There is evidence that some prebiotics may alter the microflora for GI benefits, such as ameliorating symptoms of irritable bowel syndrome, celiac disease, type II diabetes, and obesity (Zhao, 2013; Powers et al., 2013; Carvalho and Saad, 2013; Hosseini et al., 2012). This review discusses the likelihood that prebiotics and specifically galacto-oligosaccharides (GOS) can modulate colonic bacteria to improve lactose digestion and tolerance.

GOS resist hydrolysis by salivary and intestinal enzymes due to the configuration of their glycosidic bonds and subsequently reach the colon virtually intact. Ingesting GOS leads to alterations in the composition and activity of the microflora in selective manner. GOS enhance the growth of lactose-metabolizing, colonic bacteria that already exist in the digestive tract, including multiple species and strains of *bifidobacteria* and *lactobacilli* (Silk et al., 2009; Depeint et al., 2008).

Increased populations of lactose-metabolizing colonic bacteria have been correlated with increased β-galactosidase activity and GOS utilization, thereby increasing the fermentation of lactose into galactose, glucose, and short-chain fatty acids (Jiang, 1996). This adaptation of the colonic microbiota would be expected to reduce lactose-derived gas production in the lower bowel and thereby blunt the symptoms of lactose intolerance. Barrangou et al. (2003) described a locus in the *L. acidophilus* genome involved in the transport and intracellular catabolism of fructo-oligosaccharide (FOS) compounds. Similar studies on the *bifidobacterium infantis* genome identified oligosaccharide-binding proteins and ATP permeases involved in GOS utilization (Sela, 2008). These transporters and binding proteins are found in the genomes of other *bifidobacteria*, suggesting that the mechanism of GOS utilization may be widely distributed.

GOS-mediated adaptation to improve lactose tolerance was recently studied in a randomized, double-blinded clinical trial of 61 patients with lactose intolerance. Subjects were fed a high purity GOS preparation. There was a trend of improved lactose digestion and fewer symptoms of lactose intolerance post-treatment among all subjects dosed with GOS compared to the placebo population. Further, subjects on GOS were six times more likely to claim they were lactose tolerant post-treatment. In parallel, there was a dramatic change in the fecal microbiome of lactose intolerant individuals (83% of patients reported a remarkable shift in the microbiome) that were clinically responsive to dietary adaptation to the GOS treatment intake over a lifetime, there is need for tolerable and convenient approach that allows for recommended levels of milk and dairy product consumption in people suffering from lactose intolerance.

An approach that provides a simplified dosing regimen as well as the potential for extended relief from symptoms following a limited therapeutic regimen could result in greater compliance and address an unmet medical need (Jiang, 1996).

Adaptation to improve lactose tolerance has been suggested since at least the 1940s when lactose maldigesting refugees were fed dry milk as their primary/solo food and their symptoms of intolerance abated after a few days (Reddy et al., 1972, Habte et al., 1973). Some attributed this adaptation to changes in the mammalian intestinal lactase. But studies conclusively demonstrated that this enzyme does not respond to diet (Gilat et al., 1972). An alternative mechanism for the improvement in tolerance is adaptation of the intestinal microbiome. As early as 1993, adaptation of the colon bacteria was a suggested approach to improve lactose digestion and tolerance (Flourié et al., 1993). In 1998, Hertzler and Savaiano demonstrated significant improvement in lactose digestion, tolerance, and elevation of fecal beta-galactosidase due to colonic adaptation. When microbial adaptation in the human intestinal tract occurs in a person with lactose maldigestion, the altered population of bacteria increases intraluminal beta-galactosidase activity, thereby enhancing lactose digestion and reducing the production of fermentation products (Hertzler, Savaiano, and Levitt, 1997).

In summary, GOS are unique, non-digestible, and easily tolerated prebiotics that may be utilized to alter intestinal microbiota to improve lactose digestion and tolerance.