

Management Practices and Constraints of Smallholder Dairy Production in Mekelle Zone, Tigray, Ethiopia

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Abstract: This cross sectional study was conducted from November 2018 to May 2019 to assess management practices and constraints of smallholder dairy production in Mekelle zone. Data was collected from 250 smallholder dairy farmers by interview using structured and pre-tested questionnaires, group focused discussion and personal observation. In this study, 65.5% and 36.8% of the dairy farmers were males and illiterate, respectively. Moreover, 69.2% of them were involved in livestock production only, while the rest were working as crop and livestock producers. Regarding breeding management, 74.8% of the dairy farmers know when their cows are in heat. Moreover, 38.0% of them use both natural and artificial insemination services. Regarding reproductive performance, 59% and 51.2% of the dairy farmers replied the average age at first service and calving of cross breed heifers is of 1 to 2 or between 2 to 3 years, respectively. Furthermore, 58.4% of the dairy farmers replied, the average calving interval of the cross breed cows is 12 months. It is revealed that, 38.4% of the dairy farmers have complained mastitis is the major constraint which affects the health and productivity of their cows. It is found that, 87.2% of the dairy farmers get veterinary service and 88% of them take their animals to veterinary clinics when they got sick. This study has shown, 81.6 of the dairy farmers were using intensive feeding system and 85.2% them complained they have feed shortage especially during the dry season of the year. The major constraints facing the dairy farmers in the study area are Animal feed shortage (53.6%), lack of milk market (10.4%), lack of farming land (9.2%), lack of veterinary services (8.4%), lack of artificial insemination (6.8%), lack of training (6.8%) and lack of credit services (4.8%). Therefore, solving these constraints is very important for the development of the sector and improves the livelihood of the dairy farmers.

Key words: Dairy Production • Feeding • Housing • Breeding • Milking • Health • Constraints • Mekelle Zone

INTRODUCTION

The livestock sector globally is highly dynamic, contributes 40% of the global value of agricultural output and support the livelihoods and food security of almost a billion people [1]. Livestock production constitutes one of the principal means of achieving improved living standards in many regions of the developing world [2]. In sub-Saharan African countries, livestock plays a crucial role in the national economies and the livelihood of rural communities [3]. In Ethiopia, agriculture is the main economic activity with more than 80 % of the population being dependent on this practice. It contributes with approximately 50 % to the overall gross domestic product (GDP), generates 90 % of export earnings and provides employment for 80 % of the population [4]. Livestock

production is a crucial part of the agriculture and the contribution of livestock and their products to the agriculture economy accounts for 47 % [5]. Ethiopia has a high number of livestock populations and suitable climate for livestock development, a relatively favorable climate for improved, high yielding dairy cattle breeds and regions with less animal disease-stress that make the country to have a substantial potential for dairy development. Taking this in to account, this paper is prepared with the objectives of over viewing the Ethiopian dairy sector and its contribution for the economy of the country [6]. Ethiopian total cattle population is estimated to be about 59.5 million. Out of this total cattle population, the female cattle constitute about 55.5 percent and the remaining 44.5 percent are male cattle. Dairy-cows are estimated to be around 7.16 million

and milking cows are about 11.83 million heads [7]. Tigray region is the fourth highest potential region of the country in livestock production having 4.79 million cattle population next to Oromia, Amhara and SNNPR which contributes 8.05% to the Ethiopian cattle population [7]. The high number of livestock populations; favorable climate for improved high yielding cattle breeds and the relatively animal disease free environment make Ethiopia to hold a substantial potential for dairy development [8]. Dairy production is among the important components of the livestock sector which is source of animal protein, income and employment [9]. It has a great potential for improving the living standards of the people and contributing towards reduction of poverty. The ability of the dairy enterprise to generate regular income and to contribute to the household diet on a regular basis throughout the year is an advantage over other agribusiness enterprises [10]. In 2010, dairying created an estimated 588, 000 full-time on-farm jobs [6]. Dairy cattle production in the country is classified into four major livestock production systems: rural smallholder (mixed crop-livestock) production, pastoral and agro-pastoral production, urban and peri-urban smallholder dairy production and specialized commercial dairy production systems [11]. The need for milk and its products majorly come from the urban and peri urban dairy production systems. There is an increased demand for milk and milk products in and around Mekelle city due to increased population growth and urbanization. Consequently, the number of people involved in small scale intensive, large scale intensive and small holder dairy farming has increased dramatically in the vicinity of the city [12]. However, expansion and productivity of small scale dairy farms was constrained by Lack of land, shortage of feed, lack of improved animals and lack of access to artificial insemination, lack of extension services, diseases, lack of credit service and market problem during fasting period and absence of processing industry were constraints limiting dairy production [13-14]. Improvement in dairy cattle productivity can be achieved through identification of production constraints and introduction of new technologies or by refining existing practices in the system. Identification of overall management activities with their constraints and opportunities associated to dairy cattle production are preconditions for designing small holder dairy farm development strategies [15].

Therefore, this study was conducted to assess the management practices and constraints of smallholder dairy production in Mekelle zone.

MATERIALS AND METHODS

Description of the Study Area: The study was conducted from November 2017 to May 2018 in Mekelle zone. Mekelle is the capital city of Tigray Regional State which is situated at a distance of 783Km from Addis Ababa. It is located in the Northern extremes of Ethiopia extending from 33°25' to 39°38' North latitude and from 36° 271' to 40° 181' East longitude at an average altitude of 2000 to 2200 meters above sea level. It has an area of 53km square. The mean annual rainfall ranges from 11.3mm to 39.1mm and the temperature varies from 12°C in November and December to 27°C in the months of January and March [16]. Mekelle is considered a Special Zone, which is into 7 sub-cities, 33 kebele and 105 Ketenes [17]. The human population of the Mekelle city is 215546 [18]. The livestock population of Mekelle city includes 24, 419 cattle, 3, 372 goats, 4, 935 sheep, 2, 872 horses, 216 mules, 3, 080 donkeys and 293 camels. Total number of dairy farm in Mekelle city is 1, 515 (cross breed 5634 and 13104 local breeds) and the number of smallholder dairy farm is 833 [19].

Study Design and Sampling Techniques: A cross-sectional study was conducted from November 2017 to May 2018 to assess the management practices and constraints of smallholder dairy production in Mekelle City. In this study, 250 out of the total of 833 registered small-holder dairy farmers in the seven sub-cities of Mekelle city were selected randomly.

Study Population: Commercial small-holder dairy farmers who own cross and local breed dairy cows were the study populations of this study.

Data Collection: Primary data on housing, feeding, breeding, health and milking management practices of small-holder dairy farmers were collected from 250 smallholder dairy farmers by interview using structured and semi-structured questionnaire survey, group focused discussion and personal observations. Moreover, relevant secondary data were collected from the responsible Offices of the study area

Data Management and Analysis: The collected raw data was entered into an Excel sheet, cleaned, coded, imported and analyzed using a Statistical Package for Social Sciences (SPSS) version 20. Then, descriptive statistical analysis such as frequency and percentages were computed.

RESULTS

Respondents’ Biography and Socio Economic Characteristics: Out of the total dairy farmers interviewed in the current study, majority of them (65.5%) were males and (36.8%) of them were illiterate. Moreover, 69.2% of them were involved in livestock production only (Table 1).

Breeding Managements of Dairy Cows: Regarding the breeding management of dairy cows in the study area, 74.8% of the respondents know when their cows are in heat. Majority of them (59%), said, “The average age of cross breed heifers is between 1-2 years.” Moreover, 51.2% of them said, “the average age at first calving of the cross breed heifers is between 2-3 years (Table 2).

Health Management of Dairy Cows: According to the result of the present study, 38.4% of the dairy farmers were complained that there was mastitis which affects the health and production of their dairy cows in the study area. This study has found that, 88% of the dairy farmers take their animals to the Veterinary clinic when they get sick, while the rest treat their animals by themselves. On the other hand, 87.2% of the dairy farmers get veterinary services (Table 3).

Feeding Managements of Dairy Cows: According to the result of this study, 81.6% of the dairy farmers were using intensive feeding system and 85.2% them complained they have feed shortage especially during the dry season of the year. Moreover, this study revealed, 70.8% and 65.55 % of the dairy farmers provide feed and water to their dairy cows individually (Table 4).

Housing Management of Dairy Cows: The results of the present study indicated that, majority of dairy houses (61.6%) were fully closed. Moreover, 40.1% of the dairy farmers complained they did not take any training on housing management of dairy cows. As a result, 64.8% of them construct the dairy houses by themselves (Table 5).

Milking Management of Dairy Cows: The results of the present study have shown that, majority of the dairy farmers (79.6%) wash their hands before milking their cows. Moreover, 79.2% and 20.8% of the dairy farmers wash and dry the teats and udder of the cows before milking, respectively (Table 6).

Major Constraints: This study has shown that, there are many constraints which affect the development of the dairy production sector and livelihood of the dairy farmers in the study area (Table 7).

Table 1: Respondents’ Biography and Socio economic Characteristics

Variables	Category	Frequency	Percent
Sex	Male	164	65.6
	Female	86	34.4
Age	5-29	80	32.0
	30-49	122	48.8
	≥50	48	19.2
Level of education	Illiterate	92	36.8
	Basic education	40	16.0
	Elementary	60	24.0
	Secondary	36	14.4
	Certificate	7	2.8
	Diploma and above	15	6.0
Number of local breed	<5	15	6.0
	5-10	7	2.8
	>10	5	2.0
Number of cross breed	<5	145	58.0
	5-10	60	24.0
	>10	18	7.2
Farm activity	Livestock production	173	69.2
	Crop production	11	4.4
	Mixed crop livestock production	66	26.4
Farming experience	<5	116	46.4
	5-10	76	30.4
	>10	58	23.2

Table 2: Breeding management and reproductive performances of dairy cows.

Variables	Category	Frequency	Percent
Do you know when a cow is in heat?	Yes	187	74.8
	No	63	25.2
Average age at first service of cross breed heifers	< 1 years	21	8.4
	1-2 years	149	59.6
	>2 years	80	32.0
Average age at first calving of cross breed heifer	< 2years	20	8
	2-3years	128	51.2
	>3	102	40.8
Calving interval of cross breed cows	12 months	146	58.4
	>12 months	93	37.2
	I don't know	11	4.4
Do you synchronize your cows?	Yes	65	26.0
	No	185	74.0
What type breeding system do you use?	Natural	86	34.4
	AI	69	27.6
	Both	95	38.0
Number of services/conception in natural mating	Once	82	32.0
	Twice	57	22.8
	Three times	63	25.2
	>3 times	48	19.2
Number of services/conception in AI mating	Once	78	31.2
	Twice	91	36.4
	Three times	10	4
	>3 times	1	0.4

Table 3: Health management of dairy cows

Variables	Categories	Frequency	Percent
Common healthy problems	Mastitis	96	38.4
	Hoof problem	57	22.8
	Others	67	26.8
	I don't know	30	12.0
What do you do when your animals are sick?	I take them to veterinary clinic	220	88.0
	I treat them myself	30	12.0
Do you get veterinary services?	Yes	218	87.2
	No	32	12.8
If yes, do you think it is satisfactory?	Yes	171	68.4
	No	47	18.8
Do you keep health records?	Yes	102	40.8
	No	148	59.2

Table 4: Feeding management of dairy cows

Variables	Category	Frequency	Percent
What types of feeding system do you use?	Intensive	204	81.6
	Semi intensive	38	15.2
	Extensive	8	8
Do you have animal feed shortage?	Yes	213	85.2
	No	37	14.8
How do you feed your cows?	Individually	177	70.8
	In group	73	29.2
How do you provide water for your cows?	Individually	164	65.6
	In group	86	34.4
Watering frequency of your cows per day?	Once	103	41.2
	Twice	116	46.4
	Three times	24	9.6
	>three times	3	1.2
	<i>Ad libtum</i>	4	1.6
Do you feed colostrum to your newly born calves	Yes	212	84.8
	No	38	15.2
If yes, do you know the appropriate time when a calf should get colostrum?	Yes	124	49.6
	No	88	35.2
Weaning age of your calf?	<3 months	73	29.2
	3-4 months	114	45.6
	>4 months	63	25.2

Table 5: Housing management of dairy cows and calves

Variables	Category	Frequency	Percent
Types of the dairy house	Open	47	18.8
	Fully closed	154	61.6
	Partially closed	49	19.6
Did you take training on housing management of dairy cows?	Yes	149	59.6
	No	101	40.1
Who construct the dairy cows' house?	By myself	162	64.8
	Experienced and paid person	88	35.2
Do you consult professionals before constructing the dairy house?	Yes	97	38.8
	No	153	61.2
Floor type of the dairy house	Soil	87	34.8
	Concrete	157	62.8
	Cement	5	2.0
	Others	1	0.4
Presence of drainage system in the dairy house	Present	165	66.0
	Absent	85	34.0
How do you keep your calves?	In separate house	178	71.2
	Inside the mothers' house	72	28.8
Clearing frequency of the dairy house/day?	Once	111	44.4
	Twice	90	36.0
	> twice	49	19.6

Table 6: Milking management of dairy cows

Variables	Category	Frequency	Percent
Do you wash your hands before milking your cows?	Yes	199	79.6
	No	51	20.4
If yes, how do you wash?	By water only	80	32.0
	By water and soap	119	47.6
Do you wash the teats and udder of the cows before milking?	Yes	198	79.2
	No	52	20.8
If yes, do you dry the teats and udder after washing and before milking?	Yes	198	79.2
	No	52	20.8

Table 7: Major constraints of Dairy production in the study area

Major constraints	Frequency	Percent	Rank
Feed shortage	134	53.6	1 st
Lack of milk market	26	10.4	2 nd
Lack of farming land	23	9.2	3 rd
Lack veterinary services	21	8.4	4 th
Lack of artificial insemination	17	6.8	5 th
Lack of training	17	6.8	5 th
Lack of credit services	12	4.8	6 th

DISCUSSION

Out of the total 250 dairy farmers interviewed in the current study, 65.5% of them were males and 36.8% of them were illiterate. Majority of the dairy farmers in the present study area (89.2%) own cross breed dairy cows. This figure shows the awareness of the dairy farmers to keep dairy cows with high milk yield is very promising. This finding is in close agreement with the finding of Adane *et al.* [20] who reported 89.4% of the dairy farmers at the urban and peri-urban area of Hosanna, SNNPR were keeping cross breed dairy cows.

Regarding the breeding management of dairy cows, 74.8% of the dairy farmers know when the dairy cows are in heat. According to the informal communication with the dairy farmers, they know failure to detect cows that are in heat results economic loss for the producer due to extended calving intervals, milk loss and additional expense.

It has been found that 59% of the dairy farmers have replied the average age at first service of the crossbreed heifers is between 1-2 years. Moreover, 51.2% of the dairy farmers replied the average age at first calving of the crossbreed heifers is between 2-3 years.

These findings are higher than the findings of Dinka [20] in Oromia region who reported the average age at first service and calving of the cross breed heifers were 24.9 months and 34.8 months, respectively. This difference might be due to differences in management practices and agro-ecology of the respective areas. Moreover, the findings of the present study are higher than the findings of Nuraddis *et al.* [22] who reported the average age at first service and calving interval of crossbreed heifers in Gondar town were 23.2% and 34.7%, respectively. Mureda and Mekuriaw [23] in Dire Dawa have reported, the average age at first service and calving of cross breed heifers were 25.6 months and 36.2 months, respectively. Moreover, Alemselem *et al.* [24] have reported the average ages at first service and calving were 24.8 months and 35.3 months, respectively in Mekelle.

Majority of the dairy farmers in the current study (74.0%) did not synchronize their cows. This might be due to lack of awareness on the importance of synchronization and lack of synchronization service. Similarly, a study conducted by Tegegn and Zelalem [25] in Mizan Aman area, Bench Maji zone, South West Ethiopia reported the dairy farmers did not have awareness on dairy cow synchronization and after a through group focused discussion with dairy farmers and the researcher on the importance of synchronization, many of the dairy farmers were convinced and started to synchronize their cows.

The present study has shown that, only 27.6% of the dairy farmers prefer AI than natural mating. According to the informal communication with the some of the dairy farmers, unavailability of the AI service outside public working days and the failure of inseminator to arrive on time obliged half of owners to frequently revert to natural mating. In a similar study by Kefyalew and Addis [26] in Awassa- Dale, it was reported 27.2% of the dairy farmers have complained constraints like technical limitation of the AI system, lack of transport facility, poor quality of semen, poor heat detection, lack of motivation and unavailability of the service off-working hours.

According to the current study, 32% of the dairy farmers replied the number of services per conception in artificial insemination is one. Similarly, 31.2% of them replied the number of service per conception in natural mating is two. Appropriate and timely heat detection and insemination are also among major factors to lower or higher number of services per conception [27].

Regarding the health management of dairy cows, 38.4% of the dairy farmers in the current study area complained mastitis is among the major health problems

of their dairy cows. Mastitis prevalence in smallholder dairy farms may be associated with poor housing, poor hygienic conditions and feeding management of the dairy cows. In a similar study conducted by Assefa and Kassa [28] in Wolaita zone, in Sodo town and its surroundings, it was reported that using common cloth towel to dry wet udder and teats of different cows spread pathogens from sick/reservoir cows to other healthy cows.

The result of the current study revealed that, 85.2 % of the dairy farmers complained, they have animal feed shortage. According to in formal communication with the dairy farmers, feed shortage occurs especially during dry season of the year and the primary reason is due to scarcity of land for farm forage cultivation. In a similar study conducted by Niraj *et al.* [29] in Mekelle, 67% of the dairy farmers complained they have animal feed shortage due to non-availability of fodder round the year followed by high cost on feeding and feeding related constraints. Another study conducted by Sintayehu *et al.* [30] in Shashemene–Dilla area, South Ethiopia reported 76% of the dairy farmers complained they have animal feed shortage.

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