



Original Article

Dairy Cattle Production System in Central Zone of Tigray: in The Case of Aksum and Adwa

Gebrekidan Tesfay

Department of Animal Production & Technology, College of Agriculture & Environmental Sciences, Adigrat University, Adigrat, Ethiopia

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Corresponding Author:

Gebrekidan Tesfay
gebrekidan_tes@yahoo.com

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ABSTRACT

The purpose of this study was to explore the management practices of dairy cattle production in Central Zone of Tigray. A total of 160 dairy cattle holding households were selected by systematic random sampling technique. The study employed multiple methods of data analysis including descriptive statistics, Chi-square test, T-test and qualitative analysis. Majority of the urban dairy farmers depend on hay, crop residues and concentrates for feeding their dairy cattle. Whereas, the peri-urban dairy farmers rely on dry and green roughages but less on concentrate feeds. In the urban areas, pipe water was the most common water source for the dairy cattle whereas, in the peri-urban areas, the use of river was very high. Significantly ($P<0.05$) better watering frequency was observed in urban than peri-urban areas. Access to veterinary services was significantly ($P<0.05$) better in urban areas than the peri-urban areas. About 44% of the peri-urban dairy farmers trek their dairy cattle more than 6km in searching veterinary services. Waste management was relatively problematic in urban areas (36.25%) as compared to the peri-urban areas (13.75%). There is also promising urban-peri-urban linkage in dairy product and by-product supply. Therefore, an appropriate feeding, watering, health management, housing and manure utilization could be the management options to improve the existing problems.

Keywords: Farm size, high grade exotic breed, manure utilization.

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INTRODUCTION

The urban and peri-urban dairy cattle production has been developed in response to the fast growing demand for milk and milk products. Many countries have experienced very vast development in dairy sector in or around the largest urban centers, responding immediately to the market demand and profiting from the lack of links between the rural producer and the urban consumer. In Ethiopia too, urban and peri-urban dairy production systems are emerging as an important component of the milk production system. This system is contributing

immensely towards filling in the large demand-supply gap for milk and milk products in urban centers, where consumption of milk and milk products is remarkably high (Azage and Alemu, 1998). However, little research efforts have been made in Ethiopia in general and in central Tigray in particular on urban and peri-urban areas as most of the efforts are directed towards rural agricultural activities.

The few studies made so far are concentrated in and around Addis Ababa, capital city of the country. This has led to overlooking urban and peri-urban dairying from incorporating to the country's research agenda and to the overall agricultural development program. This picture has to be changed as urban dairying is becoming an important agricultural activity around major urban and peri-urban centers far from Addis Ababa. Hence, in order to design relevant dairy development strategies and implement context specific interventions for future development of the urban and peri-urban dairy production, characterization of the management practices of dairying are important. The scientific information regarding the aforementioned parameters helps as a starting point for further development endeavors in dairy enterprise in the nation. Therefore, the objective of this study is to identify the existing management practices in respect to urban and peri-urban areas.

MATERIALS AND METHODS

The study was carried out in central zone of Tigray region, Northern Ethiopia. Central Tigray Zone is one of the five zones in Tigray National Regional State. The zone approximately extends between 13⁰15' and 14⁰39' North latitude, and 38⁰34' and 39⁰25' East longitude. The altitude of the zone mainly falls within the category of 2000 to 3000 masl. Large part of the zone receives mean annual rainfall ranging from 400 to 800mm. The mean monthly maximum and minimum temperature of the zone are 30⁰c and 10⁰c, respectively (NMSA, 1996). The zone has the largest human population in the region. The specific study sites were Adwa & Axum urban and peri-urban areas with 1006 & 1024 kilometers far from Addis Ababa, capital city of Ethiopia, respectively. These two districts were selected purposively based on their conducive agroecological conditions for dairy production and large human population in the zone.

A cross-sectional survey was used in order to collect data on management practices of the dairy cattle. A multi-stage sampling technique was used in the cross-sectional survey. First cattle holding households were clustered in to urban and peri-urban. Aksum and Adwa, the larger towns in the zone, were considered as urban. The smaller towns found within a radius of 20km from the centers of the two larger towns were considered as peri-urban. Finally, based on the sampling frame obtained from the district office of Agriculture, a total of 160 cattle holding households were chosen using systematic random sampling technique. Pre-tested formal questionnaire was used in the cross sectional survey. The collected data included herd composition, feed resource and feeding, water sources and frequency of watering, veterinary services, waste disposal and manure utilization. Inferential and descriptive statistics were used to analyze the data using SPSS 16.0 (SPSS, 2007) software.

RESULTS

Management Practices of Dairy Cattle

Feed resources and feeding

As depicted in table 1, the major sources of feed for cattle in the study area were hay, crop residues, grazing, crop after math and non-conventional feedstuffs (like: 'Atela', kitchen waste and weeds). Grazing was practiced by small farmers and mostly for local animals in peri-urban areas, though there was a practice to some extent in urban areas. Majority of the urban dairy producers rely on zero grazing but smaller proportions were used roadsides, hillsides and vacant plots for grazing to their dairy cattle.

Table 1. Proportion of households using different types of feeds across the different locations

Feed types	Urban (N=80)				Peri-urban (N=80)			
	Dry season		Rainy season		Dry season		Rainy season	
	N	(%)	N	(%)	N	(%)	N	(%)
Crop residue	66	82.5	71	88.75	71	88.75	74	92.25
Natural pasture	10	12.5	11	13.75	29	36.25	29	36.25
Hay	80	100	63	78.75	75	93.75	28	35
Stover	66	82.5	13	16.25	58	72.5	6	7.5
Bran	65	81.25	60	75	37	46.25	27	33.75
Balanced feed	11	13.75	10	12.5	4	5	5	6.25
Improved forage	16	20	13	16.25	27	33.75	17	21.25
Cakes	41	51.25	31	38.75	12	15	14	17.5

N=Number of respondents

The figures obtained in the present study were larger as compared to the above mentioned reports. The main cause for lower access of urban dairy farms to grazing lands might be due to a decrease in grazing land as a result of urbanization and population growth. Large quantities of crop residues, mainly stover and straw, were produced from the surrounding rural areas and were supplied to the larger towns and village towns. In dry season Stover was used by 82.5% and 72.5% of the respondents in urban and peri-urban areas, respectively, as the main crop residue to feed animals (Table 1). Teff, barley, wheat and finger millet straws were stored around home to be used during critical feed shortage periods. In the peri-urban areas, there was a clear variation in the use of hay and stover across the season. Hay and stover were consumed highly during the dry season (93.75% and 72.5%, respectively) as compared to the rainy season which was 35% and 7.5%, respectively.

Water sources and watering

A higher proportion of the respondents indicated that their major water source was pipe water followed by Borehole in the urban areas whereas, in the peri-urban areas it was pipe water followed by river both during the dry and rainy seasons (Table 2).

Table 2. Water sources in dry and rainy season among the urban and peri-urban areas

Parameters	Location				Overall	
	Urban (N=80)		Peri-urban (N=80)		N	%
	N	%	N	%		
Dry season						
Borehole	15	18.75	9	11.25	24	15
Dam/pond	-	0	4	5	4	2.5
River	3	3.75	29	36.25	32	20
Spring	-	0	2	2.5	2	1.25
Pipe water	62	77.5	36	45	98	61.25
Rain water	-	0	-	0	-	0
Rainy season						
Borehole	16	20	8	10	24	15
Dam/pond	-	0	4	5	4	2.5
River	4	5	31	38.75	35	21.875
Spring	1	1.25	1	1.25	2	1.25
Pipe water	57	71.25	36	45	93	58.125
Rain water	2	2.5	-	-	2	1.25

N=Number of respondents

The watering frequency was significantly ($P < 0.05$) better in urban areas than peri-urban areas both during dry and rainy seasons (Table 3). In the urban areas 81.25% and 16.25% of the households offer water for their cattle twice per day and freely available, respectively, during dry seasons. Whereas in the peri-urban areas, 47.5% and 35% of the dairy cattle holding households water their animals twice per day and once a day, respectively, in dry

seasons. Similar to the dry season, the watering frequency during the rainy season differs significantly ($P < 0.05$) across the urban and peri-urban areas. Major proportions of the respondents in urban area water their cattle twice a day during the rainy season whereas in the peri-urban areas they provide once per day in the rainy season.

Table 3. Watering frequency in dry and rainy season in the study area

Frequency of watering	Location				Overall		Test	
	Urban		Peri-urban		N	%	2	P-value
	N	%	N	%				
Dry season								
Freely available	13	16.25	14	17.5	27	16.875	-	-
Once/day	2	2.5	28	35	30	18.75	-	-
Twice/day	65	81.25	38	47.5	103	64.375	29.65	0.000
Rainy season								
Freely available	9	11.25	9	11.25	18	11.25	-	-
Once/day	14	17.5	47	58.75	61	38.125	-	-
Twice/day	57	71.25	21	26.25	78	48.75	-	-
Once in two days	-	-	3	3.75	3	1.875	37.45	0.000

N=Number of respondents

²=Chi-square

Animal Health Care

The study showed that, 78.75% from the urban dwellers and 75% from the peri-urban used the local veterinary clinic to treat their cattle. About 21.25% from the peri-urban and 11.25% from the urban took their cattle to traditional healer when their cattle get ill. The reason why they fail to take their dairy cattle to the local veterinary clinic was because of ineffective services rendered (56.1%), unavailability of drugs (31.7%) and unaffordable price of drug (12.2%) in urban areas. Whereas in the peri-urban areas, 61.1%, 22.2% and 12.96% respondents explained that the price of drug was not affordable, lack of knowledge about the service and ineffective services rendered, respectively (Table 4).

Table 4. Dairy cattle health management and sanitation aspects in the study area

Parameters	Location of the farm						Test	
	Urban(N=80)		Per-urban(N=80)		df	2	p-value	
	N	%	N	%				
How do you manage cattle health problem?								
Take to local vet. Clinic	63	78.75	60	75	1	2.03	0.155	
Take to traditional healer	9	11.25	17	21.25				
Private service	8	10	3	3.75				
Do you practice deworming?	70	87.5	59	73.75	1	4.84	0.028	
Do you get service you intended for in local vet. clinic?	65	81.25	59	73.75	1	0.5	0.481	
Reason why they fail to take their cattle to local vet. Clinic (*, **)								
Price of drug is not affordable	5	12.2	33	61.1	3	17.5	0.013	
Drugs are not available	13	31.7	2	3.7				
Services are not rendered as they should be	23	56.1	7	12.96				
Lack of knowledge about the Service	-	-	12	22.2				

N=Number of respondents, ²= Chi-square, *Number of respondents in urban are 41, **Number of respondents in peri-urban are 54.

Majority of the urban dairy farmers kept their dairy cattle in significantly ($P<0.05$) better sanitary condition than the peri-urban dairy farmers. Mastitis was the most common disease in dairy farms mostly in high yielding but less hygienic dairy farms. As depicted in table 5, prevalence of mastitis was significantly ($P<0.05$) higher in urban than peri-urban areas. As 33.75% and 18.75% of interviewed dairy cattle holding households faced incidence of mastitis in their farms in the urban and peri-urban areas, respectively.

Access and Distance to Veterinary Clinic

Veterinary service was given both by government and private sectors in the urban areas. Mostly, the animal health clinics were cited in the urban areas. Those clinics conduct examination, treatment and vaccination for various diseases. As presented in Table 5, 92.5% and 7.5% of the respondents in the urban areas indicated the presence of access to governmental veterinary clinic and private veterinary services, respectively, whereas all respondents from the peri-urban rely totally on governmental veterinary services.

Table 5. Access and distance of veterinary clinic in the study area

Access and distance to veterinary clinic		Location of the farm				Test	
		Urban		Per-urban		P-value	²
		N	%	N	%		
Access to veterinary clinic	Governmental	74	92.5	80	100	0.044	6.23
	Private	6	7.5	-	0	-	-
Distance of governmental vet. service	<1km	25	31.25	17	21.25	0.000	25.2
	1-5km	52	65	36	45	-	-
	6-10km	3	3.75	17	21.25	-	-
	>10km	-	-	10	12.5	-	-
	Incidence of mastitis	27	33.75	15	18.75	0.031	4.65

N=Number of respondents

²=Chi-square

The majority of the urban dairy producers received veterinary services at the radius of one to five kilometers. Hence, the response of respondents pertaining distance to the nearest veterinary service varied significantly ($P<0.05$) across the locations. None of the respondents from the urban trek their animals beyond ten kilometers to get veterinary services but 12.5% of the interviewed households in peri-urban areas traveled greater than ten kilometers to search veterinary services for their dairy cattle.

Waste Management

Waste disposal was significantly problematic in urban (36.25%) area as compared to peri-urban (13.75 %) areas (Table 6).

Table 6. Waste disposal and manure utilization in the study area

Variables	Location of the farm				Overall		Test	
	Urban(N=80)		Per-urban(N=80)		N	%	²	p-value
	N	%	N	%				
Problem of waste disposal	29	36.25	11	13.75	40	25	10.8	0.001
Use of manure								
Source of income	8	10	15	18.75	23	14.375	-	-
Fertilizer (own farm)	17	21.25	33	41.25	50	31.25	-	-
Fuel wood	55	68.75	32	40	87	54.375	26.33	0.000

N=Number of respondents

²=Chi-square

As compared to the peri-urban areas, a higher proportion (68.75%) of respondents in the urban areas use manure for fuel wood purpose whereas, in the peri-urban areas, 41.25% reported manure to be used as fertilizer followed by fuel wood (40%).

DISCUSSION

Farms found in intra-towns both in Adwa and Axum had little access to grazing land. Hence, mainly depend on purchased hay and agro-industrial by-products. Hay was purchased immediately after the end of rainy season and stored in hay shed for feeding throughout the year especially in the urban areas. In line with this, Negusie (2006) justified that the reason for dependence of almost all of the urban farms on hay was attributed not only to relatively better quality of the feed and less access to other feeds like natural pasture, improved forages and other crop residues due to less land to grow but also to a coping mechanism against feed shortage through the use of conserved feed. According to Yoseph *et al.* (2000) in Addis Ababa, about 7 % intra-urban and 33 % large peri-urban farms used grazing along roadside and native pasture, respectively. Similar finding was also reported by Ike (2002) from Awasa which depicted 95%, 3.3% and 1.7% of the urban farms practiced zero grazing, both zero and semi-grazing, and semi-grazing systems, respectively.

From the information obtained during group discussion, locally prepared concentrate feeds using pulse hulls and corn were also given to animals raised especially in urban areas. There were local milling factories on which farms depend to get wheat bran. The costs of concentrates were unaffordable for the majority of the dairy farmers particularly to the peri-urban dairy farmers. Regardless of the cost, large proportion of urban farms were using concentrates since they become conscious about the advantage of using concentrate feeds for increased milk yield. This indicated the existence of massive opportunity for local retailers to step up their trade and potential for investors to set up feed processing plants. So that farmers could get the concentrate feeds near and increase the productivity of their dairy animals. Hence, the supply of dairy products to the high demand in the area could be optimized.

The study of Sentayehu *et al.* (2008) showed comparable usage of water sources in which majority of the urban producers (71.8%) obtained water from pipe water whereas, farmers (45.8%) in the crop livestock system water in shashemane area used river water, while 24.8% from pipe water, 10.8% lake water, 10% spring water, and the rest 8.4% other sources. This reveals that there was better knowledge of the urban dairy cattle holding households on the importance of water to dairy cattle than the peri-urban dairy cattle holding households. There is need of awareness creation regarding water sources and frequencies of watering especially in the peri-urban areas so as to maximize milk production from the dairy cattle.

Livestock production experts and veterinarians during group discussion also expressed that animal health service provision is constrained by various restraining problems; absences of enough animal health clinics and inadequate trained animal health professionals were among others. In addition, the existing animal health clinics are not well equipped with the necessary materials, equipment and drugs to provide services at their full potential. Farmer's consciousness in maintaining animal health is negligible and this coupled with the above mentioned problems has reduced the efficiency of animal health service provision in both the urban and peri-urban areas. Moreover, the reason why higher incidences of mastitis reported in urban farms might be due to the presence of large and medium farms in urban areas and hence the exotic high yielder dairy cattle that are more susceptible to were also in those farms.

Wastes such as urine, wastewater, and feed leftover were removed either manually as was the case in small and medium farms or through concrete drainages in the case of large farms. Similarly Yousuf (2003); Moses *et al.* (2004) and Yitaye *et al.* (2009) reported that, in the urban areas manure collection, transport and disposal were generally chaotic. However, urban farmers were obliged to pile the cow dung outside of the farm which caused a nuisance to the area, including the risk of local pollution due to nutrient leaching. But in the peri-urban areas,

due to alternative uses of manure as organic fertilizer, waste disposal was not well thought-out as a serious problem. In addition to this, dung was made in to cakes and sold for fuel or used by the households as plastering material for their houses. Hence, sound waste management systems should be implemented by dairy farms in order to maximize the beneficial effects and also reduce its adverse effect on the environment especially in the urban areas. Manure from the urban areas is also supplied to a limited extent to the peri-urban areas, particularly to crop producing farms. Hence, urban-peri-urban linkage is evolved informally at the moment and this should be recognized and strengthened to benefit both urban and peri-urban dwellers in taking advantage of the chain. Therefore, contribution of manure produced as organic fertilizer was, thus, found economically important to both dairy farm owners and even to the surrounding rural farmers as 10% and 18.75% of the interviewed dairy farmers in urban and peri-urban, respectively, were using manure as source of their immediate income.

CONCLUSION AND RECOMMENDATIONS

The urban farmers depend on purchased feed sources but there is better usage of home grown feeds in the peri-urban areas. In the urban areas, pipe water was the most common source of water for dairy animals. But in the peri-urban areas, river played great as source of water for the dairy cattle. The peri-urban dairy keepers trekked their animals to get veterinary service to longer distance as compared to the urban dairy producers. Hence, establishing animal health clinics and equipping them with the necessary facilities, drugs and animal health professionals could be important to identify, control and monitor dairy cattle diseases and parasites in the study area particularly in the peri-urban areas. Forage development strategies and feed conservations should be encouraged in peri-urban whereas, establishing feed processing plants are recommended in urban areas. All these showed that, interventions need to correspond to the specific needs of the dairy farmers in urban and peri-urban areas.

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