Food Science and Quality Management
ISSN 2224-6088 (Paper) ISSN 2225-0557 (Online)
Vol.52, 2016

Quality Assessment of Cattle Milk in Adea Berga and Ejerie Districts of West Shoa Zone, Ethiopia

Saba Haile[1] Mitiku Eshetu[2]
1.Jimma Agricultural Research Center, P.O.Box 192 Jimma, Ethiopia
2.Haramaya University, College of Agriculture and Environmental Sciences, School of Animal and Range Science, P.O.Box 138, Dire Dawa, Ethiopia

Abstract
This study was conducted in Adea Berga and Ejerie districts. The objectives of the study were to assess raw milk hygienic handling practices and constraints associated with milk quality. A total of 180 smallholder milk producers farmers, two dairy cooperatives, one dairy cooperative union, two milk processors and ten consumers were interviewed to collect the required information using semi-structured questionnaires and focused group discussions. About 65% the respondents were removed manure daily While 35% were removed three times a week. Most of the interviewed dairy producers 69.4% washed their hands before milking while the rest 30.6% did not wash their hands. About 62.2% of the dairy producers washed their cow's udder before milking and 37.8% were not washing. Nearly half of the respondents 46.7% were did not use towels for udder drying, 15.6% used common towel and 37.7 % reported they did not practice udder washing and drying. All of the interviewed milk producer farmers were used plastic made milk containers during milking and transported the milk to collection centers. Dairy cooperatives, Dairy cooperative union and processors used aluminum container for milk transportation and storage. Almost all of the dairy producers 98 % and milk collectors washed milking utensils after every use. In Ejerie district 3.3% of smallholder dairy producers were cleaned their milking utensil before and after usage. About 77% of the respondent washed their milk container with cold water and soap while 23% used hot water and soap. All primary dairy cooperatives and 70 % of consumers were washed their milk container with cold water and soap. The remaining 30% of the interviewed consumers were washed their milk utensils with warm water and soap. Smallholder producers used different water sources used for cleaning purpose tap water 55%, river 28% and Hand dug well 17%. All small holder milk producers used traditional cooling method. Chemical composition (fat and water) content were the major milk quality criteria to accept or rejected the milk. Major milk quality constraints in the study areas were limited awareness on hygienic handling of milk, lack of cooling facility, shortage of clean water , lack of effective quality control system and absence of quality based payment system. Thus, Awareness creation and trainings should be needed milk hygienic handling practices and introduce quality based payment improving milk quality.

INTRODUCTION

Quality milk implies the milk which is free from pathogenic bacteria and harmful toxic substances, free from sediment and extraneous substances, of good flavor, with normal composition, adequate in keeping quality and low in bacterial counts (Khan *et al.,* 2008). Bacterial contamination of raw milk can be originated from three main sources; within the udder, exterior to the udder and from the surface of milking materials, milk handling and storage equipments. Similarly, the surrounding air, feed, soil, feces and grass are also possible sources of contamination (Parek and Subhash, 2008; Torkar and Teger, 2008). If the hygienic handling of milk is not secured, milk could be turn to unsafe for direct consumption or unfit for further processing to more stable products (O'Connor, 1994).

Consumers need clean, wholesome and nutritious food that is produced and processed in a sound sanitary manner and free from pathogens. Hence, quality milk production is necessary for fulfilling consumers' demand (Khan *et al.,* 2008). To sell raw milk directly to consumers or to a processing factory, it must be handled hygienically and remains fresh and capable of being heated without curdling. Hygienic milk handling includes; using clean equipment, maintaining a clean milking environment, observing good personal hygiene and preserving the quality of milk during storage and transportation to the consumer or processing plant (Kurwijila, 2006).

In Ethiopia milk produced at smallholder farm is marketed without quality control measures. Hygienic control of milk and milk products is not usually conducted on routine bases. Apart from this, door-to-door raw milk delivery in the urban and peri-urban areas is commonly practiced with virtually no quality control at all levels (Godefay and Molla, 2000). Although, properly operational formal marketing and grading system targeted towards relating quality of products to market price is not well established, provision of milk and milk products of good hygienic quality is desirable from consumer's health point of view (Zelalem, 2012). There is no detail studies quality of raw milk from producer up to consumer level in the study areas. Therefore; this research was conducted to assess the hygienic handling practices of marketed milk and identify major fluid milk quality constraints in Adea Berga and Ejerie districts of West Shoa zone.

MATERIALS AND METHODS

The Study Areas: The study was conducted in Adea Berga and Ejerie districts of west Shoa zone. Adea Berga and Ejerie Districts are located in West Shoa zone of Oromia Regional State. Adea Berga district Borderd With; Walmera in the South, Ejerie in the South West, Meta Robi in West and Muger River in the North and East. The town of Adea berga is Enchini. Ejerie district is bordered with, South Wes Shoa Zone in South, Dendi in the West, Jeldu in North West, Meta Robi in the North, Adea berga in the North East and Walmera in East. The town of Ejerie is Addis Alem

Topographically the study areas were mainly characterized with leveled fields that make an ideal place for Agricultural activities. There are three main drainage basins in the areas; Abay, Ghibe and Awash. In addition there was high potential for ground water and smaller rivers like Berga Abay river basin. Adea Berga and Ejerie districts altitude the range of 1166 -3238 and 1872-2631 meters above sea level, rain fall condition ranges 887-1107mm and 991-1194mm and temperature ranges 11-21^{0}C and 14-18^{0}C, respectively.

Sampling Techniques: The districts were selected based on their potential, suitability for market oriented Agriculture development, clusters and infrastructure accessibility to move from one district to another. Two districts were selected based on their milk production potential then; two kebeles were selected from each district based on availability of dairy cooperatives and existence of milk producing farmers through purposive sampling techniques. Local and cross breed dairy cow owners and consumers were selected by simple random sampling techniques. Dairy cooperatives and processors were selected purposively based on active milk producer members and high volume of milk collection capacity. Only one union was found the study area selected without any criteria. Finally a total of 180 household milk producers, two primary dairy cooperatives, one dairy cooperative union, two milk processing industries, and ten consumers were interviewed.

Data Collection: Two survey tools were employed in order to collect the required information *i.e.* individual interview and group discussion. Semi-structured questionnaire format was used to collect data from smallholder produces focused on the hygienic handling practices during milk production (barn type and cleaning practices, source of water used for cleaning purpose *i.e*. udder, milker and milk utensils), type of storage container and transportation, marketing systems, quality testing methods and other related data were collected. Independent questionnaires also used for data were collected from dairy cooperatives, union, individual collectors and processors. Secondary data were collected from district livestock agency, dairy cooperatives and dairy cooperative union.

Following individual interview, focus group discussions was employed to validate the information gathered and to get in-depth information on milk production, hygienic practices, and marketing and milk quality constraints in each of the study sites. A focused group discussion was carried out with a group of seven smallholder dairy farmers, one dairy cooperative management staff, two districts and kebele livestock Agency experts from each district, a total of ten individuals (7 males and 3 females) were involved.

Method of Data Analysis: The quantitative and qualitative data were summarized on Microsoft excel sheet and analyzed using descriptive statistics by using SPSS (statistical package for social science, version 20).

RESULTS AND DISCUSSION

Household Characteristics: The overall mean male and female headed households were 97.2% and 2.8% , respectively (Table 1).The highest proportion of the respondents age were ranged16-60 years which accounts about 78.3% while the rest of the respondents were above 60 years which holds 21.7 in the study sites (Table 1). The respondents in the study area had different educational status. Nearly half of the respondents (42.2%) were able to read and write, whereas about 20% received elementary education. The remaining (36.7%) of the respondents have never been in school (Table 1). Substantial proportions of respondents in the study area were not educated; and could be identified as challenge for adoption of new technology for in the development of dairy sector in the study area.

Table 2 Sex, Age and Educational Status of respondents

Variables Category	Ejerie (n=90) N	%	Adea Berga (n=90). N	%	Overall mean Total=180 N	%
Sex of Family Head						
Male	87	96.7	88	97.8	175	97.2
Female	3	3.3	2	2.2	5	2.8
Age Category HHH						
16-60	73	81	68	75.6	141	78.3
Above 60	17	19	22	24.4	39	21.7
Education Level HHH						
Illiterate	25	27.8	41	45.5	66	36.7
Read and write	43	47.8	33	36.7	76	42.2
Elementary	20	22.2	16	17.8	36	20
12 grade completed	2	2.2	-	-	2	1.1

HHH=house hold head

Milk production: The overall average amount of milk produced by local breed cows was 1.4 litter /day for 180 days of lactation. The improved cows produced 11 litter /day for 263 days of lactation length (Table 2). The current result similar with Getu et al (2009) who reported crossbred cows 11.9 litter/day for 270 days lactation length and in terms of milk yield this result was much lower than milk produced from local cows 2.5 litter/day for 180 days lactation length in Wolmera district. These results were also lower than the overall average lactation lengths of local and crossbred cows were 9.8 and 10.1months, respectively in Burie district (Adebabay, 2009)

Table 3 Milk yield and lactation length of local and improved breed cows

Variables	Ejerie	Adea Berga	Overall Mean
Milk yield(L/day)			
Local	1.5	1.25	1.4
Improved	12	10	11
Lactation length per year			
Local	195	165	180
Improved	270	255	263

Hygienic Handling Practices during Milking

Type of housing and cleaning practices: All of the farmers in the study areas were used housed type barn for their cows and milking in the house (Table 3). Zelalem (2010) reported similar result 80.4% of the respondents were used house type barn in central highland of Ethiopia.

Maintaining the sanitary condition of milking area is important prerequisite for clean milk production (Zelalem, 2010). Most of the respondents 65% removed manure daily While 35% were removed three times a week (Table 3). Abebe *et al.* (2012) who reported similar results about 47% of the respondents clean their barn three times a week in Gurage Zone, Ezha district.

Table 4 : Types of housing and barn cleaning frequency

Variables	Ejerie (N=90) N	%	Adea Berga (N=90) N	%	Total(N=180) N	%
Type of housing						
Housed	90	100	90	100	180	100
Barn cleaning Frequency						
Daily	63	70	54	60	117	65
Three times a week	27	30	36	40	63	35

Hygienic condition of cows and milker: Most of the interviewed dairy producers (69.4%) washed their hands before milking while the rest 30.6% did not wash their hands. About 62.2% of the dairy producers washed their cow's udder before milking and 37.8% were not washing (Table 4) and simply allowed their calves to suckle before milking. The current result was lower than Haile *et al.* (2012) reported that 82.5% of the small size farm owning households in Hawassa city practice pre milking udder washing. Contrary to this result Abebe *et al.* (2012) who reported that all respondents did not use udder washing before milking in Gurage Zone, Ezha district.

The use of individual towel and following essential cleaning practices during milking is important for the production of quality milk (Zelalem, 2010). However, about 46.7% of the smallholder households did not use towels for udder drying, 15.6% used common towel and 37.7 % reported they did not practice udder drying (Table 4).

Table 5 Hygienic condition of cows and milker

Variables	Ejerie (N=90)		Adeaberga (N=90)		Total (N=180)	
	N	%	N	%	N	%
Hand washing						
Before milking	68	75.6	57	63.3	125	69.4
No washing	22	24.4	33	36.7	55	30.6
Udder washing						
Before milking	64	71.1	48	53.3	112	62.2
No washing	26	28.9	42	46.7	68	37.8
Towel used for udder drying						
Common towel	20	22.2	8	8.9	28	15.5
Just with hands	44	48.9	40	44.4	84	46.7
No washing and drying	26	28.9	42	46.7	68	37.8

Type of milking container and sanitary practices: All of the interviewed milk producer farmers were used plastic made milk containers during milking and transported the milk to collection centers (Table 5). Abebe et al. (2012) reported similar result in Ezha district of Gurage Zone where all farmers used plastic jars as milking utensil. Dairy cooperatives, Dairy cooperative union and processors used aluminum container for milk transportation and storage. In the present study, almost all of the dairy producers 98 % and milk collectors washed milking utensils after every use (Table 5). In Ejerie district 3.3% of smallholder dairy producers were cleaned their milking utensil before and after usage. About 77% of the respondent washed their milk container with cold water and soap while 23% used hot water and soap (Table 5). The current finding contradicts with the finding of Haile et al. (2012) who reported about 85.6% of the producers used warm water together with detergents to wash milk handling equipment while 12.1% of them cleaned with cold water. All milk processing industries and dairy cooperative union were cleaned their milking equipments with warm water and liquid detergents. All primary dairy cooperatives and 70 % of consumers were washed their milk container with cold water and soap. The remaining 30% of the interviewed consumers were washed their milk utensils with warm water and soap.

Table 6 Milking container and sanitary practices

Variables	Ejerie (N=90)		Adea Berga (N=90)		Total (N=180)	
	N	%	N	%	N	%
Milk utensils used for milking						
Plastic	90	100	90	100	150	100
Cleaning frequency of milk utensils						
Before and after every use	3	3.3	-	-	3	2
after every use	87	96.7	90	100	177	98
Washing of milk Equipments						
Cold water and soap	64	71	74	82	138	77
Warm water and soap	26	29	16	18	42	23

Source of water used for cleaning: Smallholder producers in Ejerie and Adea Berga districts used different water sources for cleaning purpose *i,e* tap water (55%), river (28%) and Hand dug well (17%). Water from non tap sources used for different purposes can definitely contribute to poor quality milk and milk products. Therefore, it is important that producers should at least filter and heat treat it before use (Zelalem, 2010). Dairy cooperatives, union, processors and consumers were used tap water for cleaning.

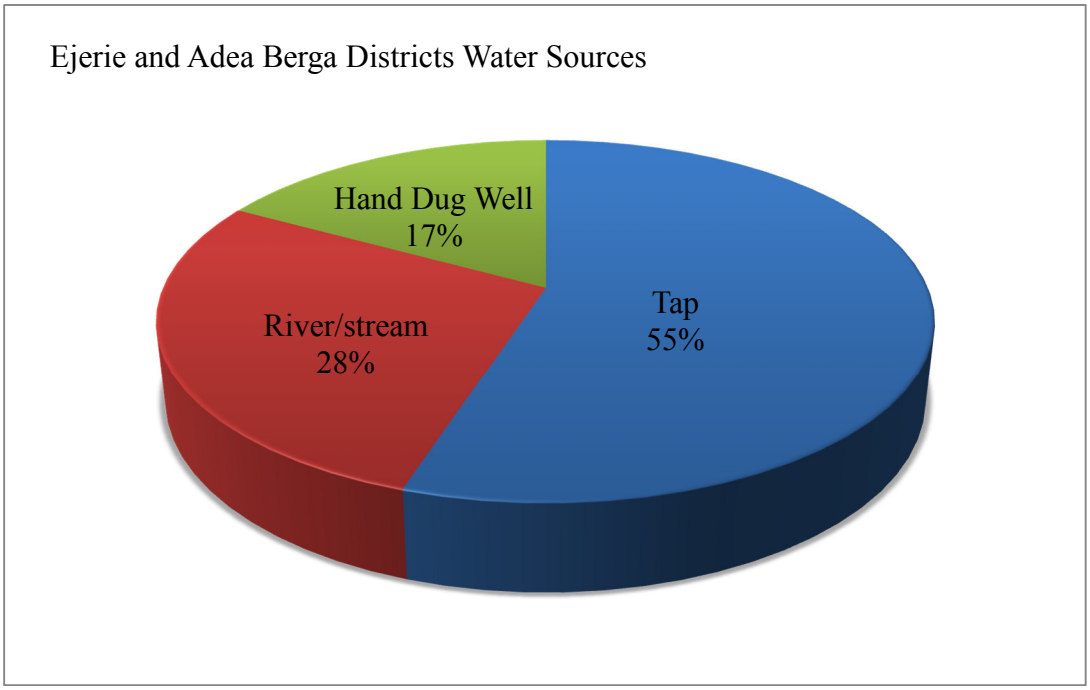

Figure 1 Ejerie and Adea Berga Water sources

Cooling System and Transportation: After milking proper milk cooling method is essential to maintain the quality of milk. All producers used traditional cooling method (put raw milk in cold water bath) and transported their milk on foot. Dairy cooperatives and unions did not have cooling facilities for raw milk during collection, storage and transportation to processing plant. Dairy cooperative union used refrigerators to preserve milk products (cheese and butter). Milk processor and dairy cooperative union used vehicles for milk collection and transportation. The vehicles were not appropriate for raw milk transportation because its lacks cooling facilities.

Fluid Milk Marketing System

Milk marketing channels and outlets: Marketing channels are routes through which products pass as they are moved from the farm to the consumer (Winrock, 1989). Marketing outlet is the final market place to deliver the milk product, where it may pass through various channels. In the study area milk was sold for the consumers through tracing of different channels and outlets.

Producer-consumer (P-C)

Producer → Dairy cooperatives→ Consumer

Producer → Individual collectors (milk hawkers) →Consumer

Producer → Dairy cooperatives union→ Consumer

Producer→ dairy processors →Consumer

Producer →Dairy cooperatives→ dairy cooperative union→ dairy processors→ Consumer

There was different milk marketing channels in the study areas through which smallholder dairy farmers were sold their milk to other market value chain actors. However, about 95% and 47% in Ejerie and Adea Berga districts milk producers follow formal marketing system respectively, In Adea Berga district Bishan Dimo kebeles smallholder farmers were sold their milk for local consumer, hotel, café, and restaurant due to the absences of dairy cooperatives and other milk collectors in the area. This finding have been different from the finding of (Van der Valk and Tessema 2010) who reported that 98% of milk produced in rural area was sold through informal chain whereas only 2% of the milk produced was reached the final consumers through formal chain. Additionally, Girma and Verschurr (2013) reported 35% of the respondents were sold their milk following both informal and formal channels and 25% of the respondent farmers were sold their milk through formal marketing channels. In informal marketing system, smallholder producers, cooperatives, unions and individual milk collectors were sold fluid milk for local consumers, hotels, restaurants, cafes and retailers.

Table 7.Small holder producers sold raw milk for different beneficiaries

Variables	Ejerie (n=90) N	%	Adea Berga (n=90) N	%	Total (n=180) N	%
Formal market						
Dairy cooperative and union	68	75.5	42	46.7	110	61
Processors and cooperative	17	19	-	-	17	9.5
Informal market						
Café, restaurant, hotel and retailers consumers	5	5.5	48	53.3	53	29.4

Milk marketing prices: Milk buying and selling price per liter varies between milk value chain actors. Dairy cooperatives and union bought milk from the producers by credits and pay their money every 15 days. Some farmers preferred to sell with cash to Shola milk processing industry. In general the annual buying and selling price of milk ranges 9.25 -11Birr/ liter. The milk price did not decline at fasting season.

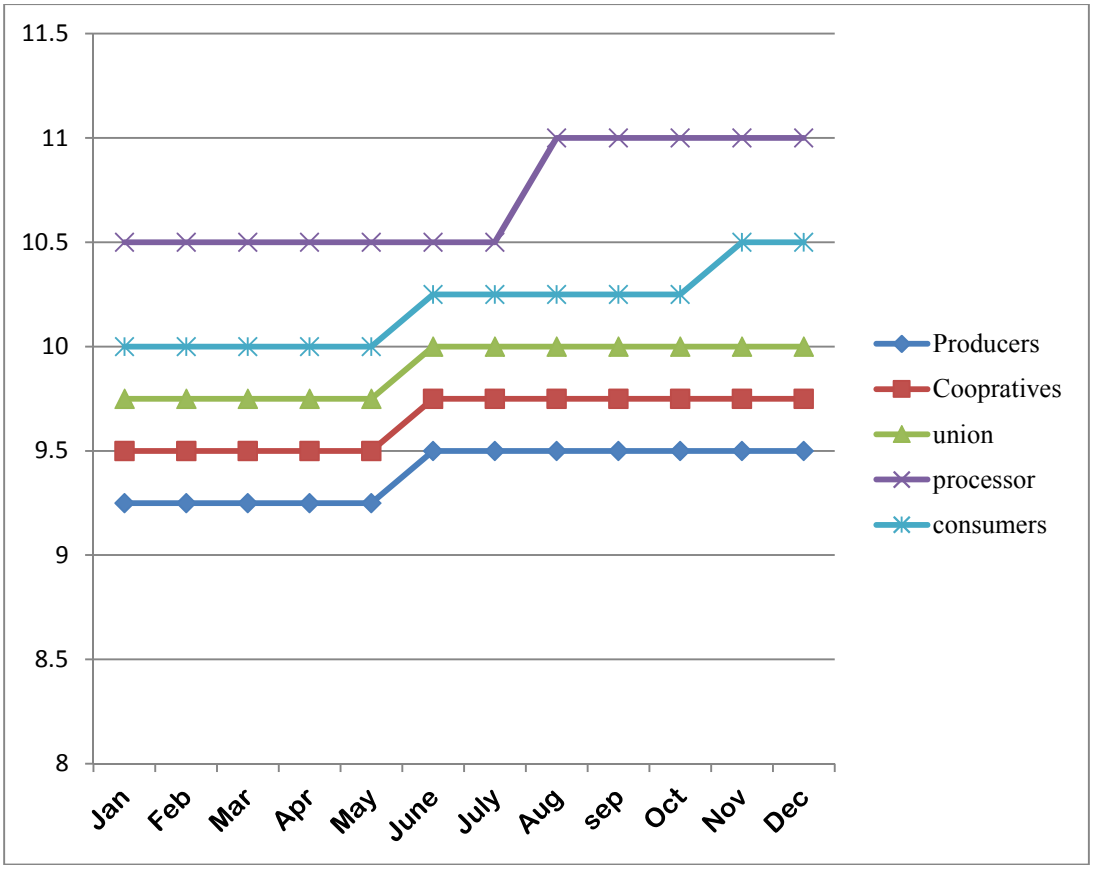

Figure 2 buying and selling price of milk

Milk quality test method during marketing: Primary dairy cooperatives, dairy cooperative union and milk processors tested the quality of milk by using of lactometer and lactoscan. Chemical composition (fat and water) content were the major milk quality criteria to accepted or rejected the milk, If the density and fat content of milk as found below the standard, raw milk was rejected because of some illegal farmer's were added water and removed fat content.

Major Milk Quality Related Constraints: Milk quality related constraints in the study areas prioritized by the respondents during group discussions were limited awareness on hygienic handling of milk, lack of cooling facility, shortage of clean water, Lack of effective quality control system and absence of quality based payment system. In each study district constraints were ranked in Table (7).

Table 8 Milk quality constraints in the study areas

Variables	Ranked	
	Ejerie	Adea Berga
Limited awareness the hygienic quality of milk	1st	1st
Shortage of clean water	3rd	2nd
Lack of cooling facility	2nd	3rd
Lack of effective quality control system	4th	4th
Absence of quality based payment system	5th	5th

CONCLUSIONS

Milk handling practices in the two study districts was under poor hygienic condition due to inappropriate utensils used for milking, shortage of clean water for sanitation purpose, lack of cooling facilities during storage and transportation. Additionally this study shows that in the two districts same small holder milk producing farmers were adulterated raw milk with water and removed the cream. This illegal practice was contribute to milk quality deterioration and reduced the standard milk composition.

RECOMMENDATIONS: Awareness creation and Trainings should be given for small holder dairy farmers, dairy cooperatives, dairy cooperatives union and individual milk collectors in milk handling and hygienic practices, if water source is not potable, it should be heat treated for washing udder and milking equipments, appropriate milk utensils used during milking and transportation, efficient milk cooling system is required at producer and milk collectors' level. Finally quality based payments introduced for improvement of the quality of milk.

REFERENCES

Abebe Bereda, Zelalem Yilma and Ajebu Nurfeta. 2012. Hygienic and microbial quality of raw whole cow's milk produced in Ezha district of the Gurage zone, Southern Ethiopia. *Wudpecker Journal of Agricultural Research 1(11):459 – 465*

Adebabay Kebede. 2009. Characterization of milk production Systems, Marketing and On- Farm Evaluation of the Effect of Feed Supplementation on Milk Yield and Milk Composition of Cows at Bure District, Ethiopia A Thesis Submitted to the Department of Animal Science and Technology School of Graduate Studies. Bahir Dar University Bhair Dar Ethiopia.

Girma Debele and Verschuur,M. 2014. Analysis of milk value chain: the case of Ada'a dairycooperative in Ada'a district, East Shawa zone of Oromia regional state, Ethiopia. Wudpecker *Journal of Agricultural Research 3(1), pp. 016 - 025*

Getu Kitaw, Liyusew Ayalew, Fekede Feyisa and Gezahegn Kebede. 2012. Liquid milk and feed value chain analysis in Wolmera District, Ethiopia.

Godefay Bekele and Molla Bayileyegn. 2000. Bacteriological quality of raw milk from four dairy farms and milk collection center in and around Addis Ababa. Berl. Münch. Tierärztl.Wschr. pp 113.

Haile Welearegay, Zelalem Yilma, Yosef Tekle. 2012. Hygienic practices and microbiological quality of raw milk Produced under different farm size in Hawassa, Southern Ethiopia. *Journal of Agricultural Research,* 1(4): 132- 142.

Khan, M.T.G., Zinnah, M.A., Siddique, M.P., Rashid, M.H.A., Islam, M. A. and Choudhury, K.A. 2008. Physical and microbial qualities of raw milk collected from Bangladesh Agricultural University Dairy Farm and the Surrounding Villages, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh, Bangl. *Journal of Veterinary Medicine*, 6: 217–221.

Kurwijila, L.R. 2006. Hygienic milk handling, processing and marketing: reference guide for training and certification of small-scale milk traders in Eastern Africa. ILRI (International Livestock Research Institute), Nairobi, Kenya.

O'Connor CB 1994. Rural Dairy Technology. ILRI Training Manual No.1. International Livestock Research Institute (ILRI), Addis Ababa, Ethiopia.

Parekin, T.S. and Subhash, R. 2008. Molecular and bacteriological examination of milk from different animals with special reference to coliforms. *Current Research on Bacteria*, 1(2): 56 -63.

Torkar, K.G. and Teger, S.G. 2008. The microbiological of raw milk after introducing to the two day's milk collecting system. *Acta Agri. Slove*., 92(1): 61-74.

Valk, van der O, Tessama A. 2010. The formal dairychain of Addis Ababa, an analysis of the integration ofsmall -scale dairy farmers in Ethiopian, Addis Ababa

Winrock. J. 1989. Conducting on-farm animal research: Procedures and economic analysis. National printers Ltd, Singapore.

Zelalem Yilma. 2010. Quality factors that affect Ethiopian milk business: Experiences from selected dairy

potential areas. Netherlands Development Organization, Addis Ababa, Ethiopia

Zelalem Yilma.2012. Microbial properties of Ethiopian marketed milk and milk products and associated critical points of contamination: An epidemiological perspective, epidemiology insights, Dr. Maria De Lourdes Ribeiro De Souza Da Cunha (Ed.), ISBN: 978-953-51-0565-7