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# Milk Production, Marketing and Processing Practices of Dairy Cattle in Debremarkos Woreda of East Gojjam Zone, Amhara Regional State

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## Abstract

**Introduction:** The study was conducted in Debremarkos Woreda, Amhara National Regional State, from October 2007 to May 2008.

**Objectives:** The objective of milk production, marketing and processing practices of dairy cattle in debremarkos woreda of east gojjam zone, amhara regional state and to get base line data on the status of dairy cattle production levels in the study area.

**Methods:** All 7 kebeles of Debremarkos were included in the study. A total of 200 households were selected randomly based on the proportion of total households in each kebele site using random number table. In formations were collected by key informant group discussion, household level questionnaire survey, farm visit and personal observations. The data were analyzed using the SPSS computer software and Excel programs.

**Results:** The mean land holding in rural farms were 1 ha and except 5 persons the rest of urban area farms were landless. The mean livestock holding was 8.36 TLU in rural areas and 5.32 TLU in urban areas. Cattle constituent 98.86% and 92.44% of total TLU per household in Urban and rural sites respectively. In urban sites cows constitute 41.20% of cattle herd and steers 0.60% and in rural sites steers constitute 20.31% and cows 29.00% of cattle herd. The proportion of cross breed and local breed cows in urban areas was 31.10% and 69.90% and for rural areas it was 3.38% and 96.62% respectively. Main feed resources were crop residues and communal grazing land and most common supplements include hay, atela, wheat bran and noug cake mix as concentrates. For the last two years AI service was not available in the Woreda. During the survey period 72.0% of urban area and 93.2% of rural area households used uncontrolled natural mating. Common animal health problems were black leg, anthrax, abortion, foot and mouth disease, ticks, liver fluke. Animal health service (treatment and vaccination) for the last two years was not available in the Woreda. Only 7.5% of urban area households used private veterinary service. The average daily milk yield was $1.50 \pm 0.68$ and $7.30 \pm 4.65$ litters for local and cross bred cows respectively.

**Conclusion:** There was a significant difference in mean daily milk yield, lactation length, age at first calving and calving interval, for local breed cattle between urban and rural areas but there was no significant difference for cross breeds except calving interval in between urban and rural areas. Main milk processing milk products include butter, ayib, sour milk, butter milk, whey and "Metata." The main milk market outlet was contractual type of informal marketing either for hotels and restaurants or neighboring consumers. Lack of improved breed cattle, disease, feed shortage, milk market, space and water were identified in decreasing order of importance as constraints for dairy production.

**Recommendation:** From this study, it was recommended that: Extension service should be improved; dairy cooperatives and bull service should be established.

## Introduction

Livestock keeping is an ancient tradition of rural areas of Ethiopia. The size and diversity of livestock resources have become vital to sustenance of rural life and in fact the largely agrarian economy of the country. Cattle constitute the predominant element of livestock wealth in Ethiopia both in the agricultural high lands and pastoral and agro-pastoral low lands, and hence the proportional contribution to the national economy is considered to be high. Based on crude assessments, the contribution of cattle to the marketed milk and meat, national wide, is estimated to be 96 and 45%, respectively [1]. Livestock provide food in the form of meat and milk, non-food items such as draft power, manure and transport services as inputs into food crop production, fuel for cooking. Livestock also serve as a source of income through sale of the items, animals, hides and skins. Furthermore they act as a store of wealth and determine social status in the community. Because of these important functions livestock play an important role in improving food security and alleviating poverty.

Although the livestock sector has a significant contribution to the national economy and food self-sufficiency, animal productivity in Ethiopia is extremely low. This is evidenced by the very low per capita consumption of protein and a very low growth rate of milk and meat production [2]. The average milk production capacity of the indigenous cow per head per lactation is estimated at 213 kg which is very low [3]. A survey study showed that average daily milk production per cow was 1.2 L and the average calving interval 27 months [4]. Per capita consumption of milk in Ethiopia is as low as 17 kg per head while the

average figure for Africa is 26 kg per head. With an annual growth rate of 3.5% the human population in Ethiopia will increase to about 139 million by the year 2020, therefore, the demand for animal products is estimated to increase substantially [3]. To meet the increasing demand for milk and milk products, improvement of the productivity of dairy cattle through appropriate technologies such as breeding programs, intensification of the dairy production systems and development of market infrastructures are crucial steps [5].

The low productivity is due to a number of factors among which are quantitative and qualitative deficiencies in the feed resource base, diseases, poor animal performance level, in adequate livestock policies with respect to extension services, marketing and infrastructure, and insufficient knowledge on the dynamics of the different types of farming systems existing in the country. Among all factors emphasis has been given for the improvement of the genetic potential of the local breeds of cattle in the country. Breed improvement programs for dairy production in Ethiopia were started by importing pure temperate breed of cows during the Italian occupation and since then crossbreeding using temperate breeds with indigenous breeds has been practiced by a number of governmental and non-governmental institutions. However, these efforts have been met with little success because of the various technical, organizational and socioeconomic constraints [6]. The development of genetic improvement programs for cattle will only be successful when accompanied by a good understanding of the production systems and when simultaneously addressing several constrains for example feeding, health control and management [7].

To develop appropriate interventions to assist smallholder dairy households, and identifying those which should be targeted requires a clear understanding of the dairy systems. Characterization is the grouping of farmers with similar practices and circumstances for whom a given recommendation would be broadly appropriate [8]. A study on market-oriented urban and peri- urban dairy production systems in the Addis Ababa milk shed developed by ILRI for general characterization of dairy systems characterized seven, market-oriented, dairy production sub-systems [9].

Four major systems of dairy production can be distinguished in Ethiopia. These are: Lowland pastoral dairy production systems, rural highland small-holder dairy production system, urban and peri-urban small scale dairy production system and large scale dairy production system [10]. The characteristics of dairy production systems in the high lands of Ethiopia are characterized by mixed crop–livestock production system and vary substantially in terms of intensification, management systems, genotypes used, type and methods of marketing and processing of milk and dairy products [6]. Even less is known about the productivity levels, major husbandry constraints and opportunities for realistic improvements in the prevalent production systems [9]. This necessitates the need to characterize the smallholder dairy production systems for livestock improvements based on the level of intensification of the farm dairy system, risk management strategies, level of access to output markets and input services, and farm/household resources available etc. Therefore, the objectives of this research were to describe milk production, marketing and processing practices of dairy cattle in Debremarkos Woreda and assess the current dairy cattle production and reproduction levels in the study area.

## Materials and Methods

### The study area

The study was conducted in Debre-Markos Woreda, which is located in Eastern Gojam Zone of Amhara National Regional State.

Debre-Markos is found at 10020'N and 37040'E and the elevation is 2411 m above sea level. Debre-Markos is the capital city of Eastern Gojam Zone and is located at a distance of 300 km northwest of Addis Ababa and 265 km from Bahirdar, which is the capital city of the Region. The Woreda has seven (7) kebeles. The climatic condition of Debre-Markos is Woinadega, with mean annual temperature of 14.5°C and a range of 13.2°C in July and August and 17.3°C in March. Mean annual rainfall is 1300 mm. More than 75% of the total rain falls in the months of June, July, August and September locally known as 'kiremt' season. The driest months are November, December, January and February locally known as 'bega' season, when less than 5% of the annual total rainfall occurs. Debre-Markos's economy depends largely on agriculture. Considered to be a high potential crop- livestock zone and where dairy activity plays a significant role in the livelihood of the farming community. The human population of Debre-Markos is 107,684 out of these 101, 983 (54,928 female and 47,055 males) live in the towns while 5, 701 (2,863 female and 2,838 males) live in rural areas (Figure 1).

### The study population

Households possessing dairy cattle in Debre-Markos Woreda and cattle owned by these households represented the study population.

### The study design

A cross-sectional and retrospective type of studies were conducted using questionnaire survey, participatory methods and observation to collect data on characteristics and practices of smallholder dairy production systems from October 2007 to April 2008.

### Sample size determination and sampling procedure

The sample size was calculated according to the formula recommended by Poet [8]: $N=(ZC/X)^2$ Where N is the estimated sample size; Z is the confidence level C is coefficient of variation in the population and X is the accuracy level. With 95% of confidence level, 50% coefficient of variation and 7% of accuracy level, a total of 196 households were required for the study. Thus, 200 households were selected randomly for this study, from which 132 households were selected from rural areas and 68 were selected from urban areas based on the proportion of households possessing dairy cattle available in each area.

### Methods of data collection questionnaire survey

Detailed structured questionnaire was prepared and used to collect information through interviewing household head or in his/her absence, the most senior member available or the household member responsible for the farm. The questionnaire was pre-tested to check clarity and appropriateness of the questions and corrected when it was necessary. Some of the information collected through interview was supported by observation.

The data collected through interview was divided into sections covering: demographic characteristics, family size and composition, land holding and use pattern, livestock herd size and composition, objectives of dairy farming, division of labor in dairy production, housing condition of dairy cattle, dairy cattle feeds and feeding systems, breeding practices, record keeping, milk marketing and processing, reproductive and productive performance of dairy cattle, dairy cattle health problems and constraints.

### Participatory appraisal

A total of five groups were formed, each containing 8-12

**Figure 1:** Map of the study area.
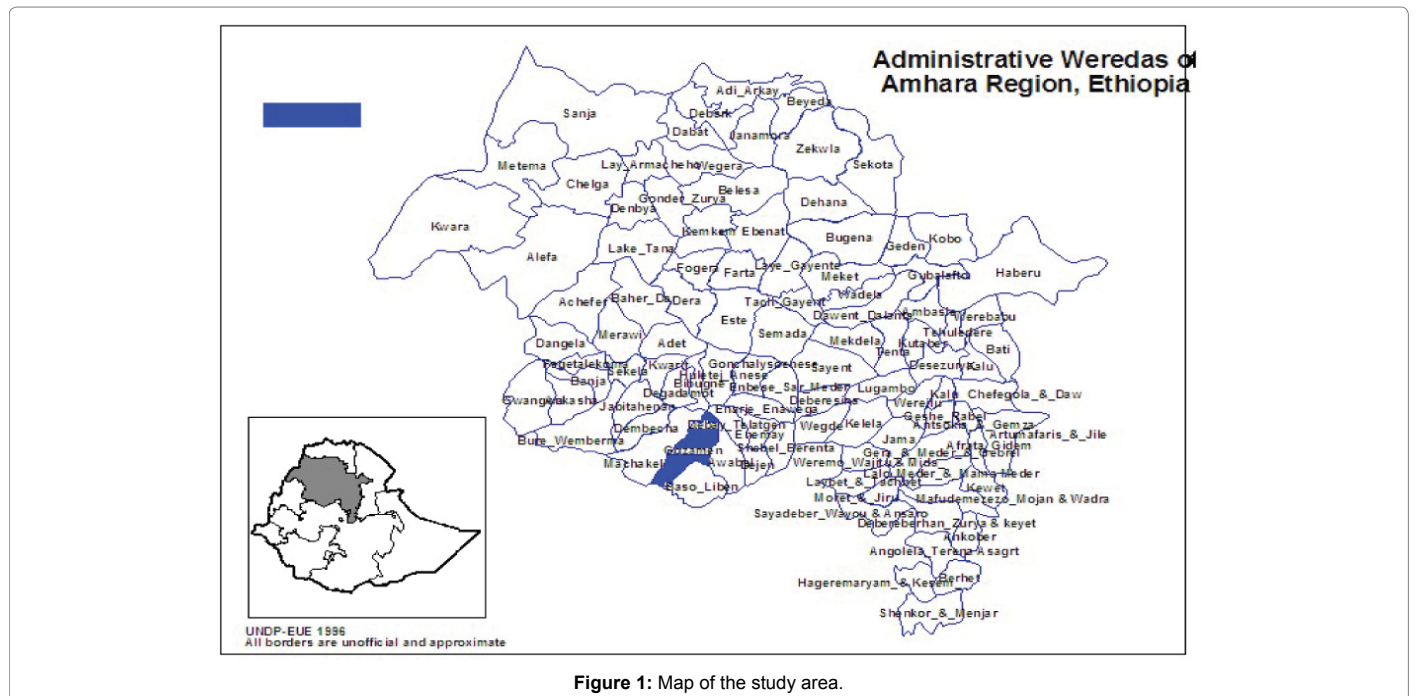
individuals. The group constituted both men and women members of the community, community leaders, livestock experts and Kebele development agents.

The information generated thorough the participatory method were constraints of dairy cattle production.

### Personal observation

Data collected through observation of the farm environment were assessing housing conditions, feeding and feed storage practices, daily milk yield of dairy cows, livestock number and health status of animals and availability of farm records.

### Data analysis

The data collected from the study was entered into Microsoft–Excel-spread sheet computer program and analyzed using SPSS statistical software computer programs (version 15, 2006). Descriptive statistics like percentage, mean, standard deviation and frequency distribution were used to describe the farming system characteristics in the study.

## Results

### Demographic characteristics

Table 1 shows the demographic characteristic of the sampled households in Debre-Markos Woreda. The overall average family size in Debre-Markos "Woreda" was 5.89 persons. The average family size was almost the same, 5.87 and 5.90 persons in urban and rural areas, respectively. From the overall sampled households, 83.5% were male headed households and the rest (16.5%) were female headed households. The highest percentage of female headed households was found in urban areas (23.53%) and the lowest percentage was found in rural areas (12.87%). Among the interviewed households, all urban area dwellers were engaged only in livestock production activity while in rural areas almost all (99.24%) were engaged in both crop and livestock production activities. Assessments of educational level of

household heads indicated that generally, illiterate, junior secondary school, and high school and above constitute 38.0%, 43.5% and 18.5% of the respondents, respectively. In the urban area, the proportions for illiterate, junior secondary school, high school and above were 19.12%, 36.76% and 44.12%, respectively and in rural areas it was 47.73%, 46.97% and 5.30%, respectively. The majority (54%, n=108) of the household heads were between 41-64 years of age. The higher proportion of households (54.41%) in urban area had a farming experience of less than 10 years as compared to those in rural areas (20.45%).

### Land holding and land use pattern

The average land holding in the rural areas was 0.98 hectare with land size ranging from 0.25 to 4 hectares. The land use pattern in the rural area showed that nearly all of (96.96%) the legally tenured land was used for crop production and the remaining 1.54 and 1.50% of land was used for plantation and natural pasture, respectively. The plantation area is mainly covered by eucalyptus tree and Gesho. The major crops produced in the rural areas of the study site were oat (Avena sativa), «teff» (Eragrostis teff) and wheat which cover 30.29%, 29.26% and 20.22% of the croplands in the rural areas of the study site. The other crops grown in the study area were maize, barely, «noug» (Guizotia abbyssinica), linseed, beans and peas which cover 8.54, 5.53, 2.54, 1.03, 1.03 and 0.99% of cropland in the study area, respectively [11].

The majority of the households (92.65%) of urban area were land less. Only 7.35% of urban area dairy farms (n=5) have legally tenured land. The land holding of those households ranged from 1-10 hectares.

### Livestock and cattle herd composition

The average livestock herd size and composition in the study area are indicated in Table 2. The average livestock holding per house hold in Debre-Markos Woreda was 7.32 TLU with an average livestock holding of 5.32 TLU and 8.36 TLU in urban and rural areas, respectively. The average cattle holding per house hold in Debre-Markos Woreda was

| Variables and categories | | Urban area (n=68) % (frequency) | Rural area (n=132) % (frequency) | Overall (N=200) % (frequency) |
|---|---|---|---|---|
| Sex of house hold head | Male | 76.47(52) | 87.12(115) | 83.50(167) |
| | Female | 23.53(16) | 12.88(17) | 16.50(33) |
| Type of agriculture | Livestock only | 100%(68) | 0.76(1) | 34.50(69) |
| | Crop and livestock | - | 99.24(131) | 65.50(131) |
| Age of house hold head | Less than 40 years | 11.76(8) | 31.06(41) | 24.50(49) |
| | 41-64 years | 58.82(40) | 51.52(68) | 54.00(108) |
| | >64 years | 29.42(20) | 17.42(23) | 21.50(43) |
| Level of education | Illiterate | 19.12(13) | 47.73(63) | 38.00(76) |
| | Primary and junior secondary school | 36.76(25) | 46.97(62) | 43.50(87) |
| | High school and above | 44.12(30) | 5.30(7) | 18.5(37) |
| Experience of dairy farming | <10 years | 54.41(37) | 21.22(28) | 65(32.50) |
| | 11-20 years | 38.24(26) | 9.39(52) | 78(39.00) |
| | >21 years | 7.35( 5) | 39.39(52) | 57(28.50) |

**Table 1:** Demographic characteristics of dairy farm owners in the study areas.

| Livestock species | Urban area (n=68) | | Rural area (n=132) | | Overall (N=200) | |
|---|---|---|---|---|---|---|
| | Mean (SD) | % | Mean (SD) | % | Mean (SD) | % |
| Cattle | 5.26 | 98.86 | 7.73 | 92.44 | 6.89 | 94.08 |
| Sheep | 0.03 | 0.55 | 0.24 | 2.87 | 0.16 | 2.33 |
| Horse | 0.02 | 0.44 | 0.09 | 1.09 | 0.07 | 0.94 |
| Donkey | - | - | 0.27 | 3.27 | 0.18 | 2.49 |
| Poultry | 0.01 | 0.15 | 0.03 | 0.33 | 0.02 | 0.16 |
| Total | 5.32 | 100 | 8.36 | 100 | 7.32 | 100 |
| SD: Standard Deviation; TLU: Tropical Livestock Unit; 1TLU: 250 kg adopted from [1] | | | | | | |

**Table 2:** Average livestock holding (in TLU) per household in the study areas.

6.89 TLU with average cattle holding of 5.26 TLU and 7.73 TLU in urban and rural areas, respectively. In both rural and urban areas, the livestock herd was dominated by cattle. Next to cattle donkeys, sheep and poultry comprised only a small proportion of livestock herd in the study area; their proportion being higher in rural areas. Donkeys were found only in rural areas. The goat population in both urban and rural areas was almost zero and was not included in the calculation.

## Cattle herd composition by breed

The cattle breeds found in Debre-Markos Woreda were local breeds (short horned zebu) and Holstein-Friesian × (short horned zebu) crossbreeds. The cattle herd size and composition in the urban and rural areas is indicated in Table 3. The mean cattle herd size per household was 7.35 and 11.60 in urban and rural areas, respectively. The range was from 2-37 cattle in urban areas and from 2-45 cattle in rural areas. The cattle herd composition in urban and rural areas was dominated by cows which was 41.20% and 29.00% in urban and rural areas, respectively. Crossbred cows comprised 31.1% and 3.38% in urban and rural areas, respectively. Average cow holding per household was 3.03 and 3.36 in urban and rural areas, respectively. The proportion of steer was higher next to cows in rural areas (20.31%) and extremely few in urban areas (0.6%), which were kept for fattening purpose. Average oxen (steer) holding per house hold was 2.36 in rural areas 0.02 in urban areas.

## Division of labor in dairy production

Family labor was involved in 91.18% of urban dairy farms and in all rural dairy farms in dairy activities. Cattle herding was done by hired laborer in 48.53% of urban dairy farms and 29.55% of rural dairy farms for whom 2 birr per cow is paid monthly for herding cattle in communal areas in both rural and urban area farms. As reported by farmers during group discussion, individual interview, and field observation, the allocation of labor in the area is usually determined by the composition of the household. Livestock herding mostly was undertaken by the children and whose age was between 6 to 14 years of age. And adult males and females also herd cattle during the absence of children. Feed collection, milking, health monitoring, selling animals were done by both adult males and females. Other activities such milk processing, cleaning cattle shed, selling of milk and milk products, cow dung making and calf management were performed mostly by females.

## Milk production, marketing and processing practices

Milking was two times per day during morning and evening except 4 farms in urban areas and 2 farms in rural areas, which practiced three times per day. Detailed information of milk marketing and processing is shown in Table 4 below. Results indicated that four types of milk and milk products were sold to consumers. These were milk, butter, fermented milk (yoghurt) and cheese. Butter was the most commonly sold milk product in the study area (93%) of the farms followed by raw milk (36%). In urban area 85.29%, 45.58%, 5.88%, and 4.41% of dairy farm owner practiced butter, raw milk, fermented milk and cheese, respectively. In the rural areas only butter and raw milk selling was practiced by 96.96% and 31% of the dairy farms, respectively.

Among households selling raw milk, 93% and 8% of the households sold directly to consumers and hotel (restaurants), respectively. The price of whole milk varied in urban and rural areas. In rural areas whole milk was sold at 3 birr per liter and in urban areas it was sold at 4.5 birr per liter. 1 kg of local cheese was sold at 8 birr per kg. About 92% of farm households practiced milk processing. Among milk processing households 99% use traditional milk processing equipment (clay pot). Most (92%) of farm the households processed raw milk at least to sour

| | Urban area (n=68) | | Rural area (n=132) | |
|---|---|---|---|---|
| Variable | Mean | % | Mean | % |
| Herd size | 7.35 | 100% | 11.60 | 100% |
| Cows | 3.03 | 41.20 | 3.36 | 29.00 |
| Local | 2.12 | 69.90 | 3.25 | 96.62 |
| Cross | 0.91 | 31.10 | 0.11 | 3.38 |
| Heifers | 1.41 | 19.20 | 2.22 | 19.20 |
| Bulls | 1.30 | 17.60 | 1.93 | 16.65 |
| Calves | 1.59 | 21.60 | 1.72 | 14.83 |
| Steers | 0.02 | 0.60 | 2.36 | 20..31 |

**Table 3:** Cattle herd size and composition in the study areas.

| Milk products sold | Urban area % (frequency) | Rural area % (frequency) | Over all % (frequency) |
|---|---|---|---|
| Raw milk | 45.58 (31) | 31.00 (41) | 36.00 (72) |
| Fermented milk(yoghurt) | 5.88 ( 4) | - | 2.00 (4) |
| Butter | 85.29 (58) | 96.96 (128) | 93.00 (186) |
| Cheese | 4.41 (3) | - | 1.5 (3) |
| Raw milk sellers to consumers | 83.87 (26) | 97.56 (40) | 93.05 (67) |
| Raw milk sellers to Hotels and Rest. | 16.12 (5) | 2.43 (1) | 8.33 (6) |
| Milk processing house holds | 82.35 (56) | 96.96 (128) | 92.00 (184) |
| Use modern processing equipment | 3.57 (2) | - | 1.08 (2) |
| Use traditional pot clay | 96.24 (54) | 100 (128) | 98.91 (182) |

**Table 4:** Types of milk and milk product marketed and milk processing practice in the study areas.

milk, butter, ghee, soft cheese and butter milk. And small proportion of households processed also local cheese into a product locally known as 'metata» which stays for a long time (one year) without spoilage specially during the long fasting period. Metata, ghee and buttermilk were used only for home consumption in the area [12].

## Conclusion

The study was conducted to characterize dairy cattle production systems/practices/, to provide baseline data and identify constraints and opportunities for dairy cattle production in the study area The results from this study reveal that:

In both urban and rural areas of Debremarkos the livestock composition is highly dominated by cattle which show the greater contribution of cattle through better management, feeding, and genetic improvement and improvement of market infrastructures. Dairy cattle production systems in the study area can be grouped as rural crop livestock mixed farming system, land less intra urban dairy farms and urban specialized dairy arms. The legally tenured land holding in the rural areas was almost one hectare and from this 96.96% was used for crop production and only 1.5% was used for natural pasture which shows that crop residues are the major animal feeds in the study area. All rural people used communal grazing land as a source of animal feed which is the other source of animal feed The communal grazing land was utilized with differed grazing system for the wet season and free grazing system in the dry season but due to the swampy nature of the grazing lands and free grazing utilization during the driest periods tramping of forage and less productivity of the communal gazing land was identified as the major cause for feed shortage which shows the need for improvement of communal grazing land utilization. Urea

treatment of crop residues and forage production are not practiced in the study area. In urban areas most of the farms used communal grazing land as a major source of animal feed in which animals were also supplemented with purchased crop residues, hay, concentrates and non-conventional feeds. This shows better feeding system of animals in urban areas as compared to rural areas.

Most of the farms 69% of rural area and 54.42% of urban area do not have raw milk selling practices due to lack of market access and small volume of milk produced and lack of milk market. Milk marketing system in the study area was contractual type of informal marketing system which lasts only to the non-fasting periods and milk marketing was stressed as a primary constraint by specialized dairy producers in urban areas who produce more milk (15-80 L) per day and also mentioned as a constraint by rural far distant farm households due to the long distant to transport milk on foot to urban areas for sell. This shows the need to improve milk market infrastructures for the improvement of dairy production in the study area. The majority of cows in the urban area 69.90% and almost all (96.62%) dairy cows in rural areas were local cows. The productivity of local cows was very low. The overall mean daily milk yields for local and cross bred cows' were $1.50 \pm 0.68$ L and $7.3 \pm 4.65$ L per day respectively. The overall mean lactation length, for local and cross bred cows was found to be $8.87 \pm 1.55$ month and $8.56 \pm 1.75$ months respectively. The overall mean age at first calving in the study area for local and cross breed cattle was $56.28 \pm 5.29$ and $35.44 \pm 11.15$ months respectively. The overall reported average calving interval for cross bred and local cows were 13.94 and 20.74 months respectively. The performance of cross breed cattle was better than local breed cattle in daily milk yield, age at first calving, and calving interval in both rural and urban areas. It was found that milk yield of cross bred cows was greater than that of local bred cows nearly by fivefold. This means that five local cows are one cross bred cow in terms of daily milk yield. The performance of local breed cattle in the urban areas was significantly higher than the daily milk yield of local cows in the rural areas which shows better management also can improve the daily milk yield of dairy cattle. Natural mating was the only method used for dairy cattle breeding. Avery small proportion of households used cross breed bull service. Farmers reported that though there was higher preference of natural mating with cross breed bulls there is limited cross breed bull in nearby. They also mentioned that the reason for lack of AI utilization were an availability at the time of heat; lack of attention for dairy production improvement; heat detection difficulty in local cows; suspicion of calving difficulty of local cows. In the study area there were no public veterinary services. Only 7.5% households used modern health treatment. But the rest 92.5% of the households used traditional method of health treatment and animal disease was mentioned as the first constraint for dairy cattle production in the area. Farmers reported that veterinary services from private sectors were not effective and costly.

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