Indian Farming **67**(12): 34–35; December 2017

Nutraceutical properties of goat milk than cow milk

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Goat milk contains a higher amount of minerals and vitamins in comparison to cow milk along with greater bio-availability in human intestine. Goat milk contains less lactose than cow's milk which may be beneficial to those who are lactose-intolerant.

Key words: Cow, Goat, Milk, Nutraceutical properties

GOAT milk contains high amount of short-and medium-chain fatty acids. Goat milk is higher in butyric, caproic, caprylic, capric, lauric, myristic, palmitic and the essential omega-3 linolenic acids, whereas it has lower content of the longer chain fatty acids stearic and oleic acid. As compared to cow milk, the utilization efficiency of goat milk fat in the diet and weight gain was improved with reduced levels of low density poprotein that increased consumption of exogenous cholesterol and decreased synthesis of endogenous cholesterol. The unique metabolic ability of capric and caprylic acids to provide direct energy instead of being deposited in adipose tissues has led to their use in a wide array of clinical disorders including hyper-lipoproteinemia, infant malnutrition, intestinal resection, epilepsy, cystic fibrosis, coronary bypass and gallstones.

The protein in goat milk is differentiated by high levels of casein and structure of the casein micelle, the wide array of bioactive peptides within these fractions as well as minor proteins and non- protein fraction which includes amino acids, nucleotides and nucleosides (Table 1). These protein characteristics of goat milk dictate many of its physical properties and health benefits. Goat casein (96%) was completely hydrolysed *in vitro* by trypsin as compared with only 76-90% of cow's casein.

Casein: Casein in milk is comprised of ~80% caseins and 20% whey proteins. The main forms of caprine and ovine caseino-macropeptides are the soluble C-terminal derivatives from the action of chymosin on k casein during the milk clotting process of cheese making. These forms of caseins are excellent sources of anti-thrombotic peptides. Casein micelles in goat milk are larger than those in cow milk, ranging from 100 to 200 nm as compared with 60 to 80 nm. The lower levels of αs1-casein in goat milk is directly related to the lower allergenicity of goat milk as compared to cow milk, which is a key benefit to infants using goat milk as their main source of nutrients and individuals suffering from cow milk allergies. Casein micelles in goat milk is also markedly different in their sedimentation rate, solubilisation, heat stability, calcium and phosphorus content than cow milk.

Table 1. Average composition of basic nutrients in goat milk and cow milk

Composition (%)	Goat milk	Cow milk
Fat	3.8	3.6
Solid not fat (SNF)	8.9	9.0
Lactose	4.1	4.7
Protein	3.4	3.2
Casein	2.4	2.6
Non- protein nitrogen	0.4	0.2
Ash	0.8	0.7
Calories/ 100ml	70	69

Amino acids

Amino acids also belong to protein fraction. The major free fatty acids in goat milk are taurine, glycine and glutamic acid, in which taurine is an essential amino acid that can be synthesized in the body from cysteine and methionine (Table 2). Taurine is also beneficial for adults due to its cardiovascular benefits such as blood pressure regulation, as well as in vision, cerebral functions, detoxification and fatty acid assimilation. Recent findings in animal studies suggested that taurine may also be useful in alleviating

Table 2. Amino acid composition of goat and cow milk (μM/100 ml)

Amino acids	Goat milk quality	Cow milk quality
Tryptophan	2.5	1.98
Threonine	2.78	2.01
Leucine	2.04	1.98
Methionine	0.96	0.85
Histidine	1.94	1.32
Isoleucine	1.64	1.23
Taurine	55.93	48.23
Aspartate	1.01	0.98
Glutamate	17.01	15.89

muscle fatigue and raising exercise capacity during workouts.

Mineral

Goat milk contains particularly high level of calcium (Ca) and phosphorus (P) as compared to human milk and also has higher level of potassium (K), magnesium (Mg) and chloride than those in cow milk (Table 3). Iron (Fe) bioavailability of goat milk is higher than that of cow milk due to the higher nucleotide content contributing to better absorption in the gut. The selenium (Se) content in human and goat milk is higher than that found in cow milk and is more bioavailable, which is attributed to the high MCFA content or soluble protein ratio in goat milk. The mineral concentrations in goat milk do not fluctuate much, but vary slightly depending on the breed, diet, individual animal and stage of lactation.

Table 3. Mineral contents (per 100 g) of goat and cow milk.

Mineral (mg)	Goat milk	Cow milk
Calcium	134	122
Phosphorus	121	119
Magnesium	16	12
Potassium	181	152
Sodium	41	58
Chloride	150	100
Sulphur	28	32
Manganese	0.032	0.02
Selenium	1.33	0.96

Neutraceutical properties of goat milk

The neutraceutical properties of goat milk are discussed here.

Cures dengue fever: In goat milk more than 27% selenium (Se) is present as compared to cow milk. Deficiency of selenium leads to decrease in platelet count in the body, which is the main problem of dengue fever. In dengue fever, mainly decrease in platelet count takes place. As the transfusion of platelets is not possible from external sources, goat milk is mainly prescribed for maintaining body fluid balance in dengue patients. Goat milk consumption increases biliary secretion of cholesterol, thereby decreasing the plasma cholesterol level, but phospholipids, biliary acid and lithogenic level remain same. Selenium deficiency also leads to irreversible cardiomyopathy.

Useful in brain development: Sialic acid present in colostrum and milk is regarded as an important biological component that plays a role in the development of the brain and in increasing immunity, in infants. The sialiloligo saccharides content of goat's milk was significantly higher than the milk of other ruminants.

Goat milk in lactose intolerance: Lactose, the main carbohydrate of milk, is broken down by lactase. If lactase activity is low or absent, undigested lactose may induce gastro-intestinal disorders as bloating, abdominal pain and diarrhoea. Lactase deficiency is generally caused by the genetically or age governed down regulation of lactase activity in old age people and infants. Symptoms have been observed after intake of less than 6 g of lactose, but most people can tolerate 12 g as a single dose of milk with no or minor symptoms. Higher doses can be tolerated, if distributed throughout the day. The consumption of yogurts and fermented products showing lactase activity assisting lactose digestion is helpful as well as the use of milks with low lactose content. Goat milk contains less lactose than cow milk and hence can be used for preventing symptoms of lactose intolerance.

Goat milk as pre-biotics: The non--digestible sugars or oligosaccharides present in milk can act as a pre-biotic that helps to maintain the health of the gastro-intestinal tract by promoting the growth of beneficial gut bacteria and preventing the growth of pathogenic bacteria. Oligosaccharides are judged to be beneficial components of human milk due to their prebiotic and anti-infective properties. Goat milk typically contains between 250 and 300 mg/l oligosaccharides, 4 to 5 -fold higher than the content present in cow milk. The oligosaccharides found in goat's milk have showed to reduce intestinal inflammation and aid recovery from colitis in animals.

Source of antioxidant peptides: Goat milk proteins can be *in-vitro* hydrolysed by enzymes or fermented by lactic acid bacteria to give potent antioxidant peptides. These antioxidant peptides possess great radical scavenging activity, iron chelation activity and inhibition of autooxidation of polyunsaturated fatty acids. Antioxidant peptides in a goat's milk casein hydrolysate made using Alcalase and Pronase (VYPF, FPYCAP, FGGMAH, YPPYETY andYVPEPF). Fermentation of goat milk by lactic acid bacteria also leads to formation of powerful antioxidant peptide.

Act as antimicrobial agent: Oligosaccharides present in goat milk, functions as scavenger receptors for various pathogens as an inhibitor of *Escherichia coli* heat-stable enterotoxin and in blocking leukocyte-endothelial cell interaction, thus serving an anti-inflammatory function. Medium chain fatty acids showed to possessed antimicrobial activity against gram negative bacteria. Digestion of goat milk by gastric enzyme pepsin results into peptides having antimicrobial nature against gram negative bacteria. Fermented goat milk also exhibits antimicrobial activity against Serratia marcesens than fermented cow milk.

SUMMARY

Goat milk is a rich source of more bioavailable proteins, fats, vitamins and minerals with great suitability for infant foods in comparison to cow milk. Due to its high nutritive value and physiological properties, goat milk should be promoted in the developing countries like India where malnutrition and diseases are more prevalent along with high poverty levels. The maintenance cost, general management and feeding of the dairy goat are very low. But commercialization and utilization of goat milk are still lacking in developing countries.

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