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Review on Production, Quality and Use of Camel Milk in Ethiopia

Sisay F^{1*} and Awoke K²

¹College of Dry Land Agriculture, Jigjiga University, Jigjiga, Ethiopia

²Department of Animal and Range Science, College of Dry Land Agriculture, Jigjiga University, Ethiopia

Abstract

The camel rearing sub-sector has been an integral part of agriculture in Ethiopia. It has been contributing to the household food, income and poverty alleviation and national economy through export. The country has huge camel resources that made it the sixth leading country in camel population in Africa. However, only little is known about camel or only limited researches have been done on camel. Hence, a little information has been gathered on different aspects of the camel. This is a review of various research results that are from published and unpublished papers over a long period of time and various reviews in the course of the camel and its milk. It has been revealed that the highest percentage of camel population exists in eastern part of the country namely Afar, Somali and eastern part of Oromiya Region. When camels are exposed to more arid and heat area, especially if drinking water is scarce, produce milk that has much higher water content than normal. Thus, it would appear that the lactating camel loses water to the milk in times of drought. This could be a natural adaptation in order to provide not only nutrients, but necessary fluid to the dehydrated camel calf. Pastoralists claim that camel milk is superior to the milk of other species.

Keywords: Camel milk; Fermented milk; Fresh milk; Milk composition; Milk production; Pastoralist

Introduction

According to Food and Agriculture Organization (FAO) [1] there are about 22 million camels in the World. Of this, 19.58 million are believed to be one-humped dromedary camels (*Camelus dromedarius*) while the remaining 2.42 million are two-humped bactrian camels (*Camelus bactrianus*). Camels live in the vast pastoral areas in Africa and Asia and divided into two different species belonging to the genus *Camelus*. Dromedary camels (*Camelus dromedaries*, one humped) that mainly live in the desert areas (arid), and Bactrian camel (*Camelus bactrianus*, two-humped) which prefer living in the cooler areas. More than 60% of the dromedary camel population is concentrated in the four North East African countries viz. Somalia, Sudan, Ethiopia and Kenya [2]. Ethiopia possesses over 925, 000 dromedary camels in 2013 that stand the country may be sixth in Africa in camel population [3]. But previously the country was ranked in third next to Somalia and Sudan. The majority of camels in the country are found in the drier areas of the Eastern part of the country and kept, among other animals mainly for milk production in these areas. It is widely admitted that dromedary camels produce more milk of high nutritional quality and for a longer period of time than other species in an environment that may be rightly termed as hostile in terms of extreme temperature, drought and lack of pasture [4].

Dromedary camels produce milk for quite longer period even during dry periods compared to cattle [5]. Dromedary camels are naturally browsers, thrive on sparse pasture and produce milk where other domesticated animals would virtually starve [6]. This characteristic makes the lactating camel a very valuable animal for the survival of the camel herders and their family in this harsh environment. According to FAO [7] Ethiopia which possesses about 925, 000 camels rank fourth in milk, whole fresh camel production (170, 000 tones) in Africa next to Somalia (1,100, 000 tones), Kenya (937, 000 tones) and Mali (242, 911 tones).

The milk composition of dromedary camel is excellent from a nutritional view point. Camel milk also has valuable nutritional properties as it contains a high proportion of antibacterial substances and higher concentration of vitamin C in comparison with cow milk. FAOSTAT [8] have reported a unique camel milk health benefit in different patients. Camel milk is much more nutritious than that of cow milk because it is low in fat and lactose contents and higher in

potassium, iron and vitamin C [9] Camel milk has medicinal properties and contains protective proteins, which may have a possible role for enhancing the immune defense mechanism [10].

Camel milk is an important component of human diet in many parts of the world. The present knowledge about the milk production potential of camels (*Camelus dromedarius*) is very limited. However, a healthy camel on good feed can produce 2000 L of milk per lactation period [11]. Most of the camel milk is drunk fresh or when it is slightly sour in pastoral areas of the country. Traditionally milk produced from camels is primarily used for direct consumption in raw state or fluid milk by the majority of pastoralists and some of consumed in the form of Dhanaan as fermented milk, in the form of tea and an ingredient for eating porage, soups, kinchie and pasta in Somali Regional State [12].

Milk Production Potential of Camel

The annual camel milk production in Ethiopia is estimated to be 170,000 tons [7]. Seifu [13] stated that a good dam could yield 9 kg of milk per day at the peak of lactation for an unspecified type of camel. Williamson [14] and Bremaud [15] gave the maximum daily production of the Somali and Adel camels as 12 and 10.4 kg respectively. According to Knoess [16] and Dahl [17] estimated that the Pakistan dromedary (bigger and reputed to be a better milker) can produce 9.1-14.1 kg of milk when well fed. Yasin and Wahid [18] Said that the amount of daily milk recovered during the first 2 weeks postpartum may vary from 4 to 9 liters in addition to the share of the young calf. The dromedary, like most other species, gives most milk near the beginning of the lactation period. In a study of the camels of northern Kenya, Leese [19] estimated their daily yield at 21 liters in the 2nd week of lactation, falling to 4.8 liters by the 16th week. One dam that had lost her calf at birth only gave 2.2 and 3.7 liters at the two respective times.

***Corresponding author:** Sisay F, College of Dry Land Agriculture, Jigjiga University, Jigjiga, Ethiopia, Tel: +251913943919; E-mail: sisayfikru69@gmail.com

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The average length of lactation in the camel is 12-18 months [20]. The variations for this trait depend mostly on management and environment (season, temperature and feed supply). The common practice of breeding camels to calve every 2 years, together with their limited breeding period, is conducive to extended lactation periods, especially under good nutritional levels. Knoess [16] Quote Russian data showing that on the rare occasions when camels calve every year a lactation period of 7 months is normal.

In general lactation yield will vary with species, breed, individual, region, feeding and management conditions, stage of lactation [20], type of work and milking frequency. The potential lactation yield of Adel camels in Ethiopia maintained on irrigated pastures was calculated as 2,847 kg from results given by Bremaud [15]. Seifu [13] wrote that the lactation yield (over 16-18 months) of a good unspecified dam under favorable tropical conditions could reach 2,722 kg or more. Knoess [16] gave the average daily milk production of the East and North African camel as 3.5-4 kg, i.e. a 9- to 18-month yield of 945-1,080 to 1,890-2,160 kg.

East Africa is the first region in the world in camel milk production (66%) followed by West Africa (20%), Asia (9%) and North Africa (5%). Regarding to meat production North Africa is the first (34%) followed by Asia (29%), East Africa (22%) and West Africa (14%) [21].

The major ethnic groups owning camels in Ethiopia are the Beja, Rashaida, Afar, Somali and Borana [22]. However, despite its significant contribution to the livelihood of the pastoralist society who does have little alternative mode of production system, up until recently the camel is one of the neglected domestic livestock by scientific community in Ethiopia [23]. They use the milk produced from camels as home consumption.

It is difficult to estimate the daily milk yield of the dromedary under pastoralist conditions owing to the inconsistency of milking frequency. Camels may be milked once a day among the Murrah of Arabia [24], from two to four times among the Somali [14,25] and the Rendille of Kenya [26], and as many as six or seven times among the Afar of Ethiopia [27]. The latter may also leave their animals Unmilked for a whole day, which may account for sporadic very high estimates of up to 13 kg of milk per day.

Composition of camel milk

In the previous section it was shown that camels can produce an adequate amount of milk in drought areas where other domestic animals have very low production. Of prime importance for the young camel, and especially for man, who drinks the milk, is the composition. Cows exposed to heat, especially if drinking water is scarce, produce milk that has a much higher dry-matter content than normal [28]. The fat content is especially high. This milk would certainly not provide a suitable diet for man or animal exposed to the same climatic and water stresses. Data concerning the composition of milk vary greatly. This can be partly attributed to the inherited capabilities of the animals, but the stage of lactation, age and the number of calvings also plays a role. Of special significance to the quality of the produced milk are the feed and water quantity and quality.

Most camel milk is drunk fresh. It is also consumed when slightly sour or strongly soured. (Milk products will be considered in a separate section). Camels' milk is generally opaque white [29]. Normally it has a sweet and sharp taste, but sometimes it is salty [30]. In certain countries there are prejudices among the urban population concerning camel milk. It is considered as having an unpleasant taste [17]. It is frothy when shaken slightly [31]. The changes in taste are caused by the type

of fodder and the availability of drinking water.

Fresh camels' milk has a high pH and the pH of milk is between 6.5-6.7 [31-33]. This is similar to the pH of sheep's milk. When camel milk is left to stand, the acidity rapidly increases [33]. The lactic acid content increases from 0.03 percent after standing 2 hours to 0.14 percent after 6 hours.

The first milk, the colostrums, is white and slightly diluted as compared with the colostrums of cow [29]. Other studies on the composition of the milk, depending on the stage of lactation, confirm these data [34]. It was found that 3 hours post-partum total solids (T.S) averaged 30.4 percent. The T.S declined to 18.4 percent during the first 2 days of lactation. This decline in T.S. was not caused by a variation in fat content, as initially the fat percentage was low, at 0.2 percent, and then greatly increased to 5.8 percent; rather the decline in total proteins and minerals was responsible. Grigoryants [33] Made a detailed study of camel colostrums and got 0.1-0.4%, 15.79-19.52%, 3.98-5.13% and 1.44-2.80 fat, protein, lactose and ash respectively. The specific gravity of camel milk is less than that of cow, sheep or buffalo milk [31].

The most important factor in camel milk is water content. Young camels, and especially the humans living in drought areas, are in need of fluid to maintain homeostasis and thermo neutrality. The water content of camel milk fluctuates from 84 percent [15] to 90 percent [33]. When examining only the effects of the lack of drinking water on camel milk, the diet remaining unchanged throughout the year, great changes in water content of milk were found [29]. With water freely accessible the water content of the milk was 86 percent, but when water was restricted the water content of milk rose to 91 percent. Water content of fodder would also affect water content of milk. Thus, it would appear that the lactating camel loses water to the milk in times of drought. This could be a natural adaptation in order to provide not only nutrients, but necessary fluid to the dehydrated calf. With the increase in water content of milk produced by thirsty camels, there was a decrease in the fat content, from 4.3 to 1.1 percent [29].

The milk fat is also different from that of other animals. When left standing, fat is distributed as small globules throughout the milk [29]. The fat globules are very small 1.2-4.2 microns in diameter [35]. The ratio of fat to total solids averages 31.6 percent [31]. This is much lower than that of the buffalo, which is 40.9 percent. The fat appears to be bound to the protein [36]. This would explain why it is difficult to extract fat by the usual method of churning sour milk [32]. In order to extract vitamin A and carotene this difference in milk fat necessitated saponification of camel milk [36]. Petroleum ether extraction, as used in milk of other animals, was not efficient enough for camel milk. Compared to cow, buffalo and ewe milk fat, camel milk fat contains less short-chained fatty acids, but the same long-chained fatty acids can be found [37]. Dhingra [38] claim that the value of camel milk is to be found in the high concentrations of volatile acids and, especially, linoleic acid and the polyunsaturated acids, which are essential for human nutrition.

Camel milk is rich in vitamin C [11,39]. This is important from the nutritional stand point in areas where fruit and vegetables containing vitamin C are scarce. Kon [40] found the vitamin C content of camel milk to vary between 5.7 and 9.8 mg percent. The vitamin C content increases, as lactation progresses [41]. The vitamin C levels are three times that of cow milk and one-and-a-half that of human milk [38].

Use of camel milk

According to the pastoralists view, milk from each species has its own unique attributes and properties. Pastoralists claim that camel

milk is superior to the milk of other species. They gave many reasons for their preference of camel milk to milk of other domestic animals. Cows' milk tend to make people fat, that is, it causes obesity but camel milk gives strength, endurance and stamina, an attribute that pastoralists need in order to pursue a nomadic life style. Unlike cows' milk, camel milk has medicinal values and can be used to treat a number of ailments in human beings. Besides, the pastoralists believe that camel milk keeps for a long time, it has high nutritional value, it contains higher levels of vitamins, it is easier to digest, and it quenches thirst. The informants also indicated that cow and sheep milk are sweeter than camel milk and have high fat content and thus suitable for butter-making [12].

In most camel rearing societies, Camel milk is mainly consumed in its raw state without being subjected to any sort of processing treatment. Consumption of raw camel milk should be of major concern from public health point of view. A recent report from Morocco indicated that higher levels of total aerobic count, enterococci, fecal coliforms and *Staphylococcus aureus* were detected in raw camel milk and this suggests the potential hazard associated with consumption of raw camel milk [42]. Similarly Benkerroum et al. [43] isolated *Bacillus*, *Corynebacterium*, *Micrococcus*, *Streptococcus*, *Staphylococcus* and *Pseudomonas* species from raw camel milk produced in Riyadh, Saudi Arabia.

There are various traditional fermented camel milk products that are produced in different parts of the world by camel herders [44-48]. *Suusac* and *garris* are fermented camel milk products in Kenya, Somalia and Sudan [44,47]. In Ethiopia, Pastoralists produce different fermented camel milk products such as *dhanaan* which is produced by pastoralists in Somali Region [12] and *ititu* is produced in the Kereyu area of the Oromia Region in the eastern part of Ethiopia. These two products are Ethiopian indigenous traditionally fermented camel milk food products.

Pastoralists in eastern Ethiopia produce traditional fermented camel milk by placing fresh camel milk in a clean and smoked container, wrapping the container with a piece of cloth, and keeping it in a warm (ambient temperature 25°C -30°C) place for about 12-24 hrs to allow spontaneous fermentation to take place [12]. Fermentation is initiated by the natural microorganisms of the milk without using commercial starter cultures or by back sloping technique (adding small amounts of previously fermented milk as a starter into fresh camel milk). In most urban homes, no attempt is made to control the fermentation. Due to spontaneous nature of the fermentation, this traditional method results in a product with varying taste and flavor often of poor hygienic quality.

Conclusion

The type of camel that exists in Ethiopia is *Camelus Dromedaries* (one humped camel). Ethiopia possesses over 925, 000 dromedary camels that stand the country sixth in Africa in camel population. The majority of camels in the country are found in the drier areas of the Eastern part of the country i.e Afar, Ethiopian Somali and eastern part of Oromiya region.

The annual camel milk production in Ethiopia is estimated to be 170, 000 tons which ranked the country fourth next to Somali, Kenya and Mali in Africa in milk production. Regarding to the composition of camel milk, it contains a high proportion of antibacterial substances and higher concentration of vitamin C in comparison with cow milk. It is also low in fat and lactose contents, and higher in potassium, iron and vitamin C.

The camel milk production potential varies from with species, breed, individual, region, feeding and management conditions, stage of

lactation, type of work and milking frequency. The major ethnic groups owning camels in Ethiopia are the Beja, Rashaida, Afar, Somali and Borana.

In most camel rearing societies, Camel milk is mainly consumed in its raw state without being subjected to any sort of processing treatment. But there are various traditional fermented camel milk products that are produced in different parts of the world by camel herders. In Ethiopia, Pastoralists produce different fermented camel milk products such as *dhanaan* which is produced by pastoralists in Somali Region and *ititu* is produced in the Kereyu area of the Oromia Region in the eastern part of Ethiopia.

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