

Camel Milk Production and Marketing: Challenges and Opportunities in Afar Regional State, Ethiopia

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Abstract

Camels play diverse roles in the livelihood of poor pastoralists by supplying food mainly milk which is considered as naturally single but nearly complete food. A cross-sectional study was done in two selected zones of Afar region with the objective of examining the major constraints of camel milk production and marketing and associated development potential for the future. According to the study, the main constraints affecting camel milk production were feed and water shortage, high feed cost, browsing land shortage, diseases and other reproductive disorders, inadequate animal health services, shortage and high cost of medicaments, lack of breeding services and decreased replacement stock due to camel calf mortality. Majority of the respondents said that there was no well developed and organized camel milk market in the region. The channel of marketing is majorly direct in which milk producers sold the milk product to customers directly by themselves. The price of camel milk varies mainly based on season, milk demand and supply around the study area. The low level of supply as compared to the demand may result the price of camel milk to increase. As fresh milk could not be kept for long hours before consumed or processed, distance from the potential consumers was another major factor that determines the price within the study areas. The major challenges affecting camel milk marketability were lack of road and transportation facilities, absence of cooling facilities, lack of milk preserving and transporting facilities, absence of organized market chain and absence of training and initiation for commercialization. However, there is a good potential of camel milk and opportunities for future development such as urbanization and industrialization, resettlement areas and others which increases the marketability of the available camel milk in the region. Therefore, solving feed and water problems, improving animal health and breeding services, and commercialization of the activity by creating market chain, marketing facilities and infrastructure and establishing milk selling cooperatives will help in future development of the sector.

Keywords: Afar, Camel milk, Ethiopia, Marketing, Production.

Introduction

Ethiopia has diversified topographic conditions with altitudes ranging from extremes of 4500 m above sea level in the Semen Mountains to areas 100 m below sea level in the Danakil depression. Within this diversity, climatic conditions vary from arid, tropical, sub-tropical to temperate conditions. Ethiopia has Africa's largest livestock population by which over 60% of its land area is semi-arid lowland, dominated by a livestock economy (Rota, 2009; ANRS, 2010). In situations where rainfall is scarce and unpredictable, pastoralism is a more appropriate livelihood strategy than rain-fed agriculture (Hatfield and Davies, 2006; SOS-Sahel Ethiopia, 2007; Raziq *et al.*, 2008; Gwida, 2010).

Camels play diverse roles in livelihood of the poor pastoralists, including the building of assets, insurance against unexpected events; have spiritual and social values, traction and movement of goods, food supply and income (Ali *et al.*, 2004; SOS Sahel-Ethiopia, 2007). Pastoralists own all the 3 million camel populations in Ethiopia supporting more than 10 million pastoralist population (Bekele *et al.*, 2002; Tezera *et al.*, 2010). Camels are extremely important livestock species in the arid and semiarid zones and contribute significantly to the livelihood of the pastoralists and agro-pastoralists living in the fragile environments (Abbas *et al.*, 2000; Tura *et al.*, 2010).

Milk plays a very important role in feeding the pastoral and agro-pastoral and urban population of Ethiopia and has high nutritional value. Milk and milk products are produced daily and sold for cash or processed. It is a source of cash in the milk shed areas that enables families to buy other foodstuffs, significantly contributing to the household food security (MOA, 2001). However, the Ethiopian milk marketing system is not well developed (Holloway *et al.*, 2002; CSA, 2005; and Woldemichael, 2008). This is reflected where only 5% of milk produced in rural areas is marketed as liquid milk. This has resulted in difficulties of marketing fresh milk where infrastructure in transport and related services are extremely limited and market channels have not been developed (Getachew, 2003).

In many instances, policy decisions on livestock product marketing in the country seem to be taken in the absence of vital information as a result of disaggregated database by the lowland and highland farming systems leading failure to properly inform policy makers to design appropriate national level livestock development strategies and policies (FAO, 2012).

According to Schwartz (1992) the camel (*Camelus dromedarius*, one humped camel) is an important

livestock species uniquely adapted to hot and arid environments and mainly kept by migratory pastoralists in subsistence production systems with emphasis on milk production. Due to urbanization the camel has undergone a change of image from 'ship of the desert' to 'food security animal' hence the need to put to full use its milk production capabilities through better management practices.

Camel milk is one of the basic sources of income, food and other socio-economic and cultural needs both for rural and urban dwellers in the region. Due to this fact it needs to introduce and develop market oriented camel milk production. The prevailing delivery of camel milk to intermediaries and consumers seems irregular and fluctuating. Researchers and funding agencies have become late to act on camel research for improvement of their milk marketing practice. Therefore, taking this gap in to consideration, this study was conducted in Afar zones of camel breeding areas with the objective of assessing factors which constrain camel milk production and marketing systems and its development opportunity.

Material and Methods

Study area

Afar region is one of the four major pastoral regions in Ethiopia located in north eastern part of the country. The region is divided in to five administrative zones, which are further subdivided into 32 districts. The regional population is estimated to be 1.2 million of which 90% are pastoralists and 10% agro-pastoralists. The majority of the land is rocky and the annual precipitation is low (150 - 500 mm/annum) which makes crop cultivation unsuitable. According to regional estimates, the livestock population of Afar is about 10.12 million TLU and out of this, about 859,580(8.5%) are camels. Due to this and other related factors, the main economy of the region depends on production of camels, camel milk marketing and consumption practices (ANRS, 2010). This research was then conducted in two purposively selected districts from two zones namely: Asayita district from Awsi Resu zone and Awash district from Gebi Resu zone.

Study design

Cross sectional study design was used to study and describe the factors affecting camel milk production and marketing in the selected study areas.

Methods of data collection

The population for this study was camel owners engaged in camel production and marketing in the stated zones. In this study, both primary and secondary data sources were used. To collect primary data, questionnaire was administered to some experts in the area and interviews were conducted to camel owners in the region. On the other hand, secondary data is collected from organizational documents, stakeholder organizations, plans and reports, online literatures and previous researches, brochures, and various documents of the Agricultural office.

Sample size and sampling procedures

Two districts were purposively selected from two zones based on camel population and accessibility. The survey has employed non-probability sampling procedure with special focus to purposive sampling technique. This is because of the difficulty to apply random sampling due to the mobile, scattered and less accessible nature of pastoral communities. The study Pastoral associations and households were also purposively selected based on camel population and camel milk traders availability. The household heads has been selected based on camel possessions and willingness to be part of the survey. The sample size was 100 households or camel owners including camel milk traders. i.e 50 camel owners from each study districts.

Data gathering tools

A set of detailed structured and semi-structured questionnaires and interviews were used to collect information from camel owners, camel milk traders, experts and other stakeholders in the sector.

Data enumerators who knew the area and well acquainted with the culture and the local language were recruited and trained on the methods of data collection and contents of the interview under close supervision of the researchers.

Methods of data analysis

The collected data were analyzed using SPSS version 20 and descriptive statistical analysis such as percentage and frequencies were used. Furthermore, qualitative data analysis method was used for the interview items.

Results

Out of the total sample size (n=100), 76 camel owners were participated in the research. The remaining (n=20) were not found in their residence due to mobility to other areas and the rest four camel owners were unable to provide relevant data for the research. Therefore, the data collected from the response of the 76 respondents was

found to be valid and used for the analysis. This accounts for 76% of the response rate.

Camel milk production performance

Majority of the camels were milked twice a day and gave 1-5 liters of milk per day in both districts (Table 1).

Table 1: Camel milk production performance per a day

Factors	Variables	Study groups			
		Asayita		Awash	
		Frequency	Percentage	Frequency	Percentage
Number of times camels are milked per day	Morning only	0	0	0	0
	Morning and evening	30	75	32	88.9
	Morning, midday and evening	10	25	4	11.1
Milk produced per camel per day on the average	Less than 1 liter	0	0	0	0
	1-5 liters	35	87.5	25	69.4
	6-10 liters	5	12.5	11	30.6
	More than 10 liters	0	0	0	0
Months of lactation	1-3 months	0	0	0	0
	4-6 months	20	50	25	69.4
	7-9 months	16	40	5	13.9
	10-12 months	4	10	6	16.7

The most important constraints influencing camel milk production were varied among the respondents from the two groups. The most important constraints specified by the respondents were lack of capital specified by 100% for both groups and lack of market for milk signified by 95% and 88.9% for the Asayita and Awash groups, respectively (Table 2).

Table 2: Constraints influencing camel milk production

Study groups	Constraints	Most important		Least important	
		Frequency	Percentage	Frequency	Percentage
Asayita	Feed shortage	38	95	2	5
	High feed prices	35	87.5	5	12.5
	Diseases and parasites	25	62.5	15	37.5
	Shortage of land for grazing	36	90	4	10
	Lack of capital	40	100	0	0
	Lack of market for milk	38	95	2	5
	Inefficient breeding service	30	75	10	25
Awash	Feed shortage	30	83.3	6	16.7
	High feed prices	28	77.8	8	22.2
	Diseases and parasites	25	69.4	11	30.6
	Shortage of land for grazing	26	72.2	10	27.8
	Lack of capital	36	100	0	0
	Lack of market for milk	32	88.9	4	11.1
	Inefficient breeding service	36	100	0	0

Market for camel milk

About 88% and 86% of the camel milk traders in Asayita and Awash, respectively says no well developed marketing activity for camel milk in the region.

Channel of camel milk

Majority of the respondent's in Asayita and Awash sold their milk directly to the household consumers and cafes either at the producers home or home to home selling and others sold to the household consumers, cafes and to drivers (Table 3).

Table 3: Consumers of camel milk and distribution channel

Description	Category	Asayita		Awash	
		Frequency	Percentage	Frequency	Percentage
Consumer	Household consumer	5	12.5	5	13.9
	Drivers	4	10	4	11.1
	Cafe	9	22.5	7	19.4
	Household consumer and drivers	4	10	3	8.3
	Household consumer and cafe	10	25	10	27.9
	Drivers and cafe	3	7.5	3	8.3
	Household consumer, drivers and cafe	5	12.5	4	11.1
	Total	40	100	36	100
Sell method	On contract basis	21	52.5	19	52.8
	On daily sell basis	10	25	9	25
	Both	9	22.5	8	22.2
	Total	40	100	36	100
Selling place	Home	8	20	8	22.2
	Distribution center	1	2.5	1	2.8
	Home to home selling	15	37.5	14	38.8
	Home and distribution center	2	5	2	5.6
	Home and home to home selling	10	25	8	22.2
	Distribution center and home to home selling	4	10	3	8.4
	Total	40	100	36	100

Pricing of Camel Milk

Marketable milk products in the study areas predominantly were whole milk. The price of milk varies in season. Prices of milk varied greatly in the study area since informal milk marketing was the dominant means of marketing. The study revealed that the major factors affecting the prices in the studied areas included variation in demand and supply relationship.

Factors affecting camel milk marketing practices

Camel feed related factors

Majority of the respondents said that they fed their camels on native browses (trees and shrubs) as revealed by the 85% and 77% of the Asayita and Awash groups, respectively. A mere 12% and 17% from each respective group use native grasses to feed camels. Majority members of Asayita and Awash groups don't grow fodder and depend on native browses and have no time to grow fodder since they practice nomadism. It is only 12% of those in Asayita and 16% of those in Awash grow fodder to their camels.

Water related factors

About 87% and 88% of the group members in Asayita and Awash, respectively get water from the nearby river. Only 10% and 11% of Asayita and Awash, respectively use pond water. The camels are mostly taken to the water sources to drink water as represented by 100% and 93.3% of the group members of Asayita and Awash, respectively. In addition to that, it was also revealed that scarcity of water is the main water related problem experienced by the camel milk producers. This was depicted by 95% and 94% of the group members of the respondents from Asayita and Awash, respectively.

Marketing related factors

Demand for camel milk was high as revealed by 100% of the respondents from both Asayita and Awash group members (Table 4).

Table 4: Marketing factors that influence camel milk marketing

Factors	Variable	Study groups			
		Asayita		Awash	
		Frequency	Percentage	Frequency	Percentage
Demand of camel milk	Yes	40	100	36	100
	No	0	0	0	0
Purchasers of camel milk	Individuals	25	62.5	28	77.8
	Caterers	12	30	6	16.7
	Others	3	7.5	2	5.5
Milk marketing outlet selection criterion	Price of milk per liter	30	75	25	69.4
	Market reliability	5	12.5	1	2.8
	Distance of market for milk	5	12.5	10	27.8

Challenges in camel milk marketing

The challenges in camel milk marketing were ranked from the most important to the least important and the importance varied to some extent among the groups. The Asayita groups classified lack of cooling facility and poor roads as their main important challenge with the percentage values of 100% and 95%, respectively (Table 5).

Table 5: Challenges faced in the marketing of camel milk

Study group	Challenges	Most important		Least important	
		Frequency	Percentage	Frequency	Percentage
Asayita	Inadequate transport means	35	87.5	5	12.5
	Poor roads	38	95	2	5
	Lack of cooling facility	40	100	0	0
	No organized market/links	30	75	10	25
Awash	Inadequate transport means	30	83.3	6	16.7
	Poor roads	28	77.8	8	22.2
	Lack of cooling facility	36	100	0	0
	No organized market/links	32	88.9	4	11.1

The main delivery methods used to deliver milk for sale was the use of purchasers specified by 50% of the members from Asayita and 42% from Awash groups, respectively (Table 6).

Table 6: Milk delivery methods and transport means used in the sale of camel milk

Factors	Variables	Study groups			
		Asayita		Awash	
		Frequency	Percentage	Frequency	Percentage
Milk delivery method	Delivered by family member	10	25	15	41.7
	Collected by cooperative society	10	25	6	16.6
	Collected by consumers/purchasers	20	50	15	41.7
Means of transport used in milk sale	Public transport	10	25	12	33.3
	Travelling on foot	15	37.5	15	41.7
	Using pack animals	15	37.5	9	25

Discussion

Most of the time, camels, like cows, are milked in the morning and evening. This was responded by 75% and 88.9% of Asayita and Awash society members, respectively. Few pastoralists milk their camels thrice (morning, midday and evening) a day. This explains why they don't produce quite large amounts of milk. The milk produced per camel per day ranges from 1-5 liters which is highlighted by 87.5% and 69.4% of the Asayita and Awash study groups, respectively. The milk production varies with season which is affected by feed availability and the lactation period. The lactation months were around 4-6 months as specified by 50% and 69.4% of the responses from the groups above, respectively. According to the gathered data, few animals had lactation periods of about 7-9 months and above.

A number of factors influence milk production and may be responsible for the large differences in

figures. These factors include: feed quantity and quality, breed, climate, watering frequency, stage of lactation and frequency of milking (Ramet, 2001; Bekele *et al.*, 2002; Farah *et al.*, 2004). Camels are usually milked twice a day – morning and evening; however, if the need arises they can be milked every 2–3 hours (Bekele *et al.*, 2002) and (Farah *et al.*, 2004) reported the number of milkings per day ranged from 1 to 4 for camels under traditional pastoral management system. Wernery (2003) stated that camels must be milked 4 to 6 times a day to gain optimal milk yield. Although there are fewer long term studies covering full lactation period, it is widely recognized that, in absolute terms, the camel produces more milk and for a longer period of time than other livestock species under harsh environmental conditions (Farah *et al.*, 2007). Average daily milk yield of the Somali breed camels is reported to range from 5 to 8 liters which is higher than the average reported by this study (Bekele *et al.*, 2002; Farah *et al.*, 2004). Under exceptionally favorable conditions, Somali camels can potentially produce more than 15 liters of milk a day during the peak of their lactation (Farah *et al.*, 2004). Ramet (2001) had also reported that under more intensive systems camels can yield up to 12 to 20 liters a day.

About insignificant amount of the Afar camel milk is marketed, the bulk of which is sold in raw form to rural consumers (10%) and only 2% reaches the urban consumers (Akweya *et al.*, 2010). The same authors stated that from the remaining milk (88%) that does not reach the market, 38% is directly used by camel keeping households and their herders as part of their food requirements and the remaining 50% (170 million liters) goes to waste. Muliro (2007) also stated that during the rainy season, much of the surplus camel milk goes to waste. There is, therefore, a great opportunity for commercialization and enhanced incomes for camel keeping pastoral communities (Muliro, 2007; Akweya *et al.*, 2010). In Afar milk marketing system is not well developed (Ahmed *et al.*, 2003) especially, market access in pastoral production system is a critical factor (Tsehay, 2002).

In Ethiopia, camel milk sector is not that much developed. There are some agents that involved in the camel milk production and marketing such sectors are found in Ethiopian Somali region and other pastoral areas. However, in Afar region there are no agents in the camel milk sector and the production and marketing activity is not well developed yet. Most of the camel milk sold to restaurants and cafes, householders, and drivers for making tea or for direct consumption by their customers. In addition, the producers also used the milk for personal home consumption. The camel milk marketers gather an income by selling their milk to consumers. Selling and gathering an income can make camel milk producers and marketers to have a better living standard.

Camel milk can be distributed to customers directly or indirectly through middlemen. Direct channel of distribution means where the milk producers sold the milk product to customers directly by themselves. Here, there is a single channel or direct contact between customers and milk producers. Indirect channel of distribution means where there is interfere by middlemen. So, the milk products reach to end users by the middlemen. There is no direct contact between producers and end users. Customers of camel milk are end users (home users), cafe, drivers, restaurants, and institutions. The camel milk is sold at home, distribution center, market place and home to home selling. Even if it is dominated by indirect channel of distribution, in Afar region Asayita and Awash districts, camel milk distributed to customers by both direct and indirect channel of distribution. In the study areas camel milk was consumed by end users (home users), cafe, and drivers. The majority of respondents sold their products to household consumers, and cafe at home and home to home selling mainly on contract basis. This practice indicates the milk marketing system found in the studied areas was dominantly informal marketing. The consumer may not get camel milk easily in the current marketing system rather by going to the producers' home, which is uncomfortable for doing business.

The number of intermediaries in a given marketing channel will have a bearing effect on both producer and consumer milk prices. The shorter the channel the more likely that the consumer prices will be low and the producer will get a higher return (Woldemichael, 2008). In this study areas, Asayita and Awash, about 37.5% and 38.8% producers delivered their milk to the customers by moving to customers home (home to home selling), 20% and 22.2% of the respondents sold their milk at home, 2.5% and 2.8% delivered their milk by opening the distribution center, respectively.

The price of camel milk varies mainly based on season, and the milk demand and supply around the study area. The low level of supply as compared to the demand may result the price of camel milk to increase. In reverse, if supply greater than demand in the market, the price for camel decrease and sold at lower price. This indicates there is fluctuation of camel milk price in the market which might discouraged the producers. The absence of milk market group can exaggerate the informal milk marketing system, actually the reason for the absence of milk market group can be the smaller amount milk produced by individual milk producers which could not be over pass beyond their few customers. Milk producers are the ones who fix price of milk and other milk products when selling their product to consumers and through negotiated prices when selling to traders. The government does not substantially intervene, in any way, through regulation or trade of milk products in the area. Marketable milk products in the study areas predominantly are whole milk. Prices of milk varied greatly in the study area since informal milk marketing was the dominant means of marketing. As fresh milk could not be kept for long hours before consumed or processed and distance from the potential consumers was a major factor that determines the price.

Majority of the respondents said that they fed their camels on native browses (trees and shrubs) as revealed by the 85% and 77% of the Asayita and Awash groups, respectively. A mere 12% and 17% from each respective group use native grasses to feed camels. The camel, by preference, is a browser of a broad spectrum of fodder plants, including trees, shrubs, and sometimes hard-thorny, bitter and halophytic (salty) plants that grow naturally in the desert and other semi-arid areas. Field (1995) noted seasonal variations, such trees, shrubs and dwarf shrubs dominated camel diet in wet season but the percentage of trees and shrubs noticeably declined during the dry season when most of these species shed off their leaves. Onjoro (2004) stated that the milk yield can be improved to over 10 liters per day with better feeding. Low milk production in pastoral system may be due to inadequate quantity and quality of forages.

When choosing supplementary feeds for camels, feed availability, its nutritive value and cost should form the guiding principle. Supplementary feed for camels can be provided in the form of pods of certain trees, such as *Acacia* trees. Other supplementary feeds can be millet, straw, sorghum, cottonseed, hay, oats, dates and other energy-giving fodder (Yagil, 1994; Wilson, 1989). According to Hashi *et al.* (1995) consumption of low quality roughages and total feed intake by camels can be improved with supplementary feeding. In their study, Dereje and Uden (2005) reported that lactating camels on range in Eastern Ethiopia substantially increased milk yield when supplemented with protein or energy feeds.

A pastoral community depends mainly on milk and milk products for its survival and therefore, these items are not perceived to be for commercial purposes. Thus it is only the households who are in a walking distance from the urban centers who sell milk and milk products to urban consumers. The scattered nature of the production units, the poor communication system, and the low rate of urbanization and low infrastructure of road facilities may also not warrant the establishment of processing plants (IPS, 2000). The main delivery methods used to deliver milk for sale in the study areas were through consumers and family members. Respondents specified that milk is collected by consumers or other purchasers. The main means of transport used in transporting milk for sale was public transport, on foot and using pack animals as mentioned by the respondents from both study districts. This is because the public transport means are readily available and are quite cheap and fast. This concurs with the informal market involves direct delivery of fresh milk by producers to consumers in the immediate neighborhood and sales to itinerant traders or individuals in nearby towns (Siegefreid, 2001). The differences in distance to different milk market places affect the price of milk (Kurtu, 2004).

Opportunities for camel milk marketing

Camel milk marketing gives a lot of opportunities for producers to generate regular income. In this case, support services in terms of accessing adequate extension service, organizing input supplies (improved genetic material, feeds, Artificial Insemination (AI), drugs), sound market opportunity and linkage are the key elements for the success of milk development (Sintyehu *et al.*, 2008). Even though many constraints that obstruct the increment of milk marketing were identified in the study area, the majority of milk producers in the study area were willing to continue and expand the sector in the future. There is rapid urbanization, extensive population growth, large unmet demand, huge potential for increased supply, emerging trends in commercialization and change in the living standard of the societies in the study area which are good opportunities for camel milk marketing in the future. As demand for camel milk grows, there is a need to access adequate animal health service, AI service, and extension and training services to increase the camel milk production potential in the area.

Conclusion

The main factors influencing camel milk production in the study areas were lack of camel feed and other health and breeding related factors. In addition to that, water scarcity was found to be the main problem in the area. The study found that there is high demand for camel milk among the consumers. The milk produced was sold mostly to individuals and some to cafes and restaurants. Price of milk per liter was used mainly as the milk marketing outlet selection criterion while market reliability also determined the criterion used to some extent. The most important problems experienced in camel milk marketing were lack of cooling facility, inadequate transport facilities, poor roads and lack of organized market connections. It was also revealed that the main means of transport used in transporting milk for sale was public transport and on foot delivery. In addition to that, the milk was delivered mostly by family members to the market. However, there is a good potential of camel milk and opportunities for future development of the sector in the region. Therefore, solving feed and water problems, improving animal health and breeding services, and commercialization of the activity by creating market chain, marketing facilities and infrastructure and establishing milk selling cooperatives will help in future development of the sector.

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Competing interest

The authors declare that they have no any competing interest.

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