



## **Happy Days Dairies Ltd. Article Series**

### **Article #5 - The Pre- and Probiotic Benefits of Goat Milk**

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## Article 5, The Pre- and Probiotic Benefits of Goat Milk

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### Introduction

The human large intestine is colonized by both beneficial as well as pathogenic bacteria. Infectious diseases are amongst the biggest disease states affecting humans every year, with gastrointestinal infections being responsible for significant morbidity and mortality worldwide (Tambeka & Bhutada, 2010). According to the World Health Organization (WHO), more than four billion episodes of diarrheal diseases occurs annually, with 2.2 million deaths attributable to enteric infection, making it the fifth leading cause of death at all ages worldwide. Enteric bacteria such as Salmonella, Shigella, E.coli, Vibrio cholerae and S.aureus species are amongst the major bacterial species causing enteric infection (Tambeka & Bhutada, 2010). Many of these disease states arise from an imbalance in intestinal bacteria such that the number of beneficial and infection-fighting gut microorganisms is insufficient, resulting in an increased colonization of harmful bacteria. Prebiotics and probiotics have a long history of use in humans in order to restore this bacterial imbalance and prevent disease.

Milk and fermented dairy products are rich sources of prebiotics and probiotic microorganisms, and are commonly consumed for maintaining gastrointestinal health. More recently, goat milk has been recommended as a healthier alternative to cow's milk, and as such their properties are commonly compared. As cow milk production is cheaper and can be done in larger volumes, it tends to have a lower market price and be more commonly consumed. However, the health benefits of goat milk are becoming more widely known and understood, and nowadays many people are choosing goat milk as a premium health product with benefits including better digestibility, nutrient absorption, alkalinity and buffering capacity, in addition to therapeutic characteristics in medicine and human nutrition. I have discussed many of the beneficial properties as well as the specific nutrient characteristics of goat milk in detail in previous articles. This article addresses the pre- and probiotic effects of goat milk and fermented dairy products and their contribution to health and disease prevention.

## **What are Prebiotics & Probiotics?**

### **Prebiotics**

Gibson and Roberfrid (1995) first defined a prebiotic as “a nondigestible food ingredient that beneficially affects the host by selectively stimulating the growth and/or activity of one or a limited number of bacteria in the colon and thus improves health.” Recently, this definition has changed to “a selectively fermented ingredient that allows specific changes both in the composition and/or activity in the gastrointestinal microbiota that confers benefits upon host well-being and health” (Macfarlane et al., 2007). In other words, prebiotics are functional components of certain foods that remain undigested until they reach the large intestine, where they encourage the growth of beneficial bacteria by acting as their energy source.

### **Probiotics**

A probiotic can be defined as a live microorganism that may confer a health benefit on the host. They are known to maintain intestinal homeostasis, offering protection against pathogenic infections. The most common strains of probiotic bacteria are Lactobacilli and Bifidobacteria, which are found in dairy products and fermented foods such as yogurt or kefir. These microbes directly help to enhance resistance against intestinal pathogens and in preventing diseases by producing compounds including organic acids (lactic and acetic acids) and bacterions that are toxic to pathogens and inhibit their growth by lowering intestinal pH (Tambeka & Bhutada, 2010). There is increasing evidence that probiotics are beneficial for protecting against gastrointestinal diseases including diarrhea, inflammatory bowel diseases such as Crohn’s disease and ulcerative colitis, irritable bowel syndrome and typhoid, among others. Similarly, a reduction of beneficial probiotic bacteria has been shown to contribute to these types of digestive problems.

## **Prebiotic & Probiotic Profile of Goat Milk and Fermented Goat Dairy Products**

Goat milk possesses nutritional characteristics that make it superior to cow milk such as smaller fat globules and presence of shorter chain fatty acids as well as digestive, immunological and antibacterial properties. In addition to these beneficial qualities, goat milk is also a good source of prebiotics due to its oligosaccharide and lactose-derived components, while its fermented products contain beneficial probiotic bacteria.

Milk contains carbohydrates called oligosaccharides, which function as prebiotics that promote the growth of *Lactobacillus bifidus* in the intestinal tract (Park, 2009). It is widely accepted that breast-fed infants are more protected against infection than formula-fed infants, which is attributed to the presence of oligosaccharides in human milk (0.7-1.2g/100ml) that are able to

## **Prebiotic & Probiotic Profile of Goat Milk and Fermented Goat Dairy Products.. continued**

stimulate the growth of immune-protective bacteria in the gastrointestinal tract (Daddaoua et al., 2006). Interestingly, the oligosaccharide profile of goat milk is most similar to that of human milk, and contains a larger amount and variety of oligosaccharides than cow milk (25-30mg/100ml versus 2-3mg/100ml, respectively), making this dairy source a healthy and therapeutic alternative to cow milk (Lara-Villoslada et al., 2006). Furthermore, many of these oligosaccharides contain sialic acid, which has been shown to promote the neurological development of infants.

In addition to oligosaccharides, goat milk also contains lactose-derived compounds such as lactulose, lactic acid and lactobionic acid which exert prebiotic properties. Lactulose and lactic acid are nondigestible, but both of these compounds act as a source of soluble fiber which can be used in the treatment of constipation and chronic hepatic encephalopathy. Lactulose in particular, is a disaccharide which is formed by the heat processing of milk and exerts beneficial health effects by selectively stimulating the growth and/or activity of probiotic bacteria including Bifidobacteria and Lactobacilli (Ebringer et al., 2008). Furthermore, nucleotides are also present in milk, which are precursors for the synthesis of glycoproteins, glycolipids and oligosaccharides. Goats have higher nucleotide content in their milk compared to other dairy sources.

Goat milk contains a greater amount of certain minerals such as calcium, zinc and magnesium than other dairy sources, which may also influence the growth of lactic acid bacteria as they are required substrates for lactose fermentation. Furthermore, the higher whey protein concentration in goat milk may also contribute to the growth of Lactobacillus acidophilus and Bifidobacteria as their growth is enhanced by the presence of higher levels of certain amino acids (Slacanac et al., 2010).

As previously mentioned, in addition to their growth being stimulated by the presence of prebiotics, probiotic bacteria are also naturally present in fermented dairy products. During fermentation the nutritive value of goat milk increases as the amount of probiotic bacteria augments. Thus, the regular consumption of products such as yogurt and kefir are particularly beneficial for health maintenance and protection against harmful disease-causing organisms (Slacanac et al., 2010; Otles and Cagindi, 2003).

## The Health Benefits of Pre- and Probiotics: Scientific Evidence

Pre- and probiotics have been studied for their numerous health benefits, which are summarized in Table 1. A review by Szajewska (2007) evaluating six meta-analyses found that infants with acute diarrhea benefit from treatment with probiotics. This article specifically found probiotic bacteria to reduce the duration and severity of diarrhea. Similarly, another meta-analysis on the treatment of traveler's diarrhea showed that probiotics significantly reduced the severity and duration of the disease. These beneficial microorganisms have also been found to improve the symptoms of constipation and inflammatory bowel disease including ulcerative colitis and Crohn's disease (Park, 2009). Clinical studies show that inflammation of the colon and small intestine in cases of ulcerative colitis and Crohn's disease are due to a loss of tolerance to resident bacteria, and that the ingestion of probiotics can lead to significant improvements in the patient's quality of life.

In addition to gastrointestinal diseases, studies have found probiotic bacteria to exert cholesterol-lowering effects. Many clinical trials show that a regular administration of selected probiotics reduces the concentration of serum cholesterol, especially low-density lipoprotein (LDL) (Ebringer et al., 2008). It is assumed that probiotic bacteria can metabolize cholesterol and therefore reduce its resorption in the gastrointestinal tract. This has been shown in experiments which indicate that both in vitro and in vivo Lactobacilli, Bifidobacteria and other milk bacteria assimilate cholesterol, incorporate it into membranes, deconjugate and precipitate the bile acids. Deconjugated bile acids are less soluble and therefore less absorbed from the intestinal lumen than their conjugated forms (Ebringer et al., 2008).

Furthermore, Slacanac et al. (2010) investigated the inhibitory role of fermented goat milk on certain intestinal and urogenital pathogens as a result of the presence of probiotic bacteria including Lactobacillus and Bifidobacteria. Their results showed a higher in vitro inhibitory effect on *C. albicans*, a pathogenic bacterial species isolated directly from the cervixes of women with diagnosed vaginal yeast infections. Similarly, fermented goat milk exerted a larger in vitro inhibitory effect on *Salmonella enteritidis* in infants diagnosed with salmonellosis. In another study, Salva et al. (2011) found fermented goat's milk to stimulate the immune system of immunocompromised mice to improve defenses against intestinal and respiratory infections.

Research has also shown the gastrointestinal benefits of prebiotic oligosaccharides in goat milk. In particular, Daddaoua et al. (2006) found goat milk oligosaccharides to be useful in the management of inflammatory bowel disease. The study was conducted on rats which were randomly assigned to three disease groups; (1) those who received goat milk oligosaccharides before colitis induction; (2) those who did not consume any goat milk, and (3) a control group. At the end of the study, the group receiving goat milk showed decreased anorexia and body weight loss as well as reduced bowel wall thickening and expression of inflammatory markers. Similarly, Lara-Villoslada et al. (2006) investigated the effect of goat milk oligosaccharides on

## The Health Benefits of Pre- and Probiotics: Scientific Evidence.. continued

dextran sodium sulfate-induced colitis in a rat model, and found that the oligosaccharides protected against weight loss and resulted in less severe lesions in the colon as well as a more favourable intestinal microflora. In addition, randomized, controlled animal trials have shown the effects of lactulose on inflammatory bowel disease, Crohn's disease and ulcerative colitis (Ebringer et al., 2008).

**Table 1. The Primary Reported Health Benefits for Products Containing Probiotic Organisms**

Restoration & maintenance of healthy flora
Diarrhea, including travelers' and antibiotic induced
Inflammatory bowel disease (IBD), including ulcerative
Colitis and Crohn's Disease
Constipation
Improving body's natural defense
Urogenital and vaginal infections
Enhancement of immune system functions
Inhibition of pathogenic and putrefactive bacteria
Cancer prevention
Allergy/atopic dermatitis prevention
Reduction of lactose intolerance
Cholesterol-lowering
Antihypertensive

(Young, 2007)

### Pre- and Probiotic Protection

Prebiotics and probiotics play a significant role in the maintenance of gastrointestinal health and disease prevention in both infants and adults. Goat milk in particular is significantly rich in lactose-derived oligosaccharides compared to other dairy forms, and fermented goat dairy products are abundant sources of these beneficial microorganisms. The combined effect of these characteristics make goat milk, yogurt and kefir important dairy alternatives that enhance overall health.

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