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Evaluation of Hygienic Status and Marketing System of Raw Cow Milk in Different Critical Points of Oromia Special Zone

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Abstract- The study was conducted at peri-Addis Ababa districts of Oromia with the aim of assessing hygienic status, knowledge gap, constraints affecting production, marketing and consumption of milk. A total of 102 milk producing farmers at Holeta, Sebeta and Sululta districts, Informal merchant, collection centers dairy cooperative and retail centers at Addis Ababa were engaged by using multi-stage purposive sampling method. About 99% of participants in the areas market whole milk and 94% of the milk produced per households was sold. About 96.1 and 23% of the participants stated that milk production and marketing in areas maintain household food security and profitable farm activity respectively. The major challenges of milk production and marketing in the areas were; feed shortage, high feed cost, disease, shortage of land for grazing, and price fluctuation during fasting season, long term contract for milk marketing and milk quality, respectively. About 40% uses traditional flavoring agents and anti-microbial effect for cleaning milk transporting equipments. Channels of milk marketing involved in this area include direct sellers, milk collection centers, informal merchants, milk cooperative unions, hotels, dairy product processing plants and retail shops. However, majority of the participants brought their milk to the collection center and private dairy processing plants. About 68.6 % and 31.4% of the participants bring milk twice daily to collection center and private processing plant, respectively. About 98%, 97.1 and 94.15% of the participants in the study sites used plastic utensils for milking, storing before transportation and transporting milk. Besides, lack of training for producers, lack of awareness on standard milk and milk product production and marketing, lack of aseptic milk handling and use of traditional flavor plants on milk microbial load were major knowledge gap in the areas and milk available to the consumer in Addis Ababa via different supply chain critical points have low hygienic status according to American and European community member state.

Keywords: hygienic practice , food security, value chain, critical points, raw milk, knowledge gap.

1. INTRODUCTION

Ethiopia is believed to have the largest livestock population in Africa. Despite its huge population, the livestock subsector in the country is less

productive in general, and compared to its potential, the direct contribution to the national economy is limited (Kedija *et al.*, 2008; Sintayehu *et al.*, 2008). Consequently, the national milk production and overall milk consumption in Ethiopia are very low, even compared with other African countries of lowest livestock population (Zegeye, 2003; Melese and Beyene, 2009).

For smallholder farmers, dairying provides the opportunity to the efficient land use, labor and feed resources and generates regular income (Yitaye *et al.*, 2009). In Ethiopia, one of the developing countries, urban and peri-urban dairying constitutes an important sector of the agricultural production system (Yitaye *et al.*, 2009). Livestock represents major national resources and form an integral part of agricultural production system (Gebrewold *et al.*, 2000). Cows contribute to about 95% of the total annual milk produced at national level, while small ruminants and camels contribute 12.5% and 6.3%, respectively (Kedija *et al.*, 2008 and CSA, 2010). More than 75% of the product is absorbed locally for consumption (Getachew and Gashaw, 2001).

Dairy production, among the sector of livestock production systems, is a critical issue in Ethiopia where livestock and its products are important source of food and income, and dairying have not been fully exploited and promoted in the country (Sintayehu *et al.*, 2008). To be effective, the efforts to improve the productivity of smallholder dairy production and improve its market orientation needs to be supported and informed by detailed understanding of the current and dynamic condition of production, marketing, processing and consumption of milk and dairy products (Asfaw, 2009).

In the context of developing countries, the potential advantages of market-oriented smallholder dairying is improving the welfare of farm households and its multiplier effects on other sectors of the economy. Milk and milk products generates income for the farm households on regular basis, milk provides a highly nutritious food for people of all age groups and particularly for infants and lactating mothers thus reducing the problem of malnutrition among rural households and the value adding activities such as the processing, marketing and distribution of milk and milk

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products also create employment opportunities in the rural and urban sectors (Bennet *et al.*, 2006 and Asfaw, 2009).

Nutritionally, milk has been defined as the most nearly "perfect food". It is a compensatory part of daily diet especially for the mothers with child as well as growing children (Javaid *et al.*, 2009; Olatunji *et al.*, 2012). It is daily produced, sold for cash or readily processed. It is a cash crop in the milk-shed areas that enables families to buy other foodstuffs, contributing significantly to the household food security. It also constitutes a significant proportion of the value of all livestock food products in Ethiopia (about 56%), while livestock food products constitute an important proportion of the value of total food products in the country (Belete *et al.*, 2010).

Milk is a complex biological fluid and by its nature, a good growth medium for many microorganisms. Because of its physico-chemical properties, it needs strict hygienic condition to avoid contamination of milk with microorganisms. Therefore, the microbial content of milk is a major feature in determining its quality (Rogelj, 2003). Food quality and safety standards in Ethiopia are one of the most concern areas because producers need to minimize loss while the general public would like to have a fair idea of what standard of food to buy for consumption. Also the safety of the food supplied for consumption especially for foods like milk is of paramount concern.

Microbial load is a major factor in determining milk quality. It indicates the hygienic level exercised during milking, cleanliness of the milk utensils, condition of storage, and manner of transport as well as the cleanliness of the udder of the individual animals (Ahmed, 2009; Fatine *et al.*, 2012). The initial microbiological quality of milk can vary substantially based on factors such as the health of the animal, the sanitary condition of the milking environment and milker (Biruk *et al.*, 2009).

Microbial contamination of milk can therefore originate from within the udder; the exterior of the teats and udder; and from the milk handling and storage equipment (Biruk *et al.*, 2009; Negash *et al.*, 2012). Unsafe milk not only impairs with public health but also its perishable nature makes it most susceptible to spoilage organisms that could result in quantitative loss of the milk. Hence, the quantitative loss of meager resource milk, due to spoilage could affect not only the small holder milk producer but also the consumption by urban dwellers and the entire nation. A range of factors can lead to food being unsafe, such as poor handling and storage conditions, naturally occurring toxins in food itself, contaminated water, pesticides and drug residues, and lack of adequate temperature control. Such safety problems, in extreme cases, can have

negative impact on the food security status of a country (FAO, 2011).

FAO (2011) defines food loss as the decrease in edible food mass throughout the supply chain which could have a significant impact on the livelihoods of many smallholders given that most of them live on the margins of food insecurity. These losses can occur at production, postharvest and processing stages in the chain (Parfitt *et al.*, 2010). For milk, losses at agricultural production level refer to decreased milk production due to unhealthy dairy cow and its environment. At postharvest handling and storage, milk loss is caused by mishandling and degradation during transportation between farm and distribution. The quality of milk may be lowered by numerous factors such as adulteration, contamination during and after milking and the presence of udder infections (Esron *et al.*, 2005).

Seventy percent of total milk sold in Addis Ababa informally comes from smallholder dairy production system located around Addis Ababa. The raw milk is thus marketed directly or through middlemen without any form of pasteurization or quality control measures (Ashenafi, 2002; Zelalem and Faye, 2006). Hygienic production and safe handling of milk from the production to consumption chain has always been a matter of consumer complaint on the ground that the milk is presumed sub standard. This could partly be attributed to non-existence of dairy facilities at small holders' production system. Usually milk is collected in a milk collection container, before loading to centers of processing or milk retail shops.

Awareness and knowledge of available standards for dairy products, processing, handling and marketing is not well ahead. One can presume that milk at the spot of immediate production may neither be sub-standard nor adulterated. Most of the concern of quality and safety are raised as milk starts along the supply chain.

In the first step, diagnostic survey was made and discussions were held with agricultural extension officers and available dairy cooperatives/unions in the three districts. Two villages were selected purposively from each district on the basis of dairy production potential, linkage to milk market, access to supply milk collection center, presence of dairy cooperative unions and accessibility. Subsequently, a total of 102 dairy farmers (40 from Holeta, 30 from Sululta and 32 from Sebeta) were selected with the help of Development Agents and used as study participants.

In addition to milk producing households, collection centers, informal merchants and dairy cooperative union at each districts were interviewed referring to milk marketing outlets, handling patterns and transportation of products to further processing and final consumers.

Following the routes, milk retailers' in Addis Ababa were also interviewed on milk handling, transportation, cooling system and if they met long-term consumer's milk demand and preference. Data were analyzed using SPSS software (ver.16, 2007) package. Descriptive statistics such as mean, frequency distribution and percentage was used to report data from survey study. Significant log mean differences were separated based on Least Significant Difference (LSD) test mean separation technique. Means were declared significant at ($p < 0.05$).

II. RESULT AND DISCUSSION

a) Herd structure

About 19.6% ($n=20$) of the participants own local dairy cows. However, majority of the participants own cross breed dairy cows. The mean number of cross breed and local cows were 2.54 ± 0.17 and 2.50 ± 0.17 , respectively, per households on the study sites. About 43.2% of the participants have more than three milking cows, 18.3% own three milking cows, 17.9% own two dairy cows and 20.6% own only one dairy cow per households. This implies that milk production is one of important income generating activity in the areas and contributes greatly to household food security and economy.

b) Hygienic practices

Hygienic practices are major pathways to produce safe and quality products for the consumers there by reduces microbial contamination and loss of product. Source and type of water used for washing hand and utensil have profound effect on microbial contamination of the milk. About 26.5, 6.9, 46.1, 2.9 and 17.6% of the participants only used cold pipe water, warm river water, warm pipe, cold river water and cold well water, respectively for washing udder and teat before milking in the whole study site (Table 1). Additionally, through hand washing (especially in the developing countries) in between milking, during pre-milking and post-milking stages by using safe disinfectants can enhance the safety of fresh milk (Oliver, 2005).

Only 77.2% of the study participants wash their hands before milking in all the study sites. The proportion was higher at Sebeta then Holeta 77.2 and 76.5%, respectively. This is due to lack of training for producers and other milk handlers on the washing of their hands and milk utensils that mitigate the growth of microorganisms and maintaining the safety of products thereby enhancing the safe product available for consumers and reduce the loss of product that have profound effect on food security.

Table 1 : Percentage hygienic practices of dairy farmers followed during milking at different study sites

	<i>Districts</i>		
	<i>Sebeta</i>	<i>Sululta</i>	<i>Holeta</i>
Hygienic practices	n=32	n=30	n=40
Practicing barn cleaning daily	94.4	95.7	98.6
Using bedding materials for milking cows	26.6	63.4	78.6
Producers followed during milking			
Washing udder before and after milking	--	--	--
Washing udder before milking only	82.5	86.3	93.3
Not common practice	3.7	3.2	--
Some times	13.2	10.5	6.7
Washing hands before milking	77.2	70.9	76.5
Type of water used for udder washing			
Cold	28.1	20.0	37.5
Warm	59.7	70.0	50
Both alternatively	9.7	-	8.3
Sources of water for farm activities			
Warm tap/Pipe water	76.7	73.6	79.0
Well water	4.6	1.2	2.0
River water	18.7	25.1	19.0

Majority of participants did not use bedding materials for milking cows in the whole study areas. But the proportion was very low for Sebeta which was related to high price of material and unavailability. Only 26.6, 63.4 and 78.6% of the respondents at Sebeta, Sululta and Holeta, respectively, use bedding materials. Use of bedding materials and frequent cleaning of barn have profound effect on reducing microbial contamination of teat and udder (Sintayehu *et al.*, 2008).

According to study participants, about 40% uses traditional flavoring agents and anti-microbial effect for cleaning milk transporting equipments. Among them about 22.5% and 20.6% used 'woira' and 'Kosorot' respectively and the remaining used 'Ajekis' and 'Largo' for washing equipments. Almost all of the participants in the study area use plastic materials for milking, storage and transportation of milk and only insignificant number of participants; 1.2% and 1.3% used metal can and

stainless steel respectively and 1.1 % used clay pot for storage before transportation.

Table 2 : Percentage milking procedure and frequency of dairy farmers followed during milking at different study site

	Districts Sebeta	Sululta	Holeta
Pre-milking procedure	n=32	n=30	n=40
Use of towel for drying udder			
Common towel for cleaning and drying udder and teat	48.1	5	72.2
Individual towel for each	3.4	4.3	3.8
Massage with bare hand	64.4	59.1	50.3
No washing and drying	3.5	10.0	12.4
Milking procedure			
Hand milking	100	100	100
Machine milking	--	--	--
Milking Frequency			
Once daily	2.1	2.6	2.0
Twice a daily	96.3	96.8	97.3

Almost all participants households in the study sites follows milking their cows per day, (91.2%)morning and afternoon, (6.9%)morning only and (1%) milk cows either mid day, evening or morning. The result of present study was similar to that of Sintayehu *et al.* (2008) who stated majority of the participants (96.3%) milk their cows twice daily in Shashmane-Dilla area, Southern Ethiopia.

c) Milk production per households and milking practice

Milk production and marketing have a significant effect on the household food security as well as contributing to the national GDP. Table 3 indicates milk production per household.

Table 3 : Mean number of milking cows per/household and milk produced per study sites

Variables	Sebeta n=32	Districts	
		Holeta N=40	Sululta N=30
No. of cows currently milked			
One	8(27.5)	10(24.5)	8(24.1)
Two	6(22.5)	7(16.7)	6(17.2)
Three	5(18.6)	7(17.2)	11(29.6)
More than three	9(31.4)	12 (29.8)	10(28.8)
1-5 liters	1(2.9)	1(3.4)	1(3.1)
6-10 liters	11(38.6)	15(37.3)	13(36.9)
>10 liters	14(52.0)	20(49.1)	18(53.4)
>15 liters	2(6.5)	4(10.2)	2(6.6)
Use of cooling system			
Refrigerator	1(3.3)	1(1.6)	1(2.6)
Traditional system	11(40.0)	20(49.1)	17(49.6)
At room temperature	16 (56.7)	19(49.3)	16(47.2)

The mean number of cow from which milk is pooled daily was 2.59 ± 0.114 per household in the whole study areas (Table 3). Majority of participants in the study areas pool milk from more than three cows (31.4%), from two cows (22.5%), from three cows(14.1%) and the remaining were from only one cows(20.7%). About 52% of the participants in study sites produce on average more than 10 liters of milk daily and 45.1% and 2.9% of participants respectively

produce 6-10 and 1-5 liters of milk per day/cow. This implies that majority of study participants produce and market high amount of milk that helps to sustain their household food security. Consumption of milk at household level was very low and majority of milk was sold per households that help to generate income.

On the contrary to the present finding, another study Teshager *et al.* (2013) found higher mean (96%) of milk consumption per household. About 96.1% of the

participants intended to expand milk production for the future while the remaining was not interested to do so. About (96.1%) and (2.3%) of the participants, respectively responded that milk production maintains household food production and generates income/profitable.

d) *Milk production and marketing in area*

Marketing system of milk at study area is unorganized and is carried out through direct sellers (milk passes directly from the producer to the consumer) and indirect marketing channels where several agencies operate between producer and consumer.

The channels in marketing of milk involved in this area include direct sellers, milk collection centers, informal merchants, milk cooperative unions, hotels, dairy product processing plants and retail shops. However, majority of the participants brought their milk to the collection center and private dairy processing plants. Almost all of the participants were marketing milk travelling on foot by holding milk and small number of the participants were supplying milk by travelling by horse cart and others are by using bicycle. That was in line with Kedija *et al.* (2008), who reported majority of participants were market milk travelling on foot by holding milk in Meiso districts of Oromia.

Majority of milk was marketed to collection centers in the case of Holeta and Sululta and then to Addis Ababa where as in the case of Sebeta, majority of milk taken to private milk processing plant, collection center to Addis Ababa and informal merchants contribute to higher share of milk marketing outlets. About 68.6 % and 31.4% of the participants bring milk twice daily to collection center and private processing plant, respectively. About 99% of the participants were marketing milk in the form of whole milk. Whereas Teshager *et al.* (2013) reported that traditionally selling of raw milk was considered as taboo and none of the respondents were involved in raw milk marketing in Algje, Oromia regional state, Ethiopia. Besides the report is higher that 64.4% that is reported by Teshager *et al.* (2013) from south western parts of Oromia.

The result of current the study for milk marketing was higher than that reported by Teshager *et al.* (2013) in Ilu Aba Bora zone in that only 10.5% overall milk was marketed which indicates that milk production is the major income generating activity in the area that helps to maintain household food security. But the results of current study agreed with that of Agza *et al.* (2013) that showed about 94% of milk produced was sold while 6% was retained for home consumption that shows the producers provide good service to the community in the area by serving as a good source of milk supply.

e) *Milk production and household food security*

Food security is alarming issue in worldwide currently. In its broad term food security describes

safety, quality and enough food for all members of household to maintain productive and healthy life. Majority of participants in the area responded that milk production and marketing have a key role in maintaining household food security and nutritious diet to all household members.

About 52%, 45.1% and 2.9% of the participants produced more than 10 liters, 6-10 liters and 1-5 liters of milk per households per day on average, respectively. This indicates that the areas were potential for milk production and it contributes significantly to household food security.

About 67.3% of participants in three districts showed that milk production and marketing plays invaluable role in household food security. From the total participants about 51.2%, 17.1 and 22% stated that milk production used as source of purchasing food crop, students school fee and saving bank, respectively. At household level, females play great role in milking, milk handling and marketing of milk. About 47.5%, 12.9% and 39.6 female, male and both gender, respectively, of the participants declared that involvement in milk production in all districts.

f) *Milk handling practices*

Major factors that affect quality of dairy products are related with type and hygienic status of milking utensils used as well as method and frequency of cleaning udder, storage of milk and transportation utensils. About 98%, 97.1 and 94.15% of the participants in the study sites used plastic utensils for milking, storing before transportation and transporting milk. The result of present study was higher than that reported by Sintayehu *et al.* (2008) in Southern Ethiopia. Besides, significant number of respondents use plastic jar having narrow neck which may not be suitable for cleaning and may cause for microbial growth. More than half of the study participants did not use aroma producing plants like woira (*Olea africana*) that have profound effect on reducing growth of microorganisms (Sintayehu *et al.*, 2008 and Asfaw, 2008). On the other hand, some participants use 'Ajekis' and Largo 'liquid soap' for washing utensils.

g) *Major challenges of Milk production and marketing in the study areas*

Milk production is one of crucial income generating activity that maintains household food security and national economy as whole. However, it is challenged by a number of factors that hinder level of production as well as safety issues of the product. As indicated in the figure1, the major challenges identified in the study sites include; feed shortage, high price of feed, disease, lack of capital, price fluctuation/market condition, and shortage of land for expansion.

Almost all of the participants were claiming feed shortage and high price of feed resource as the major

challenge in the areas. Similarly, different research works Agza *et al.* (2013); Teshager *et al.* (2013); Kedija *et al.* (2008) in different parts of Oromia were implicated that milk production in Ethiopia is highly hindered by

one or more of the above mentioned factors that affect productivity of milking cows as well as household income from them.

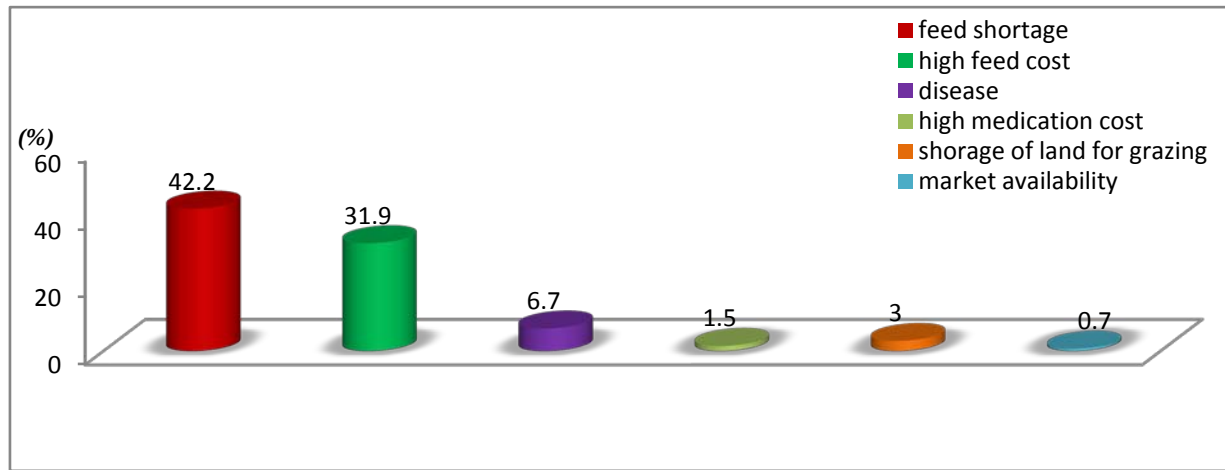


Figure 1 : The major challenges of milk production in the study site

On top of the above factors that challenge milk production in the areas, the milk produced also doesn't reach point of final consumption at required time and condition of product that creates conducive environment for growth of many microorganisms that spoil products and results in food safety hazard as well as loss of

products. Major problems of milk marketing in the area identified were indicated in Figure 2 and include; price fluctuation during fasting months, distance to selling centers and/or market, long term contracts, milk quality, lack of quality based pricing system.

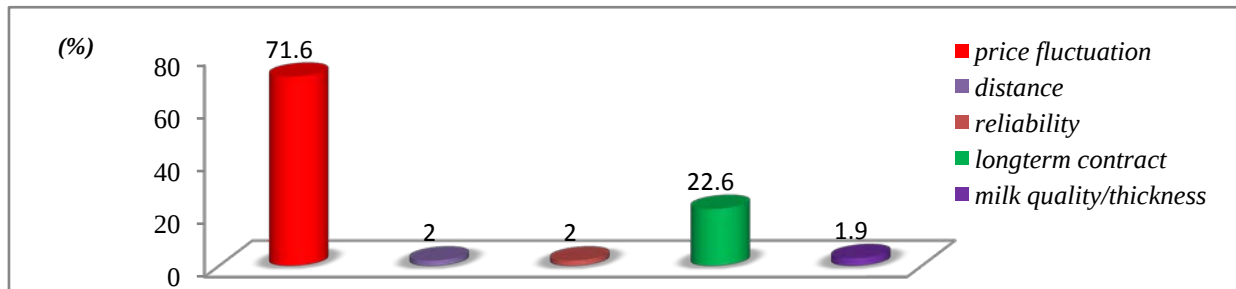


Figure 2 : The major challenges of milk marketing in the study areas

As majority of community members in the areas were Orthodox Christian followers and they do have long fasting season that abstains consumption of animal products. This also resulted in price fluctuation in milk marketing. About 96% of the participants in the area responded that fasting season has a profound effect in the amount of milk marketed and diminution of its price. Besides to that, lack of well sophisticated transportation system, lack of consistent/long term customer flow especially during fasting season, lack of cooling system and lack of standard for pricing system have also their negative contribution to marketing of milk in the areas. Problems identified were slightly similar to that reported by (Teshager *et al.*, 2013). Majority of the participants in the study area complains that during fasting season both collection centers and private milk processing

plants restricts the amount of milk to be brought to the center. These factors coupled with unavailability and expensiveness of raw materials in the area discourages milk producing households.

h) Awareness on milk production, transportation and marketing system

The level of awareness among producers play great role to maintain products in safer condition and good marketability of the products there by ensuring household food security as well improving economic status. However, although the sites are potential for milk production, majority of the participants were not in position to get support from responsible bodies for future expansion of the business and they have not got adequate training on milk production, transportation and marketing system.

According to the participants, only 52.5% of the respondents got training on milk production only from government where as the others were not well oriented in producing the product that penetrate the market and competitive in area. The level of awareness contributes a lion's share in producing market competitive product there by maintaining household food security and national economy as well.

Besides to this, awareness trigger producers to produce safe and quality item there by helps to reduce loss of product during milking, transportation and marketing chain. Due to lack of awareness, majority of the participants were not member of milk cooperative in the area. Only 45.1% of the participants were members of milk cooperatives and others were not cooperative members that challenge them in marketing the products especially during fasting season. As majority of the participants said that those who are member of dairy cooperative were not face problem of milk marketing even during long fasting season because they have agreement in milk marketing throughout production period.

Use of detergent for cleaning and traditional flavoring plants for milking and milk storing equipments have significant effect on the microbial growth on the milk. However, almost all of the participants were using 'Ajekis' for washing milking and milk transporting equipments. Only insignificant numbers of the participants were use traditional flavoring plants for washing and smoking of milking, milk storage and transporting equipments.

III. CONCLUSION

Milk production and marketing is one of the most important farm activities that helps to generate income for households, maintain household food security in study areas and contributes to national economy as well. Milk production in the study sites was highly constrained by production, handling and marketing problems that reduce the amount to be produced, safety of the product and uniform distribution of particular food item between or within group/food security in particular. The major problems identified in the areas were feed shortage and its high cost as well as price fluctuation between fasting and no fasting periods of milk consumption.

The major challenges of milk production and marketing in the areas were; feed shortage, high feed cost, disease, shortage of land for grazing, and price fluctuation during fasting season, long term contract for milk marketing and milk quality, respectively. Besides, lack of training for producers, lack of awareness on standard milk and milk product production and marketing, lack of aseptic milk handling and use of traditional flavor plants on milk microbial load were major knowledge gap in the areas.

Farm households market raw whole milk mainly to private milk processing plant, milk collection center and dairy cooperative unions rather than local market in the study area. The result obtained in this study concluded that milk available to the consumer in Addis Ababa via different supply chain critical points have low hygienic status according to American and European community member state. Milk marketing actors especially from collection center to retail shop and/vendors should use refrigerated vehicle and cold chain in place of open container and vehicle to maintain bulk tank temperature there by minimize microbial growth during transportation and storage.

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