Review Article

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Nutritional and Medicinal Superiority of Goat Milk over Cow Milk in Infants

Ashish Kumar*, Ambika Sharma**

Author Affiliation
*Department of Pharmacology, School of Medical Sciences & Research, Sharda University,Greater Noida, Gautam Buddh Nagar-210306, Uttar Pradesh, India.
**Department of Veterinary Biochemistry, College of Veterinary Sciences and Animal Husbandry, U.P. Pandit Deen Dayal Upadhyaya Pashu Chikitsa Vigyan Vishwavidyalaya Evam Go Anusandhan Sansthan (DUVASU), Mathura – 281 001, Uttar Pradesh, India.

Reprint Request
Ashish Kumar, C-20, New Campus, College of Veterinary Science, DUVASU, Mathura-281001, Uttar Pradesh.
E-mail: ashishvet77@gmail.com

Abstract

Goat milk has got an excellent medicinal and nutritional property. It has been established that the goat milk is better suited for the infant suffering from cow milk allergy and discomfort. Goat milk is very much similar to mothers' milk in many aspects when compared with the cow milk. Studies suggested that the goat milk resembles human milk, is homogenous, less allergenic, is better digested and absorbed than the cow milk. It has got an excellent buffering action. So goat milk can easily find its inclusion in infant formulas ahead of cow milk. The aim of the present review is to highlight the nutritional and medicinal potential of goat milk in infant nutrition when compared with cow milk.

Keyword: Goat Milk; Infants; Fatty Acids; Allergy; Cow Milk.

Introduction

Goat is one of the oldest domesticated animals. In ancient times also goat milk was valued the most. Goat milk still plays an important role in human nutrition. All over the world riding on high profile or big budget campaign cow milk has been made very popular, however it doesn't mean that cow milk is the best with better quality than the goat milk. In fact 65% of the milk consumption worldwide is from goat milk and is superior to cow milk in many aspects.

According to the *Journal of American Medicine*, "Goat milk is the most complete food known." It contains vitamins, minerals, electrolytes, trace elements, enzymes, protein, and fatty acids that are utilized by human body with ease. In fact, our body can digest goat milk in just 20 minutes while it takes 2-3 hours to digest cow milk.

Excerpts from Biomarker Diet [1] say that the milk consumed in biblical times differed much from the milk we consume today. The milk of the Bible came from cows and goats and was consumed straight from the animal (it was not pasteurized or homogenized), or it was immediately fermented. These 'live' foods provide excellent health benefits in contrast to today's pasteurized, homogenized, often skimmed and refortified milk, which is not only less nutritious but also can be potentially harmful and a major cause of allergies and even heart disease.

Biochemically goat milk has greater concentrations of essential fatty acids such as linoleic and arachidonic acid, Vitamin B_3, B_6, Vitamin A, and Potassium (K) than cow milk. One cup of goat milk supply 35% of our daily need of calcium, 20% of daily need of B_2. High level of potassium causes goat milk to react in an alkaline way within the body whereas cow milk reacts in acidic way due to lees amount of potassium. In Naturopathic medicine, goats are referred as bio-organic sodium animals whereas cows are referred as bio-organic calcium animals. Bioorganic sodium is an important element in keeping the joints mobile and tender. Goat milk is a rich source of the trace mineral selenium, a necessary nutrient, which keeps immune system strong and also has antioxidant properties. It is said that Mahatma

Gandhi maintained his health through drinking raw goat milk after extensively long periods of fasting [2].

The aim of the present review is to analyze the beneficial and medicinal properties of the goat milk. The review presents the studies suggesting goat milk possesses many advantages over cow milk as a nutritional source for infants and children.

Goat Milk is Naturally Homogenized

When both of fresh cow milk as well as fresh goat milk are refrigerated overnight in a glass, one can find that the goat milk looks exactly the same whereas the cow milk separates into two phases with cream on top and skim milk at the bottom. This is a natural phenomenon brought about by a compound called agglutinin. Cow milk is homogenized mechanically to destroy the fat globule cell wall in order to allow cream and skim milk to stay homogenous. These mechanical homogenization releases a superoxide (free radicals). These free radicals may cause various problems inside the body even causing mutation. Goat milk have smaller fat globules and lacks agglutinin allowing milk to stay naturally homogenous thus eliminating the concerns associated with mechanical homogenization processes.

Goat Milk Resembles Human Milk

Goat milk is as close to perfect food as possible in nature. Human milk has a more similarity with goat milk than the cow milk which may be the reason for goat milk healing properties. Although no food is better than mothers' milk at least for the first six months of life.

The oligosaccharide profile of goat milk is most similar to that of human milk and the goat milk oligosaccharides could be included in infant formulas to improve the nutrition of infants [3].

A study by the International Journal of Food Science Nutrition found that goat milk has a very different profile of the non-protein nitrogen (NPN) fraction to cow milk, with several constituents such as nucleotides having concentrations close to those in human breast milk [4]. NPN contents of goat and human milks are higher than in cow milk. Nucleotides are added to the infant formula to facilitate the immune maturation of the milk fed offspring [5]. Being an important constituents of DNA and RNA, it plays an important role in signal transduction, synthesis of apolipoproteins (Apo) A1 and Apo A1V in pre term infants and in long chain polyunsaturated fatty acids (PUFA) synthesis upregulation in neonates [5]. The nucleotide contents of the infant formula made from goat milk have nearly the same level as human milk [4].

Goat milk also resembles human milk in the protein structure. The major casein protein Beta casein found in both goat and human milk is different from the casein found in cow milk [6]. Also, the peptide mappings of alpha-lacto albumins and beta-lacto globulins in goat and human milk are completely different from those of cow milk [6]. The micelle structures of the casein between human and goat milk have a similarity than the cow milk [7]. Milk from women and goats were found to contain significantly higher concentrations of selenium than from cows [8]. Goat milk is a complete protein that contains all the essential amino acids without the heavy fat content and mucus producing materials of cow milk. Goat milk proteins are also important sources of bioactive acetyl cholinesterase (ACE) inhibitory and antihypertensive peptides. They can provide a non-immune disease defence and control of microbial infections. Important minor milk proteins include immunoglobulins, lactoferrin, transferring, ferritin, proteose peptone, calmodulin (calcium binding protein), prolactin, and folate-binding protein.

Goat Milk is Less Allergenic

Cow milk allergy is the number one allergy of children, affecting roughly 0.5 to 1.5 million children every year [9]. Cow milk contains more than 20 allergen proteins [6] which are not recognized by the immune system leading to a variety of symptoms like Hives, wheezing, vomiting, abdominal cramping, diarrhoea, skin rash (commonly near and around the mouth), runny nose, watery eyes, colic in infants and even anaphylactic shock. Alpha s1 casein is one of the main allergens in cow milk. Goat milk, like human milk, contains low levels (89% less than cow's milk) of alpha s1 casein and high levels of alpha s2 casein, which is non-allergic. Infants suffering from allergies with eosinophilia associated with the gastrointestinal tract showed improvement after shifting to goat milk. Likewise it is reported that the chronic enteropathy due to feeding of cow milk can be cured by shifting to goat milk.

In one of the study it was found that nearly 93 percent of infants suffering from cow milk allergies were able to tolerate and thrive on goat milk [10]. Another animal model study concluded that goat milk, when used as the first source of protein after a breastfeeding period, is less allergenic than cow milk [11].

The size of fat globules in Cow's milk is much bigger which may increase mucous build-up, leading to irritation in the gut. Goat's milk does not produce mucus due to the smaller size of fat globules; hence it does not stimulate a defence response from the human immune system. Allergies in adults due to cow milk are manifested by latent discomfort, pain, damage and overall lack of wellness.

Polyamines play an important role in maturation of the GIT enzymes, cell function [12] and reduce the incidence of food allergy in infants [13]. The concentration of polyamines in goat milk is highest in goat milk compared to cow and human milk [14]. It was found that five times more goat milk is required to trigger an adverse reaction than the cow milk [15]. In a mice study it was found that only one out of 13 mice weaned on to goat milk showed typical allergic symptoms in comparison to the 8 of 13 mice on cow milk [16].

Nearly every cow is given growth hormones, antibiotics, GMO feed, vaccinations; it is not uncommon to see adverse effects from consuming pasteurized cow's milk. Goats are rarely treated in such ways.

Goat Milk is Rapidly Digested and Absorbed

Goat milk has better digestibility and absorption than cow milk. Goat milk is much higher in short chain fatty acids and medium chain fatty acids than cow milk. These short chain fatty acids and medium chain fatty acids have a larger surface-to-volume ratio and are better digested and absorbed than the long chain fatty acids prevalent in cow milk [17]. In a recent study it was found that "levels of the metabolically valuable short and medium chain fatty acids like caproic, caprylic, capric and lauric acids are significantly higher in goat milk than in cow milk [18]. These higher levels of easy-to-digest short chain fatty acids and medium chain fatty acids are broken down quicker and more completely than the long chain fatty acids abundant in cow milk. The number of fat globules measuring 5µm is 80% in goat milk compared to 60% in cow milk [25]. Medium-chain fatty acids, such as capric and caprylic acids are highly antimicrobial. The medicinal property of these medium chain fatty acids helps in less deposition of cholesterol in the arteries, aid in dissolving cholesterol and gall stones and significantly contributing to the normal growth of infants. These medium chain fatty acids play an important role in improving the conditions like steatorrhea, chyluria, hyperlipoproteinemia, cystic fibrosis, gall stones, and childhood epilepsy.

In a study investigating the effect of pepsin and trypsin revealed that while these enzymes completely digested over 96 percent of available goat milk protein, less than 73 percent of available cow milk protein was able to be digested completely [7].

Goat milk also contains excessive amount of the energy rich substrate adenosine triphosphate (ATP) than cow milk [19]. ATP is the energy "currency" that our metabolism is constantly manufacturing, used for every cellular reaction in the body.

Goat milk also contains taurine, glycine and glutamic acid as free amino acids [20]. Taurine plays an important role in bile salt formation, osmoregulation, antioxidation, and calcium transport and also in central nervous system. Goat milk contains about 20-40 times much taurine than the cow milk [21].

Alkaline Powerhouse

Goat milk has an excellent buffering action inside human body. Many foods lead to the production of acids that may lead to certain health hazards [22]. In a study reported in the *Journal of Dairy Science,* the buffering capacity of goat milk, cow milk, soy milk and antacid drugs was examined. Theoretically the antacid drugs should have proven to have the best buffering capacity since their function is to reduce acid. However, the study found that goat milk overwhelmingly exceeded the buffering capabilities of the other three [23]. Another study in the *Journal of Nutrition* found that oligosaccharides from goat milk very likely play a major role in intestinal protection and repair [24]. This is important because acidic diets often cause damage to the gastrointestinal lining. Oligosaccharides act a prebiotic and have anti-infective property.

L-glutamine is an alkalinizing amino acid and is present in highest concentration in goat milk than any other milk products thereby increasing the pH of the blood. Goat's milk has long been used and recommended as an aid in the treatment of ulcers due to its more effective acid buffering capacity. Goat's milk soothes the digestive tract. Children on goat's milk have been observed to sleep through the night and remain more satisfied between meals.

The USDA and Prairie View A&M University in Texas have confirmed that goat milk has more acid-buffering capacity than cow milk, soy infant formula, and non-prescription antacid drugs.

Researchers at the Department of Physiology, University of Granada found that goat milk helps to prevent ferropenic anaemia (Iron Deficiency) and

bone demineralization (softening of bones) in experimental rats.

Lactose Intolerance

Lactose intolerance is due to the deficiency or lack of enzyme lactase leading to a condition called lactose intolerance. Easier digestion of the goat milk allows the lactose to pass through the intestines more rapidly, not giving it time to ferment or cause an osmotic imbalance means there is no "leftover" lactose. Also goat milk contains 10% less lactose than cow milk. Most lactose intolerant people are able to thrive on goat's milk and goat milk products.

In conclusion, goat milk has better nutritional and medicinal properties than the cow milk and is best suited to infants.

References

1. Markers Diet
2. Time Magazine. Great Britain: Gandhi's Goat.1931 November2
3. Daddaoua A, Puerta V, Requena P, Martinez-Ferez A, Guadix E, Sanchez de Medina F, Zarzuelo A, Suarez MD, Boza JJ, Martinez-Augustin O. Goat Milk Oligosaccharides Are Anti-Inflammatory in Rats with Hapten-Induced Colitis. J Nutr. 2006; 136: 672-676.
4. Prosser CG, Mclaren RD, Frost D, Agnew M, Lowry DJ. Composition of the non-protein nitrogen fraction of goat whole milk powder and goat milk-based infant and follow-on formulae. Int J Food Sci Nutr. 2008; 59(2): 123-33.
5. Schallera, J.P., Bucka, R.H., Ruedab, R. Rib nucleotides: conditionally essential nutrients shown to enhance immune function and reduce diarrheal disease in infants. Sem. Fetal Neonatal Med. 2007; 12: 35–44.
6. El-Agamy EI. The challenge of cow milk protein allergy. Small Ruminant Research. 2007; 68(1) :64-72.
7. Jasin´ska B. The comparison of pepsin and trypsin action on goat, cow, mare and human caseins. Rocz Akad Med Bialymst. 1995; 40(3): 486-93.
8. Debski B, Picciano MF, Milner JA. Selenium Content and Distribution of Human, Cow and Goat Milk. J Nutr. 1987; 117: 1091-1097.
9. Lara-Villoslada F, Olivares M, Jiménez J, Boza J, Xaus J. Goat Milk Is Less Immunogenic than Cow Milk in a Murine Model of Atopy. J Ped Gastroenterol Nutrition. 2004; 39(4): 354-360.
10. Freund G. Use of goat milk for infant feeding: experimental work at Créteil (France), 1996. Proceeding of the meeting Intérêts nutritionnel et diététique du lait de chèvre. Niort, France: INRA, pp:119–21.
11. Lara-Villoslada F, Olivares M, Jiménez J, Boza J, Xaus J. Goat Milk Is Less Immunogenic than Cow Milk in a Murine Model of Atopy. Department of Immunology and Animal Sciences, Puleva Biotech SA, Granada, Spain.
12. Pegg, A.E., McCann, P.P. Polyamine metabolism and function. Amer. J. Physiol. 1982; 243: C212–C221.
13. Dandrifosse, G., Peulen, O., El Khefif, N., Deloyer, P., Dandrifosse, A.C.,Grandfils, Ch. Are milk polyamines preventive agents againstfood allergy? Proc. Nutr. Soc. 2000; 59: 81–86.
14. Ploszaj, T., Ryniewicz, Z., Motyl, T. Polyamines in goats colostrums and milk a rudiment or a message? Comp. Biochem. Physiol. B: Biochem. Mol. Biol. 1997; 118: 45–52.
15. Bellioni-Businco, B., Paganelli, R., Lucenti, P., Giampietro, P.G., Perborn, H., Businco, L. Allergenicity of goat's milk in children with cow's milk allergy. J. Allergy Clin. Immunol. 1999; 103: 1191–1194.
16. Lara-Villoslada, F., Debras, E., Nieto, A., Concha, A., Galvez, J., Lopez-Huertas, E., Boza, J., Obled, C., Xaus, J. Oligosaccharides isolated from goat milk reduce intestinal inflammation in a rat model of dextran sodium sulfate-induced colitis. Clin. Nutr. 2006; 25: 477–488.
17. Razafindrakoto O, Ravelomanana N, Rasolofo A, Rakotoarimanana RD, Gourgue P, Coquin P, Briend A. Goat's milk as a substitute for cow's milk in undernourished children: a randomized double-blind clinical trial. Pediatrics. 1994; 94(1): 65-9.
18. Park YW, Juárez M, Ramos M, Haenlein GFW. Physico-chemical characteristics of goat and sheep milk. Small Ruminant Research. 2007; 68(1): 88-113.
19. Zulak IM, Patton S, Hammerstedt RH. Adenosine Triphosphate in Milk. J. Dairy Sci. 1976; 59: 1388-1391.
20. Rutherfurd, S.M., Darragh, A.J., Hendriks, W.H., Prosser, C.G., Lowry, D. True ileal amino acid digestibility of goat and cow milk infant formulas. J. Dairy Sci. 2006; 89: 2408–2413.
21. Redmond, H.P., Stapelton, P.P., Neary, P., Bouchier-Hayes, D. Immuno-nutrition: the role of taurine. Nutrition. 1998; 14: 599–604.
22. Welch AA, Mulligan A, Bingham SA, Khaw KT. Urine pH is an indicator of dietary acid-base load, fruit and vegetables and meat intakes: results from the European Prospective Investigation into Cancer and Nutrition (EPIC)-Norfolk population study. Br J Nutr. 2008; 99(6): 1335-43.
23. Park YW.Relative Buffering Capacity of Goat Milk, Cow Milk, Soy-Based Infant Formulas, and Commercial Nonprescription Antacid Drugs. J Dairy Sci. 1997; 74: 3326-3333.

24. Boehm, G., Stahl, B. Oligosaccharides from milk. J. Nutr. 2007; 137: 847S–849S.

25. Silanikovea N., Leitnerb G., Merinc U., Prosserd C.G. Recent advances in exploiting goat's milk: Quality, safety and production aspects. Small Ruminant Research. 2010; 89: 110–124.