

addition to media increased the antimicrobial activity. The component of the antimicrobial activity will be characterized and optimized in substrate containing milk, whey, or, permeate.

Key Words: Antimicrobial Agents, Nisin, Natural Preservative

580 Challenge testing the lactoperoxidase system against against a range of bacteria using different activation agents. L. W. T. Fweja, A. S. Grandison*, and M. J. Lewis, *The University of Reading, Reading, Berkshire, UK.*

Lactoperoxidase (LP) exerts antimicrobial effects in combination with H₂O₂ and either SCN⁻ or a halide. Garlic extract (GE), in the presence of ethanol (E), has also been used to activate the LP system. This study aimed to determine the effects of three different LP activation systems (LP/SCN⁻/H₂O₂; LP/I⁻/H₂O₂; LP/GE/E) on the growth and activity of three test organisms (*Staphylococcus aureus*; *Pseudomonas aeruginosa*; *Bacillus cereus*). UHT milk was used as reaction medium and the growth pattern of the organisms and a range of keeping quality (KQ) indicators (pH, titratable acidity, ethanol stability, clot on boiling) were monitored during storage at the respective optimum growth temperature for each organism. LP/I⁻/H₂O₂ reduced bacterial counts below the detection limit shortly after treatment for all three organisms, and no bacteria could be detected for the duration of the experiment (35-55 hours). The KQ data confirmed that the milk remained unspoiled at the end of the experiments. LP/GE/E, on the other hand, had no effect on the growth or KQ with *P. aeruginosa*, but gave a small retardation of growth of the other two organisms, accompanied by small increases (5-10 h) in KQ. The effects of the LP/SCN⁻/H₂O₂ system were intermediate between the other two systems and differed between organisms. With *P. aeruginosa* the system exerted total inhibition within 10 h of incubation, but the bacteria regained viability after a further 5 h, following a logarithmic growth curve. This was reflected in the KQ indicators which implied an extension of 15 h. With the other two bacteria, LP/SCN⁻/H₂O₂ exerted an obvious inhibitory effect giving a lag phase in the growth curve of 5-10 h and KQ extension of 10-15 h. When used in combination, I⁻ and SCN⁻

clearly competed for LP system intermediates and displayed negative synergy with respect to both bacterial growth and KQ.

Key Words: Lactoperoxidase, Keeping Quality, Antibacterial

581 Characterization of immuno active peptides present in cell free preparations obtained from milk fermented by L. Helveticus. A. M. Tellez*^{2,1}, M. Corredig^{3,1}, L. Brovko^{2,1}, and M. Griffiths^{2,1}, ¹University of Guelph, Guelph, Ontario, Canada, ²Canadian Research Institute for Food Safety, Guelph, Ontario, Canada, ³Food Science Department, Guelph, Ontario, Canada.

Interest in the ability of bioactive peptides to impact on immune system has grown considerably in the past decade. Fermented milk has been proposed as a source of those bioactive compounds. The objectives of this research were to confirm the effect of bioactive compounds from milk fermented by *Lactobacillus helveticus* (LH-2) on the nonspecific host defense system, and purify and characterize the active peptides. For this reason, the cell free supernatant obtained from centrifugation of the fermented milk was tested and an in vitro study using macrophages (RAW 264.7 cell line) was performed. Cytokines production (IL-6, TNF- α , and IL-1 β), Nitric Oxide (NO) production and Phagocytosis effect were used as biomarkers. Cytokine production in culture supernatants was assessed by ELISA. Trypsin-hydrolyzed fermented milk was used as negative control, and bacterial lipopolysaccharide (LPS) was the positive control. Macrophages stimulated with supernatant showed higher production of cytokines and NO compare with LPS. Phagocytosis effect was positive for macrophages stimulated with supernatant (50.75 % \pm 1.2). The supernatant from fermented milk was analyzed using size exclusion chromatography (SEC) and nine fractions were collected. All fractions were tested for activity. Two fractions (excluded volume and a fraction eluting at 15 minutes) produced higher response when used to stimulate macrophages compared with the other fractions (0.37 and 0.25 ng/ μ g of protein). These results confirmed fermenting milk with *Lactobacillus helveticus* (LH-2) improves bioactivity, and suggested that specific peptides released during fermentation enhance immune response by modulating macrophage activity.

Key Words: Fermented Milk, Bioactive Peptides, Biomarkers

Dairy Foods: On the Road from Analysis and Discovery of Functional Milk Bioactives to New Products and Health Outcomes

582 An approach to capturing and translating the biological activities and health outcomes of milk components. S. L. Freeman*, *University of California, Davis.*

Chronic disease, complex metabolic disorders and obesity dominate the current health landscape. Food has contributed to the problem and therefore food-based interventions offer great potential for not only preventing disease, but also promoting health. To translate the knowledge from analysis and discovery of functional milk bioactives to new products & health outcomes requires different methods, approaches and techniques for studying and validating benefits of these different milk components in a scientifically substantiated manner. Successfully modulating metabolism and immune protection through rational food ingredients and products offers novel solutions to lifestyle

and food choices. Milk is an appropriate model for delivering health benefits because it has evolved to nourish, protect and promote infants to not only survive but also thrive. Fundamentally, the components of milk guide health at a time of extreme vulnerability following birth. Understanding milk from this perspective of how it interacts with different biological processes will enable the development of new food products to guide health in different target population. Integrating food science, molecular biology, physiology, nutritional and clinical aspects to capture and apply the knowledge generated is a key to the development and documentation of effective dairy products. The emphasis has to be on documenting the biological activity of different milk components and how they can be applied to measurable health benefits.

Key Words: Health Outcomes, Bioactive Ingredients, Translational Process

583 The glycome and the glycoproteome of milk. C. Lebrilla*, B. German, D. Mills, and S. Freeman, *University of California, Davis*.

Oligosaccharides and proteins are the third and fourth most abundant components in human milk. Surprisingly, oligosaccharides and glycoproteins have not been traditionally well studied despite their importance as potential bioactive components in milk. The glycomic and glycoproteomic analyses of milk provide opportunities for understanding the role of milk in nutrition and as a potential source of bioactive compounds. New analytical tools are being developed that make the analysis of oligosaccharides and glycoproteins possible. Many of these tools are based on mass spectrometry and liquid chromatography separation. In this presentation, our approach to the analysis of glycans (oligosaccharide) and glycoprotein components of various types of milk from primates to humans will be discussed. Separation methods including nanoflow liquid chromatography and high performance mass spectrometry are employed to characterize the constituents of milk. The milk of five mothers are examined for a period of several months. The oligosaccharide components, the proteins, and the glycoproteins are examined during the period. Changes in the protein expression of specific proteins are observed. The oligosaccharide constituents are relatively constant but very individually while the glycosylation on proteins change dramatically. The implications of these variations are discussed.

Key Words: Mass Spectrometry, Glycome, Glycoproteome

584 Production and use of high CLA foods in human health. D. E. Bauman*¹, C. Tyburczy¹, A. M. O'Donnell¹, and A. L. Lock², ¹*Cornell University, Ithaca, NY*, ²*University of Vermont, Burlington*.

Consumers are increasingly aware of the link between diet and health, and the potential role for functional food components in disease prevention. Conjugated linoleic acid (CLA) has been identified as a bioactive component of dairy products that may benefit the maintenance of human health. The major CLA isomer in dairy products is cis-9, trans-11 (rumenic acid; RA), and it originates predominantly in the mammary gland by endogenous synthesis from rumen-derived vaccenic acid (trans-11 18:1; VA) via the enzyme D9-desaturase. Milk fat concentrations of RA can be markedly increased by manipulation of the cow's diet (e.g. polyunsaturated fatty acid-rich oils, lush pasture) and by selection of individuals naturally producing elevated levels. The content of RA varies with the total fat content of the dairy product; therefore, whole fat products such as cheese, ice cream and butter provide the most CLA to the dietary intake. Furthermore, the ratio of VA to RA is ~ 3:1 in milk fat, and VA can also be used for endogenous synthesis of RA in human tissues. When consumed as a natural component of the diet, the RA in milk fat has been consistently shown to have anti-carcinogenic and anti-atherogenic effects in biomedical studies using animal models of human disease. VA is the predominant

trans fatty acid in milk fat and the fact that humans can convert it to RA provides a compelling explanation for the observed differences in epidemiological studies investigating the effects of natural and industrial derived trans fatty acids on coronary heart disease. Biomedical studies with animal models have also demonstrated that milk fat-derived VA is anti-carcinogenic through its conversion to RA. Nevertheless, extrapolating these results to humans has been limited and problematic because chronic diseases have long latency periods and often have no consensus biomarkers. Overall, dairy products enriched in CLA represent functional foods that offer potential benefits for human health and the prevention of chronic diseases.

Key Words: CLA, Milk Fat, Human Health

585 Sources and characteristics of milk fat globule membranes. R. E. Ward*, *Utah State University, Logan*.

In raw milk, the fat is dispersed as colloidal particles ranging in diameter from 0.1 μm to over 15 μm , each coated in a bilayer of plasma membrane which originates from the secretory cell. The estimated surface of milk fat globular membrane (MFGM) in one milliliter of whole milk is estimated to be 500 cm^2 . MFGM is found in significant quantities in dairy products such as cream, cheese, cheese whey, butter serum and buttermilk. In recent years, technologies have been developed to isolate fractions from these materials rich in MFGM, and the composition and ingredient functionality of the resulting material depends on the physical treatments applied. Utilization of MFGM as an ingredient is limited by its batch-to-batch variability and susceptibility to oxidation. The MFGM is composed of proteins and lipids in approximately a 1:1 ratio with a small contribution of non lactose carbohydrate. Recent proteomic analyses of the MFGM from human, bovine and murine milks have identified over one hundred unique peptides sequences associated with this material. According to gene ontology classifiers, proteins of the MFGM are involved in membrane trafficking, cell signaling, lipid metabolism, and defense against pathogens, as well as other processes. The lipid fraction of the MFGM is primarily composed of triglycerols, and polar lipids such as sphingomyelin, phosphatidylcholine, phosphatidylethanolamine, and phosphatidylinositol with smaller amounts of phosphatidylserine, gangliosides and ether-linked lipids. The unique nature of the lipid secretion process, the vast surface area of MFGM in milk, and the growing list of bioactive constituents suggests potential nutritional functionality. MFGM is unique compared to other bioactive ingredients because of the compositional diversity and density of molecules associated with the surface. It is not unreasonable to expect synergisms in bioactivity among components, which would provide an interesting model for product development. Incorporation of MFGM and fractions thereof into foods will be expedited by scientific demonstration of beneficial bioactivity.

Key Words: MFGM, Bioactive