SEMINAR ON

HEALTH PROMOTION AND DISEASE PREVENTION OF FUNCTIONAL FOODS, NUTRACEUTICALS, AND NATURAL HEALTH PRODUCTS

Programme

TÜBİTAK TÜSSİDE, Gebze/Kocaeli, Turkey
14 June 2014

13/06/2014	Arrivals of the participants
20:00 – 21:30	Dinner with participants at TÜBİTAK TÜSSİDE Restaurant
14/06/2014	
07:30 – 08:30	Breakfast at TÜBİTAK TÜSSİDE Restaurant
08:30 – 09:00	Registration
	Moderators: Prof. Dr. Osman SAĞDIÇ Assoc. Prof. Cesarettin ALAŞALVAR
09:00 – 09:05	**Assoc. Prof. Bahadır TUNABOYLU (President of TÜBİTAK MAM)** *Welcome*
09:05 – 09:15	*Short film about TÜBİTAK MAM*
09:15 – 09:30	**Prof. Dr. Osman SAĞDIÇ (Director of Food Institute)** *Short presentation about TÜBİTAK MAM Food Institute*
09:30 – 09:45	**Assoc. Prof. Cesarettin ALAŞALVAR (Project Coordinator)** *Short presentation about the NutraHEALTH project*
09:45 – 10:15	**Mr. Grzegorz AMBROZIEWICZ (Project Officer, RTD, EC)** *Performance expectations from a REGPOT project. EC's view*
10:15 – 10:45	Nutrition Break & Networking
10:45 – 11:15	**Prof. Dr. Zhen-Yu CHEN (HONG-KONG)** *Cholesterol-lowering functional foods and heart disease prevention*
11:15 – 11:45	**Dr. Didier DUPONT (FRANCE)** *How does the structure of dairy products affect their digestion mechanisms? Consequences and human health*
11:45 – 12:15	**Prof. Dr. Reinhold CARLE (GERMANY)** *Recovery and application of polyphenols as natural food ingredients*
12:15 – 12:45	**Prof. Dr. Kenji SATO (JAPAN)** *Anti-inflammatory food-derived short chain pyroglutamyl peptide-function, possible mechanisms in action and production by fermentation*
12:45 – 14:00	Lunch at TÜBİTAK TÜSSİDE Restaurant & Networking
14:00 – 16:00	Visiting pilot plant of Food Institute
16:30	Bus leaves from TÜBİTAK TÜSSİDE to İstanbul

Dr. Zhen-Yu CHEN is a Professor and Associate Director of Food & Nutritional Sciences Programme, School of Life Sciences, The Chinese University of Hong Kong. Professor Chen is a fellow of American Chemical Society-Division of Agricultural and Food Chemistry. He received his PhD degree in 1989 from University of Massachusetts at Amherst, USA and then took his postdoctoral research at Department of Nutritional Science of University Toronto during 1989-1991. Before he joined the Chinese University of Hong Kong, Professor Chen worked in Nutrition Research Division, Health Protection Branch, Health Canada during 1992-1994. Professor Chen's research interest focuses on bioactivity of nutraceuticals, functional foods, fatty acids and cholesterol. He has published more than 200 original scientific papers in peer-reviewed journals. Professor Chen is currently an associate editor of Journal of Agricultural and Food Chemistry. He also serves as a member of the Editorial Boards including Biomedical and Environmental Sciences, Food & Function, and Chinese Journal of Food Science.

CHOLESTEROL-LOWERING FUNCTIONAL FOODS AND HEART DISEASE PREVENTION

Zhen-Yu Chen

Food & Nutritional Sciences Programme, School of Life Sciences, The Chinese University of Hong Kong, Shatin, Hong Kong, China

Most cardiovascular heart disease (CVD) involves atherosclerosis – the accumulation of cholesterol and other lipids along the wall of arteries. Atherosclerosis progresses with age, depending on several factors including mainly lifestyle and eating habits. Many studies have demonstrated that elevated concentrations of blood total cholesterol (TC) and low-density lipoprotein cholesterol (LDL-C) are the major risk factors for atherosclerosis, whereas high concentrations of blood high-density lipoprotein cholesterol (HDL-C) and a low ratio of TC to HDL-C are protective against CVD. Hypercholesterolemia patients with TC>240mg/dl have a high risk of CVD. A large number of people, probably 20-30% population have a slight to moderately increased risk because their blood TC concentration is between 200-240mg/dl. In general, a nutritionally balanced diet with reduction in saturated fat and cholesterol intake has traditionally been the first goal of dietary therapy in lowering the risk for CVD. This may reduce blood TC only by 5-10%. In recent years, many phytochemicals have attracted much interest due to their potentiality as functional foods/nutraceuticals to treat the hypercholesterolemia, especially for patients, whose TC concentration is marginally high and does not warrant the prescription of cholesterol-lowering medications. The purpose of this presentation is to brief the literature and our research about the production, application, efficacy and mechanisms of popular cholesterol-lowering nutraceuticals and functional foods. (The Research Grants Council of Hong Kong is thanked for supporting the author's research).

Dr. Didier DUPONT is Senior Scientist at INRA and is leading the "Bioactivity & Nutrition" group in Rennes that is actively working on the relationships between the structure of dairy and egg products, their digestion in the gastrointestinal tract and the consequences on human health. To reach this goal, he has developed *in vitro* static and dynamic models and has performed *in vivo* experiments on animal (pig and piglets) and human. Dr. Dupont is the scientific coordinator of COST Action INFOGEST, an international network of more than 110 research institutions gathering 330 experts on food digestion from 34 countries (2011-2015). He's the main organizer of the International Conference on Food Digestion. He's currently involved as a Work Package leader in the Pathway-27 FP7 project. Dr. Dupont acts as an expert for evaluating scientific proposals in France, Spain, Italy, Canada, Israel and Serbia and for assessing new COST Actions. He's the member of the EFSA expert group CFT/EFSA/GMO/2012/03 and is also a member of the scientific council of several French organizations. He has written more than 54 peer-reviewed articles and 10 book chapters, has coordinated a book on "Structure and Nutritional Effects of Food", given 27 international conferences and is a member of the editorial board of *Dairy Science and Technology* and *Food Digestion.*

HOW DOES THE STRUCTURE OF DAIRY PRODUCTS AFFECT THEIR DIGESTION MECHANISMS? CONSEQUENCES ON HUMAN HEALTH

Didier DUPONT

INRA – Agrocampus Ouest – Milk and Egg Science & Technology, Rennes, France

Digestion provides nutrients and energy essential to the survival and growth of the organisms. But little is known about the influence of food structure and of interactions between food components during processing on their digestibility and nutritional properties. Our objectives are to understand how dairy products are disintegrated in the gastrointestinal tract, identify the potentially bioactive molecules (peptides, amino acid, fatty acid…) released during digestion and demonstrate the physiological effect of these molecules on the host. In a first experiment, six dairy matrices (raw and heat-treated milk, stirred and non-stirred acid gels, rennet gels made of raw or heat-treated milk) of similar composition but with different micro and macrostructures were manufactured in a pilot plant. Each sample was given to six multi-canulated adult mini-pigs. Effluents were collected in the duodenum and mid-jejunum during 7h after the meal and characterized by SDS-PAGE, LC-MS-MS and ELISA. Free amino acids were quantified in plasmas. More than 16000 peptides released in the lumen during digested were identified. Among those, several are known for carrying biological activities. Compares to liquid milks, acid gels showed a delayed gastric emptying and a slower release of caseins and β-lactoglobulin in the duodenum. In a second experiment, two infant formulas adapted to reach the nutritional requirement of piglets were manufactured using either vegetable fat (STD) or a combination of milk and vegetable fats stabilized by a mixture of proteins and milk fat globule membrane fragments (EXP). The formulas were distributed with an automatic milk feeder to piglets until slaughter at 28 days. Intestinal contents and tissues as well as mesenteric lymph nodes (MLN) were collected. Microbiota diversity and composition was assessed using DHPLC and metasequencing analysis. The immunoreactivity of β-lg and Cns, as determined by ELISA, was higher in EXP than in STD intestinal contents. The secretory activity of MLN cells was modified by the formula composition, the highest IFNγ secretion was obtained in EXP piglets. Microbiota clustering successfully discriminated infant formulas according to the nature of fat. Differences in proteobacteria and firmicutes phyla were observed. These data emphasize the crucial role played by the food composition but also its structure on the digestion mechanisms, the kinetics of nutrient release and the physiological response of the host.

Dr. Reinhold CARLE is a Professor in Plant Foodstuff Technology at the University of Hohenheim, Germany. He is the fellow of Institute of Food Technologists (IFT). Professor Carle has been offered a chair "Lebensmittelsystemtechnik" at Technical University of Munich and direction of the Fraunhofer Institute for Process Engineering and Packaging in Freising, Germany. He is an Honorary Professor at the University of Food Technologies in Plovdiv, Bulgaria, a Distinguished Adjunct Professor at King Abdulaziz University in Saudi Arabia and Extraordinary Professor at University of Salvadoreña Masferrer in El Salvador. He received the award of Polyphenols 2013 from International Society of Antioxidants. Professor Carle's research work focuses on quality improvement and development of innovative processes for the production of plant foodstuffs, recovery of valuable components from plant wastes as well as their application in functional foods. Professor Carle has published more than 250 original research papers, 100 review articles in peer-reviewed journals. Besides he has 15 patents, Professor Carle is the co-editor or reviewer of numerous scientific journals (e.g. Journal of Agricultural and Food Chemistry, Food Chemistry, Journal of Food Engineering). He has been working in the scientific and technical boards, committees of several educational, and research institutions (e.g. EFSA, ERC, DFG, INRA, CSIC).

RECOVERY AND APPLICATION OF POLYPHENOLS AS NATURAL FOOD INGREDIENTS

Reinhold Carle

Institute of Food Science and Biotechnology, Chair Plant Foodstuff Technology, University of Hohenheim, Germany

Residues from plant foodstuff processing are a valuable source for the recovery of polyphenols. These compounds may be used as natural antioxidants or functional food ingredients. Apple pomace is an important raw material for pectin extraction. The colour of apple pomace and of the pectins recovered is caused by oxidation of phenolic compounds, which are co-extracted from the pomace and only partially removed by the precipitation step. Compared to citrus pectins, the brown hue limits their use as food gelling agents in very light-coloured products. A patented process for the combined recovery of pectin and phenolic compounds from apple pomace is presented. Phlorizin, the most abundant phenolic compound in apple pomace extracts, is the basic structure of a new class of oral antidiabetic drugs. Type 2 diabetes mellitus is treated by inhibition of Sodium-Glucose Co-Transporter-2 (SGLT 2). In a process patented recently, dihydrochalcones are enriched and purified from unwanted *ortho*-dihydroxy phenol compounds. From grape pomace natural food colorants and phenolic antioxidants can be recovered. In a novel enzyme-assisted process, anthocyanins are extracted without using sulphite. According to the Southampton study, some synthetic food colours are linked to hyperactivity in children. Already for many years, the own research work deals with the investigation of new natural colour sources, the extension of colour palette and the improvement of colour stability. Recently, anthocyanin-based blue food colorants could be developed using anthocyanin-metal-pectin interactions. Deoiled sunflower press cake is a promising source of food protein alternative to soy and egg protein, which is devoid of toxic substances and low in antinutritives. Sunflower proteins exhibit minimum solubility around the isoelectric point (pH 4-5). Conventional alkaline protein extraction yields dark-collared products with decreased nutritional and functional quality as co-extracted phenolic compounds are readily oxidized and thus prone to irreversible linkage to the proteins. A novel process for the production of light-coloured sunflower protein isolates was developed, combining mild-acidic protein extraction with adsorptive removal of phenolic compounds.

Dr. Kenji SATO is a Professor in the Division of Applied Biosciences, Kyoto University, Japan. He got his bachelor, MSc and PhD degrees from Department of Fisheries, Kyoto University. In 1995, he was awarded by Japanese Society of Fisheries Science for his PhD thesis entitled "*Biochemical Studies of Fish Collagen*". Before he joined the Kyoto University in 2014, Professor Sato worked in the Department of Food Science and Nutrition, Department of Food Sciences and Nutritional Health, and Division of Applied Life Sciences at Kyoto Prefectural University. His main research interests are peptides as functional food ingredients, their fractionation, adsorption, and biological functions. He is the member of Japanese Society of Fisheries Science, Japanese Cancer Association, Japanese Society of Nutrition, Food Science and American Chemical Society, and International Society for Nutraceuticals and Functional Foods (ISNFF).

ANTI-INFLAMMATORY FOOD-DERIVED SHORT CHAIN PYROGLUTAMYL PEPTIDE-FUNCTION, POSSIBLE MECHANISMS IN ACTION AND PRODUCTION BY FERMENTATION

Kenji Sato

Division of Applied Biosciences, Graduate School of Agriculture, Kyoto University, Japan

It has been reported that supplementation of wheat gluten hydrolysate decreased blood aminotransferase levels of patients with hepatitis from different backgrounds. To identify the active peptide in the wheat gluten hydrolysate, in vivo activity-guided fractionation based on large-scale preparative isoelectric focusing and D-galactosamine-induced rat acute hepatitis model was done. Acidic fractions exert hepatoprotective activity by oral administration. The peptides in an active fraction were isolated and identified; pyroGlu-Gln, pyroGlu-Gln-Gln, pyroGlu-Ile, pyroGlu-Leu and free pyroGlu. These short chain pyroglutamyl peptides were synthesized and evaluated by the same animal experiment. Consequently, pyroGlu-Leu was identified as active peptide. The pyroGlu-Leu also moderated DSS-induced colitis in mice at very low dose (0.1 mg/kg body weight). Inflammatory cytokines have been demonstrated to be elevated in hepatitis and colitis. In vitro assays revealed that pyroGlu-Leu suppresses LPS and IL-1β-induced inflammatory responses of macrophage and hepatocyte, respectively. In addition, supplementation of pyroGlu-Leu normalizes colonic microbiota in mice with DSS-induced colitis. Change in colonic microbioata has been suggested to induce host inflammatory response. These facts suggest that pyroGlu-Leu can directly and indirectly modulate host inflammatory response and moderate inflammatory diseases. In addition to the wheat gluten hydrolysate, short chain pyroglutamyl peptides including pyroGlu-Leu are distributed in Japanese traditional rice wine. PyroGlu-Leu is not directly synthesized from leucine by microorganism involved in Japanese rice wine brewing but produced by degradation of rice proteins by *Aspergillus oryzae* proteases. Japanese rice wine contains novel pyroglutamyl peptide, which can moderate colitis in the same animal model. These peptides can be produced by fermentation of steamed rice with *Aspergillus oryzae* without yeast. Then non-alcoholic beverage with potential for moderation of colitis and hepatitis could be prepared, which could be easily applied to human.