Food Science and Quality Management
ISSN 2224-6088 (Paper) ISSN 2225-0557 (Online)
Vol.116, 2022

Hygienic Practice, Microbial Quality and Physco-Chemical Properties of Milk Collected from Farmers and Market Chains in Eastern Wollega Zone of Sibu Sire Districts, Ethiopia

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Abstract
Thirty samples of fresh cow milk was taken from farmers immediately after milking and 15 milk samples was taken from market chains and analyzed for quality. From the sample about 31.08% were coagulate on clot on boiling test and 55.55% samples were coagulated on alcohol tests. Overall mean total bacterial counts, coliform and yeast and mould count were 5.74±0.10.65, 3.14±0.72 and 3.71±0.83 cfu/ml respectively and significantly different b/n producers source and markets channel source at (P<0.05). The highest total colony count was 6.77±1.1cfu/ml was observed at retailers. From the samples about 66.7% of the sample was in a normal range for specific gravity and 33.3% of the sample was not in a range of normal specific gravity. The overall mean of fat, protein, solid not fat were 4.65±0.50%, 3.67±0.05%, 8.78±0.15% respectively. In general the result indicated that milk samples collected from producers and market chains, were subjected to microbial contamination and does not meet the international milk quality standard. Therefore, adequate sanitary measures should be taken at all stages from production to consumer level.
Keywords: Chemical composition, Hygienic practice, sibu sire, microbial quality, physical quality.
DOI: 10.7176/FSQM/116-03
Publication date: June 30th 2022

I. INTRODUCTION

Milk is the most important and precious natural material which has been the basic component of human nutrition for long period of time (Edgar, 1998). It is also an excellent medium for growth of microbes like bacteria which spoil and deteriorate milk quality which is not safe for human consumption ((O'Connor, 1994). Milk can be spoiled due to different factors like health of animal, from milking environment, feed and mikers , diseased udder, storage temperature(Negash *et al,*2012). Milking and storage equipment commonly used by households are believed to be inconvenient for hygienic cleaning and cause quality deterioration of milk and impose health risks on the consumers (Tsedey *et al*, 2015).

Milk must be free from pathogenic organism that causes milk borne diseases. Contamination of milk can leads milk to be spoiled which not suit for human consumption. Many milk-borne epidemics of human diseases are spread through milk contamination. Sources of microbial contamination in milk include primary microbial contamination from the infected or sick lactating animal. The secondary causes of microbial contamination occurs along the milk value chain which may include contamination during milking by milkers, milk handlers, unsanitary utensils and/or milking equipment's and water supplies used in sanitary activities. Other secondary sources of microbial contamination occur during milk handling, transportation and storage of milk.

There is tertiary microbial contamination which occurs mainly due to re-contamination of milk after being processed due to unhygienic conditions and poor or improper handling and storage of milk during consumption (Parekh, 2008). The quality of milk is determined by its composition and overall hygiene. It is well known that the fresh milk contains some bacteria and somatic cells. These are the milk's biological constituents. The numbers of these biological constituents change according to production conditions like the animal's health and hygiene during milking, preserving and transporting the milk and the milk products. These microorganisms have an important role in the alteration and contamination of milk and milk products. Temperature control is essential to prevent milk alteration, because of the microbial growth. The number of microorganisms vary according to the temperature (season) indicating that the total number of coli forms and E. coli significantly differ in summer and winter. There is an increasing focus on milk quality and hygiene in the dairy industry. Producing high quality milk requires effective udder health programs at a herd level. The safety of milk is an important attribute for consumers of milk and dairy products. Milk and products derived from milk of dairy cows can harbour a variety of microorganisms and can be important sources of food borne pathogens. There is lack of information on hygienic practice, physco-chemical composition and microbiological quality of raw cow milk in the country in general and study area in particular. So, current study is conducted with the objective to assess hygienic practice, physco-chemical properties and microbiological quality of raw cow milk produced and marketed in

study area.

2. Material and methods

2.1. Description of the study area

Sibu Sire is one of the 18 districts of East Wellega zone, which is located in the eastern part of the zone. Sire is the capital town of the *Woreda* located on the way to Nekemte at a distance of 280 km from Addis Abeba and 50 kilometres far from the zonal capital of Nekemte. Sibu Sire district is contiguous with Gobu Seyo in the east, WayuTuka in the west, GudeyaBila in the north and Wama Hagalo to the south bordering also some part of WayuTuka in the south west. The total area of the district is about 1,054.40 km2 of land which occupies nearly7.45 percent of the zone's total area having 19 farmers associations and 3 urban centres.

This district is divided in to three distinct geographical areas with different proportions; namely the highland 7.53 percent which is very small part of the district, midland 74.2 percent and the lowland 18.27 percent. The altitude ranges from 1300 to 3020 meters above sea level. The area is experienced with mean annual temperature between 24^{0}C and 25.5^{0}C and means annual rainfall of 1015 to 1050 mm per annum. Of the total population in the district, 83 percent live in the rural areas, where directly sustains their life from the agricultural and similar activities. The dominant livestock species in the study area were cattle, small ruminants, mule, horse and poultry.

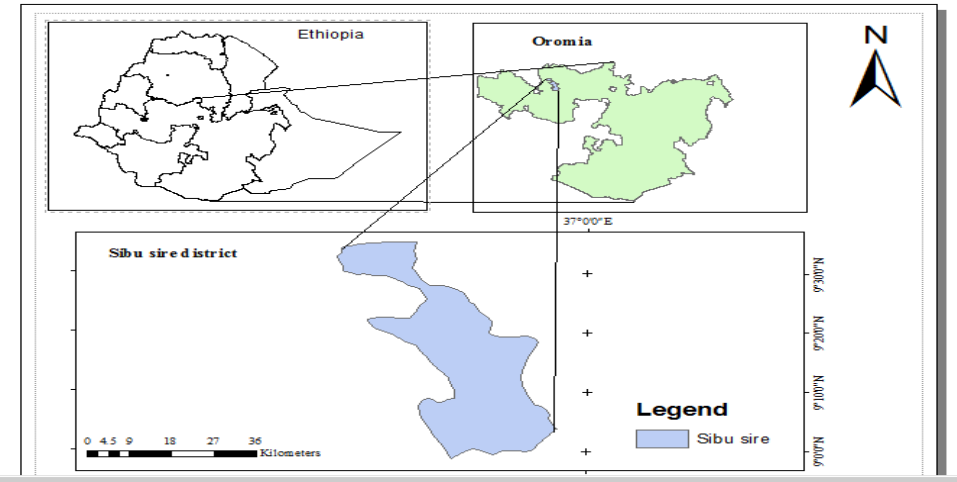

Figure 1: map of study area

2.2. Study Design and Sampling Method

The study involved both cross-sectional survey method to assess hygienic milk handling practices and laboratory test to determine microbiological quality of milk collected from farmer and different market channel. The district was stratified as highland, midland and lowland based on agro ecological zone and from each agro ecological zone two representative samples *kebeles* were selected using random sampling methods for collecting of information on hygienic milk handling practice during milking, storing and transporting.

From the three agro ecologies total of 45 samples of cow's milk were collected. Thirty (30) samples were collected from farmer at morning time and 15 samples were collected from market chains like milk collectors, retailers, and hotels. Samples were collected aseptically from the different households following the procedure of Richardson (1985) and then thoroughly mixed, labeled, coded and taken into sterile bottle of about 250mL. The samples were transported to *Holleta* dairy microbiology laboratory in an icebox and kept in refrigerator until the time of analysis. Each analysis was made in a duplicate. The analysis was performed within 36 hours after sampling Alganesh *et al* (2007).

2.2.1. Microbial analysis

Total aerobic plate count

Appropriate decimal dilution was selected and samples were thoroughly mixed and serially diluted by adding 1mL of the test portion into 9 mL of 0.1% sterile peptone water. Dilutions were made so that plate counts range between 25 and 250 colonies were counted (Richardson, 1985). Appropriate dilutions were placed on Petri dishes and pour plated with 10 to 15 mL molten plate count agar (about 45°C) and allowed to solidify for 15 minutes and incubated for 48 hours at 37°C. Finally, counts were made using a colony counter. The plate counts were calculated by multiplying the count on the dish by 10n in which n stands for the number of consecutive dilutions of the original sample (FAO, 1997).

Coli form Count

After appropriate dilution was made by transfer 1 ml of each sample or a decimal dilution on to a sterile plate,

and then added to each plate of 15 to 20 ml of VRBA tempered to 44 to 46 ^{0}C. An agar control for each flask of medium used was poured. The number of samples to be planted in any one series was selected so that there was no more than a 20-minute time lapse between diluting the first sample and pouring the last plate in the series (Michael &Joseph, 2004).

Yeast and Mould Count (YMC)

Sterile agar medium (250 ml portions in prescription bottles or flasks, autoclaved 15 min at 121°C) was prepared and then tempered to 45 ±1°C in water bath. Once medium has been tempered, it was held for 2-3 hr before use, provided water level of water bath was 2-3 cm above surface of agar in aliquot container. The potato dextrose agar was used as medium growth. (FAO, 1997).

After counting and recording bacterial colonies in each Petri dish, the number of bacteria in milliliter milk was calculated by the following formula given by American Public Health Association (APHA, 1992)

$$N = \frac{\sum c}{[(1 \times n1) + (0.1 \times n2)]d}$$

Where:

N = Number of colonies per ml or g of product;
Σ C = Sum of all colonies on all plates counted;
n1 = Number of plates in first dilution counted;
n2 = Number of plates in second dilution counted;
d = Dilution from which the first counts were obtained.

When computing TBC, CC and YMC only the first two significant digits were recorded and the bacterial count was reported as colony forming unit per millitter of milk (CFU/ml).

2.3. Data Management and Statistical Analysis

The General Linear Model (GLM) procedure of SAS version 9.1 (2002) was used to analyze milk microbial quality and properties of raw milk. Microbial count data was first transformed to logarithmic values (log_{10}) before subjected to statistical analysis in order to make the frequency distribution more symmetrical. Mean comparisons was done using the Least Significant Difference (LSD) technique when analysis of variance shows significant differences between means. Differences was considered statistically at $p<0.05$ level of significance.

The following model was used for the analysis of milk microbial quality of milk, physical and chemical properties of milk.

$Yij = \mu + \beta i + eij$

Where, Yij = individual observation for each test
μ = the overall mean
β = the i^{th} milk source effect (i=1, 2,3,4)
eij = the error term .

Table 1: Milk sampling layout for microbiological test

Agro ecologies	Kebeles	Total number of milk sampled from each source
Highland	Adda Buke	5
	Babbo Kuwe	5
Midland	Caffe Jalalle	5
	Biqila	5
Lowland	Waligalte	5
	Jarso wama	5
	Hotels	5
Market channel	Retailers	5
	Consumer	5
Total		**45**

3. RESULT AND DISCUSSION

3.1. Milking and Hygienic Practice

In all of the study area cows were hand milked and calves allowed to suckle dams prior to milking and suckling were used to stimulate milk letdown. In the study area milking practice was mainly carried out by woman and males were rarely involved in milking of the cows. About 37.5% of respondent in the midland wash their hands before milking while 62.2% of the respondent do not wash their hands. In the lowland parts of the study area

only 5.5% of the respondent washes their hands before milking, and 94.5% of the respondents don't wash their hands before milking and this was due to lack of awareness and scarcity water. Relatively midland (37.5%) respondents wash their hand before milking than lowland (5.5%) respondents. This result was in opposite with report of Bekele (2015) reported that 100% of the respondents in Dangila town of western Amhara region washes their hands before milking.

In all of the study area about 22.5% washes their hand before and after milking and 77.4% of the respondents don't washes their hand before and after milking (Table2). This was due to scarcity of water and lack awareness and this leads to poor quality milk. This finding was different from the report of Fanaye *et al.* (2015) who report that all of the interviewed respondents wash hands and milking vessels before milking cows in Bahir dar Zuria.

Table 2: Types of milking and hygienic practice of milk

	Agro-ecologies		
Variable	Highland(N=60)	Midland(N=60)	Lowland(N=60)
Hand milking			
Yes	100	100	100
No	--	--	--
Wash hands before milking and after milking			
Yes	24.5	37.5	5.5
No	75.5	62.2	94.5
Wash equipment after use			
Yes	69.2	58	48.8
No	30.8	42	51.2
Wash udder before milking			
Yes	74.5	63.75	59.2
No	24.5	36.25	41.8

N=number of respondents.

Washing and cleaning the udder of the cows before milking is the most important and the crucial thing for hygienic practices of milk production. The washing of the udder removes the dirty materials from the udder of the cows. This is because the udder of the cow has direct contact with dirty materials like urine, dung, and feed refusal (Zelalem, 2010). As observed in this study, 66.15% of the respondent washes the udder of the cow before milking and 33.85% did not wash and simply allowed their calves to suckle before milking which is considered as the calves removes the dirty of the teat and facilitate the letdown of milk. This figure is greater than the report of Saba (2015) about quality assessment of cattle milk in Adea Berga and Ejerie districts of West Shoa zone, Ethiopia.

Hygienic practice related to cleaning milk equipment and frequency of cleaning are among the major factors affecting the quality of milk and milk products. Milk get easily be contaminated by microorganism if not properly handled. Majority of the respondents interviewed uses plastic materials for milking and storing of the milk after milking except some of the respondents from lowland area (Table3). Abebe *et al*. (2013) reported similar result in *Ezrh*a district of *Gurage* Zone where all of the respondents used plastic containers as milking materials. Milking and milk storage utensils should be properly cleaned and maintained if not it can spoil the milk and milk product easily since the milk is an easily perishable product. Therefore, cleaning, and draining of equipment after each milking is important for reduction of milk microbial contamination. Producers should pay particular attention for the type as well as cleanliness of milk equipment they use for milking. Most of the respondent from highland Agro-ecologies clean their equipment with cold water but in the midland and lowland of the study area some of them use hot(boiled) water for cleaning of milking materials. Hot water was better for cleaning of milking materials as it can reduce number bacterial multiplication.

Table 3: Types of milking materials and milk material cleaning frequency

	Percentage of respondent		
Variables	Highland	Midland	Lowland
Milking material used			
Plastics	60(100)	60(100)	25(41.7)
Clay	--	--	35(58.3)
Milking materials cleaning frequency			
Before and after use	55(91.7)	50(80.3)	17(18.3)
After use only	5(8.3)	10(16.7)	43(71.7)
Source of water for cleaning of milking materials			
Cold water	60(100)	55(91.7)	12(20)
Hot water	--	5(8.30	48(80)

The number in the bracket is the percentage of respondent from the three Agro-ecologies.

3.2. Microbial Quality of Cow Milk

3.2.1. Alcohol and clot on boiling test

Samples collected from midland about 13.2% of the sample were positive with alcohol test and the least alcohol test result were seen at highland (4.44% on alcohol test) (Table 4). This variation could be differences in environmental temperature.

From the collected samples 55.5% were coagulate on alcohol test and 32.08% were coagulate on clot on boiling test. This observation supports the idea that alcohol test is more sensitive than clot on boiling test as reported by O'Connor (1994). Similarly Saba (2015) also reported that 32.2% milk samples tested with alcohol test were coagulate and only 18.8% of the samples were coagulate with clot on boiling test in *Adea berga* and *Ejere* district of west Shoa Zone.

Table 4: Alcohol and clot on boiling test in the study Area

Source of sample	N	Clot on boiling test	Alcohol test
Highland	10	0	4.44
Midland	10	8.88	13.3
Lowland	10	4.44	11.11
Market channel source			
Hotels	5	2.22	6.66
Retailers	5	8.88	11.11
Consumers	5	6.66	8.88
Total	45	31.08	55.5

N is the total number of samples taken*

3.2.2. Standard Plate Count

The analysis of the ANOVA show that there was significance difference in bacterial load among highland, midland, and lowland and market chain source of milk in study area at P<0.05 (Table 5). From the whole raw milk sample collected, the bacterial quality of milk from retailers was poorest in bacterial quality with total plate count of 6.77log10 cfu/ml and significantly different from highland samples.

The overall mean of total bacterial count of raw cow milk produced in the study area was 5.74log10 cfu/ml. It is within acceptable range of Ethiopian microbial standard for unprocessed milk **(DES, 2008).** This result was lower than the result of Siham *et al*. (2016) who reported that the total bacterial count of Omdurman and Khartoum were 9.29 ± 0.66 and 8.23 ± 0.76log10 cfu/ml respectively. Similarly it is also lower than the result of Saba (2015) who reported that the average total bacterial count of raw milk in *Adea Berga* and *Ejerie* districts of west Shoa zone (6.98log10 cfu/ml). Amakelew *et al.* (2015) also reported that 7.25 log10 of total bacterial count in *Dawa Chefa* District, Amhara region.

However, the value is not in the acceptable range of total bacterial count of raw milk of European standard. According to EU standards, total bacterial count of raw cow milk should be less than 5.6log10cfu/ml (Fernandes, 2009). However, in the present study, the total bacterial count of all milk samples exceeds the mentioned standard of European Union.

In general the high bacteria count of raw cow milk in the study area could be due to the initial contamination starting from environment like the cleaning of the area which contaminates the udder surface of the cow, the level water used for cleaning, milking equipments and material used for storage of the milk, general sanitary condition of the milkers, type of barn used. Poor hygienic practice during milking of the cow is the most cause for the existence of high number of bacteria in raw cow milk. The use of equipment for milking without cleaning lefts some amount of milk on the milking utensil and provides nutrient for microbial growth and multiplication that contaminate the next or the subsequent milk.

Table 5: Microbial count of raw cow milk (mean ±S. Deviation)

Source of milk	TBC	CC	YMC
Highland	5.18 ± 0.05^{b}	3.11 ± 0.10^{b}	3.14 ± 0.08^{b}
Midland	5.15 ± 0.05^{b}	3.38 ± 0.62^{b}	3.27 ± 0.10^{b}
Lowland	5.20 ± 0.06^{a}	3.16 ± 0.05^{ab}	3.19 ± 0.24^{b}
Retailers	6.77 ± 1.15^{a}	3.09 ± 0.77^{ab}	3.89 ± 1.97^{ab}
Hotels	5.56 ± 1.23^{a}	3.72 ± 1.65^{a}	4.37 ± 1.62^{a}
Consumers	6.58 ± 1.37^{a}	2.40 ± 1.18^{c}	4.42 ± 0.98^{a}
Overall	5.74±0.65	3.14±0.72	3.71±0.83

Different superscripts within a columns denote significant differences at P<0.05.

3.2.3. Coli form Count

Analysis of variances indicated that there were significance difference at P<0.05 among the highland, and consumer source of milk in study areas (Table 5). Difference might be attributed to factors like low hygiene during milking, contact of the udder with faecal material and poor quality of milking equipments. The overall

mean of the coliform count in the study area were 3.14log10 cfu/ml. This result is lower than the result of Asaminew and Eyasu (2011) in Bahir dar Zuria and Mecha district, Ethiopia who reported that 4.49 logcfu/ml and it is also lower than the report of Gurmessa (2015a) who reported that the total coli form counts of milk in Yabello district Borena southern Ethiopia were 6.323 log10 cfu/ml). The overall result of coliform count inthe study area is within good standard of Ethiopian unprocessed milk microbial quality 4.6log10 cfu/ml (DES, 2008) But, higher when compared with the recommended values of American public health standard which should be less than 100 cfu/ml for grade A milk and 101-200 cfu/ml for grade B milk (WHO, 1997). The presence of more number of coli form in milk in the study area indicates that the milk has been contaminated with dirty materials like dung of the cow, poor farm hygiene, use of equipments that are not properly cleaned, and unsanitary milking practice, use of contaminated water for cleaning of equipments. CC is an indicator of low hygienic standard used in production of the milk in the study area.

3.2.4. Yeast and Mold Count

The overall mean value of YMC were not significantly different (P<0.05) among milk samples collected from the three agro ecologies (Table5), but the mean value of YMC count were significantly different between milk source from the three Agro-ecologies and the milk source from hotels and consumers at (P<0.05). The total YMC count of samples from market hotels and consumers were higher than the mean YMC of the Agro-ecologies, this might be due to poor hygiene of equipment during handling, transporting and processing of milk, and indicates unsanitary conditions of handling and contamination from environment.

The overall mean of YMC for the study area was 3.71±0.83log10 cfu/l. The result was similar with report of Tashome (2016) who reported 3.902±0.477 in Smallholders in Bench Maji-Zone, Southwestern Ethiopia and greater than the result of Haile (2012) who report that the total count of YMC of sample of milk taken from the udder was 3.03log10 cfu/ml in Hawassa, Southern Ethiopia. It also shows higher YMC than the report of Amakelew *et al* (2016) who reported that the YMC of raw cow milk collected from farmers, hotels, and dairy cooperatives in Dawa Chefa district, Amhara region, Ethiopia were (0.46 log10), (0.74 log10 cfu/ml) and (0.62 log10) respectively. The increased amount of yeast and mould in the study area could be due to the use of contaminated equipments, and poor hygienic condition of the milkers. The increased count of yeast and mould from production to market is due to contamination of milk with barn bedding, farm environment, poor hygiene of milkers, use of poor quality water and fecal wastes in the farm and poor quality of transporting materials.

3.3. Properties of Milk

3.3.1. Physical Properties of Milk

Specific gravity and pH of the Milk

The specific gravity value the samples collected from the study area was in a range of 1.024-1.053(Table 6). The normal specific gravity of milk at 15.6^0c ranges from 1.026 to 1.032 (DES, 2008). The result of the study indicated that 66.7% of the samples were within normal range for specific gravity. Samples collected from producers(Highland, midland and Lowland) were within normal range for specific gravity but, samples collected from market channels were not in the normal range of specific gravity and this indicate that milk from market channel samples, fat was extracted. The result of this was in agreement with the report of Haile (2015) who report that 85% of Ejerie and 65% of Adea Berga milk samples were within the acceptable range of unadulterated milk while the rest 15 % and 35 % of the samples falls below the acceptable range.

Table 6: Specific gravity and ph of the milk

Source of milk	N	Specific gravity (%)	PH (%)
Highland	10	1.023	6.52
Midland	10	1.025	6.05
Lowland	10	1.032	6.62
Retailers	5	1.052	6.38
Consumers	5	1.041	6.43
Hotels	5	1.033	6.27

N-number of respondents.

Milk pH reflects the hygienic condition of the milk and often ranged between 6.6 – 6.8 when the temperature of the milk reads at 20^0c, because cooling of milk inhabits the microbial growth on milk. When milk temperature is increased it makes favorable condition for growth of microbe **(**Walstra *et al.,* 1999**).** The result of the current study indicate that the pH of the sample from lowland were in the range of fresh cow milk and the pH of the milk from highland, midland, retailers, consumers and hotels were not in the normal range of fresh cow milk and it was below the normal range and it indicates that the sample was contaminated by microorganism. When the pH values of milk is higher than 6.8 indicates mastitic milk and pH values below 6.6 indicates increased acidity of milk due to bacterial multiplication (O'Connor, 1995).

3.3.2. Chemical properties of milk

The overall protein, fat, total solid and SNF content of the sample were 3.67±0.05%, 4.65±0.50, 13.42±0.83and

8.78±0.15% respectively. The average protein and SNF content obtained in the current study was 3.67±0.05% and 0.45± 0.15 % (Table 7). The midland and consumer source of sample was significantly different in protein content at P<0.05. The highest protein content was recorded at highland of the study area. The average protein content of the current study was higher than the report of Teklemichael *et al.,* (2015) who report 3.420 ± 0.1% at dairy farm in Dire Dawa town Eastern Ethiopia. The overall mean protein content of the current study fulfills the requirement given Ethiopian standard for protein content of horro breed cows. According to ES standard the protein content Zebu cow protein content should not be less than 3.2%.

There was a significant difference (P<0.05) in the average fat content of cow milk between the three agroecology. The highest milk fat content was recorded at highland with 6.19 % (Table 7). The average fat content of the current study was greater than the report of Haile (2015) 3.52% in Ejere and Adaa Berga district of west shoa zone. Alganesh (2002) reported 6.1% for Horro breed in Eastern Wollega. This variation might be due to breed of cows and stage of lactation. The fat content of sample collected were within the range of Ethiopian standard for fat of zebu cows (DES, 2008).

The overall mean of total solids content of the current study was 13.42% and it was lower than the report of Gurmessa *et al.,* (2015b) who reported 15.47% in Borena Zone, Yabello district. The result of the current study was in a normal range given for total solid by Ethiopian standard that stated the total solid of cow milk should not be less than 12.5 %(DES, 2008). The highest total solid was recorded at highland (14.72%) of the study area. There was a significance difference between highland and lowland midland and hotels source of milk at (p<0.05). The variation of total solid of the cow in the study area was due to breed, lactation stage and type of feed consumed. The mean of sample collected from study area was within normal range of Europeans standard.

The SNF content of the milk was determined by subtracting fat content from total solid of the milk. The solid not fat content of the current study was significantly different between highland and other source of milk (Table7). The highest SNF content was recorded at highland source of milk. The average SNF content of the current study was within the standard of Ethiopia for zebu cows which indicate that the SNF not be less than 8.5%(DES, 2008) and lower than the report of Bekele *et al* (2015) who report 9.49% for urban and peri-urban area of Dangila in western Ahmara Region, and Gurmessa *et al.,* (2015b*)* 9.47 ±0.17% in case of Borena zone Yabello district.

Table 7: Chemical properties of milk in the study area.

Milk sampling source	N	Protein (%)	Fat (%)	TS	Solid not fat (%)
Highland	10	3.31 ± 0.08^{a}	6.19 ± 0.28^{a}	14.72 ± 0.50^{a}	9.25 ± 0.00^{a}
Midland	10	3.16 ± 0.05^{b}	5.27 ± 0.28^{b}	14.02 ± 0.46^{ba}	8.75 ± 0.33^{b}
Lowland	10	3.16 ± 0.04^{b}	4.34 ± 0.62^{c}	13.07 ± 0.83^{bc}	8.75 ± 0.00^{b}
Retailers	5	3.13 ± 0.17^{bc}	4.32 ± 0.82^{c}	13.04 ± 0.82^{bc}	8.75 ± 0.36^{b}
Consumers	5	3.06 ± 0.00^{c}	4.08 ± 0.53^{c}	13.04 ± 0.57^{bc}	8.70 ± 0.22^{b}
Hotels	5	3.05 ± 0.00^{c}	3.73 ± 0.49^{c}	12.67 ± 1.80^{c}	8.48 ± 0.00^{c}
Over all	45	3.67±0.05	4.65±0.50	13.42±0.83	8.78±0.15

Means with different superscripts letters are significantly different (P<0.05)
N =number of samples

3.4. Constraints of Hygienic Milk and Milk Product Productions

The major constraints of clean milk and milk product production in the study area were ranked based on the frequency of respondents in the study area. The constraints were ranked for each of the Agro-ecologies and summarized in Table 8. All of the respondents reported that lack of awareness was the major constraints of milk production in the study area.

Table 8: Constraints of hygienic milk and milk product production

	Agro-ecologies		
Variables	Highland N= 60	Midland N=60	Lowland N=60
Lack of awareness	1^{st}	1^{st}	1^{st}
Lack of clean water	3^{rd}	3^{rd}	2^{nd}
Low milk production	2^{nd}	4^{th}	5^{th}
Un improved milk processing equipment	4^{th}	2^{nd}	3^{rd}
Lack of quality based payments	5^{th}	5^{th}	4^{th}

Ranking was based on the frequency of respondents*

4. CONCLUSION

Generally, the microbiological quality of milk collected from the study area were within the acceptable range of Ethiopian unprocessed dairy product but not in acceptable range European dairy standard due low hygienic practice and use of un cleaned material for storage and transportation.

Specific gravity and PH of sample collected from the study area were within normal range of Ethiopian dairy standard except sample collected from market channel. The chemical composition is within the acceptable range of Ethiopian dairy standard but in a range of European. Based on this Proper sanitization, cleaning and proper transportation storage as well as at farmer level should be maintained to ensure that milk is in good quality for consumption.

Recommendations

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