Dairy Foods Symposium: Bioactive Components in Milk and Dairy Products: Recent international perspectives and progresses in different dairy species

481 Bioactive components in cow milk and products. H. J. Korhonen,* *MTT Agrifood Research Finland, Jokioinen, Finland.*

Milk is considered a nutritionally perfect food for newborn mammals. Furthermore, scientific evidence is continuously accumulating on the health-promoting effects of different milk components. These components encompass proteins, peptides, carbohydrates and lipids, glycolipids and other minor biomolecules. Their biological properties and functions are already reasonably well established and this knowledge has laid the basis for use of bioactive cow milk components as ingredients for functional foods. Industrial or semi-industrial scale processing techniques are available for fractionation and isolation of such components from colostrum and milk. Biomining and marketing of native dairy-derived functional ingredients is now emerging as a new lucrative business sector for the dairy industry and specialized bio-industries. A few milk protein and peptide-based products as well as growth factors have already been commercialized. It can be envisaged that more similar products will be launched on worldwide markets in coming years. Such products could be targeted to specific target groups so as to maintain good health status, improve performance, or prevent diet-related metabolic diseases.

Key Words: milk, bioactives, ingredients

482 Bioactive components in buffalo milk and products. M. Guo,* *University of Vermont, Burlington.*

Buffalo are the second largest source of milk supply in the world; world production of buffalo milk exceeds 75 million metric tons per year and is increasing steadily at about 3 percent per year. Because buffalo milk has higher total solids compared with bovine milk, it accounts for about twice the food contribution implied by the volume of buffalo milk produced yearly. Buffalo milk may contain almost all the bioactive compounds found in bovine milk, e.g., proteins, peptides, fatty acids, vitamins, and other bioactive compounds. Buffalo milk has higher levels of total protein, medium chain fatty acids, CLA, and contents of retinol and tocopherols than those in bovine milk. Some components may only be present in buffalo milk such as gangliosides. Because of the differences in compositional and physiochemical properties between buffalo and bovine milk, processing technology and equipment designed for cow's milk may not be suitable for buffalo milk processing. However, it has been approved that buffalo milk can be utilized for manufacture of a wide variety of functional dairy products with limited modifications in processing technology.

Key Words: bioactive, components, buffalo

483 Bioactive components in goat milk and products. Y. W. Park,* *Fort Valley State University, Fort Valley, GA.*

Milk contains a wide variety of heterogeneous mixture of chemical and bioactive compounds, which play integral roles in human health and nutrition. Once these components are liberated from milk and dairy products, they exhibit various physiological effects in the body, including gastrointestinal, cardiovascular, endocrine, immune, and nervous systems. Functionalities of bioactive peptides include antimicrobial, antihypertensive, antithrombotic, antioxidative, hypocholesterolemic, antiappetizing, immunomodulatory and mineral binding activities. Bioactive compounds in caprine milk have not been well explored compared with human and bovine milk. Quantification of bioactive components in different species milk has been difficult, due to their biochemical complexities, the small concentrations, the need to develop special methods to quantify, the compartmentalization of some of the agents, and the dynamic effects of maternal factors on the concentrations. A myriad of milk-derived bioactive peptides have been reported. Immunomodulatory peptides, as one example, include αs1-CN f194–199 (αs1-immunocasokinin) and β-CN f193–202, f63–68, f191–193 (immunopeptides), that are synthesized by hydrolysis with pepsin-chymosin. Casein fractions of goat milk proteins, such as α-, β- and k-CN, are sources of bioactive components, which contain the peptides Tyr-Gln-Glu-Pro, Val-Pro-Lys-Val-Lys, and Tyr-Gln-Glu-Pro-Val-Leu-Gly-Pro-* from β-CN, as well as Arg-Pro-Lys and Arg-Pro-Lys-His-Pro-Ile-Lys-His-* from αs1-CN, that exhibit ACE-inhibitory activity. Goat milk has therapeutic, hypoallergenic and nutritional advantages over cow milk due to its specific bioactive protein, fatty acids and mineral compositions. The short and medium chain fatty acids (MCT) in goat milk have several bioactive functionalities in digestion, metabolism, treatment of lipid malabsorption syndromes. Other bioactive components in goat milk include CLA, gangliosides, glycolipids, glycosphingolipids and cerebrosides, alkylglycerol, phospholipids, growth factors, hormones, immunoglobulins, oligosaccharides, lactose-derivatives, lactoferrin, lysozyme, nucleosides, nucleotides, minerals, and vitamins.

Key Words: goat milk, products, bioactive components

484 Bioactive components in sheep milk and products. M. A. de la Fuente* and M. Juarez, *Instituto de Investigacion en Ciencias de la Alimentacion, Madrid, Spain.*

Although in quantitative terms the production of sheep milk is of marginal importance compared with cow milk, it is of particular interest in certain areas of the world and has special relevance for arid and semi-arid regions. Most sheep milk produced in the world is processed into dairy products, mainly cheese. The specific composition of milk of sheep makes it especially valuable nutritionally and for consumer health since it generally contains higher total solids and major nutrient contents than goat and cow milk. Sheep milk is an excellent source of high-quality protein, calcium and lipids. It also became apparent during the last years, that some milk compounds possess biological properties beyond their nutritional significance that can be utilized as ingredients for health-promoting functional foods or as nutraceuticals. Milk lipids contain several components that have demonstrated healthy properties. The most important is the rumenic acid, an isomer of the conjugated linoleic acid (CLA). Data from in vitro studies and animal models suggest that rumenic acid is responsible for CLA anticarcinogenic and antiatherogenic properties, as well as a multiplicity of potentially beneficial effects on human health. Enzymatic hydrolysis of milk proteins during gastrointestinal digestion and/or milk processing can release fragments, known as bioactive peptides, able to exert specific biological activities, such as antihypertensive, antimicrobial, opioid, antioxidant, immunomodulatory, or mineral binding. With the research tools available nowadays, the presence of these components with biological activity has been demonstrated in cow but less is known about ovine milk. This presentation will discuss current knowledge of the main natural bioactive substances contained in sheep dairy products mostly linked to the lipid and protein fractions. Emphasis will be put on fatty acids as CLA and bioactive peptides, which can favorably contribute to human nutrition.

Key Words: sheep milk, dairy, conjugated linoleic acid

485 Biosynthesis and secretion of bioactive compounds in milk in relation to genetic, molecular, and endocrine mechanisms. R. M. Akers,* *Virginia Tech, Blacksburg.*

Research and general interest in bioactive components in milk and milk products has exploded in the past decade. A simple PubMed search of primary scientific journal articles using the key word bioactive shows returns of 714, 1524, and 2,751 for the years 2000, 2005, and 2010, respectively. In this review, I explore the sources of bioactive components in mammary secretions and pathways which allow for synthesis, secretion and/or transport of bioactive materials into milk and mammary secretions. In the past decade understanding of regulatory processes that affect secretion of lipids and proteins in multiple cell types has also increased. Some of these proposed mechanisms have also been examined in mammary secretory cells. A prime driver of alterations in the composition of mammary secretions e.g., the change from colostrum-like to mature milk is the state of biochemical and structural differentiation of the mammary alveolar cells. Thus understanding factors which initiate and maintain the differentiated state of these cells directly correlates with the composition of milk and therefore the presence of various bioactive components. Gene profiling, proteomic measurements and other molecular tools have made it clear that the various cells within the mammary gland (ductal and alveolar epithelial cells, myoepithelial cells, endothelial cells, fibroblasts, adipocytes, macrophages, plasma cells etc.) are capable of producing a variety of bioactive agents including hormones, growth factors, and derivatives unimagined until recently. It is important to remember that milk and mammary secretions are first and foremost biological fluids. The lactocrine hypothesis to explain how the mammary gland and its secretions can act to control neonatal development is gaining much support. It is rather ironic that while we have long appreciated the nutrient value of mammary secretions, a nearly perfect food, we are seemingly only now beginning to appreciate the rich diversity of the bioactive agents in milk and milk products.

Key Words: bioactive, mammary, milk