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Handling Practices and Quality of Raw Milk along the Milk Value Chain in South West Shoa Zone, Oromia Region, Ethiopia

Deressa Dandena Kode, Dejene Getachew Deme and Bune Tarecha Edae

Wolmera District Livestock and Fishery Resource Development Office, Holeta, Ethiopia

Abstract: The study was conducted to assess Handling practice, determine physicochemical and the microbial quality of raw cow milk along the milk value chain in Woliso and Becho district of South west Shoa Zone of Oromia Region, Ethiopia. Cross sectional study was conducted from January 2018 to early July 2018 by using questionnaire survey, farm inspection and group discussion. A total of 120 smallholder producers, five individual milk collectors, five retailers and five Hotels/ consumers were interviewed to collect the required information. Samples of raw milk were collected from producers, individual collector's retailers and hotels at morning. Physicochemical and microbial quality of raw cow's milk determined. Package for social science software (SPSS) version 20 and Statistical analysis system (SAS) version 9.1 was employed for data analysis. The overall mean family size of 8.34±404 persons with average livestock holding of 8.62±6.78.The average numbers of lactating cows owned by the respondent farmers were 2.14±1.14and 2.81±1.74 for Local and cross bred cows, respectively. Average daily milk yield of crossbred and local milking cows were 9.75and 1.78 liters, respectively. Overall mean lactation lengths of crossbred and local milking cows were 7.78 and 5.5 months, respectively. Microbial quality of raw cow's milk produced and marketed in the study area was poor and it was below ESA standard limits. Therefore, it was concluded that the microbial and physicochemical quality of raw cow's milk produced and marketed in the study areas were poor and this suggests the need for improved hygienic practices and handling of milk at all levels of milk value chain.

Key words: Milk Handling Practice · Milk · Microbial Quality · Physicochemical Quality

INTRODUCTION

Dairy production has a great contribution in improving human nutrition, particularly women and children [1]. Dairy production is a critical issue in Ethiopia for livestock based society where livestock and its products are important sources of food and income. Thus, Potential for smallholder income and employment generation from high-value dairy products, development of the dairy sector in Ethiopia can contribute a lot to poverty alleviation and nutrition in the country. However, dairying has not been fully exploited and promoted [2].

According to CSA [3] the estimate of total cow milk production for the rural sedentary areas of the country is about 3.1 billion liters. The average lactation period per cow is estimated to be about six months and average milk yield per cow per day is about 1.37 liters.

Milk is being a wholesome food with high nutritive value is often prone to easily contamination and spoilage if not handled properly. Several workers have reported milk to be an ideal growth medium for microorganisms [4]. Milk is often produced and marketed to consumers without being pasteurized nor subjected to any quality standards [5]. The unsafe handling practice results in the higher bacterial count, which in turn may cause spoilage of the milk and poor yields of its products [6].

Milk is a highly perishable product and poor handling can use both a public health and economic loss, thus requiring hygienic attention throughout the production to consumer chain. The microorganism load and types found in milk shortly after milking are influenced by factors such as animal and equipment cleanness, season, temperature, storage, personnel health, cleanness and animal health. On this basis the daily production and eventual marketing and sale of milk requires special consideration to ensure its delivery to the market in hygienic and acceptable condition [7].

Corresponding Author: Dejene Getachew Deme, Wolmera District Livestock and Fishery Resource Development Office, Holeta, Ethiopia. Tel: +25113490974/+21516858009.

In Ethiopia, milk produced at smallholder farm is marketed without quality control measures. Sterile 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 per-urban areas is commonly practiced with practically no quality control at all levels [8]. Although, properly operational proper 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 attractive from consumer's health point of view [9].

The current study was generated important information on handling practices and quality of raw Cow's milk along the milk value chain that will assist for better intervention through the identified research gaps to change the livelihood of smallholder dairy farmers and other chain actor's.

The result of this study is very useful to make strategy to strength the position of smallholder dairy farmers. Milk is a perishable dairy product, therefore production and handling of this product under proper hygienic environment reduces the chances of spoilage thus reducing the magnitude of milk losses to the farmer. Planning for improved production and extension workers need to help farmers in ways that will be technically feasible, socially acceptable and economically viable in reducing milk spoilage and milk loss.

The report from the study therefore will work as basis for improving milk quality and reduce the chances of milk spoilage and loss thus profitability of the dairy enterprise & improved incomes in dairy sectors. The handling practice and quality of raw milk was essential to understand the quality of marketed milk supply. Therefore, the purpose of this study was to assess the handling practices and quality of raw milk along the milk value chain from smallholder producer up to consumer level.

In the study areas little is known about production practice, major constraints and opportunities. In general Woliso and Becho districts in particular, no work has been done so far to assess the handling practices, quality aspects of raw cow's milk and constraint. Therefore, the purpose of this research is designed to study the handling practices and quality of raw cow's milk along the milk value chain in Woliso and Becho districts of South West Shoa Zone of Oromia Region, Ethiopia. The objective of this study was assess handling practices and quality of raw milk along the milk value chain in Woliso and Becho districts of South West Shoa Zone of Oromia Region, Ethiopia, from throught assess milk handling practice of actors in the milk value chain, determine the physicochemical and microbial quality of raw milk along the milk value chain in study area and identify the key milk marketing constraints along the milk value chain of the study area.

MATERIALS AND METHODS

Description of Study Area: The study was conducted in Woliso and Becho districts of South West Shoa Zone of Oromia Regional State, Ethiopia. There are 11 districts in the Zone. The area is considered as high potential crop-livestock production where dairy activities play a significant role in the livelihood of farmers in the area.

Woliso District: Woliso District is found in South West Shoa Zone and located at latitude 8° 32' -'8° 36' N and longitude of 37° 58'- 37° 36 'E in the South Western part of the country's capital along the main road from Addis Ababa to Jimma, on 114 km from the capital city of the country, Addis Ababa. The topography of Woliso is undulated with altitude ranging between 1600 and 2880 meter above sea level. The average maximum and minimum temperature of the district is 21°C -13°C degree centigrade respectively [10].

Becho District: Becho district is located in South West Shoa Zone of Oromia on the main road from Addis Ababa to Jimma which is 80 km from the Addis Ababa and 34km from the zonal capital, Woliso town. The district is located between astronomical grids of 8°31'N-8°45'N and 38°7.5'E-38°24. 5'E [11].

Study Design: Cross sectional study was conducted from January 2018 to early July 2018 by way of questionnaire survey and laboratory analysis of physical quality of raw cows of milk, Chemical quality of raw cow's milk and bacteriological quality (Microbial quality of raw cow's milk).

Sample Size: Farmers who own at least two milking cows and sell milk were selected for study. The samples size was determined by using proportional random sampling method. The three kebeles were selected from each district by using random sampling procedure .Totally 6 kebeles were selected for the study . The sample size of respondents was allocated from three kebeles based on expectation proportional to size.

The total two districts sample size were calculated 120. The number of smallholders owning milking cows in Woliso district three kebeles was selected randomly based on milk potential or availability of dairy potential, 200, 350 and 450. Namely, Fudu gora, Obi hojii and Bedessa qoricha kebeles (12, 21 and 27) households were randomly selected from the three "Kebeles" respectively.

Statistical Analysis: The collected survey data was analyzed by descriptive statistics using SPSS software (version.20). Microbial counts were transformed into logarithmic values (log10 cfu mL^{-1}) and these transformed values and physiochemical values were analyzed using the General Linear Model using Statistical Analysis System [12].

RESULTS AND DISCUSSION

Cattle Composition: The cattle herd size of the study area was 10.523 TLU (Table 1). The cattle herd size lower than those reported by of Mustafa. A (2012) indicated that the cattle herd size at Welmera and Sululta areas are 11.39 TLU and 13.006 TLU respectively .In the present study area the cattle herd was dominated by local breeds that results in lower TLU cattle herd size as compared with Welmera and Sululta area. The first function in the chain refers to husbandry practice, the main goods and services the farmers need in order to raise animals for income purpose (Table 1).

The Hygienic and 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 88.3% and 11.7 fenced of the respondents were used (Table 2). Most of the respondents 75% removed manure daily, three times a week 8.3% and once a week's 6.7 and two time a week's 10 %(Table 2). All of the respondents kept their cattle in separate barns from owners' homes in backyards, due to the limited available land. However, except for a few urban cattle keepers, the barns were not constructed following recommended structure. [13] and [14], reported similar results in the Addis Ababa and Northwestern Ethiopian highlands dairy production. Which as observed during the field visit, the barns were not constructed to facilitate drainage of the farm wastes leads to soiling of dairy cows and contamination of milk.

Hygienic Condition of Cows and Milker: Most of the interviewed dairy producers (72.5%) washed their hands before milking while the rest 27.5% did not wash their hands (Table 3). Milk producers and milk collectors in the study areas did not cover their hair and dressing gown during milk collection. As observed in this study, 18.3% of the dairy producers washed their cow's udder before milking and 81.7% were not washing and towel used for udder drying no Common towel, just with hands 90.8% and Use Individual towels 9.2% (Table 3). This might indicate the information gap on hygienic milk production practices among cattle keepers of the study areas. This is an opportunity for intervention of new technologies in the areas [15]. However, reported that the majority of the respondents wash their hands before milking except for only 10% of the lowlanders of Shashemane. The same author indicated that all of the highlanders, 75% and 40% of the mid- and lowlanders, respectively, wash the udder before milking. In contrast with the current result, Rahel [16] in Delbo area of Wolaita and Lemma Feta [17] in East Shoa reported that only 54.4 and 5.6% of the households washed the udder of their cows before milking. In general, the majority of respondents in all study sites practiced limited sanitary procedures before milking. They only washed their hands and few of respondents wash udder of cows before milking. In most cases the households neither used towel to dry the udder after washing no practiced other hygienic procedures like covering their hair and dressing gown. It has been reported that the sanitary procedures also reduce microbial contamination of milk [16].

Type of Milking Container and Sanitary Practices: About 95% of the interviewed milk producer farmers were used plastic made milk containers during milking and transported the milk to marketing place (Table 4). The current study, almost all of the dairy producers washed milking utensils after every use 12.5 %, before and after every use 78.3 % and before every use 9.2 %. About 28.3- % of the respondent washed their milk container with cold water, cold water and soap while 13.3 % used hot water and soap10 % and hot water 48.3% (Table 4). The use of unclean milking and transporting equipment could contribute to the poor hygienic quality of the milk. These observations are in line with findings in Ethiopia by Tolera [18].

Table 1: Cattle herd size and composition in TLU in the stallholder farmers in the study area

Variables	Wolis0(N=60) Mean ±S. D	TLU	Becho(N=60) Mean ±S. D	TLU	Overall(N=120) Mean ±S. D	TLU
Cattle	9.65±7.91	9.425	12.46 ±7.52	11.621	11.055±7.7i5	10.523
Local milk cows	1.93±1.26	1.93	2.35±1.02	2.35	2.14±1.14	2.14
Crossbred milk cows	2.77±1.84	4.155	2.84±1.63	4.26	2.805±1.735	4.21
Calves	1.22±.92	.244	1.63±.66	.326	1.425±1.79	.285
Heifers	1.64±1.47	.82	2.45±1.71	1.225	2.045±1.59	1.0225
Bulls	.93±1.15	1.116	1.35±1.11	1.62	1.14±1.13	1.368
Oxen	1.16±1.27	1.16	1.84±1.39	1.84	1.5±1.33	1.478
Sheep /Goat	3.12±2.916	.312	5.23±4.554	.523	4.175±3.735	.4175
Equines	2.44±2.626	1.952	1.58±1.579	1.264	2.01±2.1025	1.608

Table 2: Type of housing and barn cleaning frequency

	Woliso (n=60)		Becho (n=60)		Overall Total=120	
Variables	N	%	N	%	N	%
Types of house						
Housed	52	86.7	54	90	106	88.3
Fence	8	13.3	6	10	14	11.7
No house						
Frequency of clean house						
Daily	38	63.3	52	86.7	90	75
Once a weeks	4	6.7	4	6.7	8	6.7
Two time a weeks	10	16.7	2	3.3	12	10
Three times a weeks	8	13.3	2	3.3	10	8.3

Table 3: Hygienic Condition of Cows and Milkers

	Woliso (n=60)		Bochco (n=60)		Overall Mean	
Variables	N	%	N	%	N	%
Hand washing						
Before milking	46	76.7	41	68.3	87	72.5
No washing	14	23.3	19	31.7	33	27.5
Udder washing						
Before milking	13	21.7	9	15	22	18.3
Before and After milking	-	-	-	-	-	-
After milking	-		-	-	-	-
No washing	47	78.3	51	85	98	81.7
Towel used for udder drying						
Common towel	-	-	-	-	-	-
Just with hands	56	93.3	53	88.3	109	90.8
Use Individual towels	4	6.7	7	11.7	11	9.2

Table 4: Milking Container Sanitary Practices

	Woliso (n=60)		Becho (n=60)		Overall Mean	
Variables	N	%	N	%	N	%
Milk utensils used for milking						
Plastic	56	93.3	58	96.7	114	95
Aluminum	-		-	-	-	-
Clay pot	4	6.7	2	3.3	6	5
Cleaning frequency of milk utensils						
Before and after every use	46	76.7	48	80	94	78.3
After every use	8	13.3	7	11.7	15	12.5
Before every use	6	10	5	8.3	11	9.2
Washing of milk Equipments						
Cold water	-	-	34	56.7	34	28.3
Cold water and soap	2	3.3	14	23.3	16	13.3
Hot water	54	90	4	6.7	58	48.3
Hot water and soap	4	6.7	8	13.3	12	10

Table 5: Plant Used for Smoking and Cleaning of Utensils in the Study Areas

Scientific name	Vern ocular name (Afan Oromo)	Rank
Olean Africana	Ejersa	1st
Promina resinous	Tetessa	2nd

Cleaning and Smoking of Milk Vessels: According to the local understanding, the practice of smoking the container by burning wooden chips of specific trees has an advantage of imparting special taste and odor to the product and to disinfect the vessels, thus reducing the numbers of micro-organisms and there by extending the shelf life of the product. Therefore efficient cleaning and sanitation of dairy farm utensils could help to improve the quality of raw milk and its products. Plants species that are frequently used for smoking milk vessels in the study area were 1st Olean Africana (Ejersa) and 2nd promina resinous (Tetessa) were ranked. These are the most frequently used plant species for smoking milk vessels in the study area (Table 5). The reasons that they use these plants were that: they give good flavor, aroma and increase shelf life of the milk as well as slow milk fermentation process. As Lemma Feta [17], Fanaye Shiferaw [19], Alganesh Tola [20] and Zelalem Yilma [21] reported that Olea Africanais the most frequently used plant for smoking milk containers in other parts of the country.

Milk Handling Practices by Vendors

Source of Milk for Milk Vendors: Majority of the milk vendors got milk from dairy farms% 83.4 and 16.6 got from Street sellers. Majority of the vendors (93.4%) used plastic container (Jerry cans) to collect and transport their milk and 6.6 metal containers (Table 6). This might be a contributing factor for the rapid spoilage of milk as plastic jerry cans cannot be cleaned properly due to their narrow mouths and the inaccessible cavities of their handles in which microorganisms may be cannot be removed easily. The time of collected milk 63.3% morning and evening 36.7%, Milk container clean regularly 53.4% and no milk container clean 46.6% (Table 6).The washing of milk equipment vendors used water, cold water, cold water and soap, Hot water, Hot water and soap 26.7 and no boil the milk before selling 46.7% and The Frequency of the vendors clean milk place of selling 56.7%ad the rest not clean the milking selling place in the study area (Table 6).

Most losses of dairy products occur as a result of a combination of poor production and /or handling practices and lack of technical knowledge. Among others, lack of knowledge on clean milk production, use of unclean milking equipment coupled with lack of potable water for cleaning purpose probably contributed to the poor hygienic quality of dairy products produced in central Ethiopia [5].

Milk Marketing Channels and Outlets: Marketing channels are routes through which products pass as they are moved from the farm to the consumer [21]. 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. Words related to marketing outlets, marketing channels and marketing chains are important to describe milk marketing systems [22]. Marketing outlet is the final market place to deliver the milk product, where it may pass through various channels. A combination of market channels gives rise to the market chain. Marketing survey in Hawassa, Shashemane and Yergalem [23] depicted that milk producers sold milk through different principal marketing channels. From this study the main outlets for raw milk identified were vendors, directly to consumers and hotels/restaurants.

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 100% in Woliso and Becho districts milk producers follow informal marketing system, respectively.

These include itinerate /mobile traders, semi-whole sellers, retailers and consumers as reported by Woldemichael [24].

Physicochemical Compositional of Raw Cow's Milk

Chemical Quality of Raw Cow's Milk: Table14 the overall mean TS (11.26%) content obtained from the study areas. The overall of TS (total solid) in the current study was lower than the findings of who reported 16.02% for Borana cows' milk at Holeta Research Center and lower than the findings of Alganesh Tola [20] and Workneh Abebe [25] who reported 14.8% and 14.31% for Boran and Horro cows' milk, respectively. According to European Union recognized quality standards for total solids content of cow milk is not to be less than 12.5% [26]. The result current shows that, total solid content were obtained from retailers and hotels in both districts low quality standard.

Table 6: Source of milk, handling and milk container venders in the study area

	Woliso		Becho		Over all	
Variable	N=15	%	N=15	%	N=30	%
Source of milk						
Dairy farm	10	66.7	15	100	25	83.4
Street sellers	5	33.3	-	-	5	16.6
Boil the milk before sell			-	-	-	
Yes	11	73.3	5	33.3	16	53.3
No	4	26.7	10	66.7	14	46.7
Frequency of clean milk place of selling						
Yes	12	80	5	33.3	17	56.7
No	3	20	10	66.7	13	43.3
Milk container clean regularly						
Yes	9	60	7	46.7	16	53.4
No	6	40	8	53.3	14	46.6
Time of milk collection						
Morning	11	73.3	8	53.3	19	63.3
Evening	4	26.7	7	46.7	11	36.7
Types of container						
Plastic	13	86.7	15	100	28	93.4
Metal container	2	13.3	-	-	2	6.6
Washing of milk Equipments						
Cold water	3	20	5	33.3	8	26.7
Cold water and soap	5	33.3	3	20	8	26.7
Hot water	4	26.7	3	20	7	23.3
Hot water and soap	3	20	4	26.7	7	23.3

Table 7: Mean value Chemical quality of raw milk across value chain actors in the study areas

Variable	N	Fat	Protein	TS	SNF	Lactose	Ash
Producers	20	3.84^{a}	2.9^{a}	11.03^{b}	7.8^{a}	4.4^{a}	0.67^{a}
Individual collectors	10	4.47^{a}	3.0^{a}	11.9^{a}	8.1^{a}	4.5^{a}	0.64^{a}
Retailers	10	3.8^{a}	2.7^{a}	10.6^{b}	6.8^{b}	4.0^{a}	0.64^{a}
Hotels	10	2.8^{b}	2.4^{b}	8.4^{c}	6.6^{b}	3.4^{b}	0.56^{a}
Overall mean	50	3.75	2.82	11.26	7.42	4.12	0.63

Means with the same letter are not significantly different P< 0.05)

TS=Total solid, SNF=Solid not fat, SD= Standard divation

Table 8: Mean Chemical quality of raw milk for two districts

Variable	Woliso (N=25)	Becho (N=25)	Overall (N=50)
Fat	$3.53\pm.75^{b}$	3.99 ± 1.2^{a}	3.75
Protein	2.9±.305a	$2.8\pm.46^{b}$	2.824
TS	11.3 ± 1.4^{b}	11.23 ± 17^{b}	11.26
SNF	7.8±.783a	7.03 ± 1.2^{b}	7.42
Lactose	$4.2\pm.641^{b}$	$4.05\pm.72^{b}$	4.124
Ash	$0\ .67\pm.06^{a}$	$0.62\pm.1^{b}$	0.63

Means with the same letter are not significantly different P< 0.05)

TS=Total solid, SNF=Solid not fat, N=Number of sample

The overall mean value of the fat (3.75%) in the study area is higher than the Ethiopian standard (value of 3.5%) [27].The average fat content in the current study area was comparable lower than previous findings of Richardson [28] who reported 6.01% for Borana cows.' [29] Reported 4.71 percent fat for local cows' milk in Bahirdar milk shed had also reported fat content of 5.6% for Zebu cows'. The fat content of the raw milk from individual milk collectors and retailers market were significantly higher (P<0.05) than milk samples from household milk producer. This might be due to the combination of the samples from different sources.

The solid not fat (SNF) content 7.42% obtained from small holder milk producer and different milk marketing actors in the current study is to some extent lower than the result obtained by Helen and Eyassu [30] who reported SNF contents of 10.7% for cows' milk in Kombolcha woreda and the result of the current study is lower than the finding reported by Tekelemichael Tesfaye [31] for milk obtained from dairy farms (8.75%) in dire dawa town. Also, Debebe Worku [32] reported the minimum (8.3 ± 0.36%) and maximum (8.7 ± 0.36%) SNF content of raw cow's milk obtained from street vendors and milk producers in and around Addis Ababa, respectively.

The overall mean protein content 2.82% obtained from small holder milk producer and different milk marketing actors in the study area. The overall mean value of protein current study area is lower than the Ethiopian standard value of (3.20%) [27].

In the current study is to various amounts lower than obtained which was lower than the protein content of 3.1 percent reported for Zebu cows' milk.

According to Popescu and Angel [33], milk yield and composition are affected by breed, age and stage lactation, season and plant of nutrition, interval between milking, milking method, health status and bacterial activities. Due to one of these factors, the current study showed significant difference ($P < 0.05$) in the total solids (TS), fat, solid not-fat (SNF), protein, ash and lactose content of milk samples collected from household milk producers, individual milk collector, Retailers and hotels (Table 7).

The overall mean of chemical compositional of milk for fat (%), protein (%), TS %, Solids not fat (%), Lactose% and Ash contents were 3.75%, 2.82 %, 11.26%, 7.42 %, 4.12 %, and 0.63 were Woliso and Becho, respectively (Table 8).

Physical Quality of Raw Cow Milk: The mean value of specific gravity of milk sample from small holder producers, Individual collectors, Retailers and Hotels were collected 1.027±.01, 1.02±.01, 1.026±.01, 1.025±.04 and 1.025±.04 (Woliso) and 1.026±0.2, 1.027±.02, 1.022±.01 and 1.02±.004 (Becho) districts, respectively (Table 9).

The normal specific gravity of milk ranges from 1.026 to1.032 [34]. However the milk collection centers accepted 1.027 as normal parameters for specific gravity of milk. Milk at normal state, have unique physical properties, which are used as quality indicators. The density of milk was commonly used for quality test mainly to check for the addition of water to milk or removal of cream. Addition of water to milk reduces milk density, while removal of cream increases it.

The current study result is Similar to SAS [12] reported specific gravity ranging from 1.025 to 1.029 for Small holder dairy Farms in Debre Zeit. Zelalem [9] reported that majority raw whole milk sample collected from Holetta and Selale area their specific gravity were fall within the range between 1.028 and 1.032.

The overall mean Titratable acidity of cows' milk produced in the study area was 0.21. However, Titratable acidity is a measure of freshness and bacterial activity in milk. Popes and Alganesh Tola [20] reported that, high quality milk essentially needs to have less than 0.14% acidity. Therefore, milk collected from all study sites does not meet the minimum quality standard of acidity as it was much higher than the value indicated. This result is lower than the finding of Kivaria *et al.* [7] who reported an average acidity of 0.23 in Bahir Dar zuria and Mecha woreda. Similarly, this finding was lower than the report of Alganesh Tola [20] who reports 0.28 and 0.31 for raw cows' milk produced in Bila Sayo and Guto Wayu woredas of eastern Wollega, respectively.

The overall mean of physical properties of milk sample indicates on (Table 10) with TA, pH value and specific gravity contents were 6.86%, 1.026 % and .22%, in raw milk sample from the two districts. The result showed significance difference ($P< 0.05$) due to the source area of raw milk samples for acidity and specific gravity.

Microbial Quality of Raw Cow's Milk: The overall mean total bacterial count of cows 'milk produced in the study areas were 7.19±.26 log10cfu/ml (Table 11). The total bacterial count obtained in this study is generally high as compared to the acceptable level of 1×10^5 bacteria per ml of raw milk. The current study is consistent with Fanaye Shiferaw [19] who reported that the minimum and maximum total bacterial count of raw cows 'milk produced in southern region to be 6 to 8.8 lorg10cfu/ml. Commonly, lack of knowledge about clean milk production and use of unclean milking equipment would be some of the factors which contributed to the poor hygienic quality of milk produced in the study area.

The overall mean coli form count of milk produced in the area was 5.17±0.69log10 cfu/ml (Table 11). The coli-form count of cows 'milk obtained in the current study is higher than with reported by Mustafa Abu Kuffa [35] from Sululta and Welmera woradas, Oromia Special Zone Surrounding Addis Ababa (3.33log 10cfu/ml.).

Table 9: Mean ±SD Physical quality of raw cow milk along milk value chain in study areas

Location	Source	N	TA	pH	SG
Woliso	Producers	10	0.16±.02[b]	6.7±.17[b]	1.027±.01 [a]
	Individual Collectors	5	0.19±.02b	6.92±.1 [a]	1.020±.01[b]
	Retailers	5	0.22±.03[a]	7.09± .05 [a]	1.026±.01[a]
	Hotel	5	0.28±.07 [a]	7.04± .19[a]	1.025±.04 [b]
	Over all	25	0 .23±.07	6.9±.19	1.027±001
Becho	Producer	10	0.16± .07[b]	6.7± .25[a]	1.026±0.2 [a]
	Collector	5	0.24± .04[a]	6.9± .25[a]	1.027±.02 [a]
	Retailers	5	0.25±0.1 [a]	6.64±.29[b]	1.022±.01[b]
	Hotel	5	0.24± .04[a]	7.07± .36[a]	1.020±.004 [b]
	Over all	25	0.21±.1	6.8±.31	1.025±004

The mean letter a is highly significant and b is low significant at the (P< 0.05) level.

TA = Titratable acidity, SG = Specific gravity

Table 10: Mean±SD physical quality of raw milk for two districts

Location	N	TA	pH	Sp. Gravity
Woliso	25	0 .23±.07[a]	6.9±.19[a]	1.027[a]
Becho	25	0.21±0.1[b]	6.8±.31[b]	1.025[b]
Overall	50	0.22	6.86	1.26

S.D = standard deviation, TA=Titratable acidity, SG=Specific gravity

Table 11: Mean± SD value of microbial load of raw cow's milk (log 10cfu/ml) across value chain actors in study areas

Source	N	TBC	TCC	YMC	SFBC
Producers	20	7.11±.26[b]	4.94±.47[b]	5.47±.66[b]	4.98±.42[b]
Individual collectors	10	7.32±.13[a]	5.64±1.11[a]	6.17±.48[a]	5.05±.41[a]
Retailers	10	7.15±.42[b]	5.34±.16[a]	5.91±1.40[b]	4.99±.34[b]
Hotels	10	7.25±.11[a]	5.0±.68[a]	6.10±.38[a]	5.09±28[a]
Total	50	7.19±.26	5.17±.69	5.82±.83	5.01±.39

Means followed by different superscript letters within a low are significantly different (P < 0.05)

TBC=Total bacterial count, TCC= Total Coli form count, SFBC= Spore forming bacterial Count, YMC= Yeast and mould count, N= number of samples

Table 12: Mean SD microbial load log10 (cfu/ml) of milk for the two districts of the study areas

Location	N	TBC	TCC	YMC	SFBC
Woliso	25	7.15±.34[b]	5.34±.71[a]	4.98±.32[b]	5.96±.57[a]
Becho	25	7.23±.15[a]	5.01±.64[b]	5.04±.42[a]	5.68±1.02[b]
Overall	50	7.19±.27	5.17±.69	5.82±0.37	5.01±.39

Means followed by different superscript letters within a row are significantly different (P < 0.05)

TBC=Total bacterial count, TCC= Total Coli form count, SFBC= Spore forming bacterial Count, YMC= Yeast and mould count, N= number of sample

The results obtained in the current study for yeast and mould counts were 5.82±.36log10cfu/ml. The mean spore forming bacterial count in the present study was higher than the value obtained by Gurmessa Terefe [36] 5.29± 0.031. However, Tekelemichael Tesfaye [31] found a spore forming bacterial count of 6.39 log10 cfu/ml from milk vendors in Dire Dawa town. The mean value of spore forming bacterial counts found in the current study 5.01±.39 log10 cfu/ml was higher than the finding of Helen and Eyassu [30] who reported higher yeast and mould counts of 4.65 log10 cfu/ml for milk samples collected from storage containers and 7.13 log10 cfu/ml for milk samples collected from distribution containers in Hawassa, Southern Ethiopia.

The over mean values microbial qualities of milk obtained in the current study were TBC, TCC YMC and SFBC 7.19±.27, 5.17±.69, 5.82±.36and 5.016±.83 (Table 20), respectively (Table 19). The microbial qualities of milk obtained in the current study are poor compared to international bacteriological standards of dairy products according to the Ethiopian Standards Agency [27].

CONCLUSIONS

Dairy production become important component of the farming activities and income generating for household in Woliso and Becho districts of south west shoa zone of Oromia Region. The proportion of raw milk used for household consumption was relatively small and the major part of milk produced by smallholders is destined to market. The major problem of raw milk marketing in the study areas were, Price fluctuation, lack of fair market and declining of demand during fastening. The majority used utensils for milking and milk handling in study areas was plastic container and clay pot. Chemical quality of the milk samples collected from Individual collectors and retailers were found below ESA standard, except TS and fat. While the samples collected from hotels were below of Ethiopia standard agency in all chemical quality. Microbial quality of raw cow's milk produced and marketed in the study area was poor and it was below ESA standard limits. Milk produced by small-holder dairy cow owners in Woliso and Becho districts of South West Shoa Zone was poor. Therefore, it was concluded that the microbial and physicochemical quality of raw cow's milk produced and marketed in the study areas were poor and this suggests the need for improved hygienic practices and handling of milk at all levels of milk value chain.

In general, physicochemical properties and microbial qualities of the raw milk obtained from household milk producers, individual collectors, retailers and hotels are statistically significant different at $P<0.05$.

Recommendations: Based on the findings of the current study, the following recommendations are made:

Livestock sectors should give attention on extension services, skill and knowledge development as well should provide training on milk handling practices. All actors along the milk value chain should be organized and educated to increase their awareness on management of dairy animals, general milk handling and milk hygiene. In order to minimize market problem, market linkage and milk value chain should created by government agencies and all stock holders.

REFERENCES

1. Ahmed, M.M., S. Ehui and Yemesrach Assefa, 2003. Dairy Development in Ethiopia. Socio economics and Policy Research Working Paper 58. ILRI (International Livestock Research Institute), Nairobi, Kenya, pp: 47.
2. Belete, A., T. Azage, B. Fekadu and G. Berhanu, 2010. Cattle milk and meat production and marketing systems and opportunities for market-orientation in Fogera woreda, Amhara region, Ethiopia. IPMS (Improving Productivity and Market Success) of Ethiopian Farmers Project Working Paper 19. ILRI (International Livestock Research Institute), Nairobi, Kenya, pp: 65.
3. CSA (Central Statistical Authority), 2016/2017. Livestock and livestock characteristics. Agricultural Sample Survey, Statistical Bulletin, Volume II, Addis Ababa, Ethiopia.
4. Abera, K., 2008. Milk production and marketing in smallholder dairy in Kuyu District of North Shoa zone, Oromia regional state. MSc. Thesis, Addis Ababa University, Faculty of Veterinary Medicine, Debre-Zeit, 1(11): 459-465.
5. Zelalem, Y. and F. Bernard, 2006. Handling and Microbial Load of Cow's Milk and ergo-fermented Milk Collected from Different Shops and Producers in Central Highlands of Ethiopia. Dairy Technol, Ethiopian Institute of Agric. Res., Holeta Agricultural Res. Center, Addis Ababa, Ethiopia. Ethiopia. J. Anim. Prod., 6(2): 67-82.
6. Oliver, 2005. Food borne pathogens in milk and the dairy environment food safety and public health implications. Foodborne Pathogen. Dis., 2: 115-1129.
7. Kivaria, F.M., J.P. Noordhuizen and A.M. Kapaga, 2006. Evaluation of the hygienic quality and associated public health hazards of raw milk marketed by smallholder dairy producers in the Dares alaam Region, Tanzania. Tropical Animal Health Production, 38(3): 185-194.
8. Godefay, B. and B. Molla, 2000. Bacteriological quality of raw milk from four dairy farms and milk collection centers in and around Addis Ababa. Berl Münch. Tierärztl. Wschr., 113: 1-3.
9. Zelalem Yilma, 2012. Microbial Properties of Ethiopian Marketed Milk and Milk Products and Associated Critical Points of Contamination. East Africa Dairy Development (EADD) Program, Addis Ababa Ethiopia, pp: 299-300.
10. Oromia Woreda Project, 2017. Survey of Districts.
11. Ketema, H. and R. Tsehay, 2004. Dairy Production System in Ethiopia, Ministry of Agriculture, Addis Ababa, Ethiopia.
12. SAS, 2000. Analysis System (SAS) Institute, Inc, Cary, NC.

13. Yitaye Alemayehu, M., Wurzinger, Azage Tegegne and W. Zollitsch, 2009. Performance and Limitation of Two Dairy Productions System in the North Western Ethiopian highlands. Tropical Animal Health Prod., 41(7): 1143-1150.
14. Zewdu, W., 2004. Indigenous cattle genetic resources, their husbandry practices and breeding objectives in North-western Ethiopia. M.Sc. Thesis. Almaya University of Agriculture, DireDawa, Ethiopia, pp: 127.
15. Berhanu Kuma, 2012. Market Access and Value Chain Analysis of Dairy Industry in Ethiopia: The Case of Wolaita Zone.
16. Rahel, N., 2008. Traditional and Improved Milk and Milk Products Handling Practices and Compositional and Microbial Quality of Milk and Buttermilk in Delbo Watershed of Wolayta Zone, M.Sc. Thesis. Department of Animal and Range Sciences, Hawassa College of Agriculture, School of Graduate Studies, Hawassa University, Ethiopia.
17. Lemma Feta, 2004. Assessment of butter quality and butter making efficiency of new churns compared to smallholders' butter making techniques in east Shoa Zone of Oromia, Ethiopia. M. Sc. Thesis. Alemaya University of Agriculture, Dire Dawa, Ethiopia, pp: 113.
18. Tolera, D., 2007. Smallholder dairy production technology transfer and adoption constraints in mixed farming system in Girar Jarso District of North Shoa Zone Oromia Regional State. MSc. Thesis, Addis Ababa University, Faculty of Veterinary Medicine, Debre-Zeit, Ethiopia.
19. Fanaye Shiferaw, 2014. Household level milk production and child milk consumption in and around Bahirdar, Ethiopia.
20. Alganesh Tola, 2002. Traditional milk and milk products handling practices and raw milk quality in Eastern Wollega. Msc. Thesis, Alemaya University, Alemaya, Ethiopia.
21. Zelalem Yilma, 2010. Quality Factors that Affect Ethiopian Formal Milk Business; Experiences from selected dairy potential areas. Addis Ababa, Ethiopia: Netherlands Development Organization.
22. Walstra, P., T.J. Geurts, A. Noomen, A. Jellema and M.A. Boekel, 1999. Dairy Technology Principles of Milk Properties and Processes. New York: Marcel Dekker, pp: 155-170.
23. Sintayehu, Y., B. Fekadu, T. Azage and G. Berhanu, 2008. Dairy production, processing and marketing systems of Shashemane, Dilla area, South Ethiopia. IPMS (Improving Productivity and Market Success) of Ethiopian Farmers Project Working Paper 9. International Livestock Research Institute (ILRI), Nairobi, Kenya, pp: 62.
24. Woldemichael, 2008. Milk marketing chains analysis: The Case of Shashemane, Hawassa and Dale district's milk shed, Southern Ethiopia. M.Sc. Thesis, Hawassa University, Hawassa, Ethiopia.
25. Workneh Abebe, 1997. Assessment of nutritive value and consumer preferences for some varieties of cheese made from goat milk. M.Sc. Thesis Presented to the School of Graduate Studies of Alemaya University of Agriculture, Ethiopia, pp: 108.
26. FAO (Food and Agriculture Organization of the United Nations), 2007. Overview of the Turkish Dairy Sector within the Framework of EU-Accession, Rome, pp: 58
27. Ethiopian Standard Agencey (ESA): Unprocessed Whole/Raw Cow Milk Specification. 2nd ed., 2009, ES: 3460:2009.
28. Richardson, H.G., 1985. Standard Methods for the Examination of Dairy Products. 6th edn. American Public Health Association, Washington DC, pp: 133-150.
29. Asaminew, T., 2007. Production, handling, traditional processing practice Quality of milk in Bahirdar milk shed Area, Ethiopia. M.Sc. Thesis. Alemaya University, Ethiopia.
30. Helen, N. and S. Eyassu, 2007. Effect of the lacto-peroxidase system and container smoking on the microbial quality of cows' milk produced in Kombolcha woreda, eastern Ethiopia.
31. Tekelemichael Tesfaye, 2012. Quality and Safety of Raw and Pasteurized Cow Milk Produced and Marketed in Dire Dawa Town, M.Sc. Thesis. Haramaya University, Ethiopia.
32. Debebe Worku, 2010. Physic chemical Properties and Safety of Street-vended Milk in and Around Addis Ababa City (Kotebe, Bishoftu and Chancho), M.Sc. Thesis. Haramaya University, Ethiopia.
33. Popescu, A. and E. Angel, 2009. Analysis of Milk Quality and its Importance for Milk Processors. Lucrări ştiinţifice Zootehnie Biotechnology, 42(1), Timisoara, 5506

34. 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.
35. Mustafa Abu Kuffa, 2012. Value Chain And Quality Of Milk In Sululta And Welmera Woradas, Oromia Special Zone Surrounding Addis Ababa, Oromia, Ethiopia.
36. Gurmessa Terefe, 2014. Physicochemical Properties and Microbial Quality of Raw Cow's Milk in Yabello District, Borana Zone, Southern Ethiopia.