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A review on health promoting aspects of goat milk

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Abstract

Goats play an important role in livestock industry having adaptability to harsh climates which make them suitable for landless and marginal farmers. They are one of the main contributors of milk and meat products. Goat milk is different from cow and human milk, these differences in composition of cow milk and goat milk may result into the products with different sensory characteristics, nutritional and therapeutic values. Goat milk contains higher amount of calcium, magnesium and phosphorus than cow and human milk. Medium chain triglycerides (MCT) and proteins which are more in goat milk have been recognized as unique lipid and protein with unique health benefits. The soft curd of goat milk may be an advantage for adult humans suffering from gastrointestinal disturbances and ulcers. It is reported that the bioavailability of Zn is enhanced by goat milk in comparison to cow milk. Moreover, goat milk is also used as therapy against different problems including gastrointestinal disturbances, vomiting, colic, diarrhea, constipation and respiratory problems.

Keywords: Goat milk, therapeutic values, Medium chain triglycerides, health benefits.

Introduction

Goats are important small ruminants in many parts of the world. Due to the characteristics they possess in terms of withstanding harsh conditions and the low cost of maintenance ^[1], goat is considered as the major livestock of many countries such as India, Pakistan and Bangladesh ^[2]. In the developing world, goat can fulfill the difference between malnourished and healthy sustaining diet and play a vital role in the socioeconomic structure of rural poor ^[3]. The importance of goats as providers around the world of essential food in meat and dairy products has been discussed and documented in many proceeding of national and international conferences ^[4].

The milk of different ruminant species, either directly or as dairy products, comprises a food of outstanding importance for humans throughout their lives ^[5]. Goat milk has many special characteristics that can be attributed to number of health benefits. Popularity of goat milk as a functional food is increasing because of its nutritional properties and lower allergenicity in comparison to cow milk, especially in non-sensitized children and it now forms a part of the current trend to healthy eating in developed countries ^[6]. Goat milk differs from cow or human milk in higher digestibility, distinct alkalinity, higher buffering capacity, and certain therapeutic values in medicine and human nutrition. There are many nutritional and health benefits of goat milk which are related to a number of medical problems and it is considered as a substitute for those who suffer from cow milk allergy ^[7].

Goat's milk is the most complete food known which is highly compatible and nourishing natural food and also preferred due to its low fat content and its capability to neutralize the acids and toxins present in the body ^[8]. Goat milk is usually compared with cow milk. Cow milk production is much cheaper and the volumes are much larger and so cow milk has a lower market price ^[9]. Goat milk provides a great excess of Ca and P in relation to energy to human infant, both calcium and phosphorus of goat milk are absorbed by the human infant and contains about 1.2 g calcium and 1 g phosphate per litre; these concentrations are similar to those in cow milk ^[10]. Human milk contains much less of these minerals with only one-fourth as much calcium and one-sixth as much phosphate.

Goat milk differs from cow milk in having better digestibility, alkalinity, buffering capacity and certain therapeutic values in medicine and human nutrition, goat milk and its products are therefore an essential niche in the total dairy industry sector besides production differences ^[11].

Nutritional Aspects of Goat Milk

Protein

Goat's milk contains a somewhat lower amount of caseins and so high proportion of serum

proteins which is the first reason normally given to explain the greater digestive utilization made of goat milk protein than of cow milk protein^[12]. Amino acid profile of goat milk is similar to cow and human milk except for a lower concentration of cysteine^[13]. Goat milk is a valuable source of taurine for the human neonate and the adult^[14]. Polyamines are important for optimal growth, gastrointestinal tract (GIT) cell function, maturation of GIT enzymes and have been implicated in reducing the incidence of food allergy in infants^[15]. Ploszaj *et al.*^[16] found that goat colostrum and milk are rich in polyamines, highest compared to milk of other mammals, so goat milk appears to be an excellent source of polyamines for infant^[15]. Goats' milk has some particular properties that confer technological advantages in comparison to cow's milk, such as alpha-1-casein, resulting in softer gel products, a higher water holding capacity and a lower viscosity^[17, 18, 19].

Fat

Proportion of short and medium-chain fatty acids, especially butyric, caproic, caprylic, capric, lauric, myristic, palmitic, linoleic acid and linolenic acid in goat milk is much high and Caproic, caprylic and capric acids have actually named after goats, because of their predominance in goat milk^[20]. Goat milk also has higher proportions of polyunsaturated fat acid (PUFA) as well as conjugated linoleic acid (CLA). Short and medium chain fatty acids, as well as medium chain triacylglycerols (MCT), have become established medical treatments for several clinical disorders^[21]. Goat milk contains minor lipids including gangliosides, glycolipids, glycosphingolipids and cerebrosides and these minor lipids are also considered bioactive components in goat milk exert similar effects to that of cow and human milk. These functions include cell-to-cell interaction, immune recognition and, receptor functions for protein hormones and bacterial toxins such as enterotoxin and cholera toxin^[22]. Goats' milk has smaller size of fat globules that confer technological advantages in comparison to cow's milk, such as a, which provides a smoother texture in derived products^[23, 24].

Carbohydrate

Lactose is the major carbohydrate in goat milk and the content is slightly lower than in cow milk^[25]. Lactose helps in intestinal absorption of calcium magnesium and phosphorus and the utilization of vitamin D^[5]. Other carbohydrates found in goat milk are oligosaccharides, glycopeptides, and glycoproteins which are considered to be beneficial components of human nutrition due to their prebiotic and anti-infective properties^[25]. Recently, oligosaccharides from goat milk were characterized goat milk typically contains between 250 and 300 mg/L oligosaccharides, 4–5 times higher than the content in cow milk and 10 times higher than that of sheep milk, but still much lower than in human milk, at 5–8 g/L. The oligosaccharides in goat milk are complex, with a profile most similar to human milk, in comparison to cows and sheep. Thus, goat milk appears to be an attractive natural source of human-like oligosaccharides for infant, follow on, and health-promoting formulas, due to its composition and content^[26].

Vitamins

Goat milk contains 25% more vitamin B6, 47% more vitamin A than regular cow's milk, and is mainly contains vit A2^[27]. Goat milk supplies adequate amounts of Vitamin A and

niacin, and excesses of thiamin, riboflavin and pantothenate for a human infant^[28] and has much lower content of B1 (thiamine). It is remarkable that caprine milk derives its vitamin A potency entirely from the vitamin itself and entirely lacks the precursor carotenoid pigments characteristic of bovine milk, which also causes goat's milk and milk fat to be much whiter in color.

Mineral Salt

Goat milk contains major and trace minerals including Ca, Na, Mg, P, K and Zn, Mn, Se, Co, Cu, Fe respectively and Ceballos *et al* observed significantly higher level of Ca, P, Mg, Fe and Cu in the goat milk ash than those in the cow milk ash. Goat milk contain approximately 13% more calcium per serving than cow's milk, and making it one of the predominant natural minerals in milk and containing about 134% more K element^[29]. Nowadays, the better nutritional quality of goat milk compared to cow milk, on the basis of its mineral composition, is considered to result not just from the minerals provided by each, but also from the body's utilization of them, in both digestive and metabolic processes^[30].

Medicinal Aspects of Milk

The soft curd of goat milk may be an advantage for adult humans suffering from gastrointestinal disturbances^[17] and high buffering capacity of goat milk appears to be useful for treatment of gastric ulcers^[5]. Goat milk has been recommended as a substitute for patients allergic to cow milk and about 40-100% of patients allergic to cow milk proteins tolerate goat milk^[31]. There are more medium chain length fatty acid or medium Chain Triglycerides (MCT) in goat milk which have been recognized as unique lipid with unique health benefits in mal-absorption syndromes, chyluria, steatorrhea, hyperlipoproteinemia, and in cases of intestinal resection, coronary bypass, premature infant feeding, childhood epilepsy and gallstones. MCT help in inhibits or limits cholesterol deposition, also help to dissolve cholesterol gallstones and contributes to normal growth of infants^[32]. Regular intake of goat milk significantly improves the body weight gain, improved mineralization of skeleton, increased blood serum vitamin, mineral and haemoglobin levels and results in reduction of total cholesterol level due to presence of the higher MCT, 36% in goat milk versus 21% in cow milk, which decreases the synthesis of endogenous cholesterol and also helps to boost the immune system^[33]. Goat milk is rich in selenium which is a necessary nutrient for body and known for its immune strengthening and antioxidant properties. Raw milk soothes (calm) the digestive tract; people with conditions, such as bloating, diarrhea, asthma, and irritability may very well be suffering from an allergic reaction to cow's milk^[8]. Goat milk is an important sources of biorganic sodium. The lack of this mineral is thought to be caused arthritis and also inhibits the stomach's production of needed enzymes which causes bloating, and even ulcers^[8, 17]. Goat's milk contains less of the enzyme xanthine oxidase. High level of this enzyme in blood circulation can cause tissue scar on the heart that result in the liver supplying more cholesterol in order to protect the heart. Arteriosclerosis can be the result of this mechanism^[33]. So goat milk also help in preventing arteriosclerosis. It is easier to digest than cows' milk and may have certain therapeutic value^[17] and a feasible nutraceutical for gastrointestinal disorders^[34].

Therapeutic Aspects of Fermented Goat Milk

Goat milk could be a future trend in the field of probiotic fermented milk products because of several reported health benefits. Fermented milk forms a soft curd when compared to cow's milk and hence helps in easy digestion and absorption. Kullisaar *et al.* [35] showed antioxidative and anti-atherogenic effects from fermented goat milk (*Lactobacillus fermentus* ME-3) in healthy subjects. Both reduce the risk for cardiovascular disease. One disadvantage with goat milk is the almost nonexistent content of folic acid and this problem could be solved by using folate-producing bacteria during fermentation. Sanna *et al.* [36] used a mix of *Streptococcus thermophilus* and *Lactobacillus delbrueckii subsp. bulgaricus* for fermenting goat milk which resulted in to a yogurt with a significant quantity of folate and good sensory attributes. Fermentation of goat milk by using a mixed starter culture (*Streptococcus thermophilus* CR12, *Lactobacillus Helveticus* PR4 and *Lactobacillus plantarum* 1288) resulted in production of GABA, which is an inhibiting signal substance in the central nervous system, and provoked an in vitro ACE-inhibitory activity, which counteract high blood pressure [37]. Recently, fermented goat milk (*Lactobacillus rhamnosus* CRL1505) was demonstrated to stimulate the mucosal immune system and improve the defense against intestinal and respiratory infections in a mouse immunosuppressant model [38].

Why People Prefer Less Consumption of Goat Milk?

There is lack of knowledge and inability to utilize milk in forms conducive to human consumption in a wide variety of circumstances, this results in less consumption of goat milk [39]. Another challenge to manufacturers is "Goaty" and "mutton" flavour in goat milk and products that brings limitations to consume as drink or milk product [12]. As a rule, such products from goat milk are more expensive than similar products derived from bovine and ovine milk [40]. Flavor of goat milk is particular and stronger than cow's milk, which constrains its acceptability among several consumers [41]. Low daily volume, even of herd bulk milk may be one of the reasons for the difficulty in establishing an efficient processing industry of goat and sheep milk in many countries.

Conclusion

Goat has the ability to produce milk of good composition and quality for human consumption. Moreover, it also has medicinal value for human being and is healthy alternative to cow's milk that may be more easily digested than regular cow's milk, especially to children and those who have sensitive stomachs to other animals' milk. Goat milk lacks folic acid and it does not recommend for infants under one year because it can cause anemia. The superior digestibility of goat milk, the proper composition of fatty acids and its content of bioactive compounds seem to give properties suitable for treating or preventing certain medical conditions. Goat milk might have beneficial effects on malabsorption disorders and inflammatory bowel diseases. Fermented goat milk may reduce the risk of cardiovascular disease by antioxidant anti-atherogenic effects.

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