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Dairy Cattle Husbandry Practices in Selected Urban and Peri-Urban Milk Shed Areas of North Shoa Zone, Ethiopia

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Abstract: This cross-sectional study depended on using pre-tested semi-structured questionnaire to assess the current husbandry practices of dairy cattle in selected urban and peri-urban dairy farms in Debre Berhan milk shed areas of North Shoa Zone, central highlands of Ethiopia. A total of 175 dairy owners were randomly selected and interviewed. The experience of record keeping was not practice in the study areas. While few farmers had records on milk yield, service types, number of services and calving dates. Stall feeding was the primary feeding method in the areas. The respondents responded that they detect estrous and artificial insemination was the main breeding system in the study areas. Generally, the current results highlighted that housing, watering, stall feeding, estrous detection, breeding system (Mainly artificial insemination), weaning and culling practices were the main dairy husbandry practices 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 Cattle · Estrous · Feeding · Watering · Housing · Peri-Urban · Record Keeping · Urban Ethiopia

INTRODUCTION

Agriculture is the leading sector in Ethiopian functions by providing food, economy by contributing 42.3% for the 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 employment [3]. The development of the dairy sector in Ethiopia can contribute a considerable role to poverty. However, dairying has not been fully exploited and encouraged as compared with other neighbor countries like Kenya, Uganda and Tanzania [4].

The annual milk production per cow in Ethiopia is generally low (1.37 liters/day/cow) and the per capita milk consumption was only about 19.2 kg/year [5-7] which is much lower than the other African average which has 27 kg/year per capita [8]. The low productivity of dairy cows might 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 husbandry practices in the selected urban and peri-urban milk shed areas of Debre Berhan, North Shoa Zone of Central Highlands of Ethiopia.

MATERIALS AND METHODS

Description of the Study Area: The study was conducted in and around Debre Berhan milk-shed areas of North Shoa Zone of Amhara National Regional State (ANRS), Central Ethiopia which is located at 39°30' East longitude

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and 09°36' North latitudes and 130 km away to the Northeast of Addis Ababa. The elevation ranges from 2840 to 2943 meters above sea level [9]. The mean annual minimum and maximum temperatures averaged between 6.7 and 19.9 °C, respectively. The mean annual rainfall is 1026 mm with potential evapotranspiration of 1396 mm. Rainfall distribution is bimodal, usually, the long rains last from June to the beginning of September and the period of the short rains falls between February and May [9].

Sampling Procedures and Sample Size Determination: This cross-sectional study involved purposive selection of study areas but a random selection of dairy farms and farm owners from the urban and peri-urban areas. Three districts namely, Basonaworena, AngolelanaTera and Debre-Brehan town were purposively selected because of the large dairy cattle population. Of these districts, six representative milk potential areas were randomly selected based on the availability of crossbred dairy cattle and dairy production experiences.

The sample size of farms to be interviewed was determined according to The sample size was determined according the formula given by Arsham [10] for survey studies: N=0.25/SE Where, $N=0.25/SE^2$ with the assumption of 3.73% standard error. Accordingly, a total of 175 smallholder farmers were selected.

Data Collection and Data Analysis: The 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 group 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 [11] version 20 and descriptive statistics such as percentage was used to present the results.

RESULTS AND DISCUSSION

Housing and Record-Keeping Practices: Based on the interview 89.4% of farmers from urban and 68.5% from Urban and peri-urban constructed dairy cattle barns with corrugated iron roofing material for better durability. The details of roof type, floor type, materials used to make the roof and floor of the barns and frequency of barn cleaning are indicated Table 1. Animal housing is important to protect animals from predators, theft, unfavorable weather conditions and for ease of undertaking husbandry practices [12, 13]. All sampled dairy herdowners across the study areas housed their animal's in separate barns constructed purposefully for dairy cattle. This has the advantage to limit the spread of diseases from animals to humans and vice versa. Asrat *et al.* [13], reported that 83% of the total respondents in Wolayta zone kept their animals in the same house where the family lives. The majority of the respondents (89.4%) and (68.5%) in Urban and peri-urban areas constructed dairy cattle barns with corrugated iron roofing material for better durability, while the rest constructed with thatched grass and few are constructed with Plastic/Geo-membrane. The materials used to make the floor of the barns in urban and peri-urban (65.9-88.9%) of the respondents used stone for flooring. Clean, dry and comfortable bedding material is important to minimize the growth of microorganisms. However, none of the respondents were reported to use bedding material for the dairy animals. The majority of the surveyed HHs (99.5%) cleaned the barn daily. Housing conditions in many of HHs were unclean, wet and not providing a comfortable setting for the dairy animals. This may have a negative impact on the production of clean milk and milk products, in addition to increasing animal health problems. Therefore, cow sheds must be designed in such a way that it gives comfort for the animals and easy for routine daily activities like cleaning and feeding. As indicated in Table 1, in many of the study areas dairy producers were not keeping records. Similarly, in urban and peri-urban areas of Central Highlands of Ethiopia farmers have not practiced record keeping [14] and around Boditti town, South Ethiopia 95% of dairy farmers were not practiced record keeping [13]. The main reason raised for not keeping records was farmer's lack of awareness on the benefits of keeping records. The lack of record keeping may have a negative impact on productivity, decision making on progress and also may lead to inbreeding between closely related herds [15].

Record keeping is the basis for proper livestock husbandry. As indicated by Markos [16], livestock development in Ethiopia has been handicapped to a great extent due to the lack of recorded data. The study found that farmers do not keep the necessary farm records pertaining to their dairy animals. However, 14.1% of the sampled dairy herd owners in urban areas to some extent tried to keep records on breeding dates until the animals give calves and daily milk sales using an informal sheet. It is therefore essential to provide training on this useful practice to dairy herd owners to make the decision for better livestock management and thereby optimize the utilization of the available resources in the study area.

Table 1: Dairy animals' house type and frequency of cleaning

		Dairy production systems		
Variables	Description	Urban (n=85)	Peri-urban (n=90)	Overall (n=175)
Roof type (%)	Corrugated	89.4	68.5	79.0
	Thatched	4.7	30.3	17.5
	Plastic	5.9	1.1	3.5
Floor type (%)	Cement	22.4	10.0	16.2
	Stone	65.9	88.9	77.4
	Earthen	11.8	1.1	6.5
Bedding used (%)	Yes	0.0	0.0	0.0
	No	100	100	100
Cleaning frequency (%)	Daily	100	98.9	99.5
	Once / week	0.0	1.1	0.55
Record keeping (%)	Yes	14.1	8.9	11.4

n = number of respondents

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

		Dairy production systems		
Measured variables (%	Description	Urban (n=85)	Peri-urban (n=90)	Overall (n=175)
Types of dairy cattle feeding system	Stall feeding	76.5	76.7	76.6
	Grazing and stall feeding	23.5	23.3	23.4
Source of water	Tap	65.9	45.6	55.4
	River	30.6	48.9	40
	Spring	3.5	5.6	4.6
Watering frequency/day	Thrice and more	65.9	57.8	61.9
	Twice	34.1	42.2	38.1

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*. [17] 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 and Watering Frequency: As indicated in Table 2, in urban and peri-urban areas of the study areas the majority of the respondents revealed that stall feeding as the main feeding system. Furthermore, free grazing and stall feeding were the second feeding systems. Similar to the present findings, Abebe *et al.* [14] stated that in urban and peri-urban areas of Central Highlands of Ethiopia and Dessalegn *et al.* [18] reported 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 [19] 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 town, Girma *et al.* [20] 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 [21] and Emebet Moreda [22]. Bereda *et al.* [23] also reported that stall feeding as the main feeding system in the study areas. Of the interviewed farmers 65.9% from urban and 45.6% from peri-urban reported using tap water for dairy cattle. The detail of the source of water and watering frequency is presented in table 2. Similar findings were reported by Bereda *et al.* [23] in urban and peri-urban areas of the Central Highlands of Ethiopia.

The availability of feed resources in the area depends on seasons. However, concentrate feeds, crop residues (teff straw, wheat straw and barley straw) and conserved forage (hay), were used both in wet and dry seasons. Barely (*Hordeum vulgare*), Faba bean (Vicia faba L), Wheat (*Triticum aestivum*) and Oat (*Avena spp*) residues reported being the major crop residues (CR) available for dairy animals in study areas Table 3. The previous report of Bereda et al. [23] indicated that crop residues were used as a feed source for dairy animals in Debre Berhan, Sheno and Sendafa areas. Livestock feeds are obtained from different sources including crop residues (CR), grazing lands (GL), crop aftermath and fallow land and purchased Tahir *et al*. [24].

Table 3: Rank of Crop residues in the study areas (%)

Crop residues	1st	2nd	3rd	4th	5th	Index
Barely(*Hordeum vulgare*)	160	6	2	0	0	0.43
Faba bean(Vicia faba L)	2	34	80	7	3	0.21
Wheat(*Triticum aestivum*)	7	71	19	9	0	0.20
Oat (*Avena spp*)	0	49	8	26	11	0.15
Teff (*Eragrostis abyssinica*)	2	0	1	3	4	0.01

Index = sum of [5 for rank 1 + 4 for rank 2 + 3 for rank 3+2for rank 4+1for rank 5] for particular trait divided by sum of [5 for rank 1 + 4 for rank 2 + 3for rank 3+2for rank 4+1for rank 5] for all traits

Table 4: Estrous detection and breeding systems of crossbred dairy cows in the study areas

		Dairy production systems		
Measured variables (%)	Description	Urban (n=85)	Peri-urban (n=90)	Overall (n=175)
Do you practice estrous detection?	Yes	98.8	1.2	99.4
	No	100	0.0	0.6
Method of estrous detection?	Herdsman information	3.6	25.6	14.9
	Follows up during morning &night	89.3	66.6	77.6
	Using teaser bull	7.1	7.8	7.5
Breeding methods (%)	AI	30.6	26.7	28.6
	Natural mating	27.1	40.0	33.7
	AI or Natural mating	42.4	33.3	37.7
Source of bull (%)	Neighbor	82.8	81.2	81.9
	Own	17.2	18.8	18.1
Price (ETB) mean (SE)	AI	96.4(8.6)	72.6(8.0)	83.3(5.9)
	Bull	119.6(10.0)	88.3(10.8)	104(7.5)

ETB= Ethiopian Birr, n = number of respondents; AI, Artificial Insemination

Table 5: Practices of weaning and culling of dairy cattle in the study areas

		Dairy production systems		
Measured variables (%	Description	Urban (n=85)	Peri-urban (n=90)	Overall (n=175)
Do you practice calf weaning?	Yes	72.9	61.1	66.9
	No	27.1	38.9	33.1
Do you practice culling?	Yes	65.9	36.7	50.9
	No	34.1	63.3	49.1

n = number of respondents

Estrous Detection and Breeding Systems: In the current study, all of the interviewed respondents revealed as they practiced estrous detection and farmers detected estrous by follows up during morning and night time. Comparable to these results, Roelofs *et al.* [24] 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 ovulation and the shorter duration of estrous in modern, high-yielding dairy cows make visual detection of estrous more difficult [25, 26]. Additionally, a study at the veterinary clinic of the school of veterinary medicine in Debre Zeit town by Endris *et al.* [27] 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 [28]. The breeding practices of 29% in the study areas used AI for breeding the dairy animals, those who used the combination of AI and improved bulls constituted about 37.7%. Dessalegn *et al*. [18] stated that in Bishoftu and Akaki towns 50.8% and 46.4% of the respondents used artificial insemination (AI) as a breeding system for their dairy cattle. However, Asrat *et al.* [17] reported that 51.7% of the households in the urban system of Boditti town 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 to breeding bull and farmers' awareness.

A study by Misgana *et al.* [29] in East Wollega zone, Ethiopia stated that the majority of the dairy owners

(50.5%) used both natural and artificial insemination for breeding their dairy cattle alternatively which disagree with the current results. The differences might be due to herd type and management variations. Because of government subsidies, farmers are charged only 4 birrs per AI service in Ethiopia. However, the actual cost of AI service obtained was extremely expensive. This might be due to the fact that the service is mostly provided by private AI technicians. The use of bulls for natural service is common in Ethiopia and breeding bulls not reared in their herd, while only about 18.1% of them used homebred bulls. The average bull service charge was estimated to be 104 ETB/service, which is expensive when compared to the AI services.

Weaning and Culling Systems: In the study areas, all respondents have practiced calf weaning. Overall, in the present study calf weaning was experienced by the majority of the dairy owners in all areas. Culling was also practiced by most of the respondents in urban areas than peri-urban areas (Table 4). In urban and peri-urban areas of the current study the majority of the dairy producers experienced calf weaning in their farm. In agreement to these results, about 75-100% dairy cattle producers both in town and the surrounding of central highlands of Ethiopia, practiced partial suckling prior to milking and colostrum is given to calves freely [24]. Additionally, in Bure area, Adebabay [19] 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 the majority of the respondents in urban areas than peri-urban areas. Inline to these results, a study in central highlands of Ethiopia Abeba *et al.* [19] and Bereda *et al.* [23], 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 [28]. 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 [18].

CONCLUSION

It could be concluded that housing, watering, feeding, estrous detection, breeding, weaning and culling systems were the main husbandry 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 enthusiastic to expand and improve the management practices of their dairy farms. Therefore, to change the dream of the farmers into 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 training must be available for the farmers.

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