

Hygienic Milk Production, Milk Marketing and Milk Quality Evaluation in Urban and Peri-Urban of Sululta District, Ethiopia.

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Abstract

The study was conducted in Sululta district, Oromia special Zone Surrounding Finfinnee, with the objective of assessing hygienic milk production, marketing system and milk quality evaluation. Raw milk marketing channels producers to Collectors (80%), producers to processors (19%) and producers to consumers (1%), with the average milk price (25) Ethiopia Birr/L during the study was conducted. The overall mean of fat $2.968 \pm 0.27\%$, protein $2.71 \pm 0.149\%$, specific gravity 1.0161 ± 0.0007 , Solid-non-fat 5.91 ± 0.396 , temperature $23.8 \pm 0.97^\circ\text{C}$, added water $23.11 \pm 5.049\%$, freezing points $-0.4027 \pm 0.0364^\circ\text{C}$, titratable acidity 0.151 ± 0.009 and pH 6.293 ± 0.077 and there was significant ($P \leq 0.05$) difference while milk temperature was not significant ($P \leq 0.05$) difference between the two study areas. The overall mean of total bacterial count $7.80 \pm 0.25 \log^{10} \text{cfu/ml}$, Coliforms $5.71 \pm 0.24 \log^{10} \text{cfu/ml}$, Somatic cell $1.10 \pm 0.414 \log^{10} \text{cfu/ml}$ and yeast and mold $4.13 \pm 0.168 \log^{10} \text{cfu/ml}$, there was significant ($P \leq 0.05$) difference milk microbial quality between the two study areas. High bacterial load of milk due to contamination from fecal or other contaminating agents from poor pre-harvesting and post harvesting of milk handling, insufficient udder preparation, use of poor quality and un-boiled water for cleaning utensil. The chemical composition and microbial quality of milk not fulfilling milk quality standards, except titratable acidity and somatic cell count, might be due to milk adulteration, cream separation and neglected hygienic milk production practices etc. Appropriate intervention of concerned technical supportive stakeholders would be essential to overcome prevailing poor hygienic milk production, milk marketing and milk quality problem in general.

Keyword: Organoleptic test, Milk composition, Milk microbiology, Milk quality standard and contaminating agent

INTRODUCTION

Ethiopia is home for 70 million of cattle and 8.1 million camels in which female cattle are about 56% and the remaining 44% are male CSA (2021). Formal and informal milk marketing system were practiced in Ethiopia in of most dairy farmers are prefer to sell their milk through informal chain Girma and Marco Verschuur (2014), it covers 98% and no licensing requirement to

operate, low cost of operations, high producer price compared to formal channel and no regulation of operations whereas; only 2% of the milk produced reached the final consumers through formal chain Van der Valk and Tessema (2010).

The quality of milk produced in Ethiopia is poor and below the standard, due to poor pre-harvesting of milk and post-harvest handling practices Tsadkan and Gurja (2018). Mishandling and disregard of hygienic measures by milk handling personnel may enable undesirable microbes to come into contact with milk and make the milk unsafe for both direct consumption and further processing Chatterjee et al. (2006). Furthermore, high microbial count in milk threatens the health of consumers due to toxic metabolites produced by the organisms growing in it Karmen and Slavica (2008).

MATERIALS AND METHODS

Description of the Study Area

Sululta district lies between 39°30'N Latitude and 38° 30' and 39° 00 E. longitude and located on 40-70 km north west of Finfine. The topography is undulated with altitude 1600 -3318 m.a.s.l. and rainfall bi-modal and ranges from 834 to 1440 mm. The short rainy season is between February and March and the long rainy season is between June and September while the average temperature 13-28 °C.

Sampling Technique and Sample Size

The sample size for collecting quantitative data was determined by using Yemane (1967) simplified formula. $n = \frac{N}{1 + N \left(\frac{e}{100} \right)^2}$ Where; n =designates the sample size the researcher use; N= designates total number of households e =designates maximum variability or margin of error 5 % (0.05) adapted by reviewing various literature); 1=designates the probability of the event occurring. Therefore; $n = \frac{204}{1 + 204(0.05)^2} = 135$. The proportions of sample were determined by the formula of (Kaps & Lamberson, 2004), $n_i = \frac{n}{N} \times N_i$, where; n_i = desired strata, n= total sample size required, N= total number of target population, N_i = population size in each stratum

Table 1: House hold sample design

S/ N	Study area	Sample kebeles'	Total number of HHs*			Sample household**		
			Male	Female	Total	Male	Female	Total
1	Sululta area.	01 kebele	16	4	20	11	3	14
		Nono Mana Abichu	15	4	19	10	3	13
		Qasoo Wasabi	17	3	20	11	2	13
		Wale Lube	18	3	21	12	2	14
		Moye-Gajo	30	9	39	20	6	26
		Chancho-Buba	34	7	41	23	4	27
		Wararso-Malima	33	11	44	21	7	28
		Total	163	41	204	108	27	135

Source: Sululta district Agriculture Office. (2021)

Data Source and Method of Data Collection

The primary data collected from sampled households and key informants using semi-structured questionnaires from 135 sample household and secondary data was obtained from relevant published and unpublished documents. The total of 30 milk Sample was collected from farmer and milk collectors for milk quality evaluation.

PHYSICAL AND CHEMICAL TEST OF RAW MILK

Specific Gravity

Specific gravity was determined by (O'Mahoney, 1988) method. **Specific Graviy** = $\frac{CLR}{1000} + 1$

Titrate Acidity

For the determination of titratable acidity, 10 ml of raw milk sample was pipette into a beaker and three drops of 0.5% phenolphthalein indicator was added into the milk and then titrated with 0.1 sodium hydroxide (NaOH) solution until faint pink color persists. Acidity was expressed as percent lactic acid (O'Connor, 1994) and calculated as: % of Lactic acid = $(\text{ml of 0.1 N NaOH} \times 0.009) / (\text{ml of milk sample used}) \times 100$

Chemical Composition of Milk

Fresh milk sample was analyzed for determination of the major chemical composition and solids-not-fat (SNF), fat, protein and lactose, by using calibrated milk analyzers

Total Bacteria Count (TBC)

It is number of bacteria in a sample that can grow and form countable colonies on Standard Methods Agar after being held at 32°C for 48 and calculated by: $N = \frac{\sum c}{[(1+n1) + (0.1+n2)]d}$ Where

N = number of colonies per ml of milk;

ΣC = 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.

Coli Form Count

The coliform count is the number of colonies in a sample that grow and form distinctive countable colonies on Violet Red Bile Agar after being held at 32°C (90°F) for 24 hours and good quality raw milk CC not exceed 3log10cfu/ml and calculated by. $N = \frac{\sum c}{[(1+n1) + (0.1+n2)]d}$

Yeast and Mold

Plates are typically incubated at 25oC for 5 to 7 days and then examined for the presence of yeast and mould colonies and not exceed than 2log10cfu/ml and calculated by: $N = \frac{\sum c}{[(1+n1) + (0.1+n2)]d}$

Somatic Cell Count (SCC)

After milk staining done the somatic cell count can be determined by direct microscopic examination the numbers of cells/ml of milk and calculated by multiplying the average number of cells per field with Magnifications filed. $SCC = \frac{\text{avg. scoper field}}{0.0346} \times 1000$

Where Avg. scoper field = the average number of somatic cells counted per each field, 0.0346= oil immersion calibrated microscopic eye piece space, 1000 = multiplying factor

Method of Data Analysis

Analysis of variance (ANOVA) procedure of Statistical Package for Social Sciences (SPSS) version 23 was used to analysis date and the result expressed by descriptive statistics, means $\pm$ SE and frequency. The stastical model used to analysis date: $Y_{ij} = \mu + M_i + \epsilon_i$.

RESULTS AND DISCUSSION

Hygiene Milk Production Practice

Hygienic milking practice is presented in Table 10. Households who had separate milking place were (85.2%), whereas; (14.8%) milking in the barn and who were cleaning milking place before and after milking (77.8%) while (22.2%) were not cleaning. This study disagrees with Mitiku et al. (2019) who reported households (83.7%) were not cleaning animal shed and milking place before milking in Haramaya District, Ethiopia. Households in the current study were (96.3%) practice hand milking and (3.7%) using milking machine. Household practiced hand milking was, slightly less than report of Mitiku et al. (2019) who reported all the interviewed household (100%) milking cows using hand milking after either washing cow teats or after the calf suckle the dam to stimulate milk let-down in Haramaya District, Ethiopia. All households were washing hand before milking and also (98.5%) washing udder of the cows before milking.

In current study households who were washing cows' teat, higher than report of Teshome (2013) who reported (72%) of milk producers in Shashemene Town used to wash cows' teats and udder before milking. The present study different from report of Mitiku et al. (2019) who reported household did not regularly wash and clean the udder and teats of cows before milking but only whenever the cow gets contaminated with dung in Meta District of Eastern Hararghe Zone, Ethiopia.

Table 2: Hygiene production practice

		Study location				Overall%
		U(N=54)	%	Pu(N=81)	%	
Clearing milking place	Yes	45	83.3	60	74	78
	No	9	16.3	21	26	22
	Total	54	100	81	100	100
Methods of milking	Machine milking	4	7.4	1	1	3.7
	Hand milking	50	92.6	80	99	96.3
	Total	54	100	81	100	100
Washing hand milking	Yes	54	100	81	100	100
	No	00	00	00	00	00
	Total	54	100	81	100	00
Washing cow's udder	Yes	54	100	79	97	98.5
	No	00	00	2	3	1.5
	Total	54	100	81	100	100
Test for mastitis before milking	Yes	50	93	78	96	94.8
	No	4	7	3	4	5.2
	Total	54	100	81	100	100
Infected milk with mastitis	Fed to calves	46	85	29	36	55.6
	Mix with other	2	4	6	7	5.9
	Discarded	6	11	46	57	38.5
	Total	54	100	81	100	100

Note: U=urban, Pu=peri-urban=sample respondent

Households in the current study test the teats of cows for mastitis investigation and checking fore-milk for sign of mastitis presence (94.8%) while (5.2%) did not checking teat for mastitis infection before milking. This study identified producers that feeding mastitis infected milk to calves (55.6%), discarded infected milk (38.5%) and mixing with other milk for selling (5.9%), respectively. Feeding of infected milk for calves may cause disease to calves that lead the farm to unexpected treatment cost as well as mixing infected with clean milk affects milk quality or milk product quality, exposes the milk and milk products to be rejected

Utensil Used for Milking and Storage and Source of Water

The utensil used for milking, storage and source of water is presented in Table 11. The average sources of water for clearing utensil were potable water (45%), rain water (4%), river water (7%) and any water (44%). Households used plastic materials for milking (89.6%) while the rest used aluminum material (8.1%) and traditional (nonfood grade) material (2.2%), respectively.

The overall utensil used for milking and for milk storage slightly agrees Etifu and Abu Kufa (2019), who reported 94% using the plastic pail for milking and for handling and nearly 6% household were using stainless steel container in selected Districts around Addis Ababa, Ethiopia. However, the current finding does not agree with reports of Asrat et al. (2015) who reported 45% of rural producers used clay pots, (45%) used plastic utensils and the remaining 10% used aluminum utensils for milk handling in and around Boditti, Wolaita Zone, and southern Ethiopia and Mitiku et al. (2019) who report (56.6%), (41.8%) and (1.6%) of milk

producers used plastic pucket, traditional materials (qabe) and stainless steel in Meta district of Eastern Hararghe Zone, Ethiopia. Utensil used for milk storage was food grade plastic containers (77.0%), aluminum container (21.5%) and clay pot (1.5%) and all respondents were wash milk storage container

Table 3: - Utensil used for milking and storage and source of water for washing.

		Study location				Overall%
		U(N=54)	%	P(N=81)	%	
Source of water	Portable water	33	61	28	35	45
	Rain water	3	6	-	-	4
	River water	6	11	6	7	7
	Any water	12	22	47	50	44
	Total	54	100	81	100	100
Milking Utensil	Aluminum utensil	2	3.7	9	11.1	8.1
	Traditional utensil	00	00	3	3.7	2.2
	Plastics utensil	52	96.3	69	85.2	89.6
	Total	54	100	81	100	100
Washing milking utensil	Yes	54	100	80	98.8	99.3
	No	00	00	1	1.2	0.7
	Total	54	100	81	100	100
Milk storage utensil	Clay pot	00	00	2	2.5	1.5
	Plastic storage	50	92.6	54	66.7	77
	Milk can	4	7.4	25	30.9	21.5
	Total	54	100	81	100	100
Washing storage Utensil	Yes	54	100	81	100	100
	No	00	00	00	00	00
	Total	54	100	81	100	100

Note: U=urban, Pu=peri-urban, N=sample respondent

Milk Storage Time and Transportation

Milk storage and transportation time is present in Table 12. In the present study (96.3%) of the interviewed households were proximate to the milk collection center, whereas; (3.7%) far away from collection center to deliver fresh milk on time and obligated to delay milk without cooling facility led the whole milk to spoilage due to bacterial growth at room temperature.

Table 2: Milk storage time and means of transportation of milk.

			Study location				Overall%
			U(N=54)	%	Pu(N=81)	%	
Availability of MCC	Yes		53	98.1	77	95.1	96.3
	No		1	1.9	4	4.9	3.7
	Total		54	100	81	100	100
Distance of MCC	No distance		20	37	17	21	27.4
	1-3 km		32	59.3	52	64.2	62.2
	4-6 km		2	3.7	12	14.8	10.4
	Total		54	100	81	100	100
Milk transport time to market	Before and after hot		49	90.7	80	98.8	95.6
	During hot time in sun		5	9.3	1	1.2	4.4
	Total		54	100	81	100	100
Means of milk transporting	On foot and donkey		12	22.2	59	72.8	52.6
	Bajaj /car		42	78.8	22	27.2	47.4
	Total		54	100	81	100	100
Milk delaying at home	1-3 hours		33	61.1	49	60.5	60.4
	More than 3hours		21	39.9	32	39.5	39.6
	Total		54	100	81	100	100

Note: N=Number of respondents, MCC= milk collection center, U=urban, Peri-urban

The average households of the study area travelled distance to deliver milk market places 1-3km (58%), 0 km distance (24%) and 4-6km (18%), respectively. The overall distance between milk producers and milk marketing place was similar with Etifu and Abu Kufa (2019) who reported nearly 54.9% households were nearby to the market center for their raw milk marketing while about 4% of the households travel more than 10 km in selected districts around Addis Ababa, Ethiopia. Majority of the household's (95.6%) were transporting milk to marketing place before and after hot temperature to protect milk from hot exposure and avoid bacterial growth in milk as the result of hot temperature. The milk transported to selling place on foot (74.8%) while (25.2%) used Bajaj and other means of transportation systems in the study area which was not similar with Duguma (2022) who reported (96.2%) of the milk transported from farm to customers was mainly done on foot in selected towns of Jimma Zone, Oromia Regional State, Ethiopia

Raw Milk Marketing System.

Raw milk marketing system and marketing channels are outlined in Table 13. In the current study all of households were sold milk produced using through milk Collectors (80%), milk processors (19%) and consumers (1%), respectively.

Table 5: Milk marketing channels of the study area

I. Producers →	Collectors 80% →	Processors →	whole seller or retailer →	Consumer
II. Producers →	Processors 19% →	whole seller or retailer →	Consumers	
III. Producers →	Consumers 1%			

Table 3: Raw milk marketing

		Study location				Overall%
		U(N=54)	%	Pu(N=81)	%	
Did you sell milk	Yes	54	100	81	100	100
	No	-	-	-	-	-
For whom did you sell milk?	Total	54	100	81	100	100
	Processors	10	18.5	16	19.8	19
	Collectors	44	81.5	64	79	80
	Consumers	-	-	1	1	1
	Total	54	100	81	100	100
Payment system	Hand to hand	2	3.7	-	-	1.5
	after a week	42	77.8	43	53.1	63
	after two weeks	10	18.5	38	46.9	35.5
	Total	54	100	81	100	100
Refused payment back	Yes	16	29.6	14	17.3	22.2
	No	38	70.4	67	82.7	77.8
	Total	54	100	81	100	100
	Yes	54	100	81	100	100
Had milk market problem	No	-	-	-	-	-
	Total	54	100	81	100	100
	Fasting time	54	100	81	100	100
	Throughout year	-	-	-	-	-
Time of milk market problem	Total	54	100	81	100	100
	Contract sell	34	63	46	56.8	59.3
	Daily sell	8	14.8	16	19.8	17.8
	Contract and daily	12	22.2	19	23.5	23.2
Systems of milk selling	Total	54	100	81	100	100

Note: U=urban, Pu=peri-urban=sample respondent

The current result is contrary to Lemma et al. (2005) who reported that many farmers did not sell fresh milk in Eastern Shoa Zone and Eastern Wollega mainly due to market shortage and cultural restriction. Household of the study area received milk price payment after a week (63%), after two weeks (35.6%) and (1.5%) cash on hand payment. As the result of such like milk price payment system 22.2% households were reported to lose payment since milk collators or processors have refused to pay back price for the milk they took without payment as loan

Physicochemical Properties of Raw Milk

Organoleptic Test:

An organoleptic taste parameter is presented in Fig 6. An organoleptically (43.3%) normal milk, (26.7%) fair, and (30%) rancid. The average of organoleptic test was different between urban and peri-urban Sululta might be due to long storage time at room temperature, improper milking procedure, inappropriate transporting of milk, poor quality equipment and water sources etc. The average of normal organoleptic in current study was lower than the report by

Hailemikaël et al. (2016), Taddese et al. (2020) who reported (69%) and (60%) milk had a normal organoleptic taste in Around Burie Town in case of dairy cooperatives and Abuna Gindeberet district, west Shoa Zone, Oromia, Ethiopia

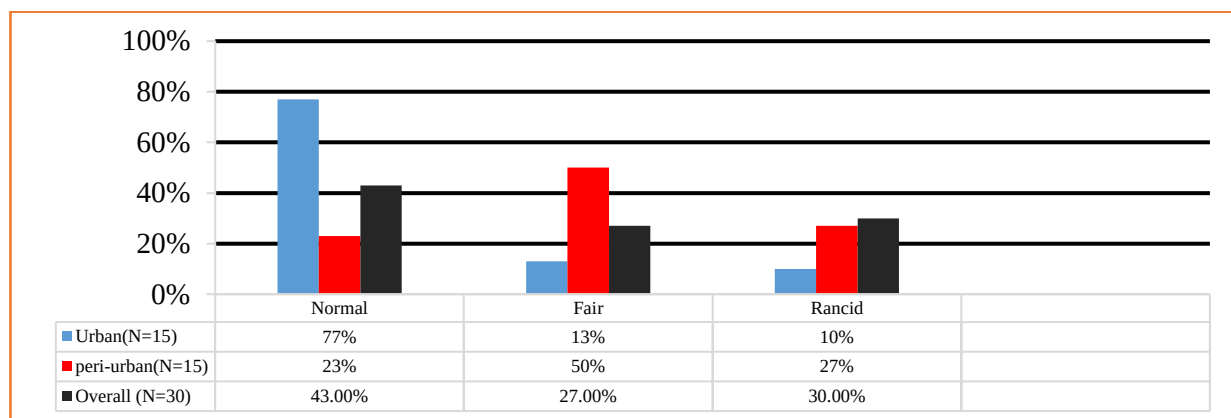


Figure 1: Organoleptic test

Fat Composition of Raw Cow Milk:

Fat composition of raw cow milk is presented in Table 15. The overall mean fat composition of raw cow milk in the present study was $2.968 \pm 0.27\%$. There was significant ($P \leq 0.05$) difference in fat composition between the two study areas in which fat% in Urban was higher than that of Peri-urban Sululta. The present finding of fat content in raw milk was less than Taddese, et al. (2020) who reported milk fat 4.19 ± 0.7 in Abuna Gindeberet District, West Shewa zone of Oromia and also less than Mitiku et al. (2019) who reported 4.60 ± 0.74 in Meta District of Eastern Hararghe Zone. In the present study, fat composition of raw milk was not fulfilling the fresh milk quality standard Tamime (2009) and Quality standard agency of Ethiopia (QSAE, 2009). This might be due to milk producers and collectors in the study area were separate milk cream after milking at their home before the milk is taken to market place or milk collectors arrived at farmer's home.

Protein Composition of Raw Cow Milk:

Protein% composition of raw cow milk is presented in Table 15. The overall mean of the protein content in the present study was $2.71 \pm 0.149\%$. There was significant ($P \leq 0.05$) difference in milk protein content between the two study areas. The current result is less than report by (Taddese et al. (2020) who documented that protein in milk 3.53 ± 0.26 in Abuna Gindeberet district, West Shewa Zone, Oromia, Ethiopia and also less than report of Mitiku et al. (2018) who reported protein in raw milk 3.40 ± 0.068 in Meta district of Eastern Hararghe Zone. Therefore, the value of raw milk protein of the current study was not fulfilling the criteria developed by quality standards authority of Ethiopia (2009), might be due to adulteration of milk with water.

The Specific Gravity of Raw Milk:

The specific gravity of raw milk is presented in Table 15. The overall mean specific gravity of raw milk was 1.0161 ± 0.0007 . There was significant ($P \leq 0.05$) difference between urban and peri-urban Sululta. The current study less was than report by Zerihun and Getenesh (2019)

who reported 1.031 ± 0.004 , 1.030 ± 0.002 , 1.029 ± 0.003 , 1.029 ± 0.001 for milk sample collected from Debrezeit, Selale, Sebeta and welmera around Addis Ababa, Ethiopia, respectively.

Solid- Non-Fat (SNF) Content of Raw Milk:

Solid-non-fat SNF content of raw milk is present in Table 15. The overall mean of Solid- non-fat SNF content of milk for the present study was $5.91 \pm 0.396\%$. There was significant ($P \leq 0.05$) difference in SNF between the two study areas. The present SNF% value was lower than report by Taddese, et al. (2020) and Mitiku et al. (2018) who reported that 9.77 ± 0.58 and 8.23 ± 0.12 in Abuna Gindeberet District, West Shewa Zone of Oromia Region and in Meta district of eastern Hararghe Zone. The current study SNF% was not within the recommended range of EQSA (2009 and 2021) and FAO (2009), might be mainly due to milk adulteration with water in the study areas.

Temperature of Raw Milk:

The temperature of raw milk is presented in Table 15. The overall mean milk temperature of the study area was $23.8 \pm .97$ co, there was no significant ($P \leq 0.05$) difference between the two study areas in raw milk temperature. It was less than report by Debela et al. (2015) and Taddese, et al. (2020) who reported 25.93 ± 0.21 co and 24.43 ± 1.04 co in Yabello districts, Borena Zone Southern Ethiopia and in Abuna Gindeberet district, West Shewa Zone, Oromia.

Adding water to Raw Milk (Adulteration):

Added water to raw milk (adulteration) is presented in Table 15. The overall mean of added water to fresh milk was $23.11 \pm 5.049\%$ and there was significant ($P \leq 0.05$) difference between the two study areas. The current finding was much greater than report by Desalegn (2018) who reported 2.80 ± 3.60 in Bishoftu and Akaki, Ethiopia. However, it was contrasted report of Taddese et al. (2020) who reported zero or no milk adulteration with water in Abuna Gindeberet district, west Shewa zone of Oromia.

The Freezing Point of Raw Milk:

The freezing point of raw milk is presented in Table 15. The overall mean freezing points of raw milk the present study area was -0.4027 ± 0.0364 co and it was significantly ($P \leq 0.05$) different between the study areas. The current study milk freezing point is less than report of Dessaleng (2018) who reported -0.55 ± 0.03 co and Shimelis (2016) who reported -0.541 ± 0.14 co in Addis Ababa, Ethiopia.

The Titratable Acidity of Raw Milk:

The titratable acidity of raw milk is presented in Table 15. The overall mean titratable acidity of raw milk of the study area was 0.151 ± 0.009 and it was significantly ($P \leq 0.05$) different between the two study areas. In the current study, the milk samples collected from the two study areas had a titratable acidity value of less than 0.20 this might be due to better milk market accessibility of producers.

The pH Values of Raw Milk:

The pH values of raw milk are presented in Table 15. The overall mean pH raw milk in the present study was 6.293 ± 0.077 and there was significantly different of pH value ($P \leq 0.05$)

between Urban and Peri-urban Sululta. It was than report of Mitiku (2019), Dessaleng (2018) and Taddese et al. (2020) who reported 6.66 ± 0.26 , 6.66 ± 0.04 , and 6.47 ± 0.42 in Bishoftu and Akaki areas, in Jibat District of West Shewa Zone, Central Ethiopia and in Abuna Gindeberet District, West Shewa Zone Oromia, respectively. The current milk pH value was not in the normal range of milk pH might be due to high bacteria activities increase acidity in rising temperature, added water to milk, improperly cleaned milking and milk storage equipment and unsafe milk transporting system etc.

Table 7: Physicochemical properties of raw cow milk

Parameters	Study Location		Overall Mean $\pm$ SE	P- value
	U(n=15) Mean $\pm$ SE	PU(n=15) Mean $\pm$ SE		
Fat%	3.995 $\pm$.31	1.941 $\pm$.221	2.968 $\pm$.27	0.000
Protein%	3.143 $\pm$.16	2.277 $\pm$.198	2.71 $\pm$.149	0.002
Specific Gravity	1.029 $\pm$.0005	1.003 $\pm$.01241	1.0161 $\pm$.0007	0.049
Solid nonfat%	6.767 $\pm$.496	5.053 $\pm$.546	5.91 $\pm$.396	0.028
Temperature $^{\circ}$ C	24.27 $\pm$ 1.7	23.27 $\pm$.99	23.8 $\pm$.970	0.613
Added water %	9.153 $\pm$ 4.80	37.06 $\pm$ 7.4	23.11 $\pm$ 5.05	0.004
Freezing point $^{\circ}$ C	-0.50 $\pm$.027	-0.3053 $\pm$.0584	-.4027 $\pm$.036	0.005
Titrate acidity	0.17 $\pm$.0107	0.131 $\pm$.0114	0.151 $\pm$.009	0.020
pH	6.58 $\pm$.046	6.01 $\pm$.103	6.293 $\pm$.077	0.000

Note: U= urban, PU=Peri-urban, SE= square error and n= numbers of samples

Milk Microbiology Quality

Total Bacterial Count:

Total bacterial count is present in Table 16. The overall mean of total bacterial count (TBC/ml) in the current study was $7.80 \pm 0.25 \log_{10} \text{cfu/ml}$. It was in Urban Sululta $7.13 \pm 0.221 \log_{10} \text{cfu/ml}$ and Peri-urban Sululta $8.47 \pm 0.374 \log_{10} \text{cfu/ml}$, respectively. There was significant TBC ($P \leq 0.05$) difference between the two study areas. The present result is higher than Tamirat (2018), Azeze and Haji (2015) and Negash et al. (2012) who were report TBC in milk $6.15 \log_{10} \text{cfu/ml}$, $7.03 \pm 0.07 \log_{10} \text{cfu/ml}$ and $7.08 \log_{10} \text{cfu/ml}$ in Addis Ababa, Ethiopia, in Hawassa and Yirgalem areas, Southern Ethiopia and in the Mid-Rift Valley of Ethiopia.

However, the current TBC result was less than Yilma (2010), Bereda et al (2012), Dehinenet et al. (2013), Taddese et al. (2020), Amistu et al. (2015), who were report TBC in raw milk $9.82 \log_{10} \text{cfu/ml}$, $8.0 \pm 0.89 \log_{10} \text{cfu/ml}$, $9.10 \log_{10} \text{cfu/ml}$, $8.13 \pm 0.31 \log_{10} \text{cfu/ml}$ and $8.07 \pm 0.834 \log_{10} \text{cfu/ml}$ of Oromia Regional, Ethiopia, in Abuna Gindeberet District, West Shewa Zone of Oromia Region and from the informal merchant in Sululta, Oromia Special Zone, Ethiopia. The TBC in current study was greater than the minimum milk quality standard value of (EQSA, 2009) which was 2×10^6 . Therefore, it was not fulfilling the minimum milk quality standard of (QSAE) of TBC of fresh milk. This might be due to improper milk storage, adulteration with water, poor quality of milk equipment, milker personal hygiene and poor barn sanitation effect etc.

Coliforms Counts:

Coliform counts are present in Table 16. The Overall mean coliforms count (cfu/ml) of raw milk from milk producers and collectors in both study area was $5.71 \pm 0.241 \log_{10} \text{cfu/ml}$. There was significant ($P \leq 0.05$) difference between the two study areas. The current coliform count was higher than Tesfaye et al. (2015), Asaminew and Eyassu (2011) and Negash et al. (2012) who reported $4.13 \pm 0.76 \log_{10} \text{cfu/ml}$, $4.49 \pm 0.11 \log_{10} \text{cfu/ml}$ and $4.35 \pm 0.06 \log_{10} \text{cfu/ml}$ in Bahir Dar Zuria, Mecha District, Ethiopia and in the Mid-rift Valley of Ethiopia.

However, it was less than report of Taddese, et al. (2020) and Zelalem and Faye (2006) who reported 5.99 ± 0.35 and $6.57 \log_{10} \text{cfu/ml}$ in Abuna Gindeberet District, West Shewa Zone, and Oromia Region and in central highlands of Ethiopia. The current CC is similar Amistu et al. (2015) who reported $5.42 \pm 1.735 \log_{10} \text{cfu/ml}$ to $5.78 \pm 0.985 \log_{10} \text{cfu/ml}$ for milk samples collected from farmer and retailer shop in Sebeta site. The presence of high Coliforms in present milk sample due to contaminated with fecal materials or other contaminating agents that attributed from insufficient peri-milking and udder preparation, poor hand washing of milker and use of poor quality, milk adulteration with water, and using non-boiled water for cleaning of milking utensil etc.

Yeast and Mould:

Yeast and Mould (YM) are presented in Table 16. The overall mean yeast and mold count (Y&M) of raw milk was $4.13 \pm 0.17 \log_{10} \text{cfu/ml}$. It was significantly ($P \leq 0.05$) different between the two study areas. The current study is less than report of Korma et al. (2018) who reported $7.21 \pm 0.21 \log_{10} \text{cfu/ml}$ for milk sample obtained from urban and rural households in Hawassa District, Southern Ethiopia. The current finding was slightly similar with Debela et al. (2015) who reported $4.266 \pm 0.032 \log_{10} \text{cfu/ml}$ in Yabello district, Oromia, Ethiopia. The higher Y&M in the current research might be due to contamination of milk during milking, poor milker hygienic, longer storage of milk in room temperature and poor handling during transportation to market and poor storage system etc

Table 8: Milk microbiology quality.

PARAMETERS	STUDY LOCATION		OVERALL (MEAN $\pm$ SE)	P-VALUE
	U(N=15) (MEAN $\pm$ SE)	PU(N=15) (MEAN $\pm$ SE)		
TBC (LOG ₁₀ CFU/ML)	7.13 $\pm$ 0.221	8.47 $\pm$ 0.374	7.80 $\pm$ 0.245	0.004
CC (LOG ₁₀ CFU/ML)	5.16 $\pm$ 0.316	6.26 $\pm$ 0.314	5.71 $\pm$ 0.241	0.019
Y&M (LOG ₁₀ CFU/ML)	3.67 $\pm$ 0.241	4.58 $\pm$ 0.168	4.13 $\pm$ 0.168	0.004
SCC (LOG ₁₀ CFU/ML)	2.20 $\pm$ 0.73	0.00 $\pm$ 0.000	1.10 $\pm$ 0.414	0.005

Note: U=urban, PU=Peri-urban, TBC=total bacterial count, CC= coli form count, Y&M= yeast and mold, SCC= somatic cell count and colony forming unit

Somatic Cell Count:

The Somatic cell count (SCC) is presented in Table 16. The overall mean of somatic cell count in current study was $1.10 \pm 0.414 \log_{10} \text{cfu/ml}$ and it was significantly different ($P \leq 0.05$) between the two study areas. The difference might be due to high productive dairy breed and big commercial farms were concentrated in urban areas which are exposure to mastitis case more

than peri-urban area. It was less than report by Etifu and Abu Kufa (2019) and Kuffa (2016) who reported $5.1622 \pm 0.07382 \log_{10} \text{cfu/ml}$ and $5.1622 \pm 0.07382 \log_{10} \text{cfu/ml}$ for milk sample from selected Districts around Addis Ababa, Ethiopia and in Sululta and Welmera Weredas, Oromia, Ethiopia, respectively.

CONCLUSION

Low price of milk came from unorganized and legalized milk marketing system that practiced mainly through informal marketing system. The presence of high Coliforms in milk sample due to contaminated with fecal materials or other contaminating agents that attributed from insufficient peri-milking and udder preparation, poor hand washing of milker and use of poor quality and non-boiled water for cleaning utensil etc. Physiochemical and microbiological quality of milk not fulfilling the required national and international standards except titratable acidity and somatic cell count that attributed from adulteration, cream separation and neglected hygienic milk production practices

Recommendation

- Different efforts concerning dairy marketing and milk quality issues should be coordinated to support dairy sector more.
- Milk quality-based payment should be implemented to force and encourage the producers to ward producing quality milk.
- Measurement should be needed to ensure quality milk production at the farmer level through the promotion of good hygienic practices and adequate sanitary measures at all stages of milk production

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