



CAMEL MILK AS A COMPLEMENTARY AND ALTERNATIVE MEDICINE

Anthropology

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ABSTRACT

Camel milk has always been a major traditional staple in the nutrition of the pastoral nomadic people. The milk is consumed either fresh, or soured for longer preservation. Camel milk has been employed as a medicine for centuries by pastoral nomadic people because of its richness in vitamins, minerals, and iron; and contains anti-bodies and immunological potency, mainly for infants. Camel milk is also a good substitute for human milk. It is low in cholesterol, sugar and protein, and contains a high concentration of insulin. Camel milk is used as an antioxidant, and tumor growth depressant; to treat prostate, breast cancer, and other cancers including leukemia, and can be used to alleviate the side effects of chemotherapy and radiation.

The main argument in this paper is that people in Asia and Africa use camel milk as a complementary and alternative medicine, mainly for cancer, in addition to it being a source of food and drink.

KEYWORDS

camel, milk, food, medicine, cancer, complementary and alternative.

Methods:

The data for this paper are derived from a broader study of complementary and Alternative Medicine in the Middle East and North Africa that took place over the course of two decades. Unstructured interviews and observation of participants were carried out in the informants' homes (men and women), as well as in the homes of healers (men and women) of different ages (twenty to eighty years old), and from a variety of groups (urban, peasant and Bedouin): camel breeders, pastoral communities, healers, patients, and veterinarians. All the material was recorded in field logs. All interviews were conducted in Arabic.

Background:

Health care systems are based upon the dyadic core, consisting of a healer and a patient. In western society, this can be a family physician, cardiologist, oncologist, or a psychiatrist. In traditional society, the healer can be a shaman, herbalist, bonesetter, or a medium. In traditional society, the state may introduce a western medical system; in such a situation, an array of medical systems or a pattern of medical pluralism will coexist. From this perspective, the medical system of a society consists of the totality of medical subsystems that coexist in a cooperative relationship with one another (1).

The camel has been mentioned in the Quran among the animals as a superior creature and miraculous creation by Allah "Do they not look at the Camels, how they are made?" (2), and its milk is mentioned in the Quran as producing sufficient milk for everyone that in Paradise there are "rivers of milk the taste of which never changes" (3). It is also part of Islamic oral tradition (4).

Pastoral nomadic Bedouin tribes in the Middle East and North Africa rear camels. Almost all the pastoral Bedouins' food is obtained from grain, mostly wheat and barley, which is grown in areas that are mostly in the joint possession of each tribe. Some of their food is obtained from herd animals, mostly sheep and goats, with some cattle and camels. To find enough natural pastureland for the herds, part of the tribe moves through the desert, sometimes over considerable distances. The primary staple in the pastoral Bedouin nutrition, among other resources, is camel meat and milk (5, 6, 7, 8, 9, 10). In fact, parallel to Arabs breeding their camels for greater milk production, ancient Arabian camel nomads were breeding themselves via consanguineous marriage and virtual consanguineous marriage to ensure that genetically their kin would continue to survive on milk in the waterless desert" (11).

Camel milk is not boiled before it is drunk. It is considered especially nutritious. Milk was the primary source of nourishment for the entire Rwala (12) family. One female camel can produce between one to seven liters of milk a day. The better the pasture, the more milk given. Fertile female camels produce milk for twelve months. The freshly obtained milk has a salty taste because the camels are fond of grazing on salty vegetation. The milk is either drunk immediately or any

remaining milk is poured into a leather bag (sheepskin or goatskin). The Rwala do not churn camel's milk. If they have too much, they boil it and from the curds make small cheeses which are eaten either dry or stewed with bread (13). The milk is used either fresh (termed *halib*), or soured for longer preservation (called *laban*). The latter is made by pouring the fresh milk into a leather bag for the purpose, where the requisite inoculants for controlled souring are maintained. Some plants on which camels graze tend to scent or flavor their milk. Camel milk is low in separable fat, but a form of butter called *jbab*, is sometimes made from it, as well as a cheese called *igt* produced by extending the souring process (13, 14). Camel breeds in Arabia ranging from coarse baggage-carrying types to high milk-yielding breeds and fine-featured breeds. Camel milk may also be mixed with well water that is too saline for human consumption, to make a mixture (*shamin*) in which the salts are diluted to drinkable level (14). The Bedouin consume both camel meat and milk as a basic source of nutrition for the family. Camel milk contains a higher level of vitamin C, protein, and mineral content than either cow or goat milk (15). Milk, also, replaces to a great extent the water Bedouin would otherwise need to quench their thirst. Some Bedouin slaughter a she-camel's calf so that their children can live off the mother's milk, and if the she-camel doesn't spontaneously yield sufficient milk, they bring her the calf of another she-camel so that the nursing calf will stimulate increased milk flow (16). Sometimes three to four she-camels are gathered together with one calf to increase their flow of milk. When the calf is not slaughtered, they reserve part of the milk for the calf, leaving one side of the udder to it and milking the other side to provide milk for their own children (17).

Camel milk contains vitamins B2, B12, and C; linoleic acid, lactose, and extracts of aromatic plants that camels graze on such as rosemary and hyssop; these extracts act as stimulants on the liver, as a hepatic (18). The composition of the milk and its attributes, however, hinge on the camel's age, quality, and the nature of the food it consumes (including availability of pasture) and availability of water - the best quality being the milk of young camel's during the first 40 days after birth of their calf. The composition of pasture plants impact on their medicinal effects (18, 19).

Camel milk production has become a booming business in Middle Eastern countries. Camel milk is drunk throughout Arabia, and it is extremely nourishing and low in fat content (20). Recently, the European Union has also allowed import of camel milk from African and Asian countries into the EU.

Among the Bedouin in the Negev (21) it is customary for the midwife to hide the umbilical cord under the supporting pole of the tent (*wasit al-bayt*) (22) or in the tent lining (*btanit al-bayt*) to symbolize the baby's ongoing loyalty to his family. One old informant (a woman, related to the author) revealed that she hung her son's umbilical cord on the neck of a she-camel (*naqa*) to symbolize his connection to camels; indeed, when he grew up he loved tending camels and was even nicknamed "father of the she-camels" (*abu al-niaq*) (23).

Treatments:

Camel milk has been employed as medicine for centuries by nomadic people because its richness in vitamins, minerals and iron (24). It is commonly used to treat hepatitis, autoimmune diseases, osteoporosis, tuberculosis, asthma, flu, hypertension, and diabetes.

Camel's milk contains anti-bodies and immunological potency, mainly for infants. It is prescribed for asthma, diabetes, tuberculosis, liver inflammation, digestive ailments, cancer, smallpox, wounds, dental diseases, lung diseases, and ascites, and as an antidote for toxins. Milk is believed to strengthen teeth, bones, and the sexual organs, especially of old men. It is used to treat anemia, tuberculosis, senility, acne, leukemia, and impotency (18), and is also used as an aphrodisiac (25).

Camel milk is used to treat hepatitis, autoimmune diseases, osteoporosis, tuberculosis, asthma, flu, hypertension, and diabetes (26). Camel milk cures hepatitis B; the special fat in camel milk soothes the liver (27).

Camel milk has numerous uses in treating illnesses. It is a purgative, and should be consumed in moderation by persons not used to it (20). It is used to treat the digestive system: for spasms, as an antiseptic digestive (due to its antihelminthic, antiparasitic, antibacterial, antifungal, antiviral, antimicrobial properties), for helicobacter pylori, gastritis, peptic ulcers, and stomachaches (17). It is prescribed due to its anti-microbial factors and for viral infections (28), and as an alternative source of nutrition for children who are allergic to cow milk (29). Camel milk is also prescribed to treat viral and bacterial pathogens (30). Camel milk contains lysozyme, an enzyme with bactericidal activity which also stimulates a rise in antibodies (31). It is prescribed for chronic pulmonary tuberculosis (32).

To treat stomach ulcers/colic, the patient drinks camel milk in one of the following mixtures: a quarter of a teaspoon of myrrh mixed in a cup of camel's milk or half a spoonful of pulverized leaves from the mastic tree (lentisk) in a cup of camel's milk; a teaspoon of the juice of carob pods mixed in a cup of camel's milk (33). Camel milk is employed to treat constipation and stomachache/abdominal pain (33). It is also taken as an anti-acid for hyperacidity to treat heartburn/ excess gastric juices (33). It is prescribed to alleviate liver pain and treat a prolapsed liver (liver displacement) (33); and also, to treat cardiovascular system, nervous system, and respiratory system disorders, as well as insomnia, and allergies.

Camel milk is used to treat disorders in liver, kidneys, gall bladder and spleen (34). It is prescribed in cases of rheumatism, leg and joint pains; the patient may also wear a bracelet (*swar*) made of camel's wool (*wabar*), and drink camel milk (35). It acts as a laxative on people unaccustomed to drinking it; to treats reoccurring acute and chronic health problems including asthma, anemia, jaundice, and spleen problems (36).

Camel's milk is prescribed to treat breast cancer and antitumor (37, 38). The lactoferrin in camel milk also has medicinal values: antibacterial, antiviral properties, as well as inhibiting tumor growth. It inhibits the occurrence and development of cancer of the skin, breast, colon, and stomach; it is used to treat Type 1 and Type 2 diabetics as well as gestational diabetes (39, 40, 41). Camel milk can alleviate the side effects of chemotherapy and radiation, making the treatment more effective and tolerable for the patient (42). It is used to treat diabetes, allergies, cancer, arthritis, tuberculosis, autism, liver disease, and more (24). A series of metabolic and autoimmune diseases have been successfully treated with camel milk (43), it is common practice to give camel milk to children as a nutritious diet that strengthens their bodies and immune system. Camel milk has been showed to improve the behavior of children on the autistic spectrum (44, 45). Blisters from burns are treated by applying goat, sheep, or camel milk to the affected area several times a day (33). To induce enhanced lactation, when the mother cannot breastfeed due to lack of milk, she and her baby drink the milk of she-camels mixed with water (33). Camel milk is used as a remedy for snakebites, and scorpion and spider bites. The dervish gives the victim camel milk and olive oil to drink (33, 13). Bedouin used to take pustules (*bathr*, pl. *buthur*) from patient with smallpox during recovery, mix them with camel milk, and give the milk to others to drink, to immunize them against smallpox (33, 46). The high mineral content (sodium, potassium, zinc, copper and magnesium) as well as a high vitamin C found in camel milk may act as antioxidant thereby removing free radicals (47). Camel milk is employed to treat diarrhea, tuberculosis, cancer, and liver cirrhosis (48). It is used to

treat dropsy, jaundice, problems of the spleen, tuberculosis (49, 50). Camel milk treats diabetes and reduces the risk of diabetic complications (51).

It is used to treat diabetes: treat Type 1 diabetes mellitus (52, 53), increases insulin level in patients with Type 2 Diabetes Mellitus (54), Type 1 diabetes (55, 56), treat diarrhea (57), and epidemic diseases (58), and Crohn's disease (59). It has anti-diabetic, and anti-cancer properties (60, 61). It treats peptic ulcers (62), enhancing the immune system's defense mechanism. Recent studies also indicate that magnesium significantly enhances the body's antioxidant defenses, and is effective against alcohol-induced oxidative stress, disturbance of liver function, and elevated cholesterol, mainly when administered with selenium (which has antioxidant properties and may help protect cells from damage) (63). Peptidoglycan in camel milk has the ability to inhibit cancer metastasis (64). Camel milk is very useful in the treatment of HIV and AIDS (65, 66). It is used to treat gastritis, stomach discomfort, HIV, tuberculosis, fever, urinary problems, hepatitis, jaundice, the common cold, diarrhea, nausea, diabetics, rickets, asthma, and anemia (67). Ibn-Sina (68) found camel milk has therapeutic effects in spleen, kidney, liver, cancer, and children diseases.

Camel milk has an anti-aging effect-filling in and smoothing fine skin wrinkles (69). Anti-tumor properties of camel milk are due to strong antimicrobial and anti-oxidative activities that help reduce liver inflammation (70). Camel milk has been used therapeutically against certain types of cancer, diabetes, colitis, autism and Crohn's disease (71). Camel milk contains protective proteins, including the immunoglobulins necessary for activating the immune system, and contains nutritional benefits for brain development (72). Camel's milk has been shown to trigger apoptosis (controlled cell death) in human breast cancer and liver cancer cells via epigenetic mechanisms; and has been applied to treat multiple sclerosis, psoriasis, Lupus, allergies-asthma (64, 70, 73).

In Sudan and the Arab world, camel milk together with garden rocket or arugula (*Eruca sativa*) are used traditionally to improve impaired liver functions. Camel milk is used in Kazakhstan as an adjunct to chemotherapy for some cancers of the digestive tract (74).

Camel milk composition:

Camel milk is low in cholesterol, sugar, and protein but high in minerals (sodium, potassium, iron, copper, zinc, and magnesium), vitamins A, B2, C and E, and contains a high concentration of insulin (75, 76). It was found that Fe and Zn occur in greater quantities in camel's milk than in cow's and goat's milk. Camel's milk contains insulin-like protein with its Zn (77). It also contains fat with a relatively large amount of polyunsaturated fatty acids and linoleic acids, which are essential for human nutrition (78). The composition of camel milk is closer to human milk and of high nutritional value and therapeutic effects (38, 48, 79). Camel milk has a high biological value compared to other ruminants' milk due to its higher levels of antimicrobial factors such as lysozyme, lactoferrin, lactoperoxidase, immunoglobulin G, and secretory immunoglobulin (28, 80). The lactoperoxidase has anti-tumor activity (38), the Peptidoglycon recognition protein (PGRP) impacts positively on breast cancer by controlling metastasis (37). Camel milk has the IgA and IgG that have proved effective against several viral and bacterial pathogens (30). Consumption of camel milk is well tolerated by children who are lactose-intolerant and therefore allergic to cow milk (29). It is used to treat viral and bacterial infections (28), and chronic pulmonary tuberculosis (32). Camel milk can be classified as a food with high nutritive and therapeutic applications, and is known for high protein, casein, potassium and vitamin C content. This milk can be the sole dietary source for a human (or for a camel for that matter) for a long period providing the minimum balance of nutrition (81). Caseins constitute 75-80 percent of the proteins in camel milk, and the increase of free radical scavenging activity by camel milk proteins and casein after their hydrolysis suggest that anti-oxidative peptides are being released and these peptides are mainly generated from the caseins rather than from the whey proteins (82). Camel milk proteins can be divided into two groups: caseins and whey proteins. The amount and type of amino acids in camel milk are high - except for lysine, glycine, threonine, and valine. The most important proteins in camel milk are whey proteins that contain albumin, lactoferrin, immunoglobulins, and so forth; it contains fats, lactose, vitamins, and minerals that treat diarrhea, tuberculosis, cancer, diabetes, and liver cirrhosis (48).

It is claimed that the value of camel's milk is to be found in the high concentrations of volatile acids, especially, linoleum acid and polyunsaturated acids, which are essential for human nutrition (52).

There was a 30-35 percent reduction in daily doses of insulin in patients with Type 1 diabetes who received raw camel's milk, demonstrating that camel milk possesses insulin-like actions that decrease the requirement of exogenous insulin in Type 1 diabetes patients (55, 56). Camel milk is used to treat diarrhea (57), and epidemic diseases (58). Camel milk helps regulate cellular sugar in the absence of endogenous insulin and in presence of exogenous oral insulin. It is assumed that micelles in camel's milk may protect the insulin present in the milk from coagulation by acidity or from digestion by pepsin in the stomach, thus allowing it to be absorbed in the micelles or to be released again to be absorbed by insulin receptors in the small intestine (52).

Insulin is one of the camel milk proteins; this milk passes the human stomach into the intestines. Therefore, insulin is not destroyed and is absorbed into the bloodstream where it reduces blood sugar (83). Since camel's milk contain high levels of vitamins C, A, B2, E and very rich in potassium, iron, magnesium and other trace elements, these vitamins and polyunsaturated elements are antioxidants, thereby removing free radicals and useful in preventing tissues injury including β -cells in the pancreas. High concentrations of antioxidants and removal of fat from the body may make the insulin receptors more responsive to available insulin (52, 84). Moisture and protein levels are higher in camel milk compared to cow milk. The comparatively low percentages of total solids and fat in camel milk carry definite positive benefits for drinking camel milk over cow milk. Post-partum changes in gross chemical composition of camel milk showed an increase in fat, while protein decreases 27 days after parturition (85). In late phase of lactation, the ash, fat and total solids were significantly higher than in the early phase of lactation. The fat is present in fixed amount in milk and its percentage changes according to the water content (which varies according to the animal's water consumption); hence, a fall in water content will increase the fat percentage while an increase in water will decrease it. In the desert, high water content with low fat percentage is a definite advantage. The higher ash contents during late lactation suggest that camel milk can provide a satisfactory level of minerals (86, 87). Differences in macro-minerals levels might be due to breed variances or different environmental conditions such as feed and soil. Different breeds of camels have different capacities to deposit minerals in their milk (88). There was a concentration of Fe, Zn and Cu in Indian dromedary camels (85). The values of trace minerals Fe, Zn, and Cu were significantly higher in camel milk, compared to bovine milk (87). The role of Zn in the development and maintenance of a well-functioning immune system has been well-established (89). The levels of vitamin A, E and B1 were reported to be low in camel milk compared to cow milk (90). The vitamin C content in camel milk is two to three-fold higher compared to cow milk. The levels of vitamin A, E and B1 were higher in camel colostrum than mature camel milk. The camel milk contains higher concentration of lactoferrin and lysozyme than bovine milk. However, the vitamin C content remains higher in mature camel milk. The low pH due to the vitamin C content stabilizes the milk and it can be kept for relatively longer periods. Milk enzymes play an important role in maintaining milk quality. The availability of a relatively higher amount of vitamin C in raw camel milk is relevant from a nutritional standpoint, since vitamin C is a powerful anti-oxidant. Camel milk can be an alternative source of vitamin C under harsh environmental conditions in the arid and semi-arid areas (i.e. where vitamin C from fresh vegetables are scarce) (87). In addition, camel milk contains fatty acids: butyric, caproic, caprylic, capric, lauric, myristic, myristoleic, palmitic, palmitoleic, stearic, oleic, linoleic, and arachidic acids (85,91). A peptidoglycan recognition protein has been detected in camel milk. This enzyme has broad antimicrobial activity and has the ability to control cancer metastasis (64). Consumption of total whey proteins in the diet has been associated with retardation of chemically induced cancers in several animal models (87). Camel milk contains vitamins; B1, B2, niacin and C, amino and fatty acid compositions, and antimicrobial factors namely lysozyme (LZ), lactoferrin (LF) and immunoglobulins (Igs). Results indicate that camel milk contained higher fat, protein (especially casein), ash, Ca, Mg, P, K, Na, Fe, and Cu, lactose and Zn (92), contains protective proteins high levels of vitamin C, A, B2 and E is very rich in magnesium and zinc (93). These vitamins are antioxidants that seem to be useful in reducing the oxidative stress caused by toxic agent (94, 95).

The rearing conditions of the camel significantly affect the proximate composition and the mineral components of the milk. The milk normally has a sweet and sharp taste, but sometimes can also have a salty taste due to the type of plants eaten in the desert by the camels. There is a high concentration of mineral elements per biomass of plants that grow in the arid areas; the minerals are subsequently taken up by the grazing animals and bio-concentrated in their tissues, including milk. High mineral contents and vitamin C, make camel milk a good source of this vitamin for desert populations where fruit and vegetables are lacking (65, 66). Also, camel milk might be helpful in the treatment of HIV and AIDS cases. Camel milk is a good substitute for human milk, as it does not contain β -lacto globulin. It is rich in healthy vitamins and minerals, especially B vitamins, and vitamin C, calcium, phosphorus, sodium, potassium, chloride, iodine, magnesium, and small amounts of iron. The main mineral compounds of milk are calcium and phosphorus, which are important elements for bone growth and proper development of newborns. The high bio-availability of these minerals enhances in a unique manner the nutritional value of camel milk (96). Camel milk has a positive impact for children with severe food allergies. Parents of such children were instructed not to heat the milk, since pasteurization would destroy the immunoglobulins and other protective proteins, mainly bacterial enzymes (97). It is claimed that the proteins of camel milk are critical components for preventing and curing food allergies because camel milk contains no beta-lactoglobulin (98) and it contains a different beta-casein (99)- the two components in cow milk that are responsible for allergies. Another relevant fact is that the components of camel milk include immunoglobulins similar to those in mothers' milk, which reduce children's allergic reactions and strengthen their future response to foods (97). Camel milk could play an important role in reduction of oxidative stress by increase in antioxidant enzymes and non-enzymatic antioxidant molecule levels, and it has been showed to improve autistic behavior in children (44, 100). Camel milk has an anti-aging effect due to the presence of α -hydroxyl acids which are known to fill out and smooth and skin wrinkles. Alpha-hydroxyl acids help to shed the outer horny layer of dead cells on the skin (epidermis) by helping to break down sugars used to hold skin cells together. This promotes the emergence of new cells, which are more elastic and clear. Alpha-hydroxyl acids helps to eliminate wrinkles and age spots and relieve dryness as they make the outer layer of the skin thinner and support the lower layer of the dermis by making it thicker. In addition, liposome occurring in camel milk is applicable as a potential cosmetic ingredient to improve anti-aging effects (69). Korashy et al., (70) investigated the molecular mechanisms that govern the effect of camel milk on human cancer cells; their study clearly demonstrates that camel milk induces apoptosis in human hepatoma (HepG2) and human breast (MCF7) cancer cells through apoptotic- and oxidative-stress-mediated mechanisms. Habib et al. (101) examined the functional properties of camel milk lactoferrin, the main iron binding protein of the milk which showed a 56 percent reduction of cancer growth.

Average milk yield of camel per day ranges between 3.5 (under desert conditions) to 40 liters (under intensive management). The best quality of young camel's milk is during the first 40 days after birth of their calf. This great variation in camel milk production may be attributed to the high genetic variation between individuals, breed, feeding and management conditions, type of work, milking frequency, and age of animal, frequency of lactation, lactation number and stage of lactation (70, 71, 72, 73).

Conclusion:

Camel milk has always been a major traditional staple in the nutrition of pastoral nomadic peoples in Asia and Africa, in addition to being a source of food and drink. Camel milk is also a good substitute for human milk. The milk is consumed either fresh, or soured for longer preservation. Camel milk is low in cholesterol, sugar and protein, but high in minerals and other trace elements, vitamins A, B2, C and E, and contains a high concentration of insulin.

Camel milk has been employed as a complementary and alternative medicine for centuries by pastoral nomadic peoples because of its richness in vitamins, minerals and iron; and it contains anti-bodies and immunological potency. It has anti-aging effect, filling in and smoothing skin wrinkles.

It is used as an antioxidant, and tumor growth depressant; to treat prostate, breast cancer, and other cancers including leukemia and can be used to alleviate the side effects of chemotherapy and radiation. It is also useful in the treatment of HIV and AIDS cases.

It is used by pastoral nomadic peoples to treat diabetes, allergies, arthritic, tuberculosis, liver disease, digestive system disorders, and dental diseases; and diseases of the cardiovascular, nervous and respiratory systems.

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Conflict of interest:

I declare that I don't have any financial interest, or any conflict of interest exists.

REFERENCES

- Baer H, Singer M, and Sussler I (1997) Medical Anthropology and the World System, A Critical Perspective. London: Bergin & Garvey.
- Quran 88:17, (1930) Translated by Mohammed Marmaduke Pickthall. Karachi: Taj.
- Quran 47:15.
- al-Bukhari S (1974) Sahih al-Bukhari. Arabic-English, vol. 7, edited by Muhammad Muhsin Khan. al-Medina al-Munawwara: Islamic University.
- Cole D (1975) Nomads of the Nomads: The al-Murrah Bedouin of the Empty Quarter. Chicago: Aldine. See also, Cole D (2006:370-392), New homes, new occupation, new pastoralism: Al Murrah Bedouin 1968-2003; In Nomadic Societies in the Middle East and North Africa: Entering the 21st Century, edited by Dawn Chatty. Leiden: Brill Publishers.
- Cole D and Altorki S (1998) Bedouin, Settlers, and Holiday-Makers: Egypt's Changing Northwest Coast. Cairo: American University in Cairo Press.
- Ismail F (1976) al-Taghayyur wal-tanmiyah fi al-mujtama' al-sahrawi (Change and Development in Desert Society). Alexandria: Alexandria University Press.
- Shuqayr N (1916) Tarikh Sina al-qadim wal-hadith wa-jughrafiyatuh. al-Qahira: matba'at al-ma'aref.
- Marx E (2013: 46-49, 86-87), Bedouin of Mount Sinai, an anthropological study of their political economy, New York and Oxford: Berghahn.
- al-'Aref A (1933:147-152) Al-Qada bayna al-Badw. Jerusalem: Bayt al-Maqdes.
- Reilly B (2013) Revisiting Consanguineous Marriage in the Greater Middle East: Milk, Blood, and Bedouins. American Anthropologist, Vol. 115, No.3, Sept.2013:374-385.
- The Rwala tribe camps in northern Arabia between latitudes 28° and 34° north and longitude 36° and 42° east (Musil 1928: 676).
- Musil A (1928:89-92, 669) The Manners and Customs of the Rwala Bedouins. New York: American Geographical Society.
- Mandaville J (2011:82-87) Bedouin Ethnobotany: Plant concepts and uses in a desert pastoral world, Tucson: The University of Arizona Press. See Mandaville J (1990: 141-143) Flora of Eastern Saudi Arabia. London and New York: Kegan Paul International.
- Gauthier-Pilters H and Dagg A (1981:164) The Camel: Its Evolution, Ecology, Behavior, and Relationship to Man, Chicago: University of Chicago Press.
- When a calf is scarified or died, the Bedouin in the Negev move his hide/skin fill it with straw, and let his mother smell it, in order to induce milk; and continue grazing pasture on that area (Haj Salameh Isbayyih Abu-Rabia, Personal communication, January 2, 1993).
- Jabbur J (1995: 136, 215-216) The Bedouins and the Desert: Aspects of Nomadic Life in the Arab East. Albany: State University of New York Press.
- Yasin SB (2003: 27-39, 52, 58, 62-65, 73, 110, 114) al-tadawi bi-alban wa-abwal al-ibil (Treatments by Camel Milk and Urine). Macca: dar tibbiyat al-khadra. (In Arabic).
- Saxena M and Kavita (2014) Association of camel milk with tuberculosis. Advances in Applied Mathematical Biosciences, Volume 5, Number 1 (2014), pp. 1-8.
- Dickson HRP (1951: 416) The Arab of the Desert: A Glimpse into Badawin life in Kuwait and Saudi Arabia. London: George Allen & Unwin.
- Abu-Rabia A (2010: 453-464) Child-Birth in Traditional Arab-Bedouin Society," in Perspectives on Israeli Anthropology, edited by Abuhav, O., Hertzog, E., & Marx, E. Wayne State University Press.
- Wasitt al-bay is the symbol of male sexual organs (for more details about this term see Havkook Y (1986: 60) From Goat Hair to Stone: Transition in Bedouin Dwellings. Tel Aviv.
- There are similar beliefs among other peoples in the world. For example, in Ponape, one of the Caroline Islands, the umbilical cord is placed in a shell and then disposed of in a way as that will best adapt the child for the career that the parents have chosen for him. Among the Cherokees, the navel-string of a boy is hung up on a tree in the woods, in order that he may be a hunter (Frazier JG (1962:247-67) "Sympathetic Magic." In Reader in Comparative Religion, an Anthropological Approach, edited by William AL and Evon ZV. New York: Harper & Row. Blom F (1992: 37) "Conception and Growth of Children." In Medical Practices in Ancient America, edited by Miguel Guzman Peredo. Mexico City: Ediciones Euroamericanas.
- Panwar et al. (2015:1-10) Camel milk: Natural medicine - Boon to dairy industry.
- Kurtu MY (2004) An assessment of the productivity for meat and carcass yield of camels (Camelus dromedaries) and the consumption of camel meat in the eastern region of Ethiopia. Trop. Ani. Health and Prod., 36: 65-76.
- al-Jawziyya IQ (1957: 35-36) al-Tib al-Nabawi (the Prophet Medicine), al-Qahira: dar ihya' al-kutub al-'Arabiya (Translated by Penelope J (1998) Cambridge: The Islamic Texts Society).
- Saltanat H, Li H, Xu Y, Wang J, Liu F, Geng XH (2009) The influences of camel milk on the immune response of chronic hepatitis B patients, Chinese J. Cellular Mol. Immunol 25: 431-433.
- El-Agamy E, Ruppanner R, Ismail A, Champagne CP, and Assaf R (1992) Antibacterial and antiviral activity of camel milk protective proteins. J. Dairy Res, 59: 169-175; El-Agamy E, Ruppanner A, Ismail CP, Champagne and Assaf R (1996) Purification and characterization of lactoferrin, lactoperoxidase, lysozyme and immunoglobulins from camel's milk. Int. Dairy J., 6: 129-145.
- El-Agamy E, Nawar M, Shamsia SM, Awad S and Haenlein GF (2009) Are camel milk proteins convenient to the nutrition of cow milk allergic children. Small Ruminant Res, 82:1-6.
- Khitam AA (2003) Camel milk plasma may help produce anti-microbial vaccine Gulf News Al-Nisr Publishing LLC.
- de Almeida R (2011) Camel milk: Characteristics and perspectives for use in clinical practice. Rev Chil Nutr Vol. 38, N°2, Junio 2011:211-218.
- Mal G Sena DS, Sena VK, and Sahani MS (2001) Therapeutic utility of camel milk as nutritional supplement in chronic pulmonary tuberculosis. Livest. Int. 7: 4-8.
- Abu-Rabia A (2015:73-74, 133-134) Indigenous Medicine among the Bedouin in the Middle East, New York and Oxford: Berghahn Books.
- al-Azraq I (1948:63) tashiyil al-manafi' fi al-tibb wal-hikma al-mushtamil 'ala shifa' al-ajsam, Bayrut: Dar al-Kutub al-'Ilmiya.
- Bailey C (1982) Bedouin Religious Practices in Sinai and the Negev. Anthropos 72 (1-2): 65-88.
- Rao RB, Gupta RC and Dastur NN (1970) Camel milk and milk products. Ind. J. Dairy Sci. 23:71-78.
- Kustikova OS (1996) Cloning of the tag-7 gene expressed in metastatic mouse tumors. Russ. J. Gene., 32: 540-546.
- Yadav AK, Kumar R, Priyadarshini L and Singh J (2015) Composition and medicinal properties of camel milk: A Review, Asian J. Dairy & Food Res., 34(2)2015: 83-91.
- Gizachew A, Teha J and Birhanu T (2014) Review on Medicinal and Nutritional Values of Camel Milk, Nature and Science 2014;12(12): 35-40.
- Wang Y and Jones P (2004) Dietary conjugated linoleic acid and body composition. Am J Clin Nutr. 79:1153-8.
- Hosam HM, Wissam IH, Schneider-Stock R, Hassan HM (2013) Camel milk lactoferrin reduces the proliferation of colorectal cancer cells and exerts antioxidant and DNA damage inhibitory activities, Food Chemistry 141:148-152.
- Levy A, Steiner L and Yagil R (2013) Camel Milk: Disease Control and Dietary Laws, Journal of Health Science 1: 48-53.
- Agrawal et al. (2004) Hypoglycemic activity of camel milk in streptozotocin induced diabetic rats, Int.J. Diab.Dev.Countries, vol. 24:47-49.
- Laila Y, AL-Ayadhi and Elamin NE (2013) Camel milk as a potential therapy as an antioxidant in autism spectrum disorder (ASD), Evidence-Based Complementary and Alternative Medicine, 8.
- Al-Kanhal HA (2010) Compositional, technological and nutritional aspect of dromedary camel milk. International Dairy Journal, 20(12): 811-821.
- Abu-Rabia A (2005) Herbs as a food and medicine source in Palestine, Asian Pacific Journal of Cancer Prevention, Vol. 6, 2005:404-407.
- Farah Z (1993) Composition and characteristics of camel milk. J. Dairy Res, 60: 603-626.
- Zibace S et al. (2015) Nutritional and Therapeutic Characteristics of Camel Milk in Children: A Systematic Review, Electronic Physician, Volume: 7, Issue: 7, Pages: 1523-1528.
- Akhundov AA, Dyrdyev B and Serebryakov ER (1972) Effect of combined treatment on water electrolyte exchange in pulmonary TBC patients. Zdravookhr. Turkm., 16: 40-44.
- Urazakov NU and Bainazarov S (1974) "Tushchibek" - The 1st clinic in history for the treatment of pulmonary tuberculosis with camel's sour milk. Probl. Tuberk. PMID: 4281921.
- Shehata M and Mousa E (2014) Evaluation of Therapeutic Efficiency of Camel Milk on Alloxan-induced Diabetic Rats, Journal of American Science 2014;10(2): 53-60.
- El-Sayed MK, Al-Shoibi Z, Abd El-Ghany A and Ate Z (2011) Effects of Camel's Milk as a Vehicle for Insulin on Glycaemic Control and Lipid Profile in Type 1 Diabetics, American Journal of Biochemistry and Biotechnology 7(4): 179-189.
- Hull SJ (2004) Camel's milk to treat diabetes. Nature, 363: 446-448.
- Ejtahed HS et al. (2015) Effect of Camel Milk on Blood Sugar and Lipid Profile of Patients With Type 2 Diabetes: A Pilot Clinical Trial, Int J Endocrinol Metab, 13(1): 1-6.
- Agrawal RP, Beniwal R, Kochar D, Tuteja F and Ghouri SK et al. (2005) Camel milk as an adjunct to insulin therapy improves long-term glycaemic control and reduction in doses of insulin in patients with type-1 diabetes A 1 year randomized controlled trial. Diabetes Res. Clin.Pract., 68: 176-177.
- Agrawal RP, Budania S, Sharma P, Gupta R and Kochar DK (2007) Zero prevalence of diabetes in camel milk consuming Raica community of northwest Rajasthan, India. Indian Diabetes Res. Clin. Pract., 76: 290-296.
- Yagil R (2013a) Camel milk and its unique anti-diarrheal properties, IMAJ 15: 35-36.
- Yagil R (2013b) Comparative Alternative Medicinal (CAM) Properties in Camel Milk for Treatment of Epidemic Diseases, Journal of Agricultural Science and Technology 3: 575-580.
- Shabo Y, Barzel R and Yagil R (2008) Etiology of Crohn's disease and camel milk treatment. Journal of Camel Practice and Research 15(1): 55-59.
- Mal G. Sena DS, Sena VK, and Sahani MS (2001) Therapeutic utility of camel milk as nutritional supplement in chronic pulmonary tuberculosis. Livest. Int. 7: 4-8.
- Sahani MS, Agarwal RP, et al (2005) hypoglycemic activity of camel milk in streptozotocin induced hyperglycemia in rats. Indian J. Anim. Sci. 75: 1365-1367.
- Eliman A and Baragob A (2014) Therapeutic value of camel milk as antitumorogenic effect against ethanol-induced gastric in rat, Biochemistry and Biotechnology Research 2(3): 32-36.
- Markiewicz-Görka I, Zawadzki M, Januszewska L, Hombek-Urban K, Pawlas K (2011) Influence of selenium and/or magnesium on alleviation alcohol induced oxidative stress in rats, normalization function of liver and changes in serum lipid parameters. Hum Exp Toxicol, 30(11):1811-1827.
- Wernery U (2006) Camel milk, the white gold of the desert. Journal of Camel Practice and Research 13(1):15-26.
- Alwan O, Igwegbe A and Ahmad A (2014) Effects of rearing conditions on the proximate composition of Libyan Maghrebi Camels' (Camelus dromedaries) milk, International Journal of Engineering and Applied Sciences, Feb 2014. Vol. 4, No. 8: 1-6.
- Alwan O and Igwegbe A (2014) Physico-Chemical Properties of Stirred-Curd Cheddar Cheese Manufactured from Farm-reared Camel and Cow's Milk: A Comparative Study, Scottish Journal of Arts, Social Sciences and Scientific Studies, Vol.8(I): 85-93.
- Asres A and Yusuf M (2015) Traditional Consumption, Therapeutic Value and Its Derived Dairy Products of Dromedary Camel (Camelus Dromedaries) Milk in Somali Regional State, Eastern Ethiopia: A Review, Global Journal of Animal Scientific Research 3(1):240-246.
- Ibn-Sina, Abu Ali (2005) Al-Qanun fi al-tib volume 3.
- Choi SK, Park KD, Kim DA, Lee DW and Kim YJ (2013) Preparation of Camel Milk Liposome and Its Anti-Aging Effects. Journal of Society of Cosmetic Scientists of Korea, 40(2): 155-161.
- Korashy HM, Maayah ZH, Allah RA, El-Kadi AO and Alhaider A (2012) Camel Milk Triggers Apoptotic Signaling Pathways in Human Hepatoma HepG2 and Breast Cancer MCF7 Cell Lines through Transcriptional Mechanism. Journal of Biomedical and Biotechnology. May 13, 2012.
- Al-Juboori et al. (2013) Nutritional and medicinal value of camel (Camelus dromedarius) milk, Food and Environment II: 221-232.

72. Shehadeh N, Gelertner L, Blazer S, Perlman S, Solovachik L and Etzioni A (2001) Importance of insulin content in infant diet: suggestion for a new infant formula. *Acta Paediatr.* (1):93-95.
73. Wernery R and Yagil R (2012) Medicinal Properties in Camel Milk for Treatment of 'Epidemic' Diseases. 3rd ISOCARD International Conference. 225-227.
74. Guakhar K and Bernard F (2004) A better knowledge of milk quality parameters: A preliminary step for improving the camel milk market opportunity in a transition economy- the case of Kazakhstan. Saving the Camel and Peoples' Livelihoods Building a Multi stockholder Platform for the Conservation of the Camel in Rajasthan, International conference, 23-25, Sadri, Rajasthan, India. pp. 28-36.
75. Knoess KH (1979) Milk production of the dromedary. Proceeding of the IFS Symposium Camels Sudan, 201-214.
76. Singh R (2001) Influence of intensive diabetes treatment on quality of life outcomes in the diabetes control and complications trial. *Diabetes Care*, 19(3):195-202.
77. Saitmuratova OK, Sulaimanova G and Sadykov A (2001) Camel's Milk and Shubat from the Aral Region. *Chem. Natural Comp.*, 37: 566-568.
78. Gorban AM, and Izzeldin OM (2001) Fatty acids and lipids of camel milk and colostrums. *Int. J. Foodsci. Nutri.*, 52: 283-287.
79. Abbas S, (2013) Physico-Chemical Analysis and Composition of Camel Milk. *The International Research Journal*, June 2013; 2(2):84-98.
80. El-Agamy El, Ruppe R, Ismail A, Champagne CP and Assaf R (1996) Purification and characterization of lactoferrin, lactoperoxidase, lysozyme and immunoglobulins from camel's milk. *Int. Dairy J.*, 6: 129-145.
81. Rathore M, Sharma M and Mahich M (2011) Camel and donkey milk bease nutritive powder: A cheaper alternative of human milk, *International Journal of Pharmaceutical Studies and Research*, 20-22.
82. Jrad Z et al. (2014) Antioxidant activity of camel milk casein before and after in vitro simulated enzymatic digestion. *Mljekarstvo* 64 (4): 287-294.
83. Yagil R, Zagorski O, van Creveld C, Saran A (1998) Science and camels' milk production, in: P. Bonnett (Ed.), *Dromedaries and Camels, Milking Animals, Mauritania*, Pp.178-191.
84. Pozzilli P, Pitocco D, Visalli N, Cavallo MG and Buzzetti R et al. (2000) No effect of oral insulin on residual beta-cell function in recent-onset Type I diabetes (the IMDIAB VII). *Diabetologia*, 43: 1000-1004.
85. Singh R, Ghorui SK and Sahani MS (2006) Camel milk: Properties and processing potential. In: Sahani MS, *The Indian camel*. NRCC, Bikaner. Pp. 59-73.
86. Mal G, Suchitra Sena D and Sahani MS (2007) Changes in chemical and macro-minerals content of dromedary milk during lactation. *Journal of Camel Practice and Research* 14(2): 195-197.
87. Mal G and Pathak KML (2010) Camel milk and milk products, *SMVS' Dairy Year Book* 2010.
88. Wangoh J, Farah Z and Puhan Z. (1998) Composition of milk from three camel (*Camelus dromedarius*) breeds in Kenya during lactation. *Milchwissenschaft*, 53: 136-139.
89. Hansen MA, Fernandes G and Good RA (1982) Nutrition and Immunity: The influence of diet on autoimmunity and the role of zinc in the immune response. *Annual Review of Nutrition* 2: 151-157.
90. Stahl T, Sallman H, Duehlmeier R and Wernery U (2006) Selected vitamins and fatty acid patterns in dromedary milk and colostrum. *Journal of Camel Practice and Research* 13(1): 53-57.
91. Narmuratova M, Konuspayeva G, Loiseau G, Serikbaeva A, Natalie B, Didier M. and Faye B (2006) Fatty acids composition of dromedary and Bactrian camel milk in Kazakhstan. *Journal of Camel Practice and Research*, 13(1): 45-50.
92. Shamsia SM (2009) Nutritional and therapeutic properties of camel and human milks, *International Journal of Genetics and Molecular Biology* Vol. 1 (2): 52-58.
93. Rahman I, Biswas SJ, Menez LA, Tores M, Forman HJ (2005) Glutathione, stress responses and redox signaling in lung inflammation. *Antioxid Redox Signal*, 7:45-59.
94. Sajitha GR, Jose R, Andrews A, Ajantha KG, Augustine P, and Augsti KT (2010) Garlic oil and vitamin E prevent the adverse effects of lead acetate and ethanol separately as well as in combination in the drinking water of rats. *Indian J Clin Biochem*, 25(3):280-288.
95. Traber MG, Stevens JF (2011) Vitamins C and E: beneficial effects from a mechanistic perspective. *Free Radic Biol Med*, 51(5):1000-1013.
96. Al-Wabel N (2008) Mineral contents of milk of cattle, camels, goats and sheep in the central region of Saudi Arabia. *Asian J Biochem*, 3:373-5.
97. Shabo Y, Barzel R, Margoulis M and Yagil R (2005) Camel Milk for Food Allergies in Children, *IMAJ*, vol.7:796-798.
98. Merin U, Bernstein SD, Bloch-Damti N, Yagil R, van Creveld C, Lindner P, and Gollop N (2001) A comparative study of milk proteins in camel (*Camelus dromedarius*) and bovine colostrum. *Livestock Product Sci.* 67:297-301.
99. Beg OU, von-Bahr-Lindstrom H, Zaidi ZH, Jorvall H (1986) Characterization of camel milk protein rich proline identifies adromedarius) and bovine colostrum. *Livestock Product Sci.* 67:297-301.
100. Al-Kanhal HA (2010) Compositional, technological and nutritional aspect of dromedary camel milk. *International Dairy Journal*, 20(12): 811-821.
101. Habib HM, Ibrahim WH, Schneider-Stick R and Hassan HM (2013) Camel milk lactoferrin reduce the proliferation of colorectal cancer cells and exerts antioxidant and DNA damage inhibitory activities. *Food Chemistry*, 141(1): 148-152.