68 Milk glycobiome and impact on human health. J. B. German*1,2, 1University of California-Davis, Davis, CA, 2Foods for Health Institute, University of California-Davis, Davis, CA.

The evolutionary origin of lactation and the composition, structures and functions of milk’s biopolymers highlight the Darwinian pressure on lactation. Lactation selected for biopolymers with considerable structural complexity that in turn provide functions from the mammary gland through the digestive system of the infant. Milk is an extensively glycosylated biological fluid whose glycan structures and functions are only recently emerging, although just one of the roles, feeding and fueling a unique microbiological community within the lower intestine of the infant is an astonishing example of evolutionary composition for biological function. Milk contains glycans, complex polymers of sugars whose stereospecific linkages are not matched by glycosidic enzymes within the mammalian infant gut. Hence, these glycan polymers travel to the lower intestine undigested. On reaching this microbe-rich environment, bacteria compete to access and ferment the sugars via different hydrolytic strategies. One specific strain of bacteria, Bifidobacterium longum ssp. infantis, (B. infantis) is uniquely equipped genetically with a repertoire of genes encoding enzymes capable of taking up, hydrolyzing and metabolizing the complex glycans of human milk. This combination of a distinct food supply and unique genetic capability results in a profound effect on the composition and metabolic products of the entire microbial community within the lower intestine of breast-fed infants. The intestinal community is dominated by B. infantis, its metabolites and its interactions with the host. The role of B. infantis and its metabolites in shielding the infant from the growth of gram-negative enteropathogens and their endotoxins is a clear benefit and consistent with a selective advantage for this aspect of lactation evolution.

Key Words: lactation, oligosaccharides, microbiome

69 Bioactive peptides in dairy products. N. P. Shah*, The University of Hong Kong, Hong Kong.

The functionality of dairy proteins is further enhanced upon liberation of bioactive peptides by proteolysis caused by naturally occurring enzymes in milk, and those in bacteria from starter cultures and probiotics. Among various bioactive peptides, antihypertensive peptides have been studied extensively. These peptides inhibit angiotensin I-converting enzyme (ACE), the key enzyme responsible for the regulation of blood pressure via the renin-angiotensin system. ACE converts angiotensin I to angiotensin II, a potent vasoconstrictor; ACE also hydrolyzes and inactivates bradykinin, a potent vasodilator. Therefore, excessive activity of ACE leads to an increased rate of vasoconstriction and development of high blood pressure. Inhibitory peptides block the ACE-mediated production of angiotensin II, and the reduction in ACE activity results in enhanced levels of bradykinin, resulting in an overall antihypertensive effect. Various food-derived peptides possess ACE inhibitory (ACE-I) properties. Caseins are important sources of those peptides. Biological significance of ACE-I peptides, their impact on human health and incorporation in functional foods have been the subject of intense research. Some antihypertensive peptides present in sour milk resist in vivo degradation and exert antihypertensive activity through the inhibition of ACE in the aorta. Most of the studies on the ACE-I production by fermentation are performed with selected strains of lactic acid bacteria mainly L. helveticus and direct hydrolysis of milk proteins with purified enzymes. A variety of naturally formed bioactive peptides have been found in fermented dairy products such as yogurt, sour milk, and cheese. These peptides are known to have multifunctional properties including immunostimulatory, opioid, hypotensive, antiatherosclerotic, and antimicrobial activities. Several commercial products with highly proteolytic strains of L. helveticus have been developed and marketed to possess hypotensive activity including Calpis sour milk, prepared by fermenting milk using mixed culture containing L. helveticus CM4 (CP790) and Saccharomyces cerevisiae, which are responsible for the release of 2 tripeptides, Val-Pro-Pro and Ile-Pro-Pro, and Evolus (Valio Ltd., Finland), which is produced by highly proteolytic L. helveticus LBK-16H.

Key Words: bioactive peptide, angiotensin I-converting enzyme, L. helveticus


It has been thought for more than 50 years that saturated fat consumption is associated with increased risk of cardiovascular disease (CVD), because it raises LDL-cholesterol, a biomarker thought to better predict CVD risk. Because of this, current dietary guidelines recommend to limit saturated fat and/or saturated fat sources such as whole milk dairy foods. In fact, recommendations for dairy products consumption are limited to low-fat and fat-free versions. However, it has to be recognized that saturated fat is not a single compound but rather comprises a broad spectrum of fatty acids, and specifically, saturated fat in dairy foods is rich in different classes of saturated fatty acids that exert differential effects on metabolic and health outcomes. Additionally, emerging scientific evidence suggests that saturated might not be harmful as it has been thought, and related with whole milk dairy products (milk, cheese and yogurt) the evidence suggests that it might be associated with lower risk of chronic diseases. Thus, the objectives for this presentation attendees are (1) to review the current nutrition landscape and barriers for saturated fat, (2) to summarize the emerging scientific evidence around saturated fat and its association with cardiometabolic diseases, (3) to summarize the emerging body of evidence on dairy foods and their connection with cardiovascular disease, obesity, type 2 diabetes.

Key Words: milk fat, human health, saturated fat

71 Milk, calcium, and human health. B. R. Martin* and C. M. Weaver, Purdue University, West Lafayette, IN.

Calcium and vitamin D are among the key nutrients contributing to growth and bone development. It is estimated that approximately 40 to 50% of consumed calcium comes from fluid milk and approximately an additional 20% from other dairy sources. Building peak bone mass to optimal levels during childhood and adolescence will reduce the risk of fracture later in life. A National Osteoporosis Position Statement evaluated the strength of the lifestyle factors on developing peak bone mass (Weaver et al., Osteoporosis International 2016). Dietary calcium and physical activity have the strongest level of evidence for positive effect followed by dairy intake and vitamin D. Later in life, the goal of lifestyle modification is to reduce bone loss. Calcium and vitamin D have been
the most studied nutrients partly because they are most often deficient. The reported effectiveness of added calcium and vitamin D from food, beverages, or supplements is mixed. Increased calcium intake has not led to lower body weight unless as part of a weight loss diet. Evidence of the recent concern of high calcium intakes on soft tissue calcification is considered insufficient to alter public health recommendations. It is prudent to have a diet that includes adequate amounts of calcium. Cow’s milk and dairy products are nutrient dense and bioavailable sources. 

Key Words: calcium, vitamin D, osteoporosis