

## Camel Milk - The Food - Medicine Interface

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Camels were originally domesticated for their milk. Camel milk production is stable in almost all seasons, which is very important for the pastoralist when the milk of other animals is seized in the dry period. Camel milk has low cholesterol, low sugar, high minerals (sodium, potassium, iron, copper, zinc and magnesium) and high vitamin C. Camel milk is unique from other ruminant's milk in terms of composition as well as claimed health effects. Camel milk has potential therapeutic characteristics, such as anti-hypertensive, anti-diabetic and anti-carcinogenic. It is often easily digested by lactose-intolerant individuals. On the other hand, camel milk also has ability to reduce the elevated level of bilirubin, globulin and granulocytes. It contains disease-fighting immunoglobulin's which are small in size, allowing penetration of antigens and boosting the effectiveness of the immune system. Camels need only 1.9 kg of dry matter to produce a liter of milk, compared with 9.1 kg for cows. Camels can provide 15 - 20 liters of milk per day. Average milk production of Pakistani camel is 19 liters per lactation, with the daily yield of 4.25 liter. Total camel milk production of Pakistan is about 862 thousand tons which makes about 6 percent in total milk production in the country.

The mainly available food item for the pastoralists is the milk of she-camel; therefore, they do not dry the animal, which results in the lengthy lactation period, even higher than 18 months. Camel milk is available in dry season and in drought conditions. Farmers report a lactation length of 270 to 525 days (9 - 18 months) with a total milk yield ranging between 1,250 to 3,650 liters with an average of 1,800 liters per lactation. The causes for a different length of lactation probably are due to the breeder's control, fluctuations in vegetation, long prevailed drought in the last decade and poor managerial practices of different areas.

The mainstay of a nomad's food is camel milk. It is consumed fresh or soured. The camel is milked twice a day, while young calves are weaned at an age of 9 to 11 months. The camels are milked twice in 24 hrs but 4 times milking is also not uncommon. The camel has a unique capability that it can be milked any time during 24 hrs and six times milking has also been noticed in some animals.

Camel's milk is generally an opaque white color and has a faint sweetish odor and sharp taste, sometimes it can be salty. Its opaque white color because the fats are finely homogenized throughout the milk whereas, the changes in taste are caused by the type of fodder and availability of drinking water. The composition of camel milk varies due to the difference of geographical origin. In general, the average amount of components of camel milk is protein 3.4%; fat 3.5%; lactose 4.4%; ash 0.79%, while water covers 87%.

Camel milk contains 3 to 3.9 percent of protein. Low quantity of  $\beta$ -casein and the lack of  $\beta$ -lactoglobulin. Casein is a major part of the protein in camel milk that constitutes 52 to 87 percent of total milk protein.

The level of dromedary camel milk fat believed to be 2.9 to 5.4 percent and can be reduced from 4.3 to 1.1 percent in the milk of thirsty camels. But a recent study reported camel milk contains only 2% fat which is mainly composed of polyunsaturated fatty acids and omega fats. Camel milk from goats or camels is more digestible for humans.

The major carbohydrate fraction in camel milk is lactose sugar which ranges between 3.3 to 5.80 percent. The nature of vegetation eaten by the camels in desert areas could be a significant factor for extensive variation in lactose contents. Camels generally like to take halophilic plants like Salsola, Acacia and Atriplex to fulfill their physiological necessities of salts. However, in some dromedary varieties of the world lactose contents found to be changed slightly over a period of time. Lactose readily digested by human lactase with no signs of "lactose intolerance".

The total amount of mineral dromedary camel milk is between 0.60 to 1.0 percent. There are significant fluctuations in minerals level due to the differences in feeding, breed, water intake. Camel milk is a rich source of various minerals like Na, K, Ca, P, Mg, Fe, Zn, and Cu are present in camel milk.

Numerous vitamins such as D, E, A, C and vitamins of B group are found in dromedary camel milk. Camel milk rich in vitamin C. It was revealed that camel milk contained three to five times more vitamin C as compared to bovine milk. The mean value of vitamin C concentration present in camel milk is 34.16 mg/L. It was reported that camel milk contains a higher concentration of niacin (B3) as compared to bovine milk. The low pH due to a higher concentration of vitamin C stabilizes the milk and therefore it can be kept for relatively longer periods without cream layer formation. The availability of relatively higher amount of vitamin C in camel milk is of significant relevance from the nutritional point of view as it exerts powerful anti-oxidant activity.

Vitamin C and important electrolytes like calcium and iron are needed for duodenal acid for calcium absorption in cases of osteoporosis are satisfied by camel milk rapidly passing the stomach, with the acid that is constantly being secreted and the vitamin C (ascorbic acid) increasing the amount of calcium absorbed and deposited in the bones.

A wide range of products is made from camel's milk such as various sour milk, cheese, khoa, butter and ghee etc. Despite common belief in south Asia that camel milk cannot be used to prepare butter and ghee due to the small diameter of fat globules, some local and foreign workers have devised methods to make butter and ghee successfully. Most common milk products made from camel milk are dahi (yoghurt), lassi (sour milk) and kurth (cheese) in northeastern Baluchistan habitats.

Health benefit potentials of camel milk are obtained through a number of bioactive components in camel milk. These components were reported to exist naturally in camel milk or derived from camel milk proteins.

The medicinal value of camel milk for a treatment of gastritis, asthma, stomach discomfort, HIV, Hamot (kar), tuberculosis, fever, urinary problems and hepatitis. Pastoralists claimed that camel milk is used to treat a number of illnesses in human beings such as Jaundice, Malaria, Constipation, to clear the stomach, post-partum care of women, to detoxify snake venom and flatulence, because camels browse on various plant species and active agents with therapeutic properties from these plant species are secreted into the milk. The immune system of the camel is stronger than that of human and the small immunoglobulin's pass from the camel milk into the human blood. As immunoglobulins are found in camel milk throughout lactation, drinking milk will provide a tool for combating autoimmune diseases by rehabilitating the immune system rather than is depression.

Currently, the value of camel milk has increased worldwide due to its high therapeutic value for human health. Studies confirmed that the composition of camel's milk is unique in terms of antioxidative factors, antibacterial, antiviral, antifungal and anti-tumor activity, hypoglycaemic, anticancer, to preventive aging, for autoimmune diseases effect.

Diabetes mellitus is characterized by abnormally high blood glucose levels, resulting from low insulin secretion and increased insulin resistance. Diabetes mellitus type 1 caused by autoimmune destruction of insulin-producing beta cells of the pancreas or malfunction of the receptors for insulin on the cell surface. The subsequent lack of insulin leads to increased blood and urine glucose. But as camel milk contains tissue repairing proteins, the problem is cured. Drinking of one liter of camel milk is sufficient can meet daily requirement of insulin (52 U/L) for a moderate diabetic patient.

A comparison between conventionally treated juvenile's diabetes with those also drinking camel milk showed that the group drinking the camel milk had significantly reduced blood sugar and reduced HbA1C levels. Because camel milk has following properties Camel milk has insulin-like activity, regulatory and Immuno-modulatory function on cells.

Camel milk contains antimicrobial enzymes (Lactoferrin and Lactoperoxidase) protective protein like caseins, stronger immune system and smaller immunoglobulins than other ruminants. Lactoferrin has inhibitory activity on both Gram-positive and Gram-negative bacteria in vitro. Antimicrobial effect of raw camel milk and heated milk suggested that the raw milk is more effective. This justified the clue that heat treatment process may have destroyed, at least partially, some of the inhibitory systems present in the milk.

Cohn's disease is a condition that causes inflammation of the digestive system or guts that boosts with autoimmune disease. Camel milk has shown a good effect for treating Cohn's diseases. Autism disease is general terms for a group of complex disorders of brain development. The etiology of many autistic cases is based primarily on autoimmune disease, affecting an intestinal enzyme responsible for the formation of amino acids from the milk protein casein. camel milk has emerged to have potential therapeutic effects in autism. The consumption of camel milk in children suffering from autism showed reduction in autism symptoms and improved motor skills, language, cognition, joint coordination and skin health. Children drinking camel milk have had amazing improvements in their behavior and diets.

Camel milk lacks proteins and thus do not cause the problem of allergies in a sensitive individual. It is also revealed that anti-tumor properties of camel milk are due to strong antimicrobial and anti-oxidative activities that help in reduction of liver inflammation and camel milk is rich with nutrients that are required for healthy liver function.

Camel milk cures both hepatitis B and hepatitis C. The special fat in camel milk soothes the liver and has a beneficial action on chronic liver patients. There is also a possibility that the relatively high concentrations of ascorbic acid in camel milk help in improving liver function.

Camel milk has a higher amount of iron chelating protein known as lactoferrin. This protein removes free iron from joints of arthritic patients thereby improves arthritis.

Researchers say that the ingredient's vitamin B, C, carotene and iron content have crucial for the skin. The milk contains lanolin and other moisturizing properties providing a calming and soothing effect on the skin. In addition to keeping the skin beautiful used to treat skin disorders such as dermatitis, Acne, Psoriasis, and Eczema. Moreover, camel milk is a natural source of alpha-hydroxy acids for softening the skin, keeping it supple, smooth and preventing wrinkles.

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