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Dairy Cattle Management Practices in Selected Urban and Peri-Urban Areas of Central Highlands of Ethiopia

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Abstract: This cross sectional study was employed using pre-tested semi-structured questionnaire to assess the current husbandry practices in purposively selected urban and peri-urban dairy farms in Assela, Bishoftu, Holetta and Sululta towns located in central highlands of Ethiopia. A total of 160 dairy owners were randamly selected and interviewed. All respondents replied they use separate house for their dairy cattle. Sixty percent of the respondents from urban Bishoftu and peri-urban Holetta (60%) kept records. However, the experience of record keeping was not reported from the other study areas. Forty percent of the respondents from urban Sululta, 40% from peri-urban Holetta, 35% from urban Holetta and 35% from urban Bishoftu had records on milk yield, service types, number of services and calving dates. Stall feeding was the primary feeding method in 95% of the respondents in urban Bishoftu, 90% of urban Assela, 65% of urban Sululta, 55% of peri-urban Holetta areas. Conversely, 80% of the respondents in peri-urban Sululta and 50% in urban Holetta used both grazing and stall feeding systems. Tethering and stall feeding were the feeding systems used by 50% of the respondents in peri-urban Bishoftu. All respondents replied as they detect estrous. Anestrous was reported as a reproductive problem by 95% of respondents in peri-urban Sululta, 75% of urban Bishoftu, 70% of peri-urban Bishoftu and 55% of peri-urban Assela. Breeding by bull service was practiced by 75% of the dairy owners in urban Sululta areas. Artificial insemination was the main breeding system in all (100%) of the respondents in peri-urban Bishoftu, 90% of urban Bishoftu, 80% of urban Assela, 65% of urban Holetta, 60% of peri-urban Holetta and 50% of urban Assela areas. Generally, the current results highlighted that housing, stall feeding, estrous detection, breeding system (Mainly artificial insemination), weaning and culling practices were the main dairy management activities in the study areas. Thus, for the improvement of the dairy sector full access to extension services, improved management practices, quality artificial insemination service, credit, land and trainings are the important issues for dairy producers.

Key words: Dairy · Estrous · Feeding · Housing · Peri-Urban · Record Keeping · Urban · Ethiopia

INTRODUCTON

Agriculture is the leading sector in Ethiopian economy by contributing 42.3% for total national gross domestic product (GDP) [1]. Out of the total agricultural GDP, livestock sector contributes about 40% to agricultural gross domestic product and the livestock subsector exclusively contributes about 26.4% to the national Gross Domestic Product [2]. In the Ethiopian household economy livestock also performs numerous functions by providing food, input for crop production and soil fertility management, cash income as well as in promoting savings, fuel, social functions and employments [3]. The development of the dairy sector in Ethiopia can contribute a considerable role to poverty alleviation and household nutrition. However, dairying has not been fully exploited and encouraged as compared with other neighbour countries like Kenya, Uganda and Tanzania [4].

The annual milk production per cow in Ethiopia is generally low (1.37 litres/day/cow) and the per capita milk consumption was only about 19.2 kg/year [5-7] which is much lower than other African average per capita of 27 kg/year [8]. The low productivity of dairy cows might

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be due to low productive and reproductive performances, poor management practices such as feeding, housing and record keeping.

Understanding the current husbandry practices helps to design suitable technologies, which are well-matched with the existing systems. Generally, discussions on the dairy husbandry practices are imperative to plan development and research activities and bring improvements in dairy productivity. Therefore, this study aimed to explore dairy cattle management practices in the selected urban and peri-urban areas of central highlands of Ethiopia.

MATERIALS AND METHODS

Study Areas: The assessment was conducted in Assela, Bishoftu, Holetta and Sululta towns which are the major dairy production belt areas in central Ethiopia.

Assela town is located at about 175 km Southeast of Addis Ababa at 7°57'N and 39°7'E with an altitude of 2430 meters above sea level. Agricultural production system is mixed crop and livestock production. Dairy farming using improved breeds is a common practice in urban and peri-urban areas [9].

Bishoftu is located at 45 km along the Southeast of Addis Ababa, the capital of Ethiopia at 9°N latitude and 40°E longitude and at 1850 meters above sea level. The annual rainfall is 866 mm, of which 84% are in the long rainy season from June to September. The annual average temperature ranges from 12.3°C to 27.7°C with an overall average of 18.7°C [10].

Holetta is located between 38.5° E longitude and 9.8° N latitude and an elevation of 2400 meters above sea level. The average annual rain fall and temperature is about 1200 mm and 18°C and the average monthly relative humidity is 60% [11].

Sululta district lies on the geographical coordinates of 9° 11' 0" N latitude, 38° 45' 0" E longitude. The area is characterized by shallow valley with an elevation of 2500 meters above sea level, almost completely surrounded by mountains with numerous small rivers which drain into the Muger River. The average annual temperature in Sululta is 14.7°C with an average rainfall of 1119 mm [12].

Sampling Procedures and Sample Size Determination: A cross sectional study involving purposive selection of study areas but random selection of dairy farms and farm owners from the urban and peri-urban (Around the towns) areas were conducted. The study areas were purposively selected as they have high potential of dairy production. The sampling frame of administrative division and dairy farms were obtained from district livestock and agriculture development offices. Depending on the frame lists and information obtained two administrative divisions (Locally called Kebles) from each production systems were purposively selected based on the availability of crossbred dairy cattle and dairy production experiences. Dairy farms were then randomly selected from each Keble and questioned about the existing dairy management practices. Before the formal survey, a pre-test survey was conducted to collect general background information about the study areas. The information that was collected in the pre-test survey helps to guide the development of actual survey questionnaire.

The sample size was determined according the formula given by Arsham [13] for survey studies: $N=0.25/SE^2$ Where, N = sample size; SE = Standard error of dairy farms. Accordingly, by considering standard error of 3.95% with 95% confidence interval (CI) as follows, $N=0.25/(0.0395)^2 = 160$; a total of 160 dairy farms were selected by random sampling method from all study areas.

Data Collection and Analysis: A comprehensive open-ended and close-ended type semi-structured questionnaire was prepared and used to collect farm information. The information gathering was also supported by farm observations and discussions. Information was collected on dairy management including feeding, housing, record keeping, calf weaning, culling, estrous detection and breeding systems. The collected data was analyzed using SPSS [14] version 20 and descriptive statistics such as percentage was used to present the results.

RESULTS AND DISCUSSION

Housing and Record Keeping Practices: Almost all of the interviewed respondents stated that there was separate house for dairy cattle. In urban Bishoftu, peri-urban Holetta and peri-urban Bishoftu majority of the respondents have records of their dairy farms. However, in peri-urban Assela, urban Assela, peri-urban Sululta, urban Sululta, urban Holetta and peri-urban Bishoftu most of the dairy owners had no recording system. Milk yield, service and calving dates were the main parameters recorded in peri-urban Holetta, urban Sululta, urban Bishoftu, urban Holetta, peri-urban

Table 1: Housing and record keeping practices in the study areas

		Study areas							
		Assela		Bishoftu		Holetta		Sululta	
Measured variables (%)		U n=20	PU n=20	U n=20	PU n=20	U n=20	PU n=20	U n=20	PU n=20
Separate house for dairy cattle?	Yes	100	85	100	100	100	100	100	100
	No	0.0	15	0.0	0.0	0.0	0.0	0.0	0.0
	Overall	100	100	100	100	100	100	100	100
Record system?	Yes	25	10	60	50	40	60	40	30
	No	75	90	40	50	60	40	60	70
	Overall	100	100	100	100	100	100	100	100
Type of data recorded	Milk yield only	0.0	0.0	0.0	0.0	0.0	5	0.0	5
	Milk yield and calving dates	5	0.0	0.0	5	0.0	0.0	0.0	0.0
	Calving and service dates	15	5	5	10	0.0	5	0.0	0.0
	Milk yield, service date and calving date	5	5	35	25	35	40	40	25
	Calving date, heat sign and service dates	0.0	0.0	10	10	5	0.0	0.0	0.0
	Milk yield, calving, heat sign, service and vaccination dates	0.0	0.0	10	0.0	0.0	10	0.0	0.0
	No record	75	90	40	50	60	40	60	70
	Overall	100	100	100	100	100	100	100	100
Reasons for no record	Record is available	15	0.0	60	30	40	50	40	25
	Lack of awareness	75	90	30	40	60	40	60	70
	Incomplete record	10	10	0.0	20	0.0	10	0.0	5
	No reason	0.0	0.0	10	10	0.0	0.0	0.0	0.0
	Overall	100	100	100	100	100	100	100	100

n = number of respondents U= Urban; PU= Peri-urban

Bishoftu and peri-urban Sululta, respectively (Table1). In peri-urban Assela, urban Assela, peri-urban Sululta, urban Sululta, urban Holetta, peri-urban Bishoftu and peri-urban Holetta, respectively many dairy owners stated that the reason for not practicing records was lack of awareness.

In the current study almost all dairy owners were used separate housing system for their dairy cattle. Similarly, Ayalew [15] reported that in South Wollo Zone, Dessie town of Ethiopia all (100%) of the urban and peri-urban respondents used separate house for their dairy cattle. Additionally, in urban and peri-urban dairy farms of Mekelle of Ethiopia a 80% in urban and a 3.33% in peri-urban medium and large scale dairy farms, respectively were used separate housing system [16]. In Bhutan, Asia 78% of the total respondents also provided house to their crossbred dairy cattle. However, the rest 22% of respondents did not supply houses to their dairy cattle [17]. Conflicting to the present results, Asrat *et al*. [18] reported that 60% of dairy producers in urban dairy production system of Boditti town, Wolaita Zone used the same house for family and animals. The differences could be attributed to variations in management systems and financial related issues.

As indicated in Table 1, in many of the study areas dairy producers were not keeping records. Similarly, in and around Boditti town, South Ethiopia 95% of dairy farmers were not practiced record keeping [18]. The main reason raised for not keeping records was farmer's lack of awareness on benefits of keeping records. The lack of record keeping may have negative impact on productivity, decision making on progress and also may lead to inbreeding between closely related herds [19].

In the present study, milk yield, service and calving dates were the main parameters recorded by dairy producers. Inline to these results, Asrat *et al.* [20] also stated that in and around Wolaita Sodo town 42.7% (Town) and 27.8% (Surroundings) of dairy farmers were found to maintain breeding/AI and reproduction records, respectively.

Feeding Systems: As indicated in Table 2, in urban Bishoftu, urban Assela, urban Sululta, peri-urban Assela, peri-urban Holetta and peri-urban Bishoftu, respectively majority of the respondents revealed that stall feeding was the main feeding system. Furthermore, grazing and stall feeding were the main feeding systems in peri-urban Sululta and urban Holetta, respectively. Additionally, in peri-urban Bishoftu half of the interviewed respondents stated that tethering and stall feeding as the primary dairy feeding management practices.

Table 2: Types of dairy cattle feeding systems in the study areas

Measured variables (%)		Study areas: Assela U n=20	Assela PU n=20	Bishoftu U n=20	Bishoftu PU n=20	Holetta U n=20	Holetta PU n=20	Sululta U n=20	Sululta PU n=20
Types of dairy cattle feeding system	Stall feeding	90	55	95	50	20	55	65	15
	Grazing and stall feeding	10	40	0.0	0.0	50	15	25	80
	Tethering and stall feeding	0.0	5	5	50	20	25	10	0.0
	Grazing, tethering and stall feeding	0.0	0.0	0.0	0.0	10	5	0.0	5
	Overall	100	100	100	100	100	100	100	100

n = number of respondents U= Urban; PU= Peri-urban

In most of the present study areas stall feeding was the main dairy feeding system. But the feeding systems in peri-urban Bishoftu of the current study were tethering and stall feeding systems. Furthermore, grazing and stall feeding were the main feeding practices in peri-urban Sululta and urban Holetta, respectively (Table 2). Inline to the present findings, Dessalegn *et al*. [21] repoeted 74.6% and 25.4% of the dairy owners in Bishoftu and Akaki towns use stall (Intensive) feeding and stall feeding with limited grazing feeding systems, respectively as the major feeding practices. Adebabay [22] also reported that the types of feeding systems noted in Bure district of Amhara region, Ethiopia were communal grazing and stall feeding. Parallel to the feeding managements in peri-urban Bishoftu of the current study, in and around Shashamane town, Girma *et al*. [23] also stated that stall feeding practiced in urban areas. Additionally, in Addis Ababa milk shed and Dire Dawa town grazing was not practiced by urban dairy farms Yoseph Mekasha [24] and Emebet Moreda [25].

Estrous Detection and Breeding Systems: In the current study all of the interviewed respondents revealed as they practiced estrous detection (Table 3). In peri-urban Sululta, urban Bishoftu, peri-urban Bishoftu and peri-urban Assela, respectively many of the dairy owners stated that there was anestrous problem in their dairy herds. But majority of the dairy farmers in urban Sululta, peri-urban Holetta, urban Holetta and urban Assela stated anestrous was not a problem in their dairy farm. Bull service was the primary breeding system in peri-urban Sululta and urban Sululta areas. On the other hand, artificial insemination was the main breeding system in peri-urban Bishoftu, urban Bishoftu, urban Assela, urban Holetta, peri-urban Holetta and peri-urban Assela, respectively (Table 3).

Dairy respondents in peri-urban Sululta, urban Bishoftu, peri-urban Bishoftu and peri-urban Assela, respectively stated that there was anestrous problem in their dairy herd. Comparable to these results, Roelofs *et al*. [26] confirmed that achieving efficient estrous detection by visual observation depends on the timing, duration and frequency of observation. In addition, discrete behavioral signs of estrous, nonattendance of standing mounts for up to 60% of ovulations and the shorter duration of estrous in modern, high-yielding dairy cows make visual detection of estrous more difficult [27, 28]. Additionally, a study at the veterinary clinic of the school of veterinary medicine in Debre Zeit town by Endris *et al*. [29] indicated that dairy owners were mostly dependent on estrous signs like bellowing, mucus vaginal discharge and mounting. Furthermore, in another study it was described that long post-partum anoestrous period is a very common problem in cows reared in a tropical environment [30].

Comparable to the natural breeding system in peri-urban Sululta and urban Sululta of the current study, Tesfa [31] stated that along with natural mating, some farmers used AI in highland and midland areas of Ethiopia. Similarly, Asrat *et al*. [18] indicated that in the mixed crop/livestock production system of Boditti town 65.4% of the households use natural mating using local bulls, 35% of the households use artificial insemination (AI) and the rest (1.7%) use both natural mating and AI service. The study by Solomon *et al*. [32] also indicated that 100% of the dairy farmers in Metekel zone, Northwest Ethiopia depend on natural mating to inseminate their cows. In Borana zone, on average 75% and 84.2% of respondents of lowland and mid-highland areas, respectively, replied that they used natural bull service for breeding system [33]. In peri-urban Bishoftu, urban Bishoftu, urban Assela, urban Holetta, peri-urban Holetta and peri-urban Assela, respectively artificial insemination was the main breeding system. Likewise, Dessalegn *et al*. [21] stated that in Bishoftu and Akaki towns 50.8% and 46.4% of the respondents used artificial insemination (AI) as breeding system for their dairy cattle. However, Asrat *et al*. [18] reported that 51.7% of the households in

Table 3: Estrous detection and breeding systems of crossbred dairy cows in the study areas

		Study areas							
		Assela		Bishoftu		Holetta		Sululta	
Measured variables (%)		U n=20	PU n=20	U n=20	PU n=20	U n=20	PU n=20	U n=20	PU n=20
Do you practice estrous detection?	Yes	100	100	100	100	100	100	100	100
	No	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Overall	100	100	100	100	100	100	100	100
Season of the year estrous mostly detected	Summer	5	0.0	0.0	0.0	0.0	10	0.0	10
	Winter	0.0	5	5	0.0	35	20	5	10
	Not seasonal	95	95	95	100	65	70	95	80
	Overall	100	100	100	100	100	100	100	100
Is there anestrous problem in cows or heifers?	Yes	45	55	75	70	45	35	20	95
	No	55	45	25	30	55	65	80	5
	Overall	100	100	100	100	100	100	100	100
Breeding system/s	Natural bull service	5	25	5	0.0	10	15	75	100
	AI	80	50	90	100	65	60	20	0.0
	Both AI and Natural service	15	25	5	0.0	25	25	5	0.0
	Overall	100	100	100	100	100	100	100	100

n = number of respondents U= Urban; PU= Peri-urban; AI, Artificial Insemination

Table 4: Practices of weaning and culling of dairy cattle in the study areas

		Study areas							
		Assela		Bishoftu		Holetta		Sululta	
Measured variables (%)		U n=20	PU n=20	U n=20	PU n=20	U n=20	PU n=20	U n=20	PU n=20
Do you practice calf weaning?	Yes	80	75	100	100	100	100	80	75
	No	20	25	0.0	0.0	0.0	0.0	20	25
	Overall	100	100	100	100	100	100	100	100
Do you practice culling?	Yes	70	60	100	85	100	95	80	75
	No	30	40	0.0	15	0.0	5	20	25
	Overall	100	100	100	100	100	100	100	100

n = number of respondents U= Urban; PU= Peri-urban

the urban system of Boditti town were used natural mating by local bulls and the remaining 48.4% used AI. The differences could be determined by access and cost of AI service, ease of getting preferred service, access of breeding bull and farmers' awareness.

A study by Misgana *et al*. [34] in East Wollega zone, Ethiopia stated that majority of the dairy owners (50.5%) used both natural and artificial insemination for breeding their dairy cattle alternatively which was not consistent with the current results. The differences might be due to herd type and management variations.

Weaning and Culling Systems: In Bishoftu and Holetta areas all respondents were practiced calf weaning. Overall, in the present study calf weaning was experienced by majority of the dairy owners in all areas. Culling was also practiced by most of the respondents in urban Holetta, urban Bishoftu, peri-urban Holetta, peri-urban Bishoftu, urban Sululta, peri-urban Sululta, urban Assela, peri-urban Assela, respectively (Table 4).

In urban and peri-urban areas of the current study majority of the dairy producers experienced calf weaning in their farm. In agreement to these results, about 90.8% dairy cattle producers both in town and the surrounding of Boditti town, practiced partial suckling prior to milking and colostrum is given to calves freely [18]. Additionally, in Bure area Adebabay [22] stated that only 8.9% of the respondents exercise weaning, 64.3% of the respondents exercise partial weaning and the rest 26.8% employ sudden weaning.

Culling was practiced by majority of the respondents in urban Holetta, urban Bishoftu, peri-urban Holetta, peri-urban Bishoftu, urban Sululta, peri-urban Sululta, urban Assela, peri-urban Assela, respectively. Inline to these results, a study in Fogera, Jeldu and Diga districts of the Nile Basin (Ethiopia) indicated that in case of emergencies both financial and agricultural the farmers tend to sell the growing herd first and breeding females were maintained in the herd for older age until reproductive performance was nearly stopped [35]. Furthermore, in Bishoftu and

Akaki areas male calves were not economical to keep and farmers sold them cheaply or culled them from the herd as soon as possible [21].

CONCLUSIONS

Dairy management practices were the core issues in improving the productivity of dairy cattle. Housing, feeding, estrous detection, breeding, weaning and culling systems were the main management practices experienced by dairy farmers in all the study areas. All farmers use separate housing system to keep their dairy cattle. The feeding of dairy cattle was mainly based on stall feeding system. Artificial insemination was described as the prime breeding system in the dairy farms. Record keeping was not effectively practiced by dairy producers because of the absence of awareness about its benefits. Generally, farmers are very eager to expand and improve the management practices of their dairy farms. Therefore, to change the dream of the farmers in to reality and for further development of the dairy sector full access to extension services, improved management practices, quality artificial insemination service, credit, land and different types of trainings must be available for the farmers.

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