

# Cattle and Camel Milk Production and Marketing: The Case Study in Aysaita Woreda, Awsi Rasu of Afar Regional State, Ethiopia

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## Abstract

A study on cattle and camel milk production and marketing system was conducted in agro-pastoral areas of Aysaita woreda based on data collected between September and December, 2011. Purposive sampling was used based accessibility to market and potentiality to cattle and camel milk production. Thus Galifage and Rumayto PAs were selected out of 11PAs. To capture gender effects in the production system, the sample household on each rural kebele was stratified into female- and male-headed households. Questionnaire based formal survey as well as PRA techniques were employed to collect both quantitative and qualitative data on cattle and camel milk production and marketing system in agro-pastoral areas of Aysaita woreda. Quantitative data were generated through interview schedule (structured, closed & open ended) and Qualitative data were derived from in depth interview, FGD, personal observation and transect walk. Most of the data were analyzed by Statistical Package for Social Science (SPSS) software VERSION 20. Simple descriptive statistics such as mean, range and percentile, ANOVA (Analysis of variance): was used to test the variability of different variables among rural kebeles and household heads and Chi-square test was used to examine difference between different variables among rural kebeles or between household heads. The traditional livestock production system practiced. The main functions of livestock rearing in Aysaita woreda were as a source of milk and milk products (76%), income (21%) and draft power (3%). The distribution of livestock species owned by respondent households consists of large number 52.6 % of goats, 28 % of cattle and 19.4 % of camels. The female to male ratio of the cattle and camels population was 85:15 and 87:13, respectively. The feed resources used for livestock in Aysaita woreda were fed principally on natural grazing, river side grazing, Swampy grazing, Aftermath grazing and Crop residues. Cow and camel milk supply to the market decreased by 48.4 % and 29.6 %, respectively during the dry season. Sale of camel milk decreases at a relatively lower rate than cow milk sale during the dry season. Households in Galifage kebele was not marketed cow's milk due to long distance of woreda town. Women often manage sheep and goats as they tend to be kept closer to the homestead. Live cattle and camels marketing is the responsibility of adult men and young boys while women and young girls are participating on small ruminants marketing. Livestock milk production and marketing, is constrained by lack of continuous supply of animal feeds, inadequate provision of veterinary services, poor infrastructure network, disease and lack of milk packaging materials.

**Keywords:** Dairy, production system, processing, utilization, marketing.

## Introduction

Ethiopia constitutes the majority of the pastoralists in the Horn of Africa. The pastoral sector represents 12% of the population (World Bank, 2001). In terms of proportion, about 17% were mobile pastoralists and 20% were agro-pastoralists (Amaha, 2002). The pastoralists inhabit in semi-arid and arid agro ecological zones of Ethiopia and cover about 67% of the national land area, with the rangeland falling in the lowlands below 1500 m.a.s.l. Currently, it is estimated to be 62% of the total landmass, where pastoralism as a production system is the dominant sector of the agriculture in the country (EARO, 2000). In arid and semi-arid lands of Ethiopia, the primary livelihoods of the pastoralists are livestock: (cattle, goats, sheep and camels.) Hence, livestock are critical to the wellbeing of the lowland households in terms of income, savings, food security, employment, traction, fertilizer and fuel (Blench, 2001).

Livestock productions in these areas contribute about 50% of the agriculture GDP and 90% of the annual live animal export earnings (EARO, 2000). The pastoral livestock production also consists of about 45-55% of the cattle, 75% of the small ruminants, 20% of the equines and 100% of the camels out of the national livestock population (EARO, 2002). The suitability of an area for either animal or crop production, and the type of animal or crop to be produced depends on the agro-ecological conditions of the area. Therefore, the first consideration in planning and implementing cattle and camel development intervention, is to describe and understand the existing real constraints and performance levels of cattle and camel under the varying traditional management practices in relation to agro-ecological zones.

In smallholder systems, livestock provides direct cash income, capital assets, produce manure which is used as fertilizer and fuel; source of power for transport and cultivation (Coppock, 1994; Leeuw *et al.*, 1999; and

Tsehay, 2002). Therefore, these make the livestock much more important in addition to being as a source of food to the community. The total milk production is estimated at about 1.2 million tons per annum, and increases at a rate of 1.2 % for milk produced from indigenous stock and 3.5 % for milk produced from the improved stock (Tsehay, 2002). In 2006, the regional bureau of Finance and Economic Development estimated that, the Region had a total population of 2,336,483 cattle, 2,463,632 sheep, 4,267,969 goats, 1,127 mules, 187,006 asses and 852,016 camels.

Even though huge livestock population is available in the region, pastoralists' participation in livestock marketing is not proportional to the volume of livestock they have or very low. This arises mainly from wide ranging socio-economic factors and absence of proper processing and marketing systems. Therefore, improving livestock productivity and their respective marketing activities may improve the sector's contribution to the GDP of our country.

### **General Objective**

The overall objective of the study was to assess milk production and its marketing in Aysaita woreda

### **Specific objectives**

- To assess the milk production and marketing of camel and cattle
- To identify the constraints of dairy production and marketing
- To analyze gender role on milk production and marketing

### **Hypothesis**

There is potentiality for cattle and camel milk production and there is access to its marketing.

### **Materials and Methods**

#### **Description of the Study Area**

The study was conducted in Asayita woreda, which is one of the 32 weredas in the Afar region. It is located at south east part of the region. It is far from the regional town, Semera by 70km and from capital city of Ethiopia, Addis Ababa 640km. The wereda has 11 rural kebeles (lowest administration unit) and two town kebeles. Out of 11 rural kebeles, six kebeles are Agro-pastoralist (both animal production and crop production areas) and the rest five kebeles are pure pastorals (area of animal production only). The total land area of the wereda is 1678.28 Km<sup>2</sup>.

#### **Agro-ecological zone and Farming systems**

The temperature of the wereda ranges from 19<sup>o</sup>C to 45<sup>o</sup>C and this rainfall is pattern bimodal; the highest amount of rainfall is 560mm which occurs from June to September (karma) and the lowest amount of rainfall is 255.3mm which occurs between January and March (sugum). The soil of the wereda from loamy to clay (WPARDO, 2004). Although mean annual rainfall is less than 200mm, the alluvial floodplains of the Awash River and its distributaries as it enters the delta provide limited but very valuable grazing lands (WoPARD, 2004). Of the total area coverage of the wereda, 13856ha of land is crop land, 5310ha is forest and bush, 4900ha is grazing land, 24ha is horticulture, 10ha is forage land and 7280ha is bare land (WoPARD, 2006).

There are two types of farming systems found in the wereda; six kebeles are Ago-pastoralist (both animal production and crop production areas) and the rest five kebeles are pure pastorals (area of animal production only). In pure-pastoral kebeles the community's livelihood is mainly depends on livestock and livestock by products such as milk, meat and sale of live animals but in agro-pastoral area the community's livelihood depend on crop besides livestock and livestock by product; they carried out crop production like maize, sesame, horticulture, and cotton etc along Awash River. This cultivation of maize crop is started from August up to September and harvesting time is in February and March (WoPARD, 2011).

#### **Demographic structure**

According to the 2007 national census data by CSA, the total population of the wereda is about 49,990 and from this 26,633 are male and the rest 23,357 are female and the population density of the wereda is about 29.8/km<sup>2</sup>.

#### **Data collection and analysis**

##### **Sampling procedures**

From the Asayita district, among 11 rural kebeles two kebeles were selected using purposive sampling which is based on the accessibility, and potentiality to cattle and camel milk production. Preliminary survey was conducted in the rural *kebeles* in order to obtain the total number of the households who have dairy animals (cattle and/ or camels). For selection of sample size of the farmers or dairy farmers using updated list, farmers

from each rural kebeles were selected using Proportional Probability to Size (PPS) approach for each rural kebeles,

A total of 120 farmers were selected based on the number of households. To assess, this gender role in the overall production system, the sample household from each rural kebeles is stratified in to female and male headed households, and was selected by using proportional probability to size (PPS) approach. For market study, the existing market sites were purposively selected due to the accessibility of the areas. To assess the milk marketing data a well-developed questionnaire was used in order to collect the amount of milk delivered to the market, price and number of the individuals who sale milk.

### **Data collection methods**

Quantitative data were generated through interview schedule (structured, closed & open ended) and Qualitative data were derived from in depth interview, FGD, personal observation and transect walk. Primary source of data was collected from respondents at field level focusing on the subject area including; household characteristics (family size by sex, age and educational background); labour input (household available labour, hired labour, labour use in terms of sex and age); major farming activity of household, household budgets and assets data: assets inventory source, income source, Labour division (family members involved in milk production and crop production); herd composition of the household(herd structure by age and sex); type of housing for cattle and camel; reproductive performance(age at first calving and calving interval); Production performance(lactation length and milk yield); type of crop grown, purpose of crop grown, type of feed, feed source, seasonal availability of feed; type of grazing, traditional milking practices, herd management such as calf management, feeding and watering strategy, housing, major cattle and camel diseases, herding and breeding practices,

Selection criteria for breeding bull and cow and also monitoring of daily milk yield, milk disposal to the market will be used to generate qualitative and quantitative data for the study. Gender role in milk production and marketing, access to veterinary and extension service, major problems of cattle and camel's milk production and marketing Secondary data were obtained from different documents both published and unpublished

### **Data Analysis**

The computer software Excel was used for data managing and most of the data were analyzed by Statistical Package for Social Science (SPSS) software VERSION 20. Simple descriptive statistics such as mean, range and percentile for family size, family labour unit, crop and grazing land holding, livestock holding, amount of milk produced, consumed and marketed. ANOVA(Analysis of variance): was used to test the variability of different parameters among rural kebeles and household heads such as crop and pasture land holdings, livestock holdings, age at first calving, calving interval, amount of cow and camel milk produced and marketed. Chi-square test was used to examine difference between different variables among rural kebeles or between household heads for parameters such as education level of the household heads, labour availability in the household, type of income and expenditure, importance of dairy animals, feeding calendar, and constraints in dairy production, feed and water shortage.

## **Result and Discussion**

### **Milk production and marketing**

#### **Milk production and Traditional preservatives**

##### **Milk production**

The primary objective of keeping cows, camels and goats in the study area was for milk production. Fresh milk, fermented milk, **whey**, and butter were among the common milk products produced and consumed in the area. However, cheese was not produced among the surveyed households. 81 % indicated that milking cows is the responsibility of only female members of the household. However, 12.5 % the respondents indicated that milking cows is the responsibility of male members of the household. Only 7 % of the respondents indicated that males take part in milking activity if the cow is aggressive and the woman is unable to easily handle animal or if the woman is too busy with other activities.

Traditional hand milking is the major type of milking practices in the whole woreda. Cow milking is under the control of women (81%) and 7% by men. Whereas camel milking is always undertaken by men and there was no proper sanitary procedure followed during milking. During milking washing of teats is not practiced, and the producers believe that during calf suckling for milk let-down, the teat get washed by the saliva of calf and therefore it is not as such important to wash the teat before milking. Labour division for milking was, however, dependent on the species of animal milked. Milking of cows is done by women (81%), 12.5% by men and 7% by both. while milking of camels is commonly done by men. Traditionally calves are allowed to suckle their dam before (to initiate milk let-down) and after milking (to drain whatever is left in the udder).

As indicated in Table 1, cows were milked twice a day 100 % and 97.5 % household in wet and dry season, respectively. whereas 55.6 %, 19.4 %, 16.7 % and 8.3 % household milked camels up to 3 times, 4 times,

2 times and 5 times a day in wet season, respectively. 91.7 % and 8.3 % of household milked camels up to 2 times and 3 times a day in dry season, respectively.

There were no differences among rural *kebeles* and gender of household heads in the frequency of milking of cows during the wet and dry seasons. Almost all of the households indicated that in case of cow milking, twice milking is a common practice in wet and dry season. However, as indicated by 2.5 % the cattle owners milking frequency decreases to once in the dry season (Table 1). Milking frequency in the area depends on feed availability. As indicated by respondents, once milking is practiced in the dry season in the evenings. Evening milking in the dry season is practiced because cows are kept far from the homestead for grazing during the day time. Milk produced in the evening is marketed in the next morning after through proper processing such as washing and smoking of utensil by different herbs properly.

Out of the total camel owners, 72 % of the respondents in study area indicated that camels are milked up to five times a day during the wet season (Table 2). However, the average milking frequency in the dry season is twice a day while thrice is common during the wet season. This result is similar to the report of Tezera and Bruckner (2000) who indicated that milking frequency of camels in Somalia region is twice per day during the wet and the dry season, respectively. Some camel holders practice six times a day milking depending on season, lactation stages and the need of milk for the family. This was practiced during wet season and /or during at early stage of lactation.

Table 1. Milking frequency of cattle in different seasons at Aysaita wereda

Season	How often milking Cows	Rural Kebeles				$\chi^2$ P-value	Sex of Household Head				$\chi^2$ P-value	Total	
		Galifage		Rumayto			Female		Male			N	%
		N	%	N	%		N	%	N	%			
Wet Season	Once morning	0	0.0	0	0.0	-	0	0.0	0	0.0	-	0	0.0
	Once evening	0	0.0	0	0.0		0	0.0	0	0.0		0	0.0
	Twice M and E	64	100	56	100		21	100	99	100		120	100
Dry Season	Once morning	0	0.0	0	0.0	0.101	0	0.0	0	0.0	0.465	0	0.0
	Once evening	3	4.7	0	0.0		1	4.8	2	2.0		3	2.5
	Twice M and E	61	95.3	56	100		20	95.2	97	98.0		117	97.5

N= Sample respondents

Table 2. Milking frequency of camels in different seasons at Aysaita wereda

Season	How often milking Camel	Rural Kebeles				$\chi^2$ P-value	Sex of Household Head				$\chi^2$ P-value	Total	
		Galifage		Rumayto			Female		Male			N	%
		N	%	N	%		N	%	N	%			
Wet Season	Twice	6	9.4	6	10.7	0.981	2	14.3	10	17.2	0.791	12	16.7
	Thrice	22	34.4	18	32.1		8	57.1	32	55.2		40	55.6
	four times	7	10.9	7	12.5		2	14.3	12	20.7		14	19.4
Dry Season	five times	3	4.7	3	5.4	0.319	2	14.3	4	6.9	0.857	6	8.3
	Twice	36	56.3	30	53.6		13	92.9	53	91.4		66	91.7
	Thrice	2	3.1	4	7.1		1	7.1	5	8.6		6	8.3
	four times	0	0.0	0	0.0		0	0.0	0	0.0		0	0.0
	five times	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0		

N= Sample respondents

According to the response of the producers the average cow milk yield per head/day in the wet and dry seasons was  $2.73 \pm 0.07$  liter and  $1.88 \pm 0.04$  liters, respectively. Lower milk yield and mean milk off-take have been reported in the wet season (1.09 liters/cow/day) and in the dry season (0.79 liters/cow/day) for cows in Maasai pastoralists (Semenye, 1987). This variation may be due to differences in feed supply and genetic makeup of the animals.

As shown in Table 3, Overall mean of cow milk produced per household per day in the wet season ( $7.29 \pm 0.24$  liters) and in dry season ( $5.33 \pm 0.18$  liters). There were significant ( $P > 0.05$ ) variations between Galifage and Rumayto rural *kebeles* in milk yield per head per day in wet season and dry season. In Rumayto kebele significantly ( $P > 0.05$ ) higher cow milk off-take per head per day ( $2.96 \pm 0.06$  liter) in wet season and ( $2.00 \pm 0.05$  liter) in dry than Galifage kebele ( $2.53 \pm 0.07$  liter) wet season and ( $1.77 \pm 0.06$  liter) dry season. But also Galifage kebele was significant ( $P > 0.05$ ) higher cow milk off-take per household per day ( $7.88 \pm 0.39$  liter) wet season and ( $5.68 \pm 0.29$  liter) dry season than Rumayto rural *kebeles* ( $6.62 \pm 0.23$  liter) wet season and ( $4.93 \pm 0.20$  liter) dry season. This was due to higher cattle and lactating cows holding of Galifage kebele.

Table 3. Estimated amount of cow and camel milk produced on wet and dry season in Aysaita woreda

Rural kebeles		Cow milk /head in wet season, L	Cow milk/ head in dry season, L	Cow milk/HH in wet season	Cow milk/HH in dry season	Camel milk / head in wet season	Camel milk /head in dry season	Camel milk/ HH in wet season	Camel milk/HH in dry season
Galifage	Mean	2.54	1.78	7.88	5.68	6.30	3.67	17.28	15.42
	N	64	64	64	64	38	38	38	38
	SE	0.08	0.06	0.39	0.29	0.17	0.14	0.89	0.84
Rumayto	Mean	2.96	2.00	6.62	4.93	6.29	3.58	17.39	14.74
	N	56	56	56	56	34	34	34	34
	SE	0.06	0.05	0.23	0.20	0.14	0.13	0.72	0.62
<b>X<sup>2</sup> p-value</b>		<b>0.000</b>	<b>0.007</b>	<b>0.007</b>	<b>0.035</b>	<b>0.971</b>	<b>0.658</b>	<b>0.927</b>	<b>0.513</b>
Total	Mean	2.73	1.88	7.29	5.33	6.29	3.64	17.33	15.10
	N	120	120	120	120	72	72	72	72
	SE	0.05	0.04	0.24	0.18	0.11	0.10	0.58	0.53

L=Litre, N= Sample respondents, SE= Standard Error of means

There were no significant ( $P > 0.05$ ) variations between Galifage and Rumayto rural *kebeles* in camel milk off-take per head/day and average camel milk produced per household per day during the wet season and dry season. Overall mean of camel milk off-take per head/day in wet season ( $6.29 \pm 0.11$  liters) and ( $3.64 \pm 0.10$  liter) in dry seasons. Similarly, Overall mean of camel milk produced per household per day in the wet season ( $17.33 \pm 0.58$  liters) and in dry season ( $15.10 \pm 0.53$  liters). This may be less pasture and less feed availability in the area in dry season.

### Traditional preservatives

As indicated in Table 7, milk processing activities are usually performed by female members of the family (wives and daughters). Milking vessels used in the study area was locally known as *ayni* and was generally washed with water and herbs of different species (used as disinfectants) and smoked for aromatic purposes. In the study area women practiced different smoking systems. Most of the women fumigate the milk utensils simply by inserting the fire wood into the utensil and shake it well or simply keep the fired stick on the top of utensil and fumigate well until the utensil is sufficiently smoked. While others use a special wall called '*Aayirebodo*', a place where smoking is performed, in which the fired wood is put inside and the utensils is kept at the top of the hole. This type of smoking method prevents the pieces of the fire wood not to be left in the milk utensil.

Table 4. Herbs used for smoking of milk utensils in different rural *kebeles* in Aysaita woreda

Herbs	Parts used	Rural kebeles				Overall	
		Galifage		Rumayto		N	%
		N	%	N	%		
Adangalita* ( <i>Cadaba rotundiflora</i> )	Stem	64	100	56	100	120	100
Alayto* ( <i>Balanites aegyptiaca.</i> )	Stem	31	48	28	50	59	49
Maderito* ( <i>Acacia mellifera</i> )	Stem	8	12.5	11	19.6	19	15.8

N=Sample respondents \* Local language used for the identification of plants names were *Afaregna*

Smoking of milk handling utensils is done to improve aroma and flavor of the milk. As indicated in Table 4, there were different plants used by households for the purpose of smoking; however, the major plants used for smoking were Adangalita (*Cadaba rotundiflora*) (100%), Alayto (*Balanites aegyptiaca*) (49%) and Maderito (*Acacia mellifera*) (15.8%).

Table 5. Change of cattle and camel milk herd size in the last five years in Galifage and Rumayto kebeles and gender of household heads of Aysaita woreda

Rural Kebeles	Total HH (N)	The change of cattle and camel milk herd size in the last five years												x2 P-value	
		Cattle						x2 P-value	Camels						
		Decreased		No change		Increased			Decreased		No change		Increased		
		N	%	N	%	N	%		N	%	N	%	N		%
Galifage	64	36	56.2	13	20.3	15	23.4	0.560	11	28.9	14	36.8	13	34.2	0.685
Rumayto	56	31	55.4	8	14.3	17	30.4		8	23.5	11	32.4	15	44.1	
Sex of HH															
Female	21	13	61.9	2	9.5	6	28.6	0.569	7	50.0	3	21.4	4	28.6	0.081
Male	99	54	54.5	19	19.2	26	26.3		12	20.7	22	37.9	24	41.4	
Total	120	76	55.8	21	17.5	32	26.7		19	26.4	25	34.7	28	38.9	

HH=Household, (N)= Total number of respondents, N= Sample respondents

According to the respondent, 89 % of camel milk herd's size decreased in the last 5 years due to recurrent drought, livestock diseases, calf mortality and shortage of feeds (Table 5).

### Milk Marketing

Table 6. Type of milk and milk products sold by the households in Galifage and Rumayto kebeles and by household heads in Aysaita woreda

Rural Kebeles	Total HH (N)	Milk and milk product sale					
		Fresh Camel Milk		Fresh Cow Milk		Butter	
		N	%	N	%	N	%
Galifage	64	38	100	5	7.8	39	60.9
Rumayto	56	34	100	55	98.2	52	92.9
x2 P-value		-		0.000		0.000	
Sex of HH							
Female	21	14	66.7	11	52.4	16	76.2
Male	99	58	58.6	49	49.5	75	75.8
x2 P-value		-		0.810		0.966	
Total	120	72	100	60	50.0	91	75.8

HH sex = Household Head sex, (N)= Total number of respondents, N= Sample respondents

The majorities of the households sell Camel's fresh milk (100 %), Cow's fresh milk (50 %) and butter (75.8 %). However, Rumayto kebele was significantly ( $P \leq 0.05$ ) higher sale of Cow's fresh milk (98 %) and butter (93 %) than Galifage kebeles (8 %) cow's fresh milk and (61 %). But there were no statistical differences in sales of products between male and female headed households (Table 6). About 56.7 % of the respondents indicated that cow milk is sold both during the dry and the wet seasons (Table 7). However, 43.3 % of the respondents sold milk during the wet season only. Participation of majority of the households in milk sales during both seasons shows that dairying is a predominant source of income generation. Milk sales during both seasons was significantly higher ( $P \leq 0.05$ ) in Rumayto (92 %) rural kebeles than Galifage rural kebeles. This result might be due to the nearness of Rumayto rural kebele to the market sites (woreda town) and it encourages them to sale milk rather than use for home consumption. This result is similar with the report of Coppock (1994) in the Borena plateau who reported that only households close to markets were able to sell milk more frequently.

Table 7. Variation in marketed cow milk due to seasons in Galifage and Rumayto *kebeles* and by household heads in Aysaita woreda

Rural Kebeles	Total HH (N)	Cow milk marketed (out of total herd milk off-take per households per day) in Different season														
		Wet season							x2 P-value	Dry season						
		Not marketed		One-fourth		Half		Not marketed		One-fourth		Half				
		N	%	N	%	N	%	N		%	N	%	N	%		
Galifage	64	59	92.2	0	0.0	5	7.8	0.000	64	100	0	0.0	0	0.0	0.000	
Rumayto	56	1	1.8	11	19.6	44	78.6		12	21.4	33	58.9	1	1.8		
Sex of HH																
Female	21	10	47.6	0	0.0	11	52.4	0.203	16	76.2	4	19.0	0	9.5	0.554	
Male	99	50	50.5	11	11.1	38	38.4		60	60.6	29	29.3	1	1.0		
Total	120	60	50.0	11	9.2	49	40.8		76	63.3	33	27.5	1	0.8		

HH=Household, (N)= Total number of respondents, N= Sample respondents

As indicated in Table 7, 50 % respondent's marketed fresh cow milk in wet season. However, 9.2 % of the households indicated that only one-fourth of the cow milk and 40.8 % of the household half of the cow milk were delivered to the market in wet season. Whereas in dry season, 28.3 % respondent's marketed fresh cow milk. Out of that 27.5 % and 0.8 % of household indicated that one-fourth and half of the milk was delivered to the market, respectively. Mostly the morning milk is sold but the evening milk is often used for home consumption.

Table 8. Variation in marketed camel milk due to seasons in Galifage and Rumayto *kebeles* and by household heads in Aysaita woreda

Rural Kebeles	Total HH (N)	Camel milk marketed (out of total herd milk off-take per households per day) in Different season										x2 P-value	
		Wet season					x2 P-value	Dry season					
		One-fourth		Half		One-fourth		Half					
		N	%	N	%	N		%	N	%			
Galifage	38	13	34.2	25	65.8	0.198	16	84.2	3	15.8	0.497		
Rumayto	34	7	20.6	27	79.4		12	75.0	4	25.0			
Sex of HH													
Female	14	7	50.0	7	50.0	0.039	6	100	0	0.0	0.178		
Male	58	13	22.4	45	77.6		22	75.9	7	24.1			
Total	72	20	27.8	52	72.2		28	80.0	7	20.0			

HH=Household, (N)= Total number of respondents, N= Sample respondents

According to Table 8, about 27.8 % of the households stated that only one-fourth of the camel milk and 72.2 % of the household half of the camel milk were delivered to the market in wet season. Whereas in dry season, 80 % and 20 % of household indicated that one-fourth and half of the milk were delivered to the market. Households in Galifage kebele were sold the morning and evening milk because of milk was sold at nearby home or along road of Aysaita to Samara road. Mostly households in Rumayto kebele were delivered the morning milk to Aysaita town but the evening milk is often used for home consumption. According to CSA, 2003, from the total milk produced in Afar region 83.34 % is used for home consumption, 10.12 % for sale, 6.53 % others including in kind wage and home consumed butter accounts 74.6 % of the total butter produced in the region. Milk produced in the pastoral areas of Ethiopia is largely consumed by the producer households themselves.

This result is contrary to the report of Coppock (1994) in Borena who indicated that out of the total milk, 66 % is consumed at the household and 24 % is sold or given to other households. However, in Eastern Showa zone of Oromia region out of the total production, about 1.2 kg per week was marketed and the remaining, 0.2 kg used for home consumption (Lemma *et al.*, 2005). A high percentage of respondents (74 %) indicated that amount of milk sale increases during the wet season. This increase in milk yield and supply to the market is mainly due to more cows calving in the wet season and increased feed availability. However, milk prices decrease during the wet season due to increases in supply.

According to Table 9, average cow milk sold per household in Rumayto rural kebele was significantly ( $P \leq 0.05$ ) higher during the wet season ( $3.02 \pm 0.14$ ) and the dry season ( $1.74 \pm 0.10$ ) than average cow milk sold per household in Galifage rural kebele was ( $2.90 \pm 0.40$ ) during the wet season and none of respondents in Galifage kebele delivered cow's milk for the dry season. There was no significant ( $P \leq 0.05$ ) difference between the amounts of camel milk sold in Galifage ( $7.24 \pm 0.61$  liters) in the wet ( $5.29 \pm 0.66$  liters) in dry

seasons. While Rumayto rural kebele ( $7.68 \pm 0.48$  liters) in the wet season and ( $5.19 \pm 0.49$  liters) of camel milk sold in the dry seasons (Table 9).

There was a highly significant ( $P \leq 0.05$ ) difference between the amounts of cow milk produced and cow milk sold in the wet and the dry seasons (Table 9). Similarly, the amount of camel milk produced and marketed differed significantly ( $P \leq 0.05$ ) between the dry and the wet season. Hence, in the study area contrary to other pastoral areas, as cow milk production per household increases, there is also an increase in milk sale. In the lowlands when there is a seasonal increase in milk production in the household, there is a tendency to increase household consumption rather than milk marketing (Coppock, 1994). A recent study in Oromia Region by Lemma *et al.* (2005) reported that on average about 3.0 liters of milk was produced/household/day and about 2.50 liters (88.3 %) was accumulated for further processing into butter and the remaining 16.7 % was consumed at the household on a daily basis. On average about 1.4 kg of butter was produced per household per week.

Table 9. Estimated amount of cow and camel milk marketed on wet and dry season in Aysaita woreda

Rural kebeles		Avg. cow milk sale/HH in wet season,L	Avg. cow milk sale/HH in dry season,L	Avg. Camel milk sale/HH in wet season,L	Avg. camel milk sale/HH in dry season.L
Galifage	Mean	2.90	-	7.24	5.29
	N	5	0	38	19
	SE	0.40	-	0.61	0.66
Rumayto	Mean	3.02	1.74	7.68	5.19
	N	55	34	34	16
	SE	0.14	0.10	0.48	0.49
<b>X<sup>2</sup> p-value</b>		<b>0.787</b>	<b>-</b>	<b>0.570</b>	<b>0.906</b>
Total	Mean	3.02	1.74	7.44	5.24
	N	60	34	72	35
	SE	0.13	0.10	0.39	0.42

L=Liter N= Sample respondents

The average cow and camel milk sale per household per day in the wet season were  $3.02 \pm 0.13$  and  $7.44 \pm 0.39$  liters, respectively. This volume decreased to  $1.74 \pm 0.10$  and  $5.24 \pm 0.42$  liters, respectively in the dry season (Table 9). Cow and camel milk supply to the market decreased by 42.4 % and 29.6 %, respectively during the dry season. This indicates that sale of camel milk decreases at a relatively lower rate than cow milk sale during the dry season. This may be due to the fact that camels can survive and still continue to produce some milk during the dry season and have relatively longer lactation length than cows and this is in line with the reports of Zeleke (1998). Rumayto rural kebele has significantly ( $P \leq 0.05$ ) more cow milk supply  $3.02 \pm 0.39$  and  $1.74 \pm 0.10$  liters, in wet as well as in dry seasons to the market than Galifage rural kebeles. As indicated Table 10, total amount of cow milk sold in wet season per day at consumer house in Aysaita town (79 liter), Tea /coffee shops (56 liter) and Selling to vendor (45.9 liter). However, total amount of cow milk sold in dry season per day at consumer house in Aysaita town (26.3 liter), Tea /coffee shops (17.7 liter) and Selling to vendor (15 liter).

Average price of cow milk sold in wet season per liter at consumer house in Aysaita town ( $6.76 \pm 0.28$  birr), Tea /coffee shops ( $8.52 \pm 2.01$  birr) and Selling to vendor ( $9.75 \pm 0.11$  birr). However, in dry season average price of cow milk sold per liter at consumer house in Aysaita town ( $10.60 \pm 0.32$  birr), Tea /coffee shops ( $14.55 \pm 0.33$  birr) and Selling to vendor ( $15.40 \pm 0.27$  birr) (Table 10).



Table 10. Quantity of milk sold and price of cows' milk in different market places during wet and dry season in Aysaita woreda

Season	Market place	Quantity of cows' milk		Price of cows' milk	
		N	Mean±SE (liter)	N	Mean±SE (liter)
Wet season	along road side	-	-	-	-
	At consumer house in Aysaita town	25	3.16±0.20	25	6.76±0.28
	Tea /coffee shops in Aysaita town	19	2.95±0.23	19	8.52±2.01
	Selling to vendor in Aysaita town	16	2.87±0.19	16	9.75±0.11
	Overall	60	3.01±0.13	60	8.12±0.20
Dry season	along road side	-	-	-	-
	At consumer house in Aysaita town	15	1.75±0.09	15	10.60±0.32
	Tea /coffee shops in Aysaita town	9	1.97±0.32	9	14.55±0.33
	Selling to vendor in Aysaita town	10	1.50±0.12	10	15.40±0.27
	Overall	34	1.74±0.10	34	13.06±0.42

SE= Standard Error of means

The reverse was true for camel milk. This is perhaps for the reason that the Aysaita market is more central for more number of rural *kebeles* and since Aysaita town is the woreda's capital, there is more demand for cow milk. Similar reports were made by Alemayehu S (2010) stated that camel milk is marketed in Aysaita, where regularly young pastoralist boys bring milk to some restaurants and other places for selling. Camel milk marketing takes place as well in Awash, Gewane and Melka Werer. From personal observation and interview with producers, Agro-pastoralists and pastoralists from the other rural *kebeles* are major milk suppliers to Aysaita town. Therefore, Aysaita town market site has more potential to access cow milk than Galifage road-side market.

As indicated Table 11, total amount of camel milk sold in wet season per day along road side (194 liter), at consumer house in Aysaita town (114.5 liter), Tea /coffee shops (37.5 liter) and Selling to vendor (189,8 liter). However, total amount of camel milk sold in dry season per day along road side (77.6 liter), at consumer house in Aysaita town (12 liter), Tea /coffee shops (19 liter) and Selling to vendor (75 liter). Average price of camel milk sold in wet season per liter along road side (10.36±0.25 birr), at consumer house in Aysaita town (10.87±0.38 birr), Tea /coffee shops (14.80±0.20 birr) and Selling to vendor (14.79±0.21 birr). However, in dry season average price of camel milk sold per liter along road side (14.71±0.22 birr), at consumer house in Aysaita town (20.00±0.00 birr), Tea /coffee shops (18.25±1.18 birr) and Selling to vendor (19.07±0.46 birr) (Table 11).

Table 11. Quantity of milk sold and price of camels' milk in different market places during wet and dry season in Aysaita woreda

Season	Market place	Quantity of camels' milk		Price of camels' milk	
		N	Mean±SE (liter)	N	Mean±SE (liter)
Wet season	along road side	28	6.93±0.76	28	10.36±0.25
	At consumer house in Aysaita town	15	7.63±0.90	15	10.87±0.38
	Tea /coffee shops in Aysaita town	5	7.50±1.39	5	14.80±0.20
	Selling to vendor in Aysaita town	24	7.91±0.47	24	14.79±0.21
	Overall	72	7.44±0.39	72	12.25±0.29
Dry season	along road side	14	5.54±0.89	14	14.71±0.22
	At consumer house in Aysaita town	2	6.00±2.00	2	20.00±0.00
	Tea /coffee shops in Aysaita town	4	4.75±0.32	4	18.25±1.18
	Selling to vendor in Aysaita town	15	5.00±0.50	15	19.07±0.46
	Overall	35	5.24±0.42	35	17.29±0.44

SE= Standard Error of means

There were generally four different milk outlets identified in the Aysaita milk shed, namely along road side of Galifage *kebeles*, at consumer house in Aysaita town, Tea /coffee shops and Selling to vendor in Aysaita town. From the total (n=93) households who sell milk, 32.3 % at consumer house in Aysaita town, 30.1 % was along road side of Galifage *kebeles*, 20.4 % was Tea /coffee shops and 17.2 % was selling to vendor in Aysaita town. But there are organized milk collecting individuals (Tea /coffee shops and Selling to vendor) who are collecting milk from the producers and then sell to consumers was accounts 17.2 % (Table 10 and 11).

Milk prices vary according to seasons. In the wet season milk and milk product price decreased in both Producer level and trader level compared to dry season. This is the face that production and milk supply is higher and prices tend to go down. On average the prices increase by 39.2% at Producer level and 41.2% at

trader level in the dry season as compared to the wet season.

## Reproductive Performance

### Age at first calving

#### Cows

The estimated overall mean ( $\pm$  SE) age at first calving for cows and camels was  $4.51 \pm 0.01$  years, and  $5.95 \pm 0.06$  years, respectively (Table 12). The age at first calving obtained in this study for cows is  $4.51 \pm 0.01$  years. Similar results found by Azage *et al.*, (2013) that the age at first calving (AFC) of indigenous heifers is long, and ranged from 52 months in the rural lowland agro-pastoral of Mieso to 54 months in the lowlands of Metema. This fact is in line with the report by MukasaMugerwa (1989) who indicated that heritability of age at first calving is generally low, indicating that this trait is highly influenced by environmental factors, feed and health. Age at first calving was more affected by environmental factor than heritability. However, the result obtained in this study fall in the range reported by Mulugeta (1990) of 4-5 years and similarly 4 to 4.5 years in Borana pastoral system as reported by Coppock (1994). In addition, the result obtained is also similar with the report (52 months) by Kurtu (2003) from Harar milk shed.

Table 12. Age at first calving of cows and camels in Aysaita woreda

Animal types	Total HH (N)	Age at first calving (years)	
		N	Mean $\pm$ SE
Cow	120	120	$4.51 \pm 0.01$
Camel	72	72	$5.95 \pm 0.06$

HH=Household, (N)= Total number of respondents, N= Sample respondents, SE= Standard Error of mean

#### Camel

According to the camel herder, mean age for first calving of camels was  $5.95 \pm 0.06$  years. This result is similar to the report of Simenew *et al.* (2013) that average age at first calving camels in Afar regional state was found to be  $5.36 \pm 0.74$  years and the range from four year to eight years. The report of Tefera and Gebreah (2001) that average age at first calving of camels in eastern Ethiopia was five years and it is similar with that reported by Ahmed *et al.* (2005) who indicated that age at first calving for camels in Afder zone of Somalia region to be 5.2 years.

### Calving interval

#### Cows

As indicated in Table 46, the overall mean calving interval of cows was  $17.47 \pm 0.27$  months. There were no significant ( $P > 0.05$ ) variations among rural *kebeles* in calving intervals of cows and camels. According to the report of Azage *et al.*, (2013) that calving interval was also long and ranged from 16 months in rural lowland system of Mieso to 26 months in rural highland dairy system of Bure. The difference could be explained mainly by environmental factors such as nutritional management. Findings of Workneh and Rowland (2004) which indicated that calving interval of cows in pastoral area of Oromia region was 15.5 months for cows but it was longer for the overall calving interval of cows taken in the region was 18.6 months. Besides this result also falls within the range of calving interval for Ethiopian zebu cattle 12-22 months reported by Mukasa-Mugerwa (1989).

Table 13. Overall calving intervals (CI) of cows and camels animals in Aysaita woreda

Animal types	Total HH (N)	Calving intervals (months)			
		N	Mean $\pm$ SE	Min.	Max.
Cow	120	120	$17.47 \pm 0.27$	11	24
Camel	72	72	$24.04 \pm 0.07$	22	25

HH=Household, (N)= Total number of respondents, SE= Standard Error of mean, Min. = minimum, Max.= maximum

#### Camels

According to table 13, the average calving interval of camels in both of the study areas of Aysaita woreda was  $24.04 \pm 0.07$  months. The mean calving interval and number of services per conception in Afar camels are  $2.6 \pm 1.4$  years and  $1.63 \pm 0.85$  respectively. Gestation length ranges from 12-13 months with average length of  $12.04 \pm 0.2$  months (Simenew *et al.*, 2013). The result obtained was in agreement with Yagil (1982) Somalia and Theodros (2009) Afar regions but lesser than Farah *et al.* (2004) in Somalia who reported  $27.4 \pm 9.3$  months and Bekele *et al.* (2008) reported  $25.5 \pm 0.4$  months in Southern camel region. On the other hand, shorter calving interval was reported by Kebebew (1998) and Bekele & Kebebew (2001) who reported similar 19 months in Ogaden and Eastern lowlands, respectively.

## Lactation length Cattle

Indigenous breed of cows are generally considered as low milk producers. However, they were the major source of milk in the study area. The lactation length of animals in the study area depends mostly on the management objective of the herder, the herder may prolong the lactation length for the sake of continues milk production or dry off the dam at early stage for the purpose of breeding the cows. As indicated in the table 14 the average lactation length for cows was  $7.20 \pm 0.18$  months. This agrees with the report of CSA (1996) who indicated that an average lactation length of cows in private holdings ranged from 5-7 months. But it is lower than 9.5 months reported by Lemma *et al.* (2005) for local cows in the East Showa zone of Oromia region.

Table 14. Lactation length of cows and camels in different rural *kebeles* in the Aysaita woreda

Animal types	Total HH (N)	Lactation length (months)			
		N	Mean $\pm$ SE	Min.	Max.
Cow	120	120	$7.20 \pm 0.18$	5	12
Camel	72	72	$12.13 \pm 0.40$	8	24

HH=Household, (N)= Total number of respondents, SE= Standard Error of mean, Min. = minimum, Max.= maximum

There was no significant difference among rural *kebeles* for lactation length of cows  $7.17 \pm 0.23$  and  $7.25 \pm 0.29$  of Galifage and Rumayto rural *kebeles* respectively. The present average lactation length of cows agrees with the 212 days reported for local cows by Kurtu (2003) in the Harari milk shed. However, the result obtained contradicts with the result reported by Semenye (1987) who indicated an average lactation length of cows in Maasai pastoral area was 12 months. This shorter lactation length may be due to the purposive drying-off of cow that the herders used or due to the death of the calf which creates problem in milk let-down.

## Camel

According to table 14, the mean (Mean  $\pm$  SE) lactation length for camels was  $12.13 \pm 0.40$  months in Aysaita woreda. Lactation length of Afar camels is 12 month in most of the cases but factors affecting lactation length include season of the year and demand for milk for more prolonged time (Simenew *et al.*, 2013). The result obtained is fairly in agreement with Yohannes *et al.* (2007) who reported 12 months for camels in Babile and Kebribeyah woredas of Jijiga zone and little higher than Theodros (2009),  $11.9 + 0.1$  months for camels in Aba'ala, North Afar, but shorter than Abebe (1991), 14 months for camels in Ogaden area and Schvarth and Walsh (1992), 15-18 months. As reported by Mukassa (1981), the lactation length varies with the breed/ type of the camel, agro ecological differences and the management decision of the owners.

According to Simenew *et al.*, (2013) reported that daily milk yield of Afar camels range from 2.01-12.0 liters per day depend on feed availability, season and water access. The overall estimated camel milk yield per head per day was  $2.2 \pm 0.06$  liters and lactation yield was 792 liters, over an average lactation period of twelve month. This result is similar to the report of Tefera and Gebreah (2001) who found that the average daily milk yield of camels in eastern Ethiopia in general was 2.5 liters per day over a lactation period of one year.

## Gender roles in milk production and marketing

Division of family labour and role of gender in dairying varies based on production system and market orientation (Azage *et al.*, 2013). Data on roles of men and women members of the household in animal management are presented in Table 15.

Table 15. Responsibility of family members for cattle and camel production and marketing activity in Aysaita woreda

Roles/Activity	Responsible member of the family			
	Male (children)	Female (children)	Men (Household head)	Women (Household wife)
	%	%	%	%
Herding and Watering cattle	68.3%	14.2%	12.5%	5.0%
Milking (cows)	9.2%	3.3%	24.2%	63.3%
Milking (she camel)	43.1%	0.0%	56.9%	0.0%
Cutting Grass for Fodder	7.5%	23.3%	0.0%	69.2%
Collecting Tree Leaves Fodder	21.7%	0.0%	68.3%	10.0%
Selling Milk	9.6%	64.9%	0.0%	25.5%
Selling of live animal	21.7%	3.3%	65.8%	9.2%
Handling of health care	21.7%	0.0%	69.2%	9.2%
Constructing Kraals	22.5%	7.5%	60.8%	9.2%

### **Herding and watering**

The allocation of labour for pastoral stock herding among Afar pastoral groups is based on gender and age clustering of family labour force. This pattern of division of labour among the family members determines the level of control and use of the grazing resources on daily and seasonal basis. According to table 15, 80.8 % of the respondent households indicated that male member of households was responsible for herding and watering of cattle and camels. While 19.2 % of the respondents also indicated that female members of the household are responsible for herding of cattle and camel if it is around their encampment. Most often women and young girls are responsible for herding small ruminants while men and boys are responsible for cattle and camels. Women virtually have no role in making decisions about pasturing areas and movement schedules. Milking and young animals are tended as base herds closer to settlement centers by young girls and boys. Whereas, Most often than not women and young girls are responsible for herding small stock while men and boys are responsible for camels and cattle (Tesfay, Y. and Tafere, K. 2004).

### **Feed collection**

Division of labour among various sexes in the household for feed collection depends on the availability of feed in the area. According to 92.5 % (Table 15) of the respondents, it is evident that cutting grass for fodder is the responsibility of the female members of the households, if there are young animals in the house. According to the availability of maize Stover and (failed crops through purposely over sowing of maize in the field to be used as animal feed) on the farm, females take all the responsibility to cut and carry the *grass* and to collect weed grass from the farm to feed calves that stay around the house for the whole day. However, 7.5 % of the respondent's household reported that male members of the households carried out cutting grass for fodder. This agrees with the findings of Coppock (1993) who reported that in Borana responsibilities of women includes gathering cut-and-carry forage and hauling water for relatively immobile calves. However, 90 % of the households indicated that collecting of tree leaves fodder is task of male members of households. However, 10% of the respondent's household reported that female members of the households involved in this task (Table 15).

### **Milking**

According to Table 15, 100 % of the households who had milking cows during the study period, 66.6 % of them stated that milking cows is the responsibility of female members of the household. However, 33.4 % the respondents indicated that milking cows is the responsibility of male members of the household. In Borana men are largely the strategists for livestock production, while women carry out day to day management and retain primary responsibility for dairy-related activities (Coppock, 1993). Participation of household members in dairy animal management also depends on the type of the herd. All households (100 %) interviewed during this study stated that all of the camel milking is the responsibility of male members of the household. A camel is owned, controlled and looked after entirely by men. However camels owned by female headed household a woman's sons will look after the camels rather than herself (Fiona *et al.*, 2008).

### **Milk and milk product marketing**

Out of total household who sold milk, 90.4 % of them indicated that milk and milk product marketing is the responsibility of female member of household. However 9.6 % of them indicated that male member of households was responsible for milk and milk product marketing (Table 15). This is similar to the reports from the Borana plateau, that milk product marketing and processing are under the control of women (Coppock, 1994).

### **Live animal marketing**

About 65.8 % and 21.7 % of the households indicated that live cattle marketing is the responsibility of adult men and male children. However, 9.2 % and 3.3 % of the households indicated that adult women and female children member of the family are participating in marketing of live animal (Table 15).

### **Handling of health care**

According to Table 15, about 90.8 % of the respondents indicated that handling of health care for cattle and camel is the responsibility male member of household. However, 9.2 % of the respondent's household reported that female members of the households responsible for handling of animal's health care. Across the rural *kebeles* they have serious problem in accessing veterinary services. As a result, a wealth of indigenous knowledge in animal health care is the major means of treating animals in the woreda.

### **Constructing Kraals**

According to Table 15, 83.3 % of the respondents indicated that constructing kraals for cattle and camels is the responsibility of male member of household. However, 16.7 % of the respondents indicated that constructing kraals for livestock can be shared by female member of household.

### Institutional Support for Dairy Production

None governmental organizations such as APDA (Afar Pastoral Development Association and also Governmental Organization like DPARC (Dubti Pastoral and Agro-pastoral Research center) are involved in providing training and consultation on animal production in general in the woreda. Afar Pastoral Development Association provides indirect assistance to Agro-pastoralists through joint activities with the Office of Pastoral and Rural Development (OoPRD) by providing of drugs and vaccines for livestock diseases and also the establishment of cooperative for Agro-pastoralists.

Table 16. Availability of any co-operatives in Galifage and Rumayto kebeles of Aysaita woreda

Rural Kebeles	Total HH (N)	Are there any co-operatives in your area			
		Yes		No	
		N	%	N	%
Galifage	64	36	56.2	28	43.8
Rumayto	56	44	78.6	12	21.4
Sex of HH					
Female	17	14	66.7	7	33.3
Male	92	66	66.7	33	33.3
Overall	120	80	66.7	40	33.3

HH (N) = Total household head number, N= Sample respondents, HH sex=Household Head sex

According to table 16, about 66.7% of respondent households were aware of existing cooperatives in their locality. However 33.3% of households were not aware of it. Out of total respondent households only 19.2 % of them were member of existing cooperatives (Table 17). Therefore, government institution and none governmental organization have to establish milk marketing cooperatives for them to benefit from collective marketing and input and service provision. There is weak extension service in most of the Afar weredas.

Table 17. Number of household who are member of any co-operatives in Galifage and Rumayto kebeles and by gender of household heads in Aysaita woreda

Rural Kebeles	Total HH (N)	Member of Cooperative			
		Yes		No	
		N	%	N	%
Galifage	64	8	12.5	56	87.5
Rumayto	56	15	26.8	41	73.2
Sex of HH					
Female	17	6	28.6	15	71.4
Male	92	17	17.2	82	82.8
Overall	120	23	19.2	97	80.8

HH (N) = Total household head number, N= Sample respondents, HH sex=Household Head sex

There are limited packages of livestock management and are highland oriented. The few extension staff available work only at Wereda and kebele levels. Recently, ATVET graduates are assigned to work as development agents. But assessment of the curriculum of ATVET indicates that the curriculum does not have specifics that can fit into the pastoral system of production. Hence, the extent to which the graduates will address the pastoral problems is less. (Yilma Jobre 2005).

Table 18. Access of livestock extensions services in Galifage and Rumayto kebeles and by gender of household heads in Aysaita woreda

Rural Kebeles	Total HH (N)	Access of livestock extensions services			
		Yes		No	
		N	%	N	%
Galifage	64	24	37.5	40	62.5
Rumayto	56	39	69.6	17	30.4
Sex of HH					
Female	17	14	66.7	7	33.3
Male	92	49	49.5	50	50.5
Overall	120	63	52.5	57	47.5

HH (N) = Total household head number, N= Sample respondents, HH sex=Household Head sex

Extension service was delivered by the *Woreda* office of agriculture and rural development. According to Table 18, about 52.5 % of respondent households had access to livestock extension services support to strengthen the extension service each sampled *Kebeles* had three development agents assigned to work; natural

resource, animal science and crop production.

Table 19. How often extension professional visited Agro-pastoralists last year in Galifage and Rumayto kebeles and by gender of household heads in Aysaita woreda

Rural Kebeles	Total HH (N)	How often extension professional visited						x <sup>2</sup> P- value
		Regularly		Occasionally		Rarely		
		N	%	N	%	N	%	
Galifage	24	0	0.0	6	25.0	18	75.0	0.000
Rumayto	39	13	33.3	17	43.6	9	23.1	
Sex of HH								0.043
Female	14	5	35.7	7	50.0	2	14.3	
Male	49	8	16.3	16	32.7	25	51.0	
Overall	63	13	20.6	23	36.5	27	42.9	

HH=Household, (N)= Total number of respondents, N= Sample respondents

As indicated in Table 19 , 20.6 % , 36.5 % and 42.9 % out of the total households who were visited by extension professional was Regular, Occasional and Rarely, respectively. But consultations are done once or twice a year without strong and regular visits. Limitation in the number and capacity of the development agents was found to be a common problem in the extension service. Lack of cooperative organizations at the pastoralist level, poor livestock extension packages promotion strategies and approaches, inappropriate content of extension packages were among the constraints faced in livestock production, productivity and marketing (Zelalem Tamrat,2007).

### Constraints of Milk Production and Marketing

#### Milk marketing constraints

As shown in Table 20, the major constraints for milk marketing identified by the producer in Aysaita woreda were Long distance to market, Lack of market or collection center, Spoilage, Shortage of Milk packaging materials, Cultural restriction and Lack of demand were first, second, third, fourth, fifth, sixth and seventh, respectively ranked and identified constraints by respondent households in Aysaita woreda.

Table 20. Problem Priority in cattle's and camel's milk marketing in Aysaita woreda

Problems	Total HH(N)	Rank	Index
Spoilage	71	3	0.19
Shortage of Milk packaging materials	71	4	0.14
Cultural restriction	70	5	0.10
Distance to market	67	1	0.26
Lack of demand	61	6	0.07
Lack of market or collection center	55	2	0.24

HH=Household, (N) = Total number of respondents,

The mean ( $\pm$  SE) distance women travel to sell milk and butter was  $7.20 \pm 0.58$ km, and ranges from 4 to 25 km. travel long distance to market ( $20.00 \pm 2.24$ km). Contrary to the results of this study, in Mieso, on average women travel to sell milk  $5.89 \pm 0.19$  km, with a range of 1 to 12 km (Kedija, 2008).

#### Constraints to cattle and camel Production

The major constraints to cattle and camel production in the study area were identified and ranked according to the perception of the informants (Table 21). Disease prevalence, Shortage of feed and water, breeding management, Poor Extension services and Market problem were first, second, third, fourth and fifth ranked and identified constraints by respondent households, respectively.

Table 21. Problems encountered in cattle's and camel's milk production and marketing in Aysaita woreda

Problems	N	Rank	Index
Breeding management	29	3	0.236
Disease prevalence	57	1	0.245
Poor Extension services	13	4	0.195
Availability of feed and water	91	2	0.238
Market problem	7	5	0.08

N= Sample respondents

Similarly, the shortage of feed and water are similar problems in all traditional livestock production systems as the production is subsistent. The traditional smallholder dairy production is characterized by its low input, feeding and management requirements and the use of indigenous genotypes (Jabbar *et al.*, 1997). Feed shortage during the dry season is becoming a more serious problem as mobility by inside or outside tribes were

restricted due to conflict.

### Feed shortage

According to table 22, the major reasons for feed shortage were Encroachment of unwanted weedy species (55 %), expansion of croplands (23.3 %), lack of forage seeds (11.7 %) and security problem (10 %). According to ACF and APDA(2005) reported that pasture availability has declined in Afar region due to increased animal and human population density, droughts and encroachment of pasture lands by weeds, especially *Prosopis*. The major feed resources are natural pasture and crop residue and these are of poor quality affecting the fertility of cows and camel milk production. Ranjhan (1999) also reported that feeding systems in smallholder dairying are primarily based on grazing of native pasture of low productivity. This also agrees with the report of Leng (1999) who indicated that feed resources from crop residue (straw and stover) and pastures (both green and mature) are of low digestibility and, on these feed resources the overall productivity of animals is reduced, animals reach puberty at a late age (often four years) and calving interval is often 18- 24 months resulting in a few number of dairy animals being milked.

Table 22. Reasons for feed shortage in Galifage and Rumayto *kebeles* in the Aysaita woreda

Rural Kebeles	Total HH (N)	Reasons for feed shortage								X <sup>2</sup> P-value
		Expansion of crop land		Security problem		Encroachment of unwanted weedy species		Lack of forage seed		
		N	%	N	%	N	%	N	%	
Galifage	64	13	20.3	4	6.2	41	64.1	6	9.4	0.161
Rumayto	56	15	28.8	8	14.3	25	44.6	8	14.3	
Sex of HH										
Female	21	5	23.8	2	9.5	12	57.1	2	9.5	0.988
Male	99	23	23.3	10	10.1	54	54.5	12	12.1	
Total	120	28	23.3	12	10.0	66	55.0	14	11.7	

HH=Household, (N)= Total number of respondents, N= Sample respondents

### Strategies to alleviate feed shortage

The major coping mechanism for drought and feed shortage were Mobility (50 %), Aftermath grazing (32.5 %), Crop residues (15 %) and Use cut and carry (2.5 %) were the strategies to alleviate feed shortage in the area (Table 23).

Table 23. Variation in coping mechanism for drought and feed shortage at Galifage and Rumayto *kebeles* in Aysaita woreda

Rural Kebeles	Total HH (N)	Major coping mechanism for drought and feed shortage								X <sup>2</sup> P-value
		Crop residues(Straws, Maize Stover)		Aftermath grazing		Mobility		Use cut and carry		
		N	%	N	%	N	%	N	%	
Galifage	64	4	6.2	15	23.4	45	70.3	0	0.0	0.000
Rumayto	56	14	25.0	24	42.9	15	26.8	3	5.4	
Sex of HH										
Female	21	3	14.3	7	33.3	9	42.9	2	9.5	0.151
Male	99	15	15.2	32	32.3	51	51.5	1	1.0	
Total	120	18	15.0	39	32.5	60	50.0	3	2.5	

HH=Household, (N)= Total number of respondents, N= Sample respondents

The availability of crop residue in the dry season is closely related to the type of crop produced (maize or sorghum). Because the stover is kept as stalks open in the field, Agro-pastoralists are not able to make efficient use of the resource for a longer period. Crop residues is used immediately after harvest; For most households, the crop residue (stover) is likely to be finished by the middle of the dry season, and this forces household to spilt the herds and mobility with their animals in search of feed and water.

Table 24. Solutions suggested by targeted households for the problem in cattle's and camel's milk production and marketing in Aysaita woreda

Problems	N	Rank	Index
Improve Veterinary services	91	2	0.210
Strengthen Extension services	87	3	0.20
Improve feed and water Availability	94	1	0.216
Improve Market infrastructure	68	4	0.17
Cooperatives	31	6	0.07
create access to credit services	39	5	0.11

N= Sample respondents

According to Table 24, the agro-pastoralists have made some suggestions to improve cattle's and camel's milk production and marketing in the area. These include Improve feed and water availability, improve access to veterinary services, strengthen extension service coverage, improve marketing infrastructure, create access to credit services and cooperatives were first, second, third, fourth, fifth and sixth ranked and suggested solutions by respondent households, respectively.

## Conclusions and Recommendations

### Conclusions

The overall mean family size (Mean  $\pm$  SE)  $7.26 \pm 0.21$ . The average (Mean  $\pm$  SE) crop land holding was  $1.88 \pm 0.10$ ha. All milk animals in the study area are indigenous breeds and have not been characterized. The average holdings goat ( $25.95 \pm 1.16$ ) per household was higher than cattle ( $13.79 \pm 0.54$ ) and camels ( $9.60 \pm 0.81$ ) holdings. However, the total numbers of animals found in the rural *kebeles* was higher for goats (3114) followed by cattle (1655) and camels (1152). The female to male ratio in the cattle and camels population among the rural *kebeles* was 85:15 and 87:13, respectively.

The overall mean (mean  $\pm$  SE) age at first calving for cows and camels was  $4.51 \pm 0.01$  years and  $5.95 \pm 0.06$  years, respectively. The overall mean calving interval of cows and camels was  $17.47 \pm 0.27$  months and  $24.04 \pm 0.07$  months, respectively. According to the respondents, average cow milk yield per head/day in the wet and the dry seasons was  $2.73 \pm 0.05$  liters and  $1.88 \pm 0.04$  liters, respectively. Similarly, camel milk yield per head/day in the wet and dry season was  $6.29 \pm 0.11$  liters and  $3.64 \pm 0.10$  liters, respectively. The estimated average cow milk produced per household per day during the wet and the dry season was  $7.29 \pm 0.24$  liters and  $5.33 \pm 0.18$  liters. Similarly, the estimated average camel milk produced per household per day was higher during the wet ( $17.33 \pm 0.58$  liters) than the dry season ( $15.10 \pm 0.53$  liters).

Milking vessels used in the study area was locally known as *ayni* and was generally washed with water and herbs of different species (used as disinfectants) and smoked for aromatic purposes. In the study area women practiced different smoking systems. Most of the women fumigate the milk utensils simply by inserting the fire wood into the utensil and shake it well or simply keep the fired stick on the top of utensil and fumigate well until the utensil is sufficiently smoked. While others use a special wall was called *Aayirebodo*. The major plants used for smoking were *Adengali (Olea africana)* (100%), *Alayto (Balanites aegyptiaca)* (49%) and *Maderito (Acacia mellifera)* (15.8%). About 28 % of the households indicated that only one -fourth of the total household camel milk production and 72 % of the household half of the total household camel milk production was delivered to the market in wet season. Whereas in dry season, 80 % and 20 % of household indicated that one -fourth and half of the milk were delivered to the market. Households in Galifage kebele were sold the morning and evening milk because of milk was sold at nearby home or along road of Aysaita to Samara road. Mostly households in Rumayto kebele were delivered the morning milk to Aysaita town but the evening milk is often used for home consumption.

The households who had labour shortage indicated that labour shortage becomes critical during the short rainy season due to the fact that more family labour is required for land preparation and at the same time animals are more mobile in search of feed and water. Male headed households had larger ( $2.01 \pm 0.12$ ) hectare of land than female headed household heads ( $1.27 \pm 0.09$ ). According to the respondents this may be due to the fact that male are polygamous and they had at least one half hectare of land for each wife and totally have big size of cropland. Results from the survey carried out indicate that 80.8 % of the respondent households indicated that male member of households was responsible for herding and watering of cattle and camels. While 19.2 % of the respondents also indicated that female members of the household are responsible for herding of cattle and camel if it is around their encampment. Most often women and young girls are responsible for herding small ruminants while men and boys are responsible for cattle and camels. Women virtually have no role in making decisions about pasturing areas and movement schedules.

However, 90 % of the households indicated that collecting of tree leaves fodder is task of male members of households. However, 10 % of the respondent's household reported that female members of the



households involved in this task. According to 100 % of the households who had milking cows during the study period, 66.6 % of them stated that milking cows is the responsibility of female members of the household. However, 33.4 % the respondents indicated that milking cows is the responsibility of male members of the household. Major constraints for milk marketing were Long distance to market, Lack of market or collection center, Spoilage, Shortage of Milk packaging materials, Cultural restriction and Lack of demand, respectively in Aysaita woreda. The major constraints to cattle and camel production in the study area were Disease prevalence, Shortage of feed and water, breeding management, Poor Extension services and Market problem, respectively. Agro-pastoralists have made some suggestions to improve cattle's and camel's milk production and marketing in the area. These include Improve feed and water availability, improve access to veterinary services, strengthen extension service coverage, improve marketing infrastructure, create access to credit services and cooperatives, respectively.

### Recommendations

The major technical constraints to dairy animal production in Aysaita woreda were feed scarcity, water shortage, poor veterinary service and limited access to markets. Contribution of milk production and marketing depends largely on assured supply of accompanying inputs such as feed, veterinary services and improved milk marketing facilities. Based on the present study, the following areas need attention if dairy production is to develop into a market-oriented business operation in the woreda.

- Improve the available natural pasture and introduce hay making; develop and implement rangeland management systems.
- To reduce calf mortality allowing the calf to suckle the colostrums in the right time with right amount is necessary. Besides, more efforts and attention should be paid for investigation of calf mortality.
- Introduce and develop improved forages as sole crops or integrated with cereal crop production (sorghum or maize system).
- Consider the possibility of selection and cross-breeding in locations where it is feasible with improved feeding and proper management systems.
- Introduce a technology for the processing of camel milk. As a result it could fulfill their demand for processed product in the household in order to strengthen the market participation position of the household in case of cow milk sale.
- Training of woreda staff, development agents and Agro-pastoralists (mainly women) on dairy production, processing and marketing
- To ease conflict, the responsible bodies from both sides should have to establish common committee from herders working for their common interest.

As a scope for future research work in the study woreda, the following points can be considered:

- Study the use of various herbs, plants and plant parts for ethno-veterinary medicine and for disinfecting milk utensils.
- Further research should be done on traditional treatments to investigate the efficiency of traditional medicine used by pastorals.

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