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Editorial Article

Camel Milk: A Nutrient-Rich Dairy Revolution

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Introduction

Camel milk, long celebrated in traditional medicine, has been recognized by various cultures for its exceptional nutritional and therapeutic properties. Mentioned in Ayurveda as part of the "Dugdha Varga" classification and acknowledged in religious texts like the Quran, camel milk has been used for thousands of years, particularly in regions with harsh climates where other dairy sources are less reliable. In modern times, the global population of camels, predominantly found in Africa and Asia, continues to be a crucial resource, especially for communities in arid environments where food and water are scarce.

Camel milk holds a special place in the state of Rajasthan, India, where camels are integral to the cultural and economic fabric of the region. Rajasthan, often referred to as the "Land of Camels," has a long history of camel husbandry, with the Raika community traditionally responsible for breeding and caring for these animals. The state's arid climate makes camels an ideal livestock choice, and their milk has been a staple in the diet of many Rajasthani communities for generations. Efforts to commercialize camel milk in Rajasthan have gained momentum, with state initiatives aiming to boost the local economy by promoting camel milk as a healthful, therapeutic product. The recognition of camel milk's medicinal properties has further cemented its importance in the region, where it is not only a source of nutrition but also a symbol of Rajasthan's rich heritage and resilience in the face of environmental challenges.

The camel, often referred to as the "ship of the desert," is not only a robust mode of transportation but also an important source of sustenance. Its milk, rich in nutrients and therapeutic compounds, is increasingly recognized as a potential superfood capable of addressing various health concerns. Countries like Afghanistan, Kenya, and Iran have long relied on camel milk as a dietary staple, particularly during dry seasons when other livestock may not produce milk.

Camel Milk Production and Market Potential:

The production of camel milk is gaining momentum, especially in regions like the Middle East, where it has become a booming industry. In India, camel milk production is also on the rise, with initiatives like the Gujarat Cooperative Milk Marketing Federation's (GCMMF) Sarhad Dairy considering its commercialization under the well-known Amul brand. The European Union's recent decision to allow the import of camel milk from African and Asian countries further

highlights its growing global popularity.

Camel milk is often considered closest to human milk, making it highly digestible even for infants. Research confirms its superior nutritional value compared to cow's milk, making it an attractive alternative for those seeking a healthier dairy option. However, the absence of established microbiological standards for camel milk in many countries, including India, poses a challenge. The Food Safety and Standards Authority of India (FSSAI) has yet to formulate such standards, although efforts are

underway in states like Gujarat and Rajasthan, which have significant camel populations.

Nutritional Composition and Health Benefits:

Camel milk is a rich source of essential nutrients, including vitamins, minerals, and fatty acids, making it a valuable addition to the diet. It is particularly noted for its low fat and cholesterol content, which contributes to its reputation as a heart-healthy beverage. Compared to cow milk, camel milk contains three times more Vitamin C and ten times higher iron content, making it a potent source of antioxidants and a vital nutrient for combating deficiencies.

The proximate composition of camel milk shows it has a higher moisture content than cow's milk, with slightly lower fat levels but comparable protein and lactose content. This balance makes camel milk not only nutritious but also a potential therapeutic food. The presence of minerals like sodium, potassium, calcium, magnesium, iron, zinc, and copper, along with vitamins A, E, C, and B1, enhances its health benefits.

Table: Proximate chemical composition of camel milk and other species milk

Proximate	Water %	Protein %	Fat %	Ash %	Lactose %
Camel	86-88	3.0-3.9	2.9-5.4	0.6-1.0	3.3-5.8
Cow	85-87	3.2-3.8	3.7-4.4	0.7-0.8	4.8-4.9
Buffalo	82-84	3.3-3.6	7.0-11.5	0.8-0.9	4.5-5.0
Sheep	79-82	5.6-6.7	6.9-8.6	0.9-1.0	4.3-4.8
Goat	87-88	2.9-3.7	4.0-4.5	0.8-0.9	3.6-4.2
Human	88-89	1.1-1.3	3.3-4.7	0.2-0.3	6.8-7.0

Source: (Fox, 2003)

Moreover, camel milk contains various fatty acids, including butyric, caproic, caprylic, and linoleic acids, which are known to boost the immune system and fight diseases. Its unique enzyme content, such as aspartate aminotransferase and lactate dehydrogenase, also plays a crucial role in maintaining milk quality and extending its shelf life.

Therapeutic Properties of Camel Milk:

For centuries, nomadic communities have consumed camel milk not just for its nutritional value but also for its medicinal properties. Modern research supports these

traditional uses, highlighting camel milk's potential in managing and treating various health conditions.

• Diabetes Management

One of the most significant health benefits of camel milk is its potential to manage diabetes, particularly type 1 diabetes. Studies have shown that camel milk contains high levels of insulin, which can help reduce blood sugar levels and improve long-term glycemic control. Research conducted at the Bikaner Diabetes Care Research Center in India found that regular consumption of camel milk significantly reduced the insulin doses required by diabetic patients. These findings suggest that camel milk could be a valuable adjunct to insulin therapy, offering a natural way to manage diabetes.

• Allergy Relief

Camel milk is also known for its hypoallergenic properties. Unlike cow's milk, which contains beta-lactoglobulin—a protein responsible for many milk allergies—camel milk lacks this allergen, making it a safer alternative for individuals with milk allergies. Moreover, the structure of beta-casein in camel milk differs significantly from that in cow's milk, further reducing the risk of allergic reactions. This unique composition makes camel milk a potential nutritional source for children and adults allergic to cow's milk.

• Autism Spectrum Disorder (ASD)

Recent studies have explored the potential of camel milk in managing symptoms of autism spectrum disorder (ASD). Oxidative stress is believed to play a crucial role in the pathology of autism, and camel milk, with its high antioxidant content, may help mitigate these effects. Research has shown that children with autism who consumed camel milk exhibited significant improvements in behaviour, cognitive functions, and motor skills. These findings suggest that camel milk could be a valuable dietary intervention for managing autism symptoms.

• Antimicrobial and Antiviral Properties

Camel milk contains several protective proteins, including lysozyme, lactoferrin, and lactoperoxidase, which have potent antimicrobial and antiviral properties. These proteins help strengthen the immune system and protect against infections, making camel milk a natural remedy for various ailments. For instance, studies have shown that

camel milk can inhibit the growth of *Mycobacterium tuberculosis*, the bacterium responsible for tuberculosis. Additionally, its antiviral properties may offer protection against a range of viral infections.

• Anti-Aging and Skin Health

Camel milk is also gaining popularity in the cosmetic industry due to its anti-aging properties. The presence of alpha-hydroxy acids (AHAs) in camel milk helps exfoliate the skin, removing dead cells and revealing a more youthful complexion. These acids also help reduce the appearance of fine lines and wrinkles, making camel milk an effective natural remedy for aging skin. Furthermore, the liposomes in camel milk, which can penetrate deep into the skin, offer potential as a cosmetic ingredient for enhancing skin health and vitality.

• Cancer Prevention

Camel milk's potent antioxidant properties also contribute to its potential as an anti-cancer agent. Studies have shown that camel milk can induce apoptosis (programmed cell death) in cancer cells, particularly in liver and breast cancer. Its ability to reduce oxidative stress and inflammation further supports its role in cancer prevention and management. Research has also demonstrated that camel milk can enhance the effectiveness of chemotherapy while reducing its side effects, making it a promising complementary therapy for cancer patients.

• Arthritis Relief

Camel milk is rich in lactoferrin, a protein with strong anti-inflammatory properties. This makes it particularly beneficial for individuals suffering from arthritis, as it can help reduce inflammation and alleviate pain. Lactoferrin also has the ability to chelate (bind) iron, removing excess iron from the joints and reducing oxidative stress, which is a common factor in the progression of arthritis.

Shelf Life and Preservation:

The shelf life of camel milk varies depending on how it is processed and stored. Unprocessed camel milk can last for up to five days at 7°C, while pasteurized milk, when heated at 65°C for 20 minutes, can last for up to 22 days under the same conditions. Additionally, camel milk can be frozen for up to a year without significant loss of quality, making it a convenient option for long-term

storage.

Challenges and Opportunities in the Camel Milk Industry:

Despite its numerous benefits, the camel milk industry faces several challenges, particularly in terms of standardization and regulation. In many countries, including India, there are no established microbiological standards for camel milk, which hinders its widespread commercialization. The lack of awareness and acceptance of camel milk among consumers also poses a significant barrier to market growth.

However, there are also substantial opportunities in the camel milk industry. As consumer interest in natural and functional foods continues to rise, camel milk's unique nutritional and therapeutic properties position it as a valuable product in the health and wellness market. The development of functional foods and beverages, such as fermented camel milk products, could further expand the industry's reach and appeal.

Conclusion:

Camel milk is a remarkable natural product with a rich history of use in traditional medicine and a growing body of scientific evidence supporting its health benefits. Its unique nutritional composition and therapeutic properties make it a valuable addition to the diet, particularly for individuals with specific health concerns such as diabetes, allergies, and autism. As the global dairy industry continues to evolve, camel milk holds significant potential as a niche product that can address the needs of health-conscious consumers.

The challenges facing the camel milk industry, including the lack of standardized regulations and consumer awareness, must be addressed to fully realize its potential. However, with continued research and development, camel milk could become a mainstream dairy product, offering a natural and effective solution for various health conditions while contributing to the sustainability and diversity of the global food supply.

In conclusion, the promotion and development of camel milk and its products represent a unique opportunity for the dairy industry to innovate and expand its offerings. By tapping into the therapeutic potential of camel milk, the industry can meet the growing demand for natural and

functional foods, ultimately benefiting both producers and consumers.

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