Title: Camels and camel milk...

-

IV. MILK PRODUCTS AND THEIR USES

As milk from the lactating camel must provide nourishment for her young calf as well as for human, not a great deal will be left for milk products. Moreover, the composition of camel milk does not allow for making some of the accepted products that are made from cow, sheep and goat milk. Nevertheless, milk products are made from camel milk, and the milk itself is used for purposes other than simply nutrition.

As in most pastoral communities, where milk for human consumption is obtained from more than one domesticated species of animal, milk products are made after milk of various animals in mixed. It is often unclear therefore if some of the products can be made from camel milk alone (Dhal and Hjort, 1976) or if the milk used is a mixture. This is often the case when camel milk is mixed with fresh or churned goat milk (Gast et al., 1969). This mixture is made with certain quantities of camel milk added until the required taste is obtained.

Not all communities use camel milk for making products. The milk of the Afar camels in Ethiopia, for instance, is not allowed to be processed or sold (Dahl, 1979).

When camel milk is not consumed fresh it must be processed as soon as possible both because its keeping quality seems to be poor and as it is further adversely affected by the climate it soon goes bad if not treated.

Many superstitions and beliefs have evolved around camel milk and milking. Only specific members of the family can graze the animals (Hartley, 1979) and the milk is considered as having medicinal as well as mystical properties.

Fermented milk products

Under warm conditions raw milk does not keep for long and actually its fermentation appears to be a means to preserve it not only for a limited period of time. Fermented products have various names in various parts of the world (Aggarwala and Sharma, 1961). In the Caucasus it is called kefir; in Armenia, matzoon; in India, dahdi; in Sardinia, gioddu; in Bulgaria, yoghurt; and in Syria, Israel and Egypt, lehben. The method of preparation of fermented milk consist in heating the milk to the boiling point (Aggarwala and Sharma, 1961) so as to kill bacteria. Subsequently it is cooled to body temperature and a small quantity of previously fermented milk is added which will work as a starter. The milk is well stirred and kept overnight at ambiant temperature. By next morning it has curdled. At that stage it has acquired a sour taste and the typical flavour of fermented milk has developed. Pathogenic bacteria were killed when the milk was boiled and conditions have developed which will make it difficult for them to develop, assuring that a re-infection took place at a later stage. Therefore, fermented milk products are edible for some time. Kheraskov (1964) described the method for commercial manufacture of kefir from camels' milk: milk is flash pasteurized at 85°C, getting rid by this means of pathogenic bacteria. The milk is then cooled to 26–30°C and then innoculated with a 3 to 6 percent of kefir culture. It is then bottled. After incubation at 20–26°C for 8 to 12 hours, a soft coagulum is formed and its acidity reaches 60°–70°T. The product is then allowed to ripen for 24–28 hours at 6 to 8°C. The end product has a refreshing flavour and a thick creamy consistency. It is white and without gas. The acidity of one-day old kefir is in the region of 95°T and its alcohol content is about 4 percent. “Chal”, or shubat, is a white sparkling beverage that has a sour flavour (Lakosa and Shokir, 1964). The “chal” is prepared by first souring it in a skin bag or ceramic jar, normally with a capacity of 30 kg. Previously soured milk is added to the fresh milk. It is well mixed and each day, for 3 to 4 days, fresh milk is added to the mixture. Eventually the end product must have 3 to 5 times the original volume of “chal” that was initially added. This is the best ratio for the “chal”. It was found that camel milk does not sour at temperatures below 10°C and this for up to 72 hours. At 30°C the milk sours in approximately 8 hours, compared with cos milk, which sours within 3 hours at a temperature of 30°C. The comparison between the composition of camel milk and camel “chal” is as follows (Grigor'yants, 1954):

	Camel milk	**“Chal”**
acidity	18°	28°
fat	4.3%	4.3%
lactose	2.75%	1.32%
non-fat solids	8.2%	6.6%
ash	0.86%	0.75%
ethyl alcohol	0	1.1%
ascorbic acid	5.6 mg%	4.8 mg%

The “chal” contains Lactobacilli lactic; streptococci and yeast (Kieselev, 1956). “Chal” was successfully prepared by using cultures of Lactobacillus casei, Streptococcus thermophilus and lactose fermenting yeasts and incubating inoculated milk for 8 hours at 25°C and subsequently for 16 hours at 20°C. Holder pasteurization did not affect the quality of the milk, but pasteurization at 85°C for 5 minutes caused the milk to have a bad flavour. “Chal” made from pure cultures of Lactobacillus casei, Streptococcus thermophilus and species of Torula had markedly less not-fat solids and lactose than the milk from which it was made (Kuliev, 1959). It contained 0.05 to 1.2 percent of CO_2.

In Mongolia “Tarag” is a cultured milk product similar to yohurt, while “Unda” is a product produced by lactic and alcohol fermentation of camel and other animals' milk (Accolas et al., 1975).

In the Ahaggar region of the Sahara milk is fermented in a manner similar to that mentioned above (Gast et al., 1969). The animals are milked into special jars, made of Tamari wood, which can hold 2 to 3 litres of milk. The milk is mixed in the jars, and if not immediately drunk, it is stored in containers made of animal skin. In these skin containers the milk sours. The milk of the previous day is mixed with fresh milk until sour. There are great changes in the fat percentages of the milk products. As it is a practice to water the animals only once every 4 to 5 days, and as the lack of drinking water can cause a decrease in fat percentage (Yagil and Etzion, 1980) the fluctuating fat content is understandable. A lehben is also made by sweetening fresh milk (Gast et al., 1969). If water is added to this mixture a longer storage time is achieved. This lehben can be kept for 5–6 days in the summer, and up to 10 days in the winter.

The methods of making butter and butter milk products can be summarized as follows (Gast et al., 1969):

- fresh milk is poured into a goat skin and allowed to ferment for 12 to 24 hours at 25°C–30°C. Then fermented milk churned for 15–20 minutes at 12–18°C. Butter and butter-milk are obtained;

- butter is mixed with clarifying agent and heated at 100–120°C for 30 minutes so as to obtain preserved butter fat;
- butter-milk is used to make dried cheese, or to prepare soup, or after sauce or water has been added is consumed immediately.

The fermented milk is sometimes churned with a little water and is called “Mattha” (Aggarwala and Sharma, 1961). When more water is added and the butter is removed it is called “Lagsi”. These make pleasant and nutritious drinks in the heat of summer. The lactose is converted into lactic acid by bacteria and into alcohol by the yeasts. There is normally no alcohol in yoghurt because of the rapid development of the lactic acid forming bacteria, which depress the growth of the yeasts.

<u>“Khoa” and other non-fermented whole milk products</u> (Yasin and Wahid, 1959).

“Khoa” is made by evaporating small amounts of milk over a hot, steady fire. (Aggarwala and Sharma, 1961). The milk is continuously stirred to prevent scorching. At first the mass left over has a buttery consistency, but after cooling, it turns into a semi-solid dough with a sweet taste. “Khoa” can be kept for about 200 days. If sugar is added it keeps for longer periods.

“Rabbri” is also made by heating milk in a shallow iron pan over a hot fire. The difference with “Khoa” is that the solids are removed successively from the thin layer of coagulated milk on the surface. Then the product is allowed to cool. When the milk reaches a fifth to an eighth of the original volume, it is removed from the fire. The mass is now gently mixed, without damaging the flakes that have formed. Sugar is added and it is then allowed to cool.

“Malai” is made by allowing large quantities of milk to simmer gently over a steady fire until a thick layer of milk fat and coagulated proteins forms on the surface. This is then removed and allowed to cool.

<u>Butter and derived products</u>

Some authors describe butter being made from camel milk (Shalash, 1979) while others categorically state that butter cannot be made from camel milk (Dickson, 1951). The preparation of butter from camel milk is not as easy as from milk of other animals owing to its unique milk-fat properties. The fat is distributed as small micelle-like globules in the milk (Dong-Wei, 1981); Yagil and Etzion, 1980). In addition, the fat is apparently bound to protein and there is a great difference in fatty acid composition. (Gast <u>et</u> <u>al</u>., 1969). Samples of camel butter are characteristically rich in polyunsaturated fatty acids. There are only traces of fatty acids with chains shorter than C-12 lauric acid. The butter does contain normal amounts of C-16 palmitic acid, and has very high content of the polyunsaturated C-18 oleic and linoleic acids, when compared with butter obtained from milk of other animals (Gast <u>et</u> <u>al</u>., 1969). The Turags' belief that camel milk is especially healthy for sick, young and old people probably because of its fat composition and vitamin content. Nevertheless, butter can be made from camel milk. Knoess observed that butter can be obtained after 15 to 20 minutes churning, whereas according to Shalash (1979) it can take up to about four hours. Butter can be made by churning fresh camel milk at 24–25°C in a special blender (Lakosa and Rakin, 1964). At lower temperatures the cream of the camel milk will not churn. Water content of butter was found to be about 13 percent and its acidity 3.3°T. Specific gravity was 0.923 and it melted at 44.5°C. This butter is used for cooking and is not eaten as butter <u>per</u> <u>se</u>. It is sometimes used by women as a cosmetic (Gast <u>et</u> <u>al</u>., 1969).

In the Sahara, butter is made by placing camel milk into a thin, hairless, goat-skin for 12 hours. This skin is never washed with water. Inside the temperature rises to 28°C, a temperature very similar to that used in the blender (Lakosa and Rakin, 1964). In winter the goat-skin is often placed into the ground near a warm fire to obtain the optimum temperature before making butter. This aids in the fermentation. Churning is done when the container is half filled with sour milk. Air is blown into the container and the top is tied off. It is hung on a tent pole and rapidly swung to and fro. This is done in the early morning and the amount of butter obtained is determined by the skill of the man doing the churning. No churning is done during the day as solar heat apparently impedes proper separation. Some cold water is added into the goat-skin before the end of churning. This aids in solidifying the butter. It is then placed in a wooden bowl or kettle. Fresh butter is not eaten, but is often used as a base for medicines. The fresh butter is difficult to preserve. It is not limpid and becomes rancid rapidly. Most of the butter is thus melted down to make Shmen or “Semma”. The butter is melted at 100–120°C for 30 minutes. A clarifying agent is added to hot butter and it is stirred with a wooden spoon. This agent can be crushed dates or a grated, roasted piece of ram horn, or leaves of certain plants or seeds. Heating destroys the bacteria and the clarification agent collects the dirt and floats to the top, where it can be skimmed off. If dates are used as clarifying agent it is then given to children. If not, it is thrown away. The leaves give the specific colouring and aroma to the butter.

The Bedouin in the Sinai Peninsula place the camel milk that is left over in a big clay jar, were it allowed to partially ferment. Then they place the milk into a leather container and shake it for about 4 hours and subsequently extract butter. Milk from quite a few camels is normally required to obtain enough butter for the requirements of the herder families. Camel butter has a harder consistency than the butter of sheep milk. The butter has a greasy appearance and taste, so only little is eaten and it is used mainly for cooking.

Cheeses

Soft cheese can be made from camel milk. The fat is bound to the milk proteins and the casein is also different from that of other animals (Ottogalli and Resmini, 1976). The alpha and beta caseins were found to react much more slowly on electrophoresis. Nevertheless, several plants that make rennet coagulated cheese from camel milk exist in the USSR (Dilanyan, 1959; Mihaine, 1962). The Tourag nomads on the other hand say that cheeses cannot be made from camel milk, as it does not curdle, and so discussion on cheese making in the Sahara is restricted to cheeses made from milk of other animals (Gast et al., 1969). However, cheeses can also be made by mixing camel milk with milk of other animals (Kheraskov, 1962; Rao et al., 1970). The cheeses made are often spiced cheeses or made without salt or sugar. The difficulty in making cheeses in the Sahara most probably refers to the technique which is being used. This is apparent as the addition of the peptic enzyme, that is collected from rabbit stomach, or from the abomasum of young goats, to camel milk causes the formation of a coagulatum. This coagulated mass is soft like cotton wool (Gast et al., 1969).

As previously mentioned, in summer the lack of proper amenities in many countries to keep milk at low temperature does not allow for storing milk. The left-over camel milk is thus curdled and soured. Casein can be prepared from this milk and the product is known as “industrial casein” (Pant and Chandra, 1980), because the product is considered unfit for human consumption. It is used for making glue and gums. Whereas industrial casein and its fractions made from cow milk were found to be rich in crude proteins, the industrial casein and its fractions when made from camel milk are poor in crude proteins. Simple and effective methods were standardized for obtaining proteins from milk whey. The proteins of camel milk whey have a relatively higher percentage of nitrogen than those obtained from the whey of cow milk (Pant and Chandra, 1980). The high percentage of proteins and the amino acid composition of camel milk industrial casein suggest that it could make a satisfactory dietary supplement to the human diet. The unpleasant odour and taste however, make it unsuitable for consumption by man or animals. It is thought that it would be possible to purify the camel industrial casein and so make it fit for human consumption.

The Bedouin of the Sinai Peninsula and the Tourag nomads (Gast et al., 1969) make a dry cheese called “Afig”. These are balls of cheese that are made from butter milk, after the butter has been made, as mentioned previously. The Afig cheese balls are placed on the sides of the tents to dry out. No other kinds of cheeses are made. The reason for this is said to be that the camel spoke to the Prophet Mohammed and it was agreed that no cheeses would be made from her milk and that her wool would not be dyed. Thus, there is a prohibition against making cheeses from camel milk, except following the making of butter.

By French standards the nutritional value of camel milk is considered to be the lowest after the ewe, goat and cow milk (Gast et al., 1969). But it is also stated that 4–5 kg of milk and milk products are enough to cover all the requirements for a man so far as calories, lipids, proteins and calcium are concerned.

No mention is made of the fact that in times of drought the ewe, goat and cow have difficulty in surviving, while the camel goes on producing; in addition, the water in the milk is an invaluable source of liquid for man; yet the camel is neglected despite the fact that it is an invaluable source of food for man in arid and semi-arid areas. Better techniques, adapted to local conditions, are required to increase the quantity and improve the quality of products obtained from camel milk.

Butter milk that is left over following churning is also used to make soup (Gast et al., 1969). Dates, pepper, water and other ingredients are added to make a tasty meal. This cold soup is prepared just before it is eaten and it is highly nutritious.

Miscellaneous uses of camel milk

Medicinal properties

In India camel milk is used therapeutically against dropsy, Jaundice, problems of the spleen, tuberculosis, asthma, anaemia, and piles (Rao et al., 1970). The “chal” and other lung ailments (Gast et al., 1963) has proven beneficial in the treatment of tuberculosis (Akundov et al., 1972). A clinic has been established in which milk is used for treatment (Urazakov and Bainazarov, 1974). Patients with chronic hepatitis had improved liver function after being treated with camel milk (Sharmanov et al., 1978). In fact, camel milk was as effective as ass milk and superior to treatment with only medication or a diet consisting of cow milk proteins.

The camel milk works as a laxative on people unaccustomed to drinking this milk (Rao et al., 1970). Apparently stomach upsets only occur when the milk is drunk while still warm. When it is cool, no ill effects have been noted (Gast et al., 1969). The milk also apparently has slimming properties (Yasin and Wahid, 1957).

Camel milk is given to the sick, the elderly and the very young because of the belief that it is not only healthier, but works especially well in bone formation (Gast et al., 1969). The belief among the Bedouin of the Sinai Peninsula, is that any internal disease can be cured by drinking camel milk. The milk is said to be of such a strength, and to have such health-giving properties, that all the bacteria are driven from the body. This said to be true only for camels that eat certain shrubs and bushes. The shrubs and bushes are, themselves, used in the preparation of medicines. However, camels which eat straw are said to lose this ability.

Mystical properties

In Ethiopia camel milk is considered as having aphrodisiac powers (Rao et al., 1970). In Somalia, among the pastoral tribes, it is believed that milk drunk on the night when the camels first drink water, following a long period of thirst, has magical powers (Mares, 1954). “He who drinks milk on this night from a thirst-quenched camel will lose the thorns that have penetrated his feet, even from childhood”.

In the Sahara there is a superstition that when camel milk is given to a certain guest, only the milk of one particular camel is given to him. (Gast et al., 1969). Therefore, if the guest casts an evil eye on the herd, only the camel, whose milk he has drunk, will be affected and will stop lactating.