kimchi in Korea and cultivated with canola sprouts (Brassica napus). Plantlike bacteria in sprout exudates were subjected to RNA sequencing to achieve bacterial mRNA profiles responding to contacts with sprouts. The results showed that 9% (log phase) and 1.7% (stationary phase) of total genes were up or down regulated when exposed to sprouts. Genes with different expression could be grouped mainly into four categories according to their predicted roles: cell envelope and outer membrane biogenesis, secondary metabolites biosynthesis/ transport, carbohydrate transport/metabolism, and amino acid transport/metabolism. Understanding of transcriptional responses of EHEC #736 to canola sprouts would provide insight into its adaptation to plants and would be further utilized for development of biocontrol strategy against food-borne pathogens.

Characterization of antimicrobial compounds from Lactobacillus sp. Isolated from Kimchi

Sung Kyung Kim*, Hae Choon Chang
Department of Food and Nutrition, Kimchi Research Center, Chosun University, Korea

Lactobacillus sp. isolated from kimchi, having broad anti-microbial spectra against pathogenic and food spoilage microorganisms; Bacillus cereus KCTC 3624, Micrococcus luteus ATCC 13513, Staphylococcus aureus ATCC 29213, E.coli O157:H7 ATCC 43895, Pseudomonas aeruginosa ATCC 27853, Salmonella enterica serovar typhi ATCC 19430, Vibrio parahaemolyticus ATCC 17892, Aspergillus flavus ATCC 22546, A. fumigatus ATCC 96918, A. ochraceus PF-2, A. nidulans PF-3, Penicillium roqueforti ATCC 10110, Penicillium expansum KCTC 6434. The antimicrobial compounds from the isolates, Lactobacillus sp., were partially purified by solid phase extraction (Isolute, C18 EC, 10 g; International Sorbent Technology, Hengoed, UK). The partially purified compounds showed antifungal activities against Aspergillus fumigatus ATCC 96918, A. flavus ATCC 22546, A. nidulans PF-3, A. ochraceus PF-2, Penicillium roqueforti ATCC 10110. However, the compounds did not inhibit growths of the other bacteria tested in this study except Bacillus cereus KCTC 3624. Furthermore, the antimicrobial activities were stable at heat (4-121°C), pH (2.5-9.5), various enzyme, and solvent treatments.
Antimicrobial Activity of Bacterium Bacillus sp. Is Enhanced in the Presence of Mold Hyphae

Haebi Yun*, Hae Choon Chang
Department of Food and Nutrition, Kimchi Research Center, Chosun University, Korea

Antimicrobial activity of Bacillus sp. was increased, when the bacterium Bacillus sp. was cultivated in the presence of Penicillium roqueforti. Bacillus sp. in the presence of P. roqueforti exhibited broad antimicrobial spectra against various food-borne pathogens such as Staphylococcus aureus ATCC 29213, Micrococcus luteus ATCC 13513, Bacillus cereus KCTC 3624 and fungal pathogens such as Penicillium roqueforti ATCC 10110, Aspergillus fumigatus ATCC 96918, Penicillium expansum. Maximum antibacterial activity was observed at 20-36 h cultivation of Bacillus sp. and maximum antifungal activity was observed at 20-120 h cultivation. The antibacterial activity of the Bacillus sp. was unstable at heat treatment over 50°C and at pH 10. The antifungal activity of the Bacillus sp. was stable at heat treatment (25-121°C) and decreased its activity at pH 2-4.

Characterization of Bacillus subtilis SN7 Harboring Anti-B. cereus Activity Isolated from Meju and Its Application to Cheonggukjang

Seul Gi Lee*, Hae Choon Chang
Department of Food and Nutrition, Kimchi Research Center, Chosun University, Korea

Bacillus subtilis SN7 harboring strong anti-B. cereus activity was isolated from meju. B. subtilis SN7 was sensitive to ampicillin, tetracycline, vancomycin, gentamicin, kanamycin, streptomycin, erythromycin, clindamycin, tetracycline, and chloramphenicol. β-Glucuronidase and β-glucosidase from B. subtilis SN7 were not detected using API zym kit. When vegetative cells and spores of B. cereus KCTC 3624 were cultured with supernatant of the B. subtilis SN7, respectively, the growths of B. cereus KCTC 3624 were completely inhibited within 24 h. Antibacterial compound from B. subtilis SN7 was partially purified with C18 Sep-pak (PPAC) and its inhibitory effect to B. cereus strain was investigated in food model (cheonggukjang). Cheonggukjang samples were treated with B. cereus vegetative cells and spores with 1.0×10^8 CFU/g and 1.0×10^5 CFU/g, respectively, there after treated with PPAC with 1% addition. None of B. cereus was detected in the cheonggukjang treated with PPAC for 30 days at 4°C. Whereas, 2.8×10^6 CFU/g of B. cereus were detected from non-PPAC treated cheonggukjang for 10 days at 4°C.

Growth Characteristics of Weisella sp., Leuconostoc sp., and Lactobacillus sp. Isolated from Kimchi on Different Growth Conditions

Eun Ji Kim*, Hae Choon Chang
Department of Food and Nutrition, Kimchi Research Center, Chosun University, Korea

Twenty-one lactic acid bacteria from kimchi were used in this study: Weisella spp., Leuconostoc spp., and Lactobacillus spp. The growth of the LAB strains was determined at 30°C. From the result of growth at 30°C, 9 LAB strains were selected for further experiment. Growth of the selected 9 LAB were monitored at -1 - -2°C for 12 weeks, at 4 and 6°C for 4 weeks, and at 15°C for 7 days. Growth of the LAB strains reached to stationary phase at 15°C for 5 days and they showed almost the same growth values as the growths of LAB at 30°C. Growth of the LAB strains reached to stationary phase at 4-6°C for 2 weeks and they showed much lower values than the growths at 30°C. W. koreensis and Lb. sakei showed high cell growth (7.6-9.3 log CFU/mL) at -1 - -2°C for 4 weeks. Whereas, W. confusa, W. cibaria, and Lb. plantarum showed the lowest cell growth (3.7-5.8 log CFU/mL) among the 9 LAB strains at -1 - -2°C. When effect of acid on the growth of 9 LAB strains was investigated, Lactobacillus spp. exhibited the highest survival rate (~88%), whereas W. koreensis exhibited the lowest survival rate (~44%) in acidic condition (pH 4.0) for 72 h among the tested LAB strains.

Development of Food Grade Medium using Chinese Cabbage Waste for Lactic Acid Bacteria Harboring Antimicrobial Activity

Song Hee Moon*, Hae Choon Chang
Department of Food and Nutrition, Kimchi Research Center, Chosun University, Korea

This study was investigated to develop the low-cost food grade culture media using chinese cabbage waste (CCW) and salted chinese cabbage waste (SCCW) produced during kimchi making process. The CCW and SCCW juices were prepared and used as medium components for lactic acid bacteria (Lactobacillus plantarum AF1, Lb. plantarum HD1, Lb. plantarum EM, Leuconostoc citreum GR1, Leu. mesenteroides TA). After addition of glucose, Mn, and Na to the CCW (CCW media) and SCCW (SCCW media) juices, those pH were adjusted into pH 6.0. When Lb. plantarum AF1 was cultured in CCW medium at 30°C for 24 h, the growth was 3.4×10^9 CFU/mL, antibacterial activity was 160 AU/mL, and antifungal activity was 640 AU/mL. Those values are almost same as the values observed in MRS broth. Under the SCCW medium, the viable cell number and antibacterial/antifungal activities of Lb. plantarum AF1 were measured with 1.5×10^9 CFU/mL, 160 AU/mL, and 640 AU/mL, respectively. Those are the same values in MRS (2.2×10^9 CFU/mL, 160 AU/mL, and 640 AU/mL). The 4 strains of lactic acid bacteria (HD1, EM, GR1 and TA) also showed the same viable cell numbers and antibacterial/antifungal activities under CCW or SCCW media.
**P12 -059**

**Application of Response Surface Methodology to Optimize the Culture Media for the Production of Biosurfactants by *Pseudomonas* sp. Z1**

**Jin Young Min**, **Hee Don Choi**  
*Korea Food Research Institute (KFRI), Korea*

The purpose of this experiment is to analyze the characteristics and chemical components of Biosurfactant (BS) produced by *Pseudomonas* sp. Z1. It was isolated from soil samples which were contaminated with oil in Daejon area. The surface tension of batch culture was 26.35 mN/m. The BS was produced by *Pseudomonas* sp. Z1. 0.53 g/L crude BS was extracted chloroform : methanol (2:1). The critical micelle concentration of the BS was 20 mg/L. The BS was thermostable (4-121°C) and could withstand a wide range of pH (2-12) and NaCl concentration (0-20% w/v). The isolated biosurfactant had good emulsifying activities and was good quality in terms of stability. One carbon substrates and two nitrogen sources were examined for their effects on BS production. To further optimize the component of fermentation medium, seventeen experiments were designed by response surface modelling method (RSM) to explore the concentration of three critical components in the medium. The RSM analysis gave an optimal concentration of peptone 0.37%, sucrose 3.68% and potassium 0.05%, respectively, predicting a maximum biosurfactant yield of 10.988 g/L obtained from experiments.

**P12 -060**

**Production of Bacteria-free Radish Seeds Using Combined Treatments of Gaseous Chlorine Dioxide and Dry-heat**

**Moonhak Choi**, **Hyun-Sun Seo**, **Jihyun Bang**, **Jee-Hoon Ryu**  
*Department of Biotechnology, Korea University, Korea*

The objective of this study was to produce sterile radish seeds using gaseous chlorine dioxide (ClO₂ gas). First, we produced ClO₂ gas solution in airtight containers and measured the concentrations of ClO₂ gas at 25°C and 55°C. It was found that ClO₂ gas was produced in greater amounts (p≤0.05) at 25°C than 55°C. Next, radish seeds were exposed with ClO₂ gas in airtight containers under relative humidity of 100% at 25 or 55°C and measured the populations of mesophilic aerobic bacteria (MAB) on radish seeds. For the control seeds (without ClO₂ gas), the populations of MAB were not significantly (p>0.05) changed for 6 h regardless of temperature. After treatment with ClO₂ gas at 25°C for 6 h, the populations of MAB were decreased by 3 log CFU/g. Finally, when radish seeds were exposed to ClO₂ gas at 55°C, MAB on radish seeds were completely inactivated within 2 h. The germination rates of radish seeds were not significantly decreased after treatment with gaseous ClO₂. These results indicate that ClO₂ gas and dry-heat treatments have synergistic antibacterial effects and can be used to produce bacteria-free radish seeds without loss of seed viability.

**P12 -062**

**Comparison of Enzyme Specificity of Two Glycogen Debranching Enzymes from *Methylobacillus flagellatus* KT**

**Eun-Jin Je**, **Jong-Hyun Jung**, **Cheon-Seok Park**  
*Graduate School of Biotechnology and Institute of Life Sciences and Resources, Kyung Hee University, Korea, ¹Korea Atomic Energy Research Institute, Korea*

Amylolytic enzymes represent a group of starch hydrolases and related enzymes that are active towards the α-glycosidic bonds in starch and related poly- and oligosaccharides. The three best known amylolytic enzymes are α-amylase, β-amylase and glucoamylase. With sequence-based classification of glycoside hydrolases (GHs), *Methylobacillus flagellatus* KT possesses two amylolytic enzymes genes, *Locus_number 1369* and *Locus_number 1169*. These genes are corresponding to typical debranching enzyme (isoamylase). However, the structural analysis revealed that *Locus_number 1369* (MFA) is related with GH57 whereas *Locus_number 1189* (MFDE) is GH57. Two genes were successfully expressed in *E. coli* and their enzymatic properties were compared each other. The optimal temperature of MFA and MFDE were 55°C and 40°C, respectively. Both enzymes were activated by adding KCl and NaCl. The addition of salt shifted optimal temperature of MFDE by 5°C (35°C) while those of MFA was not changed. Interestingly, MFA showed its catalytic specificity towards short length side chain (G3).

**P12 -061**

**Antimicrobial Activities of Gaseous Chlorine Dioxide as Affected by Relative Humidity against Mesophilic Aerobic Bacteria on Radish Seeds**

**Hyeri Son**, **Hyun-Sun Seo**, **Jihyun Bang**, **Jee-Hoon Ryu**  
*Department of Biotechnology, Korea University, Korea*

The objective of this study was to investigate the influence of relative humidity (RH) on the antimicrobial activities of gaseous chlorine dioxide (ClO₂ gas) against mesophilic aerobic bacteria (MAB) on radish seeds. First, we measured the concentration of ClO₂ gas which had been evaporated from aqueous ClO₂ in air-tight containers with 23% or 100% RH at 25°C. As a result, ClO₂ gas was generated in greater (p≤0.05) amounts at 23% RH than 100% RH. Next, we determined the populations of MAB on radish seeds when the seeds were incubated at 25°C with or without ClO₂ gas under 23% or 100% RH. The initial populations of MAB on the seeds were 3.7-3.8 log CFU/g. Without ClO₂ gas, the populations of MAB were not significantly (p>0.05) changed regardless of RH for 6 h. When treated with ClO₂ gas at 23% or 100% RH, the numbers of MAB on seeds were decreased to 2.6 or 0.7 log CFU/g, respectively, for 6 h. These results indicate that the antimicrobial activities of ClO₂ gas against MAB on radish seeds were enhanced as RH was increased. This study will provide basic information in developing sanitizing program of sprout seeds using gaseous antimicrobial agents including ClO₂ gas.
**Functional Analysis of Atypical Sucrose Isomerase Homologue from Gluconobacter moribef G707**

Minji Kim*, Jong-Hyun Jung1, Cheon-Seok Park

*Graduate School of Biotechnology and Institute of Life Sciences and Resources, Kyung Hee University, Korea, 1Korea Atomic Energy Research Institute, Korea*

Sucrose isomerase (EC 5.4.99.11) can transform sucrose to sucrose isomers, isomaltulose and trehalulose. Those sucrose isomers are spotlighted as alternative sweeteners since they are non-cariogenicity, low calorific value, and low glycemic properties. Recently, a new sucrose isomerase candidate gene has been identified from *Gluconobacter moribef G707*. It contains a molecular structure similar to GH 13 family enzymes such as oligo-1,6-glucosidase and amylosucrase. A sucrose isomerase gene from *G. moribef G707* (gmsi) was cloned by PCR and successfully expressed in *Escherichia coli* BL21 (DE3) using expression vector, pHCXHD. The gmsi gene contained the coding regions of 1,752 bp which encoded 584 amino acids. The recombinant GMSI was purified by Ni-NTA affinity chromatography and was observed molecular weight of 69 kDa by SDS-PAGE. The recombinant enzyme displays its maximal activity at 45°C and pH 5.0. In addition, the recombinant enzyme displayed isomerization activity as well as hydrolysis activity on sucrose.

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**Increasing Maltose Production of Archaeal Maltose Forming α-Amylase from Pyrococcus sp. ST04 by Site-directed Mutagenesis**

Myeong-Eun Lee*, Jong-Hyun Jung1, James F. Holden2, Eui-Jeon Woo1, Cheon-Seok Park

*Graduate School of Biotechnology and Institute of Life Sciences and Resources, Kyung Hee University, Korea, 1Research Division for Biotechnology, Korea Atomic Energy Research Institute, Korea, 2Department of Microbiology, University of Massachusetts, USA, 3Korea Research Institute of Bioscience and Biotechnology (KIRIBB), Korea*

Maltose is not only useful resource for manufacturing a candy and ice cream in food industry, but also has an attraction in the pharmaceutical industry as a replacement material of glucose and a precursor of maltitol. A maltose-forming α-amylase from *Pyrococcus* sp. ST04 (PSMA) is a novel thermostable amylase displaying dual hydrolysis activity toward α-1,4- and α-1,6-glycosidic linkages and only release maltose in exo-type manner. Despite of outstanding properties, PSMA has a fatal weak point that is low α-1,4-linkage hydrolysis activity. To improve the hydrolytic activity toward polymer, we investigated the substrate binding pattern based on the 1.8 Å crystal structure. Especially, phenylalanine residue at 218 in helix-loop-helix (207-222) is most closely positioned on +1 substrate binding site of PSMA. Remarkably, 17 of the saturated mutants at Phe218 exhibited higher activity than wild type in maltotriose hydrolysis, and four mutants (F218A, F218G, F218E, and F218S) deal with advanced maltose production from amylpectin than that of β-amylase. Taken together, the results proposed that PSMA could be used as a replacement of β-amylase in maltose production from starch.

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**Development of Fermented Sap Beverage Using GABA Producing Bacteria**

Jae Won Kim*, Seung Jun Yeon, Dong Jun Kim1, Kwang Yup Kim

*Department of Food Science and Biotechnology, Chungbuk National University, Korea, 1Department of Forest Science, Chungbuk National University, Korea*

This study is carried out to increase the production of γ-amino butyric acid (GABA) by *Lactobacillus brevis* CMF20 in several kinds of saps. The fluids of saps were filtered through 0.22 μm membrane filter and fermented with lactic acid bacteria. The isolated *L. brevis* CMF20 produced GABA to the concentration of 276.42 μg/mL at optimum conditions of pH 6.5, 37°C for 24 h in MRS broth. *L. brevis* CMF20 cultivated in MRS broth containing 0.8% MSG showed the highest GABA production up to the concentration of 1011.86 μg/mL. The production level of GABA obtained at 1% MSG, 2% sucrose, 5% soytone and 1% magnesium sulfate with addition of rice bran extract in the sap was 307.912 μg/mL. These results demonstrate that adding rice bran extract in sap is possible for the development of fermented sap beverage with increased GABA content.

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**Production of Fermented IMO Syrup by a Strain of L. plantarum**

Hyo-Hee Kim*, Chang-Hwan Oh1, Won-Pyo Lee, Woo-Hyun Lee

*Division of Biological Science and Technology, College of Science and Technology Yeung University, Korea, 1Department of Oriental Medical Food and Nutrition, Semyung University, Korea*

Isomaltooligosaccharides (IMOs) is a mixture of short-chain carbohydrates which has a digestion-resistant property. The raw material used for manufacturing IMO is starch such as organic rice, which is enzymatically converted into a mixture of isomaltooligosaccharide. To date, several studies have shown favorable functional properties of IMOs, including the prebiotic effect and improved bowel function. In this study, optimal manufacturing process of high purity IMO syrup was established by using four kinds of enzymes; α-amylase from *Bacillus amyloquefaciens*, maltogenic α-amylase from *Aspergillus orzeae*, pullulase from *Bacillus acidopulluliticus* and transglucosidase from *Trichoderma reesei*. The manufactured IMO syrup was further fermented by a strain of *L. plantarum* that has immune-stimulation activity. The fermented IMO syrup was analyzed to determine the content of yield rate for reducing sugar by DNS method and IMOs by High performance liquid chromatography. The IMO syrup was also determined for its residual sugars, heavy metals, and mineral content during 14 days of storage.
Isolation of Strains of Microorganism with High Enzymatic Activity from Sigumjang Which Is a Traditional Fermented Food in Gyeongsang-do Area

Hojeong Jeong*, Sangdon Lee, Sangwook Kim, Soohyung Lee, Hyouin Song, Gidong Han
Department of Food Science and Technology, College of Natural Resources, Yeungnam University, Korea

Sigumjang made with barley bran is traditional fermented food in Gyeongsang-do area. Appearance, tastes and flavors of sigumjang differs from traditional fermented soybean paste. Sigumjang is characterized by shorter fermentation time, lower salt contents and lower order compared to doenjang. Manufacturing method of sigumjang is not standardized so far because it is made so differently by region. The aim of this research is to suggest the basic information for standardization of sigumjang through investigating strains of microorganism with high enzymatic activity from sigumjang. We investigated the enzymatic activity of 19 kinds of sigumjang collected from Daegu and Gyeongsang-do area including Pohang, Gyeongju, Seongju, Gyeongsan, Changnyeong, Hapcheon, Geochang, and Sancheong. 15 strains showed high hydrolysis activity of cellulose, starch, protein after measuring 40 strains collected from the 19 kinds of sigumjang. Finally one strain of S-23 was selected through checking enzymatic activity of cellulase, amylase and protease. S-23 was identified as Bacillus amyloliquefaciens subsp. based on its 16S rRNA sequence analysis.

Fermentation of a Functional Whey Vinegar Using Yeast and Acetobacter

Won-Pyo Lee*, Jae-Im Choi, Hyo-Hee Kim, Woo-Hyun Lee, Sung-Sik Yoon
Division of Biological Science and Technology, Yonsei University, Korea

This study was conducted to ferment functional whey vinegar, which has been actively studied on functional characteristics. Yeast Kluyveromyces lactis and Acetobacter aceti were selected to ferment lactose and to produce acetic acid in the two stage fermentation process. For alcohol fermentation, 7% alcohol concentration was obtained at 10°Bx of initial whey, 30°C, and six days after fermentation. On the other hand, initial alcohol concentration is reported a critical factor to initiate the acetic acid fermentation. Acidity after typical 8-day fermentation throughout this experiments, final acidity reached up to 5.96% under 9% of initial alcohol concentration, under which the fermentation proceeds at two days after inoculation. At 1° of initial Bx, the total acidity was 5.09%. The optimal conditions for the acetic acid fermentation were as follows: 8 days of shaking incubation (200 rpm) at 30°C, 9% (v/v) alcohol concentration, 1°Bx fermenting broth, 15% (v/v) starter size, and 2% initial acidity. In terms of functionality, strong anti-oxidant activity was detected. Further studies need to explore the more health-promoting properties.
Synergistic Antimicrobial Effects of Lysozyme and Organic Acids on *Listeria monocytogenes* and *Vibrio parahaemolyticus*

Myeonggeun Oh*, Jiyeon Lee, Yoonhwa Jeong, Kwang-Wook Ko, Misook Kim
Department of Food Science and Nutrition, Dankook University, Korea, 1Daeho Corporation, Korea

This study was performed to confirm the synergistic antimicrobial effects of lysozyme and organic acids such as malic acid (MA), succinic acid (SA), lactic acid (LA), citric acid (CA) and acetic acid (AA) on *Listeria monocytogenes* and *Vibrio parahaemolyticus*. The bacteria were mixed with serially diluted agents and incubated at 37°C for 24 h to determine minimal inhibitory concentrations (MICs). The MICs of lysozyme on *L. monocytogenes* and *V. parahaemolyticus* were 50 mg/mL and 200 mg/mL. Organic acids had MICs of 0.25% (MA, SA, LA, and CA) or 0.13% (AA) against *L. monocytogenes* and 0.25% (LA and CA) or 0.13% (MA, SA, and AA) against *V. parahaemolyticus*. Synergistic effects of the combinations were determined using a checkerboard method. *L. monocytogenes* was synergistically inhibited by the combination of lysozyme and MA, SA, LA or CA. Lysozyme did not interact with AA against *L. monocytogenes*. The synergistic inhibitory effects of the combination of lysozyme and organic acids were not observed against *V. parahaemolyticus*. These results suggest that the combination of lysozyme and one of MA, SA, LA, or CA could be effectively used to control *L. monocytogenes* in the food system.

Effect of Cavitation on Liquid Food Sterilization

Jung Geun Park*, Yeo Jin Lee, Ae Son Um
Lab. of Food Safety and Toxicology, Department of Food Science and Nutrition, College of Human Ecology, Hanyang University, Korea

The purpose of this study was performed to evaluate the sterilizing power of sterilizer using cavitation. The material used was water and *Escherichia coli* was used as the strain for assessment of sterilizing power. Setting the conditions of the experiment was divided into 2 types (T1: Water 30 L, Cavitation-treat; T2: Water 30 L, Heat-treat), starting from initial temperature of 22°C to the final temperature of 100°C. We took 5 samples in 7-minute intervals to evaluate the sterilizing power of *E. coli*. Experimental results were as follows. Two log cycles decrease in T1, one log cycle decreased in T2 and *E. coli* was found from 22°C to 65°C while the germs were found at up to 100°C in T2. The cavitation showed higher log reduction than heat treatment. This study demonstrated that the cavitation technique may be more effective in sterilizing power in water than heat treatment.

Effects of Plant Extracts and Lactic Starter Cultures on Fermentation and Functional Properties of Herbal Yogurt

Nam Su Oh*, Ji Young Lee, Yong Kook Shin
Red Center, Seoul Dairy Cooperative, Korea

The objective of this study was to evaluate the effects of different Korean traditional herb extracts and two types of commercial starter cultures (single culture of *S. thermophilus* and co-culture of *S. thermophilus* and *L. delbrueckii* subsp. *bulgaricus*) on fermentation and functional properties of yogurt. Compared to plain yogurt, the samples with added herb extracts increased acidification rate and reduced the time to complete fermentation (pH 4.5), especially co-cultured yogurt supplemented with herb extracts decreased the time by 2-folds. Furthermore, after fermentation, supplementation of the herb extracts enhanced antioxidant and α-glucosidase inhibition activities with increased total phenolic and total flavonoid contents compared with plain yogurt. In particular, the highest functionality of yogurts was observed in co-cultured yogurt supplemented with *Morus alba* L. leaf (MA). These findings indicated that the application possibility of Korean traditional herb extracts as a functional ingredient in the manufacture of commercial herbal yogurt.

GABA (gamma-amino acid)-enriched Products by Lactic Acid Bacterial Fermentation Using Sea Tangle Extract

Deok-Hoon Kim*, Hae-Na Han, Gab-Jin Kim, Young-Mog Kim
Department of Food Science and Technology, Pukyong National University, Korea

This study was conducted to develop a value-added product using sea tangle *Saccharina japonica*. It has been known that glutamate converts into gamma-amino butyric acid (GABA) by lactic acid bacterial fermentation. Among of lactic acid bacterial strains tested in our previous studies, *Lactobacillus brevis* BJ-20 exhibited the highest efficacy in converting GABA in sea tangle water extract. In order to optimize the GABA production, the lactic acid bacteria was inoculated into and cultivated in the water extract. The GABA production was determined by HPLC analysis after fermentation by adding several growth factors such as glucose, yeast extract and amino acids. The addition of yeast extract in sea tangle water extract resulted in the GABA production. However, no GABA production was observed in the absence of yeast extract. In conclusion, yeast extract is one of critical factor in the bioconversion of glutamate into GABA. In order to address these phenomena, more study will be needed. For example, it needs to clarify the relationship between the bacterial growth and the growth factor or between the expression of glutamate decarboxylase in the bacterial cells and the growth factor.
Antibacterial Effect of Chitosan Conjugates against *Propionibacterium acnes* Causing Acne Vulgaris

Ji Hoon Kim*, Yun Hye Kim, Seung Mok Yeom, Song Hee Kim, Hong Yeop Park, Young Mog Kim
Department of Food Science and Technology, Pukyong National University, Korea

*Propionibacterium acnes* has been recognized as pus-forming organisms that trigger inflammation in acne. This bacteria was one of the commonly isolated skin organisms, induces an inflammation of the sebaceous glands in human face, neck, chest or back. To overcome the problem of side effects, medicinal and marine organisms derived compounds have been investigated for the treatment of acne. Chitosan is a naturally occurring mucopolysaccharide. Several bioactivities of chitosan and chitosan-derived conjugates such as antioxidant, anticancer, antimicrobial, and enzyme inhibitory effects have also been reported. However, there is no further information on the antibacterial activity of the conjugates against *P. acnes*. In the present work, we investigated the antibacterial activity of the chitosan conjugates. Among of them, chitosan-sinapic acid conjugate (CSA) exhibited the highest antibacterial activity against *P. acnes*. The results of this study suggest that the compounds derived from chitosan can be a potential source of natural antibacterial agents and a pharmaceutical component against acne-related bacteria.

Rapid Detection Methods for Pathogens in Foods

Mili Ryu*, Jungseop Roh, Myungkyo Jung
Analysis Team, HAITAI Confectionery and Foods Co., Ltd., Korea

*Staphylococcus aureus* is one of the major pathogens that can cause food poisoning. So, enterotoxigenic *S. aureus* should be regulated by the official method in the Korean Food Standards Codex. The official methods to detection of enterotoxin from food matrix rely on selective media. Also, the method have disadvantages such as long time requirement and distinguishing one species only from each selective medium although they are high costs. It is difficult to prevent the food poisoning and the investigation of the outbreaks immediately. In this study, PCR, Q-sep and real-time PCR in the detection of *S. aureus* are conducted for reducing analysis time and estimating the results precisely. Two days are required to detect the *S. aureus* by PCR, Q-sep and real-time PCR. Therefore, these methods are accurate, convenient, rapid and cost effective.

Antibacterial Activity of Supercritical CO₂ Oil from *Asiasarum heterotropoides* against Skin Pathogens

Saravana Periaswamy Sivagnanam*, A.S.M. Tanbirul Haque, Adane Tilahun Getachew, Jin Nam Moon, Yeon Jin Cho, Byung Soo Chun
Department of Food Science and Technology, Pukyong National University, Korea

*Asiasarum heterotropoides*, a deciduous perennial herb, is widely distributed in East Asia, Europe and North America. Asiasari radix extracts have been shown to have hyperalgesia inhibitory, antitussive, immunoglobulin inhibitory, memory enhancing, hair growth promoting, melanogenesis inhibitory and anticancer effects. In the current work we have evaluated the antibacterial potential of essential oil of *A. heterotropoides*. The antibacterial activity is studied against skin pathogens, mainly body odor causing bacteria. The essential oil was extracted by using Supercritical Carbon dioxide (SC-CO₂). The oil showed significant antibacterial activity against *S. epidermidis*, *P. freudenreichii*, *M. luteus*, *C. jeikeium*, and *C. xerosis*. The antimicrobial activity was assessed by well diffusion and Minimum inhibitory concentration (MIC). The determined values of well diffusion and MIC analysis studies of the *A. heterotropoides* oil indicate that *M. luteus* is the most sensitive bacterium against all the bacteria. The obtained data highlight the potential of *A. heterotropoides* essential oil as a natural antibiotic in the treatment of skin infections.

Antibacterial Activity of Benzyl Isothiocyanate against Oral and Fish Microorganisms

Mi-Ok Ko1,2*, Jeong- Yeon Ko1, Mi-Bo Kim2, Sang-Bin Lim1,2
1Department of Food Bioengineering, Jeju National University, Korea, 2Jeju Wellbeing Vegetables RIS System, Jeju National University, Korea

Antimicrobial activities of benzyl isothiocyanate (BITC) from cruciferous vegetables were investigated against oral and fish microorganisms. BITC showed antimicrobial activities against all oral and fish microorganisms tested. The minimum inhibitory concentration (MIC) of BITC ranged from 50 to 400 μg/mL against oral microorganisms (five facultative anaerobic bacteria, *Streptococcus mutans*, *S. sobrinus*, *Staphylococcus aureus*, *Enterococcus faecalis*, *Lactobacillus casei* and a yeast, *Candida albicans*). The MIC of BITC ranged from 3.91 to 31.25 μg/mL against fish microorganisms (four aerobic bacteria, *Edwardsiella tarda*, *Vibrio ichthyovenleri*, *V. harveyi*, *Photobacterium damselae* and two facultative anaerobic bacteria, *S. parauberis*, *S. iniae*). BITC showed the strongest antimicrobial activity against *C. albicans* among oral microorganisms and against *L. casei* among aerobic bacteria. In addition, BITC showed the highest antimicrobial activity against *E. tarda* among fish microorganisms, followed by *V. ichthyovenleri* and *V. harveyi*. These results suggest that the BITC from cruciferous vegetables can be used as an antimicrobial agent against oral and fish microorganisms.
Screening of Bacillus Strains for Potential Probiotics Isolated from Kimchi

Eun Bi Jeon*, Hwan Hoe Yu, Sung Ho Son, Na-Kyoung Lee, Hyun-Dong Paik
Department of Food Science and Biotechnology of Animal Resources, Konkuk University, Korea

Kimchi is a traditional fermented food of Korea, which is made from cabbage, red pepper, garlic, and jeot-gal. Kimchi has beneficial properties such as antioxidant, antimutagenic, antitumor, and immune stimulation effect. Since 1950s, Bacillus species has been used in probiotics. The spores, are made from Bacillus, can survive itself when it encounter extreme environment. The property of generating spores is a high advantage as probiotics. The aim of this study is to identify the probiotic potential of the Bacillus strain isolated from Kimchi. Among isolated 27 strains, isolated BK was selected by high acid tolerance. Isolated BK was identified as Bacillus subtilis. BK was resistant to pH 2.5 and 0.3% oxgall condition. According to the result of API ZYM kit, Bacillus subtilis BK generated α-glucosidase but didn't generate β-glucuronidase which is carcinogenic enzyme. In addition, Bacillus subtilis BK was determined amylase and protease activities by DNS and Folin-ciocalteu method. Depending on these results, Bacillus subtilis BK have probiotic potential.

Enhanced Physical and Functional Properties of Sweet Pumpkin and Old Pumpkin by Co-fermentation Using Lactic Acid Bacteria

Young-Cheol Song1*, Sam-Pin Lee1,2
1Department of Food Science and Technology, Keimyang University, Korea, 2The Center for Traditional Microorganism Resources, Konkuk University, Korea

This study was performed to develop co-fermented sweet pumpkin (SP) and old pumpkin (OP) by lactic acid fermentation. The SP and OP paste were fermented with 10% sucrose and 0.5% yeast extract by Leuconostoc mesenteroides SM for 2 days at 25°C. The 2nd fermentation was carried out by Lactobacillus plantarum K154 for 5 days at 30°C. The pH in fermented SP and OP decreased to pH 4.09, and pH 4.06. But the acidity increased to 2.25, and 2.16%, respectively. Viable cell count of fermented SP showed the highest value of 2.95E+09 CFU/mL on day 1 of 2nd fermentation. Consistency of fermented SP showed to increase as fermentation time was increased, but fermented OP was not increased. The Insoluble dextran content of fermented SP was 3.20% higher than fermented OP. The soluble dextran content was 2.41, and 2.12%, respectively. Mannitol production was the highest after 1st fermentation for 2 days and then decreased at the 2nd fermentation time. A 1% GABA was produced in the 2nd fermented SP and OP with 3% MSG by L. plantarum K154 during 5 days. Conclusively, the final fermented SP and OP could be utilized as multi-functional ingredients for food and bio industry.

Antioxidant Activities of Chamomile (Matricaria recutita L.) Flower Fermented by Various Probiotics

Eun-Hye Park*, Won-Young Bae, Hyun-Suk Kim, Su Jin Eom, Dong-Yim Choi1, Kee-Tae Kim2, Hyun-Dong Paik
Department of Food Science and Biotechnology of Animal Resources, Konkuk University, Korea

Chamomile (Matricaria recutita L.) has an antioxidative property and has been used as an herbal medicine in Europe. The purpose of this study was to enhance the antioxidative effect of chamomile by fermenting it using the following probiotic strains: Bacillus polyfermenticus, Lactobacillus plantarum, and Pediococcus acidilactici, and to determine the pH, total titratable acidity, and viable cell numbers during fermentation. Functional properties of fermented chamomile were determined using the DPPH radical-scavenging assay, β-carotene bleaching assay, and ferric reducing antioxidant power (FRAP) assay. The L. plantarum fermented sample showed greater DPPH radical scavenging activity, and the B. polyfermenticus fermented sample had greater reducing ability than did any other sample, as determined by the FRAP assay. In the β-carotene bleaching assay, the antioxidative activities of B. polyfermenticus, L. plantarum, and P. acidilactici fermented samples were 78.30, 65.79, and 82.86%, respectively, within 24 h of culture. These results suggest that chamomile sample fermented with probiotic strains could be used as functional substances having antioxidant properties.

Antioxidant and Tyrosinase-inhibitory Effects of Water Extract of British Yelowhead (Inula britannica) Flower Fermented by Lactobacillus plantarum

Eun-Hye Park*, Won-Young Bae, Hyun-Suk Kim, Su Jin Eom, Kyoung Jun Han, Dong-Gue Shin1, Kee-Tae Kim2, Hyun-Dong Paik
Department of Food Science and Biotechnology of Animal Resources, Konkuk University, Korea

Inula britannica has known to be traditional pharmaceutical plant because it has various effects for treatment of digestive disorders, bronchitis, and inflammation. This study was focused on antioxidative and tyrosinase-inhibitory activities of fermented I. britannica water extracts fermented by Lactobacillus plantarum isolated from kimchi. As bioactive compounds, total flavonoids and polyphenolics were determined. Functional properties were assessed on the basis of 1) antioxidant activity using β-carotene method and ferric reducing antioxidant power method 2) tyrosinase inhibitory activity. As a result, β-carotene bleaching activity and ferric reducing ability of extract fermented for 72 h was increased 1.16 folds and 1.30 folds, respectively, depending on fermentation time compared to non-fermented extract. In addition, it appeared that 72 h-fermented extract had 1.42 folds higher levels of inhibitory activity against tyrosinase than control (p<0.05). From these results, it is suggested that fermentation of I. britannica water extracts can enhance antioxidative and tyrosinase-inhibitory activity and that can be applied to functional food or cosmetic industry.
Anticancer Effect of Probiotic *Bacillus polyfermenticus* KU3 Isolated from Kimchi

Sung-Ho Son*, Na-Kyoung Lee, Eun Bi Jeon, Gi Hoon Jung, Hyun-Dong Paik

Department of Food Science and Biotechnology of Animal Resources, Konkuk University, Korea

*Bacillus polyfermenticus* KU3 was isolated from kimchi, and its potential probiotic characteristics included anticancer effect was investigated. The spore cell of *B. polyfermenticus* KU3 was highly resistant to artificial gastric conditions. When *B. polyfermenticus* KU3 was plated at a concentration of 8.10±0.05 log CFU/well, we found that 7.92±0.06 log CFU/well of the bacteria adhered to the human intestinal cell lines, HT-29. The cytotoxicity of *B. polyfermenticus* KU3 was evaluated in various cancer and normal cells using the MTT assay. Proliferation of HeLa, LoVo, HT-29, AGS, and MCF-7 cells was inhibited by 96.12, 95.18, 94.20, 90.58, and 94.97%, respectively. However, the proliferation of normal MRC-5 cells was not inhibited by 22.17% cytotoxicity. We also demonstrated the anti-inflammatory activity of *B. polyfermenticus* KU3 under lipopolysaccharide-induced inflammatory conditions, as the reduction in nitric oxide and proinflammatory cytokines (TNF-α, IL-10, TGF-β2, and CON-2). These results demonstrate the *B. polyfermenticus* KU3 inhibited proliferation of various cancer cells and could be used as functional foods for prophylactic therapy.

Optimum Production of Poly-γ-glutamic Acid and γ-Aminobutyric Acid by Co-fermentation of Herb Extracts Using *Bacillus subtilis* and *Lactobacillus plantarum*

Jae-Won Choi*, Sam-Pin Lee1,2
1Department of Food Science and Technology, Keimyung University, Korea, 2The Center for Traditional Microorganism Resource (TMR), Keimyung University, Korea

Co-fermentation of herb extracts was performed by *Bacillus subtilis* HA and *Lactobacillus plantarum* K154 for the production of poly-γ-glutamic acid (γ-PGA) and γ-aminobutyric acid (GABA) in the presence of sodium-1-glutamate (MSG). The 1st fermentation was performed by *B. subtilis* HA for 2 days at 42°C and then the 2nd fermentation was carried out with 1% skim milk and 3% glucose by *L. plantarum* K154 for 5 days at 30°C. The pH in fermented herb extracts with MSG decreased, but the acidity was increased by lactic acid fermentation. The 1st fermented herb extracts showed pH of 6.13-6.95 and 2.0×10^4-4.23×10^6 CFU/mL of viable cell counts, consistency of 1.18-1.50 Psv, and 3% mucilage content. After the 2nd fermentation for 2 days, mucilage content and consistency showed decreasing. The 2nd fermented herb extract showed pH 6.95-4.36, acidity 0.07-1.20%, 3.60×10^4-1.10×10^5 CFU/mL of viable cell count and 1% GABA. Conclusively, the co-fermented herb extracts using *Bacillus* sp. and *Lactobacillus* sp. can be fortified with probiotics, peptides, mucilage, and GABA.

Antioxidant, Anti-inflammatory, and Anticancer Effect of Probiotic *Lactococcus lactis* KC24

Sung-Ho Son*, Na-Kyoung Lee, Su Jin Eom, Hyun-Dong Paik

Department of Food Science and Biotechnology of Animal Resources, Konkuk University, Korea

The aims of this study were demonstrated anti-inflammatory, antioxidant, and anticancer effect of *L. lactis* KC24. Nitric oxide production was reduced in all groups treated with *L. lactis* KC24 (3.21-4.94 μmole) compared to the control LPS-stimulated cells without *L. lactis* KC24 (43.25 μmole). Tumor growth factor (TGF)-β2 was increased, while interleukin (IL)-18 was decreased in LPS-induced condition. The FRAP value of intact cell was 4,138.14 (μmol GAT/mL) compared to the control LPS-induced 1,175.59 (μmol GAT/mL). Tumor growth factor (TGF)-β2 and nitric oxide showed decreasing. The 2nd fermented herb extract showed pH 6.95-4.36, acidity 0.07-1.20%, 3.60×10^4-1.10×10^5 CFU/mL of viable cell count and 1% GABA. Conclusively, the co-fermented herb extracts using *Bacillus* sp. and *Lactobacillus* sp. can be fortified with probiotics, peptides, mucilage, and GABA.

Ice-wine: Physical and Chemical Composition Changes during Freeze Concentration and Fermentation Processes

Jong-jin Park*, Chang-Jae Kang, Dong-Hui Kim, Eun-Ji Kim, Young-In You, Si-Young Hwang, Hui Teng, Won-Young Lee

School of Food Science and Biotechnology, Kyungpook National University, Korea

Comparing to thermal concentration methods, freeze concentration can maximally preserve volatile aromas and polyphenol compounds. In this study, *Campbell Early* grape juice was cryo-concentrated to 36°Bx, fermented with *Saccharomyces cerevisiae* Fermivin and made into ice-wine. Physical and chemical changes during freeze concentration and fermentation processes were investigated. In general, freeze concentration showed a substantially increase of sugar concentration, and no sign of decomposition of nutrients of grape juice was observed. Temperature showed insignificant effect on the variations of color, pH, malic acid, and amino acids during concentration process, but sample concentrated at 20°C got higher quinic acid and free sugar contents than those concentrated at 4°C. During fermentation process, pH and total acidity increased to 3.70 and 1.30%, respectively. Alcohol concentration reached 10.40% but the sugar concentration reduced from 40.20°Bx to 24.43°Bx after 22 days of fermentation. Total polyphenol content decreased from 0.27 to 0.17 mg GAT/g, and total anthocyanin content dramatically decreased from 0.85 to 0.32 mg MGE/kg during fermentation process.
Protease Activity and Characterization of Bacillus amyloliquefaciens CGD3 Isolated from Doenjang

Rea-Hyun Lee*, Su-Jin Yang, Yul-Ri Gu, Ho-Yong Chae, Joo-Heon Hong
Department of Food Science and Technology, Catholic University of Daegu, Korea

In this study, one GRAS strain was screened from doenjang, a traditional Korean fermented food, as a microorganism producing protease due to the formation of a clear zone on the medium including skim milk. From the analysis of the gene sequence of 16S ribosomal RNA, the strain was identified as Bacillus amyloliquefaciens and was therefore named B. amyloliquefaciens CGD3. The protease activity by this strain reached 9.36 U/mL at 72 h. When the nutrient broth medium was prepared with 6% NaCl, 5% glucose, and the initial medium pH 5.0, the B. amyloliquefaciens CGD3 showed maximum growth. Among bovine serum albumin, casein, egg white, elastin, skim milk, casein was the most effective nitrogen source in the production of protease by B. amyloliquefaciens CGD3. The protease from B. amyloliquefaciens CGD3 showed the highest activities at pH 6.0-7.0 and 30°C, and casein was the most proper substrate for enzyme activity. The maximum protease activity reached 17.32 U/mL at 72 h, which was about 1.85 fold higher than that of the the original medium. The study provides reference data for further industrial fermentation production of protease.

Characterization Xylan-utilizing Yeast Pseudozyma tsukubaensis from Yellow Chrysanthemum

Hyun-Su Sim*, Eun-Hee Park, Myoung-Dong Kim
Department of Food Science and Biotechnology, Kangwon National University, Korea

Yeasts strains showing xylanase activity were explored for a variety of sources such as fermented foods and flowers. A yeast strain showing high level of xylanase activity on RBB- xylan plate were isolated and identified as Pseudozyma tsukubaensis via analysis of nucleotide sequence of the internal transcribed spacer1 (ITS1) region of 18S ribosomal RNA and based on its morphological, physiological, and biochemical characteristics. Maximum xylanase activity of 2,544.24±57.39 unit/mg protein was obtained at 55°C and pH 5.0. This is the first report to reveal the existence of xylanase activity in P. tsukubaensis.

Optimization of Lactic Acid Fermentation Using an Overgrown Antler

Soon-Young Kwon1*, Ji-Gyun Park1, Min-Ju Kim1, Geun-Min Jang1, Ji-Yeon Choi1, Sam-Pin Lee1,2
1Department of Food Science and Technology, Keimyung University, Korea, 2The Center for Traditional Microorganism Resource (TMR), Keimyung University, Korea

Old antler of deer was fermented by lactic acid bacteria to produce the bioactive compounds. The extract of old antler was performed by 100°C for 2 days. The extract showed 9.98% protein and 1.1 mg% calcium. The enzyme extraction of extract pomace was carried out using pepsin, resulting in the increase of tyrosine content. The fermentation of extract was performed with 2% glucose, 1% MSG and omija extract by Lactobacillus plantarum K154 for 7 days at 30°C. Viable cells count indicated 1.7×10⁷ CFU/mL after 3 days. The pH was decreased to 4.3 from initial pH 6.11, and acidity was increased from 1.42% to 0.18% by L. plantarum K154 for 3 days. Monosodium glutamate (MSG) was converted to y- amino butyric acid (GABA) during the fermentation time. Conclusively, the LAB fermentation of old antler of deer could provide the novel ingredient with probiotic and GABA.

Effect of the Safety-verified Novel Starter Candidate Application to Soybean Fermentation

Bitnara Lee*, Do-Won Jeong1, Jong-Hoon Lee
Department of Food Science and Biotechnology, Kyonggi University, Korea, 1Department of Food Science and Biotechnology, Shinansan University, Korea

Coagulase-negative staphylococci (CNS) were identified as a predominant bacterial group in our living bacterial community analysis of traditional doenjang manufacturing process and exhibited growth at 21% (w/v) NaCl condition. To select starter candidates for doenjang fermentation, we assessed the safety of 81 CNS isolates, 49 Staphylococcus saprophyticus strains, 14 S. succinus strains, and 18 S. xylosus strains, from meju and doenjang. Twenty-five strains exhibited resistances to at least one antibiotic. Eleven and five strains exhibited α- and β-hemolysis, respectively. Thirty-four CNS strains, 23 S. saprophyticus strains, 9 S. succinus strains, and 2 S. xylosus strains, cleared all of the safety hazard tests. After the biogenic amine production determination of 34 strains, the technological properties of 34 strains were assessed. S. succinus 14BME1, which was selected as the most applicable strain, was inoculated into steamed soybean and the volatile compounds produced during soybean fermentation were monitored. As the growth of the strains, organoleptic nutty flavor was monitored and pyrazine was dramatically increased.
Physicochemical Characteristics and Sensory Evaluation of Makgeolli with Sweet Pumpkin Brewed with Different Saccharification and Fermentation

Sun-Hee Moon*, Pyo-Hyeon Kim, Jong-Bang Eun
Department of Food Science and Technology and Functional Food Research Center, Chonnam National University, Korea

Makgeolli, Korean rice wine, added with sweet pumpkin (MSP) was brewed with two different manufacturing methods, simultaneous saccharification and fermentation (SSF) and separate hydrolysis and fermentation (SHF) at 25°C, for 7 days and its physicochemical characteristics were investigated. pH of MSP by SSF and SHF decreased during fermentation, but titratable acidity and L* value of MSP by SSF and SHF increased during fermentation for 7 days. Alcohol content of MSP by SSF and SHF increased to 6.56% and to 8.35%. Soluble solid content of MSP by SSF and SHF increased slightly during fermentation. In sensory evaluation, MSP by SSF and SHF was not significantly different in flavor, sweetness, bitterness and color. However, sorness of MSP by SSF was higher than that of MSP by SHF. The MSP by SHF showed highest score in over acceptability. In conclusion, makgeolli added with sweet pumpkin brewed by SHF would be better in quality than that done by SSF because MSP by SHF had better sensory properties than that by SSF.

Adsortion Characteristics of Heavy Metals on Yeasts

Ha-Na Jang*, Hyun-Il Jun, Young-Soo Kim, Geun-Seoup Song
Department of Food Science and Technology, Chonbuk National University, Korea

This study was carried out to investigate the adsorption ability of heavy metal (arsenic, cadmium, and lead) on yeasts. The suitable culture time was 12 h on the growth curve and viable cell of five yeasts incubated 28°C and YPD media. The dry cell weight of twenty five yeasts measured in the range of 8.70-38.47 mg/mL. In addition, the remin content in mixed heavy metal solution measured also in the range of 0.62-1.02 μg/mL for arsenic, 0.52-0.93 μg/mL for cadmium, and 0.87-0.94 μg/mL for lead. The results indicated the adsorption ability of yeasts exhibited higher cadmium than that of arsenic and lead. Among three yeasts (SCRM100307, SCRM100352, and SCRM100421) suggesting the high adsorption ability for cadmium, the SCRM100421 for arsenic, cadmium, and lead had lowest values (68.8, 41.8, and 64.9%) than that of comparison B (1.66, 1.58, and 1.61 μg/mL) at 7 mL of mixed heavy metal solution, respectively.

Vibrio vulnificus Glycogen Branching Enzyme Preferentially Transfers Very Short Chains: N1 Domain Determines the Chain Length Transferred

Hye-Jin Cho*, Jong-Tae Park
Department of Food Science and Technology, Chungnam National University, Korea

The glycogen branching enzyme from Vibrio vulnificus (VvGBE) transfers short side chains (DP 3-5) significantly greater than any other bacterial glycogen branching enzyme (GBE). To elucidate the role of the N-domain of VvGBE in the unique branching pattern, domain-truncated (N1 and N) and N1-domain-swapped (with VvGBE N1 replacing the counter part of Escherichia coli GBE) mutants were constructed. The truncation mutants synthesized branched products with a greatly reduced proportion of short chains. The swapping mutant exhibited a branching pattern of the short chain region similar to that of VvGBE. We conclude that the N1-domain of VvGBE has a crucial role in the determination of the branching pattern of glycogen.
Relationship between Structure and Functionality of Polysaccharide Produced from Bacteria

Ji-Yun Kwak*, Jong-Tae Park
Department of Food Science and Technology, Chungnam National University, Korea

Escherichia coli mutant, TBP38, is a double knock-out mutant, ΔmalP (maltodextrin phosphorylase) and ΔglgA (glycogen synthase), derived from strain MC4100. The molecular size of the polysaccharide produced by TBP38 was 2.6×10^6-4.6×10^6 Da and increased as the culture time passing. Three polysaccharides (extracted after cell culture for 48, 60, and 72 h) showed narrow molecular size distribution. A ratio of short side-chains (DP<12) in polysaccharides was over than 50% and number-average degree of polymerization (DPn) decreased from 9.8 to 8.4 as the time passing. Water-solubility of the polysaccharides was 70 to 290 times greater than that of amylopectin. Kn values of polysaccharides were more than 2-fold greater than that of amylopectin to porcine and human pancreatic α-amylase. kcat values were similar to both of α-amylases. Polysaccharides produced by TBP38 had lower digestibility to amyloglucosidase than that of amylopectin. Intriguingly, the polysaccharides showed the immunostimulating effects on mouse macrophage cell.

Quality Characteristics of Organic Acid during Fermentation Processes of Makgeolli

Jiyeon Seong*, Hyejeong Jeon, Hong Sik Kong
Genomic Informatics Center, Hankyong National University, Korea

Makgeolli is Korean traditional alcoholic beverage that has historically been brewed. In this study was carried out to investigate the changes in titratable acidity, amino acid content, sugar contents, alcohol contents, pH, reducing sugar, yeast population, lactic acid bacteria, sensory evaluation and organic acid during the fermentation processes of makgeolli by yeast strain type. As a results, organic acids, including lactic acid, succinic acid and citric acid were increased with fermentation time. Furthermore, the quality characteristics of makgeolli by varying the kind of the yeast was found to be seen the difference between each other. Therefore, studies concerning the yeast to improve the quality of makgeolli are continuously considered necessary.

Application of Soy Powder or Skim Milk to 0.1 M Sodium Phosphate Buffer Solutions and Its Effect on the Viability of Lactococcus lactis during Storage

Hyun Jung Gwak*, Sang-il Lee, Keon Jin Lee, Sang Hyun Ha, Young-Bae Chung, Hae Woong Park
World Institute of Kimchi, Korea

The viability of Lactococcus lactis was evaluated in different buffer solutions, i.e., 0.9% saline solution, Ringer’s solution, and 0.1 M sodium phosphate buffer solution during 14 days. Adding of soy powder or skim milk to 0.1 M sodium phosphate buffer showed a positive effect on the viability of L. lactis over the whole storage, whereas few L. lactis cells were survived in 0.9% saline solution and Ringer’s solution. The viability of L. lactis was improved when 0.3% skim milk or 0.3% soy powder was added to sodium phosphate buffer solution. The highest viability of 91.4% was observed three days after storage when 0.3% soy powder was added to the buffer. There was significant difference in 0.9% saline solution and Ringer’s solution between initial cell concentration and viability, whereas no significant difference was observed in sodium phosphate buffer.

Application of Skim Milk to 0.1 M Sodium Phosphate Buffer Solutions and Its Effect on the Viability of Lactobacillus brevis during Storage

Hyun Jung Gwak*, Sang-il Lee, Keon Jin Lee, Sang Hyun Ha, Young-Bae Chung, Hae Woong Park
World Institute of Kimchi, Korea

The viability of Lactobacillus brevis was evaluated in liquid solutions, i.e., 0.9% saline solution, Ringer’s solution, and 0.1 M sodium phosphate buffer solution during 14 days. The more initial bacterial concentration was, the higher viability of L. brevis was observed; the survival rate of bacterial cells, which were formulated in 10^12 CFU/mL, was slightly higher than one formulated in 10^11 CFU/mL. The viability of L. brevis was improved when 0.3% skim milk or 0.3% soy powder was added to buffer solution. Sodium phosphate buffer solution adding 0.3% skim milk was best, followed by solution with 0.3% soy powder and Ringer’s solution. The viability of L. brevis decreased as time passed. The highest rate of 63.1% was observed in buffer solution adding 0.3% skim milk 28 days after storage, whereas few L. brevis were survived in 0.9% saline solution. Regardless of initial bacterial concentrations, survival rate of L. brevis in 0.9% saline solution was lower than other buffer solutions over the whole storage.
Biological Activities of Radish Juice Fermented by *Pediococcus pentosaceus* and *Lactobacillus plantarum*, which are Isolated from *Omegisool*

Yeong Ji Oh\*, Kyung Eun Moon, Min Hee Kim, Dong Sun Jung

Department of Food Science and Technology, Seoul Women’s University, Korea

The purpose of this study was to investigate biological activities of fermented radish juices with lactic acid bacteria (LAB). The radish juices were fermented with *Omegisool*-originated *Lactobacillus plantarum* SW03 and *Pediococcus pentosaceus* SW01, and *L. rhamnous* as a control strain. The fermented radish juices were evaluated with radical scavenging activity, tyrosinase inhibitory activity, and SOD-like activity. The pH of fermented radish juices was rapidly decreased from 5.99 to 3.3-3.78 after 3 days fermentation at 25°C. DPPH and ABTS radicals scavenging activity, and SOD-like activity of the fermented radish juices were slightly increased after fermentation with LAB. The tyrosinase inhibitory activity of the fermented radish juice, especially with *L. plantarum* SW03 was 1.68 mg/mL of IC50 value, which is a more than 3 times higher activity than that of non-fermented radish juice. Therefore, the fermented radish juice by LAB showed improved biological activities such as radical scavenging activity and tyrosinase inhibitory activity.

Synthesis of Oligosaccharides Using Purified Bifidobacterial α/β-Galactosidases from Recombinant *Escherichia coli*

So Young Oh\*, Myeong Soo Park\(^2,3\), So Youn Youn\(^1\), Geun Eog Ji\(^1,3\)

\(^1\)Department of Food and Nutrition, Research Institute of Human Ecology, Seoul National University, Korea, \(^2\)Department of Hotel Culinary Arts, Yeonsung University, Korea, \(^3\)Research Institute, Bifido Inc., Korea

Galactosidases may catalyze both hydrolysis and trans-galactosylation reactions. Hydrolytic activity has been applied in the food industry for decades for reducing lactose contents in milk. However, trans-galactosylation activity, which yields galactooligosaccharides (GOSs), has been studied less than the hydrolytic activity. GOSs have shown beneficial effects on the promotion of the growth of bifidobacteria. In the present study, we screened the enzymatic activity of five strains of recombinant *Escherichia coli* strains which express αβ-galactosidase from *B. longum* RD 47. Two strains expressing strong activities of β-galactosidase (G1 strain) and α-galactosidase (G7 strain) were chosen for further studies. αβ-Galactosidases from G1 and G7 were purified by His-tag purification method. The purified enzymes were characterized with respect to the activities and stabilities according to temperature, pH, and metal ions. The fucosylated -oligosaccharides and β-galacto-oligosaccharides were synthesized by β-galactosidase and α-galacto-oligosaccharides such as raffinose by α-galactosidase, respectively.

Enzyme Treatment For Non-heat Extract of *Salvia miltiorrhiza*, Bunge

Sun-Hwa Kim\*, Mi-Na Jeon\(^2\), Young-Jin Seo\(^3\), Jong-Soo Kim\(^1\), Gi-Un Seong\(^2\), Shin-Kyo Chung\(^3\), Yong-Jin Jeong\(^1,2\), Mi-Yeon Kim\(^3\)

\(^1\)KMF Co., Ltd., Korea, \(^2\)Department of Food Science & Technology, Keimyung University, Korea, \(^3\)Bonghwa Plant Experiment Station, Korea, \(^4\)School of Food Science & Biotechnology, Kyungpook National University, Korea

*Salvia miltiorrhiza*, Bunge is a perennial herb plant belonging to the branch of Labiatae. This is performed to develop the effective extracting system in order to utilize the active components industrially. This study evaluated the physical and chemical properties the enzymatic treatments on non-heat extraction of the root of biennial and triennial bunge. The change in the total soluble solid content showed the highest value of 4.85°Bx at 8 h using the complex of amylase and cellulase, and showed the lowest value of 2.30°Bx at 4 h without enzyme. The change in pH was the lowest in the complex enzyme extracting at 4 h, the extraction using the enzyme of cellulase system showed a high value in general, and especially the highest value of pH 6.26 was shown at the section extracting for 4 h. The total phenolic compounds content showed the higher value as the extracting time increased regardless of the kinds of enzyme. DPPH, ABTS, and nitrite scavenging ability are increased concentration dependently and showed 80% over activity at 100 ppm. Amylase treated extract showed the highest activities. As result, amylase was the optimum enzyme for industrial utilization.
Identification and Characterization of Glycogen Debranching Enzyme from Thermoaacidophilic Archaeaon, Sulfolobus acidocaldarius DSM639

Minjeong Park*, Naenun Yun, Jihee Park, Jeonghyun Moon, Suzy Suh, Jaeho Cha
Department of Microbiology, College of Natural Sciences, Pusan National University, Korea

Glycogen debranching enzymes mainly contribute to the degradation of glycogen in various organisms. A gene (saci, 1439) encoding a putative debranching enzyme of Sulfolobus acidocaldarius is located in the trehalose biosynthesis gene cluster. The gene, designated TreX, was cloned and expressed in S. acidocaldarius MR31. The amino acid sequence of TreX had 73% identity with the TreX (SsoTreX) from S. solfatari cus. The recombiant enzyme was purified and the molecular weight of the enzyme was estimated to be 82.6 kDa. TreX had an optimal activity at pH 4.5 and 75°C. The enzyme have ability to hydrolyze α-1,6 glycosidic linkages of amylopectin, pullulan and glycogen, although it did not show hydrolyzing activity to α-1,4 linkages. Similarly to SsoTreX, this enzyme has both hydrolitic and transglycosylation activity when reacting with high concentrations of substrate. To compare the debranching patterns between this enzyme and isoamylase from Pseudomonas sp., after reaction of the enzymes with amylopectin, the products were analyzed. TreX produced relatively longer glucan chain than isoamylase. These differences are probably due to the unique transglycosylation activity of TreX.

Thermostable α-Galactosidase from Caldicellulosiruptor bescii DSM6725: Cloning, Characterization, and Substrate Specificity

Areum Lee*, Jihee Park, Jeonghyun Moon, Sujin Kim, Jaeho Cha
Department of Microbiology, College of Natural Sciences, Pusan National University, Korea

α-Galactosidase (E.C.3.2.1.22) is an enzyme that hydrolyzes terminal α-1,6 linked D-galactosyl residue from the nonreducing end of oligosaccharides and polymeric galactomannans. The α-galactosidase is an important technological and medicinal application. Caldicellulosiruptor bescii is a thermostable bacterium which has many enzymes related with carbohydrate degradation and their enzymes are suitable for biomass degradation because of their stabilities to high temperature and acidic environments. A gene (Cbes_0460) encoding a putative α-galactosidase from C. bescii DSM6725 was cloned and the recombinant protein was expressed and purified. The size estimated by SDS-PAGE was 84.6 kDa and it forms tetramer in nature. Its primary sequence is most related to the GH family 36. The purified Cbes_0460 was optimally active at pH 5.0 and 70°C and had a half-life of 15 h at 70°C. Enzyme activity with the metal ions and inhibitors indicated that thiol groups are involved in the α-galactosidase activity. The result of the kinetic studies revealed that melibiose was hydrolyzed more rapidly than raffinose and stachyose although the enzyme has higher affinity to stachyose than melibiose.

Effects of Lactic Acid Bacteria Fermentation on the Antioxidant and Anti-inflammatory Activity of Brown Algae Eisenia bicyclis Extract

Hae-Na Han*, Sung-Hwan Eom1, Deok-Hoon Kim, Ji-Hoon Kim, Song-Hee Kim, Young-Mog Kim
Department of Food Science and Technology, Graduate School, Pukyong National University, Korea, 1Korea Food Research Institute, Korea

This study was conducted to evaluate an effect of lactic acid bacteria fermentation on antioxidant and anti-inflammatory activity of edible brown alga Eisenia bicyclis. Lactic acid bacteria were inoculated and cultivated in E. bicyclis water extract. The antioxidant activities of extract were then assayed both before and following fermentation. Antioxidant activity was determined by assaying levels of radical scavenging activity against 2,2-diphenyl-1-picrylhydrazyl (DPPH), hydroxyl radical and alkyl radical. Lactic acid bacteria fermentation of E. bicyclis extract resulted in the enhancement of antioxidant activity. The greatest enhancement of antioxidant activity was seen in the DPPH radical scavenging assay in which E. bicyclis extract fermented by Pediococcus pentosaceus MBP-34 strain for 12 h. In addition, the fermented extract exhibited higher inhibitory activity (96.66%) on nitric oxide productions than those of other lactic acid bacteria fermented extracts and raw extract (189.60%). As a result, fermentation by bacterial strain is an attractive strategy for developing value-added food ingredients.
Antibacterial Activity of Siegesbeckia pubescens Extracts against Pathogenic Bacteria
Bo La Choi1*, Eun Ji Cho1, Seung Hyun Lee1, Myeong Jin Lee1, Jin Ho Bang1, Chae Eun Kim1, Se Young Oh1, Byung-Woo Kim1,2, Tae Hoon Kim1, Jung-Kil Seo1, Eun-Woo Lee1,2
1Department of Life Science and Biotechnology, Daegeu University, Korea, 2Blue Bio Industry RIC, Daegeu University, Korea

Soybeans Fermented by Aspergillus oryzae FMB S46471 and Lactobacillus brevis GABA 100
Yincong Li1*, Geun Eog Ji1
1Department of Food and Nutrition, Research Institute of Human Ecology, Seoul National University, Korea, 2Research Institute, Bifido Inc., Korea

Analysis of GABA and Isoflavone Contents in Soybeans Fermented by Aspergillus oryzae FMB S46471 and Lactobacillus brevis GABA 100
Yincong Li1*, Geun Eog Ji1
1Department of Food and Nutrition, Research Institute of Human Ecology, Seoul National University, Korea, 2Research Institute, Bifido Inc., Korea

Enhanced Health Functionality of Yogurt Added with Momordica charantia L.
Suin Park*, Yoonhwa Jeong, Han Sub Kwak, Sungyul Yu1, Youngseung Lee, Misook Kim
Department of Food Science and Nutrition, Dankook University, Korea, 1Department of Clinical Laboratory Science, Semyung University, Korea

Momordica charantia L. (M. charantia) is a well-known fruit containing an insulin-like peptide. We prepared yogurt using skim milk added with 1%, 2%, or 3% M. charantia powder. The fermentation was performed by a commercial yogurt starter culture containing Lactobacillus delbrueckii ssp. bulgaricus, and Streptococcus thermophilus at 42°C for 6 hours. The number of viable cells and pH value were 8.53 log CFU/mL and 3.96 in 1% MC, 8.86 log CFU/mL and 3.97 in 2% MC, and 7.59 log CFU/mL and 5.89 in 3% MC at the end of fermentation, and maintained during seven day storage whereas these were 7.51 log CFU/mL and 5.02 in the control yogurt (CONT). The total acidities of 1% MC and 2% MC were higher than CONT. Yogurt syneresis was the lowest in 1% MC, followed by 2% MC, 3% MC, and CONT during the storage. Also, the addition of M. charantia increased antioxidant capacity of yogurt. Therefore, we suggest that M. charantia can be effectively used to prepare yogurt with the enhanced functionality.

Quality Characteristics of Porcine Blood Based on the Protease Hydrolysis Condition
Joo-Young Park1*, Yong-Jun Jo1, Da-Na Seok2, Mi-Yeon Kim1, Yong-Jin Jeong1,2
1KMF Co., Ltd., Korea, 2Department of Food Science & Technology, Keimyung University, Korea

The porcine blood produced from the domestic slaughterhouse contains a 13-17% of good quality protein and iron. Inevitably, a great portion of them were disused. This study was carried to develop the supplement of amino acid using the porcine blood and examined the physical and chemical change after hydrolysis in the quality according to the kind, concentration, and hydrolysis time of enzyme. Among the 5 kinds of protease, KMF 15 (A), pH value was the lowest and the total content of the free amino acid was the highest. Depending on the concentration of enzyme, pH value decreased, and the content of soluble solid increased. The total content of free amino acid increased with the increase of enzyme concentration, but increased no more at a 0.2% and over concentration. The total content of free amino acid of A enzyme was 5.44 g/100 at the point of 4 h, but decreased as the time of hydrolysis over 4 h. As a result, hydrolysis with a 0.2% of A enzyme for 4 h, the content of soluble solid and free amino acid were the highest, this condition can be utilized as processing condition for manufacturing the supplement of amino acids using porcine.
Species Analysis of Selenium in Selenium-enriched Bifidobacterium bifidum BGN4 Using HPLC-ICP-MS

Weihong Jin1*, Cheolho Yoon1, Jeong-ah Kim1, Geun-eog Ji1,2
1Department of Food and Nutrition, Research Institute of Human Ecology, Seoul National University, Korea, 2Research Center, Bifido Co., Ltd., Korea, 3Seoul Center, Korea Basic Science Institute, Korea

Selenium is a trace element essential for human health and has received considerable attention with its nutritional value. In this research, 10 strains of lactic acid bacteria was screened to select a strain with both high selenium uptake efficiency and the ability to transform inorganic selenium to the organic form. The total selenium was detected by Inductively Coupled Plasma-Atomic Emission Spectrometer (ICP-AES). Se species was separated by anion-exchange chromatography, and detected by inductively coupled plasma-mass spectrometry (ICP-MS). The results showed that more than 90% of the organic selenium in B. bifidum BGN4 is selenomethionine. Considering that B. bifidum BGN4 is a well-known probiotic strain with clinically proven beneficial effects, Se-enriched B. bifidum BGN4 may provide dual healthy functions for the daily supplementation of selenium and regulation of intestinal bacteria.

Evaluation of Various Media on Selective counting of Bifidobacterium

Hyeon Ju Park1*, Geun-eog Ji1,2
1Department of Food and Nutrition, Seoul National University, Korea, 2Research Institute, Bifido Inc., Korea

Currently, the viable cell counting of the Bifidobacterium in the product containing Bifidobacterium mixed with general lactic acid bacteria needs to be performed using BS medium. However, Bifidobacterium grown on BS medium undergoes remarkable cell death, thus the test method of Korean Food Standards Codex for Bifidobacterium using BS medium needs revision. This study was carried out to compare the viable cell numbers of Bifidobacterium counts using different agar media (MRS, BL, BS 2X, TO, TOS-MUP, and TOS-MUP 2X). The results showed that the number of Bifidobacterium counted on MRS, BL, TOS, and TOS-MUP 2X medium were similar but significantly lower on BS medium. The viable cell counts of Bifidobacterium on BS 2X and TOS-MUP medium were slightly lower than that of MRS medium. B. breve KCTC 3220 and B. infantis KCTC 3249 incubated for 3 days showed about 10^8 CFU/mL on MRS and BL media but did not grow at all on BS medium, whereas the number of B. animalis KCTC 3219 showed 10 fold lower counts on BS medium than on MRS and BL media. Thus the death rate of Bifidobacterium on BS medium differed considerably depending on the bacterial strains and their incubation periods.

Physicochemical Properties and Volatile Flavor Compounds of Kiwifruit Wine according to Production Year

Hee Yul Lee*, Seong Hoon Jeong1, Min Ju Ahn, Ji Hyun Shin1, Joo Young Lee2, Hyeon Kook Jo2, Weon Taek SEO, Kye Man Cho
Department of Food Science, Gyeongnam National University of Science and Technology, Korea, 1Namhae Garlic Research Institute, Korea, 2Farming Corporation OrumJooga Winery, Korea

The physicochemical properties of dry wine produced from domestic kiwifruit according to production year of from 2008 to 2012 were studied. pHs of wine were from 4.02 (F wine, production year 2009, sterilized) to 4.11 (D wine, production year 2012, non-sterilized) and their acidities were lowest in D wine (0.79%) and highest in F wine (1.18%). All the wines have the same soluble solids of 8°Bx and 12% of alcohol, respectively. The reducing sugar was the lowest in A wine (production year 2008, non-sterilized) and the highest in D wine. The lactic acid was detected as a main organic acid and the free sugar was detected only fructose. As main flavor components, ethyl acetate and 1-pentanal were detected and their sum of 80-90% and a small amount of phenylethyl alcohol which providing rose-like aroma was also detected.

Physicochemical Properties and Volatile Flavor Compounds of Produced Mixture Wine with Kiwi and Permission Fruits Using Wild Yeast, Saccharomyces cerevisiae Y28

Hee Yul Lee*, Weon Taek SEO, Seong Hoon Jeong1, Chung Eun Hwang, Min Ju Ahn, Ji Hyun Shin1, Joo Young Lee2, Hyeon Kook Jo2, Kye Man Cho
Department of Food Science, Gyeongnam National University of Science and Technology, Korea, 1Namhae Garlic Research Institute, Korea, 2Farming Corporation OrumJooga Winery, Korea

We studied optimum condition of rapidase treatment for kiwi and persimmon juice and the physicochemical properties of the mixing wines with kiwi and persimmon were produced by Saccharomyces cerevisiae Y28. As the result, the optimum conditions were obtained as 0.3% rapidase for 1 h in kiwi and 0.3% rapidase for 3 h in persimmon. The pH of wines was negligibly increased, which ranges around 3.69 to 3.77, while the acidity of wines was decreased from to 2.07 to 1.51% according to higher ratio of persimmon at 14 days fermentation. The ranges of 8°Bx and reducing sugar in wines were decreased which ranges around 9.6 to 8.8 and 6.07 to 6.90 g/L, respectively, after fermentation. Major organic acid in wines were identified as tartaric acid, malic acid, and citric acid. The free sugar such as sucrose and glucose were a little detected in wines, but fructose was completely absent. The major flavor components were identified as ethyl acetate and hydrazine, and 1,1-dimethyl. Importantly, phenylethyl alcohol was detected from the all wines that have a typical rose-like flavor.
Screening of Bacillus spp. with Potential Probiotic Properties Isolated from Korean Traditional Soy Sauce

San-ki Lee*, Yoon-hwa Jeong, Sung-ryul Yu1, Young-seung Lee, Han Sub Kwak, Misook Kim

Department of Food Science and Nutrition, Dankook University, Korea, 1Department of Clinical Laboratory Science, Semyung University, Korea

Bacillus spp. were isolated from Korean traditional soy sauces, and evaluated for probiotic potentials in order to select candidates to be used as probiotic starters for the production of soybean fermented foods with the enhanced functional properties. Among seventeen soy sauces, thirteen soy sauces included Bacillus spp. with the resistance to artificial gastric juice containing 1% pepsin (pH 2.0) and bile juice containing 3% bile salt. These were all gram-positive and rod shape bacteria producing endospore. Ten Bacillus spp. possessed antimicrobial activity against Escherichia coli, Staphylococcus aureus, B. cereus, or Listeria monocytogenes. Bacillus sp. E-1, J-1, M-1, and N-1 strongly inhibited against B. cereus, and E-1 inhibited the growth of L. monocytogenes. Hydrophobicity of ten potential probiotic Bacillus spp. was ranged from 20.27% to 89.85%. More details will be discussed.

Selection of Micrococcus luteus G9 as a Starter Culture for Ginseng Fermentation

Seon-Eun Park*, Seon-A Yoo, Seung-Ho Seo, Hong-Seok Son

School of Oriental Medicine, Dongshin University, Korea

In order to select the most suitable strain for fermentation of ginseng extract, a total of 33 bacteria isolated from ginseng and 6 strains (Lactobacillus fermentum, Lactococcus lactis, Bifidobacterium longum, Leu. mesenteroides, L. plantarum, and L. bulgaricus) purchased from KCTC, KCCM were characterized with respect to their growth capability, β-glucosidase activity and sensory evaluation in ginseng fermentation. G9 was selected as a potential culture based on the ability to form detected black zone in esculin agar, grow faster than other strains and show relatively good sensory evaluation (flavor). G9 also showed higher β-glucosidase activity than other laboratory strains, excluding Leu. mesenteroides. The selected strain was identified as similarity to known sequences of Micrococcus luteus based on phylogenetic analysis using 16S rDNA partial sequence and was designated M. luteus G9.

Quality Characteristics of Fermented Sausage Prepared with Soy Sauce

Seon-A Yoo*, Seong-Eun Park, Seung-Ho Seo, Hong-Seok Son

School of Oriental Medicine, Dongshin University, Korea

The aim of the study was to evaluate the effect of soy sauce addition during fermentation of fermented sausages, in terms of organic acid, amino acid and sensory characteristics. Three batches of fermented sausage were produced: without soy sauce addition and with 2% or 3% (v/w) of soy sauce. The pH decreased sharply in the sausage fermented with soy sauce addition and with 2% or 3% (v/w) of soy sauce. The concentrations of organic acid, amino acid and sensory characteristics. Among seventeen soy sauces, thirteen soy sauces included Bacillus spp. with the resistance to artificial gastric juice containing 1% pepsin (pH 2.0) and bile juice containing 3% bile salt. These were all gram-positive and rod shape bacteria producing endospore. Ten Bacillus spp. possessed antimicrobial activity against Escherichia coli, Staphylococcus aureus, B. cereus, or Listeria monocytogenes. Bacillus sp. E-1, J-1, M-1, and N-1 strongly inhibited against B. cereus, and E-1 inhibited the growth of L. monocytogenes. Hydrophobicity of ten potential probiotic Bacillus spp. was ranged from 20.27% to 89.85%. More details will be discussed.

Fermentation of Ginseng Berry by Mycotoxin Non-producing Molds and Its Biological Activities

Zhipeng Li*, Hyung Jin Ahn1, Nam Yeon Kim1, Yu Na Lee1, Geun Eog Ji1,2

1Department of Food and Nutrition, Research Institute of Human Ecology, Seoul National University, Korea, 2Research Institute, Bifido Co., Ltd., Korea

Ginseng has been used as a kind of precious remedy for thousands of years. Ginsenosides are the main components responsible for the pharmacological and biological activities. Especially, ginseng berry contains more than 4 times higher content of ginsenoside Re than ginseng root. In the present study, we used Aspergillus niger and A. oryzae strains, which did not produce mycotoxin such as aflatoxin, cyclopiazonic acid, and ochratoxin, to ferment ginseng berry for the purpose of deglycosylating ginsenosides. The results showed that A. niger tended to efficiently degrade PPD type ginsenosides such as Rb2 to cK and that A. oryzae tended to efficiently degrade PPT type ginsenoside such as Re to Rh1. Various studies have shown that cK has cytotoxic and anti-inflammatory effects while Rh1 has anti-allergic and anti-diabetic effects. In the present study, fermentation ginseng berry exhibited high cytotoxicity, inhibited nitric oxide produce from LPS-stimulated RAW264.7 cells and β-hexosaminidase from calcium ionophore A23187-challenged RBL-2H3 cells. Moreover, fermentation has significantly enhanced these activities which were also affected by experimental molds.
Effect of Storage Temperature and Alcohol Content on the Quality of Takju during Storage Period

Seung-Ho Seo*, Seong-Eun Park, Seon-A Yoo, Hong-Seok Son

School of Oriental Medicine, Dongshin University, Korea

This study was performed to investigate the quality characteristics of takju under different storage temperatures (4°C and 20°C) and alcohol content (6, 8, 10, and 12%) during 90 days of storage. Free amino acid contents in takju stored at 20°C increased gradually from the early stage of storage period regardless alcohol content. However, no significant differences were observed for pH, total acidity and free amino acid content in takju stored at 4°C during 90 days of storage. Lactic acid contents in shelf life of takju stored at 4°C increased after storage (1,883.5 mg/L-1,914.6 mg/L), whereas those in takju stored at 20°C increased after storage (1,883.5 mg/L-4,736.1 mg/L). Thus, we concluded that the shelf life of takju could be extended more than 30 days in case it stored at 4°C.

Analysis of Microbial Community Based on Genomic Analysis Using Next Generation Sequencing (NGS) and Based on Viable Organism Using Selective Media of Korea Traditional Cheese-Kunrak

Jin-Kyoung Jung*, Sun Hyun Park, Sang-Dong Lim, Yong Sun Cho, Myung-Ki Lee

Korea Food Research Institute, Korea

Kunrak, a type of Korea traditional cheese, is made using tarak which is a yogurt produced with makgeolli as the fermentation starter. Kunrak is produced by removing whey from tarak followed by a drying process for the safe and long term storage. Kunrak procedure is similar to Arruul that major dairy products is consume in Mongolia. In this study, we aimed to analyze changes in the microbial community of kunrak. Kunrak was manufacture based on the method described in 'Imwonsibyukji' and was analyzed the change of microbial community. Manufactured kunrak was ripening period for 96 h at 20, 30, and 40°C. Bacterial population size was analyzed using 6 different selective culture media. The results using selective media showed that, the major community of kunrak was Enterococcus faecalis, E. faecium. Microbial community structure was analyzed by using next-generation sequencing (NGS) at the phylum, class and genus levels. The results using NGS at the genus level showed that, the microbial ecosystem of kunrak was dominated by Bacillus sp. in early ripening stage. And Pediococcus sp. was dominant in later ripening stage. The results provide the basic data of produce conditions for standardized manufacturing process of kunrak.

Comparison of Microbial Sanitation Level between HACCP and Non-HACCP Certificated Meatpacking Process in Korea

Hyojin Choe*, Jong-Mi Choi, Hyung-ku Lim, Byounghoon Kim, Jinman Kim, Seung-hee Beak

Korea Livestock Products HACCP Accreditation Service, Korea

The hazard analysis critical control point (HACCP) system is safety guard of food chain from farm to table. This study is conducted to determine that the influence of HACCP on meat packing process and bucher shops by monitoring microbial levels between HACCP and non-HACCP. It is tested numbers of indicator bacteria of contamination (aerobic bacteria (AB), coliform bacteria, E. coli) and qualitative tested of food-borne pathogens on products, row meat, hands, knife, chopping board and floor in HACCP and non-HACCP certificated shop (n=200). As the result, the numbers of AB in non-HACCP (beef product : 5.4×10^5 CFU/g, carcass surface : 1.0×10^6 CFU/cm², tools and environments : 6.7×10^7 CFU/cm², hand, knife) was higher than HACCP (beef product : 6.5×10^5 CFU/g, carcass surface : 2.1×10^7 CFU/cm², tools and environments : 1.6×10^8 CFU/cm², hand, knife). None of sample has detected Salmonella spp, however Listeria monocytogenes has only detected from non-HACCP (products, row meat). It has been shown that HACCP system makes positive effect on meat packing processes.

Temperature Distribution in a Packed-bed of Canola Seeds during Radio Frequency (RF) Heating with Seed Moisture Content and Bulk Volume

Daeyeon Yu*, Bijay Shrestha, Oon-doo Baik

University of Saskatchewan, Canada

This research investigated temperature distribution in a packed-bed of canola seeds at various moisture contents (5 to 11%) and bulk volumes (small-62.5, medium-562.5, and large-1,562.5 m³) during RF heating. To reach a specific temperature, the required RF exposure time decreased with seed moisture content (MC). The hottest spots (80°C) were detected at the geometric centers of the bulk canola seeds of small and large volumes. In the RF heating of the medium volume samples, the hottest spot (80°C) was moved toward to the edge from the geometric center with MC due to the edge effect. The relatively higher temperatures between middle and outer regions in the medium volume canola seeds unlike the heating of small and large volumes. The temperature distributions of 2% agar gel at different sizes determined by thermal imaging supported the observations with the bulk canola seeds. The estimated electric potentials throughout the upper electrode of the RF heater for dielectric heating of the bulk canola seeds increased with seed MC. Based on the temperature uniformity (θ) values evaluated, more uniform RF heating was observed with the medium bulk volume in spite of the edge effect.
**P13 -002**  
**Improved Interactive Computer Program for Predicting Food Freezing Process**  
Jongsoon Kim*, Elena Castell-Perez1, Rosana Moreira1  
Pusan National University, Korea, 1Texas A&M University, USA

This study introduces a new interactive Matlab-based computer program which can predict temperatures and thermal properties in freezing process of foods using finite difference method (FDM). This program is a revision of a Fortran-based computer program developed in 1989. The user interface and data retrieval represent a major improvement over the previous version. There are significant changes in the user-friendliness and flexibility of the program. The user can choose the product in the list box and enter the product properties in the text box of GUI (Graphic User Interface). In addition, the user can enter the input parameters (initial and final temperatures, ambient air temperature, and convective heat transfer coefficient) for simulating the freezing process. After the simulation, the user can plot the temperatures (surface, center, and average) of the product, density, thermal conductivity, and enthalpy during the freezing process, and save them into a text file format. Furthermore, this program runs without dependence on Matlab, because it is a stand-alone executable. This program could be used as a guideline for freezing equipment design and operation.

**P13 -004**  
**Analytical Method Validation for Determination of Cyanidin-3-glucoside in Black Rice Bran Extract**  
Eun Ju Yang*, Suk Jung Kim, Kyoung Mi Kim, Hyo Ju Kim  
Jeonnam Bioindustry Foundation, Food Research Institute, Korea

A simple HPLC method for the quantitative analysis of cyanidin-3-glucoside (C3G) in black rice bran extract as a functional food ingredient was developed and validated in this study. Chromatographic analyses were performed on C18 column (4.6×250 mm, 5 μm) with a mobile phase 0.1% trifluoro acetic acid (TFA) and 0.1% TFA contained in 50% acetonitrile at a flow rate of 1 mL/min gradient mode. UV detection was performed at 520 nm. The method showed linearity in the calibration curve at a coefficient of correlation (R²) of 0.99. The limit of detection and limit of quantification for the method were 13 μg/mL and 40 μg/mL, respectively. Relative standard deviation (RSD) values of data from intra- and inter-day precision were less than 2.33% and 1.22%, respectively. Recovery rate test at C3G concentrations of 25, 30, and 45 μg/mL scored between 97.18-107.67% with RSD values from 1.65-3.71%. The results showed that the proposed HPLC method was simple, rapid, precise and accurate, which is useful for the routine determination of C3G in black rice bran extract.

**P13 -003**  
**Effects of Freezing Rate and Terminal Freezing Temperature on Frozen Croissant Dough**  
Sangeun Yoon1*, Choongjin Ban1, Young Jin Choi1,2  
1Department of Agricultural Biotechnology, Seoul National University, Korea, 2Center for Food and Bioconvergence, Seoul National University, Korea

Freezing process has an adverse effect on bread obtained from frozen dough. Croissant is one of the representative breads produced by freezing process to improve the productivity and reduce laboring cost. In this study, we confirmed the quality of croissant affected by various freezing rates and terminal freezing temperatures (Tt). Firstly, the croissant dough was frozen with 0.72 to 3.56°C/min as the freezing rate, while Tt was set to -20, -40, and -55°C. In DSC thermogram, the peak was the broadest at the fastest freezing rate, indicating that ice crystals were evenly distributed during phase transition in the dough. Additionally, SEM images showed that the microstructure was kept intact at the fastest freezing rate. However, the yeast viability was higher at slow freezing rate. Moreover, in the thermogram of yeast, the minor peak indicated that ice crystals were grown in the cell. Intracellular ice crystals negatively influenced on both cell membrane and cytoplasm. Therefore, the yeast viability was decreased by the reduction of Tt. The results showed that the dough frozen at 1.5°C/min to -20°C was the best freezing method for producing frozen croissant dough.

**P13 -005**  
**Study on the Thermal Conductivity of Instant Noodles by a Transient Plane Source Method**  
Heewon Kim*, Suyong Lee  
Department of Food Science & Technology and Carbohydrate Bioproduct Research Center, Sejong University, Korea

A shortened rehydration time is one of the important attributes of instant noodles. The rehydration rate of the noodles has been measured by cooking the noodles until the white core disappears. However, there are no systemic and scientific methods to measure the rehydration properties of the noodles. Thus, an alternative approach is necessary for the objective and reliable study. In this study, a transient plane source method was applied to instant noodles as a novel method to investigate their rehydration properties. In addition, the changes in the thermal conductivity of the noodles were monitored depending on the moisture content and cooking time. As a result, the thermal conductivity of the noodles correlated linearly with the moisture content. The thermal conductivity of the noodles had a tendency to increase with increasing cooking time. There was a great relationship between the textural properties of the noodles and their thermal conductivity. Thus, the thermal conductivity of the noodles measured by a transient plane source method can be used as a new and promising indicator to investigate the rehydration properties of noodles.
Antimicrobial Effect of Natural Plant Extracts against *Propionibacterium acnes*

Yun-Hye Kim*

Department of Food Science and Technology, Pukyong National University, Korea

Acne vulgaris, simply acne is a common human skin disease. It has been known that a commensal bacterium *Propionibacterium acnes* can cause inflammation related with acne, which may result in scarring or hyperpigmentation. To find an alternative way to treat acne, we investigated antibacterial agents against *P. acnes* from natural resources. In this study, we investigated the antimicrobial activity of the methanol extract from various natural resources including marine algae and terrestrial plants against *P. acnes*. We evaluated the antimicrobial effect of natural resources against *P. acnes* by disk diffusion assay. Among of natural plant extracts, we determined that some extracts exhibited strong antibacterial activity at the concentration of 5 mg per disc against *P. acnes*. Currently, we tried to elucidate the anti-Acne action mechanism of natural plant extracts. Consequently, the results of the present investigation are expected to contribute to the development of an alternative phytotherapeutic ingredient without any adverse side effects because of its non-toxicity to human race.

Inactivation of *Bacillus cereus* Spores Using Superheated Steam

Hae Jin Seong*, Young Jin Choi

Department of Agricultural Biotechnology, Seoul National University, Korea

*Bacillus cereus* endospores originated in soil and food have resistance to heat, and induce the illness after germination. To study inactivation effect of super-heated steam (SHS) on *Bacillus cereus* spores, the sterilized sand inoculated with *B. cereus* (ATCC 14579) spores (5.7 log CFU/g) was exposed to saturated steam (SS) at 100°C, and four different temperatures of SHS. After the exposure to SS, and 120, 140, 160, and 180°C SHS for 300 s, the reduction of viable spores was 1.3, 2.3, 2.5, 2.5, and 2.7 log CFU/g, respectively. In addition, the spore reduction of all samples became slow after certain times, which might be attributed to drying effect of SHS. In this respect, survival curves were fitted with biphase model, and D-values for SS, and 120, 140, 160, and 180°C SHS in initial stage were calculated as 48.1, 47.2, 21.4, 10.5, and 10.2 s, respectively. Therefore, SHS is more effective than SS on inactivation of *B. cereus* spores, and higher SHS temperature treatment could be better. These results suggest that pretreatment with SHS could reduce total sterilization time by lowering the initial contamination of a raw material.

Study on Development of Thickeners Using Natural Food Materials for People with Swallowing Disorder

Ha-Kyung Jin*, Jung-Ah Han

Department of Foodservice Management and Nutrition, Sangmyung University, Korea

The elderly with swallowing disorder need texture-modified food with thickeners. Many researchers have focused on gelling agents such as gums for increasing viscosity, however, problems associated with reduced food intake could be happened for the elderly with consumption of the thickening agent. So in this study, we used two types of natural food materials containing functional component as well as dietary fibers as thickeners, freeze-dried yam and lotus root powders. In water base, yam powder showed viscosity from 284 to 2,328 cp with from 5 to 8% concentration at 90°C, and the viscosity increased from 824 to 3,132 at a serving temperature, 60°C. The viscosity of lotus root powder were 652-2,220 cp with from 6 to 8% concentration at 90°C, and the value also increased from 1,032 to 2,980 at 60°C. The higher concentration of powder in water, the higher viscosity was obtained. The viscosity also increased with time dependent, and higher viscosity was obtained at 60°C than at 90°C. This results could prove that natural food powders containing functional materials as well as dietary fibers could be used for thickeners, especially for foods of elderly with swallowing disorder.

Compositional Analysis of Isolated Inorganic Minerals from Oranges and Luminescence Characteristics of Marker Minerals Exposed to Ionizing Radiations

Yunhee Jo*, Bhaskar Sanyal1, Hyun-Gyu Lee, Yaping Gao, Hae-Jun Park2, Joong-Ho Kwon

Kyungpook National University, Korea, 1Bhabha Atomic Research Centre, India, 2Korea Atomic Energy Research Institute, Korea

Identification of irradiated fruits is of importance to control irradiation processing in compliance with the existing regulations. Composition analysis of the isolated minerals from oranges and luminescence studies on the standard marker materials could confirm the origin of luminescence results in orange samples. The XRD and SEM/EDX analyses on separated minerals from oranges revealed that quartz and feldspar were the major constituents. Photostimulated luminescence (PSL) and thermoluminescence (TL) analyses carried out to identify standard marker materials (quartz and feldspar) exposed to gamma ray, electron beam and X-ray demonstrated that feldspars were the major contributors to the PSL and TL emission, which showed a dose-dependent increase. The solid lines represented polynomial fits of TL for all radiation sources, namely gamma ray, electron beam, and X-ray with R² of 0.9948, 0.9994, and 0.9974, respectively. Stable TL signals implied a successful detection of irradiated oranges even after a prolonged storage.
Quality Characteristics of Rice and Rice Starch *Yakju*
Jieun Kang*, Jaewoon Kim, Hanseok Choi, Chanwoo Kim, Suwhan Yeo, Seoktae Jung
Fermented Food Science Division, National Academy of Agricultural Science, Korea

*Yakju*, a Korean traditional alcoholic beverage, is made from rice and nuruk. In this study, we investigated that the fermentation characteristics in *yakju* was made with rice and rice starch. These are classified according to raw material (rice, rice starch) and fermented starter (enzyme supplements, modified nuruk, traditional nuruk, yellow rice koji). The crude protein components of rice, rice starch and starter were determined to be as follows (%): rice 6.69, rice starch 0.44, enzyme supplements 7.84, modified nuruk 15.29, traditional nuruk 14.28, yellow rice koji 7.28. As for alcohol contents, rice with traditional nuruk (20.13±0.12%) showed higher than other nuruk. For the concentration of organic acids, there were rice starch *yakju* (389.83-538.34 mg%) higher than rice *yakju* (259.27-357.70 mg%). A nitrogen compound concentrations were rice *yakju* (498.38-5,976.93 ppm) showed higher than rice starch *yakju* (600.43-4,463.79 ppm). Further studies involving the quality analysis of the rice, rice starch and fermented starter (enzyme supplements, modified nuruk, traditional nuruk, yellow rice koji) are needed.

Development of Electrospun Pullulan Nanofiber with Quercetin-loaded β-Cyclodextrin for Addressing Low Drug Solubility
Il Woo Lee*, Xiguang Chen†, Hyun Jin Park
School of Life Science and Biotechnology, Korea University, Korea, †College of Marine Life Science, Ocean University of China, China

Pullulan (PUL) is a water soluble microbial polymer as an exo-polysaccharide. Due to its resistance to heat and stability at a wide range of pH, pullulan was used as wrapping material and film for food and oral-care industry. Quercetin (QU) is an one of flavonoids originated from plants and easily found in foods, such as fruits and vegetables, especially onion and tea leaves. Major ability of quercetin is to remove free radicals called as antioxidant. Cyclodextrins (CDs) are cyclic oligomers composed of seven α-(1,4) linked glucopyranose subunits. Inherent ‘round’ shape and its inner hydrophobic site made β-CD versatile in food and pharmaceuticals as a material for drug delivery. In this study, PUL and QU were used to fabricate nonwoven nanofiber loading QU as a model sparingly soluble drug via electrospinning (ES). To enhance the loading efficiency, we conducted loading method for trapping hydrophobic drugs into the internal region of β-CD in a vacuum. Our aim is to analysis the release profiles of QU and to elucidate the effect of β-CD on the release behavior of QU from PUL/QU and PUL/QU@β-CD nanofiber matrix.

Stability of Capsaicin Loaded Nanoemulsions Coated with Biopolymers
Song Ji Chae*, Jung A Ko, Hyun Jin Park
School of Life Science and Biotechnology, Korea University, Korea

Multilayer emulsions containing oleoresin capsicum were prepared by the layer-by-layer deposition technique based on the electrostatic interaction. A primary emulsion containing anionic lecithin-coated droplets was prepared using a high-pressure homogenizer. Secondary and tertiary emulsions were formed by coating with cationic polysaccharide (chitosan) and anionic polysaccharide (hyaluronic acid, HA), respectively. This study investigated the influence of environmental stresses, such as pH and temperature on the stability of capsaicin loaded multilayer emulsions. The stability of multilayer emulsions to pH (2-10), and thermal treatment was determined. The nanoemulsions were stable at 4, 20, 37, and 75°C as indicated by the fact that the particle size remained constant and there was no visible evidence of phase separation. On the other hand, the HA nanoemulsions stored at 37 and 75°C were unstable, exhibiting a large increase in mean particle size. These results provide useful information for facilitating the design of multilayer emulsion systems to encapsulate and stabilize capsaicin for application within food products.
**P13 -014**

**Study of an Influence of HPMC Concentration on the Characteristics of Gibberellin Loaded Alginate/HPMC Hydrogel Bead**

Sundo Kwon*, Hyunjoo Park  
**School of Life Science and Biotechnology, Korea University, Korea**

Sodium alginate is a natural polysaccharide found in brown algae. It is a water soluble salt of alginic acid, and consisted of linear copolymer of (1-4)-linked α-L-guluronic acid (G) and β-D-mannuronic acid (M). Sodium alginate can form water insoluble hydrogel by crosslinking when it meets cations except magnesium. Hydroxypropyl methylcellulose (HPMC) is a non-ionic water soluble cellulose ether derived from natural pulp. HPMC used as an emulsifier, lubricant, coating film, and thickening and suspending agent. HPMC can affect to the release profile of other polymer carriers by altering the physical structure if used as copolymer. Gibberellin is a slightly water soluble (5 g/L) plant hormone. Major ability of gibberellin is that influence various developmental process such as germination, stem elongation, flowering, fruiting, and tissue development. In this work, gibberellin was encapsulated within the alginate bead which containing HPMC as a matrix model. Potassium nitrate (KNO₃) was used as core material that is commonly used to treat crops by fertilizers, but at high doses can reduce seed germination. Therefore, aims of this study were to control the release of fertilizers (KNO₃) from the matrix composed of HPMCP and HPMC, and to investigate effect of HPMCP : HPMC ratio. In order to determine these composite, we used scanning electron microscopy (SEM). The matrix had average thickness of 3 μm. And we also confirmed patterns of coated formulation by X-ray diffraction (XRD). In addition, a release study investigated that KNO₃ release from HPMCP and HPMC matrix by using USP method. Moreover, we also confirmed presence of mold by digital photo images. Coated formulation was found to provide better protection against mold when compared to control.

**P13 -015**

**Colorimetric Artificial Nose for Identification of Wines**

Junghee Woo*, Hyunjin Park  
**School of Life Science and Biotechnology, Korea University, Korea**

An electronic nose is a major device that identifies the specific components of an odor and analyzes its chemical makeup to identify it. However, this sensor has a general lack of chemical discrimination, which makes differentiation among similar species problematic. Recently, the colorimetric sensor array provides enormous discriminatory power using a cross-responsive array containing a diverse family of chemically responsive dyes. Digital imaging of the dye array before and after immersion provides a color change profile as a unique fingerprint for each. In this study, wines with different kinds of fruits are selected as samples because a comparison between European grape wines and Korean raspberry (bokbunja) wines have not been fully studied. Identification of different kinds of wines using CSA is an aim of this study. The principle component analysis followed by the hierarchical cluster analysis were utilized to discriminate different kinds of wines. Differentiation between even very similar wines proved to be straightforward. In the future, new colorimetric sensory dyes can be added to expand the capability of the current array.

**P13 -016**

**HPMCP Layered Soybeans Modified with HPMC as Matrices for Controlled-release of Fertilizers**

Myungkook Kim*, Hyunjoo Park, HyonHlo Baek  
**School of Life Science and Biotechnology, Korea University, Korea, 1Department of Sustainable Biomaterials, Virginia Polytechnic Institute and State University, USA**

Hydroxypropyl methyl cellulose phthalate (HPMCP) has been studied for many years due to low water solubility. hydroxypropyl methyl cellulose (HPMC) is a water-soluble compound used as the matrix model. Potassium nitrate (KNO₃) was used as core material that is commonly used to treat crops by fertilizers, but at high doses can reduce seed germination. Therefore, aims of this study were to control the release of fertilizers (KNO₃) from the matrix composed of HPMCP and HPMC, and to investigate effect of HPMCP : HPMC ratio. In order to determine these composite, we used scanning electron microscopy (SEM). The matrix had average thickness of 3 μm. And we also confirmed patterns of coated formulation by X-ray diffraction (XRD). In addition, a release study investigated that KNO₃ release from HPMCP and HPMC matrix by using USP method. Moreover, we also confirmed presence of mold by digital photo images. Coated formulation was found to provide better protection against mold when compared to control.

**P13 -017**

**Cold Plasma Treatments for Preservation of Citrus unshiu**

Mee Yeon Won*, Sea Cheol Min  
**Department of Food Science and Technology, Seoul Women’s University, Korea**

The effects of cold plasma (CP) treatments on the growth inhibition of Penicillium italicum on citrus unshiu were investigated. The weight loss and the temperature changes of Citrus unshiu in treatment were also investigated. The treatment variables were plasma-forming gases (nitrogen, nitrogen-oxygen mixture [nitrogen:oxygen = 99.3:0.7], helium), power (400, 650, and 900 W), pressure (667 Pa), and time (2, 5, and 10 min). The CP treatment with nitrogen gas (900 W, 10 min) resulted in the highest reduction of P. italicum (% disease incidence: 20.1-28.8%). The weight loss after CP treatments and the temperature change during treatments were 0.7-7.0°C (initial temperature: 20°C) and 0.19-0.47%, respectively. A CP treatment has demonstrated the potential for the application to C. unshiu and possibly other citrus fruits as the method to preserve their qualities.
Validation of an Analytical Method for Acetaldehyde and Formaldehyde in Food Matrices Using Solid Phase Microextraction Followed by GC-MS

Hye-Seung Jeong*, Eun-Yeong Son, Young-Suk Kim
Department of Food Science and Engineering, Ewha Womans University, Korea

An efficient method was developed to analyze the contents of acetaldehyde and formaldehyde in food matrices. Validation was carried out in food matrices, such as peanut butter, beef, milk, and 20% ETOH, on the base of LOD, LOQ, precision and recovery using SPME-GC-MS after derivatization with O-(2,3,4,5,6-pentafluorobenzyl) hydroxylamine hydrochloride. LOD values for acetaldehyde in peanut butter, beef, milk and 20% ETOH were 15.1, 7.8, 12.2, and 11 ng g⁻¹, respectively, whereas LOQ levels were 430, 76, 17.4, and 38.1 ng g⁻¹, respectively. On the other hand, precisions at three different levels (RSD%) were 1.6-14.6, 2.2-8.1, 1.4-5.9, and 1.4-7.3, respectively, whereas recoveries were in the range of 111.2-137.6, 107.3-128.3, 95.4-107.2, and 99.2-114.9%, respectively. LOD values for formaldehyde in peanut butter, beef, milk and 20% ETOH were 15.1, 7.8, 12.2, and 11 ng g⁻¹, respectively, whereas LOQ levels were 45.7, 23.7, 37, and 33.4 ng g⁻¹, respectively. The respective precisions at three different levels (RSD%) were 3.2-12.4, 5.7-14.6, 1.7-14.3, and 4.2-12, whereas the recoveries were in the range of 100.2-106.2, 110.1-123.4, 97.7-116.1, and 86.3-122.8%, respectively.

Nutritional Content and Antioxidant Activity of Rice Bran by Different Stabilization Procedures

Hyo Ju Kim*, Yoo Kyung Seon, Kwang Ho Jung, Eun Ju Yang
Jeonnam Bioindustry Foundation, Food Research Institute, Korea, *Inno-Nutribio Corp., Korea

Rice bran is a valuable by-product of the rice milling industry, a good source of many vital nutrients. The limitation to food application of rice bran is its instability during storage, leading to rancidity and the presence of heat-labile antinutritional factors. Rice bran was treated to stabilize it by roasting (RO), superheated steam (SS) and hot-air (HA) process. The nutritional composition of the raw and stabilized rice bran was analyzed. Moisture content of rice bran decreased after RO and HA treatment. Ash, lipid and protein content were 16.47 mg%, respectively) of RO rice bran were significantly higher than those of raw and other stabilized rice bran. Total polyphenol contents and DPPH scavenging capacity were showed no significant differences between treatments.

Optimization of Enzymatic Hydrolysis Conditions of Rice Bran for Development of Natural Seasoning Material

Hyo Ju Kim*, Hoo Mo Goo, Eun Ju Yang
Jeonnam Bioindustry Foundation, Food Research Institute, Korea, *Maerl Foods Co., Ltd., Korea

This study was carried out to establish the enzymatic hydrolysis conditions of rice bran for development of natural seasoning material. Commercial proteases were used for hydrolysis of rice bran. The quality properties of rice bran hydrolysates added rice protein were increased more 2-4 times than that of the control (not added rice protein). AN/TN ratio and sensory characteristics were the best at rice bran-rice protein ratio of 3:1. From these results, the enzymatic hydrolysis conditions established in this study could be applied for development of natural seasoning material from rice bran.

Microbial Decontamination of Cherry Tomato by Cold Plasma

Ji Hyeon Kim*, Bo Yeong Choi, Sea Cheol Min
Seoul Women’s University, Korea

The effects of cold plasma (CP) treatments on the inhibition of Salmonella inoculated on cherry tomato and the qualities related to freshness of cherry tomato were studied. The CP treatments were optimized against Salmonella reduction with the treatment parameters of plasma-forming gas (N₂, N₂-O₂ (99.3:0.7, v/v), He, and He-O₂ (99.8:0.2, v/v)), microwave power (400, 650, and 900 W), and treatment time (2, 6, and 10 min). The weight and surface temperature of cherry tomato were measured before and after the treatments. The number of Salmonella on cherry tomato significantly decreased after the CP treatments with He and He-O₂ (p<0.05). Both weight loss and surface temperature change of cherry tomato after CP treatment were minimal with He and He-O₂ (p<0.05). The He-O₂ CP treatment at 900 W for 10 min exhibited the highest reduction of Salmonella on cherry tomato (2.4±0.3 log CFU/g reduction). The results of this study demonstrated that the CP treatments with He and He-O₂ could be potentially applied as a non-thermal method to decontaminate fresh vegetables from Salmonella.
Application and Preparation of Nanoemulsion for Food and Beverage System

Hee Joung Joung*, Gye Hwa Shin, Hyun Jin Park
School of Life Science and Biotechnology, Korea University, Korea

The aim of this research is to develop nanoemulsions and directly apply to food and beverage system. In this study, nanoemulsions were prepared by high pressure homogenization method. Characterization of nanoemulsions was performed by measuring particle size and PDI with various ratio of surfactant concentration. Morphology of nanoemulsions was observed by CLSM and TEM image. Antioxidant activity and in vitro digestion ability were tested by using DPPH, ABTS and TBARS assay. Nanoemulsions were physically stable for one month at room temperature. The surfactant concentration had an effect on particle formation. As increasing surfactant ratio of nanoemulsions, particle size was decreased. Nanoemulsions showed a significant effect in DPPH, ABTS, and TBARS scavenging activity. Nanoemulsions fortified milk showed significantly lower lipid oxidation than control milk. This condition of nanoemulsions is suitable system for beverage industry.

Monosaccharides Production from Brown Seaweed (Sargassum horneri) Using Pressurized Hot Water Extracts

Saravana Periaswamy Sivagnanam*, Hee Chul Woo¹, Byung Soo Chun
Department of Food Science and Technology, Pukyong National University, Korea, ¹Department of Chemical Engineering, Pukyong National University, Korea

Seaweeds are used as foods in worldwide. They are potentially good sources of non-starch polysaccharides, minerals, trace elements, and certain vitamins. The decomposition of carbohydrate into a reducing sugar, monosaccharides, and polysaccharides offers economic value. Many studies have been performed to convert carbohydrates from marine macroalgae into monosaccharides, polysaccharides and other compounds. In this study, Sargassum horneri (brown seaweed) was treated with pressurized hot water extraction (PHWE) at temperature range of 100-260°C, while pressure vary between 15 to 220 bar for the desired temperature studied. The obtained PHWE of S. horneri were investigated for their total organic carbon (TOC), pH, Maillard reaction products (MRPs) and monosaccharides content. TOC was increased as the temperature increased, pH varies from 5.31-6.91. The contents of main monosaccharides like glucose (6.58 g/L), fructose (8.46 g/L) and mannitol (17.30 g/L) were found to be very high at 180°C. The monosaccharide composition indicated that PHWE of S. horneri has a good potential for its use in fermentation industry and as human food.

Optimization of Microwave-assisted Extraction Process for Blue Honeysuckle (Lonicera coerulea L.) Using Response Surface Methodology

Hui Teng*, Hyunbo Kang, Sanghwan Park, Minyeong Kim, Enyoung Yun, Soojoong Lim, Jongin Park, Wonyoung Lee
School of Food Science and Biotechnology, Kyungpook National University, Korea

Functional compounds including anthocyanins, polyphenols, and flavonoids were extracted from blue honeysuckle using highly efficient microwave-assisted extraction. Extraction process was modeled and optimized according to response surface methodology (RSM). The independent variables were ethanol concentration (0-100%), extraction time (1-9 min), and microwave power (60-300 W). Dependent variables were total anthocyanin contents, total polyphenol contents, total flavonoid contents, and antioxidant activity. Four-dimensional response surface plots were generated based on the fitted second-order polynomial models to get optimal conditions. Estimated optimal conditions were 54-72%, 7.1-7.6 min, and 243-251 W. Ridge analysis predicted the maximal responses of total anthocyanin content, total polyphenol content, total flavonoid content, and antioxidant activity were 6.80 mg CGE/g, 14.90 mg GAE/g, 36.00 mg RE/g, and 89.10%, respectively. Verification experiment was carried out at the predicted optimal conditions, and no significant difference was observed between predicted and experimental values, indicating a good fitness of fitted models and successful application of RSM.

Changes in the Dielectric Properties of Red Pepper Paste at Different Concentration Influenced by Microwave Heating

Seung In Hong*, Hwa Shin Lee¹, Ah Reum Cho, Sang Gwon Moon, Rae-Seoung Park², Jihyun Jang², Changyul Cheon², Keun Taik Lee²
Packaging Center, CJ CheilJedang Center, Korea, ¹Department of Food Processing and Distribution, Gangneung-Wonju National University, Korea, ²School of Electrical and Computer Engineering, University of Seoul, Korea

The dielectric properties of red pepper paste were investigated to determine the effects of heating in a microwave oven. Different concentrations (10, 20, 50, and 100%) of Korean traditional red pepper paste were prepared with water. The loss factor and penetration depth of samples were determined at a microwave frequency of 2.54 GHz, using an open-ended coaxial probe connected to a network analyzer. The loss factors increased from 0.2 to 0.7 at 25°C and from 0.23 to 1 at 70°C as the concentration of red pepper paste increased. However, the penetration depth decreased from 12 mm to 6 mm at 27°C and 9 mm to 4 mm at 70°C as the concentration increased. High concentration of red pepper paste can effectively convert electric energy to heat energy because of its high loss factor. In this case, however, the uniform heating could not be achieved because of low penetration depth of the sample during microwave heating. Therefore, the red pepper paste concentration should be optimized to prevent the occurrence of hot spots during heating in a microwave oven.
Physicochemical Properties of *Styela clava* Skin according to Ultra High-pressure Treatment

Bo Ram Kim*, So Hae Park, Won Baek Kim, Jiho Kwang, Kyoung Yoon Koo, Minji Kim, Heesook Lee
Pusan National University, Korea

The aim of this study was to evaluate the effects of ultra-high-pressure (UHP) on the *Styela clava* skin (SCS), of which process could modulate an enzymatic reaction efficiency throughout the alteration of materials especially on their physical structure affected by the pressure and processing time. After treatment of high-pressure (50, 200, and 400 MPa) and different time (5, 15, and 30 min) on *Styela clava* skin, physicochemical properties of SCS were analyzed. Scanning electron microscopy (SEM) revealed that the surface of SCS was changed to non-homogenous and rough surface after treatment of UHP. X-ray diffraction (XRD) was introduced to determine the effect of high pressure treatment on SCS. XRD analysis indicated that the crystallinity of SCS decreases to according to UHP treatment. And product analysis was performed to determine the hydrolysis products of the cellulose by thin layer chromatography (TLC) using various substrates. UHP-treated SCS had higher hydrolysis of substrate compared to non-treated SCS. This work provides a potential use of UHP processing for modulation of enzyme hydrolysis efficiency.

Applications of Magnetic Resonance Imaging Techniques for Agricultural and Food Products

Seong Min Kim*
Department of Bioindustrial Machinery Engineering, Chonbuk National University, Korea

Agricultural and food quality factors are very important to customers. The quality factors can be divided into two factors such as internal and external factors. External factors such as color, surface defects, and shape can be easily detected compared to internal factors such as internal tissue break down, insect damage, and water and sugar contents. Magnetic resonance imaging (MRI) has been successfully utilized to examine or to measure various internal physical and chemical parameters including chemical components, internal disorders, and internal structure in agricultural and food products. MRI techniques can be applied to the most agricultural and food products in a non-invasive nondestructive way. Additionally, various factors related to the quality of agricultural and food products can be measured at the same time from the target sample. In this study, fresh fruits and dairy products were investigated using an industrial grade 1 T MRI system to estimate their magnetic resonance parameters and to characterize their physical states. Also, 3 dimensional MRI technique was used to acquire 3D information from the samples.

Antioxidant Activity of β-Cyclodextrin Inclusion Complexes Containing trans-Cinnamaldehyde

Yeon-Ji Jo*, Sang-Gi Min, Sung-Hee Park, Ji-Yeon Chun
Department of Bioindustrial Technologies, Konkuk University, Korea

In this study, trans-cinnamaldehyde (CIN)-β-cyclodextrin (β-CD) inclusion complexes was prepared by using self-assembly with various molar ratios between β-CD (0.3% or 1.8%) and CIN (1:0.25, 1:0.5, 1:1, 1:2, and 1:3) and then physical properties and antioxidant activity (DPPH, ABTS and FRAP assays) of CIN-β-CD inclusion complexes were evaluated. For the results, particle size showed significantly increasing trend at higher β-CD% and longer storage period. Highest encapsulation efficiency was determined as 47.59% at 1:0.5 ratio of β-CD inclusion complex and CIN-1.8%. In antioxidant capacity evaluation by using DPPH, ABTS and FRAP assays, at CIN-0.3% β-CD inclusion complex was significantly in effective compare with non-included CIN in all methods. However, at CIN-1.8% β-CD inclusion complex, the highest of DPPH radical scavenging activity (33%) was observed at 1:3 ratio. And ABTS•⁺ radical cation scavenging activity was significantly improved as increase of CIN molar ratio at 1.8% β-CD inclusion complex. In this study, we concluded that antioxidant capacity of CIN-β-CD inclusion complexes was dependent on concentration of β-CD and CIN.

Effect of High Pressure Cold Pasteurization Process on the Physicochemical Properties of Chilled Abalone

Yun-Kyung Lee*, Sang-Gi Min, Geun-Pyo Hong
Department of Food Science and Technology, Sejong University, Korea, 1Department of Bioindustrial Technologies, Konkuk University, Korea

High pressure cold pasteurization (HPCP) has been developed as a novel technique to preserve foods for long-term storage period without quality deteriorations. The main advantage of HPCP is that foods can be stored under sub-zero temperature without freezing. The present study was conducted to investigate the effect of various HPCP on the physicochemical properties of abalone. The changes in physicochemical properties of abalone were evaluated at various pressure (50, 100, 150, and 200 MPa) and temperature (-5, -10, -15, and -20°C). The pH value of the HPCP treated abalone was significantly increased with increasing pressures (p<0.05). The L* of abalone was significantly increased with increasing pressure (p<0.05), while a* was slightly increased from 100 to 200 MPa. The b* of abalone was not significantly changed by HPCP. The shear force of HPCP treated abalone decreased with increasing pressure up to 150 MPa, thereafter increased. The WHC was not significantly affected by HPCP treatment. In total plate count, aerobic microbial content tended to decrease with increasing pressure. Therefore, it is demonstrated that the qualities of abalone was maintained by HPCP processing.
Effects of Pressure Shift Freezing Conditions on the Quality Characteristics of Abalone

Yun-Kyung Lee*, Sang-Gi Min¹, Geun-Pyo Hong
Department of Food Science and Technology, Sejong University, Korea, ¹Department of Bioindustrial Technologies, Konkuk University, Korea

The qualities of frozen foods are closely depend on the freezing rate, and rapid freezing has been recommended to minimize quality deteriorations of frozen foods. Pressure shift freezing (PSF) was recognized as the most rapid freezing technique. The present study investigated the effects of various PSF conditions on the qualities of abalone. Abalone was pressurized (50-200 MPa) and cooled down to the corresponding freezing point (-5 to -20°C) of abalone. First freezing was occurred by depression and second freezing was conducted at -40°C freezer. After 24 h, the frozen abalone was thawed in running water for 30 min and qualities were analyzed. Based on the result of this study, distinct characteristics of abalone were observed depending on the applied pressure levels. In particular, abalone treated at higher than 150 MPa showed severe quality modification in color, shear force and water holding capacity. In particular, significant changes in color, shear force and water holding capacity of abalone were detected. The abalone treated at 100 MPa exhibited the best quality characteristics, reflecting the optimal condition of PSF for abalone was -100 MPa.

Optimization of Quality Characteristics and Shelf-life of Chilled Abalone Using Response Surface Methodology

Yun-Kyung Lee*, Geun-Pyo Hong
Department of Food Science and Technology, Sejong University, Korea

Explosive consumers’ demands trigger the abalone the most expensive marine food resource. Abalone had a limited shelf-life (no more than 3 days) during refrigerated storage, hence current preservative techniques for abalone were absolutely depended on freezing and drying. High pressure has a potential application to extend shelf-life of abalone without quality losses. In the present study, the quality characteristics and shelf-life of abalone were estimated using response surface methodology. Based on the results, holding time was not important factor, hence short-time processing was favorable in economic aspect. Increasing pressure up to 400 MPa greatly increased the shelf-life of abalone for >15 days, however, pressure-induced quality modification was simultaneously occurred. Pressurization at < 200 MPa had no advantage to extend shelf-life of abalone. Therefore, pressurization at 200-300 MPa was estimated as an optimal condition to extend shelf-life of abalone for 10 days without quality modification. Consequently, the present study demonstrated practical application of high pressure in marine food processing such as abalone and other muscles.

Quality Characteristics of Freeze-dried Abalone by Various Freezing Processes and Freeze-dried Boiled-dried Abalone Comparison of Moisture Sorption Isotherms

Yoon-Ji Jo*, Sang-Gi Min, Geun-Pyo Hong
Department of Food Science and Technology, Sejong University, Korea, ¹Department of Food Science and Technology, Sejong University, Korea

This study compared freeze-dried (FD) abalone to boiled-dried (BD) abalone according to three freezing methods in the quality characteristics of the abalone after rehydration. Also the moisture sorption isotherm (MSI) profiles of FD and BD abalone at 15, 25, and 35°C were investigated. Abalone was frozen by convection freezing (CF), air-blast freezing (ABF) and deep freezer (DF). After frozen, all samples were carried out freeze-dried. Dehydrated samples were measured such as color, hardness appearance, and water holding capacity. For the quality characteristics of the abalone result, color, and water holding capacity were not significantly changed. But the equilibrium moisture content (EMC) and the calculated monolayer moisture content of FD abalone were higher than those of BD abalone. Additionally, the appearance of FD abalone was similar to that of fresh abalone, reflecting a potential application of FD to produce value-added dried abalone.
Effects of Various Hydrothermal Processing Conditions on the Physicochemical Properties and Characteristics of Soy Hydrolysates

Yeon-Ji Jo*, Geun-Pyo Hong1
Department of Bioindustrial Technologies, Konkuk University, Korea, 1Department of Food Science and Technology, Sejong University, Korea

This study investigated the effects of various hydrothermal treatments on the characteristics of soy hydrolysates. Soybean was treated at various temperatures (150-250°C) without holding time. Physicochemical properties of the hydrolysates, molecular weight distribution, free amino acid content, solubility, pH, color, and water content of soy hydrolysates were determined. Protein content and free amino acid were increased after 190°C processes compared to control. For color measurement, lightness were increased by high temperature with decreasing in yellowness. The pH of samples was decreased by various temperature. But higher than 250°C, the pH were again increased with temperature. GPC indicated that increasing temperature had a potential advantage in lowering the molecular weight of soy hydrolysates. However, disruption of amino acid was also occurred at extreme temperature (>200°C). The results indicated that hydrothermal processing at 190°C was the best condition from both an energy efficiency perspective and bioactive peptide preparation.

Changes of Phenolic Acids and Vitamin E Profiles on Germinated Rough Rice (Oryza sativa L.) Treated by High Hydrostatic Pressure

Min Young Kim*, Sang Hoon Lee, Gwi Yeong Lee, Meishan Li, Nara Yoon, Heon Sang Jeong
Department of Food Science and Biotechnology, Chungbuk National University, Korea

This study was performed to investigate the changes in the phenolic acid and vitamin E profiles of germinated rough rice with high hydrostatic pressure treatment (HPT). Rough rice was germinated at 37°C for two days and subjected to 0.1, 10, 30, 50, and 100 MPa pressures for 24 h. The total phenolic acid content increased from 85.37 μg/g at 0.1 MPa to 183.52 μg/g at 100 MPa. The highest gallic acid (4.29 μg/g), catechin (9.55 μg/g), caffeic acid (6.62 μg/g), p-coumaric acid (8.36 μg/g), ferulic acid (14.99 μg/g), naringin (6.18 μg/g), trans-cinnamic acid (45.23 μg/g), naringenin (16.18 μg/g), and kaempferol (40.95 μg/g) contents occurred in the sample treated at 100 MPa after germination. The maximum vitamin E contents of about 2.56 (BG) and 4.34 mg/100 g (AG) were achieved at 30 MPa. These results suggest that combined HPT and germination increased the elution of active materials.

Effects of Hydrothermal Processing Media and Holding Time on the Cell Viability of Soy Hydrolysates

Munkhtugs Davaatseren*, Sang-Gi Min1, Geun-Pyo Hong2
Department of Bioresources and Food Science, Konkuk University, Korea, 1Department of Bioindustrial Technologies, Konkuk University, Korea, 2Department of Food Science and Technology, Sejong University, Korea

A soybean (Glycine max), one of widely spread and consumed food around the world, has beneficial effect on several diseases due to its significant amount of bioactive compounds. However, functional and physicochemical properties of soybean can be differ depending on preparation process such as hydrolysis and extraction methods. The purpose of this experiment was to evaluate the effect of hydrolysis method on cell viability of soybean protein hydrolysate, American native (AN), Korean daewon (KDW), Korean neulchan (KNC), and Korean saedanbaek (KSB), were prepared by using distilled water, 20%, and 50% ethanol for 10 and 100 min. All samples significantly reduced cell viability in a close-dependent fashion. Furthermore 10 min treatment had higher cell toxicity compared to that of 100 min treatment, and with exception of KSB group, DW-solvent group had higher cell toxicity compared to EtOH-solvent group. Taken together, soybean prepared in 50% EtOH treated for 100 min could be most suitable processing method to solve issues related to consumption by reducing possible toxicity, and improve functionality. However, further in vivo and in vitro studies needed to support more detail findings.

Changes of the Anthocyanin and Proanthocyanidin Contents on the Black Bean in Different Acidic Extraction Condition

YeongMi Ji*, Sang Hoon Lee, Gwi Yeong Jang, MeiShan Li, Min Young Kim, Nara Yoon, Eun Hee Kim, Heon Sang Jeong
Department of Food Science and Biotechnology, Chungbuk National University, Korea

Influence of various acidic extraction condition was studied for the optimal anthocyanin and proanthocyanidin extraction from black bean. Extracts were prepared with 80% methanol solutions containing HCl, acetic, formic, phosphoric and citric acids of different concentrations (0.1, 0.2, and 0.3%). Total anthocyanin and proanthocyanidin contents of black bean were determined by HPLC and spectrophotometer. Total anthocyanin content was the highest in 0.3% HCl-methanol extract (1.742 mg/g). The 0.3% formic acid-methanol extract showed the highest proanthocyanidin content. Also, in the equivalent pH condition (pH 2), total anthocyanin content of the 21% citric acid extract (1,330 mg/g) was higher than that of the 0.02% HCl extract (1,185 mg/g), but there was no significant difference. As a result, acidic condition is significant factor of anthocyanin and proanthocyanidin extraction from black bean.
Quality Characteristics of Noodles with Germinated Brown Rice, Sorghum and Barley by Different Extrusion Temperatures

Eun Hee Kim*, Sang Hoon Lee, Gwi Yeong Jang, MeiShan Li, Min Young Kim, Nara Yoon, Heon Sang Jeong
Department of Food Science and Biotechnology, Chungbuk National University, Korea

We conducted this study to investigate the quality characteristics of noodles with germinated brown rice, sorghum, and barley. The noodles were evaluated for cooking properties, color, texture, and sensory properties. The cooked weight, water absorption, and turbidity of the cooked germinated rice noodles were 46.00-49.00 g, 130-145%, 0.233-0.497 (A675). Sorghum and barley noodles were respectively 43.00-49.00 g, 115-145%, 2.44-3.05 and 41.00-46.00 g, 105-130%, 0.576-0.720. The turbidity decreased as the extrusion temperature increased. Hunter’s color were different depending on the type of grain. The hardness of the noodles was significantly increased relative to that of wheat noodle, but the cooked noodles were similar to one another regardless of temperature condition. A sensory characteristics (appearance, flavor, texture during mastication, taste, and overall quality) of sorghum noodle were significantly decreased relative to that of wheat noodle, but germinated brown rice and barley noodle were not different. As the results of this study indicate that extrusion processing could be used to make the extruded noodles with germinated brown rice, sorghum and barley.

Effects of Heat Treatment on Tricin and TTGE (Tricin-O-(threo-β-guaiacylglyceryl) ether) Contents in Rice Hull (Oryza sativa L.)

Nara Yoon*, Sang Hoon Lee, Gwi Yeong Jang, Meishan Li, Min Young Kim, Heon Sang Jeong
Department of Food Science and Biotechnology, Chungbuk National University, Korea

The objective of this present study was to evaluate effects of heat treatment on content of tricin and TTGE (tricin-O-(threo-β-guaiacylglyceryl) ether) in rice hull (Oryza sativa L.). Rice hull was heated at 80, 100, 120, 140, and 160°C for 1, 3, and 5 h, and extracted with 70% ethanol. The heated rice hull extract was fractionated into solvent fraction of hexane and chloroform. Tricin and TTGE contents were increased after heat treatment. The highest tricin and TTGE contents occurred in the sample treated at 140°C for 1 h. Before heat treatment, the tricin and TTGE contents were 1.55 and 37.94 μg/g, respectively, whereas after heat treatment, it increased to 143.83 and 290.12 μg/g, respectively. According to the results, the increases in tricin and TTGE contents of rice hull by heat treatment were remarkable. Therefore, the heat treatment was considered to develop as a technology for functional materials.

Functional Components and Antioxidant Activities on Ethanol Extracts of Sweet Potato Leaves with Extraction Conditions

Meishan Li*, Sang Hoon Lee, Gwi Yeong Jang, Min Young Kim, Nara Yoon, Heon Sang Jeong
Department of Food Science and Biotechnology, Chungbuk National University, Korea

This study was carried out to investigate the optimum extraction conditions for functional components (lutein, β-carotene, total polyphenol, flavonoids, and phenolic compounds) and antioxidant activities (ABTS and DPPH radical scavenging activities) from sweet potato leaves. Extraction conditions were ethanol concentrations (1st extraction: 100% ethanol; 2nd extraction: 50-90% ethanol), and times (30, 60, and 90 min). The highest values of lutein and β-carotene content were obtained by 1st and 2nd extraction at ethanol concentration of 100 and 90%, respectively. The extraction yield of lutein and β-carotene were decreased with increasing extraction time. The maximum polyphenol, flavonoid content, ABTS, and DPPH radical scavenging activity were 32.3 mg GAE/g, 17.0 mg CE/g, 17.0 mg AA eq/g (AEAC), respectively. The optimum extraction condition was as flowed: ethanol concentration of extraction solvent was 100% (1st extraction) and 60% (2nd extraction), extraction time was 30 min.

Effects of High Hydrostatic Pressure Treatment on the Chemical Composition of Germinated Rough Rice (Oryza sativa L.)

Min Young Kim*, Sang Hoon Lee, Gwi Yeong Jang, Meishan Li, Nara Yoon, Heon Sang Jeong
Department of Food Science and Biotechnology, Chungbuk National University, Korea

This study was performed to evaluate changes in the chemical composition of germinated rough rice with high hydrostatic pressure treatment (HPT). Rough rice was germinated at 37°C over 6 days (control), and then subjected to HPT at 30 MPa for 24 h. The highest crude protein content in the control sample after 6 days of germination was 9.54%. Crude lipid content increased from 2.04-2.74% (control) to 2.27-3.10% (HPT). HPT samples showed higher values of total free sugar and glucose content than those of the control. The total amino acid value was not significant, but the essential amino acid content increased from 0.45-5.09 mg/g in the control to 1.57-5.30 mg/g in the HPT sample. The major fatty acids were found to be palmitic, oleic, and linoleic acid. The content of oleic acid decreases with HPT, whereas that of linoleic and linolenic acid increased slightly during the initial stages of germination. These results suggest that HPT after germination efficiently depolymerizes chemical components and enhances the content of essential nutrients.
Optimization of Extraction Condition for Tricin and TTGE (Tricin-O-(threo-β-guaiacylglyceryl) ether) in Rice Hull (Oryza sativa L.)

Nara Yoon*, Sang Hoon Lee, Gwi Yeong Jang, Meishan Li, Min Young Kim, Heon Sang Jeong
Department of Food Science and Biotechnology, Chungbuk National University, Korea

This study was conducted to develop the optimal extraction condition for tricin and TTGE (Tricin-O-(threo-β-guaiacylglyceryl) ether) from rice hull (Oryza sativa L.). Experimental design was used to investigate the effect of ethanol concentration of extraction solvent (50, 60, 70, 80, and 90%), extraction time (0.5, 1, 2, 6, 12, 24, and 48 h), and extraction methods (sonication and agitation) on tricin and TTGE contents. Tricin and TTGE contents increased with increasing ethanol concentration of extraction solvent until 70% ethanol and then decreased in 80 and 90% ethanol. In sonication extraction method, tricin content increased with time and TTGE content was the highest at 1 h treatment. In agitation extraction method, tricin and TTGE contents increased with time. The highest tricin content occurred in the sample treated with 70% ethanol for 24 h by agitation (7.591 μg/g). The highest TTGE content occurred in the sample treated with 70% ethanol for 1 h by sonication (42.94 μg/g). Recovery of optimized tricin and TTGE were 92.34 and 71.8%, respectively. Therefore the optimized extraction condition will be used to develop the functional materials.

Changes in Flavonoid Contents of Rhus verniciflua Stokes Extracts with Different Heating Conditions

Gwi Yeong Jang*, Gun Mook Yoon1, Sang Hoon Lee, Meishan Li, Min Young Kim, Yoon Jeong Lee, Heon Sang Jeong
Department of Food Science and Biotechnology, Chungbuk National University, Korea

This study investigated changes in flavonoid contents (fustin, fisetin, sulfuretin, and butein) of Rhus verniciflua stokes (RVS) extracts with different heating conditions. Bark, xylem parts, and RVS were extracted at room temperature, 80, 100, 120, 140, and 160°C for 1, 3, and 5 h, respectively. Total polyphenol contents, DPPH and ABTS radical scavenging activities significantly increased as increasing temperature. Total flavonoid contents of extracts heated at 80 and 100°C were lower than that of non heating. Total flavonoid contents of xylem and RVS extracts were higher than bark extracts. DPPH and ABTS radical scavenging activities of bark extracts were higher than xylem extracts. The optimal extraction conditions of total polyphenol, flavonoid contents, DPPH and ABTS radical scavenging activities of bark extracts were higher than xylem extracts. The optimal extraction conditions of total polyphenol, flavonoid contents, DPPH and ABTS radical scavenging activities were 140°C/3 h, 140°C/1 h, 140°C/3 h and 140°C/3 h, respectively. These results suggest that the optimum extraction temperature and time considering extraction yield, antioxidant activities and cost are 140°C and 3 h, respectively.

Changes in Antioxidant Compounds and Antioxidant Activities of Rhus verniciflua Extract with Different Heating Conditions

Gwi Yeong Jang*, Gun Mook Yoon1, Sang Hoon Lee, Meishan Li, Min Young Kim, Yoon Jeong Lee, Heon Sang Jeong
Department of Food Science and Biotechnology, Chungbuk National University, Korea, 1Institute of Health & Environment Research, Korea

This study was performed to investigate the changes in antioxidant compound and antioxidant activities of Rhus verniciflua stokes (RVS) extracts with different heating conditions. Bark, xylem parts, and RVS were extracted at room temperature, 80, 100, 120, 140, and 160°C for 1, 3, and 5 h, respectively. Total polyphenol contents, DPPH and ABTS radical scavenging activities significantly increased as increasing temperature. Total flavonoid contents of extracts heated at 80 and 100°C were lower than that of non heating. Total flavonoid contents of xylem and RVS extracts were higher than bark extracts. DPPH and ABTS radical scavenging activities of bark extracts were higher than xylem extracts. The optimal extraction conditions of total polyphenol, flavonoid contents, DPPH and ABTS radical scavenging activities were 140°C/3 h, 140°C/1 h, 140°C/3 h and 140°C/3 h, respectively. These results suggest that the optimum extraction temperature and time considering extraction yield, antioxidant activities and cost are 140°C and 3 h, respectively.

Effect of Medium Pressure Treatment on Enzyme Impregnation into Meat

Hwa-Jin Lee*, Kwang-Il Kim1, Mi-Jung Choi1, Hyung-Yong Cho
Laboratory of Bioguided Processing and Food Engineering, Department of Food Science and Biotechnology, CHA University, Korea, 1Laboratory of Nano-Bio Materials, Department of Bioresources and Food Science, Konkuk University, Korea

This research investigated a possibility of accelerating enzyme infusion into meat by medium-pressure treatment. Meats in solution of enzyme were processed under medium pressure (50-200 MPa) at 25°C for 5 min. We observed electrophoretic patterns, microstructures and texture properties of meats at before and after medium pressure infusion treatment. The results of SDS-PAGE showed that the heavy molecular weight product band as MHC was degraded into lower molecular weight products at the lower part of the gel. Transmission electron microscopy of the enzyme infused muscle revealed that M-line and myosin filaments of A-band were absented from the myofibrils with increasing applied pressure. The Warner-Bratzler shear forces of treated meats were no different from non-treated meat. Enzyme infusion into meat was accelerated with increasing of pressure but this was not linked to meat tenderness.
P13 -046

Influence of Enzyme Infusion Methods on Firmness of Carrot (Daucus carota)

Hwa-Jin Lee*, Kwang-Ik Kim1, Ye-Won In, Hyung-Yong Cho
Laboratory of Bioguided Processing and Food Engineering,
Department of Food Science and Biotechnology, CHA University, Korea; 1Laboratory of Nano-Bio Materials,
Department of Food Science and Biotechnology, Seoul Women’s University, Korea

Carrots were infused in solution of enzyme by vacuum infusion (VI), pressure infusion (PI) or vacuum-pressure infusion (VPI) with the aim to decrease the firmness. Carrots in solution of enzyme were processed under atmospheric, vacuum (-100 - -600 mmHg) and medium pressure (10-200 MPa) at 25°C for 5 min. We measured contents of penetrated enzyme, changes of firmness and microstructure at before and after infusion treatment. The results of SDS-PAGE showed that the fragment of enzyme was detected after infusion treatment. VPI treated carrot was higher intensity for enzyme band than VI or PI treated carrots. For all treatments studied, the treated sample was softer compared with the control. Firmness of VPI treated carrot was lower than firmness of VI or PI treated carrots. Scanning electron microscopy of treated carrots showed that cell was broken by infused enzyme. Vacuum-pressure infusion was observed to be best method able to accomplish an impregnation of enzyme solution into carrots and hence capable of decreasing the firmness of the carrots.

P13 -048

Development of Low Salted Fish Sauce Using Pressure Assisted Enzymatic Hydrolysates of Anchovy

Ye-Won In*, Eun Bang, Hyung-Yong Cho
Laboratory of Bioguided Processing and Food Engineering,
Department of Food Science and Biotechnology, CHA University, Korea

The purpose of this study was to develop low salted anchovy sauce by adding hydrolysates of anchovy (APH) to Korean traditional fermented anchovy sauce (KA sauce). APH was prepared pressure assisted enzymatic hydrolysis of raw anchovy. In the 1st step, role of salt in KA sauce were investigated and reducing salt by 20% were targeted in this research. Sensory evaluation for bitter taste of APH was conducted by standard caffeine solution (0.02%). The results showed that APH had a lower bitter taste in comparison with standard caffeine solution. This suggests that APH may have a no impact on bitter taste. In the 2nd step, samples were prepared with various ratio of KA sauce to APH for the optimum product formulation. Panelist evaluated samples with pleasantness and several sensory attributes by discriminative test. The prepared sample by combination with a ratio of 4 to 1 was no significant difference in the overall taste intensity (p<0.05). Salt and nitrogen contents were 16% and 10%, respectively. The potential of commercial production of low salted anchovy sauce using APH was confirmed.

P13 -047

Effect of High Pressure Treatment on Rheological Properties of Rice Flour and Puffed Rice

Eun Bang*, Hyung-Yong Cho
Laboratory of Bioguided Processing and Food Engineering,
Department of Food Science and Biotechnology, CHA University, Korea

This study was conducted to investigate rheological change of rice flours and puffed rice flours by high pressure treatment. Rice flour suspensions and puffed rice flour suspensions of 4% dry matter were treated at 0.1, 100, 200, 300, 400, 450, 500, and 550 MPa for 3 min, and their microstructure and rheological characteristics were analysed. Gelatinization enthalpy of rice flours increased with increasing treatment pressure. But gelatinization enthalpy of puffed rice flours was constant regardless of treatment pressure. Additinally scanning electron microscope showed that puffed rice flours treated by high pressure displayed less compacted particles than rice flours. Test samples with high pressure treatment showed lower storage modulus and loss modulus in an oscillatory frequency range between 0.1 and 100 rad/s than untreated. Also, rice flour suspensions showed lower storage modulus and loss modulus than puffed rice flour suspensions in same range. Results showed high pressure treatment of rice flours and puffed rice flours caused changes in starch crystallinity affecting the functional properties of flour such as its rheological behavior.

P13 -049

Cold Plasma Treatments for Microbial Safety and Preservation of Fresh Lettuce

Yeong Ji Oh*, Han Bii Lee, Ah Young Song, Jung Eun Kim, Sei Mi Lim, Seo Heol Min, Kyung Bin Song1, Deog Hwan Oh2
Department of Food Science and Technology, Seoul Women’s University, Korea; 1Department of Food Science and Technology, Chungnam National University, Korea; 2Department of Food Science and Biotechnology, Kangwon National University, Korea

Cold plasma (CP) treatment has been investigated as the method to inhibiting foodborne pathogens and extending storage life of fresh lettuce. Lettuce was treated with N2-CP at 667 Pa for 10 min at 400 W or 900 W and stored at 4 or 10°C to study the effects of the CP treatment for the microbial inhibition and the physicochemical properties of lettuce, including weight, water activity, color, the concentration of ascorbic acid, and antioxidant activity. Sensory properties of appearance, flavor, and brittleness were also evaluated. The CP treatments inhibited E. coli O157:H7 and S. Typhimurium in lettuce by 2.3±0.2 and 2.0±0.6 log CFU/g, respectively. Weibull model adequately described the microbial inhibition by the CP treatments. Antimicrobial effects of the CPT against E. coli O157:H7 and S. Typhimurium inoculated on lettuce were demonstrated during storage. The treatment did not affect the physicochemical properties of lettuce during storage (p>0.05). The CP treatment demonstrated potential for improving microbial safety of vegetables, without significant loss of their physicochemical and sensory properties.
Influences of Die Temperature on the Physical Properties and Ginsenoside Hydrolysis by Enzyme of Extruded White Ginseng

Kwan-Hyung Choi*, Sang-Hee An, Gi-Hyung Ryu
Department of Food Science and Technology, Kongju National University, Korea

The aim of this study is to investigate the effect of die temperature on physical properties and ginsenoside hydrolysis by enzyme of extruded white ginseng (EWG). The observed variables in extrusion process were feed rate (100 g/min), moisture content (20%), screw speed (200 rpm), die diameter (3 mm), and die temperature (150, 160, and 170°C). The extruded white ginseng at the die temperature of 170°C showed high expansion index than other extrudates. Increasing of die temperature increased the specific length of extrudates. The highest of water absorption index and water solubility index from extruded white ginseng at the die temperature of 160°C were 3.88 g/g and 47.63% respectively. Using the Viscozyme L, Novozym 39095, and Liquozyme surpa, ginsenosides were converted. The reducing sugar of extruded white ginseng at the die temperature of 160°C was the highest at 766.35 mg/g in Viscozyme L at 6 h. Reducing sugars of extruded white ginsengs measured in the fast activation time was also high when compared to white ginseng found. The degradation products measured by TLC was confirmed that converted ginsenosides by enzyme was increased.

Functional Analysis of Potato Protein Interacting to the Intestinal Mucosa Membrane Protein

Xiaocen Chen*, Jaesun Choi, Sunghee Kim, Jinkyu Lim
Major in Food Biomaterials, Kyungpook University, Korea

Potato has been known to offer protection against colon cancer, improve glucose tolerance and insulin sensitivity, lower plasma cholesterol and triglyceride concentrations, increase satiety, and possibly even reduce fat storage. We hypothesized that the protease resistant potato proteins might interact with the small intestinal mucosa layer. Then, the interaction between potato proteins and the intestinal mucosa layer may generate some functional signals for the satiety control which are well characterized outcome of the potato protein consumption. To study the function of protease resistant potato proteins, the interaction of potato proteins to the small intestine mucosa layer was identified by affinity cross-linking and mass spectrometry analysis was applied to identify the interacting protein. Cell signaling change by potato protein were analysis by phosphoproteomic analysis.

Soy Proteins Inhibit Cholesterol Absorption with Cells by Interacting with Cholesterol Transporting Proteins

Jaesun Choi*, Xiaocen Chen, Sunghee Kim, Jinkyu Lim
Major in Food Biomaterials, Kyungpook National University, Korea

Soy protein is believed to play important roles in inhibition of blood cholesterol absorption. Form our previous studies, we found that isoflavone-free defatted soy protein is resistant to in vitro digestion by proteases, such as pepsine and pancreatin. We called the protease resistant soy protein as protease resistant food protein (PRFP). Moreover, we demonstrated that the soy protein interacts with a human enterocyte, Caco-2, as well as small intestinal villi. When Caco-2 cells were treated with cholesterol micelles in the presence or absence the defatted soy protein, defatted soy proteins inhibit the cholesterol absorption. Thus, we hypothesized that soy PRFPs interact with NPC1L1 or ABC G5/G8 on the cell surface and inhibit cholesterol transport into cells. To verify the hypothesis Caco-2 cells transfected with NPC1L1 or ABC G5/G8 were tested for binding of soy proteins to the transfected gene products. At the same time, cholesterol transport to the NPC1L1 and ABC G5/G8 cDNA was blocked by soy proteins. We also analyzed the physical interactions of soy proteins to NPC1L1 and ABC G5/G8 proteins.

Body Weight Controlling in Mice by Soy Protein due to Fecal Microbiome Profile Changes

Sunghee Kim*, Jaesun Choi, Xiaocen Chen, Jinkyu Lim
Major in Food Biomaterials, School of Food Science & Biotechnology, Kyungpook National University, Korea

Soybean is considered as a high quality protein because soy proteins contain substantial amounts of all the essential amino acids. Previous studies examining protease resistance of soy proteins showed us that the major protein in soybean were resistant to digestive protease. We assume that the protease resistant soy proteins passed to small intestine can interact with the intestinal epithelial layer and change the physiological status of the body. The fluorescently labeled soy proteins by FITC could decorate outer membrane layer of a human enterocyte, Caco-2 cell, and epithelial layer of the microvilli of the small intestinal tissue sections. Mice fed high fat diet showed significant increase in body weight and abdominal fat weight while the soy protein supplemented high fat diet reduced the body weight compared to the high fat diet fed mice. Metagenomic analysis of the fecal microbiomes from the high fat and high fat with soy protein diet fed mice showed significant changes in microbiome profiles. This study suggests that the body weight controlling effect of soy protein could be the microbiome changes in the intestine by soy protein.
Encapsulation of *Lactobacillus acidophilus* by Ionic Gelation Using a Chitosan and Phytic Acid

Sung Hyun Lee*, Jeong Un Kim, Hafiz Shahbaz, Saewon Chun, Namho Ha, Jiyoung Park
Department of Biotechnology, Yonsei University, Korea

Probiotic bacteria provide many physiological effects on improving the functions of intestines and benefit the health of consumers. However, viability of probiotics is generally reduced while passing through a harsh gastric environment. Encapsulation of bacterial cells is used to improve their tolerance in harsh gastric environment. Chitosan (CS) is often used as a wall material and phytic acid (PA) is used as a cross-linking agent for capsules. Additionally, calcium carbonate (CaCO₃) is used in the capsules as a neutralizing agent. The aim of this study was to prepare L. *acidophilus*-loaded PA-CS capsules by ionic gelation and to investigate capsules' susceptibility to a gastric environment. During the incubation in a simulated gastric fluid (SGF), planktonic *L. acidophilus* was completely inactivated within 90 min; while *L. acidophilus* coated in CaCO₃-PA-CS capsules showed only 0.64 log reduction after 2 h incubation in the SGF. The populations of planktonic and capsulated *L. acidophilus* showed 0.69 and 1.96 log reduction after 4 weeks storage at 4°C, respectively. Results indicated that CaCO₃-PA-CS capsules can provide a suitable delivery system for oral delivery of probiotics.

Effect of Liposome Encapsulated Salt on Noodle Physicochemical Properties

Jiseon Lee*, Soojin Kim, Jae-Hee Seo, Mi-Jung Choi
Laboratory of Nano-Bio Materials, Department of Bioresources and Food Science, Konkuk University, Korea

Sodium chloride is one of the major ingredients of noodle and it affects soft, smooth and elastic textural properties. However, excessive salt intake induces health risks such as high blood pressure and heart diseases which become one of the alarming health issues. The purpose of this study was to enhance the salty taste by localization of encapsulated salt. It was prepared by dissolving 20% salt and 2% lecithin in distilled water using high speed homogenizer (11,000 rpm, 5 min), ultrasonicator (40% power, 3 min) and then freeze dryer. The populations of planktonic and capsulated *L. acidophilus* showed 0.69 and 1.96 log reduction after 4 weeks storage at 4°C, respectively. Results indicated that CaCO₃-PA-CS capsules can provide a suitable delivery system for oral delivery of probiotics.

Effect of Storage Time and Temperature on Physicochemical Properties of Spinach

Jung Guy Lee*, Kwang-Il Kim, SangYoon Lee, Soojin Kim, Jae-Hee Seo, Sang-Gi Min¹, Mi-Jung Choi
Laboratory of Nano-Bio Materials, Department of Bioresources and Food Science, Konkuk University, Korea

The most of green vegetables, including spinach and lettuce, relatively short shelf-life compared to other vegetables due to their relatively high respiratory quotient. Purpose of this study was to observe the effect of liposome coated or non-coated pectinase on carrot softening by using vacuum pressure impregnation. To form pectinase coated liposomes as a impregnation medium, 2% lecithin and 2% pectinase was homogenized by high speed homogenizer at 10,000 rpm for 3 min and ultrasonificater at 54% of 200 W for 3 min. Cylinder type of carrots (3×1 cm) were impregnated pectinase liposome, non-coated pectinase, distilled water (control) under vacuum pressure at 100 mbar for 5 min. The samples were kept at 4°C and 25°C for 24 h to make softening. Twenty four h pectinase treatment significantly reduced the hardness of carrot. For the total color difference results, treated samples were significant differences compare with control sample. The impregnation grade of enzyme was measured by using electrophoresis method. Consequently, there were no significant differences between physicochemical properties of carrot treated with liposome coated pectinase and non-coated pectinase. Further studies are needed to understand and find optimum conditions including reaction time, enzyme concentration and pressure.
**P13 -058**

**Tendering Effect of Liposome Coated Hemicellulase on Carrot**

Soojin Kim*, Munkhtugs Davaatseren, Kwang-Il Kim, Sang Yoon Lee, Jiseon Lee, Jung Gyu Lee, Jae-Hee Seo, Mi-Jung Choi

Laboratory of Nano-Bio Materials, Department of Molecular Biotechnology, Konkuk University, Korea

It is difficult to chew or bite a rigid food for the elderly because of mouth muscle weakness, salivary dysfunction. Hemicellulase, an enzyme which degrades polymer hemicellulose, can make the food tender for aging people. In this study, the liposomes were applied to encapsulate the enzyme comparing of the effect of non-coated and coated hemicellulase. Mixture of 2% hemicellulase and 2% lecithin solution was processed by using high-speed homogenizer (10,000 rpm, 3 min) and ultrasonification (3 min). Carrots were cut into cylinder type (3×1 cm) and immersed in distilled water (D.W, control), non-coated hemicellulase (NCH) and coated hemicellulase (CH) for 48 h at 4°C. The properties of carrots were evaluated at interval of 12 h. The hardness of NCH and CH was 1,000 nm and the smallest particle size.

**P13 -060**

**Effect of Blanching Time on the Physicochemical Properties of Mugwort**

SangYoon Lee*, Munkhtugs Davaatseren, Jung Gyu Lee, Mi-Jung Choi

Department of Bioresources and Food Science, Konkuk University, Korea

The consumption of wild vegetables is limited due to significant loss of storage stability after harvest. Pre-treatments may affect on quality of vegetable during freezing or thawing. However, many wild vegetables don’t have optimal pre-treatment prior to freezing storage yet. In this research, to optimize blanching time of mugwort, they were washed, hot water blanched at 100°C for 10, 20, 30, and 40 s, soaked in cold water, and then air-dried for 10 min. The pH of mugwort increased from 6.32 to 6.74 through blanching and total color difference (ΔE) showed the lowest value with 30 s blanching without any significant difference. The water contents also increased with blanching treatment about 4.6%. Aerobic bacteria and total coliform of raw mugwort about 6.7 log CFU/g and 4.5 log CFU/g respectively, which diminished to 3.7 log CFU/g through 20 s blanching, and no coliform were detected after blanching. After 30 s blanching, aerobic bacteria level reduced under the limit of detection (<30 colonies). Considering microbial aspect, it is assumed that 30 s blanching is optimal pre-treatment to maintain quality of mugwort before other processing.

**P13 -059**

**Physicochemical Properties of Soybean Peptide Loaded Chitosan Nanoparticles**

Jae-Hee Seo*, Yeon-Ji Jo1, Munkhtugs Davaatseren, Mi-Jung Choi

Department of Bioresources and Food Science, Konkuk University, Korea, 1Department of Bioindustrial Technologies, Konkuk University, Korea

Soybean peptide has various functional which are blood pressure regulation, body fat and blood glucose reduction, however, bioavailability of peptide is two low due to its fragile in stomach. Therefore, the soybean peptide was encapsulated by cross-linkage interaction between positive charged chitosan and negative charged peptide. The optimal formulation was developed to study the physicochemical properties of soybean peptide loaded chitosan nanoparticles. The chitosan and soybean peptide were dissolved in acetic acid buffer, these were diluted by dropwise method (2 mL/min) and then the nanoemulsion was treated with high speed homogenizer and ultra-sonication. The particle size and zeta potential was determined by using DLS method, and encapsulation efficiency was measured. When the concentration of peptide was increased, zeta potential of the complex particles was about 40-50 mV. The emulsion containing 4% of the peptide solution was 3,000 nm, it containing 50% of the peptide solution was 1,000 nm and the smallest particle size.

**P13 -061**

**Development of Microwave Integrating Cold Plasma Treatment for Onion Powder Safety and Preservation**

Mee Yeon Won*, Jung Eun Kim, Hee Soo Park, Sea Cheol Min

Department of Food Science and Technology, Seoul Women’s University, Korea

The effects of cold plasma treatments (CPT) on the inhibition of Bacillus cereus spores, Aspergillus brasiliensis, and Escherichia coli O157:H7 on onion powder (OP) and the physicochemical properties of OP were studied. OP was treated with CP for 10, 14, 25, 36, and 40 min, which was generated with helium at 400, 474, 650, 826, and 900 W. The CPT were conducted with simultaneous exposure to microwave at either 0.17 W/m² (CP-LMW) or 0.25 W/m² (CP-HMW). The CP-LMW (474 W, 36 min), resulting in the temperature change at the onion surface from 29.9 to 34.2°C, inhibited spores of B. cereus and A. brasilienensis by 1.4±0.3 and 1.3±0.2 log spores/cm², Weibull model adequately described the inhibition of B. cereus spores by the CP-HMW. The CP-HMW (400 W, 40 min) reduced the numbers of A. brasilienensis and E. coli O157:H7 by approximately 1.5 and 4 log CFU/cm². The CP-HMW did not affect physicochemical properties of OP during storage at 4 and 25°C for 28 days (p>0.05). The CPT has demonstrated the potential for the application to OP and possibly other powder products as the method to decontaminate the products without significant loss of their qualities.
Hydrolysis of Soybean Protein Isolate Using Subcritical Water

Yunhee Hwang*, Jong Hyun Lee, Hyung-Yong Cho1, Jung-Kue Shin2, Mi-Jung Choi3, Seokhoon Lee
R&D Center, Biovan Ltd., Korea, 1Laboratory of Bioguided Processing and Food Engineering, Department of Food Science and Biotechnology, CHA University, Korea 2Department of Korean Cuisine, Jeonju University, Korea, 3Laboratory of Food Engineering, Department of Food Science and Biotechnology of Animal Resources, Konkuk University, Korea

Hydrolysis of soybean protein isolate (SPI) using subcritical water (SCW) was conducted to study the feasibility for producing protein hydrolyzate. SCW hydrolysis of SPI suspension (5%) was conducted in an electrically heated batch reactor (2 L). The effects of temperature (230 to 270°C) and holding time (10 to 30 min) on the degree of hydrolysis (DH) and the production of peptides and amino acids were studied by surface response method. The DH was determined by derivatizing the hydrolyzates with OPA solution. The maximum DH and amino acid yield achieved was 22.6% at 264°C for 27 min. It was confirmed a great influence of reaction temperature and holding time on the hydrothermolysis of soybean protein, but the holding time had less of an effect on amino acid yield when the temperature was higher than 230°C.

Development of Low Fat Rabbit Meat through Dietary Supplementation of Oat

Muhammad Issa Khan1,2*, Muhammad Rizwan Tariq1, Cheorun Jo2
1National Institute of Food Science and Technology, University of Agriculture, Faisalabad-Pakistan, 2Department of Agricultural Biotechnology, Seoul National University, Korea

The current study was designed to investigate the dietary responses of oat supplementation in rabbit feed on reduction of total fat and improvement in fatty acids profile of rabbit meat. Rabbits were divided into three different groups and reared for two months on supplemented diets. Control group rabbits were fed alfalfa while rabbits of treatment groups were fed 2% and 4% oat in control diet. The supplementation of oat at 4% in rabbits feed significantly improved the growth performances of rabbits and reduced the fat level in the rabbits meat. The fatty acid profile also showed the improvement as PUFA to SFA ratio was greater in meat of rabbits fed the feed containing 4% oat when compared with the control. Future studies will be focused on bio-evaluation of low-fat rabbit meat in hypercholesterolemia.

Development of Continuous Freeze Concentration System Using Slurry Ice Crystal Formation

Min-Yong Kim*, Yeong-Woo Shin, Jong-Deog Kim1
Department of Refrigeration Engineering, Chonnam National University, Korea, 1Department of Biotechnology, Chonnam National University, Korea

In order to determine optimum condition for concentration of fruit juice, freezing concentration system has been developed. This system is composed of refrigerator for freezing water in the fruit juice, agitator for separation ice and cooled juice and control system for optimum brine temperature. Undirected cooling type has been used for cooling brine circulated freezing concentration vessel. The characteristics of freeze concentration system is to obtain concentrated juice continuously. The process of this system is consisted of sensing system of brine, concentration juice, ice crystal in cooler. According to the freezing ratio, concentration ratio of orange juice was measured, also, sugar content, ascorbic acid, phenol, and color are measured. The relationships of functional components with freeze concentration time were determined. In addition program of determining optimum process conditions were developed. Therefore, it is possible to obtain desiring concentration ratio of functional components content. Cold storage system are composed of LED. To measure the contents of functional components according to the variation of LED wave length in refrigeration system, LED (R,G,B) was installed.
Quality Characteristics of Jeju Purple Sweet Potato Tart Controlled Moisture Content Using Molecular Press Dehydration or Maltodextrin Addition

Man Jae Cho*, Hyun Jung Kim
Department of Food Bioengineering, Jeju National University, Korea

In this study, purple sweet potato tarts were prepared with molecular press dehydrated purple sweet potatoes and maltodextrin as a dehydrating agent along with purple sweet potato added maltodextrin in order to control moisture content during storage. Overall the quality characteristics of tarts made with molecular press dehydrated purple sweet potatoes were degraded compared to tarts made with the non-treated purple sweet potatoes except moisture contents and water activities. Tarts made with purple sweet potato added maltodextrin at concentrations of 5, 10, and 20% maintained lower moisture content in the outer shell during early storage, but these had lost the capability to control moisture content after 10 days of storage. These results indicated that tarts made with molecular press dehydrated purple sweet potatoes effectively controlled moisture contents and water activities during storage although the quality and sensory characteristics decreased. On the contrary to these results, tarts made with purple sweet potatoes added maltodextrin constantly maintained total phenolics, anthocyanins, DPPH free radical scavenging activity, color, and sensory evaluation during storage.

Effect of Dietary Processed Sulfur Supplementation on Texture Quality, Color and Mineral Status of Dry-cured Ham

Ji-Han Kim*, Min-Gu Ju, Jin-Ju Bae, Fengqi Yang, Go-Eun Hong, Chi-Ho Lee
Department of Food Science and Biotechnology of Animal Resources, Konkuk University, Korea

The present study aimed to investigate the chemical composition, oxidative stability, and texture attributes of dry-cured ham from pigs fed processed sulfur (S, 1 g/kg feed), and from those fed a basal diet (CON), from weaning to slaughter (174 days). Total collagen content and soluble collagen of the S group was significantly lower than that of the control group (p<0.05). Brightness of the S group was significantly higher than that of the control group (p<0.05), while the redness of the S group was lower than that of the control group (p<0.05). The S group showed significantly lower Fe and Ca content than the control group (p<0.05), whereas the proteolysis index of the S group was significantly increased compared to the control group (p<0.05). The feeding of processed sulfur to pigs led to increase oxidative stability related to lipids and pigments in the dry-cured ham (p<0.05). These results suggest that feeding processed sulfur to pigs can improve the quality of the texture and enhance the oxidative stability of dry-cured ham.

Quality Characteristics of Low-fat Frankfurters with Dietary Fiber Extracted from Apple Pomace

Yun-Sang Choi*, Tae-Jun Jeong1, Cheon-Jei Kim1, Su-Kyung Ku, Jung-Min Sung, Dong-Ho Seo, Jong-Dae Park, Ki-Hong Jeon, Young-Boong Kim
Food Processing Research Center; Korean Food Research Institute, Korea, 1Department of Food Science and Biotechnology of Animal Resources, Konkuk University, Korea

Apple pomace is the primary by-product produced during apple juice production. The by-products of apple pomace are normally used as animal feed or fertilizer and some portion goes wasted. Apple pomace contains dietary fiber, polyphenols, vitamins, and organic acids required for health. Fat plays an important role in stabilizing meat emulsions. However, high fat diets are associated with obesity, hypertension, cardiovascular diseases, and coronary heart diseases. Thus, the objective of this study was to investigate the effects of replacing fat with dietary fiber extracted from apple pomace on quality characteristics of low-fat frankfurters. Increased fat level resulted in decreased moisture content, cooking loss, and emulsion stability of low-fat frankfurters; whereas, increase in fat content, caloric energy, pH, lightness, redness, hardness, cohesiveness, gumminess, chewiness, and overall acceptability of sensory characteristics was observed. The results from this study show that inclusion of apple pomace fiber in the formulation will be improving quality characteristics relative to regular-fat control.
Effect of Mixed-cultures of Saccharomyces cerevisiae, Torulaspora delbrueckii JK08 and Pichia anomala JK04 on Structural Features of Bread and Its Influence on Textural Profiles

Wahyono Agung1,2,3, Woo-Won Kang2, Heui-Dong Park3
1 School of Food Science and Biotechnology, Kyungdong National University, Korea, 2Department of Food & Food-service Industry, Kyungpook National University, Korea, 3Department of Agricultural Technology, State Polytechnic of Jember, Indonesia

In this study, we made breads leavened with mixed-cultures of Saccharomyces cerevisiae, Torulaspora delbrueckii JK08 and Pichia anomala JK04. Then, its structural features and textural properties were evaluated. The structural features of bread crumb were characterized by cell density, mean cell area and cell area fraction. While, the textural properties were characterized by hardness, chewiness, cohesiveness and springiness. The bread leavened with co-culture of S. cerevisiae and T. delbrueckii produced the smallest and less varied cell area than those of other cultures. In contrast, the bread leavened with single culture of S. cerevisiae produced the greatest and more varied cell area. The cell density was inversely correlated to mean cell area. It demonstrated that the greater the cell density, the smaller the mean cell area and vice versa. We found that the cell density, mean cell area and cell area fraction significantly correlated to cohesiveness. But, these were insignificant to hardness, springiness and chewiness. We suggested that the use of mixed-cultures affected the structural features and textural profiles of bread.

Effect of Dextrin-oil Mixture on the Rehydration Property of Instant Noodles

Areum Jang*, Jaeyong Shim1, Seokki Lee2, Suyong Lee
Department of Food Science & Technology and Carbohydrate Bioproduct Research Center, Sejong University, Korea, 1Department of Food & Biotechnology, Hankyung National University, Korea, 2Serim Flavor Co., Ltd., Korea

The global consumption of instant noodles has been rapidly growing due to their cooking convenience, affordable price, and various flavor. With this trend, a great deal of effort has been made to improve the quality attributes of the noodles. Specifically, the improvement of rehydration rate of instant noodles has been a challenge faced by the noodle manufacturers. In this study, dextrin-oil mixture was incorporated into the formulation of instant noodles and evaluated as a rehydration improver for the noodles. The thermal conductivity of the noodles prepared with dextrin-oil mixture exhibited higher thermal conductivity. These results were highly linked to the porous structure of the noodles confirmed by the SEM images. Thus, the noodles with the dextrin-oil mixture showed reduced cooking time by 36%, compared to the control. This study can thus encourage the food industry to enhance the quality attributes of instant noodles by improving their rehydration property.

Combined Effect of Transglutaminase and Polyphenol Extracts on the Rheological and Noodle-making Properties of Wheat Flour

Joo Young Kim*, Sang-Ho Yoo, Suyong Lee
Department of Food Science & Technology and Carbohydrate Bioproduct Research Center, Sejong University, Korea

Noodle manufacturers are facing a challenge to boost the health benefits of noodle products due to the increasing demand of health-conscious consumers. In this study, polyphenols were extracted from green tea and mulberry and then used together with transglutaminase (TG) for instant noodles. Wheat flour containing both TG and polyphenol extracts exhibited different pasting patterns from that with TG only. Specifically, higher peak viscosities were observed in the TG-polyphenol samples. When TG was incorporated into the formulation of instant noodles, the use of TG decreased the extensibility of dough while the resistance to extension (Rmax) varied depending on several processing factors such as reaction time. Specifically, the highest Rmax was observed when a loaf of noodle dough before sheeting was treated with TG for 20 min. Moreover, the combined use of TG and polyphenol extracts affected the breaking stress and oil uptake of instant fried noodles. These results suggest that the functional properties of instant noodles may be enhanced by the combined use of TG and polyphenol extracts, probably providing positive effects for the noodle industry.

Comparison of Preference of Sausages with Different Addition Types and Quantities of Mushrooms

Yong-Seon Lee*, Seon-Yi Won, Jae-Soon Seo, Dae-Hyoung Lee, Heui-Yun Kang, In-Tae Park
Gyeonggi-do Agricultural Research and Extension Services, Korea

Mushroom sausages with different addition methods were manufactured and differences in their qualities were compared to increase mushroom consumption. After adding rice flour 7% of fork meat for settlement of contents added to sausages, it was found that organic functions of rice flour were better than eggs or wheat flour. When raw shiitakes, oyster mushrooms and Hericium erinaceum were added at the ratio of 30% to fork meat, preference was excellent. Regarding addition types of mushrooms to make sausages, to add raw mushrooms through removing moisture after toasting them showed high values in terms of physical properties, such as hardness, cohesiveness and elasticity, and preference was good. About kinds of mushrooms, the taste was better if shiitakes and oyster mushrooms were added. Preference of H. erinaceum was lower than other mushrooms. The anti-oxidative activity was high in sausages added by shiitakes and the β-glucan content was 13.3 mg/g, the highest, in H. erinaceum, followed by shiitakes and oyster mushrooms.
Solidification and Digest Rate of Pudding Following Sub-ingredients

Yong-Seon Lee*, Seon-Yi Won, Jae-Soon Seo, Dae-Hyoung Lee, Heui-Yun Kang, In-Tae Park
Geonggi-do Agricultural Research and Extension Services, Korea

In order to develop light meals for senior citizens, soft puddings were manufactured by adding old pumpkins, radishes, pumpkin-sweet potatoes and chestnut-sweet potatoes based on bean that are good for digestion and their properties were studied. The solidity of ingredients for solidifying pudding was 0.04 kgf in 1% of gelatin and 4% of dextrin and their sugar content was proper at 16.4°Bx. The sugar content of puddings added by 16% of sub-ingredients to 64% of soybean liquid was 15.7-19.2°Bx, lower than or similar to counter products. Digestion ratios following sub-ingredients were similar in general, at 92-97%, and the anti-oxidative activity was the highest, 95.7%, in purple sweet potato puddings. Other ingredients showed high rations in general.

Subcritical Water Extraction of Dietary Fiber from Musa sapientum L. Peel

Min-Jung Ko*, Seon-Yi Won, Jae-Soon Seo, Myong-So Chung
Department of Food Science and Engineering, Ewha Womans University, Korea

Subcritical water extraction (SWE) can be used to extract dietary fiber by varying the temperature-dependent dielectric constant of water. The polarity of water decreases with increasing temperature (ε = 53 at 110°C to ε = 36.5 at 190°C), which makes SWE a selective extraction process. It is also eco-friendly, safe, and inexpensive due to the use of only purified water as the solvent. Musa sapientum L. (banana peel) is widely used for its nutritional values all over the world. This study investigated SWE of soluble dietary fiber (SDF) from Musa sapientum L. peel, including the effects of varying the extraction conditions of temperature (110-190°C) for 10 min under high pressure (<10 MPa). SWE was conducted using an automatic accelerated solvent extractor (ASE 350, Dionex). The dietary fiber extracts were analyzed using the enzymatic gravimetric method of the Association of Official Analytical Chemists. The maximum yields of SDF under extraction condition of 170°C and 10 min was 12.58%, and solid contents was 0.55 g/g Musa sapientum L. peel using SWE method. The SWE could be a practical method for the effective extraction of nutraceuticals from various plants.

Effect of Various Levels of Curdlan on Rheological Properties of Pork Myofibrillar Protein Gel

Chang Hoon Lee*, Koo Bok Chin
Department of Animal Science and Functional Food Research Center, Chonnam National University, Korea

Curdlan can be used as gelling agent on the foods since it has potential gelling properties. Thus, the purpose of this study was performed to evaluate the rheological properties of pork myofibrillar protein (MP) containing various levels of curdlan to improve gelling properties of MP. Pork MP mixtures were mixed with 0.5, 1.0, and 1.5% of curdlan. Cooking yield, gel strength, viscosity and microstructure were measured to evaluate the MP gel characteristics. The addition of curdlan significantly affected the viscosity of the MP mixtures (p<0.05). Cooking yield of MP gels were shown the increased value with increased levels of curdlan. There were significant differences in the gel strength of the curdlan at the control, 0.5 and 1.0% of curdlan (p<0.05), but no obvious differences were observed between those with the 1.0 and 1.5% of curdlan levels (p>0.05). When the curdlan was added, the microstructures of MP gels became compact and denser structure as compared to control. Based on these results, the addition of curdlan could be used as gelling agent in meat products.
Characterization of Reconstituted Rice Prepared by Extrusion of Rice Flour with Different Hydrocolloids and Heat-moisture Treatment

Chang-Hee Kim*, Eun-Ji Choi1, Jun-Seok Kum1, Jong-Dae Park2, Seung-Taik Lim
School of Life Sciences and Biotechnology, Korea University, Korea, 1Korea Food Research Institute, Korea

Effects of hydrocolloid addition (xanthan gum, gellan gum, and resistant starch) and heat-moisture treatment (70°C, 5 h, and 70% moisture) on the physical properties of reconstituted rice prepared by extrusion. Swelling power and solubility of the reconstituted rice were increased by increasing the extrusion temperature. The solubility of the heat-moisture treated rice samples was higher than that of the untreated rice, while the swelling power decreased. Also, the solubility and swelling power deceased by adding resistant starch. In vitro digestibility are slowly digestible starch content were in the following order: CON<XGR<GGR<XSR<RSR, whereas, the resistant starch content was in the following order: RSR<XSR<CON<GR<XGR<GGR. Scanning electron micrographs of the reconstituted rice exhibited irregular porous structure. The result from texture analysis showed that the hardness and adhesiveness of the rice sample containing xanthan gum (0.5%) with heat-moisture treatment was most similar to those of nature rice.

Nutritional and Functional Characterization of Jerky Using Sea Rainbow Trout

Yong Jung Kim*, Sang In Kang, Jun Kyu Lee, Su-Gwang Lee, Sung Hwan Park2, Byeong Dae Choi, Min Soo Heu1, Jin-Soo Kim
Department of Food Science and Technology/Institute of Marine Industry, Gyeongsang National University, Korea, 1Department of Food Science and Nutrition, Gyeongsang National University, Korea

This study was conducted to investigate food component characterization of jerky using sea rainbow trout (J-SRT) prepared under multiple response optimal conditions (seasoning time, drying temperature and drying time) on the moisture content, amino nitrogen content, and sensory overall acceptance of jerky from sea rainbow trout (J-SRT) using response surface methodology (RSM). The optimal seasoning time, drying temperature and drying time regarding the dependent variables (moisture content, amino nitrogen content, and sensory overall acceptance) were 3.4 h for seasoned time, 63.4°C for drying temperature and 8.3 h for drying time. The moisture content, amino nitrogen content, and sensory overall acceptance of J-SRT prepared under multiple response optimal conditions were 20.5±0.7 g/100 g, 1.14±0.2 g/100 g and 6.8±0.6 score, which were similar to the predicted values, such as 20.7 g/100 g, 1.15 g/100 g and 6.8 score, respectively. Both actual values and predicted values almost coincided each other. Therefore, the estimated response surface model was adapted for optimization of RJ-SRTF processing.

Quality Characteristics of Elderly-friendly Kkakdugi

Seung-Joo Lee*, Sun-Ock Park
Department of Culinary and Food Service Management, Sejong University, Korea

In this study, the physico-chemical properties and consumer preferences of cooked kkakdugi, elderly variations of uncooked kkakdugi, were examined. Significant differences in the pH of samples were observed with an overall decreasing trend in pH, hardness, lactic acid, and salinities over time during fermentation. Titratable acidity was increased with the storage time. Lactic acid levels increased until optimum maturity of kkakdugi, after the lactic acid contents were reduced dramatically during storage. According to preference tests of the elderly people over 65 years-of-age, in terms of appearance, aroma, taste, texture and overall acceptance, kkakdugi with Blanching time of 3 min was most preferred significantly compared to longer blanced samples.
Application of Hydroxypropylmethylcellulose (HPMC) as a Substitute for Inorganic Polyphosphate in Meat Processing

Eun Ji Lim*, Sang Youb Lee
Samsung Fine Chemicals Co., Ltd., Korea

The aim of this study was to provide a processed meat product without inorganic polyphosphate one of the essential additives in conventional meat processing but harmful to humans, maintaining the same qualities such as water holding and texture. A combination of hydroxypropylmethylcellulose (HPMC) and sodium carbonate (pH control agent) was applied to pork as a substitute for inorganic polyphosphate. Characteristics of sausage like pH, water holding capacity and sensory were evaluated. The pH of sausage increased with proportional concentration of sodium carbonate, but no effect from hydroxypropylmethylcellulose (HPMC). The higher the pH, the higher the water holding capacity. At the same pH, the higher hydroxypropylmethylcellulose (HPMC) content, the higher the water holding capacity. In terms of sensory evaluation, texture of 2% combination of hydroxypropylmethylcellulose (HPMC) and sodium carbonate was equal or slightly higher than those of sausage with 2% polyphosphate and its necessary additive. All in all, a combination of hydroxypropylmethylcellulose (HPMC) and sodium carbonate would be a considerable solution to the concern related to harmfulness of inorganic polyphosphate.

Changes in Moisture and Crude Fat Contents of Soybeans by Processing Condition

Se-Jeong Oh*, Hye-Kyung Han, Mi-Ran Yang, Ju-Hye Lee, Young-Min Choi, Se-Na Kim, Haeng-Ran Kim
Functional Food and Nutrition Division, Department of Agrofood Resources, National Academy of Agricultural Science, Rural Development Administration, Korea

Soybeans are important food for ingredient of fermented soybeans such as cheonggukjang and doenjang, tofu, and others, which are used in various processing methods. This study was conducted to investigate the changes in moisture and crude fat contents of white bean, green kernel black bean (seoritae), and black bean by varied processing methods such as raw, roasting, and boiling, as those beans are one of the most often used ingredients in Korea. Specifically, to be used as a sample, they were roasted for 25 min, or steeped in water for 4 h before being boiled for 40 min. As a result, although there was difference in contents by bean kind, all the 3 types of beans showed boiled ones having highest moisture content, followed by raw and roasted ones, and roasted ones having highest crude fat content, followed by raw, and boiled ones. These results will be used as basic data to publish ‘Standard food composition table’ by monitoring change in moisture and fat contents of Korean beans, constructing data base of them, and providing the accurate nutrient information.

Physical and Sensory Characteristics of Gangjung Made of Enzyme Treated Waxy Rice

Ju-Hye Lee*, Kyung-Mi Kim, Se-Na Kim, Haeng-Ran Kim, Kwang-Ok Kim
Functional Food and Nutrition Division, Department of Agrofood Resources, National Academy of Agricultural Science, Rural Development Administration, Korea

1Department Food Science and Technology, Ewha Womans University, Korea

This study was conducted to investigate desirable enzyme treatment conditions in manufacturing gangjung by evaluating the physical and sensory characteristics. Consequently, gangjung made from enzyme-treated waxy rice flour showed texture with a similar degree of hardness and a similar number of peak compared to gangjung made from waxy rice steeped in optimum steeping conditions. In the results of the sensory evaluation of gangjung made from enzyme-treated waxy rice flour, gangjung made from waxy rice flour treated with α-amylase 25 units for 120 min and protease 20 units for 5 min to the 100 g waxy rice flour, respectively, showed a similarity in ‘a degree of expansion’, compared to gangjung made from waxy rice flour steeped in optimum steeping conditions, which contributes to manufacturing a desirable gangjung without ‘sourness’ and ‘butyric acid flavour’. Particularly, the sample treated with α-amylase 25 units for 120 min was high-quality and soft gangjung that can be melted in the mouth, compared to the sample treated with protease 20 units for 5 min.

Changes in Moisture and Crude Fat Content of Vegetables by Blanching

Hye-Kyung Han*, Se-Jeong Oh, Mi-Ran Yang, Ju-Hye Lee, Young-Min Choi, Se-Na Kim, Haeng-Ran Kim
Functional Food and Nutrition Division, Department of Agro-Food Resource, National Academy of Agricultural Science, Rural Development Administration, Korea

Vegetables with various flavors, tissues and colors contain vitamins and minerals and can be classified into leaf vegetables (cabbage), stalk vegetables (leaf beet) and root vegetables (carrot). Blanching is a cooking technique that stops enzyme actions that can cause loss of flavor, color and texture. This study was conducted to identify the changes in moisture and fat content of cabbage, leaf beet and carrot by blanching. Regarding blanching conditions, cabbage and carrot & leaf beet were treated for 30 s and 1 min, respectively. The results showed moisture content of raw cabbage was higher than that of blanched ones and raw cabbage showed lower fat content than blanched ones. Moisture content in the leaf beet did not show significant differences between raw and blanched ones and raw leaf beet showed higher fat content than blanched ones. Carrot did not show significant changes between raw and blanched ones both in moisture and fat contents. These findings will be used to provide and share accurate food nutrition information with the consumers.
Substitution of Normal and Waxy-type Whole Wheat Flour on Bread-making Quality

Induck Choi*, Chon-Sik Kang, Kooan-Sik Woo, Hye-Young Park, Soon-Duck Yoon, Young-Keun Cheong, Sea-Kwan Oh, Wook-Han Kim

National Institute of Crop Science, RDA, Korea

Whole wheat flour (WWF) contains more vitamins, minerals, antioxidants and other nutrients than regular wheat flour. This study was conducted to investigate the effects of substituting normal wheat ‘Kounkung (KK)’ and waxy ‘Shimnichal (SC)’ on bread-making properties. Whole wheat flour was substituted at 20 and 40% for white flour, which was then formulated for bread dough (100 g). Quality was evaluated on physical properties of dough and its baked products. As increasing WWF levels, particle size showed an increasing coarseness, whereas pasting viscosity decreased, showing the lowest in SC40 composite flour. Mixograph showed higher water absorption in 40% WWF than 20% regardless of normal or waxy. Dough mixing time was higher in KK than SC blends, showing wheat type affected dough properties. There was no significant difference in bread loaf volume between normal and waxy wheat, but bread crumb firmness was significantly lower in waxy wheat. Substituting up to 40% WWF could be considered a practical option with respect to functional qualities. Replacing waxy WWF has a positive effect on bread-making formulation in terms of improving softness and glutinous texture.

Quality Characteristics and Storage Stability of Calorie-reduced Chiffon Cakes

Yu-Na Song*, Jung-Ah Han

Department of Foodservice Management and Nutrition, Sangmyung University, Korea

For calorie reduced cake preparation, sugar-alcohols such as sorbitol (S), maltitol (M), polyglycol (PG) and fructo-oligo-saccharides (FO) were replaced 70% with sugar (C), and the physicochemical and sensory properties as well as storage stability of chiffon cakes were measured. The viscosity of dough and moistness of cake was the lowest in control, and the values were highest in the cake with M and PG. Volume of cakes was the highest for that with M, and then that with FO>S>C>PG, in order. For the textural properties, chiffon cake with C and S were harder than those with other sugar-alcohols or FO, however, after storage of chiffon cakes in refrigerator or room temperature, it showed a reverse tendency. At 5-day storage at room temperature, mold was shown in all of the cakes, except that with S. In the microbial experiment, the cake with S also showed the best storage ability during 5-day storage at the room temperature. In the result of sensory test, the quality of cake with M or S was most acceptable.

Effect of Granulation on Physical Properties of Xanthan Gum Powder

Jong Yeon Kim*, Sung Gun Kim, Yu Ri Jang, Byoungseung Yoo

Department of Food Science and Biotechnology, Dongguk University, Korea

Fluidized bed granulation for particle enlargement has received considerable attention within the food process industries. The granulated products often have improved flowability and enhanced physical properties. Their physical properties are affected by the type of binder and binder concentration. In this study, the physical properties of granulated xanthan gum (XG) prepared using a top-sprayed fluidized bed granulator were investigated at different dextrin concentrations (0, 5, 10, and 15% w/w). All granulated samples were considered as powders with low or intermediate cohesive by their Hausner ratio (HR). This is in accordance with their higher Carr index (CI), indicating a very good flowability. The K and ηa,100 of granulated XG were higher than those of the nongranulated XG, and the highest values in K and ηa,100 of granulated XG were observed at 5% dextrin concentration. There were no noticeable changes in flow properties between 10 and 15% concentration of dextrin. Dynamic rheological values at higher concentrations were higher than those at 0% concentration. Fluidized bed granulation greatly influenced on rheological properties of XG in the lower concentrations of dextrin.

Rheological and Pasting Properties of Rice Starch as Modified by Tara Gum

Hwa Young Lee*, Seung No Yoon, Byoungseung Yoo

Department of Food Science and Biotechnology, Dongguk University, Korea

Studies on starch-gum mixtures in food industry are necessary because the physical properties of starch-based foods can be improved by adding commercial gums. To understand the effects of adding tara gum (TG) on rice starch (RS), the steady and dynamic rheological properties of RS-TG mixture (5% w/w) were measured at different TG concentration (0, 0.2, 0.4, 0.6% w/w). Flow properties were determined by rheological parameters for the power law and Casson models. All samples showed pseudoplastic and thixotropic behaviors with high yield stress. Native starch displayed a highly thixotropic behavior as compared to RS-TG mixtures. Consistency index (K), apparent viscosity (ηa,100) and yield stress (σy) values increased with an increase in TG concentration. Storage moduli (G’) were more predominant than loss moduli (G”) with all concentrations of TG. The addition of TG resulted in a significant increase in the peak, breakdown, final, and setback viscosities, and their viscosities also increased with an increase in TG concentration.
Heat-moisture Treatment of Rice Flour for the Texture-modification of Tofu

Shu An*, Kwang Yeon Lee, Hyeon Gyu Lee
Department of Food and Nutrition, Hanyang University, Korea

Utilization of rice flour in tofu and effect of heat-moisture treatment (HMT) of rice flour (RF) were investigated along with textural attributes of tofu. The effects of treatment condition (moisture content of 10-30%, heating temperature at 100-140°C for 1.5 h) on tofu added with RF were observed using a response surface methodology (RSM). Based on the response surface and superimposed plots, the optimized conditions of HMT-RF was obtained (moisture content: 22%; heating temperature: 130°C), which became more stable during continuous heating and agitation than native one. The optimum conditions were applied with RF and tofu was prepared with treated RF, as addition for soymilk (10, 20, and 30 g/100 g) in comparison with that of native-RF. Yield and moisture content of tofu prepared with native and HMT-RF were higher than that control of tofu without RF. All textural parameters of tofu prepared with native-RF apparently reduced compared to those with HMT-RF. In the sensory evaluation, the tofu with 10% HMT-RF had higher than tofu with native-RF. From the above results, the addition of HMT-RF could maintain the quality of tofu and be useful for and developing an acceptable rice tofu.

Changes in Quality Characteristics of Tofu with Freezing Treatment of Soybeans

Zi Gu*, Kwang Yeon Lee, Hyeon Gyu Lee
Department of Food and Nutrition, Hanyang University, Korea

The objective of this study was to investigate how the length of time of soybean freezing treatment affects the quality characteristics of tofu. Soybeans were not frozen or were frozen at -18°C for 5 h or 24 h. The yield and moisture content of tofu made from soybeans that were frozen were lower than tofu made from unfrozen soybeans. Tofu made from frozen soybeans showed a higher protein content and lower fat content than the control. The -18°C, 5-h freezing treatment produced tofu with a similar water content as the control. However, freezing for 24 h significantly increased the syneresis of the tofu. All tofu samples were similar in color. Tofu made from frozen soybeans showed higher hardness, gumminess and chewiness than the control. Freezing treatment also made the microstructure of tofu more uniform than the control. However, after 24-h freezing, hardness decreased and the microstructure of tofu appeared to form pores, indicating a decrease in quality. Sensory evaluation showed that mouth-feel decreased with increasing of freezing time. Among all of tofu samples, tofu made from soybean with -18°C, 5-h freezing treatment showed the highest score of overall acceptability.

Utilization of Mulberry Pomace as Source of Antioxidant for Noodles Making

Sun Ah Park*, Kwang Yeon Lee, Hyeon Gyu Lee
Department of Food and Nutrition, Hanyang University, Korea

Mulberry pomace, as a by-product of juice and wine making, are receiving increased interest because of their pharmacological properties such as anti-obesity effect and blood pressure reduction. They are a rich source of dietary fiber and natural pigment, anthocyanins. The effects of addition level of mulberry pomace on the noodle quality and antioxidant properties were investigated. Results suggested that increasing mulberry pomace concentration proportionally increased cooking weight loss. However, water absorption decreased as mulberry pomace increased. Low level of mulberry pomace conferred violet color to cooked noodles, whereas higher level showed more deep purple with decreased brightness. With the increase in mulberry pomace content, hardness, adhesiveness, springiness and cohesiveness of the cooked noodles significantly decreased (p<0.05). The antioxidant mulberry pomace was detected in noodle made from both raw and cooked, generally increasing with % mulberry pomace added. These results suggested that the incorporation of mulberry pomace into the formulation can be used to develop the noodles with good colorants and antioxidant capacity.

Effect of Heat-moisture Treatment and Annealing on the Physicochemical Characteristics of Cereal Flours

Jing Zeng*, Kwang Yeon Lee, Hyeon Gyu Lee
Department of Food and Nutrition, Hanyang University, Korea

Various cereal flours (millet, wheat, barley, maize, and tartary buckwheat) were hydrothermally modified by annealing (ANN) and heat-moisture treatment (HMT) and physicochemical properties were determined in comparison with their native counterparts. HMT was treated at 120°C for 2 h at moisture content of 30% in drying oven (HMTD) or autoclave (HMTA), while ANN was done for 18 h at 300% moisture at temperature 50°C in shaking water-bath. The color value of cereal flours was significantly affected by hydrothermal treatments. Decrease in lightness, and increase in redness or yellowness might be due to nonenzymatic browning effect of cereal flour during hydrothermal treatment. All cereal flours showed significant decrease in swelling power after HMT treatment as compared to the native flours. However, there was no significant difference between ANN flours and native one. The solubility significantly decreased for HMTD and HMTA treatment of all cereal flours, whereas it slightly increased for annealed barely, maize and tartary buckwheat flours. The particle size distributions of HMT treated flours were increased compared to native flours while ANN treat flours were the opposite.
Effect of Xylanase Treatment on the Physicochemical and Nutritional Qualities of Cakes with Dietary Fibers Extracted from Whole Grain Barely

Ji Eun Yoon*, Kwang Yeon Lee, Hyeon Gyu Lee
Department of Food and Nutrition, Hanyang University, Korea

Whole grain barley is known to contain more vitamins, minerals and dietary fiber than regular, refined grain one. Dietary fiber (DF) extracted from whole grain barley was subjected to xylanase treatment. Xylanase-modified barley DF (XBDF) was incorporated into wheat flour at 1 and 3% levels and cake quality and in vitro starch digestion as well as antioxidant capacity were investigated comparisons with native barley DF (NBDF). Both of XBDF and NBDF significantly increased hardness and decreased springiness and cohesiveness of cakes; XBDF showed the strength effect compared to NBDF. However, XBDF and NBDF promoted a similar decrease in crumb color and moisture content of control cakes. The increased level of XBDF and NBDF resulted in cakes with higher antioxidant properties. When compared at the same level, XBDF cake exhibited higher level of total phenol content, DPPH and ABTS radical scavenging activity than NBDF cake. The level of XBDF showed significant suppressive effect on in vitro starch digestibility compared with the control and NBDF cakes. This study demonstrated that xylanase treated-barely DF could be used as functional ingredients for fiber-rich food products.

Effect of Roasting Process on Various Cereals (Rice, Barley, Buckwheat, Mung Beans, Waxy Millet, and Mixed Flour) by Extrusion

Mi-Seon Kim*, Dong-Ho Seo, Hyun-Wook Choi, Jung-Min Sung, Yun-Sang Choi, Jong-Dae Park, Jun-Seok Kum
Korea Food Research Institute, Korea

This study was conducted to investigate the effect of roasting process for extruded cereal (rice, barley, buckwheat, mung beans, waxy millet and mixed flour). The roasting condition was 200°C in temperature and 3 min in roasting time. The extruded cereals were analyzed Moisture contents, Water solubility index (WSI), Water absorption index (WAI) and microstructure by scanning electron microscopy (SEM). Moisture contents of extruded cereals with roasting process as 0.67-4.17% were lower than those of extruded cereals without roasting process as 11.54-19.68% because the water evaporated though three stages of process (extruding-drying-roasting). After roasting treatment, Water solubility index of extruded cereals showed an increased tendency except rice and barley. Water absorption index was not significantly different in all samples with or without roasting process. According to the SEM result, the outer and inner of extruded cereals were observed shear and porous structure by extrusion and roasting process.

Preparation and Characterization of Mucoadhesive Buccal Nanoparticles

Ji-Woon Suh*, Ji-Soo Lee, Hyeon Gyu Lee
Department of Food and Nutrition, Hanyang University, Korea

The aim of this study was to prepare and characterize the mucoadhesive buccal nanoparticles (NPs) using natural polysaccharides. Chitosan (CS) and dextran sulfate sodium salt (DS) reported to have mucoadhesive properties were used to prepare mucoadhesive NPs and their physicochemical properties were investigated. The sizes of CS/DS NPs were in the range of 100-200 nm. The mucoadhesive properties of CS, DS, and CS/DS NPs were evaluated by measurement of mucin and buccal cell adsorbed on polymers and NPs. As the molecular weight of DS was increased, the amount of both mucin and buccal cell adsorbed on DS significantly increased. There was no significant difference in the adhesive interactions of CS/DS NPs and CS/sodium tripolyphosphate pentabasic (TPP) NPs (control group) with mucin; however, the mucoadhesion of CS/DS NPs to buccal cell was 5 times higher than those of CS/TPP NPs. The results suggested that the buccal mucoadhesive properties of nanoparticles could be improved using natural mucoadhesive polymers.

Effect of Surichwi Proportion and Transglutaminase Treatment on Rice Flour for Quality Characteristics of Frozen Surichwi Rice Cake

Dong-Ho Seo*, Mi-Seon Kim, Bo-Young Kim, Hyun-Wook Choi, Jung-Min Sung, Yun-Sang Choi, Jong-Dae Park, Jun-Seok Kum
Korea Food Research Institute, Korea

The purpose of this study was to investigate the quality characteristics of frozen Surichwi rice cake by adding Surichwi contents and transglutaminase (TGase) treated rice flour. The Hunter color b value of frozen Surichwi rice cake was increased in proportion to the added Surichwi. Texture profile analysis (TPA) revealed that gumminess and chewiness were increased with corresponding increase in the amount of added Surichwi. According to sensory evaluation of frozen Surichwi rice cake, the acceptance was the best in the color and overall preference when adding 15% Surichwi. Based on our study, we have found that the Hunter color (L and b) and TPA parameters (hardness, gumminess, and chewiness) values of frozen Surichwi rice cake with TGase treated rice flour were significantly decreased in comparison with those of frozen Surichwi rice cake with normal rice flour. The sensory acceptability scores of the TGase-treated frozen Surichwi rice cake were found to be significantly higher than those of the normal frozen Surichwi rice cake. In conclusion, we suggest that TGase treated rice flour is an effective ingredient for improving the overall quality of frozen rice cake.
Physicochemical Properties of Buckwheat by Pretreatment methods

Eun-Ji Choi*, Chang-Hee Kim, Dong-Ho Seo, Hyun-Wook Choi, Yun-Sang Choi, Jung-Min Sung, Jun-Seok Kum, Jong-Dae Park
Korea Food Research Institute, Korea

To provide data for processed foods with buckwheat (*Fagopyrum esculentum*), we processed buckwheat with different conditions such as annealing (ANN), heat-moisture treatment (HMT) and different milling method. Also the buckwheat porridge was manufactured with those types of buckwheat and their physicochemical and sensory characteristics were investigated. In RVA pasting viscosity, as processing time increased, pasting temperature decreased. Peak viscosity was lower in HMT than that of ANN. Breakdown which is indicated gel stability was higher in 40°C ANN than that of 60°C. Setback was high in the longer treatment time regardless of the heat treatment methods. The moisture contents of dry and wet milling buckwheat powder (WBP) were 12.32-12.96%. In the mean size and water binding capacity, WBP was higher than dry milling buckwheat powder (DBP). In the results of sensory evaluation showed that buckwheat porridge with WBP had high viscosity and overall acceptability than buckwheat porridge with DBP. Accordingly, it was suggested that the application suitable buckwheat processing when using buckwheat for buckwheat processed products.

Effect of Whole-grain Flour on the Physicochemical and Nutritional Properties of Instant Fried Noodles

Hyeon Ji Kim*, Yong Jin Cho, In Young Bae¹, Suyong Lee
Department of Food Science & Technology and Carbohydrate Bioproduct Research Center, Sejong University, Korea,
¹Department of Food Fermentation, Far East University, Korea

The practical applications of whole-grain flour to processed food products have been still limited mainly due to its undesirable processing performance. In this study, the positive effects of whole-grain flour on the oil uptake and *in-vitro* starch digestibility of instant fried noodles were investigated. Whole-grain wheat flour rich in dietary fibers, exhibited decreased development time and stability of the dough and also showed lower Mixolab torque values of starch gelatinization and retrogradation. In addition, lower thermal conductivity was observed in the whole-grain dough. When the whole-grain noodles were subjected to frying, the reduced oil uptake was observed that could be attributed to the less porous noodle structure. The content of released glucose after *in vitro* digestion had a tendency to decrease with whole-grain flour. Also, the instant fried noodles with whole-grain flour had a low value of predicted glycemic index. Thus, the use of whole-grain flour imparted various functional benefits to instant fried noodles. It will be worthwhile to extend the use of whole-grain flour to a wider variety of food products.

Extraction of Rutin from Buckwheat Milling Fractions and Its Application to Instant Fried Noodles for Rutin Fortification

Yong Jin Cho*, Suyong Lee
Department of Food Science & Technology and Carbohydrate Bioproduct Research Center, Sejong University, Korea

It is well-recognized that tartary buckwheat is a major source of rutin whose content is dependent on its milling fractions. In this study, the experimental procedures to extract a rutin-enriched material (REM) from buckwheat milling fractions, were established and the REM was then utilized to fortify wheat-based instant fried noodles with rutin. An ultrasonically-assisted ethanol extraction process produced REM containing 31.8 g/100 g of rutin. REM did not affect dough stability and development time during mixing at room temperature while it decreased the thermo-mechanical properties of the dough. The use of REM did not influence the oil absorption of the instant fried noodles during frying. The oxidative deterioration of the instant fried noodles during storage was reduced by the use of REM. In this study, instant fried noodles were fortified with rutin (250-500 mg/100 g) which corresponded to the recommended daily dose of rutin and their quality attributes were characterized. Therefore, rutin-derived health benefits can be obtained from the intake of REM-incorporated wheat products.

Anti-inflammatory Effect of Sargachromanol I Isolated from *Myagropsis myagroides*

Min-Ji Kim*, Na-Kyung Ahn¹, Yeon-Uk Choi¹, Won-Min Pak¹, Si-Woo Bark¹, Ji-Hye Park¹, Nan-Young Bae², Sun-Hee Park², Koh-Bong-Woo-Ri Kim, Dong-Hyun Ahn¹
Institute of Food Fisheries Sciences, Pukyong National University, Korea, ¹Department of Food Science and Technology, Pukyong National University, Korea

Currently, marine organisms are great sources of structurally diverse bioactive compounds with many biological activities. The anti-inflammatory materials from natural resources, which have already been proved safe, have been developed and applied to food and medicines. A pharmacological reduction in the levels of LPS-inducible inflammatory mediators is one of the necessary conditions to alleviate diverse inflammatory disorders caused by activation of macrophages. This study was carried out to isolate the bioactive compounds from *Myagropsis myagroides* methanol extract (MMME) and investigate a chemical structure and verify its anti-inflammatory effect. MMME was fractionated using *n*-hexane, chloroform, ethyl-acetate, butanol, and aqueous soluble part. Compounds were isolated for the most active part (*n*-hexane) by silica-gel column chromatography. Purification of fractions was performed using HPLC analysis and Sargachromanol I was isolated. This compound showed the inhibitory effect of IL-6 and TNF-α. In conclusion, this study demonstrates that Sargachromanol I has a potent anti-inflammatory effect and can be applied to a therapeutic agent.
Antioxidant Activity of Sargassum coreanum Root and Stem Extracts

Yeon-Uk Choi*, Won-Min Pak, Si-Woo Bark, Na-Kyung Ahn, Ji-Hye Park, Nan-Young Bae, Sun-Hee Park, Koth-Bong-Woo-Ri Kim, Min-Ji Kim1, Dong-Hyun Ahn
Department of Food Science and Technology, Pukyong National University, Korea, 1Institute of Fisheries Sciences, Pukyong National University, Korea

The purpose of the present study was to investigate the antioxidant activity in ethanol and water extracts of root and stem of *Sargassum coreanum*. Antioxidant activities were evaluated by several reliable methods such as total phenolic compounds, DPPH radical scavenging activity, chelating effect, reducing power, and rancimat method. Total phenolic compounds of ethanol and water extracts were 32.79 mg/g and 15.55 mg/g, respectively. DPPH radical scavenging activity of ethanol extract was 96% at a concentration of 1 mg/mL, and was higher than that of water extract. Ethanol and water extracts have little chelating effect at all concentrations. Ethanol and water extracts increased reducing power in a concentration-dependent manner. In particular, ethanol extract was more effective than water extract. Antioxidant index measured by Rancimat was lower than those in BHT, but ethanol extract was higher than water extract. These results suggest that ethanol extract of *S. coreanum* root and stem has more potent antioxidant activity than water extract and can be used as a natural antioxidant.

Antioxidant Activity of Ethanol and Water Extracts of *Zostera marina*

Na-Kyung Ahn*, Ji-Hye Park, Won-Min Pak, Si-Woo Bark, Nan-Young Bae, Sun-Hee Park, Min-Ji Kim1, Dong-Hyun Ahn
Department of Food Science and Technology, Pukyong National University, Korea, 1Institute of Fisheries Sciences, Pukyong National University, Korea

This study investigated the antioxidant activities of ethanol and water extracts from *Zostera marina*, a green seaweed, collected at Busan. The antioxidant effects of *Z. marina* extracts were determined by measuring total phenolic content (TPC), DPPH radical scavenging activity, chelating effect, reducing power, and rancimat assay. The TPC of ethanol and water extracts of *Z. marina* was 2.12±0.02 and 3.88±0.05 mg/g of dry sample, respectively. The DPPH radical scavenging activity of ethanol extract (92% at 0.5 mg/mL) was higher than that of water extract (71% at 0.5 mg/mL). The antioxidant index of extracts increased in a dose-dependent manner. The antioxidant index by rancimat assay was higher in ethanol extract than water extract at 5 mg/mL. Extracts showed weak reducing power activity. Meanwhile, the chelating effect was higher in water extract (66% at 1 mg/mL) than ethanol extract (6% at 1 mg/mL). These results suggest that ethanol and water extracts from *Z. marina* have significant antioxidant activity.

Antioxidant Activity of Ethanol and Water Extracts of *Sargassum hemiphyllum*

Sun-Hee Park*, Won-Min Pak, Si-Woo Bark, Na-Kyung Ahn, Yeon-Uk Choi, Ji-Hye Park, Nan-Young Bae, Koth-Bong-Woo-Ri Kim1, Min-Ji Kim1, Dong-Hyun Ahn
Department of Food Science and Technology, Pukyong National University, Korea, 1Institute of Fisheries Sciences, Pukyong National University, Korea

Antioxidant activities of ethanol and water extracts from *Sargassum hemiphyllum* were determined by total phenolic compounds, DPPH radical scavenging activity, reducing power, chelating effect, and rancimat method. Total phenolic compounds of ethanol and water extracts were 30.64 mg/g and 17.12 mg/g, respectively. Ethanol and water extracts from *S. hemiphyllum* increased reducing power in a concentration-dependent manner. The ethanol extract from *S. hemiphyllum* at a concentration of 1 mg/mL exhibited strong DPPH radical scavenging effects with reducing power while water extracts from *S. hemiphyllum* also showed strong DPPH radical scavenging with chelating effects. Antioxidant index of ethanol extract from *S. hemiphyllum* measured by rancimat was higher than water extract, but ethanol and water extracts from *S. hemiphyllum* were lower than those in BHT. These results suggest that ethanol extract of *S. hemiphyllum* exhibited higher antioxidant activities than water extract, and can be potentially used as proper natural antioxidants in the food industry.
Effects of PEF Treatments on the Cell Membrane Permeabilization and Softening of White Radish and Carrot

Sae Mee Cha*, Eun Ju Song, Dong Jun Park1, Dong Un Lee
Department of Food Science and Technology, Chung-Ang University, Korea, 1Korea Food Research Institute, Korea

The effects of pulsed electric field (PEF) treatments on the vegetable cell membrane permeabilization and softening were investigated. The PEF treatment was conducted with electric field strength of 1.0-2.5 kV/cm using a fixed pulse width of 30 μs. The degree of cell membrane permeabilization was increased as the increase of field strength and pulse number. The cell membrane permeabilization was estimated by using biological conductivity spectrometer. Using vegetable's electrical conductivity [Ω/m] at a low kHz range, membrane permeabilization figures were estimated by calculating the conductivity disintegration index Z. As texture analysis, the effect of PEF treatments was measured by hardness [N/m²] and cutting force [N]. The electric field strength of 2 kV/cm resulted in greater than 40% reduction in cutting force [N] in carrot. The results showed that when field strength and pulse number of PEF treatment increase, the cutting force [N] and hardness [N/m²] decrease because of cell rupture increasing.

Physicochemical Properties of Korean Wheat Cultivar Grown by Region

Nayoung Lee*, Choon-Sik Kang1, Choon-Ki Lee1, Young-Keun Cheong2, Hag-Sin Kim2, Jae-Geun Koo
Department of Food Science and Biotechnology, Kunsan National University, Korea, 1National Institute of Crop Science, Rural Development Administration, Korea

Korean wheat cultivars, Keumkang, was collected in Gwangju and Jeonju region and investigated on the physiological properties of wheat cultivar. Water, ash, crude lipid, and amylose content of the samples were measured. Damaged starch, water holding capacities, color value, and thermal properties of Keumkang cultivar were investigated. Water contents of Keumkang collected in Jeonju and Gwangju were 12.38-13.11, and 11.42-12.57%, respectively. Ash content was 0.38-0.75% range. Crude protein contents of Keumkang collected in Jeonju and Gwangju were 9.46-13.13 and 9.15-13.30%, respectively. Amylose contents of Keumkang collected was 27.07-29.27% range. Damaged starch of Keumkang collected in Jeonju was 5.99, 5.66, 5.07, and 4.11%, respectively. Water holding capacity of Keumkang collected in Gwangju was 90.82 and 92.71%, respectively. Color L* value of Keumkang collected was 93.27-94.85 range. Onset (T0) of Keumkang collected in Gwangju was 56.61 and 56.19°C, respectively. Enthalpy of gelatinization of Keumkang collected in Jeonju was 2.535, 1.958, 2.139, and 2.742 J/g, respectively.

Comparison of Functional Constituents from Mulberry (Morus alba L.) at its Various Maturation Stages in Greenhouse and Open Field Conditions

Hayun Kim*
National Academy of Agricultural Science, Korea

This study was conducted to investigate the change of functional constituents from Mulberry (Morus alba L.) at its various maturation stages in greenhouse and open field conditions. The ripened stages were classified as five stages by the color of fruit. Total capacity of anthocyanins was grown as the ripening stage. Ripened stage had higher contents of two anthocyanins, cyanidin and malvidin. The mulberry in open field had higher contents of cyanidin and malvidin than that in greenhouse. In the case of flavonoids, the total content of quercetin was decreased as the mulberry is going ripened and the content kaempferol had no difference in all stages. Quercetin of the material in open field had higher contents than that in greenhouse, and kaempferol of the material in greenhouse had higher contents than that in open field. In the case of phenolic acid, the contents was increased as the stage. Caffeic acid of material in greenhouse had higher contents than that in open field. These results provide useful information to cultivation for the development and standardization of high quality mulberry as well as their processed foods.

Quality Characteristics of Sweet Jelly Using Cereal Flour

Nayoung Lee*, Jung-Kil Seo, Seung-Yong Lim, Yong-Tae Kim, Kwon-Sam Park, Jae-Geun Koo
Department of Food Science and Biotechnology, Kunsan National University, Korea

Cereal flour, colored rice, was prepared and investigated the quality characteristics of sweet jelly using colored rice flour. Water and amylose content, damaged starch, and particle size of the samples was measured. Color value and texture profiles of sweet jelly using colored rice was investigated. Water contents of Deuraechan, Heukhyang and Heukssel was 8.44, 7.91, and 9.11%, respectively. Amylose contents of Deuraechan, Heukhyang, and Heukssel was 18.53, 19.07, and 17.85%, respectively. Damaged starch of Deuraechan, Heukhyang, and Heukssel was 13.21, 16.65, and 7.52%, respectively. Particle size of the Deuraechan was significantly higher than that of colored rice such as Heukhyang and Heukssel. Color L* value of sweet jelly using Heukhyang and Heukssel was 32.90 and 24.56, respectively. Sweet jelly using Heukssel was lower brightness. Hardness of sweet jelly was measured using texture analyzer. Hardness of Heukhyang and Heukssel was 214.24 and 200.86, respectively. Hardness of sweet jelly was increased according to soaking time of agar used made sweet jelly.
Control of Bread Quality of Ready-to-bake Bread Using Polyglycitol Syrup and Modified Starch

Kee Hyuk Sohn*, Hye-Eun Jo, Sanghoon Ko
Department of Food Science and Technology, Sejong University, Korea

The purpose of this study was to investigate the effect of polyglycitol syrup (PGS) and modified starch on bread quality of ready-to-bake product. Bread doughs were frozen at -45°C for 30 min and then stored at -18°C in a refrigerator over storage time for 60 days and subsequently they were thawed, fermented, and finally baked. The specific volumes of control group (M0P0), 1% modified starch added group (M1P0), 1% PGS added group (M0P1) and 1% modified starch and 1% PGS added group (M1P1) were 2.6, 2.9, 2.9, and 3.45 mL/g, respectively when the breads were baked with the unfrozen doughs. The specific volumes of M0P0, M1P0, M0P1, and M1P1 made of frozen doughs stored for 60 days were 2.0, 2.3, 2.1, and 2.1 mL/g respectively. The hardness values of M0P0, M1P0, M0P1, and M1P1 were made of the unfrozen doughs were 23.34, 14.74, 17.16, and 13.19 N, respectively, while those made of frozen doughs stored for 60 days were 42.68, 36.44, 37.32 and 30.46 N, respectively. As a result, the addition of modified starch and PGS increased volume and developed soft texture of the breads because they improved survival of yeast, its activity and dough strength.

Biotransformation of Phenolics (Phenolic Acid, Flavanol, and Isoflavone) during the Fermentation of Doenjang by Bacillus subtilis HJ18-9

Kyung-Ha Lee*, Yeon-Jeong Jang1, Jin Song1, Eun-Ju Kim1, Hye-Young Park, Induck Choi, Sea-Kwan Oh
National Institute of Crop Science, RDA, Korea, 1National Academy of Agricultural Science, RDA, Korea

This study was conducted to investigate the change of isoflavone aglycone, flavanols, and phenolic acid composition of doenjang that were prepared using whole soybean meju inoculated with different Bacillus strains (Control, KACC 15935, and HJ18-9) individually. Doenjang mixed with 34% whole soybean meju, 14% salt and 51% water was fermented at 30°C for 60 days. The contents of isoflavone aglycone (daidzein, genistein, and glycitein) in doenjang fermented with B. subtilis HJ18-9 were significantly increased up to 1.00×10⁴ μg/g at the end of fermentation, compared to that of the other strains. The levels of catechin, epicatechin, and epigallocatechin were increased while flavonol gallate was decreased in all samples. In addition, regardless of the strains, total phenolic content increased markedly during fermentation, while levels of 2,2-diphenyl-1-picrylhydrazyl (DPPH) radical-scavenging activity increased. These results suggested that doenjang could be used to increase the bioactivity via fermentation with B. subtilis HJ18-9. Hence, it would be beneficial for the food industry if components of doenjang could be separated and developed into functional products.

Effect of Enzyme Impregnation on the Texture Softening of Vegetables

Chan-Eun Park*, Yong-Gi Chun, Hyun-Hee Lee, Bum-Keun Kim, Dong-June Park
Korea Food Research Institute, Korea

This study was carried out to investigate the new softening technology of vegetables (bellflower root, carrot, lotus root, and burdock) for the elderly people who have masticatory and dysphagia problems. Fifteen enzymes were chosen to soften vegetables. Among fifteen commercial enzymes, the three enzymes (pectinex, viscozyme, and novozyme) exhibited a marked degree of softening on vegetables at 1.0% concentration of enzymes. To find the level of enzyme concentration on tissue degradation the enzyme impregnation at a 0.1, 0.5, 1.0, and 2.0% concentration of pectinex, viscozyme, and novozyme were evaluated. As the concentration of three enzymes (pectinex, viscozyme, and novozyme) increased, the hardness decreased significantly (p<0.05). Changes in the microstructure of vegetables were observed by scanning electron microscopy (SEM). The results indicate that enzyme impregnation could soften the texture of vegetables and will contribute to the development of care food for the elderly people.

Softening of Jumbo Squid (Dosidicus gigas) by Enzyme Injection

Sung-Hwan Eom1*, Yong-Gi Chun1, Ha-Young Jung2, Sang-Hoon Lee1,2, Dong-June Park1
1Korea Food Research Institute, Korea, 2University of Science and Technology, Korea

In this research, we investigated a new softening technology in the main body of the jumbo squid (Dosidicus gigas) for the elderly people who have masticatory and dysphagia problems. Seven enzymes were chosen to soften jumbo squid. Enzyme solution was injected into Jumbo squid and the hardness was measured by texture analyzer. Bromelain and collupulin were evaluated as the most adequate, in which jumbo squid were progressively softened by the bromelain and collupulin treatment: the hardness reached 5.6×10⁴ N/m² at 1.00% of bromelain concentration and 6.7×10⁴ N/m² at 1.00% of collupulin concentration while retaining their shape. The results of this research indicate that enzyme injection process could soften the texture of jumbo squid.

2015 KoSFoST International Symposium and Annual Meeting
**Texture Softening Effect of Beef and Chicken by Enzyme Injection**

Sung-Hwan Eom*, Yong-Gi Chun, Sang-Hoon Lee, Dong-June Park  
*Korea Food Research Institute, Korea*  

This research focuses on a new softening technology for use with chicken breast and eye of round beef in order to assist elderly individuals who have difficulty with eating due to changes in their ability to chew (masticatory function) or swallow. We investigated the hardness of chicken breast and eye of round beef through use of a texture analyzer after injection of a commercial enzyme. Among seven commercial enzymes, bromelain and collupulin exhibited a marked softening effect on chicken breast and eye of round beef 1.00% of enzyme concentration. The hardness of bromelain-treated chicken breast reached $1.4 \times 10^4$ N/m$^2$, of collupulin-treated chicken breast reached $3.0 \times 10^4$ N/m$^2$, and of bromelain-treated eye of round beef reached $3.2 \times 10^4$ N/m$^2$, respectively, while their original shapes did not change. To find the level of tissue degradation with specific enzymes, bromelain and papain were evaluated at concentrations of 0.1, 0.25, 0.50, and 1.00%, respectively. The results of this research indicates that enzyme injection could be one of the useful techniques to soften chicken breast and eye of round beef and will contribute to the development of foods for the elderly people.

**Preparation of α-Tocopherol Loaded Nanostructured-Lipid Carriers (NLC) and NLC Based Gel**

Ah-Ra Cho*, Eun-Ji Lee, Chan-Eun Park, Bum-Keun Kim, Dong-June Park  
*Korea Food Research Institute, Korea*  

The aim of this experiment is development of α-tocopherol loaded NLC and NLC based gel and confirm the rheological properties for elderly people. The α-tocopherol loaded NLC was prepared by the method of emulsion evaporation and low temperature solidification. Medium chain triglyceride (MCT) and glycerol monostearate (GMS) were used as liquid lipid and solid lipid, respectively. The mean particle size of α-tocopherol loaded NLC was 301.2 nm and zeta potential α-tocopherol loaded NLC and NLC based gel were classified as nectar-like/syrup like (50-350 cP). These results indicate that the development of α-tocopherol loaded NLC and NLC based gel could have effect on nourishing supplement beverage for the elderly people.

**Rheological Properties of Food Emulsion Containing α-Tocopherol for the Elderly People**

Eun-Ji Lee*, Ah-Ra Cho, Yong-Gi Chun, Bum-Keun Kim, Dong-June Park  
*Korea Food Research Institute, Korea*  

The aim of this study was to compare the viscosity of emulsion with commercial thickening agents and to identify the suitable viscosity of emulsion sol which is nutritional supplement for easy swallowing in the elderly people. Oil in water emulsion was prepared with high pressure homogenizer up to 1000 bar using MCT oil as organic phase and PGPR as an emulsifier to stabilize α-tocopherol which widely used as antioxidants in food. Commercial thickening agents (Thick and easy, Toromi up S, Yeonha care, Toromi power smile, Toromi perfect) were used to control the viscosity. There were some differences in the apparent viscosities with thickening base materials, such as starch, guar gum and xanthan gum-base. All samples except Thick and easy showed a shear-thinning plastic flow behavior with yield stress. The apparent viscosity of Toromi up S was 117.25 cP, while xanthan gum based thickening agents were 165.73, 151.47, and 223.07 cP, respectively. These results show that xanthan gum based thickening agent could be a good food addition to make the diets of elderly people.

**Effect of Hydraulic Puffing on Physicochemical Characteristics of Cereal Grains**

Hye-Ri Jeon*, Hye-young Park, Induck Choi, Sea-Kwan Oh, Jae-Kwon Lee  
*National Institute of Crop Science (NICS), RDA, Korea, 1Department of Food Science and Biotechnology, College of Natural Science, Kyonggi University, Korea*  

The Physicochemical properties associated with the hydraulic puffing process were evaluated for three different grains: pressed barley, sorghum, and whole wheat. The various cereal samples were puffed by hydraulic puffing machine at optimal temperature (approximately 270-285°C). Puffed sorghum snack had higher damaged starch and WAI than other samples. In addition, Rapid Visco Analyzer profiles showed that peak viscosity of sorghum snack was the highest due to the high content of damaged starch. Moisture contents of puffed cereal snacks had no significant differences among the samples. After puffing, barley showed a low bulk density, but the porous matrix is easily damaged by an external impact. The bulk density of puffed wheat snack was higher than other snacks. This may presumably due to the presence of the hull in wheat grain, which interrupted the puffing during processing. As a result, the puffed sorghum snack has uniform porous matrix and higher binding strength than the other grains in hydraulic puffing process condition.
Quality Characteristics of Salted Cabbage Prepared with Summer Kimchi Cabbage Cultivars

Sang-Un Park*, Eun-Ji Choi, Young-Bae Chung
World Institute of Kimchi, Korea

The most common three cultivars (Cheongok, Chungwang, and Kangsimjiang) of kimchi cabbages harvested in summer were salted with brine (10 and 13%), and quality characteristics (salinity, pH, acidity, moisture, reducing sugars, firmness, and microbial analysis) of salted kimchi cabbages were studied. The salinity of all three cultivars of salted kimchi cabbages were decreased by 1.43% to 2.93% after washing process. pH of salted kimchi cabbages was slightly increased from 5.86 to 6.16. On the other hands, acidity data showed the opposite trend of pH results. The reducing sugars of salted kimchi cabbages were reduced by 28.84 mg/g to 43.03 mg/g after washing process. The firmness (force kg) of salted kimchi cabbages were decreased by 0.59 kg to 0.71 kg after washing process. The microbial (total bacteria, lactic acid bacteria, coliform bacteria, yeast, and mold) of salted kimchi cabbages was reduced after washing. This study is expected to help determine optimum salting condition for summer kimchi cabbages.

Dynamic High Pressure Processing Development for Strawberry Juice Preservation

Jin Seong Won*, Song Hee Seo, Sea Cheol Min
Department of Food Science and Technology, Seoul Women's University, Korea

Effects of dynamic high pressure (DHP) processing on the microbial stability, 'Bx, vitamin C, and color of strawberry juice were studied and compared with those of conventional thermal processing. Freshly prepared strawberry juice was thermally processed at 110°C for 1 min or processed by DHP with 3 passes at 205 MPa and 20, 50, 60, or 70°C. Both thermal and DHP processes reduced the number of indigenous microorganisms by more than 6 log CFU/mL. The 'Bx, vitamin C, and redness were higher with the juice treated by DHP at 20°C than the thermally processed juice (p<0.05). The DHP processing integrated with heating at 70°C resulted in the inhibition of indigenous microorganisms a comparable to the degree obtained by the thermal process and demonstrated higher 'Bx and lightness values of the juice than thermal processing (p<0.05). DHP processing, both with and without integration with heating, was proved to be effective for pasteurizing of strawberry juice with minimal losses of sugar, vitamin C, and color. The results also demonstrate the potential use of DHP as a non-thermal method for pasteurizing strawberry juice.

Effect of Roasting Conditions and Extraction Methods on Quality Characteristic of Omija (Schizandra chinensis B.) Seeds Oil

Hyeon Jeong Lee1,*, Jeong Seok Cho1, Jun Hyung Sung1, Ji Young Choi2, Jung Hoon Park1, Hun Sik Chung3, Kwang Deog Moon1,2
1Department of Food Science and Technology, Kyungpook National University, Korea, 2Department of Food Science and Technology, Pusan National University, Korea, 3Food and Bio-industry Research Institute, Kyungpook National University, Korea

In this study, the influence of different roasting temperature-time conditions and extraction methods on the quality characteristic of omija seeds oil was investigated. Roasting omija seeds were divided into 5 groups by roasting temperature-time conditions: raw and roasting (150°C-10 min, 150°C-20 min, 250°C-10 min, 250°C-20 min). Omija seeds oils were obtained by solvent (using n-hexane) and press (using machine) extraction using each raw and roasting omija seeds. The L* value was decreased but a* value and b* value were increased as the increase of roasting temperature and time. L* values of press extraction showed lower than those of solvent extraction. Peroxide value (POV) of omija seeds oil was decreased according to the increase of roasting temperature and time. POV of omija seeds oils using press extraction were higher than those of omija seeds oils using solvent extraction. Generally ABTS radical inhibition of omija seeds oil using solvent was significantly higher than those of omija seeds oil using press. In this result, solvent extraction and the increase of roasting temperature-time were more effective to low POV and high ABTS radical inhibition.

Inhibition of Non-enzymatic Browning in Juice Concentrate from a New Cultivar of Asian Pear, Hwasan Treated with Different Ascorbic Acid Concentrations During Storage

Gui-Hun Jiang*, Seung-Hee Nam, Jong-Bang Eun
Department of Food Science and Technology and Food Research Institute, Jeonnam Agricultural Research & Extension, Chonnam National University, Korea

The non-enzymatic browning of pear juice concentrate from a new cultivar, Hwasan treated with different ascorbic acid (AsA) concentrations were investigated during storage at 45°C for 72 h. After soaking at different AsA solutions (1.50, 2.00, and 2.50%) for 30 min, the pears were pressed to extract juice and concentrated to achieve 75°Bx by a rotary evaporator. The non-enzymatic browning of pear juice concentrate from a new cultivar, Hwasan treated with different ascorbic acid (AsA) concentrations decreased slowly compared to that of control (not treated) during storage for 72 h. However, control increased faster in a value during storage compared to other samples. Chroma, Aε and browning index of all juice concentrates treated with AsA were lower than that of control and increased during storage. After storage for 12 h, hue angle of juice concentrates treated with 1.50 and 2.00% of AsA and control decreased rapidly compared to concentrate with 2.50% AsA. In conclusion, the pretreatment of AsA to a new cultivar of pears, Hwasan for juice concentrate had good effect for inhibition of non-enzymatic browning during storage.
Quality Characteristics of Steamed Rice Cake (Baekseolgi) Using Different Particle Sizes of Dry-milled Rice Flour

Ji-Hye Park*, Gui-Jung Han, Jeom-Sig Lee¹, Choon-Ki Lee¹, Hye-Min Han
Department of Agrofood Resources, National Academy of Agricultural Science, Rural Development Administration, Korea, ¹Department of Central Area, National Institute of Crop Science, Rural Development Administration, Korea

This study compared the quality characteristics of steamed rice cake (baekseolgi) prepared with wet-milled rice flour (WRF) and different particle sizes of dry-milled rice flour (DRF) in order to be applied DRF to rice processed products. DRF were sieved through 100 (DRF1), 150 (DRF2) and 270 mesh (DRF3) after milling used the air-classification mill. The particle size analysis, starch damage contents, RVA, appearance, volume, color value, texture properties and sensory evaluation were determined. The smaller particle size, the more the starch damage contents was increased (p<0.05). The volume of baekseolgi using DRF1 was similar to WRF, while that of baekseolgi using DRF3 was smallest. The L-value of baekseolgi using DRF2 was highest. However, it was smaller than that of WRF (p<0.05). The b-values of baekseolgi using all particle sizes of DRF were higher than that of WRF (p<0.05). The result of analysis of texture analyzer, hardness of DRF2 was statistically similar to that of WRF. Adhesiveness of DRF2 was lower than those of DRF but higher than that of WRF. Our results suggest that baekseolgi using DRF is able to be improved qualities as much as commercial baekseolgi.

Physical Characteristics of Hypsizigus marmoreus by Drying Methods

Su-Yeon Back*, Sung Soo Kim, Hyun-Ku Kim, Dong-Hwa Shon, Jeong-Ryong Do
Korea Food Research Institute, Korea

This study examined the effect of drying temperature on the qualitative properties of Hypsizigus marmoreus. The mushroom samples were dried in a hot air dryer at 40, 50, 60, and 70°C, respectively, to attain a 8±1% moisture content. The time required to reach the target moisture content was 3-5 h. The color L-values of the samples were decreased with increasing drying temperature and time, whereas the a- and b-values were increased. After rehydration, water uptake of the dried plesus and stipe samples were 2.69-3.72 times and 2.63-3.55 times, respectively. The pileus and stipe of F velutipes by drying in convection oven at 70°C for 3 h showed the best rehydration characteristic and sensory values of lightness after drying.

Production of Jujube, Black Jujube and Jujube Seed Extract Fortified with Mucilage by Bacillus subtilis

Yong-Seon Park¹*, Seun-Ah Yang¹, Sam-Pin Lee¹ ²
¹Department of Food Science and Technology, Keimyung University, Korea, ²The Center for Traditional Microorganism Resource (TMR), Keimyung University, Korea

This study was successfully performed the alkaline fermentation of jujube, black jujube, and jujube seed by Bacillus subtilis HA for the production of mucilage including γ-PGA. The extract of jujube, black jujube and jujube seed were used to ferment with a defined medium at 42°C for 3 days. In the presence of 3% MSG, fermented black jujube showed pH 6.18, 0.09% acidity after 2 days. And the soluble solid content of the black jujube was decreased from 4.80°Bx to 3.00±0.00°Bx. Also, viable cell counts increased from 2.14×10⁸ CFU/mL to 6.56×10⁸ CFU/mL. The mucilage content showed higher value of 2.22±0.03%, compared to those of other conditions. The consistency was the highest value with 2.19 Pa·s⁻¹ after 2 days, and then decreased with longer fermentation. The fermented product provided the enhanced functional properties and showed hepatotoxicity inhibition based on the concentration-dependent.
Quality Characteristics of Mayonnaise on Hamburger Steak

Jae Hwan Lee*, Sang Young Park, Hyeong Seon Park, Chan Ho Park, Ki Ju Hong, Byoung Sang Chung

The purpose of this study was to investigate the sensory and mechanical characteristics of hamburger steak containing various levels of mayonnaise (0, 1, 3, 5, and 7%). Mayonnaise is a mixture of oil, egg yolk, vinegar and spice, and is probably one of the most widely used sauces or condiments in the world today. Traditional mayonnaise is an oil-in-water emulsion with 70-80% of oil. Mayonnaise is widely used for salads, sauces, dressing, and sandwich. As mayonnaise ingredients, oil and vinegar influenced mechanical properties and sensory characteristics of foods such as flavor, mouthfeel, texture, and color in a special way. According to sensory evaluation, overall acceptability, savory, color acceptability and mouthfeel were highest in hamburger steak with 5% mayonnaise. In terms of change in color, the hunter color values of L (lightness) and a (redness) increased with increased amounts of mayonnaise. In the measurement of the texture, the hardness appeared to be lower in hamburger steak with 7% of mayonnaise than control (0% of mayonnaise). Therefore, hamburger steak containing 5% mayonnaise was the most effective compared with other ones.

Effects of Ozone Gas on Properties of Wheat Flour

Min-jung Lee1,2*, Se-eun Lee1, Seung-taik Lim2, Sang-sook Kim1

1Korea Food Research Institute, Korea, 2 Korea University, Korea

The effects of various concentration (117 ppm, 1,642 ppm, 2,487 ppm, 2,694 ppm for 30 min) of ozone gas on the physicochemical properties (whiteness, color (L, a, b), pH, pasting properties by rapid visco analyzer (RVA), solvent retention capacity (SRC), resistance and extensibility by texture analyzer) of wheat flour (WF) and specific volume (SV) of bread were investigated. Whiteness of WF was significantly increased and the b value of WF was decreased with the ozone concentration. WFs treated with ozone were relatively higher in pasting characteristics (peak viscosity and final viscosity) and SuSRC (succrose) than WF without ozone treatment (control). The extensibility of dough was decreased as the ozone concentration increased and ozone treated WF (117 ppm) had the highest specific volume among samples tested. Total plate count of ozone treated WF was lower than that of control. The results of this study showed that ozone treated WFs were higher in whiteness and pasting properties and lower in microbial count than control. Overall, WF treated with ozone (117 ppm) resulted in higher SV of bread than others.

Physicochemical and Sensory Evaluation of Sweet Potato Leather Added with Different Levels of Gelatin

In-Young Kim*, So-Ah Jo, Jong-Bang Eun

Department of Food Science and Technology and Functional Food Research Center, Chonnam National University, Korea

The physicochemical characteristics and sensory evaluation of sweet potato leather (SPL) added with different levels of gelatin were investigated. SPL added with 7% gelatin showed the highest moisture content. Soluble solid content of SPL added with 3% gelatin was higher than that of SPL added with 5% and 7% gelatin. There were no significant differences in water activity and titratable acidity among all samples. In the color, SPLs added with 3, 5 and 7% of gelatin were no significantly different in L value, while SPL added with 7% of gelatin was the lowest in a and b value at 0.25 and 58.56. In texture profile, SPL added with 7% of gelatin was higher in the hardness, gumminess and chewiness than SPLs with 3 and 5%, but there were no significant differences in springiness and cohesiveness. In sensory evaluation, SPLs added with 3, 5, and 7% were not significantly different in color, appearance, and flavor; however, SPL added with 5% gelatin showed the highest score in texture, taste and overall acceptability. In conclusion, 5% gelatin would be the best additional level for SPL with gelatin because it had the best sensory quality.

Physicochemical and Microbiological Characteristics of Dried Seafood Mix Flavoring for Soup with Different Cutting Sizes and Its Extract with Boiled Water

Ah-Young Jeong*, Sung-Jin Hong, Jong-Bang Eun

Department of Food Science and Technology and Functional Food Research Center, Chonnam National University, Korea

Chemical and microbiological characteristics of dried seafood mix flavoring for soup (DSMFS) including anchovy, kelp, shrimp and large eyed-herring and physicochemical characteristics of its extract with boiled water were investigated. The dried seafood were re-dried at 50°C for 3 h, had different size reductions - the whole, the cut and the ground- and 12 g of each samples was extracted with 600 mL of boiling water for 10 min. The moisture content, water activity (Aw), volatile basic nitrogen (VBN) content and number of total bacteria, yeasts and molds of dried seafood were 7.88%, 0.189, 7.084 mg N/100 g, 3.45×10⁴ CFU/mL and 3.05×10⁴ CFU/mL. As the sizes decreased, L* value and turbidity decreased, and amino nitrogen content, a* and b* value, and content of taurine, glycine, alanine and arginine increased. The histidine content of the extract with ground DSMFS was the lowest. There were no significant differences in soluble solid content and salinity among samples. In conclusion, ground type of dried seafood could be good for teabag-typed DSMFS in terms of taste and nutritional value.
**Rheological Properties of Yam (Dioscorea batatas DECNE) and Seaweed (Laminaria japonica) Mixture as a Thickening Agent**

Jun-Kyu Park*, Si-Yeon Lee, Bum-Soo Ko, Jae-Kwon Lee
Department of Food Science and Biotechnology, College of Natural Science, Kyunggi University, Korea

Rheological properties of dried yam (Dioscorea batatas DECNE) and seaweed (Laminaria japonica) powder mixture at varying contents were assessed to develop a thickening material. Flow behaviors of yam and seaweed mixture samples exhibited a shear-thinning and thixotropic behavior regardless of yam concentration and addition levels of seaweed. The thixotropic hysteresis loop analysis indicated that the yam and seaweed mixtures had higher resilience than that of yam alone. Dynamic oscillatory test revealed that storage modulus ($G'$) and loss modulus ($G''$) of yam and seaweed mixture increased with the increase of yam content as well as addition of seaweed, although the levels of seaweed addition did not affect the $G'$ and $G''$.

**Effect of Doenjang (Soybean Paste) Extract on the Quality of Kimchi**

Tong-Eng Chuob*, Jong-Bang Eun
Department of Food Science and Technology Functional Food Research Center, Chonnam National University, Korea

This study was carried out to investigate the potential use of doenjang (soybean paste) extract (DE) in place of anchovy juice as an ingredient in kimchi fermentation, in order to improve kimchi quality such as flavor and taste. Quality characteristics were monitored during progressive fermentation of kimchi with doenjang extract (KDE) 5, 10, and 15% in 10 days at constant temperature (20°C). The change in chemical and microbiological characteristics of kimchi which was fermented with DE was investigated. The result showed that the pH level of KDE was lower than the control as the fermentation progressed. Moreover, the total acidity of KDE was higher than the control after fermentation for two days. Both the growth of lactic acid bacteria and total bacteria in kimchi showed that the viable microorganism in kimchi, mostly lactic acid bacteria, significantly increased until 7 days after the fermentation with DE. In sensory evaluation, the taste, flavor, saltiness and overall acceptability of the new form of kimchi increased significantly by adding 10% (v/w) of DE. In conclusion, kimchi added with DE 10% can improve the flavor and taste of the kimchi and had the best sensory quality.

**Effects of Antioxidant Activity and Chemical Characteristics on Dried Meat Added with Tocopherol**

Su Kyung Ku*, Yun Sang Choi, Ki Hong Jeon, Jong Dae Park, Hee Ju Kim1, Young Boong Kim
Korea Food Research Institute, Korea, 1Meat Bank, Korea

This study was carried out to evaluate the effects of antioxidant activity and chemical characteristics on dried meat added with tocopherol. The dried meat was produced using trimming meat as raw material. The tocopherol was added in order to inhibit the oxidation when producing the dried meat. The moisture content of dried meat showed the range of 9.56-11.21%. The water activity and the yield are shown to be correlated with moisture content. As the tocopherol addition is increased, the lightness (L value) and yellowness (b value) showed the tendency of increase. Sensory evaluation was not significantly different according to the tocopherol content. The DPPH radical scavenging activity of dried meat showed the range of 29.77-83.64%. TBA value tended to decrease with increasing the tocopherol. Therefore, addition of tocopherol affected the oxidative stability of the dried meat.

**Reseasches on Standardization of Functional Ingredient for Ginseng (Panax ginseng C. A. Meyer) Processing Development**

Sun Young Kim*, Jin Soo Han, Sun Young Kang, Ji Hyun Kim, Hyun-Sun Lee
Agency for Korea National Food Cluster, Korea

This study investigated the effects of the change of ginsenoside content in the ginseng (Panax ginseng C. A. Meyer) for establishment of standardization method according to the processing condition with steaming or Ultra high pressure (UHP). The changes on physicochemical properties of fresh ginseng during repeated 6 times steaming processes up to 95°C for 4 h, were investigated. The results showed that the protopanaxadiol (PPD) ginsenoside contents rate gradually increased among the total ginsenoside contents while the times of steaming process increased. As the times of steaming processes increased, the total flavonoid, polyphenol contents and FRAP value increased. Also UHP extraction is a novel technology that can be used as a non-thermal extraction of bioactive components. To confirm the effects of UHP on ginsenoside composition, each fresh and red ginseng were treated at UHP (100, 200, 300, and 400 MPa) for 5, 10, and 15 min, were investigated. UHP had effect on the increasing yield of total ginsenosides and several ginsenoside among the 15 ginsenosides were different. From these results obtained, various processes and their combination can be applied to enhance the functionality of ginseng.
Quality and Antioxidant Characteristics of Omija (Schizandra chinensis B.) Beverage by Different Methods

Jun Hyung Sung, Jeong Seok Cho, Hyeon Jeong Lee, Jung Hoon Park, Ji Young Choi, Kwang Deog Moon

1Department of Food Science and Technology, Kyungpook National University, Korea, 2Food and Bio-industry Research Institute, Kyungpook National University, Korea

In this study, the physicochemical characteristics and antioxidant capacities of omija (Schizandra chinensis Baillon) beverage depending on three different methods was investigated. Dry omija was extracted with fermented ethanol and prepared in three types: freeze-dried (FD), granule (GR), spray-dried (SD). Beverage was prepared with FD, GR, and SD of water extract. The total soluble solid contents varied from 1.96 to 2.63°Bx, and the pH ranged from 3.05 to 3.59. Anthocyanin contents of FD, GR, and SD were 583.75, 5.41, and 616.25 mg/L, respectively. The L* value (lightness) was the highest in GR, but the a* value (redness) was highest in FD. Reducing sugar contents ranged from 0.41 to 2.02 g/100 mL. The total phenolic contents of FD, GR, and SD were 7.04, 0.33, and 7.40 GAE mg/100 mL, respectively. Antioxidant capacities were examined by DPPH, ABTS, FRAP. FD and SD showed high ABTS and DPPH radical scavenging activities, but GR was not showed activities. These results indicated that FD and SD were higher antioxidant activities than GR.

Enzymatic Hydrolysis of Rice Starch as a Fat Replacer in Preparation of Low Fat Mayonnaise

Si-Yeon Lee, Jae-Kwon Lee
Department of Food Science and Biotechnology, College of Natural Science, Kyonggi University, Korea

The objective of this study was to evaluate the characteristics of low-fat mayonnaise containing maltodextrin with different levels of enzymatic hydrolysis in comparison to full-fat mayonnaise. Rice-based maltodextrins with a dextrose equivalent (DE) range of 2 to 6 were prepared by α-amylase hydrolysis. The fat contents in mayonnaise could be reduced up to 50% by maltodextrin replacement. Scanning electron microscopy showed that the droplets of oil in mayonnaise were distributed more uniformly as a replacement with maltodextrin increased. Viscosity of mayonnaise increased with increasing the replacement of maltodextrin from 10 to 50%, showing shear thinning and time-dependent thixotropic behavior. Mayonnaise with 50% maltodextrin replacement with DE range 2 to 3 showed the greatest emulsion stability presumably due to its highest viscosity. Sensory attributes, such as appearance, flavor, texture and oiliness of low-fat mayonnaise were not significantly different from those of full-fat mayonnaise. These results suggested that maltodextrin with DE range of 2 to 3 could be used as a fat replacer in preparation of mayonnaise with reduced fat content up to 50%.

Foaming Properties of Fresh Whipping Cream Added to Soymilk Treated with High Hydrostatic Pressure

Seung-Yong Lim, Jae-Geun Koo, Kwonsam Park, Yongtae Kim, Nayoung Lee, Jung-Kil Seo
Department of Food Science and Biotechnology, Kunsan National University, Korea

The objective of this study was to evaluate the foaming properties of fresh whipping cream adding soymilk treated with high hydrostatic pressure (HHP) for improving foaming properties. Soybean was homogenized, pasteurized at low temperature (65°C for 30 min), standardized to 15% total solids, and treated with HHP at different treatment conditions. HHP-treated soymilk resulted in greater overrun and foam stability than the control soymilk without HHP. An optimum condition of HHP treatment resulted at 300 MPa for 15 min according to the result of foaming properties in HHP treated soymilk. As a result of foaming properties with real whipping cream added to 10% or 15% of soymilk treated at optimum HHP condition, the real whipping cream including 10% of HHP treated soymilk resulted in better foaming properties than that including 15%. HHP treated soymilk has a potential to be used in whipping foods like whipping cream or ice cream if controlling optimum contents of soymilk.

Effects of Fermentation on Color and the Acrylamide Formation of Potato Chips

Joongjae Lee, Yoon Hyuk Chang, Youngseung Lee, Yoonhwa Jeong, Han Sub Kwak, Misook Kim
Department of Food Science and Nutrition, Dankook University, Korea, 1Department of Food and Nutrition, Kyung Hee University, Korea

Potatoes are subject to the development of browning color and the formation of acrylamide upon deep-frying due to their high reducing sugar and amino acid contents. The objective of this work was to minimize browning color and the acrylamide formation by bacterial fermentation prior to frying. Potato slices were fermented by each of four bacteria such as Lactobacillus reuteri, Weissella cibaria, Leuconostoc mesenteroides, and Bacillus methylotrophicus for 24 h at 23°C. In all fermentation groups, the number of bacteria was rapidly increased and the pH value decreased to 4.0. The reducing sugar content of potato slices decreased up to 70% when fermented by L. mesenteroides. A linear correlation was found between reducing sugar of potato chips and their color after deep-frying. It is concluded that the fermentation process can positively affect the color development and the acrylamide formation. More details will be discussed.
Physicochemical Properties and Storage Stabilities of Encapsulated Lactobacillus plantarum CGKW3 with Rice Flour
Dae-Hoon Lee*, Hye-Mi Park, Rea-Hyun Lee, Yoo-Seok Jeong, Hee-Kyung Jung, Jae-Gon Cho, Joo-Heon Hong
Department of Food Science and Technology, Catholic University of Daegu, Korea, 1Biohealth Convergence Center, Daegu Technopark, Korea, 2Young Poong Co., Korea

The physicochemical properties and storage stabilities of encapsulated Lactobacillus plantarum CGKW3 powders were investigated. The encapsulated powders of L. plantarum CGKW3 (LP-S10, LP-S20, LP-S30, and LP-S50) was achieved with 10, 20, 30, and 50% rice flour by spray-drying. The particle size of encapsulated L. plantarum CGKW3 powders were 82.26–131.17 μm and powder flowability was good by showing the shape of the spherical. The water absorption and water solubility of encapsulated L. plantarum CGKW3 powders were 74.4–76.4% and 97.28–131.17%, respectively. The total organic acid content of LP-S10 was 79.57 mg/g, and the organic acid content increased with an increase in the rice flour. The free amino acid content of LP-S10 (1,152.53 mg/g) was higher than that of the other powders. The pH, acidity, and viable cell count of encapsulated powders did not differ during 40 days at room temperature. The pH, acidity, and viable cell count of encapsulated powders did not differ during 40 days at room temperature. The purpose of this study was to investigate the treatment effect of calcium lactate dipping on quality changes of irradiated water dropwort. Total aerobic bacteria of non-irradiated water dropwort were about 3 log CFU/g, and 4 kGy gamma-irradiation effectively sterilized the water dropwort. However, the irradiating dose resulted in the significant decrease of its sensory quality in general. Especially, low scoring in texture (mainly chewiness and crunchiness) becomes a critical factor, which reduces the value of water dropwort as a healthy side dish. To improve this quality, water dropwort were irradiated with the sterilizing dose of 4 kGy after dipping in 1.5, 3, and 4.5% solutions of calcium lactate for 10 min. The results showed that all scores including texture were noticeably improved by the use of calcium lactate, and firmness also got much better than irradiated control only. On the other hand, the change of pH value and titratable acidity upon the calcium lactate dipping was negligible. Our results suggest that sensory quality (including texture) of irradiated gamma-irradiated water dropwort can be improved by the treatment of calcium lactate.

Quality of Commercial Broiler Breast Fillets Retailed in Korea
Inyong Yang*, Pureum Im, Jinsu Kang, Hansub Kwak, Misook Kim, Yoonhwa Jeong, Youngseung Lee
Department of Food Science and Nutrition, Dankook University, Korea

Overall quality of six kinds of commercial broiler breast fillets (A-F) retailed in Korea were examined including proximate analysis, shape profile analysis, pH, color, tenderness, water holding capacity, descriptive analysis and consumer testing. Fillets were purchased in a local market (120 fillets=20 fillets for each type). Significant variations in quality between products were observed, indicating a broad range of product quality in the marketplace. Moisture content of the fillets was 74.4–76.4% and protein, fat, and ash contents were 21.8–25.2, 0.25–0.81 and 1.07–1.16%, respectively. The pH ranged from 6.2 to 6.4, while color values (L*, a*, and b*) were 52.2–57.2, -3.5–0.6, and 8.3–13.6, respectively. Cooking loss was 16.9–25.7%, while shapes (height, width, and length) of the fillets were also significant between fillets (15% variation in average). Product C (100% natural, no artificial ingredients/preservatives) was found to be most liked by consumers. Tenderness of products tested was rated in average between “slightly tough” and “neither tough nor tender” by 55 consumers.

Use of Seawater for Cost-effective Cultivation and Harvesting of Microalga Scenedesmus obliquus
Jong-Hee Kwon*
Department of Food Science & Technology and College of Agriculture & Life Science, Gyeongsang National University, Korea

Microalgae hold great promise as a source of food and biochemicals. The main obstacles to their industrial application are the high cultivation and downstream costs related to media and harvesting. In the work, we explored the multiple potentials of seawater to address key issues relating to the cultivation of microalgae Scenedesmus obliquus. Use of seawater to replace some of the freshwater and nutrients in BG11 medium such as MgSO4, CaCl2, and NaCO3 can improve lipid and chlorophyll production in S. obliquus cultivation without loss of biomass accumulation. Most notably, growth in a medium containing seawater led to significant improvements in auto-flocculation, with no additional pretreatment. Compared with cells grown in BG11, the harvesting efficiency by auto-flocculation at 1 h was increased 24-fold in cells grown in the 10% seawater-added medium. The use of seawater-supplemented media opens up a new avenue to the reduction of cultivation costs related to media preparation and biomass harvesting for microalgal industry.
Impact of Different Processing Variables on Yields, Compositional Properties and Sensory Attributes of White Wine from Seedless Thomson Green Grapes

Dan-Bi Woo*, Mi-Young Kim, Ye-Seul Kim, Jie-Yu Luani, Mee-Ryung Lee, Jae-Sik Kim1
Department of Food and Nutrition, Daegu University, Korea, 1Kyungpook National University Podomaul, Korea

The objectives of this study were to evaluate the effects of processing variables on the compositional and sensory attributes of white wines. Four white wines were manufactured with different processing variables; i) fermented with skins (FWS), ii) fermented without skins (FW/OS), iii) fermented with skin and enzyme (pectinases and cellulases) (FEWS), iv) fermented without skin and with enzyme (FEW/OS). All wines were fermented for 14 days at 20°C. Yields of each wine, chemical composition, such as alcohol, pH, titrable acidity (TA) and etc. were measured. The yield of FEWS wine (~85%) were significantly (p<0.05) higher than other white wines (~65%). TA was 0.70, 0.56, 0.64, and 0.81 g/100 mL in FWS, FW/OS, FEWS, FEW/OS, respectively. In sensory evaluation by trained panels, the preference was more significantly correlated (p<0.05) with TA than pH; TA value had significantly (p<0.05) negative correlation with sensory preferences. These results suggest that the addition of enzymes can dramatically increase the yield of wines but could presumably accelerate the production of organic acids, such as tartaric acids during fermentation, resulting in a decrease in consumer acceptability.

Effect of Concentrations on Rheological and Pasting Properties of Potato Flour Dispersions

Hye Mi Heo*, Chu In Won, Yong-Ik Jin1, Dong-Chil Chang1, Misook Kim2, Youngseung Lee2, Yoon Hyuk Chang
Department of Food and Nutrition, Kyung Hee University, Korea, 1Highland Agriculture Research Institute, RDA, Korea, 2Department of Food Science and Nutrition, Dankook University, Korea

The objective of this study was to investigate the rheological and pasting properties of potato flour dispersions at different concentrations (3, 4, 5, 6, and 7%, w/w). A potato cultivar ‘Goun’, used in this study, was developed by Highland Agriculture Research Center, RDA. Potato flour dispersions showed shear-thinning behaviors (n = 0.44-0.51) at 25°C. Apparent viscosity (ηa), consistency index (K), and yield stress (σo) were significantly increased with the increased in potato flour concentrations. Storage modulus (G') and loss modulus (G'') were significantly increased with the increase in potato flour concentrations. G' value significantly increased with increased frequency (ω) from 0.63 to 63.8 rad/s. Magnitudes of G' and G'' were significantly increased with an elevation in potato flour concentrations. G' values were considerably greater than G'' over the entire range of frequency (ω), with the high dependence on ω. Cox-Merz rule was not applicable to potato flour dispersions. Rapid Visco Analyzer data showed that peak viscosity, trough viscosity, and final viscosity of the samples were significantly increased with the increase in potato flour concentrations.

Effects of Super-heated Steam Treatment on Physical Properties of Extruded Rice Snack Containing Various Levels of Brown Rice

Bum-Soo Ko*, Jun-Kyu Park, Si-Yeon Lee, Mi-Yeon Lee1, Young-Mi Yoo1, Eun-Kyoun Jo1, Jae-Kwon Lee
Department of Food Science and Biotechnology, College of Natural Science, Kyunggi University, Korea, 1Dason Food, Korea

This study was conducted to investigate the effects of brown rice replacement as well as super-heated steam (SHS) treatment conditions on physical properties of rice snack for early childhood. Milled rice replaced with different levels of brown rice (30 and 50%, w/w) was heated with SHS at different levels of temperature (150 and 250°C) and duration (60 and 120 s), then extruded using a single screw extruder. Physical properties of rice snack, such as hardness, bulk density, water uptake and deformability were measured. Hardness and bulk density decreased as the temperature and duration of SHS increased. Water uptake increased with increasing temperature and duration of SHS as well as amount of brown rice replacement. Higher the water uptake, disintegration of rice snack subsequent to soaking in water occurred more readily. Microstructure of rice snack showed that SHS treatment caused the formation of smaller air cells with thinner cell wall inside of rice snack. Through the appropriate SHS treatment, physical properties of rice snack containing brown rice could be altered to meet the needs required for the early childhood in terms of texture, hydration and deformation.

Forming Ability and Gelling Properties of Egg White according to the Age of Laying Hens and Storage Time

Chuanshun Ren*, Malshick Shin
Department of Food and Nutrition, Chonnam National University, Korea

Foaming abilities and gelling properties of egg white as the main functional characteristics were evaluated using fresh and stored eggs at 15°C for 14 days. The experiment was conducted to study the effect of Haugh unit (HU), pH of egg white albumen, egg white foaming ability, gelling and engel food cake properties. A total of 12,400 eggs obtained from Hy-Line Brown hens at 20 and 60 weeks of age were used to experiment the effect of hen age and storage time. The eggs were obtained freshness and after storage at 15°C for 14 days. There was a clear negative effect of the age on the quality of grade and HU. The A-grade had the percentage of 80% at least age of 48 weeks. And the HU reduced suddenly to the value of 80 from the age of 56 weeks (p<0.001). There was significantly difference in foaming ability but no tendency according the age of laying hens. Gelling properties significantly showed to improve the hardness, gumminess, chewiness by increased the age of hens (p<0.05).
**Effect of Fat Level on the Quality Properties of Ground Pork Patties Containing Salt by Microwave Cooking**

Jong Youn Jeong*, Cheon Jei Kim
School of Food Biotechnology & Nutrition, Kyungsung University, Korea, 1Department of Food Science & Biotechnology of Animal Resources, Konkuk University, Korea

This study was carried out to evaluate the cooking effect of fat level with NaCl (1.5%) on the microwave cooking properties of ground pork patties. Ground pork patties were processed from pork hams to achieve fat level of 10, 15, 20, and 25%. Each patty was cooked from a thawed state to 76.7°C in a microwave oven with full power (700 W). Cooking time decreased but cooking rate increased as fat level increased. After microwave cooking, protein content, moisture content, and fat retention in patties tended to decrease as fat level increased from 10 to 25%. Total cooking loss and drip loss were increased with fat levels, whereas the small differences in diameter reduction and thickness of patty were observed. Shear force values were lowest for 25% fat patties but highest for 10% fat patties. In raw patties, 10% fat patties had lower L* values and higher a* values compared to patties with more fat, but these differences were decreased when patties were cooked. In visual evaluations, 10% fat patties showed more pink color in surface and interior than more fat patties (15, 20, and 25%) and more air pockets were noted with an increase of fat level.

**Improving Effect of Guar Gum on Physicochemical and Sensory Properties of Sterilized Bean Curd Ice Cream by Gamma Irradiation**

Jong-Heum Park*, Young-Min Yoon, Beom-Seok Song, Jae-Kyung Kim, Dong-Ho Kim
Advanced Radiation Technology Institute, Korea Atomic Energy Research Institute, Korea

The purpose of this study was to investigate the effect of guar gum on the sensory quality characteristics of irradiated bean curd ice cream. Total aerobic bacteria of non-irradiated bean curd ice cream were about 3.2 log CFU/g, and 2 kGy gamma-irradiation effectively sterilized the bean curd ice cream. Addition of guar gum to irradiated bean curd ice cream decreased redness (a* color value), while increased the viscosity and yellowness (b* color value). Such a tendency was dependent on the concentration of guar gum. The result of sensory property showed that overall acceptability of irradiated bean curd ice cream was best when 0.1% guar gum was added. However, irradiation-induced off-flavor tended to do not decrease by the addition of guar gum. Our results indicated that Guar gum might improve the sensory quality of gamma-irradiated bean curd ice cream. Further studies such as addition of antioxidants and various food additives are required to control irradiation-induced off flavor.

**Effects of Processing Properties of Spent Hen Breast Meat with Physical Treatments Like Pulsed Electric Field (PEF) and Super-heated Steam (SHS)**

Ki Hong Jeon*, Yoon Seon Hwang, Yeong Bung Kim, Yun Sang Choe, Eun Mi Kim, Dong Un Lee
Division of Convergence Technology, Korea Food Research Institute, Korea, 1School of Food Science and Technology, Chung-Ang University, Korea

Processing properties of breast meat from spent hen with physical treatment like steaming, pulsed electric field (PEF) and super heated steam (SHS) were investigated and compare it from broiler. The condition of steam was at 85°C for 20 min, PEF treatment to the chicken breast was 0.4-1.5 KV/cm for 10 s and SHS treatment was oven temp 300°C, steam temp 350°C for 8 min. In the experiment of color of chicken breast meat, L value was getting lower but a and b value were higher with heating treatments. In the results of heating loss, steam treatment of spent hen was 45.25%, PEF treatment 39.77%, SHS treatment was 35.35% while steam treatment of broiler was 32.95%. It is believed PEF and SHS treatments can help to decrease heating loss of spent hen breast meat. Also, the hardness of spent hen breast meat treated steam, SHS and PEF were 13.74, 13.87, and 14.08 kg, respectively but it decreased significantly to 10.73 kg after PEF and SHS treatment (p<0.05). Also it helps to increase the score of texture in the sensory evaluation from 3.8 to 6.0. With these experiments, breast meat from spent hen was believed to increase its quality with physical treatments.

**Physicochemical and Antioxidant Activities of Fermented Black Ginseng**

Do- Yeon Kim*, Yeong-Su Kim, Jae-Ho Choi, Da- Jeong Kim, Jong-Dae Park, Mi-Yae Shon
International Ginseng & Herb Research Institute, Korea

In this study, we investigated physicochemical and antioxidant properties of fermented black ginseng. The white ginseng was treated using citric acid and fermented by *Aspergillus oryzae* at 40°C for 3 days. After fermentation, the black ginseng was prepared by five times steamed-drying cycles. Total polyphenol and ginsenoside (Rg3, Rk1, Rg5) contents of fermented black ginseng were increased to 24% and 28%, respectively, compared with those of non fermented black ginseng. The nitrite scavenging activity, ABTS scavenging activities and DPPH scavenging activities of the fermented black ginseng increased 14, 18, and 21%, respectively, compared with those of non fermented black ginseng. Based on these results, it was suggested that antioxidant activities of black ginseng improve according to fermentation and the increasing number of steaming-drying cycles, which was derived from increase of total polyphenol and ginsenoside Rg3, Rk1, Rg5 contents.
Color Stability of Wheat Fiber Dyed with Safflower (Carthamus tinctorius L.) Red Pigment during Processing and under Storage Conditions

TaeJun Jeong*, YunSang Choi†, HyunWook Kim‡, YounKyung Ham, Cheonjei Kim
Department of Food Science and Biotechnology of Animal Resources, Konkuk University, Korea, †Research Group of Convergence Technology, Korean Food Research Institute, Korea, ‡Meat Science and Muscle Biology Lab, Department of Animal Science, Purdue University, USA

The color affects of aesthetics, safety, sensuality, and permissibility to consumers during the selection. According to published research, the artificial food coloring agent are used adverse health effects such as hypersensitivity disease, especially in early childhood. Consequently, consumers demand for natural coloring agent has increased. Safflower (Carthamus tinctorius L.) consist of the stem, leaves, seeds and flowers are used for coloring agent purposes. Safflower flowers produce red and yellow pigments and mainly used as a material of dye. Safflower petal contains about 30% of yellow pigment and 0.83% red pigment which can be used as coloring agent for food. However, Safflower red pigment deteriorates during processing. Safflower red pigment was bound to wheat fiber. Therefore, the objective of this study was to comparing the pigments stability indicates wheat fiber dyed with safflower is more stable than safflower red pigment in temperature, pH treatment and salt concentration. In conclusion, wheat fiber dyed with safflower could achieve color stability under varying temperature, pH and salt concentration.

In vitro Genetic Toxicity and Antimutagenic Effects of Black Ginseng Extract

Yeong-Su Kim*, Do-Yeon Kim, Jae-Ho Choi, Da-Jeong Kim, Jong-Dae Park, Mi-Yae Shon
International Ginseng & Herb Research Institute, Korea

Black ginseng is produced by repeatedly steaming ginseng nine times which has more than 30 different ginsenosides with various physiological and pharmacological activities. How ever there no information of its genetic toxicity. In this study, The in vitro antimutagenic and genetic toxicity of black ginseng extract was experimented by using bacterial reverse mutation test (Ames test). The in vitro reverse mutation test using Salmonella Typhimurium (TA100, TA1,535, TA98, TA1,537) and Escherichia coli (WP2 uvrA) were performed with black ginseng extract at the concentrations 0-1,000 μg/plate. Black ginseng extract was negative in Ames test with both S. Typhimurium and E. coli with and without S-9 mix. The antimutagenicity of black ginseng extract was evaluated in modified Ames test. The number of mutated colonies induced by mutagen were reduced by black ginseng extract treatment in all strains. According to these results, we concluded that black ginseng extract did not cause bacterial reverse mutation and may have antimutagenic effects.

Image Analysis to Evaluate the Maturity of Cherry Tomato

Jeong Seok Cho1*, Hyun Jeong Lee1, Jun Hyung Sung1, Ji Young Choi1, Jung Hoon Park1, Kwang Deog Moon1,2
1Department of Food Science and Technology, Kyungpook National University, Korea, 2Food and Bio-industry Research Institute, Kyungpook National University, Korea

This study was performed to evaluate the maturity of cherry tomato using image analysis method. The objective of this study is to investigate the analysis possibility of maturity of cherry tomato using image analysis method. Cherry tomatoes were divided into 4 groups in accordance with maturity (M1=green; M2=yellow; M3=pink; M4=red). Image acquisition performed using a digital camera and image analysis performed using MATLAB image processing toolbox. Some algorithms based on color space conversion were used to analyze RGB and CIE L* a* b* color index. Colorimetric analysis for lycopene contents and external color changes also performed. The M4 group showed the highest, CIE a* value and the lowest G (green), CIE L* value using image analysis. The CIE L* and a* values using colorimeter also indicated similar tendency with image analysis. The lycopene contents showed the highest value in M4 group and lowest value in M1 group. Generally, cherry tomato changes the surface color from green to red as it ripening. The colorimeter is well-known for method to analyze the surface color of food. In this study, image analysis was also suitable for analysis of surface color of cherry tomatoes.

Study on the Image Analysis to Evaluate the Marbling and Color Index of the Beef

Jeong Seok Cho1*, Hyun Jeong Lee1, Jun Hyung Sung1, Ji Young Choi1, Jung Hoon Park1, Kwang Deog Moon1,2
1Department of Food Science and Technology, Kyungpook National University, Korea, 2Food and Bio-industry Research Institute, Kyungpook National University, Korea

The objective of this study is to investigate the analysis possibility of the marbling and color index of beef using image analysis method. Image acquisition performed using a digital camera (NEX-5N; Sony, Tokyo, Japan) and image analysis performed using MATLAB image processing toolbox (version 8.2; Mathworks, Natick, MA, USA). To analyze the marbling (fat contents), some algorithms based on otsu thresholding method were used. The changes of RGB and CIE L* a* b* color index during storage were also analyzed. It is possible to calculate the marbling (fat contents) by separating the red portion (muscle meat) and white portion (meat fat) using image analysis. R (red), G (green), B (blue) values using image analysis decreased during storage. CIE L* values also consistently decreased, but CIE a*, b* values were not consistent. It means that the image analysis is able to analyze the marbling (fat contents) and color index (especially R, G, B, CIE L* value) of beef.
**P14 -091**

**Evaluation of Quality Characteristics and Mineral Contents of Commercial Salted Kimchi Cabbages**

Hye-Young Seo*, Ae-Ri Han, In Min Hwang, Hye Min Jung, Eung Soo Han

*World Institute of Kimchi, Korea*

This study was conducted to evaluate the quality characteristics and mineral contents of commercial salted Kimchi cabbage. The moisture, salinity, microbial properties and mineral contents of purchased salted Kimchi cabbages from 20 companies were investigated. The moisture contents in the samples ranged from 91.3 to 94.3%, salinity ranged from 0.4 to 2.0%, and uniformity of salting (CV) ranged from 18.3-54.8%. The salting degree of purchased salted Kimchi cabbage from different companies was significantly different (p<0.05). The number of total aerobic bacteria ranged from $10^5$ to $10^8$ CFU/g, and coliform bacteria ranged from $10^2$ to $10^5$ CFU/g, whereas *E. coli* were not detected in all samples. The sodium contents ranged from 108.8 to 514.0 mg/100 g, potassium contents ranged from 172.4 to 316.2 mg/100 g, calcium contents ranged from 34.0 to 67.7 mg/100 g, and magnesium contents ranged from 8.6 to 35.2 mg/100 g. The sodium contents among the target minerals were shown differences between the samples depending on their salinity. The potassium and calcium contents were similar in the samples, and the coefficient of variation of their contents were 15.1 and 18.2%, respectively.

**P14 -092**

**Changes in Sodium-potassium Ratio in Kimchi Cabbage of Cultivars after Salting Process**

Miran Kang*, Ae-Ri Han, In Min Hwan, Seon-hwa Cheon, Eung Soo Han, Hye-Young Seo

*World Institute of Kimchi, Korea*

This study was conducted to evaluate the salting characteristics of cultivars of Kimchi cabbage. The selected Kimchi cabbage cultivars were Choongwang and Daetong of spring cultivars, and Chuwol, Cheongomabi, Hwiparam Gold, and Hwiparam of fall cultivars, which are all salted in 10% NaCl solution for 16 h. The sodium-potassium ratio (Na/K ratio) was investigated as indicator for salting process. The Na/K ratio were measured as range of 0.02-0.06 depending on the potassium content in raw Kimchi cabbages. Their ratio in the salted Kimchi cabbages were increased with increasing sodium content. The Na/K ratio of salted spring cultivars showed 2.19 to 2.62, which were significantly higher compared to fall cultivars to 1.49 to 1.77 (p<0.05). The salinity also showed higher in salted spring cultivars at 1.70 to 2.27%, while fall cultivars showed 1.44 to 1.61%. ‘Hwiparam Gold’ among all samples had the highest potassium content (218.6 mg/100 g), and the Na/K ratio was the lowest in salted samples. These results indicate that the salting characteristics of Kimchi cabbages differ depending on the season than cultivars.

**P14 -093**

**Effect of Particle Size to Develop Green Beverage Using Young Green Barley Leaves Powder**

Jimyoung Kim*, Chuanshun Ren, Hyunjin Kim, Malshick Shin

*Department of Food and Nutrition, Chonnam National University, Korea*

To develop green beverage using young barley leaf powder (YBLP) instead of green tea powder latte, young green barley leaves which have higher contents of chlorophyll, superoxide dismutase, saponarin, protein, and dietary fiber, were investigated relationship between particle size and emulsion stability. The emulsion stabilities of YBLP in water or in milk were measured according to the particle size and concentration of YBLP and sugar content of green beverages. YBLP was manufactured by Saetteumwons (Yeunggwang, Jeonnam) using different grinding machine. The average particle sizes of YBLP were 99.18 and 20.18 μm, respectively. Because the large sized YBLP was very unstable in water, its particles were precipitated after 1 h storage. But the small sized YBLP was stable in green beverage, especially in milk, it was found to use for green YBLP beverage. The sugar and YBLP contents for green barley latte were tested by the method of sensory evaluation. The 1.5-1.75% of YBLP and 3-4.5% of sugar were very proper ingredients for green barley latte. The best formula of green barley latte was 1.5% of YBLP and 3% of granular sugar in 200 mL of milk (15.20%°Bx).

**P14 -094**

**Properties of Egg White by the Age of Laying Hens and Storage Time**

Chuanshun Ren*, Onbit Jeong, Huina Yoon, Malshick Shin

*Department of Food and Nutrition, Chonnam National University, Korea*

The aim of this work was to study the Haugh unit (HU), pH, yolk and albumen index, weight loss and specific gravity. A total of 12,400 eggs obtained from Hy-Line brown hens at 20 and 60 weeks of age were used to investigate. The effect of hen age and storage time of eggs on the interior qualities of eggs, such as Haugh unit, pH, loss weight and specific gravity was investigated. The Hy-line Brown hens were 20 and 60 weeks of age were used to investigate. The effect of hen age and storage time of eggs on the interior qualities of eggs, such as Haugh unit, pH, loss weight and specific gravity was investigated. The Hy-line Brown hens were 20 and 60 weeks of age and the eggs were used fresh spawn instantly and stored at 15°C for 14 days. Egg samples were weighed and broken and after then albumen and yolk height and width, pH, Haugh Unit (HU), weight loss and specific gravity, and yolk albumen index were measured shown a clear negative effect. The storage time of eggs had not affected on the weight loss, specific gravity, yolk and albumen index and HU. Total eggs were randomly divided into 7 groups according to hen age. The average egg weight reduced by 3.78% (p<0.05) and HU reduced from 95.61±5.39 to 79.96±9.64 (p<0.05). The emulsifying activity index (EAI) and emulsion stability index (ESI) show the highest value at group-4 significantly (p<0.05), respectively.
Muffin Development Using Blueberry Powder

Seung Jo Lee*, Bo Kyeung Chung, Sea Cheol Min
Department of Food Science and Technology, Seoul Women’s University, Korea

Muffin was developed using blueberry powder. Blueberry was freeze-dried at -70°C and 750 mmHg and milled to prepare powder. Muffin formulation contained flour (36.5%), egg (7.3%), vegetable oil (14.6%), milk (25.5%), sugar (14.8%), salt (0.4%), and baking powder (0.9%). The concentrations of blueberry powder in the muffin formulation were 0, 5, 10, and 15% (w/w). Effects of ratio of flour and blueberry powder on the texture, color, and sensory properties were evaluated. As the concentration of blueberry powder increased, hardness increased while gumminess and chewiness decreased (p<0.05). Springiness, cohesiveness, and resilience were not significantly different among the muffin samples with different blueberry powder concentrations. The Hunter L and b values of crust and muffin crumb decreased as the concentration increased, while their Hunter a values decreased. Blueberry powder concentrations of 5 and 15% resulted in high preference in taste, texture, and overall acceptability. Muffin with good sensory properties was able to be developed using blueberry powder.

Hydration Properties and Dynamic Oral Processing of Backsulgi Formulated with Dry-milled Rice Flour

In-Young Lee*, Hyo-Rim Seo, Weon-Sun Shin
Laboratory of Food Chemistry & Culinary Science, Department of Food & Nutrition, Hanyang University, Korea

Traditional rice flour requires multiple steps, soaking, swelling, milling, which are not easily made at home, this wet-milled has short shelf-life and inconvenient distribution. This study evaluated hydration properties of dry-milled rice flour fractionated with three different particle sizes and textural properties of backsulgi, resulting in three flours with different properties. The dry-milled flour is superior in aspect of longer shelf-life enabling easier distribution and retail opportunity. The work conducted also includes optimizing rice cake recipes in terms of texture and sensory properties. The result showed that WHC increased with the particle size decreased from 42.2 to 49.3 μm, indicating more opportunity of water absorption due to the increased surface area. Addition of sugar increased WHC in dry-milled rice flour composed of the smallest particles. As for sensorial properties, sponginess and lightness of the rice cakes prepared with dry-milled rice flours significantly increased, but stickiness and adhesiveness decreased. We confirm that increased water content led to an increase in volume of rice cakes, and subsequently provided a soft texture to the rice cake.

Quality Characterization of Microwave Vacuum Drying of Shiitake Mushroom (Lentinula edodes)

Yunhye Oh1*, Gyoung Choi1, Seonghee Myeong2, Soyoung Kim1, Eunhye Jo1, Jeongsu Park1, Heejeong Chae1,2
1Hoseo University, Korea, 2Natural Choice Co., Ltd., Korea

The quality characteristics including color and sensory characteristics, re-hydration ratio, and microstructure of dried shiitake mushroom using microwave vacuum drying were examined. Hot-air drying and vacuum freeze drying were used for comparative study. The drying time for microwave vacuum drying, hot-air drying and vacuum freeze drying were 110 min, 4 h and 48 h, respectively. Sensory characteristics including color, flavor, texture, shape and overall preference of the mushroom were evaluated and it was found that there were significant differences in quality characteristics depending on the drying method. The vacuum freeze drying showed the worst quality characteristics whereas hot-air drying showed the worst quality characteristics. The color characteristics of pileus were measured by color-meter, the lightness (L-value) of microwave vacuum dried mushroom did not show a significant difference compared to non-dried mushroom. The mushroom was dried by microwave vacuum drying, hot-air drying and vacuum freeze drying. As a result, re-hydration ratio of microwave vacuum dried mushroom was lower than that of vacuum freeze drying, and higher than that of hot-air drying.

Physico-chemical and Antioxidant Properties of Infused Tea from Amaranth Leaves by Different Roasting and Steaming Conditions

Seung-Joo Lee*, Sang-Heung Lee
Department of Culinary and Food Service Management, Sejong University, Korea

To verify the possible of manufacturing a Amaranth leaf tea, Amaranth leaf was roasted and steamed each of them once and three times at 200°C for 4 min of roasting, 20°C for 3 min of steaming after which their total polyphenol, flavonoid and sensory characteristics were compared. The total polyphenol, flavonoid, and proanthocyanidin content of Amaranth leaf tea increased 1st roasting, the DPPH, ABTS radical scavenging ability increased 1st steaming. Furthermore, the total poly phenol, flavonoid, and proanthocyanidin content of increased 3rd steaming, the DPPH, ABTS radical scavenging ability increased 3rd steaming. Moreover, the lightness of chromatricity increased as the roasting, the yellowness of chromatricity as the steaming and redness of chromatricity tended to increase as the heat treatment more. Additionally, the turbidity and brownness index of the Amaranth leaf increased as the 3rd roasting. Evaluation of the sensory characteristics of the Amaranth leaf tea increased each of 1st roasting and 1st steaming as color, mouth feel, and sweetness.
Quality Characteristics of Jochung Added Jerusalem Artichoke Powder

Seung-Joo Lee*, Aye-Jin Lee
Department of Culinary and Food Service Management, Sejong University, Korea

This study was performed to investigate the effect of Jerusalem artichoke powder on the quality characteristics of jochung. Jerusalem artichoke powder was added at 0% (JA0), 4% (JA1), 8% (JA2), 12% (JA3), and 16% (JA4) to improve functional properties of jochung. Content of crude protein, crude ash, moisture content, pH, DPPH radical scavenging activity, fructan and polyphenol increased with increasing amount of Jerusalem artichoke powder, while viscosity, color and soluble solids contents decreased. Jerusalem artichoke powder contained free sugar contents of maltose and fructose. The maltose was 21.08% in JA0 and 34.48% in JA4. The fructose was 0.05% in JA0 and 0.29% in JA4. The overall sensory preference score was JA1 the highest. JA0 was attach castle 6.43, viscosity 6.53. The aftertaste was JA0 the highest, JA4 the lowest. The optimal concentration of Jerusalem artichoke powder was found in the range of 4-8%.

Quantitative Comparison of WDEIA-causing Allergen from Korea-homegrown and Imported Wheat Grains

Nam Taek Lee*, Namhyun Chung1, Young Sig Park, Pyo June Pak1, Ju Hee Kim1
Functional Food Research Center, College of Life Science & Technology, Korea University, Korea, 1Department of Biosystem Engineering, College of Life Science & Technology, Korea University, Korea

Gluten proteins composed of gliadins and glutenin subunits play a major role in preparing bread, noodle and other types of food made of flour. However omega-5-gliadin, one of the wheat gluten subunits, was characterized as a major allergen of wheat dependent exercise induced anaphylaxis (WDEIA), Bakers' asthma and other types of food allergy. To analyze the allergen factor responsible for WDEIA, gluten proteins from homegrown and imported wheat grains were extracted and applied to the SDS-PAGE. And the amount of each ω-5-gliadin was analyzed and compared. Among 10 samples (7 imported species and 3 homegrown species), the amount of ω-5-gliadin prepared from Ko-so wheat species, a Korean habitat, showed the lowest level, equivalent to 88% that of NS/DNA. The preliminary results slightly, but not clearly, back up the claims of many Koreans who have experienced less allergic symptoms after taking meals prepared from Korean homegrown wheat.

Physiochemical and Nutritional Characteristics of Glycated-fish Protein Hydrolysates

Hyeonjin Jeon*, Yoonsook Kim
Korea Food Research Institute, Korea

This study was conducted to investigate physiochemical and nutritional characteristics of glycated-fish protein hydrolysates (GFPH). From four GFPHs with different molecular weight, the production yield and browning index were high in GFPH from under 5 kDa. Slightly higher palatability of sensory evaluation was noted in GFPHs from low molecular weight when compared with high molecular weight. A dynamic characteristics measured storage modulus (G`) and loss modulus (G") increased as the frequency increase and G' presented higher value than G". As concentration of GFPH decrease, values for the surface tensions were increased but density did not show consistency. The emulsifying capacity of GFPH improved from 2.41% of FPH to 28.79%, emulsifying stability and the solubility of GFPH were higher than those of FPH. Foaming stability was also increased by glycation of fish protein hydrolysates. Burnt smell and fishy smell were not significantly different among all samples. The palatability was correlated with fishy smell and meaty smell even though there were no significances between GFPH and FPH. GFPH has a potential application as an additives, functional materials.

Effect of Cooking on Pigments and Antioxidants of Daraesoon

Jeongha Kim*, Haecheon Ahn, Jungin Kim1, Eunok Choe
Inha University, Korea, 1Inje University, Korea

Dried daraesoon (shoot of Siberian gooseberry tree, Actinidia arguta Planchon) is rehydrated to cook as namul. Heating for cooking may change its useful components and health functionality. This study evaluated the antioxidants (polyphenol, flavonoids, and tocopherols) and pigments (chlorophylls and carotenoids) of daraesoon during cooking. Dried daraesoon was pretreated by soaking in water (16 h), boiling (30 min), and infusing (1 h). It then was heated for 10 or 20 min in a 180°C oven with or without perilla oil. Polyphenols and flavonoids were determined by spectrophotometry. Tocopherols, chlorophylls, and carotenoids were quantified by HPLC. Pretreatment significantly decreased polyphenols from 13.32 g/kg to 44.26 g/kg and flavonoids from 1.15 g/kg to 6.63 g/kg in daraesoon, however, it increased tocopherol and chlorophyll contents. Heating increased polyphenol, tocopherol, and chlorophyll contents, and perilla oil addition further increased them. On the other hand, flavonoid, chlorophyll, and carotenoid contents decreased by heating. The results strongly suggest that health functionality of daraesoon namul may be improved by appropriate heating and perilla oil addition.
Citral Degradation in Micelles Made of Polyoxylethylene Alkyl Ether-type Surfactants

Sung Joon Park*, Chi Rac Hong, Seung Jun Choi
Department of Food Science and Technology, Seoul National University of Science and Technology, Korea

In aqueous solution, surfactant-made micelles could control the rate of chemical degradation of poorly water-soluble food flavors. To evaluate how the molecular structure of surfactant has an influence on the chemical degradation rate of food flavor, micelles were prepared with polyoxylethylene alkyl ether-type surfactants that had very similar molecular structure with various hydrophilic head sizes and hydrophobic tail lengths. The chemical degradation of citral in micelles was found to be highest in acidic condition. There was no significant difference in the chemical degradation rate of citral in micelles in non-acidic conditions, regardless of the hydrophilic head size or hydrophobic tail length. Polyoxylethylene alkyl ether-type surfactants with larger hydrophilic heads retarded the chemical degradation of citral in an acidic environment with relatively high effectiveness, indicating that the length of the hydrophobic tail rarely influenced the micelle’s ability to chemically stabilize citral.

Physicochemical Properties of Barley Grown in Jeju and Optimization of β-Glucan Extraction

Hyo Jin Kim*, Hyun Jung Kim
Department of Food Science & Technology, Korea National University of Transportation, Korea

Barley is an excellent source of the soluble dietary fiber, β-glucan. However, the physicochemical properties including β-glucan characteristics of barley grown in Jeju have not been studied. This study investigated the physicochemical properties of barley varieties grown in Jeju and the characteristics of β-glucan after determining the optimum extraction condition. Jeju naked barley contained greater amount of starch and total dietary fiber than other varieties of barley. β-Glucan contents of Jeju naked barley and Jeju beer barley were 8.63% and 4.95%, respectively. β-Glucan was extracted at 45, 55, 65, and 75°C for 3 h. The β-glucan yield of Jeju naked barley at 45, 55, 65, and 75°C was 71.0, 73.7, 83.5, and 66.6%, respectively, and that of Jeju beer barley was 64.8, 71.3, 69.6, and 65.3% respectively. β-Glucan in Jeju naked barley and Jeju beer barley was greatly extracted at 65 and 55°C. These results suggested that the barley grown in Jeju containing high amount of β-glucan presented different physicochemical properties and there was an optimum temperature for the extraction of β-glucan so that possibly applying develop various types of food products with health benefits.

Response Surface Methodology (RSM) to Optimize Accelerated Solvent Extraction (ASE) of Lutein and Neoxanthin in Paprika Leaves

So Hee Yoon*, Jae-Hyun Kang, Jo Won Lee, Bo Ra Kim, Tong Lee, JiHyun Park, BoKyung Moon
Department of Food and Nutrition, Chng-Ang University, Korea

Paprika has been widely cultivated in Asia, Africa and Mediterranean countries and recently, the use of it is increasing. We aimed to identify the optimum conditions for the extraction of lutein and neoxanthin from paprika leaves using response surface methodology (RSM), and achieve improved analytical resolution and sensitivity between lutein and neoxanthin using an ultra performance liquid chromatography (UPLC) system. The optimized method employed; For lutein, 79.63% ethanol as the extraction solvent, 93.26°C as the temperature and 5 min of static time; For neoxanthin, 100% ethanol as the extraction solvent, 139.04°C as the temperature and 3.57 min of static time. The adjusted coefficient of determination (R²) for the lutein extraction model was 0.9518. The probability value (p) for lutein analysis was 0.000 which demonstrated a high significance for the regression model. R² value for neoxanthin was 0.7891 and the probability value was 0.199. Under the conditions used in this experiment, the mean extraction yield of lutein and neoxanthin were 232.60 μg/g and 46.89 μg/g, respectively.

Propyl Gallate Inhibits Adipogenesis in Human Adipose Tissue-derived Mesenchymal Stem Cells

Ung-Kyu Choi*
Department of Food Science & Technology, Korea National University of Transportation, Korea

Propyl gallate (PG) used as an additive in various foods has antioxidant and anti-inflammatory effects. Although the functional roles of PG in various cell types are well characterized, it is unknown whether PG has effect on stem cell differentiation. In this study, we demonstrated that PG could inhibit adipogenic differentiation in human adipose tissue-derived mesenchymal stem cells (hAMSCs) by decreasing the accumulation of intracellular lipid droplets. In addition, PG significantly reduced the expression of adipocyte-specific markers including peroxisome proliferator-activated receptor-g (PPAR-g), CCAAT enhancer binding protein-a (CEBP-a), lipoprotein lipase (LPL), and adipocyte fatty acid-binding protein 2 (aP2).
Quality Characteristics of Cheonggukjang Prepared with Germinated Soybeans by the Addition of Smoking Process

Ung-Kyu Choi*
Department of Food Science & Technology, Korea National University of Transportation, Korea

This study was investigated to changes in quality characteristics of cheonggukjang made with germinated soybeans which is produced by the addition of smoking process. The L value of smoked cheonggukjang made with germinated soybean (SGS) was higher than that of non-smoked cheonggukjang made with non-germinated soybean (NCNS) and non-smoked cheonggukjang made with germinated soybean (NCGS). The a value of NCNS was highest followed by NCGS and SGS. The b and \( \Delta T \) value was similar compared to the L value. The amino acid of NCGS was significantly decreased compared to NCNS, whereas no remarkable difference in amino acid content was observed in NCGS and SGS. The moisture content of NCGS was increased more than 8% compared to that of NCNS. The moisture content of SGS showed significantly decreased compared to NCGS, whereas the moisture content of SCS was higher than NCS. The viscous substances content of SGS was significantly increased compared to NCNS. No remarkable difference in viscous substances content was observed in NCGS and SGS. The number of aerobic bacteria in SGS was significantly decreased compared to NCGS.

Changes in Taste Component of Cheonggukjang Prepared with Germinated Soybeans by the Addition of Smoking Process

Hwa-Young Park*, Ung-Kyu Choi
Department of Food Science & Technology, Korea National University of Transportation, Korea

This study was investigated to find out changes in taste components of cheonggukjang made with germinated soybeans which is produced by the addition of smoking process. The total organic acid content of smoked cheonggukjang made with germinated soybean (SCGS) was four times higher than that of non-smoked cheonggukjang made with non-germinated soybean (NCNS), whereas the total organic acid contents of SGS was lower than that of non-smoked cheonggukjang made with non-germinated soybean (NCGS). The total free sugar content of SGS and SGC was about three times higher than that of NCNS. The total free amino acid content of NCGS was significantly decreased compared to that of NCNS. The content of essential amino acids of SGS showed a significantly increased compared to that of NCNS. The ratio of glutamic acid to the total free amino acid in NCNS and SGS was 19.6%. The sensory evaluation in appearance, aroma, taste, and overall quality of SGS was significantly increased compared to that of NCNS and NCGS. These results suggest that smoked cheonggukjang with germinated soybean could be utilized usefully for the development of the novel fermented food.

Changes in the Crude Fat and Phytosterol Contents and Fatty Acid Composition of Waxy Corn Kernels during Ripening

Mi-Jung Kim*, Sun-Lim Kim¹, Yu-Young Lee, Beom-Young Son, Jin-Seok Lee, Gun-Ho Jung, So-Young Kim, Hyo-Jin Park
Department of Central Area Crop Science, NICS, RDA, Korea, ¹National Institute of Crop Science, RDA, Korea

This study was conducted to investigate the crude fat and phytosterol contents and fatty acid composition of waxy corn, Ilmichal and Heukjinjuchal, during ripening stage. Crude fat content of waxy corn was increased as matured \((p<0.05)\). Ilmichal has higher crude fat content than Heukjinjuchal. Phytosterol in unsaponifiables were mainly composed of \( \beta \)-sitosterol, stigmasterol and campesterol. The contents of all phytosterol components were increased according to ripening. Phytosterol composition in unsaponifiables of waxy corn observed varietal difference. A slightly higher amount of stigmasteryl was reported in Ilmichal as compared to Heukjinjuchal. Fatty acid were mainly composed of palmitic acid (C16:0), oleic acid (C18:1) and linoleic acid (C18:2). Fatty acid composition was showed a significant change according to ripening. The composition of palmitic acid and linoleic acid were decreased according to maturation, but oleic acid composition was increased.

Variation of Globulin Composition and Its Relationship with Processing Properties in Korean Soybean Varieties

Mi-jung Kim*, Sun-lim Kim¹, Mi-yeon Lee, Hyo-jin Park, Choon-ki Lee, Jeom-sig Lee, Areum Chun, Mi-ra Youn, Ji-eun Kwak, Jang-hee Lee, Wook-han Kim
Department of Central Area Crop Science, NICS, RDA, Korea, ¹National Institute of Crop Science, RDA, Korea

This study was conducted to investigate the subunit composition of glycinin and \( \beta \)-conglycinin in Korean soybean varieties and its processing properties, because the glycinin (11S globulin) and \( \beta \)-conglycinin (7S globulin) composition of soybean have been reported to correlate with processing properties. The subunit composition of glycinin and \( \beta \)-conglycinin isolated from 33 varieties were analyzed by capillary electrophoresis system. The 11S compositions of soybean varieties were 57.8-80.1%, and the 7S compositions were 18.2-39.8%. The peak viscosity of the soybean varieties using the Rapid Visco Analyser (RVA) has positive correlation between crude protein contents, acidic subunit and glycinin composition \((p<0.05)\). There was a linear relation between crude protein contents and hardness of tofu in soybean varieties \((p<0.05)\). In the textural characteristics of tofu from the soybean varieties, hardness, adhesiveness, springiness, chewiness and gumminess were observed positive correlation with \( \alpha \) subunit of \( \beta \)-conglycinin composition. While acidic subunit composition of glycinin showed a negative correlation with adhesiveness and cohesiveness.
Proximate Analysis of Soybean Sprouts by the Parts and Cooking

Kyongae Lee*, Sungpyo Kim, Yongho Kim
Soonchunhyang University, Korea

Germination of soybean is a simple and low-cost, relatively easy to produce. Utilization of soybeans in germinated form has been limited in the West, but small-seeded legume sprouts are increasing in popularity. Germination increases the digestibility of protein and starch, and overcome anti-nutritional factors. Soy sprout is well accepted that diet can affect health by various mechanisms. Dietary factors are attracting a lot of interest and increased consumption of soy sprouts is expected. Therefore, the evaluation of nutritive values in different parts and with cooking of soy sprouts needed. Soybean sprouts with different seed coat colored soybean cultivars were cultivated for five days and then separated into its components of head (cotyledon) and stem (hypocotyl) without hair root. The resulting soybean sprout samples were used for chemical constituents analysis. Carbohydrate, protein, lipid and ash were found more, while moisture found lesser, in the cotyledon than in the hypocotyl of fresh soy sprout, regardless of the soybean cultivars. There was only a small difference between the fresh and the cooked soy sprouts in chemical compositions.

Antioxidant Capacities of Pre-Germinated and Germinated Pigmented Rice (Oryza sativa L. Cv. Heukjinju and Keunnunjami)

Soo Im Chung*, Lara Marie Pangan Lo, Yao Cheng Zhang, Su Jin Nam, Xingyue Jin, Mi Young Kang
Kyungpook National University, Korea

The antioxidant potential of the pre-germinated and germinated newly cultivated purple coloured rice samples Heukjinju (HJ) and Keunnunjami (KJ) are investigated in this study. Powdered rice grain samples were extracted with 80% methanol and their corresponding Fe2+ Chelating Ability(Fe2+), Reducing Power (RP), 2,2'-azinobis[3-ethylbenzthiazoline]-6-sulfonic acid (ABTS) Radical Scavenging and Superoxide Dismutase (SOD) Activity were determined. Results showed that after the 72 h germination period, both rice samples have enhanced antioxidant capacities. KJ has higher Fe2+ Chelating Ability (91.55±0.26%), RP (0.99±0.01), ABTS Scavenging Activity (139.83±0.83 mg AEAC/g) and SOD (78.22±0.73%) as compared to their parent, HJ. In addition, the 1, 1-Diphenyl-2-picrylhydrazyl (DPPH) and Hydroxyradical (OH) Scavenging Activity effective concentration at 50% (EC50) were determined and KJ showed lower values than HJ indicating that even at lower temperatures, KJ can already exhibit antioxidant activities than its parent HJ. With these results at hand, these pigmented rice varieties can be further to develop not only as nutritious food but also as food with medical benefits.

Effect of Different Pretreatments on Thermoluminescence Characteristics of Starch Exposed to E-beam and X-ray

Hyun-A Nam*, Hyun-Kyu Kyung, Song-Yi Gu, Gui-Ran Kim, Joong-Ho Kwon
School of Food Science and Biotechnology, Kyungpook National University, Korea

Starch is one of various food items allowed for food irradiation to control microbes and insects in Korea as well as Codex standard. Recently, electron beam and X-ray are replaced γ-ray as irradiation source by consumers' acceptance. Thermoluminescence (TL) technique, that is one of identification methods for irradiated food, has demonstrated its applicability to various foods as detection markers. Thus, separating marker minerals from food is essential for TL analysis. Accordingly, the current density separation (DS) with a limited efficiency was compared to acid (AC) and alkali hydrolysis (AK) separations for starch samples irradiated with e-beam and X-rays (0, 1, 5, and 10 kGy) by analyzing their TL glow curves and TL ratios (TL1/TL2). DS-treated starch showed unclear glow curves irrespective of radiation sources and doses. But, TL glow curves of AC-treated starch could be identified between non-irradiated and irradiated samples at any doses and sources, and in case of AK only 10 kGy-irradiated starch was possibly identified. From the results, AC has potential as an alternative to the current official pretreatment (DS) in TL analysis for starch treated with E-beam and X-rays.

Comparative Analysis of the High-value Bioactive Components of Pre-germinated and Germinated Pigmented Rice (Oryza sativa L. Cv. Heukjinju and Keunnunjami)

Lara Marie Lo*, Soo Im Chung, Yao Cheng Zhang, Xingyue Jin, Mi Young Kang
Kyungpook National University, Korea

This study sought to investigate the variation of the quantities of the major bioactive compounds between pre-germinated and germinated newly developed purple pigmented rice cultivar, Heukjinju (HJ) and Keunnunjami (KJ) in South Korea. Powdered rice samples were subjected to γ-aminobutyric acid (GABA) analysis and High Performance Liquid Chromatography (HPLC) analysis. Results revealed that germination process enhanced GABA quantities by more than 10-fold. Total γ-oryzanol and ferulic acid contents also doubled after 72 h germination period with KJ having the higher quantities than its parent HJ. Germination also increased the total tocopherol and tocotrienol homologues contents by ≥2-folds, but are present only in minute amounts in both rice cultivars. In both rice samples, δ-tocopherol is not detected. The analysis of these bioactive compounds indicates the possibility of these newly developed pigmented rice samples to be considered as nutraceutical foods and as a better alternative to the commonly consumed white rice with health benefits.
Improvement of the Lipid Oxidative Stability of Yakgwa, Korean Traditional Fried Dessert

Eunok Choe*, Boyoung Oh, Kyungae Lee
Inha University, Korea, Sunchunhyang University, Korea

Yakgwa is a Korean traditional dessert which provides sweet and rich taste. It is made mainly from honey, sesame oil, and wheat flour, and its quality largely depends on the degree of lipid oxidation due to high content of oil and frying. This study was performed to improve the storage stability of yakgwa by addition of food materials having potential anti-oxidative activities. Yakgwa was made with wheat flour (100 g), glutinous rice flour (100 g), sugar syrup (50 g), soju (40 g), sesame oil (38 g), and the dough was fried in soybean oil. Cinnamon, ginger, or gardenia seed powder was added at 2.5% of the wheat and rice flour. Yakgwa samples were stored at 30°C in the dark, and the lipid oxidation was evaluated by peroxide, conjugated dienoic acid, and p-anisidine values. Pigments and antioxidants were also monitored during storage. Addition of ginger or gardenia seed powder decreased lipid oxidation and degradation of polyphenols, tocopherols, and lignans of yakgwa and the frying oil oxidation. Addition of cinnamon showed little effect. The results suggest that the storage stability of yakgwa and its health potential could be improved by the addition of ginger and gardenia seed.

Quality Improvement of Robusta Coffee by Germination and Enzyme Treatment for Green Coffee Bean

Hye-Min Kwon*, Seung-Min Oh, Seung-Kook Park
Department of Food Science and Biotechnology, Kyung Hee University, Korea

The world production of Robusta coffee accounts for 25% and it is primarily used for instant coffee and blending with Arabica coffees. Majority of Robusta’s flavor are described as harsh, rubbery, and bitter. The aim of this study was to develop a new method for improving the flavor quality of Robusta coffee by gentle germination of Robusta green coffee beans (RCCBs). Two different treatment methods were developed to germinate or hydrolyze RCCBs; soaking followed by germination (G) or germination with enzyme addition (E). After germination, the non-volatile compounds in green coffee bean including carbohydrates, free amino acids, caffeine and chlorogenic acids were analyzed by HPLC and UPLC. The volatile aroma compounds in roasted coffee were analyzed by SPME-GC-MS. Both sucrose and glucose levels were decreased in G group and sucrose level was further decreased in E group. Most of the free amino acids were increased for both treated coffee beans. Undesirable flavor compounds that include 1-methylpyrrole, pyridine, 4-ethyl-2-methoxyphenol, and 2-methoxy-4-vinylphenol were significantly decreased, whereas desirable compounds were significantly increased in the treated coffee bean.

Volatile Aroma Compounds and Sensory Characteristics of Instant Coffee Mix

Hye-Min Kwon*, Ji-Sook Min, Seung-Kook Park
Department of Food Science and Biotechnology, Kyung Hee University, Korea

Instant coffee is usually consumed in the form of coffee-mix, which contains coffee creamer, dried skim milk, and sugar in addition to soluble coffee powder. It is less palatable than freshly brewed coffee, however, it is widely consumed in Asia and European countries due to the convenience. The aim of this study was to investigate the volatile aroma compounds of instant coffee mix with coffee creamer or dried skim milk. Eight different commercially available coffee mix were chosen in this study. SPME-GC-MS analysis showed that the addition of coffee creamer and dried skim milk suppressed overall volatilities of black instant coffee aroma; the level of 2-furfuryl acetate was reduced, whereas 1-methyl-1H-pyrrrole, benzaldehyde, and ethyl pyrazine were increased in the coffee-mix compared to that of black coffee alone. Sensory evaluation indicated that the flavor intensity of coffee-mix was decreased than that of black coffee alone. Both coffee creamer and dried skim milk had little distinctive aroma, but they significantly contributed to the flavor profile of coffee-mix, suggesting that both of them were acted as flavor modifiers in coffee mix.

Quality Improvement of Brazilian Coffee by Germination and Enzyme Treatment of Green Coffee Bean

Hye-Min Kwon*, Aram Min, Seung-Kook Park
Department of Food Science and Biotechnology, Kyung Hee University, Korea

Although Brazil is the world’s major coffee producer with about 35% of all coffee production, Brazilian coffee is usually considered as low quality compared to other Arabica coffee. Germination changes the compositions of green coffee, which leads to the changes of aroma precursors. Therefore, the aim of this study was to improve the flavor quality of Brazilian coffee by germination (G sample) and enzyme treatment (E sample). After germination, the levels of sucrose were decreased in both samples, and glucose was decreased only in the G sample, but was significantly increased in the E sample. The levels of total free amino acids were doubled in both samples due to the germination. HS-SPME-GC-MS results showed the reduction of undesirable flavor compounds such as 2-furanmethanol and pyridine, and the enhancement of desirable aroma compounds such as furfuryl acetate and 3-methylbutan-1-ol. Some desirable flavor compounds were newly produced including 2,3-dimethylpyrazine and tetramethylpyrazine. In this study, we demonstrate a new technology that can improve the flavor quality of Brazilian coffee by easy and simple pretreatment of green coffee bean prior to roasting.
Effect of Cooking Condition for Some Vegetables on Textural and Antioxidant Properties

Hyun-Jung Ko*, Tian Yu Sun, Jung-Ah Han
Department of Foodservice Management and Nutrition, Sangumyung University, Korea

Effect of cooking condition on hardness and antioxidant activity of carrot and balloon flower were studied. First, the cooking condition was determined by three-categorized hardness values: high (>5,000 g), medium (3,000-5,000 g), low (<1,000 g). At each cooking condition, the antioxidant activity (1,1-diphenyl-2-picrylhydrazyl, DPPH) was measured. For Balloon flower, the high hardness was obtained by boiling 1 min, and medium and low hardness were obtained by boiling 5 and 11 min, respectively. The highest antioxidant activity (54.9%) was obtained at 11 min boiling. In the case of carrot, high hardness was obtained by 8 min boiling, and medium and low values were obtained by 14 and 23 min, respectively. Carrot also showed increased antioxidant activity by longer cooking time, the highest was 69.8% at 8 min, and 78.9% at 23 min boiling, respectively. This findings are especially good for the people who has masticatory dysfunction such as elderly, and more database needs to be established for texture softening with higher antioxidant properties.

Intrinsic Polyphenol Oxidase-like Activity of Gold@Platinum Nanoparticles

Jo-Won Lee*, Bo-Ra Kim, So-Hee Yoon, Tong Li, Jihyun Park, BoKyung Moon
Department of Food and Nutrition, Chung-Ang University, Korea

Metal nanoparticles (NPs) have received considerable attention in recent years because of their unique properties and potential applications in catalysis. However, few studies have employed an integrated approach to investigate the enzyme mimetic activities of metal NPs. The aim of the present study was to evaluate the polyphenol oxidase (PPO) mimetic activity of gold@platinum (Au@Pt) NPs. Using electron spin resonance (ESR), we determine the oxygen consumption during autoxidation of phenols substrates and apple juice. The resolution of the super hyperfine structure of the low-field ESR line of CTPO is dependent on the oxygen concentration in the solution. The time-dependent increase in super hyperfine splitting indicates the disappearance of oxygen in the solution. The presence of Au@Pt NPs increased the oxygen consumption rates of pyrogallol, L-DOPA and catechol, which confirms the catalytic role of Au@Pt NPs in the autoxidation of these phenols substrates. Also, we determined the catalytic activity of Au@Pt NPs in the apple juice. Au@Pt NPs resulted in a significant increase in the ESR signal compared with ESR signal observed when AA was present.

Effect of Different Cooking Methods on Phytochemical Content and Antioxidant Activity in Petasites japonicas Stem and Colocasia esculeta (L.) Schott Root

Jinwoo Yang*, Minhong Shin, Hye Min Han¹, Jaemin Lee, Jiyoung Jeon, Junsoo Lee
Brain Korea 21 Center for Bio-Resource Development, Division of Animal, Horticultural, and Food Sciences, Chungbuk National University, Korea, ¹Department of Agrofood Resources, National Academy of Agricultural Science, Rural Development Administration, Korea

In this study, Petasites japonicas Stem and Colocasia esculeta (L.) Schott Root consumed in Korea were analyzed for phytochemical content and antioxidant activity to determine the effect of different cooking methods including Blanching, boiling, steaming, and microwaving. The results of study revealed that cooking cause a significant decrease in the vitamin C content. In case of P. japonicas stem, there was significant increase of bioactive compounds including total polyphenol, total flavonoid, vitamin E, and β-carotene by cooking. However, steaming of P. japonicas stem decreased polyphenol contents. Contents of vitamin E and β-carotene of C. esculeta (L.) Schott Root was significantly decreased by all cooking methods. On the other hands, microwave treatment increased total polyphenols and total flavonoids contents. These bioactive compounds showed positive correlation with the antioxidant capacity. The overall results of this study reveal that cooking of plant based foods may cause changes of bioactive compounds and it depends on the different cooking methods.
Different Pretreatments Affect Thermoluminescence Responses of Irradiated Feldspar with E-beam and X-ray

Hyon-Kyu Kyung*, Hyun-A Nam, Kashif Ameer, Gui-Ran Kim, Haeng Mi Byeon, Joong-Ho Kwon
School of Food Science and Biotechnology, Kyungpook National University, Korea

Feldspar, standard marker minerals for thermoluminescence (TL) analysis, was irradiated with electron beam and X-ray (0, 1, 5, and 10 kGy) to determine the effect of different pretreatments [density separation/DS (DW/ambient)], acid hydrolysis/AC (6 N HCl/90°C/1 h), alkali hydrolysis/AK (80% KOH /90°C/1 h)]. TL glow curves (TL1) of treated feldspar were measured and were normalized through a re-irradiation at 1 kGy (TL ratios, TL1/TL2). Glow curves of non-irradiated feldspar showed peaks at around 390°C under all pretreatments. However, glow peaks of irradiated feldspar with both sources showed in range of 163-207°C irrespective of pretreatments, which were found within the positive range of 150-250°C for irradiated samples (Codex Standards). TL ratios verified above results indicating<0.1 (negative) for non-irradiated and >0.1 (positive) for irradiated feldspars. The order of TL intensities of irradiated feldspar was 2.83×10^5-2.09×10^5 in DS > 8.49×10^4-8.19×10^4 in AK > 7.47×10^4-8.18×10^5 in AC. Conclusively, DS and both hydrolysis were found applicable as pretreatments for successful TL analysis, even if marker minerals are subjected to thermal conditions during AC and AK.

Effects of Ultrasonic-assisted Extraction on Antioxidant Activities and Total Phenolic Compounds from Curcuma (Curcuma longa) Rhizome by Different Concentration of Ethanol

Tran Van Cuong*, Koo Bok Chin
Department of Animal Science and Functional Food Research Center, Chonnam National University, Korea

This study was performed to investigate the antioxidant activities and total phenolic compounds (TPC) from Curcuma longa rhizome with various grades of ethanol in combination with two factors of ultrasonic-assisted extraction (UAE) of time and temperature. These results showed that the possible influence of extracting solvents and UAE conditions on TPC and antioxidant activities in this plant. As the results, UAE was increased with increasing ethanol concentration, reach the highest in ethanol 80% extract, and decreased at pure ethanol whereas distilled-water showed a lowest. However, antioxidant activities of ethanol 50% were higher than those of other grades. In addition, these results indicated that ultrasonic-assisted extraction (30-60 min) enhances the release of TPC into the solvents, which was significantly higher than those of conventional method for 24 h, moreover lower temperature extraction was better than those of UAE and antioxidant activities. In conclusion, this study indicated that ultrasonic-assisted extraction could be considered as a good technique to extract phenolic compounds and offers potential for maintain bioactivities with less time.

Effects of Germination on Phenolic Acid Content and Antioxidant Activity of in Brown Rice

Donghwa Cho*, Seung-Taik Lim
School of Life Science and Biotechnology, Korea University, Korea

Changes in phenolic acid content, associated enzymes (phenylalanine ammonia-lyase; PAL, and cell wall peroxidase; CW-PRX) and antioxidant activity of the shoot and grain parts of brown rice (BR), during germination (30°C, 4 days), were examined. The BR-shoot weight ratio did not change after one day of soaking, but increased during the four days of germination. Free phenolic acid content and PAL activity in BR shoots rapidly reached their maximum values on the second day of germination. Insoluble phenolic acid content, as well as CW-PRX activity, in the shoots increased continuously during germination. However, in the grain part of germinating seeds, both insoluble and soluble phenolic acids increased slightly. Overall antioxidant activity levels, as determined by an ABTS assay, increased during four days of germination. Furthermore, antioxidant activity in the shoots also increased significantly during the germination, and was closely related to the changes in bound phenolic acid content. The results suggest that the activities of PAL and CW-PRX involve the changes of free and bound phenolic acid levels during germination.

Bioactive Compound Contents and Antioxidant Activity in Purple Kohlrabi (Brassica oleracea L. var. Gongylodes) with Different Extracting Solvents

Linh Nguyen Thuy*, Eun-Sun Hwang
Hankyoung National University, Korea

Purple Kohlrabi is a member of Brassicaceae family which is known for its potential source of bioactive substances like glucosinolates, polyphenols and flavonoids. We investigated the content of these phytochemicals and antioxidant abilities in purple Kohlrabi. The fresh Kohlrabi was freeze-dried and extracted by water or 80% ethanol. Total phenolic and flavonoid contents in Kohlrabi extracts ranged from 7.27-11.60 mg gallic acid equivalent, 7.36-11.94 mg catechin equivalent in 1 gram dry weight. In general, the samples treated by 80% ethanol showed higher polyphenolic and flavonoid contents than water extracts. The inhibition of 2,2-diphenyl-1-picryl-hydrazyl (DPPH) and 2,2’-azino-bis-3-ethylbenzothiazoline-6-sulphonic acid (ABTS) radical scavenging activities of water and 80% ethanol extract at 5,000 mg/mL were 57.85% and 62.54%; 45.90% and 44.86%, following the exact order. At the same concentration extract, the reducing power ability of them was 14.60% and 15.25%, respectively. Overall, these results support that purple Kohlrabi contains bioactive compounds such as polyphenols, flavonoids and anthocyanins, which might contribute positive effects on human’s health.
Effect of Pressurized Hot Water Extraction on Amino Acid Composition of Ginseng Hydrolysate

Saravanan Periaswamy Sivaganam*, Yeon Jin Cho, Yang Bong Lee, Byung Soo Chun
Department of Food Science and Technology, Pukyong National University, Korea

Ginseng (*Panax ginseng* C. A. Meyer) is one of the most widely cultivated herbal products in Korea. This plant has been reported to harbour a variety of bioactive chemical compounds. Some of the over 900 naturally occurring non-protein amino acids, mostly from plant origin, can have beneficial effects as anti-carcinogens or by enhancing insulin production. In this regard, pressurized hot water extraction (PHWE) is an excellent choice for the production of extract with functional activity from ginseng. Therefore, the PHWE as green technology can be used for the extraction of ginseng functional compounds from ginseng stem and root hairs for safe and rapid methodology. The objectives of this study were to optimise the process of PHWE to increase yields of functional compounds, such as free amino acid and structural amino acids from different ginseng stems and root hairs. The different varieties of ginseng was treated with pressurized hot water extraction (PHWE) at temperature range of 180 and 240°C, while pressure vary between 15 and 32 bar for the desired temperature studied. The obtained PHWE of *P. ginseng* were investigated for their free amino acid and structural amino acids.

Activities of *Asiasarum* Radix Essential Oil Recovered by Supercritical CO₂ Extraction against Five Bacteria Causing Human Body Odor

A.S.M. Tanbirul Haque*, Jin Nam Moon, Saravanan Periaswamy Sivaganam, Yeon Jin Cho, Byung Soo Chun
Department of Food Science and Technology, Pukyong National University, Korea

Essential oils (EOs) from *Asiasarum heteropoids* were extracted by traditional solvent and Supercritical CO₂ (SC-CO₂) extraction method and evaluated their antioxidant activities along with antimicrobial and inhibitory properties against five human body odor producing bacteria (*Staphylococcus epidermidis*, *Propionibacterium freudenreichii*, *Micrococcus luteus*, *Corynebacterium jeikeium*, and *Corynebacterium xerosis*). In oil composition fifteen components were founds among them most abundant component was methyl eugenol (37.59%). EOs exhibited a strong antioxidant activity, highest ABTS⁺ and DPPH scavenging activity was 91.6±3.3% and 89.04±0.2% respectively at ethanol with hexane extraction. TPC and TFC high amount was 23.10±0.37, 4.90±0.09 mg/g respectively. In SC-CO₂ with ethanol at 200 bar/50°C was ethanolic under condition of 110°C for 10 min (*P. luteus*). The minimum inhibition concentration (MIC) for the oil against on bacteria ranged from 10.05±0.10 to 45.90±1.59 μg/mL. Against *M. luteus* lowest MIC was found. Methyl eugenol is one of the major factors which working against human body odor producing bacteria.

Identification of Characteristic Aroma-active Compounds from Acai Berry (*Euterpe oleracea*)

Seung Hee Lim*, Hyung Hee Baek
Department of Food Engineering, Dankook University, Korea

The objective of this study was to identify volatile compounds and aroma-active compounds from acai berry (*Euterpe oleracea*). Volatiles were isolated by liquid-liquid continuous extraction (LLCE) and high vacuum distillation using solvent assisted flavor evaporation (SAFE). The LLCE was carried out with acai berry juice (400 mL) plus deodorized distilled water (850 mL) and dichloromethane (250 mL) for 5 h. The SAFE was carried out with acai berry juice (150 mL) at 40°C and 8.6×10⁻⁶ torr. To identify characteristic aroma-active compounds of the acai berry, gas chromatography-mass spectrometry-olfactometry was used. The major volatile compounds of acai berry from LLCE were cis-3-hexenal, benzyl alcohol, linalool oxide, phenylethyl alcohol, maltol, 8-hydroxylinalool, vanillin, and α-3-oxo-iodon. The major volatile compounds of acai berry from SAFE were cis-3-hexenal, benzyl alcohol, linalool oxide, and phenylethyl alcohol. The aroma-active compounds of acai berry were cis-3-hexenal having green grass aroma, cis-linalool oxide having flower aroma, trans-linalool oxide having wood aroma, phenylethyl alcohol having rose aroma and vanillin having vanilla aroma.

Changes in Physicochemical Characteristics and Antioxidant Activity of *Helianthus tuberosus* L. Powder and Extracts Depending on the Roasting Temperatures

Hyun Jung Hwang*, Jeong Ah Park, Jeong In Choi, Sung Won Hur, Mi Sook Cho
Department of Nutritional Science & Food Management, Ewha Womans University, Korea

This study is carried out to evaluate the effects of the roasting temperature on the physicochemical characteristics and antioxidant activity of the *Helianthus tuberosus* L... *Helianthus tuberosus* L. were roasted for 10 min at 70, 90, and 110°C, were milled and extracted with hot water. The CIE L* (lightness) values were maximum at 90°C. Browning index and turbidity of the extracts were proportionally increasing with the roasting temperature. The pH of the extracts was decreased at the roasting temperature of above 90°C. The highest hydroxyl radical scavenging was found under condition of 70°C, roasted for 10 min (p<0.05). The highest total phenol contents and DPPH radical scavenging were roasted under condition of 110°C for 10 min (p<0.05). The results of this study showed that the roasted *Helianthus tuberosus* L. has antioxidant activity, and is considered to have significant health benefits.
Effects of Extrusion Process on Nutraceutical Components and Antioxidant Activity of Gastrodia elata Blume

Yu Ra Kang*, Soo Young Seo, Min Seung Kang, Ji Yeon Kim, Jin Hye Lee, Yoon Hyuk Chang
Department of Food and Nutrition, Kyung Hee University, Korea

The purposes of this study were to (1) investigate the changes in nutraceutical components of Gastrodia elata Blume during extrusion process and (2) elucidate the effects of extrusion process on the antioxidant activities of Gastrodia elata Blume. Gastrodia elata Blume was extruded in a twin screw extruder with four different zone 4 barrel temperatures (100, 110, 120, and 130°C). The quantities of gastrodin and vanillyl alcohol extracted from extruded Gastrodia elata Blume (EGB) were significantly higher than those extracted from non-extruded Gastrodia elata Blume (NGB). However, the quantities of 4-hydroxybenzyl alcohol and 4-hydroxybenzaldehyde extracted from EGB were not different from those extracted from NGB. Total polyphenol contents of EGB were significantly higher than those of NGB. Based on the results on DPPH radical scavenging activity, FRAP, ABTS radical scavenging activity and reducing power of EGB, it was found that the antioxidant activities of EGB were significantly higher than those of NGB. Furthermore, all the antioxidant activities of EGB were significantly elevated with increasing barrel temperatures from 100 to 130°C.

Characterization and Quantification of Policosanol in Tea Tree Leaves and Commercial Green Tea Products as Determined by GC-Tandem Mass Spectrometry

Sol Ji Choi*, Su Yeon Park, Ji Su Park¹, Hee Jeong Park, Ju Hui Kang, Je Young Shin, Sang Kyu Park², Mun Yhung Jung
Department of Food and Biotechnology, Graduate School, Woosuk University, Korea, ¹Korea Food Research Center, Korea, ²Department of Food Science and Technology, Nambu University, Korea

Policosanol is a mixture of bioactive long-chain aliphatic alcohols known to have a range of health promoting effects. Young leaves and old leaves (hard and turf leaves) of tea trees were hand-picked in two different seasons from a local farm. The contents and compositions of PCs in tea tree leaves greatly varied with harvesting seasons and type of leaves. The total contents of PCs in young leaves harvested in spring and autumn were 739 and 1,353 mg/kg on a dry weight basis, respectively. The total quantity of PCs in old leaves harvested in spring and autumn were 905 and 710 mg/kg, respectively. Octacosanol was the most predominant PC in young leaves harvested in spring. However, in young leaves harvested in autumn and old leaves harvested in spring and autumn, triacontanol was the most abundant PC. The total contents of PCs in commercial green tea leaves were in the range of 824-1,365 mg/kg. This represents the first report on the contents and compositions of PC in leaves of tea tree and commercial green tea products, showing unambiguous evidence of their potential as rich sources of PCs, health promoting bioactive components for functional foods and nutraceutical supplements.

Characterization of β-Lactoglobulin-fucoidan Conjugate through Maillard Reaction

Hyunwoong Park*, Weon-Sun Shin
Department of Food and Nutrition, College of Human Ecology, Hanyang University, Korea

β-Lactoglobulin [β-lg]-fucoidan conjugates were prepared through the Maillard reaction (60°C and 79% relative humidity for 96 h). Molecular characteristics of the β-lg-fucoidan conjugates were investigated using atomic force microscopy (AFM), circular dichroism (CD) spectroscopy, fourier transform infrared spectroscopy (FT-IR), differential scanning calorimetry (DSC) and dynamic light scattering measurements. AFM image showed that conjugates have nano-structure, regular spherical shape and generally large size than β-lg-fucoidan mixture. CD spectra and FT-IR showed that there were no changes in secondary structure, but tertiary structure of β-lg formed a slightly unfolded state, thereby exposing internal part of secondary structure, so β-lg formed a molten globule state during the 60°C heating stage. DSC exhibited fucoidan improving heat stability of β-lg molecule. The surface tension for fucoidan showed a slight decrease, while the other samples showed a more prominent decrease depending on pH condition resulting in a change in the surface charge.
**Characterization of Cricket (Gryllus bimaculatus) Chitosan and Its Application to Nanobeads**

Kyo-Sung Chae*, Weon-Sun Shin  
Laboratory of Food Chemistry, Department of Food and Nutrition, Hanyang University, Korea

Among edible insects, the field cricket (Gryllus bimaculatus) is commonly consumed as a food around the world. The nutritional quality of the cricket protein, fatty acids and chitin has been studied before. This study was performed to assess physicochemical properties of the chitosan extracted from crickets, and its potential use in the food industry. The degree of deacetylation (DA), FTIR spectra analysis, X-ray diffraction (XRD), molecular weight (Mw), SEM, color, pH, and zeta potential were measured. Finally, cricket chitosan nanoparticles (NPs) were prepared, and the optimal conditions (acetic acid concentration and addition of NaCl) identified. The results showed that the Mw of the cricket chitosan was lower than that of commercial chitosan; however DA, FTIR, and XRD analysis were similar to commercial chitosan. The particle size (208.27±3.47 nm), zeta potential (35.72±1.29 mV), PDI (0.27±0.03), count rate (255.92±3.23 kcps) for the cricket chitosan NPs were measured. Increased acetic acid concentration and NaCl volume reduced the cricket chitosan NPs size. As results showed, field crickets could be a novel source of chitosan for the food & pharmaceutical industry.

**Effect of Root Size on Flavor Quality of Ginseng Hydrolysate Obtained from Subcritical Water Extraction**

Su-Kyeong Moon*, Ji-Eun Yang, Saravana Periaswamy Sivagnanam, Byung-Soo Chun, Yang-Bong Lee  
Pukyong National University, Korea

Ginseng (Panax schinseng) is one of the most common functional ingredients in Oriental countries including Korean. The flavor contents in ginseng were proceeded by using subcritical water extraction and their flavor qualities were evaluated. Fresh ginseng was extracted using subcritical water at the condition of 180°C and 16 bar in order to measure flavor contents. Sensory evaluation of the extracts was done by using original extracts and 10 time dilutes. The sensory results and aroma analysis. These results may help to provide the basic data for applying super critical extracts of ginseng into industrial food ingredients.

**Toxicity Assessment of Genetically Modified Drought-tolerance Rice and Inserted Gene Product CaMsrB2 Protein**

Simyung Lee*, Wonhui Lee, Yunsoo Yeo, Seonwoo Oh, Sooyun Park, Soyoung Lee, Hyunsuk Cho  
Division of Biosafety, National Academy of Agricultural Science, Rural Development Administration, Korea

Drought-tolerant rice was recently developed by inserting the CaMsrB2 gene from pepper producing methionine S-reductase (CaMsrB2). To assess the toxicity of genetically modified drought-tolerant rice, we conducted bioinfomational comparisons of the amino acid sequences that are not similar to known toxic proteins. Sufficient quantities of CaMsrB2 protein were produced in Escherichia coli for in vitro evaluation and animal study. We compared the amino acid sequences and molecular mass after the purifying the CaMsrB2 protein from highly expressed bacteria and genetically modified rice which were identical. We also investigated the acute and 90-days oral toxicities. No adverse effects were observed in mice following acute oral exposure to 2,000 mg/kg body weight CaMsrB2 protein of body weight and 90 days oral exposure to drought-tolerant rice seeds. These results indicate that CaMsrB2 proteins and drought-tolerant rice demonstrate no possible toxicities when used in foods and feed.
Developments of Assessment Methods on Allergenicity in Rice

Wonhui Lee*, Simyung Lee, Seonwoo Oh, Yunsoo Yeo, Sooyun Park, Soyoung Lee, Hyunsuk Cho
Division of Biosafety, National Academy of Agricultural Science, RDA, Korea

Food allergy is an adverse health effect arising from a specific immune response that occurs reproducibly on exposure to a given food. The prevalence of food allergies is increasing every year. It indicates that food allergy is a major issue that cannot be ignored. Rice is a cereal grain produced and consumed worldwide as maize crops and is the predominant staple food especially in Korea. In contrast, there have been only a few studies on rice allergy and allergen. To assure the food safety using the food safety assessment, allergenic materials contents have to elucidate. But until now, rice has rare tools for detecting allergen materials and symptoms than the other major allergenic foods such as milk, egg, etc. For these reasons, this study was performed to develop the new method for detecting allergenic materials using antibody. This method can help elucidating allergen contents in rice. Our study offers new insights into the existence of rice and method can help elucidating allergen contents in rice. We furthermore investigate quantity of allergenic proteins in rice using antibody technology.

Overexpression and Refolding of BACE1 (β-Secretase) in E. coli

Yeon-Ji Lee*, Yong-Tae Kim, Sun Joo Park¹
Department of Food Science and Biotechnology, Kunsan National University, Korea, ¹Department of Chemistry, Pukyong National University, Korea

BACE1 is a membrane-associated aspartic protease involved in cleavage of amyloid precursor protein to generate the amyloid β peptide, the principal component of the plaques found in brains of Alzheimer’s disease patients. In the amyloid hypothesis for Alzheimer’s disease, accumulation of amyloid β peptide is thought to be responsible for the development of the disease. Since BACE1 processes the APP at a key step in generating the amyloid β peptide, it is regarded as a major target for drug design in Alzheimer’s disease. To determine its function and to develop inhibitors from various sources, we constructed an overexpression vector for the producing BACE1. The gene encoding human BACE1 protease was amplified using polymerase chain reaction and cloned into the pET11a expression vector, resulting in pET11a/BACE1. Recombinant BACE1 protease was overexpressed successfully in E. coli as inclusion bodies, dissolved in denaturation buffer, and then refolded using the rapid dilution method. The refolded protein was purified via low-speed fast protein liquid chromatography using Sephacryl S-300 gel filtration and Resource-Q chromatography. The BACE1 protease was produced an active form.

Development of Cellular Proteasome Activity Assay

Soyoung Kim*, Hyungmun Yoon
Department of Food and Nutrition, Sungshin Women’s University, Korea

Proteasome has been reported that it stimulates activation of NF-κB, by degrading ubiquitinated IκB-α. NF-κB regulates cell proliferation as a transcription factor. The purposes of this study were to develop cellular proteasome activity (CPA) assay, to compare with the existing method of using cell extract (CE), and to evaluate the 26S proteasome inhibition activities (PIAs) of selected phytochemicals using the CPA assay. According to a proteasome activity study results of CE, PIAs has been showed that among about 20 flavonoids, especially it had high PIAs in order of myricetin, baicalein, hesperidin, baicalin, kaempferol, epigallocatechin gallate (EGCG) in 200 μM. However, results of CPA assay showed that EGCG significantly had the highest PIA (p<0.05), followed by myricetin, kaempferol, baicalein, hesperidin, and baicalin in 100 μM. Also, the results showed that among selected triterpenoids, Betulinic acid significantly had the highest PIA (p<0.05), followed byoleanolic acid, and ursolic acid in 100 μM. CPA assay has benefit in creating more stimulated condition of organisms than CE assay.

Methanol Extract of Helianthus tuberosus Suppresses IL-1β Maturation by Modulating Inflammasome Activation

Kyung won Kang*, Suna Gu, Je hee Son, Woo jeong Lee, Eun young Oh, Young-Joo Yi, Sang-Myeong Lee
Division of Biotechnology, Chonbuk National University, Korea

The NLRP3 inflammasome is a multiprotein signaling complex, and mediates inflammatory innate immune responses through caspase-1 activation and subsequent IL-1β secretion. However, its aberrant activation often leads to inflammatory diseases. Therefore, targeting NLRP3 inflammasome offers considerable therapeutic promise for the treatment of inflammatory diseases. Here, we investigated the effects of methanol extract of Helianthus tuberosus (MEHT) on NLRP3 inflammasome in bone-marrow derived macrophages (BMDM). Our results demonstrated that MEHT effectively suppressed NLRP3 inflammasome activation in LPS-primed and ATP or nigericin treated BMDM, resulting in reduced IL-1β secretion. This effect was well correlated with lower levels of caspase-1 in MEHT treated BMDM. Furthermore, MEHT significantly attenuated IL-1β secretion mediated by AIM2 and NLRC4 inflammasome, which were induced by Listeria monocytogenes and Salmonella Typhimurium, respectively. These results indicate that MEHT may act as a broad spectrum inflammasome inhibitor. Further study will test whether MEHT suppresses inflammasome activation in vivo models.
Inhibition of NLRP3 Inflammasome by Highly-purified γ-Oryzanol Component, Sitosteryl Ferulate, Isolated from Korean Rice Bran

Da hee Kim*, Je hee Son, Young-Joo Yi, Heon-Woong Kim¹, Jung-Bong Kim², Sang-Myeong Lee

Division of Biotechnology, Chonbuk National University, Korea, ¹Department of Agro-Food Resources, National Academy of Agricultural Science, Rural Development Administration, Korea

The γ-oryzanol, a mixture of sterols and ferulic acid ester of triterpene alcohols, is mainly present in rice grain. Previously, γ-oryzanol has been implicated in prevention of obesity and diabetes, and anti-cancer activity. However, the effects of γ-oryzanol on inflammation have not been studied yet. The NLRP3 inflammasome is a multiprotein signaling complex and its aberrant activation often leads to inflammatory diseases. Therefore, targeting NLRP3 inflammasome offers considerable therapeutic promise for the treatment of inflammatory diseases. Here, we isolated cycloartenyl ferulate, 24-methylenecycloartenyl ferulate, campesteryl ferulate and sitosteryl ferulate from γ-oryzanol mixture by HPLC and investigated the effects of these compounds on NLRP3 inflammasome in bone-marrow derived macrophage (BMDM). Interestingly, only sitosteryl ferulate inhibited IL-1β secretion in a dose-dependent manner. Moreover, this compound suppressed caspase-1 activation and subsequent IL-1β maturation. These results indicate that sitosteryl ferulate could be used as a therapeutic agent for inflammasome-mediated diseases.

Effective Light and Dark Cycle Induction for the Varying Biochemical Production by Chlorella sp. Isolated from Tongyeong, Korea

Kyoungjun Ko¹,², Kichul Cho³, Kil-Nam Kim⁴, In-Kyu Yoo⁵, Daekyung Kim⁶

¹Jeju Center, Korea Basic Science Institute (KBSI), Korea, ²Faculty of Marine Biomedical Sciences, Jeju National University, Korea, ³Korea University of Science & Technology, Korea

Due to valuable biochemical accumulation, many attentions have been focused on regulation of microalgal culture system to enhance valuable biochemical components. In order to optimize productivities of biomass, and varying biochemical, the effect of photoperiod cycle on the growth and biochemical accumulation of locally isolated Chlorella sp. was studied in the lab-scale batch culture system. Chlorella sp. was aseptically isolated and cultivated in the growth chamber regulated with different L/D cycles (4:20, 8:16, 12:12, 16:8, and 20:4 h of light and dark cycle). In the results, the highest growth rate and pigment content were obtained at 20:04 and 4:20 of L/D cycle. Maximum carbohydrate per equivalent biomass was resulted at 20:04 of L/D cycle, protein and lipid per equivalent biomass were exhibited at 12:12 of L/D cycle, and the highest content of fucoxanthin and astaxanthin content per cells was achieved at 12:12 and 8:16 of L/D cycle respectively. The results show that particular L/D cycle can strongly affect varying biochemical accumulation in locally isolated Chlorella sp.

Improvement Effect of Alcoholic Fatty Liver by Glutathione-enriched Saccharomyces cerevisiae FF-12 in Rats

Da Jeong Choe*, Hee-Young Ahn, Ha-Rin Jin, Tae-Hoon Kim, Young-Wan Kim, Young-Su Cho

Department of Biotechnology, Dong-A University, Korea

The purpose of present study was the improvement effect of Saccharomyces cerevisiae FF-12 on alcoholic fatty liver in rats. Alcohol-feeding rats (SD) were fed diets with glutathione-enriched S. cerevisiae FF-12 growth in YM broth (YMB) as S group, glutathione-enriched S. cerevisiae FF-12 growth in optimal conditions of glutathione production as OS group at the 5% (w/w) level of each and silymarin as SM group at the 0.1% (w/w) level for 4-weeks periods. Administration of alcohol control (C) resulted in significantly increased liver marker enzymes activities of AST, ALT, ALP, LDH and γ-GTP in serum. Especially, OS group markedly mitigated elevation from alcohol-induced liver marker enzymes in serum. Total protein, albumin and globulin were no difference among all groups. C group decreased concentrations (mg/g) of glutathione in liver and serum, but S and OS significantly increased from alcohol-induced reduction of these parameters. Alcohol treatment induced the marked accumulation of large lipid droplets and resulted in typical histopathology of alcoholic fatty liver, but S and OS group administration attenuated lipid droplet accumulation in hepatocytes.

Sargachromanol G Suppression RANKL-induced Osteoclastogenesis

Eun-yi Ko*, Kil-Nam Kim, Weon-Jong Yoon¹, Soo-Jin Heo², Daekyung Kim

Jeju Center, Korea Basic Science Institute (KBSI), Korea, ¹Jeju Biodiversity Research Institute (JBBRI), Jeju Technopark (JTP), Korea, ²Global Bioresources Research Center, Korea Institute of Ocean Science & Technology, Korea

Inflammatory cytokines play a major role in osteoclastogenesis, leading to the bone resorption that is frequently associated with osteoporosis. Sargachromanol G (SG), isolated from the brown alga Sargassum siliquastrum, inhibits the production of inflammatory cytokines. In the present study, we determined the effect of SG on receptor activator of NF-κB ligand (RANKL)-induced osteoclast formation. SG inhibited RANKL-induced osteoclast differentiation from RAW 264.7 cells without signs of cytotoxicity. Additionally, the expression of osteoclastic marker genes, such as tartrate-resistant acid phosphatase, cathepsin K, matrix metalloproteinase 9, and calcitonin receptor, was strongly inhibited. SG inhibited RANKL-induced activation of NF-κB by suppressing RANKL-mediated IkB-α degradation. Furthermore, SG inhibited RANKL-induced phosphorylation of mitogen activated protein kinases (p38, JNK, and ERK). This study identified SG as an inhibitor for osteoclast formation and provided evidence that natural compounds, such as SG, are an alternative medicine for preventing and treating osteolysis.
6″-Debromohamacanthin A, A Bis (indole) Alkaloid, Inhibits Angiogenesis by Targeting the VEGFR2-Mediated PI3K/AKT/mTOR Signaling Pathways

Gi Dae Kim*, Jongheon Shin¹, Sang Kook Lee¹
Department of Food and Nutritional Science, Kyungnam University, Korea, ¹College of Pharmacy, College of Pharmacy, Seoul National University, Korea

Hamacanthins, bis (indole) alkaloids, are found in a few marine sponges, including Spongiosorites sp. Hamacanthins have been shown to possess cytotoxic, antibacterial and antifungal activities. However, the precise mechanism for the biological activities of hamacanthins has not yet been elucidated. In the present study, the anti-angiogenic effects of 6″-debromohamacanthin A (DBHA), an active component of isolated hamacanthins, were evaluated in cultured HUVRECs and endothelial-like cells differentiated from mES cells. DBHA significantly inhibited VEGF-induced cell proliferation, migration and tube formation in the HUVEC. DBHA also suppressed the capillary-like structure formation and the expression of PECAM. DBHA suppressed the VEGF-induced expression of MAPKs and the PI3K/AKT/mTOR signaling pathway. In addition, DBHA inhibited microvessel sprouting in mES/EB-derived embryoid bodies. In an ex vivo model, DBHA also suppressed the microvessel sprouting of mouse aortic rings. The findings suggest for the first time that DBHA inhibits angiogenesis by targeting VEGFR2-mediated PI3K/AKT/mTOR signaling pathway in endothelial cells.

Calcium Induced Mitogen-activated Protein Kinase Activity Increases the Expression of Fast-twitch Fiber Phenotype in Skeletal Muscle Satellite Cell Culture

Sungkwon Park*
Department of Food Science & Technology, Sejong University, Korea

Skeletal muscle is composed of diverse fiber types, yet the underlying molecular mechanisms responsible for this diversification remain unclear. Herein, we report that extracellular signal-regulated kinase (ERK) 1/2 pathway is preferentially activated in fast-twitch muscles. Intracellular calcium level is increased by caffeine treatment in myotubes isolated from Semitendinosus muscle in vitro. Increase in calcium concentration in turn activates ERK1/2 in myotubes in vitro. At the same time, pharmacological blocking of ERK1/2 pathway decreased creatine kinase activity in satellite cells isolated from white semitendinosus muscles. Inhibition of ERK signaling in cultured myotubes increased slow-twitch fibers. Activation of ERK2 signaling by calcium treatment induced up-regulation of fast-twitch fiber program in myotubes in vitro. These data suggest that the MAPK signaling, most likely the ERK1/2 pathway, can be activated by calcium treatment and induce the expression of fast-twitch fiber phenotype.

Enhanced Biomass and Biochemical Constituents Derived from Oceanic Microalgae Nannochloropsis granulata under Fucoidan Supplemented Mixotrophic Culture

Kichul Cho¹², Kil-Nam Kim⁷, Seong-Pyo Heo⁷, Daeyoung Kim¹², Tatsuya Oda²
¹University of Science & Technology, Korea, ²jeju Center, Korea Basic Science Institute (KBSI), Korea, ³Division of Biochemistry, Faculty of Fisheries, Nagasaki University, Japan

Recent years, microalgae-derived biomass and constituents considered as valuable bioresource as future source of functional food. Therefore, enhanced production of algal biomass with varying nutritional properties are becoming an important factor. In our study, effect of brown algae-derived polysaccharides fucoidan from Fucus vesiculosus supplemented culture was investigated to evaluate biomass and functional biochemical components on their body. In the results, enhanced biomass was determined on the fucoidan concentrations-dependent manner at 0-300 μg/mL with enhanced carotenoid content. Also, higher lipid content was obtained from N. granulate culture at high fucoidan concentrations than control. Since fucoidan used for functional food with varying bioactivity, its usage for the algal culture can be enhance nutritional function of microalgae. Therefore, these results show that a form of polysaccharide fucoidan from F. vesiculosus can be useful additive for the algal carbon sources and enhanced biomass production.

Simple and Reproducible Analysis of Intermediates for Long-chain Dicarboxylic Acid Biotransformation Based on Gas Chromatography-flame Ionization Detector

Jae-Hong Min*, Hyun-Woo Kim, Yong-Han Cho, Jung-Eun Lee, Kyungmoon Park¹, Do Yup Lee, Yong-Chool Park
Department of Bio and Fermentation Convergence Technology, Kookmin University, Korea, ¹Department of Bio and Chemical Engineering, Hongik University, Korea

Long-chain ω-hydroxycarboxylic acids are used in the production of a variety of chemical products for foods, cosmetics and pharmaceuticals. For the analysis of multiple-reaction intermediates for long-chain dicarboxylic acid biotransformation, simple and reproducible methods of extraction and derivatization were developed on the basis of gas chromatography with flame ionization detector (GC-FID) instead of mass spectrometer (MS). In the derivatization step, change of the ratio of pyridine to MSTFA from 1:3 to 9:1 resulted in high peak intensity (p=0.021) and reproducibility (0.6%CV) when analyzing 32 g/L ricinoleic acid (RA). Extraction of RA and ω-hydroxyundec-9-enoic acid (ω-HUA) with water containing 100 mM Tween 80 showed 90.4-99.9% relative extraction efficiency and 2-7%CV compared to those with hydrophobic ethyl acetate. In conclusion, reduction of pyridine content and change of extraction solvent to water with tween80 provided compatible derivatization and extraction methods to GC-FID based analysis of long-chain carboxylic acids.
Molecular Mechanisms of Transcriptional Regulation of the Pentose Phosphate Pathway in *Saccharomyces cerevisiae*

Yoonhee Cho*, Young-Suk Lee, Deok-Yeol Jeong, Sooah Kim1, Kyoungh Heon Kim1, Yong-Su Jin2, Soo Rin Kim
School of Food Science and Biotechnology, Kyungpook National University, Korea, 1Department of Biotechnology, Korea University Graduate School, Korea, 2Department of Food Science and Human Nutrition, University of Illinois at Urbana-Champaign, USA

Recent studies have reported that deletion of the PHO13 gene leads to transcriptional activation of the pentose phosphate genes, which contributes to the improved stress tolerance and C5-sugar metabolism in *Saccharomyces cerevisiae*. However, the molecular mechanism of the transcriptional activation has not been studied yet. A goal of the present study is to discover a transcription factor that is responsible for the PHO13 deletion-induced transcriptional activation. By transcriptome analysis, it was found that expression profiles of a transcription factor, STB5, responded to the deletion of PHO13. Moreover, the presence of STB5 and the physical binding of the SHb to a target gene were required for the PHO13 deletion-induced transcriptional activation. However, its overexpression of STB5 alone did not yield the transcriptional and phenotypic changes. Therefore, we concluded that the transcription factor STB5 is necessary for the PHO13 deletion-induced transcriptional activation, but it is not sufficient to explain its molecular mechanism.

Cordyceps militaris Inhibits Atopic Dermatitis and Allergic Contact Dermatitis in a Murine Model

Heeri Choi*, Yujiao Tang1,2, Sang-Ho Moon1,2, Eun-Kyung Kim, Eun-Ju Choi
Division of Sport Science, College of Science and Technology, Konkuk University, Korea, 1Division of Food Bio Science, College of Biomedical and Health Sciences, Konkuk University, Korea, 2Korea Nokyong Research Center, Konkuk University, Korea

The Cordyceps species are insect-borne mushrooms that have been ethnopharmacologically used for skin diseases such as eczema and dermatitis. In this study, we examined the effect of *Cordyceps militaris* on atopic dermatitis (AD) and skin lesions. This paper examines whether *C. militaris* modulates AD symptoms by using an existing AD model based on the repeated local exposure of the house dust mite extract (dermatophagoides farinae extract, DFE) and 2,4-dinitrochlorobenzene (DNCB) to the ears of BALB/c mice. *C. militaris* suppressed DFE/DNCB-induced expression of cytokines such as interleukin (IL)-4, IL-5, IL-10, IL-17, IL-22, IL-31, and interferon (INF)-γ in the ear tissue. In addition, to define the underlying mechanisms of action, tumor necrosis TNF-α/INF-γ-activated human keratinocytes (HaCaT) model was used. *C. militaris* inhibited the expression of cytokines and chemokines through the downregulation of NF-κB in HaCaT cells. Our results suggest that *C. militaris* can be a candidate for the functional food of AD.

Antimicrobial Activity and Mechanism of Action of Analog Peptides Derived from the American Oyster Defensin (AOD) Isolated from the American Oyster, *Crassostrea virginica*

Chang-won Lee*, Han Ju Yu, Seung-Yong Lim, Na Young Lee, Yong-Tae Kim, Kwon-Sam Park, Jae-Geun Koo, Ki-Young Lee1, Sang-man Cho*, Jung-Kil Seo
Department of Food Science and Biotechnology, Konkuk National University, Korea, 1Department of Marine Biotechnology, Kunsan National University, Korea, 2Department of Marine Aquaculture and Aquatic Sciences, Kunsan National University, Korea

American oyster defensin (AOD) was purified from the acidified gill extract of the American oyster, *Crassostrea virginica*. This peptide was composed of 38 amino acids containing 3 disulfide bonds with 4,265.0 Da and showed strong antibacterial activity. To develop the lead peptides as antibiotic candidates, we designed and synthesized 3 analogues (cvA1-cvA3) predicted the turn structure consisting of 9 amino acids with a disulfide bond at the C-terminus of AOD, and evaluated their biological activity and also studied on their mechanism of action such as gram-negative bacteria but any significant activity against gram-positive bacteria. Our experimental results showed cvA2 and cvA3 exhibited significant antimicrobial activity without hemolytic activity, and killing kinetic studies and membrane permeabilization assay indicated that cvA2 and cvA3 did not directly act on the membrane. Gel retardation studies revealed that cvA2 and cvA3 bound to DNA and inhibited to migrate on agarose gel. These results suggest that antimicrobial mechanism of cvA2 and cvA3 may be related to the interaction with intracellular components such as DNA. Our results indicated that these peptides have potential for future development as novel antimicrobial agent.

Mode of Action of Antimicrobial Analogue Peptides Derived from cgMolluscidin Isolated from the Pacific Oyster, *Crassostrea gigas*

Min Kyeong Jeong*, Bo-Hye Nam1, Eun-Woo Lee2, Ki-Young Lee1, Sang-man Cho*, Jung-Kil Seo
Department of Food Science and Biotechnology, Konkuk National University, Korea, 1Biotechnology Research Division, National Fisheries Research and Development Institute, Korea, 2Department of Life Science and Biotechnology, Dongeui University, Korea, 3Department of Marine Biotechnology, Kunsan National University, Korea, 4Department of Marine Aquaculture and Aquatic Sciences, Kunsan National University, Korea

cgMolluscidin consisting of 55 amino acids with 5,568.7 Da was antimicrobial peptide purified from the acidified gill extract of the Pacific oyster, *Crassostrea gigas*. This peptide showed potent antimicrobial activity against both gram-positive and gram-negative bacteria but any significant activity against *Candida albicans* without hemolytic activity. To develop the lead peptides as antibiotic candidates, we designed and synthesized 3 analogues (cgA1-cgA3) predicted the turn structure consisting of 9 amino acids with the C-terminal amidation, and evaluated their biological activities and studied on the action mode of analogues. Our experimental results showed cgA2 and cgA3 exhibited significant antimicrobial activity especially against *C. albicans* without hemolytic activity. Membrane permeabilization results indicated that cgA2 significantly permeabilized bacterial membrane and cgA3 also showed potent membrane-permeabilizing ability. Gel retardation studies revealed that cgA3 only bound to DNA and inhibited to migrate on agarose gel. These results suggest that cgA2 may directly target the bacterial membrane, but cgA3 may target intracellular components such as DNA.
Qualitative and Quantitative Detection Methods of Resveratrol Synthesis GM Rice Developed in Korea

Kong-sik Shin*, Hee-jong Woo, Myung-ho Lim, Jin-hyoung Lee, Yang Qin, Taek-ryoun Kwon, Hyun-suk Cho
Department of Agricultural Biotechnology, National Academy of Agricultural Science, RDA, Korea

Resveratrol is a type of natural phenol, and possesses anti-fungal and antibacterial activity as a phytoalexin produced by plants. Recently, resveratrol synthesis rice was developed in Korea, which transformed the resveratrol synthase gene into rice. Meanwhile, to monitor an unintended release of the developed genetically modified (GM) crop, the development of a reliable detection method for GM crop should be required. In this study, specific PCR primers for the detection of RS rice was designed on the basis of the flanking junction sequences, and SPS gene sequence also was used as an endogenous reference. Target specific amplicons could be clearly detected from RS rice events. Also, the limits of detection using the event-specific primers of GM lines were approximately 0.1%. The real-time PCR was performed using TaqMan probe. Absolute limits of quantification of real-time PCR were established with 10 copies for plasmid. Then different amounts of genous reference. Target specific amplicons could be clearly detected from RS rice events. Also, the limits of detection using the event-specific primers of GM lines were approximately 0.1%. The real-time PCR was performed using TaqMan probe. Absolute limits of quantification of real-time PCR were established with 10 copies for plasmid. Then different amounts of GM rice were quantified by the established method. Thus, this method is expected to be suitable for the traceability of RS rice line owing to the primer position that mainly corresponded to the 3’-transgene integrated site.

Bfi2 Modulates Adipocyte Plasticity via Induction of PRDM4

No-joon Song*, So-mi Kwon, Suji Kim, Seo-hyuk Chang, Byunghyun Jang, Kye Won Park
Department of Food Science and Biotechnology, Sungkyunkwan University, Korea

Increases in activities of thermogenic adipocytes can hold tremendous promise for the treatment of obesity and metabolic diseases. In this study, bfi2, plant derived natural phenol, was identified as an inducer of WAT browning. Treatment of bfi2 induced the expression of energy dissipating thermogenic genes including UCP-1 in cultured adipocytes and mice. Bfi2 prevented weight gains, improved glucose homeostasis, and increased energy expenditure in diet induced obese mice. Furthermore, bfi2 lowered body weight and improved glucose metabolism in pre-established obese mice. PRDM4 identified as a bfi2 regulated gene recapitulated the effects of bfi2 on thermogenic program. Bfi2 compromised its effects on thermogenic induction in PRDM4 silenced cells, indicating the importance of PRDM4 in bfi2 mediated thermogenic responses. Together, this study highlights the effects of bfi2 in WAT browning, further indicates the possibility of bfi2 as a novel approach against obesity and metabolic diseases.

Interaction of E. coli Bacteriophage with Inflammatory Response of Rats

Won Jung Park*, Ji Yeon Hwang, Yoon Jae Song¹, Jong Hyun Park
Department of Food Science and Biotechnology, Gachon University, Korea, ¹Department of Life Science, Gachon University, Korea

Although the use of bacteriophages as disinfectants or alternatives to antibiotics has received much attention, the safety of bacteriophages in humans is still in doubt. To determine inflammatory immune responses against phages, rats were treated with the phage cocktail of log 8 PFU for E. coli a day for four weeks. At the end of the treatment, efficiency and body weight were measured, there were no significant differences. In the serum of rats treated phages cocktail, phages were not detected and no notable changes were observed on histopathological examination of liver, kidney, and spleen. There were the slight changes (not statistically significant) in organ weights of rats treated with the cocktail. No remarkable changes were observed in the levels of 12 proinflammatory cytokines in treated phage cocktail. The expression of proinflammatory cytokines, except COX-2, was not affected by the treatment phage cocktail. Interestingly, the expression of COX-2 in the spleen of rats treated phage cocktail was increased 2.4-fold compared to the control. Therefore, these results indicate that there were no significant inflammatory responses in rats orally fed with the bacteriophage cocktail.

Methanol Extract of Ipomoea batatas Activates NLRP3 Inflammasomes

Da hee Kim*, Dong-Won Seo, Young-Joo Yi, Sang-Myeong Lee
Division of Biotechnology, Chonbuk National University, Korea

Ipomoea batatas has been known to possess anti-oxidant, anti-diabetic and anti-cancer activity. However, the effects of Ipomoea batatas leaf and stem extract on inflammasomes have not been studied yet. The NLRP3 inflammasome is a multiprotein signaling complex which consists of NLRP3 sensor, caspase-1 and ASC. NLRP3 inflammasomes play an essential role in innate immune responses against microbial infection through maturation of IL-1β and IL-18. Here, we investigated the effect of methanol extract of Ipomoea batatas (MEIB) on NLRP3 inflammasome using human monocytic cell line, THP-1. When THP-1 cells were treated with MEIB in the present of LPS, IL-1β secretion triggered by LPS was intensified in dose-dependent manner. In addition, similar results were obtained when LPS-primed THP-1 cells were treated with MEIB. We also found that MEIB enhanced the cleavage of proIL-1β via caspase-1 activation in LPS-primed THP-1 cells. Using specific inhibitors, we found that MEIB stimulated THP-1 cells to produce IL-1β through ATP and K⁺ efflux. Taken together, our results suggest that MEIB could be a NLRP3 inflammasome inducer and further studies are on-going to identify molecular mechanisms.
Anti-adipogenic and Pro-osteogenic Effects of Luteolin are Mediated by Induction of Heat Shock Protein 40 (DNAbj1)

So-Mi Kwon*, Suji Kim, No-Joon Song, Seo Hyuk Chang, Byunghyun Jang, Kye Won Park
Sungkyunkwan University, Korea

Luteolin (3,4,5,7-tetrahydroxy flavone), a major dietary flavone, regulates various biological effects including cancer progression, insulin resistance, and inflammation. However, its actions on adipogenesis and osteogenesis along with the underlying molecular mechanisms have yet to be identified. To investigate the actions, C3H10T1/2 and 3T3-L1 cells were treated with luteolin and induced to differentiate into adipocytes and osteoblasts. Luteolin suppresses adipogenesis, but increases osteogenesis. In mechanism studies, luteolin increases expression of heat shock protein 40 (DNAbj1) but not other heat shock proteins. Introducing DNAbj1 small interfering RNA promotes adipocyte differentiation but inhibits osteoblast differentiation. Conversely, forced expression of DNAbj1 decreases lipid accumulation but stimulates alkaline phosphatase activity. Finally, the effects of luteolin are significantly blunted in DNAbj1 knockdowned cells, further suggesting that DNAbj1 is, at least in part, required for the luteolin’s dual actions. Together, our data further implicate luteolin as an ingredient for the development of functional foods and drugs in metabolic diseases and bone related diseases.

Endoplasmic Reticulum Stress Induced by Coicis semen in a Model of Liver Cell

Hwa Yeon Kim*, Hye Me Kim, Hong Jin Lee, Hyang Sook Chun
Department of Food Science and Technology, Chung-Ang University, Korea

Recent evidence indicates that endoplasmic reticulum stress (ER stress)-mediated cell dysfunction is involved in pathogenesis of human chronic disorders including diabetes and neurodegeneration. Coicis semen has been widely consumed as a herbal medicine in South Korea. The aim of this study was to investigate whether the ethanol extract of Coicis semen (CSE) and coixol (6-methoxy-3H-benzoxazol-2-one) induce ER stress in liver cells. The expressions of ER stress markers including binding immunoglobulin protein (BiP), C/EBP homologous protein (CHOP) and X-box binding protein 1 (XBP1) were examined by qRT-PCR, XBP1 splicing assay and Western blot analysis. CSE and coixol inhibited cell proliferation with IC50 of 250 and 350 μg/mL, respectively. The gene expressions of BiP, CHOP and XBP1 were increased in a dose-dependent manner by CSE and coixol when compared to those of the vehicle control. Western blot analysis confirmed that BiP was up-regulated by CSE treatment. CSE treatment with 400 and 500 μg/mL increased spliced XBP1. However, coixol did not affect the splicing of XBP1. These results suggest that the high dose of Coicis semen has a potential to induce ER stress in liver cells.

A Potential Hair Growth Enhancer Associated with Inhibition of Hair Follicle Regression in C57BL/6 and Nude (BALB/C nu)

Shahnaz Begum*, Jeonghee Cho1, Jisu Han1, Kyunghyun Min1, Mira Lee, Jeen Kim, Lijuan Gu, Kangju Choi, Changkeun Sung2
Research and Development Center, DBIO Incorporation, Korea, 1Department of Food Science and Technology, Chungnam National University, Korea

Eclipta alba (L.) Hassk is traditionally acclaimed for therapeutic properties of various human ailments. Petroleum ether extract of E. alba played a great role on genetically predisposed to balding pattern nude (BALB/C nu) mice hair follicle. In this study, we evaluated whether petroleum ether extract (PEE) has a possible involvement to suppress TGF-β action during follicular morphogenesis and anagen-catagen transition period in C57BL/6 mice. As, we found that PEE (1.25% and 2.5% solution) have dose dependent hair growth stimulation on depilated C57BL6 and nude (BALB/C nu) mice model. PEE (2.5%) showed outstanding effect on increasing the skin thickness with increasing the number of HF compared to other groups. PEE-treated mice displayed more BrdU positive cells and fewer apoptotic cells than catagen follicles of vehicle-treated mice. In contrast, the number of proliferating keratinocyte was reduced and increases the expression of TGF-β1 in vehicle-treated mice skin. These data suggest that PEE might be regulating of catagen induction in vivo and enhance the keratinocyte proliferation.
Effect of Eclipta alba on Hair Re-growth in Testosterone-treated mice

Shahnaz Begum*, Jeonghee Cho1, Jisu Han1, Kyunghyun Min1, Mira Lee, Kangju Choi, Jeun Kim, Lijuan Gu, Jingjie Li1, Yunbo Wang1, Changkeun Sung1

Research and Development Center, DBIO Incorporation, Korea, 1Department of Food Science and Technology, College of Agriculture and Biotechnology, Chungnam National University, Korea

Androgenetic alopecia (AGA) is the most common form of alopecia, caused by androgens in genetically susceptible men and women. In this study, we aimed to evaluate the hair growth activity of Eclipta alba in testosterone-induced alopecia. We attempt to isolation and identification of major components of E. alba and investigate the effect of topical PEE and major constituents (wedelolactone and saponin) of E. alba on testosterone (T)-induced alopecia C57BL/6 mice model. After topical application of PEE (5 mg and 10 mg/mouse) on the back of testosterone-treated C57BL/6 mice, inhibited hair re-growth suppression and induced earlier conversion of telogen-to-anagen. On the other hand prolonged telogen phase was observed in T + vehicle-treated mice. Topical PEE significantly induced synchronized early onset of anagen (p<0.05). PEE showed greater dose dependent inhibitory effects against testosterone 5α-reductase (5αR) when compared with T + wedelolactone and T + saponin of E. alba. This is the first report that PEE of E. alba enhances in vivo hair re-growth based on their inhibitory activity against testosterone induced androgenic alopecia model.

Gene-based Predictive Modeling for γ-Aminobutyric Acid Production by Lactic Acid Bacteria

Bo Young Byun*, Jae-Hyung Mah

Department of Food and Biotechnology, Korea University, Korea

This study was conducted to develop predictive models for the growth, gad expression and γ-aminobutyric acid (GABA) production of lactic acid bacteria. For this, five test strains of Lactobacillus brevis and L. plantarum were cultured under different conditions: incubation temperatures of 30-35°C, initial pH of 4-6, and salt concentrations of 0-3%. In the primary modeling for the prediction of three dependent variables, the empirical data were fitted into the Baranyi model to calculate the specific rates (SR) and lag times (LT), which gave the estimated conditions for the maximum SR and minimum LT of bacterial growth, gad expression and GABA production as follows: 32°C, pH 5, and 0% salt. Secondary models were subsequently developed to describe the primary model parameters as functions of dependent variables. The optimum conditions for bacterial growth, gad expression and GABA production, which were predicted by using one of the log-normal and exponential decay models, were the same as those obtained from the primary models. Therefore, this study suggests that mathematical predictive tools are useful to promote gad expression and thereby enhance GABA production of lactic acid bacteria.