Symposium: Dairy Foods: Changes and Challenges of Probiotics in Dairy Products

423 Probiotics: From Metchnikoff to bioactives. N. P. Shah*, *Victoria University*, *Melbourne, Victoria, Australia*.

Nobel Laureate Ilya Metchnikoff suggested that human body was slowly poisoned by toxins present in the body produced by pathogens in the intestine and bodys resistance steadily weakened by proliferation of enteric pathogens, all of which were successfully prevented by the consumption of fermented milk. Probiotics are live microorganisms which when administered in adequate amounts confer a health benefit on the host. Traditionally probiotics have been incorporated in yoghurt; however, a number of carriers for probiotic have been examined recently including mayonnaise, and spreads, in addition to other products of dairy origin i.e. cheese or cheese-based dips. It has been estimated that there are approximately 70 probiotic-containing products marketed in the world. Probiotic organisms are also available commercially in milk, sour milk, fruit juices, ice cream, single shots and oat-based products. Lunebest, Olifus, Bogarde, and Progurt are some of the commercial products. Probiotic products are very popular in Japan as reflected in more than 53 different types of probiotic containing products on the market. Commercial cultures used in these applications include mainly strains of *Lactobacillus* spp., *Bifidobacterium* spp. and *L. casei*. Since Metchnikoffs era, a number of health benefits has been contributed to products containing probiotic organisms. The strains *L. rhamnosus* GG (Valio), *Saccharomyces cerevisiae* Boulardii (Biocodex), *L. casei* Shirota (Yakult), and *B. animalis* Bb-12 (Chr. Hansen) are certainly the most investigated probiotic cultures with the established human health efficacy data against management of lactose malabsorption, rotaviral diarrhoea, antibiotic-associated diarrhoea, and *Clostridium difficile* diarrhoea. The functionality of dairy proteins may also be enhanced via liberation of bioactive peptides through proteolysis. Among bioactive peptides, angiotensin I-converting enzyme (ACE) inhibitors have been extensively studied due to their hypotensive role. Accordingly, several commercial products with highly proteolytic strains of *L. helveticus* have been developed and marketed to possess hypotensive activity including Calpis®, and Evolus®.

Key Words: Probiotics, ACE-I Peptides, Proteolytic System

424 Probiotics in natural cheese. B. Dias* and N. Mix, *Kraft Foods Inc*, *Glenview, IL*.

Significant increase in consumer awareness of probiotic cultures has boosted these cultures to becoming one of the top consumer trends in foods delivering health benefits. While probiotics have traditionally been found in yogurts, natural cheese has proven to be a good carrier for these cultures. Furthermore, studies have suggested that consuming probiotics in a cheese matrix is favorable for the viability of probiotics through the digestive tract. This has led to the marketing of several varieties of cheese containing added probiotic cultures. Natural cheeses are comprised of a complex microbial ecosystem which is in a constant state of flux as the cheese ages. Changes, including the addition of probiotic microorganisms, have the potential to significantly impact the chemical and microbiological properties of cheese. Hence, careful selection of strains is necessary to minimize alterations to the flavor and texture of cheese.

This presentation will review and discuss recent developments in relation to the production of probiotic cheese, the advantages and disadvantages of cheese as a carrier, the stability of probiotic cultures in cheese, and the impact of processing on the viability of probiotics in natural cheese.

Key Words: Cheese, Probiotic

425 Development of yoghurt and specialty milks containing probiotics. C. P. Champagne*, *Agriculture and Agri-food Canada*, *St. Hyacinthe, QC, Canada*.

Yoghurt and fermented milks have been the most widely used food matrixes for the development of probiotic-containing functional foods. In this review-type presentation, the potential for innovation in this field will be examined. As opposed to starter cultures which are often prepared at the dairy plant, in yoghurt manufacture, probiotics are generally inoculated with direct-to-the-vat (DV) cultures. They are found in frozen or freeze-dried form. Examples will be given as to the effect the method of storage of the DV probiotic concentrate, its method of preparation (thawing or rehydration procedures) and the moment of addition in the yoghurt process on the viability of the probiotics in the product. Probiotic bacteria generally do not grow well in milk and are adversely affected by starters and storage conditions. Examples will be given on how strain selection, ingredients selection (flavours, enzymes, fruits or vegetables, prebiotics), strain microencapsulation and packaging can be used to innovate and develop new products while addressing these stability problems. Unfermented milks are now seen on the market. Data will be presented on the effect of strain viability of probiotics in such products is affected by strain and some technological processes (degassing, strain encapsulation). Fluid milk could be or great interest in promoting the survival of probiotics to the gastric environment, and some thoughts on the effect of the food matrix on probiotic functionality will be offered.

Key Words: Lactobacillus, Bifidobacterium, Functional Foods

426 Recent trends in the microencapsulation and delivery of probiotics in dairy foods. K. Kailasapathy*, *University of Western Sydney*, *Hawkesbury, NSW, Australia*.

Micro encapsulation has become the recent tool used for protecting and delivering bio-actives in the development of bio-functional foods. Probiotic foods are by far the largest functional food market. They provide several health benefits including immuno stimulation. Viability, physiological and metabolic activity of probiotic bacteria in a food product at the point of sale are important consideration for their efficacy, as they have to survive during shelf life of a food, transit through high acidic and alkaline conditions in the gastro-intestinal tract. It is essential that products sold with any health claims meet the recommended criterion of a minimum of 1million CFU/g of probiotic bacteria at the expiry date and the minimum therapeutic dose per day is suggested to be 100 million cells. The reported health benefits of probiotic bacteria are: enhancement of immunity against intestinal infections, immune enhancement, prevention of diarrhoeal diseases, prevention of colon cancer, prevention of hypercholesterolemia, improvement in lactose utilization, prevention of upper gastro-intestinal tract diseases and stabilisation of the gut mucosal barrier. Various studies have shown that probiotic organisms survive poorly in foods like yoghurt and fermented milks with cell numbers being much lower than the recommended levels at the expiry date. Therefore there is a need to protect the probiotic bacteria against adverse processing and storage conditions as well as during transit in the gastro-intestinal tract. Micro encapsulation is an inclusion technique for entrapping live cells such as probiotic bacteria, into a polymeric (gelled) matrix that may be coated by one or more semi-permeable polymers, by virtue of which the encapsulated substance become more stable than the free one. The aim of our investigation was to study the survival of micro encapsulated bacteria in fermented dairy products and their release in the gut and immune-stimulating effects; stability and release.

Key Words: Microencapsulation, Probiotics, Controlled Release

427 Identification of probiotic features in *Lactobacillus acidophilus* affected by dairy delivery. M. A. Azcarate-Peril*, R. Tallon, and T. R. Klaenhammer, *North Carolina State University*, *Raleigh*.

Historians generally agree that yogurt and other fermented milk products were born by accident when Neolithic people living in Central Asia, where the climate was appropriate, noticed that milk, which they carried in pouches made out of sheep's stomachs, had curdled. Today, fermented milk products are often associated with good health and extended life, and some members of the lactic acid bacteria group are recognized as probiotics. In fact, *Lactobacillus acidophilus*, a member of this group, is commonly added to yogurt to promote health benefits. Approximately, 80% of the yogurt in the United States contains added *L. acidophilus*.

This study examined how growth or delivery in milk systems impacts the expression of traits that are important for probiotic activity, fermentative properties, and survival in a dairy environment or the human gastro-intestinal tract. We employed microarray hybridization experiments to first, monitor gene expression of *L. acidophilus* cells propagated in milk during early, mid and late logarithmic phase, and stationary phase. Second, we characterized gene expression after exposure to specific milk components: casein, alpha-lactalbumin, beta-lactoglobulin, glycomacropeptide, and milkfat globule membrane fractions. Additionally, we investigated how mutations in genes differentially expressed during growth in milk affect acidification activity, survival under storage conditions, and adhesion to mucin and Caco-2 tissue culture cells. Whole genome transcriptional studies provided us with an overview of how probiotic organisms survive and function in both the dairy environment and the gastrointestinal tract. From this point on, a functional genomics approach is instrumental to elucidate the role of genes induced or repressed in the presence of compounds of interest, and how we can reprogram bacterial genetic systems to benefit the host.

Key Words: Probiotics, Gene Expression, Milk and Dairy Products