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Physical and chemical quality of raw cow's milk produced and marketed in Shashemene Town, Southern Ethiopia

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The aim of this study was to assess physical and chemical quality of raw cow's milk produced and marketed in Shashemene town, Ethiopia. A total of 48 samples of raw cow's milk were collected in the morning. All of the samples were collected using proportional random sampling method. The means for temperature, pH, specific gravity, titratable acidity, total solids, fat, solids-not-fat, protein, ash and lactose contents of milk samples were $22.83 \pm 1.22^{\circ}\text{C}$, 6.32 ± 0.07 , 1.030 ± 0.000 , $0.194 \pm 0.006\%$, $12.87 \pm 0.11\%$, $4.28 \pm 0.05\%$, $8.59 \pm 0.07\%$, $3.43 \pm 0.00\%$, $0.74 \pm 0.00\%$ and $4.43 \pm 0.06\%$, respectively. Significant differences ($P < 0.05$) were found for the values of temperature, pH, titratable acidity, total solids, fat, protein, ash and lactose contents between the sources of milk samples (dairy cooperative milk collection centers, hotels, small shops and small scale milk producers). Therefore, it was concluded that the chemical composition was adequate as compared to the standard level.

Key words: Chemical quality, physical quality, raw cow milk, Shashemene town.

INTRODUCTION

Milk is used throughout the world as a human food in at least one form or more. Because of its high nutritive value, milk is considered as one of the most important diet items of many people (Mehari, 1988). Nutritionally, milk has been defined as "the most nearly perfect food". The demand of consumers for safe and high quality milk has placed a significant responsibility on dairy producers, retailers and manufacturers to produce and market safe

milk and milk products (Adesiyun et al., 1995; Hahn, 1996; Mennane et al., 2007).

Milk produced at smallholders farm in Ethiopia is marketed without any form of pasteurization or quality control measures. Hygienic control of milk and milk products in Ethiopia is not usually conducted on routine bases. Apart from this, door-to-door raw milk delivery in the urban and peri-urban areas is commonly practiced

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with virtually no quality control at all levels (Godefay and Molla, 2000).

Moreover, most of the studies conducted yet concerning the bacteriological quality of either raw or pasteurized milk were on milk collecting centers and processing plants in Addis Ababa and its vicinity (Alehegne, 2004). However, there is no study conducted on quality of raw milk collected from dairy cooperative milk collection centers, hotels, small shops and small scale milk producers in Shashemene town. In addition, there is no formal quality control system in place to monitor and control the quality of milk produced and sold in the town. Unfortunately, due to unorganized and non regulated marketing system, the safety and quality of milk could not be taken for granted at consumer level. So far, there is no documented information on the safety and quality of raw milk produced and sold in Shashemene town. Therefore, the objective of this study was to assess physical and chemical quality of raw cow's milk produced and marketed in Shashemene town.

MATERIALS AND METHODS

Study area

This study was carried out in Shashemene town, which is located between 7°11'09" to 7°13'19"N latitude and 38°35'02" to 38°37'05"E longitudes. Shashemene town is found in Oromia National Regional State, West Arsi Zone, and located 250 km south of the Addis Ababa, and placed at the road junction of Addis Ababa to Hawasa, Bale and Arba Minch. The town is located at an altitude ranging from 1900 to 1950 m above sea level (masl). Its annual average temperature ranges between 18 and 25°C and has moderate annual rainfall ranging between 800 and 1300 mm (BoFED, 2012).

Research design

The study involved a laboratory-based investigation aimed to assess the quality of raw cow's milk produced and marketed in Shashemene town. A total of 48 samples of raw cow's milk were collected at morning from dairy cooperative milk collection centers, hotels, small shops and small scale milk producers from purposively selected three *Kebeles*.

Sources of data and sampling techniques

Milk samples were collected from the dairy cooperative milk collection centers; hotels, small shops and small scale milk producers. A total of 48 samples of raw cow milk were collected in the morning from four different sampling points namely, dairy cooperative milk collection centers, hotels, small shops and small scale milk producers from purposively selected three *Kebeles*. Five hotels, five small shops milk sellers, five small scale milk producing households and one dairy cooperative milk collection center from those who took part in the interview were selected at each *Kebele*. All the samples were collected using proportional random sampling method.

Samples of morning raw milk were aseptically taken twice at different times (December 2012 to February 2013) from each sampling point in five days interval. During collection, approximately 300 ml raw milk sample was aseptically collected from bulk milk container of producers and sellers and placed into sterile glass bottles. Subsequently, samples were labeled and put into icebox

and immediately transported to the Dairy Technology Laboratory of Hawassa University to analyze physical and chemical quality of raw cow milk. The analysis was performed within two to three hours after sampling.

Physical and chemical quality of raw milk

Temperature and pH

The temperature of the milk samples was determined at the collection point using thermometer while the pH of the milk samples were determined in the laboratory using a digital pH-meter (Hannan 301, Hungary) based on the procedure described by O'Connor (1995).

Specific gravity

Fresh milk sample was filled sufficiently into a glass cylinder (100 ml capacity). Then, lactometer was held by the tip and inserted into the milk. The lactometer was allowed to float freely until it reached equilibrium. Then the lactometer reading at the lower meniscus was recorded. At the same time, thermometer was inserted into the milk sample and the temperature of the milk was recorded (O'Mahony, 1988). The following formula was used to calculate the specific gravity of the milk.

$$\text{Specific gravity} = (L/1000) + 1$$

Where, L = corrected lactometer reading at a given temperature, that is, for every degree above 15.56°C, 0.2 was added to the lactometer reading but for every degree below 15.56°C, 0.2 was subtracted from the lactometer reading (O'Mahony, 1988).

Titrateable acidity of milk

Titrateable acidity of the milk samples was determined according to the method of the Association of Official Analytical Chemists (AOAC, 1990). 9 ml of milk sample was pipetted into a beaker and 3 to 5 drops of 1% phenolphthalein indicator was added to it. The milk sample was then titrated with 0.1 N NaOH solution until a faint pink color persisted. The titrateable acidity, expressed as % lactic acid, was finally calculated using the following formula.

$$\text{Titrateable acidity (\%)} = \frac{N/10 \text{ NaOH (ml)} \times 0.009}{\text{Weight of milk sample}} \times 100$$

Total solids

For the determination of total solids content, fresh cow milk sample was thoroughly mixed and five grams was transferred to a pre-weighed and dried flat bottom crucible (AOAC, 1990). The milk samples were dried in a hot air oven (Model-EDSC made in England) at 102°C for three hours. Finally, the dried samples were taken out of the oven and placed in desiccators to cool at room temperature. Then, samples were weighed again and total solids were calculated by the following formula according to Richardson (1985):

$$\text{Total solids} = \frac{\text{Crucible weight} + \text{Oven dry sample weight} - \text{Crucible weight}}{\text{sample weight}} \times 100$$

Crude protein determination

Total protein content of the milk samples were determined by the Kjeldahl method (AOAC, 1990). For digestion, five grams of milk sample was warmed in a water bath at 38°C and poured into a Kjeldahl flask. 15 g potassium sulphate, 1.0 ml of copper sulphate solution and 25 ml of concentrated sulphuric acid were added into the flask and mixed gently. The digestion was carried out in a digestion block until a clear solution appeared. Then, it was allowed to cool at room temperature.

For distillation, digestion flask was placed in the distillation equipment and then 30 ml of distilled water and 75 ml of 50% sodium hydroxide solution were added into it. Then, ammonia was distilled and 50 ml of 40% boric acid solution using bromocresol green indicator were added until blue color appeared. Finally, the sample was titrated with 0.1 N hydrochloric acid solution from a burette until a faint pink color solution was formed and the burette reading was taken to the nearest 0.01 ml. Blank test was carried out using the above procedure except that water was used instead of test sample. The percentage of nitrogen in the milk samples were calculated as follows:

$$N (\%) = \frac{(V_s - V_b) \text{ HCl consumed} * \text{NHCl} * 1.4007}{\text{sample weight}} \times 100$$

$$CP (\%) = N (\%) \times 6.38$$

Where, N (%): percentage nitrogen by weight; Vs: volume of HCl used for titration of sample; Vb: volume of HCl used for titration of the blank; CP (%): percentage of crude protein.

Determination of fat content of milk

Fat content was determined by Gerber method. Milk sample (11 ml) was mixed with commercial sulfuric acid (10 ml) having a specific gravity of 1.82 dispensed into butyrometer and 1 ml of amyl alcohol was added into the butyrometer having the sulfuric acid and then closed with rubber cork. After closing the butyrometer using a butyrometer stopper, the content was shaken and inverted several times until all the milk samples were digested by the acid. Then, the butyrometer was placed in a water bath at 65°C for five minutes. The sample was centrifuged in Garber centrifuge machine for five minutes at 1100 rpm (Richardson, 1985). Finally, the sample was taken back to the water bath adjusted at 65°C for 5 min and fat percentage was recorded from the butyrometer reading (Richardson, 1985).

Determination of ash content

The ash content of the milk samples was determined gravimetrically. The dried milk samples used for determination of total solids content were ignited in a muffle furnace (Model EF5 made in Holland) at a temperature of 550°C until they were free from carbon (heating continued until black color disappeared or the ash residue appears grayish to white) for four hours, then the samples were transferred to the desiccators to cool down. Finally, the ash content was calculated according to Richardson (1985);

$$\text{Ash} (\%) = \frac{\text{Residue weight}}{\text{Sample weight}} \times 100$$

Determination of solids-not-fat content

The solids-not-fat content of the milk was determined by subtracting

the fat percentage from of total solids percentage (Richardson, 1985).

Determination of lactose content

The lactose content was determined by subtracting the fat, protein and total ash percentages from the percentage of the total solids (O'Mahoney, 1988).

Statistical Analysis

Data on the physical and chemical quality were analyzed using General Linear Model (GLM) procedure of SAS (SAS, 2009). Mean separation was carried out using the least significant difference (LSD) technique when analysis of variance showing significant differences between means and differences were considered significant at $p < 0.05$.

RESULTS AND DISCUSSION

Physical quality of raw cow's milk

The physical properties of raw milk samples collected from dairy cooperative milk collection centers, hotels, small shops and small scale milk producers in Shashemene town are shown in Table 1. The mean temperature of raw milk samples were significantly different ($P < 0.05$) among milk sample sources. On the other hand, there was no marked difference between milk samples collected from dairy cooperative milk collection centers and hotels. The temperature of milk samples collected from small scale milk producers was significantly higher than those of the dairy cooperative milk collection centers, hotels and small shops. This might be due to variations in the milk handling equipment and handling techniques.

In the study area, lack of cooling system and inefficient use of refrigerator in milk sellers increased the temperature of the milk samples in the current study. This could contribute to the increased number of microbial contaminants in the study area. Inadequate cooling will increase bacterial counts by allowing a better environment for bacterial growth during storage (Reinemann et al., 2005).

The pH values of milk samples collected from hotels was significantly lower ($P < 0.05$) than those of dairy cooperative milk collection centers, small shops and small scale milk producers sample (Table 1). The average (\pm SD) pH of milk samples obtained from dairy cooperative milk collection centers (6.17 ± 0.07), hotels (6.07 ± 0.03) and small shops (6.37 ± 0.03) were not within the normal pH range indicating that there were bacterial growths in the milk samples. However, the average pH value of milk samples obtained from small scale milk producers (6.67 ± 0.03) were within the normal pH range of fresh cow milk indicating that the milk were most probably obtained directly from households shortly after milking. Fresh cow milk has a pH value that ranges from 6.6 to 6.8 (O'Connor, 1995; FAO, 1999). The pH values higher than 6.8 indicates mastitis milk and pH

Table 1. Mean values (\pm SD) for physical quality of raw cows' milk obtained from dairy cooperative milk collection centers, hotels, kiosks and small scale milk producers in Shashemene town (n = 48).

| Variables | Milk source | | | | Over all mean |
|-----------------------------|---------------------------------|--------------------------------|--------------------------------|--------------------------------|-------------------|
| | DCMCCs (n = 3) | Hotels (n=15) | Kiosks (n=15) | SSMPs (n=15) | |
| Temperature ($^{\circ}$ C) | 19.67 \pm 0.33 ^c | 20.33 \pm 0.33 ^c | 21.67 \pm 0.33 ^b | 29.67 \pm 0.33 ^a | 22.83 \pm 1.22 |
| pH value | 6.17 \pm 0.07 ^c | 6.07 \pm 0.03 ^c | 6.37 \pm 0.03 ^b | 6.67 \pm 0.03 ^a | 6.32 \pm 0.07 |
| SG | 1.030 \pm 0.001 | 1.029 \pm 0.002 | 1.030 \pm 0.001 | 1.031 \pm 0.001 | 1.030 \pm 0.000 |
| TA (%LA) | 0.203 \pm 0.007 ^{ab} | 0.213 \pm 0.003 ^a | 0.197 \pm 0.003 ^b | 0.163 \pm 0.003 ^c | 0.194 \pm 0.006 |

Means followed by different superscript letters within a row are significantly different ($P < 0.05$), SG = Specific gravity, TA= Titratable acidity, LA = lactic acid, Kiosks = Small shops, DCMCCs = Dairy cooperative milk collection centers, SSMPs = Small scale milk producers, n= number of samples.

values below 6.6 indicates acidity increase of milk due to bacterial multiplication (O'Connor, 1995). Consequently, the low pH of milk collected from dairy cooperative milk collection centers, hotels and small shops might probably be due to the production of acid resulting from bacterial growth and multiplication in the milk samples.

There was no significant difference in milk specific gravity among the dairy cooperative milk collection centers, hotels, small shops and small scale milk producers (Table 1). The specific gravity of normal milk ranges from 1.027 – 1.035 g per ml with a mean value of 1.032 g per ml (Tamime, 2009). In the current study, the result of milk samples collected from four sources falls within the ranges of Tamime (2009) finding. According to O'Connor (1993), the higher value of specific gravity (1.035) indicates skimming off fat whereas the lower value than normal value of specific gravity of milk (1.020) is indicative of addition of water. Similar on-farm result of specific gravity of 1.030 was reported by Zelalem and Ledin (2001). Furthermore, adulteration of milk with water that was usually done in order to increase the quantity of milk lowers milk's specific gravity while addition of solids such as flour or sugar into milk and removing the butterfat increases the specific gravity of milk beyond 1.035 (O'Connor, 1995; Omore et al., 2005).

The mean titratable acidity were significantly different ($P < 0.05$) among milk samples collected from dairy cooperative milk collection centers, hotels, small shops and small scale milk producers (Table 1). On the other hand, there was no marked difference among milk samples collected from dairy cooperative milk collection centers and small shops. In the current study, the milk samples collected from dairy cooperative milk collection centers, hotels and small shops had a titratable acidity value of greater than 0.16% which indicates that the milk samples were kept at room temperature for longer period of time and under poor handling practices until they were sold. On the other hand, the milk samples obtained from small scale milk producers had a titratable acidity value proximate to the range of apparent acidity of normal fresh cow milk.

The production of acid in milk is normally termed "souring" and the sour taste of such milk is due to lactic acid production. The percentage of acid present in milk is a rough indicator of its age and the manner in which it has been handled. Normal fresh milk has an apparent acidity of 0.14 to 0.16% as lactic acid (O'Connor, 1995). The titratable acidity milk obtained from hotels was significantly ($P < 0.05$) higher than that of dairy cooperative milk collection centers, small shops and small scale milk producers (Table 1). This might be due to bacterial growth and multiplication during transportation of milk and longer storage of the milk before sale. Asaminew and Eyassu (2011) reported higher acidity for milk samples collected from individual farmers (0.23 \pm 0.01) and dairy cooperatives (0.28 \pm 0.01% lactic acid) in Bahir Dar Zuria District. Similarly, Zelalem and Faye (2006) reported higher titratable acidity (0.27) for milk samples collected from the dairy shops in Addis Ababa, DebreZeit, Sebeta and Selale, Ethiopia.

Chemical quality of raw cow's milk

In the present study, the data indicate the presence of significant difference ($P < 0.05$) in the total solids (TS) content among milk samples collected from dairy cooperative milk collection centers, hotels, small shops and small scale milk producers. However, there was no marked difference among milk samples collected from hotels and small shops (Table 2). The total solids content of milk samples collected from dairy cooperative milk collection centers was significantly ($P < 0.05$) higher than milk samples obtained from hotels, small shops and small scale milk producers. The average total solids content of milk samples from dairy cooperative milk collection centers was 13.40 \pm 0.06%. This value is greater than the findings of Bille et al. (2009), Mirzadeh et al. (2010) and Teklemichael (2012) who have reported TS of 12.33, 12.57 and 12.580%, respectively. Total solids content of milk collected from hotels, small shops and small scale milk producers averaged between

Table 2. Mean values (\pm SD) for chemical quality of raw cows' milk obtained from dairy cooperative milk collection centers, hotels, kiosks and small scale milk producers in Shashemene town (n = 48).

| Variables (%) | Milk source | | | | |
|---------------|-------------------------------|-------------------------------|--------------------------------|-------------------------------|------------------|
| | DCMCCs (n = 3) | Hotels (n=15) | Kiosks (n=15) | SSMPs (n=15) | Over all mean |
| TS | 13.40 \pm 0.06 ^a | 12.90 \pm 0.21 ^b | 12.67 \pm 0.07 ^{bc} | 12.50 \pm 0.00 ^c | 12.87 \pm 0.11 |
| Fat | 4.50 \pm 0.06 ^a | 4.27 \pm 0.09 ^b | 4.23 \pm 0.03 ^b | 4.10 \pm 0.00 ^b | 4.28 \pm 0.05 |
| SNF | 8.90 \pm 0.00 ^a | 8.63 \pm 0.12 ^b | 8.43 \pm 0.03 ^{bc} | 8.40 \pm 0.00 ^c | 8.59 \pm 0.07 |
| Protein | 3.45 \pm 0.00 ^a | 3.42 \pm 0.00 ^b | 3.42 \pm 0.00 ^b | 3.42 \pm 0.00 ^b | 3.43 \pm 0.00 |
| Ash | 0.76 \pm 0.01 ^a | 0.73 \pm 0.00 ^b | 0.73 \pm 0.00 ^b | 0.72 \pm 0.00 ^b | 0.74 \pm 0.00 |
| Lactose | 4.69 \pm 0.00 ^a | 4.48 \pm 0.11 ^b | 4.28 \pm 0.03 ^c | 4.26 \pm 0.00 ^c | 4.43 \pm 0.06 |

Means followed by different superscript letters within a row are significantly different ($P < 0.05$), TS = Total solid, SNF= solid not-fat, Kiosks = small shops, DCMCCs = dairy cooperative milk collection centers, SSMPs = small scale milk producers, n= number of samples.

12.90 \pm 0.21, 12.67 \pm 0.07, and 12.50 \pm 0.00%, respectively (Table 2). European Union established quality standards for total solids content of cow milk not to be less than 12.5% (FAO/WHO, 2007). Therefore, the average total solid content (12.87%) of milk samples in the present study was within the recommended standards. Different values for total solid content of raw milk samples have been reported by different scholars. The variation could be due to difference in breed, feeding and management practices which have important effects on milk composition and quality (O'Connor, 1995).

The fat content of milk from the dairy cooperative milk collection centers was significantly higher ($P < 0.05$) than the fat content of milk obtained from other sources. This difference might be due to variability among the breeds of cows, within a breed and stage of lactation. However, there was no significant difference ($P > 0.05$) in fat content observed among hotels, small shops and small scale milk producers. The average fat content of milk obtained from dairy cooperative milk collection centers (4.50 \pm 0.06%) was greater than the earlier findings of Mansson et al. (2003), Janštová et al. (2010) and Teklemichael (2012) who reported a fat content of 4.3, 3.79 \pm 0.18 and 3.862 \pm 0.412%, respectively for milk produced in dairy farms. On the other hand, the average fat content of raw cow's milk obtained in this study (4.28 \pm 0.05%) was lower than the earlier finding of Fikrineh et al. (2012) who reported a fat content of 5.48 \pm 0.19% for milk samples collected from households producing local and crossbred cows. According to European Union quality standards for unprocessed whole milk, fat content should not be less than 3.5% (Tamime, 2009). Consequently, the average fat content (4.28 \pm 0.05%) observed from four milk samples were within the recommended standards.

In the current study, the data indicate the presence of significant difference ($P < 0.05$) in the SNF content among milk samples collected from dairy cooperative milk collection centers, hotels, small shops and small scale milk producers. However, there was no marked difference among milk samples collected from small

shops and small scale milk producers (Table 2). The SNF content of milk samples collected from dairy cooperative milk collection centers was significantly ($P < 0.05$) higher than milk samples obtained from hotels, small shops and small scale milk producers.

SNF content of milk from dairy cooperative milk collection centers averaged 8.90 \pm 0.00%. This value is greater than the finding reported by Teklemichael (2012) for milk obtained from dairy farms (8.75 \pm 0.301%) in Dire Dawa town. According to European Union quality standards for unprocessed whole milk, solids-not fat content should not be less than 8.5% (Tamime, 2009). Accordingly, the average SNF content (8.59%) observed for four milk samples were within the recommended standards.

The average SNF content of milk samples obtained in the present study was less than the findings of Bille et al. (2009), Janštová et al. (2010) and Fikrineh et al. (2012) who reported higher value of 8.7, 8.96 and 9.10%, respectively from raw cow's milk samples. Debebe (2010) also reported the minimum (8.3 \pm 0.36%) and maximum (8.7 \pm 0.36%) SNF content of raw cow's milk obtained from street-vendors and milk producers in and around Addis Ababa, respectively. The difference observed in SNF content of milk could be due to difference in the feeding practices, season, milking method and lactation period exerted (Suman et al., 1998).

Significant difference ($P < 0.05$) in protein content was observed among dairy cooperative milk collection centers, hotels, small shops and small scale milk producers. This difference might be due to variability among the breeds of cows, within a breed, feed, and stage of lactation. However, there was no marked difference ($P > 0.05$) among milk samples collected from hotels, small shops and small scale milk producers. Protein content of milk obtained from dairy cooperative milk collection centers, hotels, small shops and small scale milk producers were 3.45 \pm 0.00, 3.42 \pm 0.00, 3.42 \pm 0.00 and 3.42 \pm 0.00, respectively. Protein content of milk obtained from dairy cooperative milk collection centers was significantly higher ($P < 0.05$) than milk

obtained from hotels, small shops and small scale milk producers (Table 2).

The average protein content of raw milk obtained from dairy cooperative milk collection centers was lower than the earlier findings of AbdElrahman et al. (2009) who reported a protein content of 3.48% for milk produced in dairy farms. Correspondingly, Fikrineh et al. (2012) reported higher protein content ($3.46 \pm 0.04\%$) for milk samples collected from households rearing local and crossbred cows. However, Mirzadeh et al. (2010) and Debebe (2010) reported lower protein content of milk $3.2 \pm 0.22\%$ and $3.2 \pm 0.11\%$ in the dairy farms and milk producers, respectively. Similarly, Teklemichael (2012) reported lower protein contents (3.42%) for milk collected from dairy farms in Dire Dawa town compared to the present study. According to European Union quality standards for unprocessed whole milk, total protein content should not be less than 2.9%, (Tamime, 2009). Therefore, the average protein content ($3.43 \pm 0.00\%$) observed from four milk samples were within the recommended standards.

Ash content of raw milk obtained from dairy cooperative milk collection centers, hotels, small shops and small scale milk producers averaged 0.76 ± 0.01 , 0.73 ± 0.00 , 0.73 ± 0.00 and 0.72 ± 0.00 , respectively (Table 2). The ash contents of milk samples collected from dairy cooperative milk collection centers was significantly higher ($P < 0.05$) than milk samples obtained from hotels, small shops and small scale milk producers. The ash content of cow milk remains relatively constant, 0.7 to 0.8% and it is influenced by breed, stage of lactation and feed of the animal (O'Connor, 1995).

Lactose content of milk obtained from dairy cooperative milk collection centers, hotels, small shops and small scale milk producers were 4.69 ± 0.00 , 4.48 ± 0.11 , 4.28 ± 0.03 and $4.26 \pm 0.00\%$, respectively (Table 2). The present study, revealed the presence of significant difference ($P < 0.05$) in the lactose content among milk samples collected from dairy cooperative milk collection centers, hotels, small shops and small scale milk producers. This might be due to the action of lactose hydrolyzing enzymes produced by microorganisms as a result of storage temperature variation. However, there was no marked difference among milk samples collected from small shops and small scale milk producers (Table 2). The lactose content of milk samples collected from dairy cooperative milk collection centers was significantly ($P < 0.05$) higher than milk samples from hotels, small shops and small scale milk producers. According to European Union quality standards for unprocessed whole milk, lactose content should not be less than 4.2% (Tamime, 2009). Therefore, average lactose content ($4.43 \pm 0.06\%$) observed for the four milk samples were within the recommended standards.

According to O'Connor (1995), the composition of milk can vary depending on breed of the animals, interval between milkings, completeness of milking, stage of

lactation, feed of the animal, age and health status of the milking cows. Microbial activities such as degradation of proteins and lipids of milk can also change the composition of milk (O'Connor, 1995).

Conclusions

The physical and chemical qualities of the collected raw cow's milk were within the recommended levels of European Union and FAO established quality standards. These findings may be helpful for the concerned governmental regulatory bodies to monitor the quality of the commercial milk products in the market. It would be a great interest if further investigations are to be carried out to examine other microbial quality and safety of cow milk and milk products. The study will create awareness among community or consumers level in the town of Shashemene.

Conflict of interests

The authors did not declare any conflict of interest.

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