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Original Research

Dairy Cattle Production and Milk Handling Practices under Different Management Systems in Bako-Tibe District, Western Oromia, Ethiopia

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Abstract

The study was conducted in the Bako-Tibe district of West Shoa Zone with the objective to assess dairy production and milk handling practices under varied management systems. A questionnaire survey, key informant interview and focus group discussion were employed. The major sources of feed for cattle in the study area were natural pasture (90.6%), crop residues (8%), and improved forage (1.4%). Natural mating was the main breeding system in the majority (94.7%) of rural and 80.2% of urban dairy production settings. A significant number of milk producers in the peri-urban (55.7%) and rural areas (45.8%) were using plastic containers as milking utensils for storage whereas bottle gourd was a dominant (50%) milk-storage utensil in the rural production system. Generally, the hygienic practice during milk production in the study area was poor and milk-handling practices were traditional and milk is liable to contamination. Limited awareness of hygienic handling of milk, shortage of clean water (index = 0.2), lack of smoking and cleaning plants (index = 0.188), and poor hygienic condition were the major constraints of clean milk production in the study area. The major dairy production constraints in the study areas were lack of grazing land followed by the prevalence of diseases and inadequate supplementary feed. It was concluded that the reproductive and productive performances of both local and crossbred cows were relatively low, and milk handling practices in the study areas were suboptimal. Hence, intensive extension services and awareness creation on hygienic milk production, handling, and utilization are recommended.

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INTRODUCTION

Livestock plays a significant role in the urban, peri-urban, and rural economy of Ethiopia. Ethiopia with its large livestock, 60.39 million cattle, 31.30 million sheep, 32.74 million goats, 2.01 million horses, 0.46 million mules, 8.85 million donkeys, 1.42 million camels, and 60.04 million chickens is highly populous in Africa (CSA, 2018). The development of the dairy sector in Ethiopia is playing a significant role in smallholder income generation, employment, poverty alleviation, and nutrition. According to the reports by Gebreegziabhare (2010), livestock contributes to about 30-40% of the Agricultural Gross Domestic Product (GDP), 16-20% of the national GDP, and 14-16% of foreign exchanges in Ethiopia.

Dairy production in Ethiopia depends mainly on indigenous livestock genetic resources cattle contribute about 80% of the livestock value-added products (FAO, 2019). About 98.59% of the total cattle in the country were indigenous breeds whereas the remaining were hybrid and exotic breeds that accounted for about 1.22% and 0.19%, respectively (CSA, 2018). The average lactation milk yield of indigenous cows ranged between 494-850 kg under optimum management practices and cows usually do not produce their first calves earlier than 35-53 months of age and the average calving interval reported was about two years (Alemayehu and Moges, 2014).

Milk, being a wholesome food with high nutritive value is often prone to early contamination and spoilage if not handled properly. Mishandling and disregard of hygienic measures by milk handling personnel may enable undesirable microbes to come into contact with milk and in some cases to survive and multiply in sufficient numbers and make the milk unsafe for both direct consumption and further processing (Chatterjee *et al.,* 2006). Moreover, poor milk quality reduces the market value of milk causing income losses to producers and traders. Furthermore, high microbial count in milk threatens the health of consumers due to toxic metabolites produced by different organisms growing in it (Karmen and Slavica, 2008). The quality of milk produced in Ethiopia is poor and below the standard which is due to poor pre-milking and post-harvest handling practices and highly perishable characteristics of the milk (Tsadkan and Gurja, 2018). Production of high-quality milk is generally not easy to achieve in developing countries due to factors such as poor hygiene and sanitation during milking, and milk handling, unclean water, high ambient temperatures, lack of cooling facilities, and inadequate infrastructures for milk transportation to the processing facilities (Berg, 1988). No recent studies had been conducted on a dairy production system, hygienic milk production, and tradition of milk handling practices in particular that compares the peri-urban and rural production system in the area. The present study was conducted to assess dairy production and milk handling practices under different management systems in the Bako-Tibe district in western Oromia.

MATERIALS AND METHODS

Description of the Study Areas

Bako Tibe district is located in West Shoa Zone at about 236km West of Addis Ababa on the main road from Addis Ababa to Assosa through Nekemte. The district borders East Wollega in the West, Horro Guduru Wollega in the North, Chaliya District in the East, and Bilo Boshe District (East Wollega zone) in the South. The administrative center of this District is Bako with other small towns including Shoboka and Tibe. The district lies at 9.12^0 latitude and 37.05^0 longitudes with an elevation of 1743 meters above sea level. The annual rainfall of the district ranges between 1000 and 1500 mL and the annual temperature ranges from 13.2^0c to 27.9^0c (Bako-Tibe District Agricultural and Natural Resource Office, 2020, unpublished report)

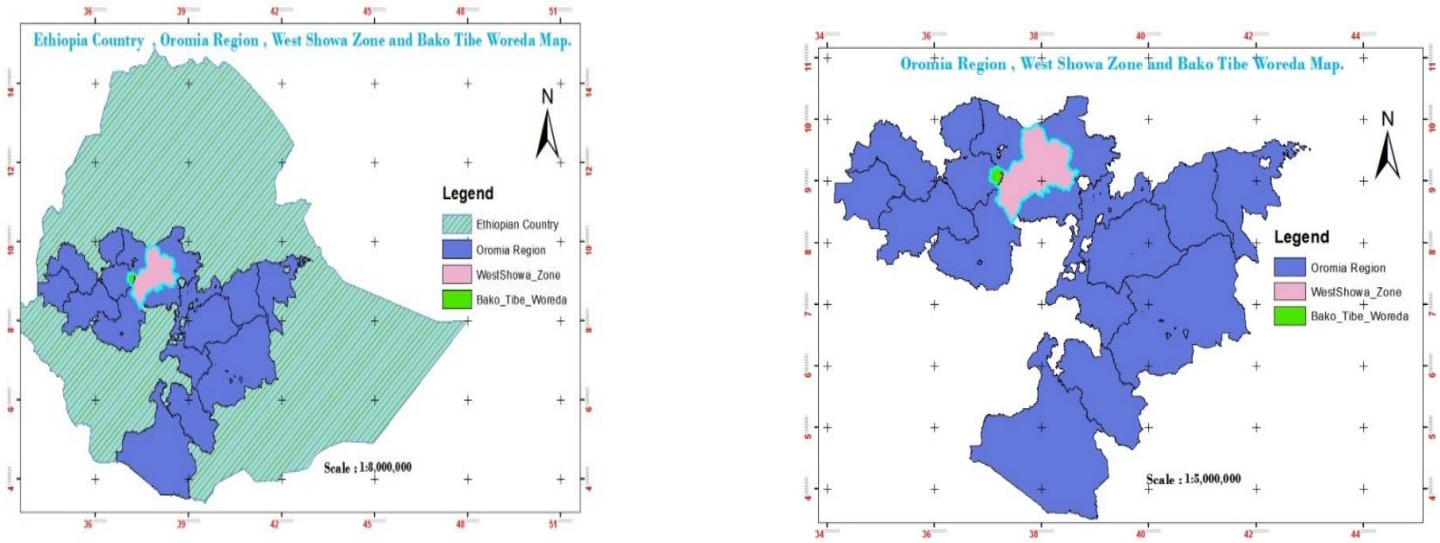

Figure 1: Map of the study area

Data Sampling Method

Bako-Tibe district is selected purposively based on the presence of a relatively large number of cattle, a large number of dairy cattle producers, high demand for milk and milk products, varied ecologic setup, and accessibility. From Bako Tibe district, four potential 'Kebeles' (Kebele is the smallest administrative structure in Ethiopia) were identified and after having livestock population data (cattle) at each kebele in the district, selected kebeles, namely, Bako 01, Barri Abo, Dembi Dima, and Bechera Oda-Gibe were selected purposively based on smallholders' dairy cattle holding potential and viability of dairy production. Individual households owning dairy cows of any breed and size were identified and listed in selected 'Kebeles' and individual dairy-producing households were randomly selected from the list for an interview. The numbers of respondents in each 'kebele' were selected using a proportional sampling approach using Yamane (1967) formula:

$$n = \frac{N}{1+N(e)^2}$$

Where; n = sample size

N = is the total number of population

e = is the degree of accuracy desired (0.05).

Accordingly, from a total of 1020 households rearing lactating cows in four representative 'kebeles', 287 households (97 households from peri-urban with a population size of 298) and (190 households from rural 'kebeles' with a population size of 722) were randomly selected.

The rank Index formula was also employed to set the order of importance of constraints of dairy production according to Musa *et al.* (2006).

The Rank Index was calculated as:

Rank Index= Sum of (7 × number of households ranked first + 6 × Number of households ranked second + ... 1 × Number of households ranked seventh) for individual constraints divided by sum for overall constraints.

Methods of Data Collection

A semi-structured questionnaire was prepared in accordance with the study objectives and translated into the vernacular language of the study area (Afan Oromo). Data were collected on socio-economic characteristics of households, productive performances [lactation length (LL) and lactation milk yield (LMY)], reproductive performances (age at first calving (AFC), days open (DO), and calving interval (CI)] of the local and crossbred cows, major feed resources, housing, breeding system, breed types, and related constraints. Hygienic handling practices during milk production and other related data were also collected.

Data Management and Analysis

The data collected from different sources were coded and entered into a spreadsheet (Microsoft Office Excel 2007) for data cleaning. Descriptive statistical analysis was employed for quantitative data like mean, frequency distributions, and percentages using Statistical Package for Social Sciences (SPSS version 20) software. Descriptive statistics was also employed to summarize reproductive and productive performances, milk handling practices, and hygienic quality of milking equipment. The pair-wise ranking technique was used in the data analysis to identify and prioritize the major constraints related to dairy production.

Statistical Model set: $Yij = \mu + mi + \varepsilon ij$, Where, Yij = Observation of i^{th} production system in j^{th} production area μ = the overall mean, mi = fixed effect of i^{th} (i = peri-urban & Rural production system) εij = the residual error.

RESULTS AND DISCUSSIONS

Sample Household Characteristics

A characteristic of sample households of the study area is presented in Table 1. Among the total interviewed respondents (N=287), the majority (86.4%) of the respondents were male while only about (13.6%) were female. The majority age of the respondents in the study area ranges between 36-45 years (35.2%). The result showed that people in the most productive age were actively engaged in dairy activities. Of the total households interviewed, 88.5% are married. Concerning to level of education, the highest percentage (46.3%) of the respondents had attended primary school and 25.1% of the respondents had not attended any formal or informal education.

Table 1: Characteristics of sampled households in the study are

Attributes and Variables	Peri-Urban		Rural		Total	
	N	%	N	%	N	%
Sex						
Male	79	81.4	169	88.9	248	86.4
Female	18	18.6	21	11.1	39	13.6
Age						
Below 25yrs	7	7.2	10	5.3	17	5.9
25-35yrs	21	21.6	52	27.4	73	25.4
36-45yrs	35	36.1	66	34.7	101	35.2
46-65yrs	30	30.9	51	26.8	81	28.2
Above 66yrs	4	4.1	11	5.8	15	5.2
Marital Status						
Single	1	1.0	7	3.7	8	2.8
Married	86	88.7	168	88.4	254	88.5
Separated/divorced	3	3.1	8	4.2	11	3.8
Widowed	7	7.2	7	3.7	14	4.9
Educational level						
Illiterate	20	20.6	52	27.4	72	25.1
Primary School	33	34	100	52.6	133	46.3
Secondary School	30	30.9	30	15.8	60	20.9
Diploma and above	14	44.4	8	4.2	22	7.7

Cattle Herd Structure

The mean cattle holding and herd structure is presented in (Table 2). The cattle holding per household in the rural production system was significantly ($p < 0.05$) higher than in the peri-urban production system with an overall average cattle herd size of 7.46 ± 3.48 heads per household. As presented in Table 2, the overall mean number of cattle per herd across the rural production system was 7.46 ± 3.48, whereas in the peri-urban area, less mean population (6.56 ± 3.26) was reported. The higher mean and standard deviation number of cattle in the rural production area could be connected to the larger farm sizes occurring within this region and the considerable number of oxen present compared to the peri-urban area. This result in the present study is comparable with the document of Ayenew *et al*. (2008) who reported a larger number of cattle kept by crop-livestock farmers, like in peri-urban and rural areas, than by livestock farmers in an urban area, which might be because of higher demand of working animals and their replacers in rural crop-cultivating households.

The total mean number (2 ± 2.00) of crossbred cattle was lower in the rural production system than those in the peri-urban production system. This is in harmony with the finding in rural Bure by Azage *et al*. (2013) who stated that the proportion of crossbred cattle is very low in rural dairy production systems, better in peri-urban and higher in urban dairy production systems. The variation may arise from higher demand for higher milk-producing crossbred cattle in the peri-urban areas, whereas the preferences of rural households for local breeds are more resistant to disease and more tolerant to feed and water shortage

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Table 2: The mean cattle herd structure of sampled households in the two production systems

Cattle breed and type	Rural		Peri-urban		Overall		P-Value
	N	Mean ±SD	N	Mean ± SD	N	Mean ±SD	
Total Herd Size	190	7.46 ±3.48	97	6.56 ± 3.26	287	7.16 ± 3.43	0.036
Number of Local cattle	190	7.36 ± 3.43	91	6.08 ± 2.92	281	6.95 ± 3.32	0.002
Male calves	140	1.24 ± 0.55	53	1.13 ± 0.34	193	1.21 ± 0.50	0.171
Female calves	132	1.21 ± 0.46	61	1.11 ± 0.32	193	1.18 ± 0.42	0.139
Heifers	81	1.35 ± 0.59	51	1.31 ± 0.61	132	1.33 ± 0.60	0.767
Bulls	84	1.4 ± 0.69	42	1.36 ± 0.53	126	1.39 ± 0.64	0.698
Oxen	137	2.23 ± 1.17	44	1.89 ± 1.38	181	2.14 ± 1.23	0.111
Cows	190	2.8 ± 1.13	91	2.46 ± 0.99	281	2.69 ± 1.09	0.015
No. of Crossbred	9	2 ± 2.00	17	4.59 ± 2.03	26	3.69 ± 2.34	0.005
Male calves	5	1 ± 0.00	13	1.23 ± 0.44	18	1.17 ± 0.38	0.265
Female calves	3	1 ± 0.00	14	1 ± 0.00	17	1 ± 0.00	-
Heifers	4	1 ± 0.00	7	1 ± 0.00	11	1 ± 0.00	-
Bulls	-	-	3	1 ± 0.00	3	1 ± 0.00	-
Oxen	-	-	-	-	-	-	-
Cows	2	-	15	-	17	-	0.453

Dairy Cows' Reproductive Performance

The mean reproductive performance of dairy cows in the study area is presented in Table 3. The study revealed that the overall mean age at first service (AFS) for local and crossbred heifers in the study areas was 45.90 ± 7.04 and 35.34 ± 6.36 months, respectively. The mean age at first calving (AFC) for local and crossbred cows was 55.22 ± 7.1 and 44.38 ± 6.49 months, respectively. This shows local cows in the study area took about ten more years to reach the age of first service and calving implying lower productive time with possible higher costs of keeping them in the stock. The mean age at first calving in this

study was found insignificant (p >0.05) variation between the local breed and their crosses in both production systems. However, the result of this study for local cows was higher than the value (50.59 ± 6.94) reported by Belay *et al*. (2012b) in *Dandi* District of West Shoa Zone and the value (53.52 ± 7.68 months) reported by Adebebay (2009) in *Bure* district of Amahara region. The mean AFC obtained for a local heifer in the present result is in agreement with the report by Ulfina *et al.* (2004) who documented a range of 40 ± 2 to 59 ± 2 months of AFC for heifers of Horro breed maintained under different feeding management at *Bako* Agricultural research center.

The overall mean caving interval (CI) for both local and crossbred cows in the study districts were 22.10 ± 5.12 and 19.33 ± 3.28 months, respectively. The current finding was slightly similar to the finding of Belay *et al*. (2012a) who reported 22.19 ± 7.73 months for the calving interval of local cows in Dandi district of West Shoa Zone. The result from the study areas for local breeds was less than that of Mulugeta and Belayneh (2013) who reported 24.94 months for the indigenous breed in North Shoa Zone of the Oromia regional state. Similarly, the reported average calving interval for the local breed in the study areas was shorter than (25 months) the findings reported by Mukassa-Mugrewa *et al*. (1989) in Zebu cattle, but longer than the value (14.63 months) reported for the Boran breed (Million and Tadelle, 2003). The mean calving interval reported from the study areas for crossbred cows was greater than the findings of Bekele *et al*. (1991) who reported an average CI of 15.83 months for smallholder crossbred dairy cows in the central highland of Ethiopia. Short calving intervals in the study areas might be an indication of better management practices regarding nutrition in terms of quality and quantity and better heat detection.

The overall mean lactation lengths for local and crossbred cows were 8.13 ± 1.61 and 9.6 ± 0.66 months, respectively (Table 3). Kedija *et al*. (2008) and Adebebay (2009) also reported almost similar results (7 months for local cows and 9 months for cross cows) at the Meiso district of Eastern Ethiopia and the *Bure* district of Northwestern Ethiopia, respectively. However, the lactation length for local cows observed in the current result was almost similar to the national average lactation length (7 months) (CSA, 2005), whereas the overall mean lactation length in crossbred cows observed in the current study was shorter than the lactation length (11.7 months) reported for crossbred cows in the central highland of Ethiopia (Zelalem and Ledin, 2001). This variation might be associated with different husbandry practices in terms of nutrition and other management in the study areas as well as breed type used.

Table 3: The mean across the production systems in the study area

Parameters	Variables	Rural Mean ± S.D	Peri-Urban Mean ± S.D	Overall Mean ± S.D	P-Value
AFS	Local	46.29 ± 6.82	45.04 ± 7.5	45.90 ± 7.04	.180
	Cross	35.5 ± 0.707	35.07 ± 6.87	35.13 ± 6.36	.934
AFC	Local	55.55 ± 6.87	54.5 ± 7.6	55.22 ± 7.1	.265
	Cross	44.5 ± 6.87	44.34 ± 7.01	44.38 ± 6.49	.980
CI	Local	22.02 ± 5.08	22.28 ± 5.24	22.10 ± 5.12	.695
	Cross	20.5 ± 0.70	18.61± 2.9	18.86 ± 2.77	.391
LL	Local	8.04 ± 1.64	8.33 ± 1.52	8.13 ± 1.61	.170
	Cross	9.25 ± 0.35	9.65 ± 0.68	9.6 ± 0.66	.441
NSPC	Local	1.9 ± 0.52	1.81 ± 0.48	1.87 ± 0.48	.173
	Cross	1.8 ± 0.28	1.74 ± 0.57	1.75 ± 0.53	.900
DO	Local	234.41 ± 52.62	228.57 ± 60.47	232.61 ± 55.11	.420
	Cross	105 ± 21.21	98.76 ± 13.49	99.6 ± 13.89	.574

AFS= Aga at first service (months), AFC= Age at first calving (months), CI= Calving interval (months), LL= Lactation length (months), NSPC= Number of service per conception, DO= Days Open (days), S.D= Standard deviation

The overall mean values of NSC for the study areas for the local and crossbred dairy cows were 1.87 ± 0.48 and 1.75 ± 0.53, respectively. The mean value of NSC 1.87 documented for local breed cows in the present study is closer to the 1.79 reported by Habtamu *et al*. (2010) for Jersey cows and is slightly higher than the mean NSPC 1.56 reported for Friesian x Zebu crosses, by Belay *et al*. (2012b) and the mean NSPC 1.52 reported by Hunduma (2012) for crossbred cattle.

The average days open (DO) for local and crossbred cows were 232.61 ± 55.11 and 99.6 ± 13.89 days, respectively. The current result of DO for local cows was lower than 340.3 days for Boran cows at the *Tatessa* cattle breeding center reported by Yifat *et al*. (2012). This variation might be attributed to the differences in breed and climates of the study areas.

Daily Milk Yield in the Production System

The mean Daily milk (litter/day/cow) yield of local and crossbred cows in the production system is presented in Table 7. The overall mean milk yield per cow per day for local and crossbred cows was 1.69 ± 0.54 and 6.97 ± 0.64, respectively (Table 4). The study revealed also that the average milk yield of

local cows in rural and peri-urban production systems was not significantly different. The current result is in line with the findings of Mulugeta and Belayneh (2013) who documented 1.67 liters per cow per day milk yield for the local cows in '*Chacha'* town and nearby 'kebeles' of North Shoa zone, Amhara region. However, the mean milk yield per day per cow for local and crossbred cows in the study district was lower than the mean milk yield per cow per day 1.82 and 8 liters reported for local and crossbred cows respectively, by Adebebay (2009) & in West *Gojam* Zone, Bure district and Belay *et al*. (2012) who stated 1.76 ± 0.89 liters for local cows in West Shoa Zone, *Dandi* district. Generally, the overall average milk yield per cow per day of local cows in the study areas is in the range of the average national milk standard of 1.3-1.54 liters reported for local cows by Land O'Lakes (2010). However, in the case of crossbred cows, great differences were observed when compared with the results of different authors. This might be associated with different husbandry practices in terms of poor nutrition and management in the study areas.

Table 4: The mean Daily milk yield (litter/day/cow) of local and crossbred cows across the production system

Breed	Mean + SD of daily milk yield in litters			P - V a l u e
	Rural	Peri-urban	Total	
Local	1.67 ± 0.54	1.76 ± 0.54	1.69 ± 0.54	0.302
Crossbred	6.66 ± 0.707	7.02 ± 0.64	6.97 ± 0.64	0.477

Milk production evaluated against the stage of lactation of cows.

The average milk yield for local and crossbred cows is indicated in **Table 5.** Accordingly, the average milk yield of local as well as crossbred cows at all lactation stages did not differ significantly (p>0.05) in both production systems.

Table 5: The mean lactation performance of local and crossbred cows in the two production systems

Breed type	Stage of lactation	Rural (N = 190) Mean ± S.D	Peri-urban (N=97) Mean ± S.D	P-Value
Local	Beginning	1.98 ± 0.47	2.08 ± 0.56	0.484
	Mid	1.67 ± 0.47	1.73 ± 0.68	0.323
	Late	1.37 ± 0.46	1.39 ± 0.68	0.828
	Mean	1.66 ± 0.46	1.73 ± 0.48	0.477
Cross	Beginning	8.00 ± 0.71	8.34 ± 0.63	0.167
	Mid	6.5 ± 0.71	7.12 ± 0.79	0.298
	Late	5.5 ± 0.71	5.6 ± 0.68	0.679
	Mean	6.66 ± 0.71	7.02 ± 0.64	0.302

Handling practices during milking, milk processing and storage

Hygienic handling practices of milk

Types of housing and barn cleaning frequency of the study area is presented in Table 6. Majority (80.8%) of the farmers in the study areas were using house type barns for their cows and milking was undertaken in the house. Zelalem (2010) reported a similar result where about 80.4% of the respondents in the central highlands of Ethiopia were using house-type barns. Godfery (2013) reported the advantage of milking cows in housed barns that farmers milking in open air may expose their milk to contaminants entering from the surrounding environment. Mbabazi (2005) also confirmed the report farmers milked their animals from undesignated poorly maintained milking shades/parlors predisposing milk to contamination and spoilage. Maintaining the sanitary condition of the milking area is an important prerequisite for clean milk production (Zelalem, 2010). Most (65%) of the respondents were removing manure daily while about 21% of them were removing only weekly in a peri-urban production system. Whereas 44.2% of the respondents were removing manure daily while about 32.1% of them were removing only weekly. Abebe *et al.* (2012) reported different results about 47% of the respondents cleaning their barn three times a week in Gurage Zone, Ezha district.

Table 6: Types of housing and barn cleaning frequency of the study area

Variables	Rural (N=190)		Peri-Urban (N=97)		Total (N=287)	
	N	%	N	%	N	%
Type of housing						
Housed	146	76.8	86	88.7	232	80.8
Fenced	41	21.6	11	11.3	52	18.1
No barn	3	1.6	-	-	3	1
Barn cleaning frequency						
Daily	84	44.2	65	67	149	51.9
Weekly	61	32.1	21	21.6	82	28.6
Monthly	1	0.5	-	-	1	0.3
No clean	44	23.2	11	11.3	55	19.2

Hygienic milk storage and utensils

Hygienic milking and utensil handling practices are presented in Table 7. The study revealed that smoking and washing milking utensils were reported normal practices in the study area. As indicated in Table 7, all (100%) of respondents were performing both washing and smoking as cleaning methods

Table 7: Hygienic practice of milking and storage utensils in the study are

Variables	Rural (N=190)		Peri-Urban (N=97)		Total (N=287)	
	N	%	N	%	N	%
Only washing	-	-	-	-	-	-
Both washing and smoking	190	100	97	100	287	100
Purpose of smoking						
Good flavored and aroma	117	61.6	67	69.1	184	64.1
Increase shelf life	59	31.1	23	23.7	82	28.6
Facilitate fermentation	14	7.4	7	7.2	21	7.3
Inhibit bacterial growth	0	0	0	0	0	0

Smoking milking utensils had its purpose in the study area. According to the result, all milk producers in rural and peri-urban areas practiced smoking of milking and milk storage utensils to add good flavor and aroma (64.1%), increase the shelf life (28.6%), facilitate fermentation (7.3%).

Wood plants and herbs used for smoking and cleaning milking utensils

Different herbs and **wood** plants used for smoking and cleaning milk-handling utensils in the study area are presented in Table 8. The current study indicated that the highest proportion of dairy producers in both production systems are smoking milking and milk storage utensils by using locally available plants in order to produce milk with good flavor and aroma since such types of flavored milk are highly liked by milk consumers. In line with the present study, the major reasons outlined by the households for smoking dairy product equipment are to improve the taste and/or flavor of the milk products and to extend the shelf life (Kassahun,. 2013). *Debeka* (*Deinbollia kilimandsharica*) (55.7%) followed by *Ejersa* (*Olea africana*) (24%) and other smoking plants *Cheka* (*Capurnea aurea)* (20.2%) were also used for smoking milking and milk storage equipment. The most common herbs used for cleaning and washing milking and milk storing equipment are *Kusaye (Lantana trifolia)* (66.9%) and *Keifo* (21.6%) in the study area.

Smoking of milk and milk handling equipment is a common practice in many parts of Ethiopia and milk vessels are usually smoked using wood splinters of "*Weyira*" (*Olea africana)* to bring a desirable aroma to the milk. Smoking was also found to lower the microbial load of raw milk (Mogessie and Fekadu, 1993; Almaz *et al*., 2001). According to Hellen and Eyassu (2007), low acid production was observed in milk samples stored in smoked containers as compared to the non-smoked containers at 7hrs and 24hrs intervals of storage time. These authors also reported low coliform count in milk samples kept in smoked containers as compared to that of the control at 7hrs of storage time

Table 8: Plants used for smoking and cleaning of milk handling utensils in the study area

Vernacular Name (Afan Oromo)	Scientific Name	Production System					
		Rural		Peri-urban		Overall	
		N	%	N	%	N	%
Plants used for smoking							
Debeka	*Deinbollia kilimandsharica*	106	55.8	54	55.7	160	55.7
Cheeka	*Capurnea aurea*	49	25.8	20	20.6	69	24
Ejersa	*Olea Africana*	35	18.4	23	23.7	58	20.2
Herbage plants used to wash/rub milk utensils							
Kusaye	*Lantana trifolia*	126	66.3	66	68	192	66.9
Tejsar	unidentified	22	11.6	11	11.3	33	11.5
Kefo	Unidentified	42	22.1	20	20.6	62	21.6

Constraints of Dairy Production in the Study Area

Major constraints associated with dairy production in the Bako-Tibe district are presented in Table 9. The present study revealed that shortage of grazing land (indexed-0.223), prevalence of disease (indexed-0.202), and inadequate supplementary feeds (indexed-0.184) were the major constraints of dairy production in the study area (Table 9). The production constraints documented in the present study are comparable with the findings of Haftu (2015) who reported a shortage in availability and high costs of feed as major constraints in Hossana town, in southern Ethiopia. Shortage of feed was also reported major constraint to milk production, age at first calving, and calving interval in crossbred dairy cows in Jimma town, Oromia State, Ethiopia by Belay *et al.* (2012) in line with the current study. Yilma *et al* (2011) in agreement with the present study reported inadequate animal feed resources as one of the important challenges of the Ethiopian dairy sector.

Table 9: Constraints associated with dairy production in the study area

Constraints	Rank							Score	Index	Rank
	1st	2nd	3rd	4th	5th	6th	7th			
Lack of grazing land	132	116	26	8	5	0	0	1797	0.223	1
Prevalence of disease	82	88	80	23	11	0	3	1630	0.202	2
Inadequate supplementary feed	61	48	75	86	16	0	2	1484	0.184	3
Space limitation for dairying	6	10	66	102	82	10	41	1147	0.142	4
Improved dairy cattle procurement	4	9	5	31	26	153	59	674	0.084	6
Lack of AI/breeding service	0	10	5	25	122	120	5	791	0.098	5
Extended dry season	2	6	12	12	25	54	177	518	0.064	7

. Rank Index= Sum of (7 × number of households ranked first + 6 × Number of households ranked second + ...1 × Number of households ranked seventh) for individual constraints divided by sum for overall constraints

CONCLUSIONS

Significant difference in production and reproduction performance between the two production systems and the dairy cattle breeds was recorded. The inferior reproductive and productive performances of local dairy cows and rural production systems in comparison to the peri-urban production system might be attributed to genetic performance and poor management. In both production systems, it was identified that the main constraints for dairy production were a shortage of feed and grazing land, livestock disease prevalence and lack of improved dairy cattle breeds, and insufficient AI and veterinary services. The hygienic practice during milking was poor and milk handling practices also prone the milk product to contamination.

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