Appraisal of Milk Production, Processing and Marketing In Selected Urban and Peri- Urban Dairy Production Systems of Northwestern Ethiopia

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Abstract
An assessment on cow milk production, processing and marketing systems was conducted in urban and peri-urban production in Bahir Dar and Mecha districts, Northwestern Ethiopia. Purposive sampling technique was employed to select representative study sites called *kebeles* (lower level administrative units) in both urban and peri-urban production areas. A total of 264 households heads were selected by using systematic random sampling techniques. Questionnaire survey, focus group discussion and key informants' interview were employed to collect primary data. To complement the survey based information, 24 households (12 in each production system) who had lactating cows were voluntarily selected and a follow up study was conducted for a month. The result indicated that the average cattle herd size of households was 8 heads per household, with no significant variations between urban and peri-urban production areas. The number of female calves were found > male calves 1.54 (0.95%) and 1.27 (0.83%) in urban and peri-urban production systems, respectively. The cattle breeding systems used by both production systems were AI (artificial insemination) (58%), natural meting (15.5%) and both (26.5%). The dairy cattle breeds used for milk production in both production systems were cross bred cows (56.1%), local breed cows (18.9%) and both local and cross bred cows (25%). Major feed resources used by the households were crop residues, hay, and industrial by products, natural grazing and concentrate feeds. Water sources for animals in both production systems were river; hand dug well and pipe sources. Average milk production per cow per day for local breed and crossbred cows were 2.76 and 9.02 liter with the mean lactation length of 9.49 and 8.36 months, respectively. In the urban production system 1.5% milk was processed for marketing and 89.4% in peri-urban production system were processed for marketing. With regard to marketing of milk and milk products, both formal and informal marketing systems were existed in the production systems. The dairy production in the study areas was constrained mainly by shortage of land, price fluctuation, disease, high feed price. To mitigate the above problems the government and non-governmental organizations should give a higher priority for the development.

Keywords: Dairy, marketing, processing, urban, peri-urban.

1. Introduction

Ethiopia has the largest livestock population in Africa and the contribution of livestock and livestock products to the agricultural economy is significant. Recent figures indicate that the livestock sector contributes about 12-16% of national GDP, 30-35% of agricultural GDP, 15% of export earnings and 30% of agricultural employment. Livestock contribute to the

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livelihoods of 60-70% of the population [1]. The country was reported to have approximately 58 million cattle [2], the female constituting about 32,024,087 (55.38%) and males 25,805,866 (44.62%). Out of which indigenous cattle were 57,013, 427 (98.6%), hybrid 706,794 (1.22%) and exotic breeds 109,733 (0.18%). Dairy production is an important component of livestock farming in Ethiopia. The increasing demand for dairy products in urban and peri-urban areas, long-standing culture of dairy products consumption, and favorable policy are indicators of the importance and potential of dairying in the country.

The Ethiopian central statistical agency [2] estimated that 3.06 billion liters of cow milk was produced in the year. However, many of the processing plants attain volumes that are significantly below their capacity. Many say that "there is more demand than we can supply", although some farmers perceive that there is a lack of demand which prevents them from expanding production and that their cost price is higher than the market price perceptions differ [1]. In order to improve the production, and quality of milk and milk products, it is important to know the information on the milk production, processing, handling and marketing system of all the dairy products produced in the different production systems of the country and understands their traditional and improved processing steps. The traditional handling, processing and utilization of milk in the study area [3], highland and central rift valley [4], have been assessed and reported. However, there is lack of information about the current status of dairy cow production, milk processing and marketing systems in different districts. Nevertheless, understanding the production, processing handling and marketing system in urban and peri-urban production systems are essential to design relevant milk development strategy in the area, that will result in improve quality milk and milk products production, handling and processing practices and market system. Therefore, the overall aim of this study is to contribute in filling the information gap by investigating milk production, handling, processing and marketing systems in urban and peri-urban dairy production systems of Bahir Dar and Mecha districts.

2. Materials and Methods

Description of the Study Areas

The study was conducted at Bahir Dar and Mecha urban and peri-urban dairy production systems, of Bahir Dar district and Mecha districts of Amhara region. Bahir Dar town is located in north western part of Ethiopia, in Amhara National Regional State, at a distance of 565 km from Addis Ababa (Figure 1) The city is situated an altitude of 1801 meter above sea level and has area coverage of 42,160 hectare (ha). The area receives an average rainfall 1,224 mm and the minimum daily temperature 10.3^{o}C maximum 26.3^{o}C. Bahir Dar city divided in twelve urban kebeles and eight rural kebeles with a total human population of male 154,539 female 171,624 total 326,163 (Source Bahir Dar town administration finance and economy office, personal communication). Mecha is one of the districts in the west Gojjam administrative zone in the Amhara region. The district is bordered by Yilmana Densa district to the East, South Achefer district to the West, Bahir Dar Zuria district to the North and Sekela district to the South. The two agro climatic zones in the district are a high land that covers 20% of the area and the remaining 80% consists of moderate temperate. About 92% of the district's economy is dependent on Agriculture. Mecha district 75% percent of the study area is gently sloping, 13% is moderately sloping and 8% mountainous while, 4% consists of valley soils [5].

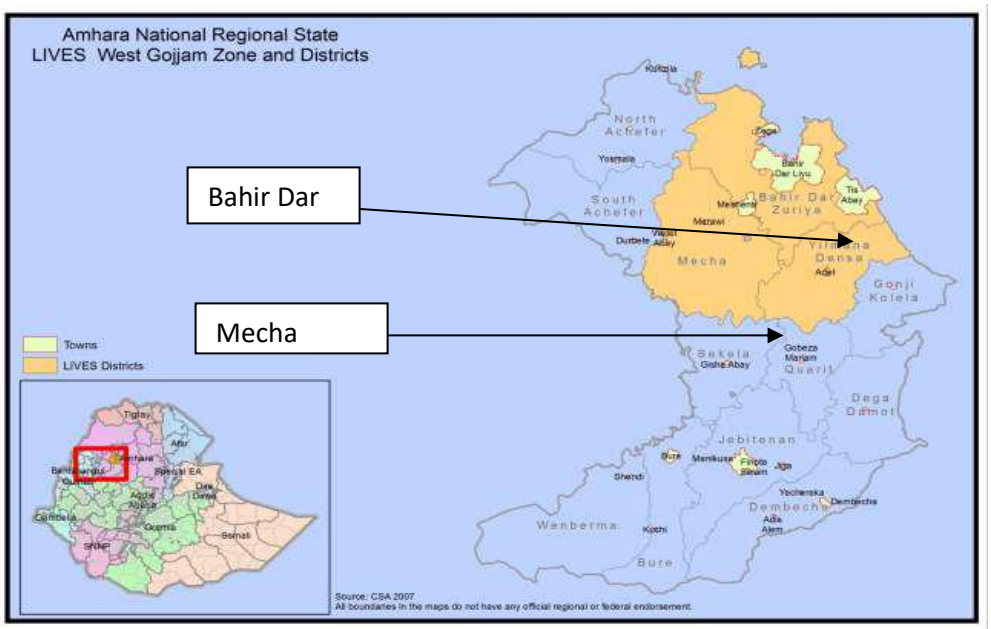

Figure 1. Map of the study areas

Data collection and analysis

Both purposive and random sampling techniques were employed as a representative for the whole sample framework. Based on the availability of production potential, access to market, cooperative organizations and infra structures two urban areas 100% and 6 peri- urban PAs (30%) from the total were selected in purposive sampling technique. The sample was proportionally distributed for two urban production system and six kebeles in peri-urban production system in the study areas. Based on the sampling formula 33 households from each kebele were selected in simple random sampling techniques from a list of registered dairy producers. A total of eight focus group discussion in each kebele with 7-12 members was held. Six milk and milk product processors based at Bahir Dar and seven primary dairy cooperatives out of which one from Mecha was used for key informant discussions. Moreover, livestock and fishery offices in the study areas were used for key informant discussions. The formula used to determine the sample size was indicated below.

$n = N/1+(N)e^2$

$1 + (N)e^2$

Where, "N" is total population, "e" is error ,"n" is sample size [6]

To assess the status of dairy cattle production under on farm condition, 24 households were voluntarily selected (12 from urban) and (12 from peri-urban) production systems were monitored for a month. The data was collected to complement the survey result in both urban and peri-urban production systems in the study areas. Data obtained were entered into Microsoft excel spreadsheet and analyzed by using (SPSS version 23). Descriptive statistics such as means, frequency, and percentage were used to summarize the data. One-way ANOVA was also used to analyze the quantitative data.

3. Result and Discussion

Socio Economics Characteristics

According to the current study, out of the total interviewed dairy cattle producers in the urban dairy production system (N =66) 86.4 % were male head and 13.6 were female headed households. Whereas, in the peri urban dairy production system (N=198) 97.5 % were male headed and 2. 5% were female headed households (Table 1). More female households were observed in urban production system than peri-urban production system may be due to the presence of better market for milk and milk

products in the urban production system. Generally dairy production is the very important option for female households to improve and sustain their livelihoods. The current study is directly similar with that of [4], who reported 86.7 and 13.3% male and female headed households in the highlands and central rift valley of Ethiopia. However, the current result is smaller than [7], who reported 77.78% and 22.22 male and female households in urban and peri-urban areas of Dangila district.

According to the current study, different categories of educational status were observed. Comparing the educational status of households proportionally there were more unable to read & write in peri-urban production system (25.8%) than in urban (18.2%). There were more read and write households in peri-urban production system (45.1%) than in urban (36.4%). proportionally almost equal percent of elementary school completed households found (19.7% and 18.6%) in urban and peri-urban production systems observed. However, more junior school completed households (25.8%) were found in urban production system than peri-urban (8.3%). Only in peri-urban production system that households completed high school and above 3% were recorded (Table 1).

The result indicated that proportionally households in the urban production system are better educated than peri-urban production system. However, the households in both production systems are mainly educated (above read and write) which is mandatory to easy understand trainings; refer manuals and adopt technologies, to accept and implement new ideas and technologies regarding to dairy production and to share experience between producers. The households in the current study were proportionally educated than[8], who reported 73.6 and 64% illiterates in trans-human and sedentary production system in Enderta district. Better educated households were reported by[9], in Jimma urban dairy production system, none educated 1.9%, primary school (20.4%), junior secondary school (11.1%), senior secondary school (24.1%), college (35.2%) and university (7.4%) than the current study results. Generally, dairy farmers need to get more education and extension service for efficient milk production in the country as stated by [10] in Tanzania.

Table 1. Household position & educational status

Household position	Urban (N=66)		Peri-urban (N=198)		Overall (N=264)	
	N	%	N	%	N	%
Male headed	57	86.4	193	97.5	250	94.7
Female headed	9	13.6	5	2.5	14	5.3
Educational status						
Unable to read & Write	40.32 (10.3)		46.2 (9.46)		44.74 (9.9)	
Read & write	6.42 (2.28)		6.18 (2.17)		6.24 (2.2)	
Elementary school	62.3%		58.48%		59.58	
Junior school	27.8%		29.2%		28.9	
High school & Above	9.9%		12.02%		11.53	

n=number of respondents

According to the survey study, the average family size per household in the urban and peri urban dairy production systems was 6.42 $\pm$ 2.28 and 6.18 $\pm$ 2.17 respectively (Table 2). The labor source for major milk and milk products activity were the households. Accordingly, the more family size of the household will have more labor for dairy activities. The average household family size observed in this study in urban and peri-urban production system was comparable with [11], who reported 7.13$\pm$ 0.24, 6.70$\pm$ 0.88 and 7.13 $\pm$ 0.77 in small, Medium and large farm sizes in Hawasa [6], who reported 5.74$\pm$1.88 and 6.0$\pm$ 2.22 in the urban and peri-urban production systems in Dangila district. However, the current finding was lower than [3], who reported 8.2 and

7.2% in the current study areas. The proportion of the productive age (<55 &>14 years old) was 62.3 and 58.48 percent in urban and peri urban production system found respectively. The proportion of children (<15 Years) who are not participate in the major dairy activities was 27.8% and 29.2 % in the urban and peri-urban dairy production systems, respectively. Whereas, old enough (>55 years) household members was 9.9 and 12.02% in urban and peri-urban dairy production systems respectively. In this study, higher proportions of the family size were in the productive age which is very important to perform the major dairy activities in the household. This indicates that the family members in the productive age group are higher in both urban and peri-urban production systems. The current result is in line with different reports [3, 7, and 11].

Table 2. Age and family size of respondents

Age & family size	Urban (N=66) Mean (SE)	Peri-urban (N=198) Mean (SE)	Overall (N=264) Mean (SE)
Age	40.32 (10.3)	46.2 (9.46)	44.74 (9.9)
Family size	6.42 (2.28)	6.18 (2.17)	6.24 (2.2)
<55 &>14 years old	62.3%	58.48%	59.58
<15 Years	27.8%	29.2%	28.9
>55 Years	9.9%	12.02%	11.53

Source of income of respondents

Source of income for the households in the production systems have been studied and dairy production was found the major source of income for the households at urban and peri-urban production systems in the study areas. According to the finding 78.8% of the household's source of income was from dairy production in the urban dairy production system whereas, 59.1% of the source of income in peri-urban dairy production system found from crop, dairy farm and fattening (Table 3). The study was indicated dairy production considered as a major source of income for the improvements of the livelihoods of the producers. This may be as a result of urbanization, keeping improved dairy cows and change in consumption patterns of the urban and peri-urban societies. The current result is in disagreement with[8], who reported 74% of the household's source of income was from crop sell and dairy products marketing was observed the third important source of income for the households of Enderta district. Dairy production in the current study areas was found higher level of source of income than [12], who reported 48.9% of dairying contributed for the total household income in southern Ethiopia.

Table 3. Source of income for households

Livelihood source of income	Urban (N=66)		Peri-Urban(N=198)		Overall(N=264)	
	N	%	N	%	n	%
Dairy farming, fattening crop			6	3	6	2.3
Dairy farming crop fattening	6	9.1	6	3	12	4.5
Fattening dairy crop			3	1.5	3	1.1
Fattening crop dairy			6	3	6	2.3
Crop dairy fattening	6	9.1	117	59.1	123	46.6
Crop fattening dairy			24	12.1	24	9.1
Dairy	52	78.8	3	1.5	55	20.8
Crop & Dairy			33	16.7	33	12.5
Dairy & Fattening	2	3			2	0.75

n= number of respondents

Labor source and distribution in milk production

Like other parts of the country, family members are the major source of labor for dairy activities in the study areas. The survey study indicated that 90.9 and 98.5% cattle purchase performed by husband in urban and peri-urban production systems respectively. Milk processing and handling mainly operated by 95.5 and 100% by wife in urban and peri-urban production systems in the study areas (Table 4). The activity of cattle breeding (72.7%) in urban and (11.1%) in peri-urban production systems and milking (45.5%) in urban production system was operated by hired labor in the study areas. According to the study, labor disaggregation was observed for different dairy activities in both production systems. High proportion of labor/employed was found in urban production system. The result is comparable with [13], who reported 75.7% hired labor in large and medium scale farms [12], who reported the proportion of wife and husband in dairy activities.

Table 4. Labor distribution in the household

Labor based activities	Responsibility	Urban (N=66)		Peri-urban (N=198)		Overall (N=264)	
		N	%	N	%	N	%
Cattle purchase	Husband	60	90.9	195	98.5	252	96.6
	Wife	6	9.1	3	1.5	9	3.4
Milk processing & handling	Husband	0	0	0	0	0	0
	Wife	54	81.8	198	100	252	95.5
	Sun/labor	12	18.2	0	0	12	4.5
Breeding	Husband	6	9.1	176	88.9	182	68.9
	Wife	12	18.2	0	0	12	4.5
	Sun/labor	48	72.7	22	11.1	70	26.5
Milking	Husband	6	9.1	41	20.7	47	17.8
	Wife	24	36.4	45	22.7	69	26.1
	Both	6	9.1	112	56.6	118	44.7
	Sun/labor	30	45.5	0	0	30	11.36
Marketing	Husband	30	45.5	109	55.1	139	52.7
	Wife	18	27.3	18	9.1	36	13.6
	Both	18	27.3	71	35.9	89	33.7
	Sun/labor	0	0	6	3.03	6	2.27

n= number of respondents

Landholding

In the urban and peri-urban production systems 0.0067 and 1.46 hectare of land were owned by the producers respectively (Figure 2). The proportion of land between the production systems is varied significantly especially in the urban production system. According to the study there was a high shortage of land for different dairying activities. Land is the most important component in dairy production for feed production, housing, proper waste disposal and for other important dairy management activities. However, in the current study areas, especially in urban production system there is a very short supply of land for dairy production which accounts the reduction of overall profitability of the household and further expansions. The land holding was very smaller as compared to the result found [14], at Gambela 3.0 and 2.18 hectare of land per household in urban and mixed crop livestock production systems.

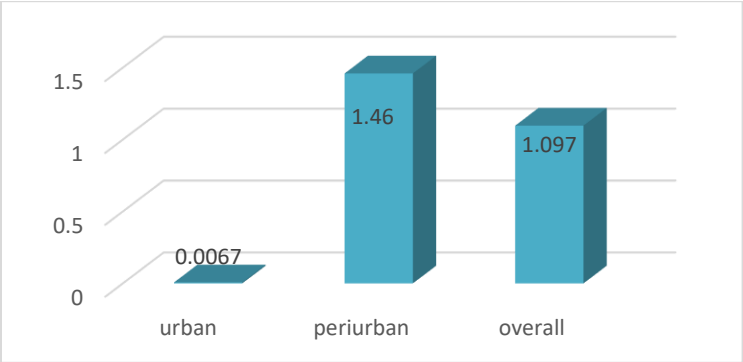

Figure 2. Landholding in urban and peri-urban production systems

Livestock characteristics

Poultry and cattle are the dominant livestock found in both urban and peri-urban production systems. The average mean number of cattle kept by urban and peri-urban production systems were 9.56 (3.83) and 8.49 (5.08) respectively (Table 5). The current result is proportionally higher than [15], who reported that the average cattle kept was 9.7 and 6.5% in urban and peri-urban production systems in western Ethiopian highlands and the current result was lower than [7], who reported 11.6 and 15.76 in urban and peri-urban areas of Dangila town.

Table 5. Livestock herd characteristics

Livestock species	Urban (N=66)		Peri-urban (N=198)		Overall (N=264)	
	Mean (SE)	%	Mean (SE)	%	Mean (SE)	%
Cattle	9.56 (3.83)	100	8.49 (5.08)	100	8.76(4.81)	100
Sheep	1.4 (2.32)	3	2.12 (4.56)	64	2.45(3.45)	67
Poultry	1.23(2.45)	4	8.45(0.32)	78	9.7(2.56)	82
Donkey	0	0	0.45 (0.32)	83	0.45(1.24)	83

SE= standard error

According to the study indigenous dairy cows are only found in the peri-urban production system and proportionally the number of crossbred lactating cows were greater in number than indigenous lactating cows in peri-urban production system. The average mean of crossbred lactating dairy cow in urban and peri-urban production systems were 4.48 $\pm$ 1.85 and 1.81 $\pm$ 0.97 respectively (Table 6). This result was higher than 1.04 $\pm$0.89 and 0.65 $\pm$ 0.86 reported by [16], at Agarfa district, Ethiopia. The average mean of indigenous lactating cow in peri-urban production system was found 1.51$\pm$ 0.96. According to the finding it is possible to conclude improved dairy cows are increasingly kept to produce more milk than local breed cows in the study areas. The result is the best indicator for the establishment of medium and large milk and milk products processors in the study areas to sustain the production. The average mean numbers of female crossbred calves were proportionally more in number than crossbred male calves in the study areas. In the urban production system 1.89$\pm$1.0 and 1.66$\pm$ 0.47 were female and male crossbred calves respectively and in the peri-urban production system 1.37 $\pm$ 0.89 and 1.14$\pm$ 0.89 were female and male calves, respectively. This result was found disagree with those who believe AI service gives birth of more male calves than female calves in the study areas.

Table 6. Dairy cattle characteristics

Livestock species	Urban (N=66)		Peri-urban (N=198)		Overall (N=264)	
	N	Mean (SE)	N	Mean (SE)	N	Mean (SE)
Indigenous lactating cow	0	0	95	1.51(0.96)	95	1.51 (0.96)
Indigenous dry cow	0	0	89	1.31(1.00)	89	1.31 (1.00)
Crossbreed lactating cow	66	4.48(1.85)	141	1.81(0.97)	207	2.66 (1.81)
Crossbreed dry cow	47	3.29(2.09)	89	1.30(0.67)	136	1.99(1.64)
Indigenous bull and heifer	0	0	140	2.64(1.44)	140	2.64(1.44)
Crossbreed bull & heifer	35	3.17(1.83)	103	1.60(1.00)	138	1.97(1.41)
Indigenous male calves	0	0	68	0.90(0.81)	68	0.90(0.81)
Indigenous female calves	0	0	69	0.82(0.74)	69	0.82(0.74)
Crossbreed male calves	42	1.66(0.47)	104	1.14(0.89)	146	1.27(0.83)
Crossbreed female calves	66	1.89(1.00)	121	1.37(0.88)	187	1.54(0.95)

n=number of respondents, SE=standard error

Feed resources and feeding systems of dairy cattle

Crop residue/hay, concentrate feeds, industrial by products (oil cake and wheat bran) and local beverage products (*Attela* &*Brint*) are a common feed sources used by dairy producers in both production systems (Table 7). Crop residue feeding with emulsify local beverage was the most common feeding practice used by both urban and peri-urban production systems (100%). Concentrate feeds were also used by urban and peri-urban production systems 9.1 and 27.3 %, respectively. However, grazing as feed source was used only by peri-urban dairy production system. The study indicated that grazing as a source of feed was used by low producers which are the best indicator for future sustainable dairy development in the study areas. This study is in line with [17], who reported industrial by-products, crop residues, and hay, were the major feed resources in the current study areas. Moreover, the current finding is also similar with [8,18], Hossana town.

Two types of feeding systems (based on stall feeding and stall feeding and grazing) were practiced in the study areas (Table 6). Only stall feeding system (zero grazing) 100% practiced in urban production system, while stall feeding and grazing with stall feeding (semi grazing) systems (62.1%, 37.9%) were practiced, respectively in the peri-urban dairy production system. To increase the production and productivity of dairy cows using stall feeding system is very important to increase production by reduced loss of energy by travel; accordingly, the peri-urban production system should scale up the stall feeding system. The current result is in opposed with [19], who reported the dominant feeding system were grazing and grazing with some stall feeding in western Oromia.

Provision of additional/supplementary feeds based on the productivity of cattle was practiced in the study areas. Out of the total interviewed households 67.4% and 28% in urban and 65.7 and 28.3% in peri-urban production systems were provide additional feeds for lactating and pregnant dairy cows respectively. Provision of supplementary feeding based on the production stage of dairy cows is mandatory to maintain the production and productivity. Supplementary feeding need to be based the requirement of the dairy cattle. The current study is comparable with [19] who reported 82%, 71%, 58% respondents in Jimma, Baddalle and Naqamte respectively

who provide supplementary feeds to their lactating cows. Based on the availability, respondents in both production systems provide feeds in combination of different feed resources. The current result is in line with [20] who reported 69.6% and 30.4% additional feeds provided to lactating and pregnant cows respectively in Wolitasodo. More households provide supplementary feeds than [21], who reported 39% of the peri-urban dairy producers provide supplementary feeds for lactating cows.

Table 7. Dairy cow feed sources and feeding systems of respondents

Feed resources & feeding	Urban (N=66)		Peri-urban(N=198)		Overall (N=264)	
	N	%	N	%	N	%
Crop residue & hay	66	100	198	100	264	100
Locale beverage	66	100	198	100	264	100
Concentrate	6	9.1	54	27.3	60	22.3
Industrial by products	66	100	198	100	264	100
Grazing			148	74.7	148	56
Feeding practices						
Stall feeding	66	100			164	62.1
Stall feeding & grazing					100	37.9
Supplementary feeding	54	81.8	192	97	246	93.18
For which animals						
Lactating	48	72.7	130	65.7	178	67.4
Pregnant & lactating	18	27.36	56	28.3	74	28

n=number of respondents

Water sources for dairy cattle

In the urban production system totally clean water (98.5%) was available and supplied for dairy cows from supplied pipe than whereas, in the peri-urban production system river is the major water source available (40.4%) for dairy cows. The remained water sources for peri-urban production system were hand dug well (32.3), supplied pipe/tank 21.2 and spring water (6.1%) (Table 8).dairy cows need more water freely to increase milk production, to regulate body temperature. This result is in line with [22], reported river and pipe are the major water sources in Burie town [12].

Table 8. Water sources for livestock

Water source	Urban (N=66)		Peri-Urban (N=198)		Overall (N=264)	
	N	%	N	%	N	%
River	0	0	80	40.4	80	30.3
Hand dug well	1	1.5	64	32.3	65	24.6
Supplied pipe/tank	65	98.5	42	21.2	107	40.5
Spring water	0	0	12	6.1	12	4.5

n=number of respondents

Housing of dairy cows

Housing of dairy cattle in the urban production system 90.9% & in the peri-urban 51% was used loose house/separate house from the households. Moreover, 9.1% and 49% dairy producers in the urban and peri-urban production systems were used mixed housing with households respectively (Table 9). Housing is not only important to protect the cows from hazard environment and thieves it is also important to provide every management aspect like feeding, watering, milking and proper waste disposal and breeding as nearly as possible in the farm. The current study is comparable with[12], who reported 85%

used separate/loose housing in urban production system at Shashemenie area[20], the urban dairy producers 91.9% used separate house in and around Wolita sodo towns.

Table 9. Dairy cattle Housing types

	Urban (N=66)		Peri-urban(N=198)		Overall (N=264)	
Housing type	N	%	n	%	N	%
Separate/loose house	60	90.9	101	51	161	61
Mixed with households	6	9.1	97	49	103	39

n=number of respondents

Dairy breeds and breeding systems used by dairy producers

In the urban production system 100% producers were used crossbred dairy cows to produce milk in contrast, 41.4%, 33.3 and 25.3% in peri-urban production system was used crossbred dairy cows, both crossbred and local breeds and local breeds only for milk production respectively (Table 10). The current result is disagreeing with [7], who reported indigenous dairy cows are the dominant breed used (87.59%) in the peri-urban production system and crossbred dairy cows (56.7%) are more dominant in the urban production system for milk production. Ai, natural mating and both AI and natural mating breeding methods was used in urban and peri-urban production systems. In the urban production system 48.5% and 51.5% used AI and both natural & AI mating systems to breeding dairy cows respectively. In the peri-urban dairy production system 20.7, 43.9 and 35.4% were used natural mating (using bull), AI and both natural mating and AI respectively to breeding dairy cows. There is noticeable difference between our local and there crossbred dairy cows in economically important traits. Genetic improvement of cattle is the key element to improve the production of milk and milk products as well as to respond the increasing demand of milk and milk products in the study areas. Provision of improved dairy cows/bull and successful breeding/AI service are critically important issues for the sustainable development of dairying in the study areas. The current study was found better than [23], who reported (73.4%) and (26.6) used natural mating and AI breeding systems respectively in Dawa Chefa district and also the current result is better in using AI and both AI and natural mating for breeding system than the result 68.9% used natural mating, 28.9% used AI and 2.2% used both AI and natural mating reported by[20], at Wolita Sodo[21], who reported AI only 7.8%, Natural mating only 66.7% and both AI and matiral mating 25.6% in Southwest Ethiopia, Ethiopia.

Table 10. Breeding system and breeds used for milk production

Breeding systems	Urban (N=66)		Peri-urban(N=198)		Overall	
	N	%	N	%	N	%
Natural breeding	0	0	41	20.7	41	15.5
Ai	32	48.5	87	43.9	119	45.1
Both	34	51.5	70	35.4	104	39.4
Breed used for milk production						
Local	0	0	50	25.3	50	18.9
Cross breed	66	100	82	41.4	148	56.1
Both	0	0	66	33.3	66	25

n= number of respondents

Milk production performance

The average milk production for both indigenous and crossbred dairy cows was studied in both urban and peri-urban production systems (Table 11). In the urban production system only crossbred dairy cows were used for milk production. The average milk production for crossbred dairy cows in the urban production system was 12.12(±2.04) with the average lactation length of 9.63(±1.65). In the peri-urban production system both local and indigenous dairy cows were kept by dairy producers. The average daily milk yield of indigenous dairy cows in the peri-urban production system was found 2.76(±1.44) litters and for crossbred dairy cows was found 7.62 (±3.17) liters. Highly significant difference in daily milk yield was seen in urban and peri-urban crossbred dairy cows (P value 0.001). The production difference of crossbred dairy cows in the study area may be the result of poor marketing for raw milk in the peri-urban production system as a result the management for dairy cows become poor. The same with the variation for lactation length between the two production systems is due to lack of market for raw milk as a result milking at late stage of lactation is fully stopped left over for suckling. The result is almost similar with focus group and key informants' discussions conducted in the study areas.

The daily milk yield result of this study for local/indigenous dairy cows was higher than[16] ,who reported 1.49 liters per day in Dawa Chefa District and 2.15 (±0.29) and 1.73 (±0.49) in urban and peri-urban production systems respectively reported by[17], Hossana town, Hadya zone. Moreover, the daily milk yield result for crossbred dairy cows in peri-urban production system was in agreement with[21], who reported 7.21 (± 2.34) and higher than 7.10 (±1.62) and 6.35 (±1.15) in urban and peri-urban production systems respectively reported by [17], at Hossana town, Hadya zone. The present result of lactation length for indigenous dairy cows 9.49(±2.35) in peri-urban production system was almost comparable with 10.59 (±0.85) in peri-urban production system reported by [21], and higher than 7.9 (±1.45) and 7.63 (±1.52) in urban and peri-urban production systems reported by [17], at Hossana town, Hadya zone. The current result of lactation length for crossbred dairy cows 9.63 (±1.65) and 7.79 (±1.6) in urban and peri-urban production systems were below than 10.2(±1.25) and 9.86(±1.69) in urban and peri-urban production systems of Hosana town reported by [17].

Table 11. Milk production performance and lactation length

Average milk production & lactation length	Urban		Peri-urban		Overall		P-value
	n	%	n	%	N	%	
Average milk production for indigenous cows	0	0	141	2.76(1.44)	141	2.76(1.44)	
Average milk production for cross breed cows	66	12.12(2.04)	146	7.62(3.17)	212	9.02(3.54)	0.001
Average lactation length for indigenous cows	0	0	130	9.49(2.33)	130	9.49(2.35)	
Average lactation length for crossbred dairy cows	66	9.63(1.65)	148	7.79(1.6)	214	8.36(1.65)	0.85

n=number of respondents

Milk processing practices

In the urban dairy production system 100% milk was processed in to other milk products primarily for home consumption whereas, in peri-urban dairy production system 89.4% milk was processed in to other milk products primarily for marketing (Table 12). According to the survey study and focus group and key informants' discussions, 89.4% respondents in peri-urban production system were processed milk into other products due to lack of sustainable raw milk marketing in the area. Increase number of

cooperatives and milk and milk products processers in the peri-urban production system will increase and facilitate raw milk marketing in the same fashion income for peri-urban producers will improved. The current result is agreement with [9], who reported the majority of milk processed into other milk products for home consumption in Jimma town urban dairy farms.

Table 12. Milk consumption and processing

Purpose of milk processing	Urban		Peri-urban		Overall		P-value
	N	%	N	%	N	%	
For home consumption	66	100	84	42.4	108	40.9	0.47
To increase shelf life	0	0	95	48	96	36.4	0.001
For marketing	0	0	177	89.4	178	67.4	0.001

n=number of respondents

Milk processing products

The major milk products found in the study areas were sour milk (*ergo*) (89.4, 55.1%), traditional butter "*Kibie*" (62.2,98.5%), cheese "*Ayib*" (89.4, 60.6%), whey (*telelaaguat*) (89.4, 48.5%) and ghee (17.8, 42.4%) in urban and peri-urban production systems respectively and traditional fermented cottage cheese "*Zurie"* (48.5%), found the only milk product in peri-urban production system (Table 13).Production of diversified milk and milk products based on consumer's preference will result better market return for producers, processers and other milk and milk product sellers. On the other hand, producing long shelf life milk products in the study areas were practiced due to lack of market for whole milk. According to the respondents in the study areas (traditional fermented cottage cheese) were marketable milk product due to long shelf life storage. The current finding is more similarly with [3, 18].

Table 13. Milk processing practice of respondents

	Urban		Peri-urban		Overall	
Milk products	N	%	n	%	N	%
Sour milk	59	89.4	109	55.1	168	63.6
Butter	41	62.2	195	98.5	236	89.4
Cheese	59	89.4	120	60.6	179	67.8
Traditional fermented cottage cheese	0	0	96	48.5	96	36.4
Whey	59	89.4	96	48.5	155	58.7
Ghee	10	17.8	84	42.4	94	35.6

n=number of respondents

Milk processing materials

In the urban production system guard (59.1%), clay pot (18.2%) & plastic container (13.6%) and in the peri-urban production system guard (71.7%) and clay pot (26.3%) were used for processing sour milk in to other milk products in the study areas (Figure 3). Processing materials should be safe to clean and dry to produce quality milk products. The same processing materials with different level of importance was observed in the study areas with [9], who reported clay pot 4%, gourd 12% and plastic container 80% in Jimma town and also with Gezu et al. (2015) [18] who reported churning materials clay pot 100% and 99.3% in urban and peri-urban production systems respectively in Hosana town.

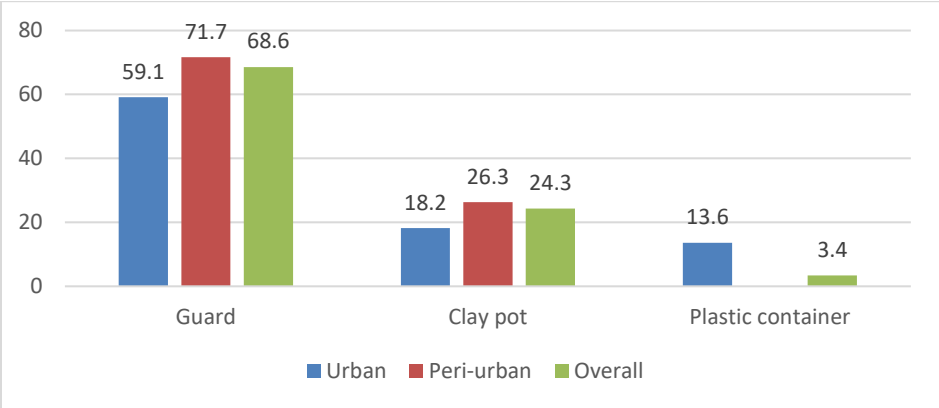

Figure 3. Milk processing materials

Milk and milk products handling

Aluminum can, guard, clay pot and plastic container were the major milk and milk products handling materials found in the urban production system (Table 14). Aluminum can (31.8%, 21.2%) plastic container (51.5%, 41.9%) and clay pot (16.6 and 6.1%) found to be milk and milk products handling materials in urban and peri-urban production systems respectively. Gourd was used only (30.8%) in peri-urban production system. Aluminum can and plastic containers were major milk and milk products handling materials observed in both urban and peri-urban production systems whereas, gourd and clay pot was found as milk and milk products handling materials occasionally used by dairy producers in the urban and peri-urban production systems.

Using proper cleaning steps (rinsing, brushing and drying) of milking, storage and processing materials should be considered as daily routine activities to maintain the quality as well as to sustain the marketing of milk and milk products in both urban and peri-urban production systems. The current result is almost similar with [9], who reported clay pot 4.3% and gourd 8.7% and plastic container 87% in urban dairy farms of Jimma town.

Table 14. Milk and milk products handling

Handling materials	Urban(N=66)		Peri-urban(N=198)		Overall(N=264)	
	n	%	n	%	N	%
Aluminum cans	21	31.8	42	21.2	63	23.9
Plastic containers	34	51.5	83	41.9	117	44.32
Gourd	0	0	61	30.8	61	23.1
Clay pot	11	16.6	12	6.1	33	12.5

n= number of respondents

Marketable milk and milk products

According to the survey and monitoring results in the urban dairy production system whole milk (81%, 100%) and butter (18.8%,33.3%) were found the only marketable milk and milk products respectively and in the peri-urban production system whole milk, yogurt, traditional fermented cottage cheese, butter and ghee(72.7%, 100%), (2.5%, 12.5%)(35.4, 58.3),(84.3, 100%) and (16.7%, 33.3) were found marketable milk and milk products in survey and monitoring results respectively (Table 15). Like other parts of Ethiopia diversified milk and milk products are marketed more in peri-urban areas than urban areas due to the lack of market for raw milk. According to the group and key informant's discussions held in both production systems marketing of raw milk had better profit than other marketable milk and milk products. Facilitate raw milk marketing in peri-urban production system will increase profitability of producers and source of income for processors, day labors and other

service providers in the study areas. The current result was found almost similar with marketable milk and milk products 90% whole milk in urban production system and 52.5%, 26.4% and 21.1%, respectively whole milk, sour milk and butter respectively in crop livestock system reported by [24], at Gambela South West Ethiopia. Moreover, butter (92.4, 100%), raw milk (89.7, 67.2) ghee (36.3, 55.9) and cheese (38.4%, 12.3) in urban and peri-urban production system reported by [7], at Dangila town.

Table 15. Marketable milk and milk products

Milk products	Urban (N=66)		Peri-urban (N=198)		Overall (N=264)	
	N	%	n	%	n	%
Whole milk	54	81.8	144	72.7	198	75
Yogurt	0	0	5	2.5	5	1.9
Traditional fermented cottage cheese	0	0	70	35.4	70	26.5
Butter	12	18.2	167	84.3	179	67.8
Ghee	0	0	33	16.7	33	12.5

Monitoring study

In order to complement the survey results, found in both production systems milk yield, milk processing, milking, processing and handling materials were monitored for a month. A total of 24 households from both production systems were voluntarily selected. From the family members who can read and write were selected and oriented how to scale and registered the milk produced during the morning and evening time.

Milk production

According to the monitoring result the average milk production for lactating indigenous and cross breed cows were 3.02 and 10.58 l liter/day, respectively (Table 16). Significant difference ($P<0.05$) was seen in daily milk yield of crossbred dairy cows between urban and peri-urban production systems.

Table 16 Milk production performance in monitoring

Breed type	Urban N=12	Peri-urban (N=12)		Overall, N=24		P-value
	N	%	N	%	n	%	
Indigenous	0	0	12	3.02	12	3.02	
Crossbreed	12	11.25	12	9.9	24	10.58	0.04

Milk processing

Based on the monitoring results in both production systems milk was processed into different milk products for the purpose of home consumption and marketing (Table 17). The major milk products found in both production systems were sour milk (*Ergo*), butter, cheese, ghee, and cottage cheese. In the overall, the above mentioned milk products are marketable however, in the urban production system whole milk and butter are the only marketable products found in the monitoring results. Overall, based on the monitoring results whole milk (100%), Butter (66.7%) cottage cheese (29.1%), ghee (16.7%) and yogurt (12.5%) found marketable products in both urban and peri-urban production systems.

Table 17. Marketable milk & milk products

Milk products	Urban (N=66)		Peri-urban (N=198)		Overall (N=264)	
	N	%	N	%	n	%
Whole milk	12	100	12	100	24	100
Yogurt	0	0	3	25	3	12.5
Traditional fermented cottage cheese	0	0	7	58.3	7	29.1
Butter	4	33.3	12	100	16	66.7
Ghee	0	0	4	33.3	4	16.7

Constraints of dairy development

Shortage of land, high feed price, feed shortage, disease problem and market fluctuations were the main constraints found 84.8%, 81.8%, 75.75%, 69.69% and 62.12% respectively in the urban dairy production system, in contrast, in the peri-urban production system 83.3%, 72.2, 70.7%, 67.7% and 64.6% were market fluctuation, disease problem, AI (artificial insemination) service problem, feed shortage and high feed price the main constraints respectively (Table 18).

According to the key informants and focus group discussions held in both production systems the main constraints were almost observed without significant difference. The different constraints found in the study areas were the major ones and accounted for the low production and productivity of dairy cattle, insufficient and inefficient AI service provision was resulted low breed improvement in peri-urban production system which results low production of milk and milk products. land shortage in the urban production system hinder the expansion of farm of the producers, in appropriate waste disposal, disease transmission between animals and humans and the overall production and productivity and income have been found affected. The current result is similar with other parts of the country; prioritized constraints were shortage of feed, limited space for proper housing and waste disposal and disease incidence reported by Haile *et al.* (2012) [11], in Hawasa city southern Ethiopia. The shortage of feed constraint observed in the current study is in agreement with report from Kenya [25] who reported that shortage of feed was one of the constraints in dairy development in the country. Moreover, the constraints observed in the current study are in agreement with tropical African report by [26]. To enhance the dairy sector in Ethiopia, constraints must be mitigated and appropriate interventions must be sought by government and non-government actors as stated by different research reports in other countries [27, 28].

Table 18. Constraints in both production systems

Urban			Peri-urban		
Variables	N	%	Variables	N	%
Land shortage	56	84.8	Market fluctuation	165	83.33
High feed price	54	81.8	Disease problem	143	72.2
Feed shortage	50	75.75	AI service problem	140	70.7
Disease problem	46	69.69	Feed shortage	134	67.7
Market fluctuation	41	62.12	High feed price	128	64.64

n= number of respondents

4. Conclusion

The dairy production in the study areas was accounted the major source of income of the households; this is the best indicator for further encouragement of more households to engage in dairying. Milk production per cow for local and crossbred dairy cows observed in the study areas was not high due to poor management of animals. Milk processors and cooperatives are established in the urban and peri-urban production systems, this can be the major entry point for sustainable milk and milk products marketing, so that, the government and non-government institutions should give more attention for the development of dairy processors and cooperatives in both urban and peri-urban production systems in the study areas. Formal and informal marketing systems were observed in the study areas however, formal marketing system was in better situation due to the presence of dairy cooperatives and milk processers. Hence, promotion based on its nutritional importance, source of income and employment opportunities should rely on government institutions and others and nongovernment institutions. Enhancing dairy sectors is indirectly the enhancement of create employment opportunity, input and service providers and reduction of poverty in different forms.

References

1. Zijlstra J., Berhanu T., Vernooij A., Boere A., Lee J. Investment opportunities in the Ethiopian dairy sector. 2015.

2. CSA (Central Statistical Agency), Agricultural sample survey, Volume II report on livestock and livestock characteristics, Federal Democratic Republic of Ethiopia, Central Statistical Agency; Statistical bulletin number 587.2018.

3. Tassew A., and Seifu E. Small-Scale Milk Processing, Utilization and Marketing of Traditional Dairy Products in BahirDar Zuria and Mecha Districts, Northwestern Ethiopia. Journal of FoodTechnology Research.2009;1(2):122-32.

4. Wondatir Zewdie and Mekasha Yoseph. Feed resources availability and livestock production in the central rift valley of Ethiopia, International Journal of Livestock Production, 2014, 5(2):30-35.

5. Habtamu A. Factors affecting the sustainability of rural water supply system: the case of Mecha District, Amhara region, Ethiopia, MSc thesis, Cornell University, USA.2012.

6. Yamane T (1967). Statistics: An Introductory Analysis, 2nd Edition, New York: Harper and Row.

7. Bekele A., Fekadu B., Mitiku E. Handling, processing and marketing of cow milk in urban and peri-urban areas of Danigila town Western Amhara region. Global Journal of Food Science and Technology,2015, 3 (3): 159-174.

8. Tsadikan Z. Study on cattle milk production, processing and marketing system in Enderta district Tigray regional, state. MSc thesis. Addis Abeba University. 2012.

9. Belay D., Janssens J. Smallholder Milk Processing and Marketing Characteristics at Urban Dairy Farms In Jimma Town Oromia Regional State. Global Veterinaria, 2014, 3 (3): 285-292.

10. Gwandu, S. H. Nonga H. E., Mdegela R. H., Katakweba A. S., Suleiman T. S., and Ryoba R. Assessment of Raw Cow Milk Quality in Smallholder Dairy Farms in Pemba Island Zanzibar, Tanzania, Veterinary Medicine International, 2018:1- 9.

11. Haile W., Zelalem Y., Yosef T. Challenges and opportunities of milk production under different urban dairy farm sizes in Hawassa city, Southern Ethiopia. African journal of Agricultural research,2012, 7 (26): 3860-3866.

12. Sintayehu Y., Fekadu B, Azage T, Berhanu G. Dairy production, processing and marketingsystems ofShashemeneDilla area, South Ethiopia. SNV. Dairy Investment Opportunities in Ethiopia.2008.

13. Nigussie G. Characterization and evaluation of urban dairy production system in Mekelle city, Tigray region.Ethiopia, MSc thesis, Hawassa University, Hawassa, Ethiopia. 2006.

14. Gatwech T.D. Dairy production, processing and marketing system, a case study of Gambela, South West Ethiopia. MSc thesis, Addis Abeba University. Addis Abeba, Ethiopia.2012.

15. Ayenew YA, Wurzinger M, Tegegne A, Zollitsch W. Performance and limitation of two dairy production systems in the North western Ethiopian highlands. Trop Anim Health Prod. 2009

Oct;41(7):1143-50. doi: 10.1007/s11250-008-9294-3. Epub 2008 Dec 14. PMID: 19083118.

16. Leyla A. Assessment of milk production potential, milk processing, consumption and marketingin Agarfa district of Oromia regional state Ethiopia. MSc thesis, Haramaya University, Ethiopia.2016.

17. Tassew A.. Production, handling, traditional processing practices and quality of milk in Bahir Dar milk shed area, Ethiopia. M. Sc, Thesis, Haramaya University, Ethiopia.2007.

18. Gezu T., Haftu K. and Sefa S. Production, processing and constraints of cow milk in and around Hosanna Town, Hadya Zone, Southern Ethiopia. Global Science research journal, 2015, 3(3):092-098.

19. Ulfina G., Giregna D., Alganesh T.,Prasad S., Mulugeta K. Dairy production potential and challenges in Western Oromia milk value chain, Oromia Ethiopia. Journal of agriculture and sustainability,2013, 2(1):1-21.

20. Asrat A., Feleke A., Ermias B. Characterization of cattle production systems in and around Wolaita sodo town, southern Ethiopia, Scholarly Journal of Agriculture science volume,2015, 6(3): 62-70.

21. Demissu H., Fekadu, B. & Gemeda D. Dairy Productive Potential, Challenges and Production opportunities of Horro and their F1 Jersey Crossbred Cows. A Case of Guduru Livestock production and Research Center and Its Surroundings, West Oromia, Ethiopia. Science, Technology and Arts Research Journal.,2014, 3(4). 79-84.

22. Mebrahtom and Hailemichael. Comparative Evaluation on Productive and Reproductive Performance of Indigenous and Crossbred Dairy Cow Managed under Smallholder Farmers in Endamehoni District, Tigray, Ethiopia. Journal of biology, agriculture and healthcare, Vol. 6, No. 17, 2016.

23. Gebeyew K, Amakelew S, Eshetu M, Animut G. Production, Processing and Handling of Cow Milk in Dawa Chefa District, Amhara Region, Ethiopia. J Veterinar Sci Technol ,2016, 7: 286. doi:10.4172/2157-7579.1000286

24. Getachew Felleke and Gashaw Geda. The Ethiopian Dairy Development, A Draft Policy Document, MOA/FAO, Addis Abeba, 2001, Ethiopia.

25. Odero-Waitituh J A. Smallholder dairy production in Kenya; a review. *Livestock Research for Rural Development.2017, Volume 29, Article #139.* Retrieved October 27, 2020, from http://www.lrrd.org/lrrd29/7/atiw29139.html.

26. Gillah K., Kifaro G., Madsen J. Urban and peri urban dairy farming in East Africa: A review onproductionlevels, constraints and opportunities. Livestock Research for Rural Development;2012, 24(11):198

27. Lokuruka Michael N.I. Overview of dairy processing and marketing in East African dairy value chains: Opportunities and challenges, African Journal of Food Science, 2016, 10(11):254-262.

28. Baliyan Som Pal & Gosalamang Dikgang Stephen. Analysis of Constraints and Opportunities in Dairy Production in Botswana: Producer's Perspectives, International Journal of Business and Management; 2016, 11(3):248-256.