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# Goat Milk as a Functional Food: Less Popular yet Nutritionally Substantial

# Neelam Kumari\*

Department of Nutrition, Home Science, Isabella Thoburn College, Lucknow, Uttar Pradesh, India

#### ABSTRACT

In the present era, people are inclined toward consuming health promoting foods. Goat is a significant contributor of meat as a part of non-vegetarian food in our country, its milk is less popular but quite significant because of its various nutritional properties. Goat milk is also significant in terms of its potential as functional food. Various studies have shown its memory improvement attribute. Its hypoallergenic traits, antioxidant contents, and various nutrients specific to only goat milk make it a super food. Goat milk has higher level of calcium, potassium, and phosphorus than cow and human milk. Its digestibility is better due to smaller fat globules. It also contains several bioactive peptides which enhance its antioxidant property. Goat milk composition makes it a suitable food for vulnerable especially for dengue, for elderly in age related memory declining health problems. Goat milk also has immune modulatory properties due to oligosaccharides and several bio peptides which have shown their worth to modulate host inflammatory cytokines. Thus, goat milk has strong potential as a functional food with nutritional significance and need to be experimented for its potential in various health problems.

Key words: Goat milk, Functional food, Nutrition, Value addition.

#### **1. INTRODUCTION**

Goat milk is nutritionally vital and plays a considerable role in providing essential nutrients [1-8]. It is rich in proteins, vitamins, and fatty acids that possess significant biochemical functions. Goat milk provides higher levels of calcium, potassium, and phosphorus. It is hypoallergic and its small fat globules make it easily digestible. Thus, due to its composition, it can be widely used as a functional food to upgrade health status as well as improving quality of life. Furthermore, goat milk includes quite a few bioactive peptides with effective antioxidant capacity [10-13]. There have been very few studies which have explored the role of goat milk in various degenerative diseases, memory and learning, and particularly, during aging [14].

Goat milk has better digestibility, alkalinity, buffering capacity, and certain therapeutic values in medical nutrition therapy, goat milk and its products may be an important inclusion in diet of sick and needy populations. Goat milk is a valuable source of taurine for the human neonate and the adult. Polyamines are essential for ideal growth, gastrointestinal tract (GIT) cell function, and maturation of GIT enzymes and have been implicated in minimizing the rate of food allergy in infants. Goats' milk has some special attributes that such as alpha1-casein, resulting in softer gel products, a higher water holding capacity, and a lower viscosity [15-17].

### 2. NUTRIENTS IN GOAT MILK

#### 2.1. Carbohydrate

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. Lactose is the major carbohydrate in goat milk. Lactose helps in intestinal absorption of calcium magnesium and phosphorous, and the utilization of Vitamin D.

#### 2.2. Protein Content

The quantity of small-sized casein micelles is comparatively higher in goat's milk than cow's milk that explains the better digestibility of goat's milk (Haenlein, 2004).

#### 2.3. Minerals

Goat milk provides a more absorbable form of Ca and P that are needed for maintaining bone mineral density. Goat milk contains significantly greater iodine contents than human milk, which would be important for human nutrition since iodine and thyroid hormones are involved in the metabolic rate of physiological body functions (Underwood, 1977). Goat milk is rich in selenium (Se) which is a necessary nutrient for body and known for its immune strengthening and antioxidant properties.

#### 2.3.1. Fat

Goat milk also has higher size of polyunsaturated fat acid as well as conjugated linoleic acid. Goat milk has lipids including gangliosides, glycolipids, glycosphingolipids, and cerebrosides that are significant bioactive components.

#### 2.3.2. Vitamins

Goat milk stores enough amounts of Vitamin A and niacin. One limitation with goat milk is the almost nil content of folic acid and

#### \*Corresponding author:

E-mail: neelamkumari0809@gmail.com

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**Received:** 09<sup>th</sup> October 2021; **Revised:** 17<sup>th</sup> October 2021; **Accepted:** 22<sup>nd</sup> October 2021 this problem could be solved using folate-producing bacteria during fermentation while using fermented food products with goat milk [14].

The peculiar flavor and aroma of goat milk different from cow milk constrain its acceptability among some consumers. Low daily volume is another factor for its less availability and popularity.

Basic composition of various milk (Mean values per 100 g) [13]

Constituents	Goat	Cow
Fat (g)	3.8	3.6
Protein (g)	3.5	3.3
Lactose (g)	4.1	4.6
Ash (g)	0.8	0.7
Total solids (g)	12.2	12.3
Calories (Kcal)	70	69

#### **3. HYPOALLERGIC EFFECTS**

Goat milk has been recommended as a substitute for patients allergic to cow milk. Between 40 and 100% of patients allergic to cow milk, proteins tolerate goat milk. Infants suffering from gastrointestinal allergy and chronic enteropathy against cow milk were reportedly cured by goat milk therapy. The higher protein, non-protein N, and phosphate in caprine milk give it greater buffering capacity compared to cow milk. Some physicochemical properties of caprine milk such as smaller fat globules, higher percent of short and medium chain fatty acids, and softer curd formation of its proteins are advantageous for higher digestibility and healthier lipid metabolism relative to cow milk [14].

#### 3.1. Immunomodulation

The immunomodulatory properties of goat milk can be attributed to the compounds such as peptides and oligosaccharides that were reported to modulate host inflammatory cytokines (Daddaoua *et al.*, 2006 and Santosh *et al.*, 2016). The milk can trigger innate and adaptive immune responses in the human body that can help fight against inflammation (Jirillo and Magrone, 2014). Lara-Villoslada *et al.* (2006) reported that goat's milk oligosaccharides decrease intestinal inflammation in rats and contribute to the recovery of damaged colonic mucosa. Furthermore, goat whey increased the expression of proteins such as mucins and occludin proteins that increase the gut barrier property (Araujo *et al.*, 2017).

#### 3.2. IAntiatherogenic Property

Sonu and Basavaprabhu 019 reviewed that goat milk is rich in mediumchain triglycerides (MCT) (MCT including fatty acid esters of caproic, caprylic, and capric fatty acids). These MCT have shown a lowering effect on plasma cholesterol in rat models (Alferez *et al.*, 2001) and also to inhibit cholesterol deposition in the tissues (Babayan, 2009). Consumption of goat milk triggers the release of nitric oxide blood cells that, in turn, reach the bloodstream through the lymphatic route, thus provoking vasodilatation and exerts a cardio-protective and antiatherogenic effect (Tilahunzenebe *et al.*, 2014). Cholesterol-lowering ability of goat milk-derived peptides and fats (Ibrahim *et al.*, 2017; Moreno-Montoro *et al.*, 2017; and Kalyan *et al.*, 2017) and therefore indicating their possible role in controlling coronary artery diseases.

#### 3.3. Lactose Intolerance

Lactose intolerance is a digestive disorder caused by the inability to digest lactose (vital milk sugar). Goat milk is an alternative source

for people with lactose intolerance. Goat milk is more completely and easily absorbed than cow milk, leaving less undigested residue in the colon to ferment and cause the uncomfortable symptoms of lactose intolerance (Haenlein, 2004 and Aliaga, 2010).

#### 3.4. Overcomes Dengue Viral Fever

Dengue, the most common major health problem (viral fever) in India, is transmitted to humans by Aedes Egypti (Neuberger *et al.*, 2016). Treatment of dengue fever typically involves the use of goat milk and milk products since they are rich in Se (13.7 ng/mL). Nevertheless, the Se concentration in the milk depends on several factors such as feed, climatic conditions, and breed (Dael *et al.*, 1992; Singh *et al.*, 2016; and Zhang *et al.*, 2018). The deficiency of Se has been positively correlated with the decrease in platelet count, which is a key marker to recognize the onset of dengue fever. Se has an anticlotting effect whereas, thrombotic or pro-clotting effects are mainly observed due to the Se deficiency (Mahendru *et al.*, 2011).

#### 3.5. Anticancer Properties

Several lactic acid bacteria that are isolated from goat milk have also reported demonstrating anticancer effect (Mittu and Girdhar, 2015) and therefore suggesting the use of goat milk-derived LAB for groundwork of fermented milk product yield similar therapeutic properties that the bacterial strains

#### 3.6. Antimicrobial Property

The total inhibitory effect of milk is generally greater than the sum of the individual antimicrobial effect of immunoglobulin and other defense proteins, namely, lactoferrin, lactoperoxidase, lysozyme, and other peptides. Therefore, the synergistic effect of naturally occurring proteins and peptides provides the antimicrobial effect. In this regard, the lacto peroxidase was found that it has inhibitory action against plethora of pathogens, namely, *Vibrio cholera, Salmonella typhi, Klebsiella pneumonia* [9], *Shigella dysenteriae*, and *Staphylococcus aureus* (Anonymous, 1998; Esmaeilpour *et al.*, 2016; and Montoro *et al.*, 2017).

#### 3.7. Nutrients of Therapeutic Significance in Goat Milk

Vitamins in 100 g	Goat milk	Cow milk	Human milk
Vitamin A (IU)	185	126	190
Vitamin D (IU)	2.30	2.00	1.40
Serum albumin/Lactoferrin n %	5.1-21.5	4.0-5.71	
Minerals in 100 g	Goat milk	Cow milk	Human milk
Ca (mg)	134	122	33
P (mg)	121	119	43
Mg (mg)	16	12	4
K (mg)	181	152	55
Se (ug)	1.33	0.96	1.52
Source (Park et al., 2007) [13]			

Ample nutritional and health benefits of goat milk are the paramount factors that need attention for nutritional therapy to use goat milk and milk products as functional foods. The better digestibility of goat milk is the key factor with the positive health effects, namely, anticancer, anti-inflammatory, antiatherogenic, and anti-allergenic diseases that make it a substantial functional food.

#### 4. CONCLUSION

The low allergy attributes of goat milk, its easy digestibility, the mineral contents, its composition of fatty acids, and bioactive compounds make it a vital functional food of future to be extensively used for medical nutrition therapy. Goat milk may be extensively used for beneficial effects on gastrointestinal disorders through its fermented products and its role in various degenerative diseases.

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## \*Bibliographical Sketch



Dr Neelam Kumari is an associate professor with a keen interest on working on foods with therapeutic significance and involved with teaching and research on underutilized foods as well as wrking for the welfare of community through nutrition science.