DAIRY FOODS SYMPOSIUM: DAIRY FOODS CONSUMPTION, GUT MICROBIOTA, AND HUMAN HEALTH

0276 Probiotics and health benefits with reference to synthesis of γ-aminobutyric acid by selected probiotic bacteria. N. Shah* and Q. Wu, *The University of Hong Kong, Hong Kong.*

Traditionally, probiotics have been added to yogurt and other fermented foods for health benefits. Currently 56 species of *Lactobacillus,* including *L. acidophilus* and *L. casei* and 32 species of *Bifidobacterium,* exist. These probiotic cultures are able to restore the normal balance of microbial populations in the intestine and offer several therapeutic benefits. There has been an increasing demand for health-promoting food ingredients. Different milks fermented with bacteria, yeasts, molds or enzymes offer a broad range of possibilities to cover different health aspects with new bioactive components such as lactoferrin, micronutrients, CLA, sphingolipids and bioactive peptides or synthesize exo-polysaccharides. In particular, milk-proteins and associated bioactive peptides released during microbial or enzymatic fermentation of milk offer a broad spectrum of new functional properties including anti-hypertensive, anti-microbial, anti-oxidative, and immuno-modulatory properties. Gamma-aminobutyric acid (GABA), a non -protein amino acid, is mainly found in the brain and regulates vertebrate physiological and psychological behaviors such as anxiety and depression blood pressure and hormone secretion. The synthesis of GABA in the brain decreases with age, especially in elders. Hence, there has been increasing interest in use of probiotics for GABA production. In this study, several GABA-producing LAB isolates have been isolated from naturally fermented foods such as Korean kimchi. Previous screening methods are time-consuming and inefficient. In the present study, we have developed a novel screening and identification method for GABA-producing LAB from Korean kimchi. Acid treatment was applied to screening procedure to obtain acid-tolerant LAB isolates, and then a simple identification of GABA-producing LAB based on release of gas by these bacteria has been developed. The amount of GABA produced by LAB isolates at various monosodium glutamate (MSG) concentrations and incubation times in MRS medium was quantified by HPLC. Genetic identification of high GABA-producing LAB was performed by both 16S rRNA gene and glutamate decarboxylase gene. Nine potential GABA-producing LAB isolates were selected by observing gas release during fermentation. The conversion ability of MSG into GABA for all nine LAB isolates was 100% (supplementation level 10 g/L MSG, incubation time 24 h), over 80% (supplementation level 30 g/L MSG, incubation 48 h), over 60% (supplementation level 50 g/L MSG, incubation time 72 h) and over 50% (supplementation level 70 g/L MSG, incubation time 72 h). These nine LAB isolates were genetically identified as *Lactobacillus brevis* by 16S rRNA gene and confirmed by glutamate decarboxylase gene.

Key Words: probiotics, γ-aminobutyric acid, health benefits

0277 Gut mircobiota, probiotics, bioactives (such as CLA, USFA), trans-fatty acids and their relationship to health. H. Gill*, *RMIT University, Melbourne, Australia.*

The human gastrointestinal tract harbors ten times more microorganisms than somatic cells in the human body. These organisms are part of a diverse and complex ecosystem comprising over 3.3 million genes that encode a vast repertoire of enzymes and metabolites with the ability to significantly influence human health and wellbeing. While a majority of these microbes exert health-promoting effects on the host, some possess the potential to cause disease. In a healthy state, the gut microbiota is known to confer a range of health benefits relating to immune function, nutrition, host metabolism and protection against pathogens. Alterations in the normal composition of the gut microbiota are associated with an enhanced predisposition to immunoinflammatory, autoimmune, metabolic and degenerative disorders. Consequently, there has been an increasing interest in developing nutrition/diet-based strategies for correcting gut microbiota dysbiosis. The use of probiotics is one such strategy that has been found to be effective in restoring perturbed gut microbiota composition and function and promoting/restoring optimal health. Amongst the many health benefits associated with probiotics, a large proportion of research attention over the last two decades has focused on their immunomodulatory and anti-infection properties. There is evidence that specific probiotics strains are effective in preventing and/or managing a range of enteric infections and modulating the functioning of the immune system. In healthy subjects and subjects with suboptimal immunity, specific strains are able to boost immune function, whilst in subjects with dysregulated immune system, such as allergy and inflammatory bowel disease, probiotics are effective in restoring immune homeostasis and reducing the severity of immunoinflammatory disorders. A variety of mechanisms by which probiotics mediate their health-enhancing or disease-preventing effects have been suggested. These include direct interaction with the host immune system and through the production of diverse array of bioactive molecules/metabolites. Dairy-based products are common vehicle for delivering probiotics. Being a rich source of essential nutrients and a variety of biologically active substances with synergistic physiological effects, these products offer a significant advantage over other non-dairy products. Milk also contains trans-fatty acid, vaccenic acid, which humans convert into rumenic acid, the biologically active form of CLA. Other fatty acids in milk are also known to exert beneficial health effects. This presentation will provide an overview of recent advances in health-promoting effects of gut microflora, probiotics and bovine milk fatty acids, especially related to immunoregulation, and novel health-enhancing food products.

Key Words: micrcobiota, probiotics, bioactives

0278 Overview of whey protein based bioactivities (including colostrum) in gut and health promotion.
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The high nutritive value and diverse functional properties of milk proteins are well known. In recent years, intense scientific research has focused on the identification of factors within bovine milk that may be relevant to improving human health. The best characterized whey-based bioactive proteins include α-lactalbumin, β-lactoglobulin, immunoglobulins, lactoferrin, lactoperoxidase and growth factors. These proteins exhibit a wide range of biological activities that may influence the digestive function, metabolic responses to absorbed nutrients, growth and development of organs and disease resistance, as well as gut microbiota and microbiome. Some whey proteins may reduce the risks of chronic human diseases. Whey protein constituents have been reported to have functional roles in various biological processes and organ systems in geriatrics, and thus help in the management of geriatric health problems through proper nutrition. Whey components have beneficial effects on intestinal health in four areas: prebiotic effects, antimicrobial and antiviral properties, anticancer properties and gut associated lymphoid tissue. Whey proteins are a good source of various bioactive peptides that are encrypted within the proteins and can be released during gastric digestion or food processing by enzymes or microbes. Whey protein-derived peptides have been shown to exert a wide range of bioactivities affecting the cardiovascular, immune and nervous systems. The efficacy of a few peptides has already been established in animal and human studies. A number of commercial whey-protein based products with potential health effects are on the market and their number is envisaged to increase on global markets.

Key Words: whey protein, bioactivity, health

0279 Milk fat globule membrane components and gut health effects. R. Ward* and K. Hintze, *Utah State University, Logan, UT.*

Milk fat globule membrane (MFGM) is a complex biopolymer that is primarily composed of polar and neutral lipids and membrane glycoproteins. MFGM is present in all dairy products to some degree, but may be isolated as a co-product from the manufacture of butter and cheese. Based on its composition, it has been suggested that MFGM may have value as a nutraceutical ingredient, yet relatively few studies have been conducted to test this assumption. Individual components of MFGM, such as sphingomyelin and gangliosides, have been shown to reduce the development of preneoplastic lesions in rodent models of colon cancer, and a recent study from our lab extended this finding to MFGM itself. In addition, MFGM itself, and isolated components have been shown to protect the barrier properties of the gut against stress-induced permeability development. Several groups have shown MFGM has antiviral and antibacterial properties, and recent data from our lab indicates MFGM may affect the microbiome composition and metabolism. Lastly, we have recently conducted an acute and a chronic human trial investigating the effects of MFGM on gut health and resilience.

Key Words: milk fat globule, nutraceuticals, gut health

0280 Human gut microbiota, diet and health.
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It is well established that gut microbiota composition and metabolic capabilities can have far reaching effects on host physiology. Further, diet composition can play a major role in modifying gut microbiota. However, the extent to which beneficial effects of dietary modification are mediated through changes in gut microbiota is largely unknown. The Gut Check study was a cross-sectional investigation of the relationship between gut microbiota, habitual diet, intestinal inflammation and selected health biomarkers. Fifty males and eighty-two females between the ages of 18 and 79 provided photograph assisted 3-d food intake records along with stool and blood samples collected immediately following the food records. Diet records were analyzed for selected foods and macro and micronutrient content. Fecal samples were processed for microbiota composition and additionally analyzed for calprotectin levels (a marker of intestinal inflammation). Blood samples were processed for biomarkers of inflammation, insulin sensitivity and endotoxin levels. Despite the recognized limitations associated with assessing dietary intake (even with photo assisted food intake records), strong associations were identified between selected dietary factors and microbiota composition. As an example, we identified a strong positive linear trend ($P < 0.0001$) between tertiles of total milk intake and the relative abundance of the Ruminococcaceae family. A weaker negative association was found between tertiles of milk intake and the Alcaligenaceae family. The relative abundances of the gut microbiota were also associated with parameters of health. Thus the Ruminococcaceae family (members of which have been shown to be higher in controls versus individuals with type 2 diabetes) was negatively associated with diastolic and systolic blood pressure (DBP, SBP) and circulating endotoxin levels. Thus, one would expect that increasing total milk intake would increase Ruminococcaceae and lower blood pressure. Conversely, the relative abundance of the Alcaligenaceae family was negatively associated with BMI, triglycerides, fasting glucose and waist circumference suggesting that increasing milk consumption would adversely affect parameters of metabolic

syndrome. Effects associated with calcium intake were minor, suggesting a primary effect of dairy intake as opposed to generalized effect of calcium intake. In total, these data emphasize the complicated interactions between diet, gut microbiota composition and health parameters and a need to conduct carefully controlled diet intervention studies.

Key Words: microbiota, metabolism, intake