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Weldegiorgis Y
College of Agriculture, Maichew ATVET College, Ethiopia

Tadesse A
College of Dry land Agriculture and Natural Resources, Mekelle University, Ethiopia

Gebremariam B
College of Agriculture and Natural Resources, Raya University, Ethiopia

Correspondence:
Weldegiorgis Y
College of Agriculture, Maichew ATVET College, Ethiopia
Email: brhanegebremariam@gmail.com

Characterization of Dairy Value Chains in the Case of Urban and Peri-Urban Area of Southern Tigray

Weldegiorgis Y, Tadesse A, Gebremariam B

Abstract

The study aimed at analyzing of the existing dairy value chain in the southern zone of Tigray. Primary data were collected from multiple sources including a total of 120 dairy producers, value chain actors: 24 traders, 20 consumers and 8 service providers in Edamehoni and Alamata districts. The collected data was analyzed using application of appropriate statistical tools and simple descriptive statistics. Dairying accounted 53.33 and 23.33% of the total generated family income for urban and peri-urban dairy producers; respectively. The finding indicated that input suppliers, producers, traders, consumers and service providers are involved directly and/or indirectly along dairy value chains in the study areas. Accordingly, producing and processing, collecting, storing and marketing dairy products are the major activities which were performed by the actors. Out of all milk value chain actors about 61% retailers (café and restaurant) and 39% milk producer, were involved in the value addition of milk in both study areas. Most of the smallholder dairy producers in the study sites have been using traditional dairy production technique that results in low milk production. Creating awareness and other capacity building intervention of smallholder dairy producer for quality and quantity milk production are one of the ways to assist dairy producers in building on their resources to create more income by managing their dairy farm skillfully and get a good price in the market. Hence, all concerned organizations (chain enablers) should focus on the provision of appropriate training for both dairy producer farmers and extension agents on how to manage improved breed dairy cattle and incorporate new technologies profitably into farm level production strategies.

Keywords: Dairy, Milk, Farming system, Smallholder, Urban, Peri-urban, Value-chain actors.

INTRODUCTION

Ethiopia holds substantial potential dairy development mainly due to its large livestock population coupled with the relatively suitable environment for livestock production [1]. According to [2] report, Ethiopia is a home for an estimated 57.83 million cattle. Out of this total cattle population, the female cattle constitute about 55.38% of the national herd. Out of this total female cattle population, dairy cows are estimated to be around 20%. Dairying is one of the investment areas where farmers can undertake to improve their standard of living [3]. It is a developmental tool as it expands and sustains three major mechanisms out of poverty; securing the assets, improving smallholders and pastoral productivity and increasing market participation by poor [4].

In Ethiopia, dairy value chain accounts about 500,000 smallholder rural farmers who produce about 1,130 million liters of milk, of which 370 million liters of raw milk, 280 million liters of butter and cheese and 165 million liters that are consumed by the calves [5]. The remaining 315 million liters are marketed through both informal and formal retailers through cooperatives and farmers' organizations. Currently,the demand for dairy products in the country exceeds supply, which is expected to encourage rapid growth in the dairy sector [6]. Value-chain characterization can play a key role in identifying the distribution of benefits of actors in the chain. That is, through the analysis of margins and profits within the chain, one can determine who benefits from participation in the chain and which actors could benefit from increased support or organization [7].

Ethiopia has complex dairy value chain, with both formal and informal channels. Only 5% of the milk produced in Ethiopia is sold in commercial markets [8]. A dairy sector has significant contribution in supporting household income and as sources of food in Edamehoni and Alamata districts. The most utilize dairy products in these districts are raw milk, butter, and cottage cheese. Dairy sector has a crucial role in improving the livelihoods of farmers through family income generation, job creation as well as improving

the nutritional status of the family in Edamehoni and Alamata districts (OoARD, 2016). Despite of this importance of the sector, little emphasis was given to value chain studies rather scholars continue in dealing marketing related studies of dairy sectors [9, 10]. Hence, this study was designed to address this knowledge gap.

Dairy farming has an economic contribution in the southern zone of Tigray. It creates job opportunities and source of income for smallholder farmers and other value chain actors. Smallholder dairy farmers and other value chain actors have key economic and job creation opportunities. Most of the previous studies in the Tigray region were conducted changes in the value chain of dairy development [11], dairy value chain analysis of in the central zone of Tigray [12] and value chain analysis of cow milk [13]. However, there is no study conducted on the dairy value chain characterization of smallholder farmers in the southern zone of Tigray. The linkage amongst the chain actors, the role of each actor, and the channel of smallholders are not clearly understood. For this reason, it has been difficult to formulate and implement the appropriate intervention in relation to dairy value chain development actions in the study area. Therefore, it is imperative to conduct comprehensive studies that can cover dairy value chain characterization in two selected district of southern zone of Tigray.

MATERIALS AND METHODS

Descriptions of the Study Area

The study was conducted in the southern zone of Tigray (SZT) region, Ethiopia. It is one of the seven zones in Tigray regional state located 590 km from Addis Ababa to thenorth. The zone is bordered by Amhara regional state in the west and southeast, eastern Tigray zone in the north and Afar regional state in the northeast. The zone has high, low, and mid-altitude agro-ecologies [14]. The altitude variation in the zone ranges from 930 to 3925 m.a.s.l. Similarly, the mean annual temperature ranges from 9 to 32ºc. The rainfall is bimodal that relying on the *Belg* (short rain season) from mid-January to March, and the *Kiremt* (rainy season) rains from mid-June to mid-September and the highest rainfall occurs during the rainy season. The annual mean rainfall ranges from 400 to 912 mm. The main crops grown in the *Belg* season are barely, wheat and peas. Similarly, barley, wheat, sorghum, teff, peas, lentils, and fababeans are the main crops cultivated during summer. Wheat and barley are the main food crops while pulses are the main cash crops in the area [15]. The zone has an estimated population of 714,845 heads of cattle, 276,943 sheep, 369,894 goats, 159,999 donkeys, 1,525 horses, 913,916 chickens and 43,706 bee hives [16]. The major feed resources in the area are natural pastures, crop residues (wheat, barley, sorghum, maize and teff straws) and cactus pear [15]. Out of the five districts of southern Tigray zone: two districts namely: Edamehoni and Alamata were purposely selected for the study.

Descriptions of Edamehoni District

It is located about 660 km North of Addis-Ababa and 120km south of Mekelle. It has an estimated area of 62,184ha. Bordering with districts of Emba-Alaje, Ofla, Raya Azebo and Amhara region in the South. The district`s total population and households number are estimated to be 136,883 and 24,850, respectively. Out of the total population size, about 69,807 are females. The district's altitude is estimated to range from 1800 to 3250 m.a.s.l. Theaverage temperature ranges from 12.07^0c to 24.96^0c. The mean annual rainfall ranges from 600-800 mm and the area is situated on geographic coordinates of 12^0 47' North latitude and 39^0 32' East longitudes [17]. The same sources Edamehonidistrict is well known for its high potential for wheat, barley, faba bean and maize production and also rich in livestockresources. According to [16], the district has an estimated population of 57,905 heads of cattle, 76,422 sheep, and 64,254 goats.

Descriptions of Alamata District

Alamata district is one of the five districts of southern Tigray zone. It is located about 180 km south of Mekelle (the capital city of Tigray) with 600 km North of Addis-Ababa. Alamata is bordered by Afar region from the east and by Amhara region from the south and west. It has an estimated area of 55,030 hectares. The district`s total population size and households number are estimated to be151, 575 and 28,799, respectively. Out of the total population size, about76,726 are females. The district's altitude range from 1178 to 3148 m.a.s.l. Average temperature ranges from 22 ^{0}c to 40^0c. The rainfall amount ranges from 615 to 927 mm with an average of 715.14 mm and geographically the area lies at 39º 35'East longitude and 12º 15' North latitude. Alamata district is well known for its high potential in livestock production and crop cultivation such as sorghum, maize, millet, teff, chickpea, barley and wheat [17]. According to [12], the district has an estimated population of 112,757 heads of cattle, 62,121sheep, and40, 086 goats.

Sampling Procedure

The multi-stage sampling procedure was employed to undertake the study. In the first stage, two districts (Edamehoni and Alamata) were selected purposively considering the potential for dairy farming from the five districts of southern zone of Tigray region. Secondly, each district was stratified into urban (crossbreed owning) and peri-urban (local breed owning dairy farming) based on their involvement in the dairy farming. Moreover, for urban dairy production system Alamata and Maichew and peri-urban dairy production system Simret and Selam-Bikalsi were selected purposively. Dairy farmers who owned 1-5 cows from indigenous and crossbred production system were selected from each study areas. Thirdly, from each selected areas 30 households were selected randomly for survey study. Equal sampling methods were employed to select 60 households from each of production system. A total sample size of 120 household's was selected from the two districts. Then, value chain actors [input suppliers (4), traders (Restaurants, snack, café and hotels) (20), consumers (20) and service providers including: Office of Agricultural and Rural Development (OoARD) (2), Dedebit Credit and Saving Institution (2), artificial insemination service provider (2) and veterinary service provider (2)] were involved based on the availability and size. Accordingly, a total sample respondent of 172 was used for this study (120 smallholders' dairy producers and 52 other market actors participating in thedairy value chain).

Method of Data Collection

The data used for this study were collected both from primary and secondary sources. Primary data on the production and marketing system collected from producers, input supplier, retailers (Restaurants, snack, café, and hotels), service providers and consumers using semi-structured questionnaires and group discussion with key informants. The primary data collected from dairy farmers were focused on farm household landholding, dairy cattle holding size, income sources, inputs used, milk and butter production, processing and marketing, market information, credit access, access to extension services and demographic characteristics of the household. Moreover, the questionnaire for traders (input suppliers) includes the type of business, buying and selling system, the source of initial capital and demographic characteristics of the traders. The questionnaire for the retailers (Restaurants, snack, café, and hotels) includes buying price, the cost of transportation, labor cost, selling cost, and the amount of purchased and sold per year, total income per year. The checklist was prepared for the discussion purpose with key informants. Secondary data were collected from different published and unpublished reports such as Office of Agriculture and Rural Development (OoARD), Office of Trade Agency (OoTA) and various websites.

Methods of Data Analysis

The data collected from different sources were analyzed using SPSS version 20 and summarized using simple descriptive statistics. Descriptive statistics such as frequency, percentages, means and standard deviations were used to characterize dairy value chain actors, functions and service providers. Moreover, independent t-test and cross-tabulation (x^2-test) were used considering the objectives of the research. According to [18] methodology using the profit margin or the value added to a product at each stage of the value chain is calculated and the proportion of value addition at each stage relative to the value added along the value chain is

also calculated for each actor in the different channels (Therefore, it was calculated as:)

Value-added =Revenue - Total cost ----------1

Where;

Revenue =Sales volume * Unit price

RESULTS

Access to services

Credit access: The purpose of credit access is for the purchase of dairy cows and other inputs such as (feed cost, vaccination and treatment, housing construction and other related expenses). From the urban and peri-urban households, about 81.7 and 73.3% of them had credit access, respectively. Dedebit Credit and Saving Institute (DCSI) is the major credit source and followed by Rural Credit and Saving Cooperatives (RCSC).

Access to market information: There was significant (P<0.01) difference in access to market information between urban and peri-urban dairy producers. From the urban and peri-urban dairy producers, 83.3 and 46.7% of them had marked information, respectively. Governmental and non-governmental offices through mass media and extension services were the major sources of market information.

Table 1: Access to credit services and market information of households

Variables	Response categories	Production system				X^2-test	Total	
		Urban		Peri-urban				
		N=60		N=60			N=120	
		Frequency	%	Frequency	%	P –value	Frequency	%
Credit access	yes	49	81.7	44	73.3	0.274	93	77.5
	No	11	18.3	16	26.7		27	22.5
Market information	yes	50	83.3	28	46.7	0.000***	78	65
	No	10	16.7	32	53.3		42	35

Where: *** (P<0.01), % = Percent N = sample size

Extension services: About 90 and 58.4% of urban and peri-urban households had access to extension services related todairy production activities, respectively. From the total urban dairy producers 23.7, 32.2, 18.6 and 25.5% of them get extension services daily, weekly, monthly and yearlybasis, respectively. While from the peri-urban dairy producers 6, 24.5, and 24.5 and 44.8% of them got extension services on dairy activities daily, weekly, monthly and yearlybasis, respectively. Comparatively, there is more extension coverage in urban than peri-urban dairy producers due to farmers get good access to dairy houses shed in city areas which areprovided by thegovernment.

Table 2: Access to extension contact of households in Alamata and Edamehoni districts

Extension contact of frequency	Production system				Total	
	Urban		Peri-urban			
	(N=60)		(N=60)		(N=120)	
	Frequency	%	Frequency	%	Frequency	%
Daily	14	23.3	3	5	17	14.2
Weekly	19	32	12	20	31	25.8
Two weeks	10	16.7	14	23.3	24	20.0
Monthly	15	25	20	33.4	35	29.2
Never	2	3	11	18.3	13	10.8

N= Sample size % =Percent

Value chain analysis

Dairy value chain actors and their marketing functions in study area

In this study, different dairy product market participants were identified in the exchange functions between producer and the final consumer. The main actors participating in the dairy value chain are input suppliers, smallholder dairy producers, café and restaurants and consumers of the dairy product. This value chain map shows the flow of dairy products and services among the major actors starting from the supply of inputs and production up to consumption stage. Moreover, the development and operation of enabling and supportive business development services (e.g. market information, infrastructure, credit and extension services) play acritical role in how well the value chain responds to consumer demands.

Input suppliers

Dairy products value chain in the study area starts from the concept of design of products from production with the use of inputs to consumers and distribution of value-added milk products. The major dairy farm inputs which are supplied by input suppliers in the study area includes improved dairy breed, feed, labor, artificial insemination and veterinary services and processing equipment. The households obtain the major dairy farming inputs from different sources such as Office of Agriculture and Rural Development (OoARD), Tigray Agriculture Research Institute

(TARI), DSCI, RCSC, and private sectors that are the major input suppliers that play a great role in the study area to encourage milk value addition along the dairy value chain. The main inputs used in smallholder dairy farming discussed below:

Dairy cows /Heifers /: About 73.1, 15.4, and 11.5% of urban (crossbreed owners) obtained the dairy cows/heifers/from the purchase of local markets, own farm and from both, respectively. Whilethe peri-urban households (local breed owners) acquire from local markets (45.5%) followed by the own farm (36.3%), and gift (18.2%).

Feed: In both urban and peri-urban dairy production system, feed resources for dairy cattle are obtained in three ways (Table 3).Ownfarm production [improved forage(alfalfa and elephant grass), crop residue (straw and stover), purchase of feeds such as green fodders, Attela, grass hay, concentrate feed and Raya brewery by product]. About 84.5, 8.7 and 6.8% of urban households find the feeds from local markets, own production and both from the market and own, respectively. However, the peri-urbanhouseholds obtain from own production (58.45%) followed by local market (32%) and from both (9.55%).

Processing equipment: Most of the processing function in the value chain is carried out by traditionally available materials made from a clay pot. All the households use locally available processing equipment (pot clay). All the urban dairy producers get the processing equipment from the local market. Whereastheperi-urban dairy producers get from own (62.5%), market (32.1%) and from the market and own production (5.4%).

Table 3: Sources of major inputs in the study areas

Inputs	**Production system**															
	Urban (N=60)								**Peri-Urban (N=60)**							
	Market		**Own Farm**		**Own and Market**		**Gift**		**Market**		**Own Farm**		**Own and Market**		**Gift**	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Heifers	19	73.1	4	15.4	3	11.5	-	-	5	45.5	4	36.3	-	-	2	18.2
Processing equipment	23	100	-	-	-	-	-	-	18	32.1	35	62.5	3	5.4	-	-
Feed																
Grass Hay	25	100	-	-	-	-	-	-	-	-	39	90.7	4	9.3	-	-
Straw	40	73	7	13	8	14	-	-	9	15	41	68	10	17	-	-
Green Fodder	37	79	6	13	4	8	-	-	-	-	45	85	8	15	-	-
Stover	41	75	9	16	5	9	-	-	3	5	52	93	1	2	-	-
Attela	32	80	4	10	4	10	-	-	21	72	4	14	4	14	-	-
Concentrate feeds	60	100	-	-	-	-	-	-	24	100	-	-	-	-	-	-

N= Sample size, %= Percent

Labour: The main sources of labor for the dairy activities operation are from family members (80%) and hired labour (20%). The important dairy farm operations are milking, cleaning milk containers, milk storing and preserving, barn cleaning, milk and butter marketing, and milk processing. Key dairy herd management practices are feeding, watering, health management and heat detection. Members of the household have different responsibilities for different dairy farm operations and herd management practices. As shown Table 4, the labour division among family members with respect to dairying activity in the study is about 65.7and 57.2% male are highly involved in buying dairy animals and feed preparation, respectively. Sale and transport of dairy products are activities not often done by amale.

Preserving and processing, cleaning milking containers, dairy product transportation, milking cows, selling dairy products, cleaning barn and troughs areactivities commonly done by afemale. Females take the major responsibility for dairying activity because men mainly do outside home activities other than dairying activity. About 36.5, 35 and 27.6%hired labouris used for herding, mating, and feeding and watering dairy cows, respectively. Some activities such as for feed preparation (24%), heat detection (21.3%) and cleaning barn and troughs (20%) are also responsiblefor hired labour. Preserving and processing (19.7%) and transport of dairy products (16.3%) are done by girls. Feeding, watering, breeding, and herding are responsibelities boys.

Table 4: Labour division of households in dairy value chain

Activities	**Labour division**				
	Male (%)	**Female (%)**	**Boys (%)**	**Girls (%)**	**Hired labour (%)**
Feed preparation	57.2	5.3	10	3.5	24
Feeding and watering cows	23.2	16.8	23.8	8.6	27.6
Preserving and processing	-	77	3.3	19.7	-
Heat detection	46.4	16.7	10.9	4.7	21.3
Dairy product transportation	2.8	61.3	9	16.3	10.6
Cleaning milking containers	-	75.6	-	10	14.4
Cleaning barn &feed troughs	16.4	46.5	5.7	11.4	20
Health management	29.4	38.2	5.9	5.1	21.4

Buying dairy animals	65.7	20.6	10.8	2.9	-
Herding	14.8	9	24.5	15.2	36.5
Mating dairy cows	32.7	3.5	24.8	4	35
Milking cows	18	53	2.7	7	19.3
Selling dairy product	12	52	6	4	26
%= Percent					

Artificial insemination and veterinary services: Artificial insemination (AI) and animal health services are important inputs to the dairy sector. The present findings revealed that 98.3 and 78.3% of urban and peri-urban dairy producers use AI, respectively and the remaining use natural mating. Pertaining AI services, all households get the service exclusively from OoARD. The current study showed that 93.3 and 81.7% of urban and peri-urban dairy producers use veterinary services, respectively. Concerning the veterinary services, the urban households get, and from OoARD (51.8%), private suppliers (26.8%) and both (21.4%). While peri-urban households get veterinary services and from OoARD (61%), both (25%), and private suppliers (14%). Table 5 shown that urban dairy producers get more veterinary servicesfrom private suppliers' sector as compare to peri-urban dairy producers.

Table 5: Sources of artificial insemination and veterinary service of the study areas

Inputs	**Production system**											
	Urban						**Peri-Urban**					
	OoARD		**Privet supplier**		**Both**		**OoARD**		**Privet supplier**		**Both**	
	N	%	N	%	N	%	N	%	N	%	N	%
AI	59	100	-	-	-	-	47	100	-	-	-	-
Vaccination and drug access	29	51.8	15	26.8	12	21.4	30	61	7	14	12	25

AI=Artificial Insemination, OoARD= Office of Agriculture and Rural Development

Credit services: The major sources of credits access for both dairy farming systems are DCSI, RCSC, and relatives. As shown in Table 6, about 84% of urban and 74.5% of peri-urban dairy farming households obtain the credit access from DCSI, and RCSC, respectively**.**

Table 6: Sources of credit service

Inputs	**Production system**											
	Urban						**Peri-Urban**					
	DCSI		**RCSC**		**Relatives**		**DCSI**		**RCSC**		**Relatives**	
	N	%	N	%	N	%	N	%	N	%	N	%
Credit access	41	84	-	-	8	16	5	11.4	33	75	6	13.6

N= Sample size % = Percent
DCSI = Dedebit Credit and Saving Institutes
RCSC= Rural Credit and Saving Cooperative

Small holder dairy producers

Producers are the very important actors along the dairy value chain. They are the producer–sellers. A large proportion of dairy products is produced and processed by smallholder dairy farmers in the study area. The largest share of dairy products and value-added products are produced by urban and peri-urban dairy producers. Key activities at the production phase include the keeping of dairy cattle, feeding dairy cows, milking and delivering the milk for local market, husbandry practices like breeding, calf rearing, and disease control. The main dairy products produced and consumed are fresh milk, butter, yogurt (fermented milk), buttermilk, cottage cheese, and whey. The average milk production produced per day on the-fasting period of urban and peri-urban households are 14.89±9.32 and 4.61±2.4liter per household, respectively. While the average milk production produced per day on fasting period of urban and peri-urban households are 13.6±8.5 and 3.42±1.73liter per household, respectively. The average milk production produced per year of urban and peri-urban households are 3127±1959 and 922.7±515 liter/ households, respectively. There was significant ($P<0.01$) variation in milk yields in the urban and peri-urban household. The milk yield produced in urban households is higher than peri-urban households. Average annual butter yield produced by urban and peri-urban households are 24.5±16.42and 23.28±15.96kilogram per household, respectively.

Table 7: Milk and butter production of households in the study areas

Dairy products	Production system				T-test	Total	
	Urban		Peri-urban				
	(N=60)		(N=60)			(N=120)	
	Mean	SD	Mean	SD	P-value	Mean	SD
Milk production/day/litter/HH							
Non-fasting	14.89	9.32	4.61	2.4	0.000***	9.75	5.16
Fasting	13.6	8.5	3.42	1.73	0.000***	8.6	5.12
Total milk produced per year	3127	1959	922.7	515	0.000***	2051.9	1237
Butter production/kg/week/HH							
Non- fasting	0.45	0.08	0.57	0.16	0.10	0.52	0.12
Fasting	1.3	0.42	1.12	0.40	0.12	1.21	0.41
Total butter produced per year	24.5	16.42	23.28	15.96	0.15	23.89	16.19

Where: ***= (p<0.01) N= Sample size SD= Standard deviation HH=Household

Marketing of dairy products

Dairy producers, retailers (café and restaurants) and consumers are the key participants in dairy product marketing in the study area.

Dairy producers

Out of the total milk produced by the smallholder producers about 85% and 77.6% was sold to neighbors and cafeterias in urban and peri-urban dairy farming, respectively. Whereas the rest 15% and 22.4% of produced milk are utilized for home consumption in urban and peri-urban dairy farming system, respectively. The fasting period has a significant impact on the demand and selling price of milk in study areas. Producer's supply a high amount of milk to the market on the non-fasting periods than fasting periods and the milk price often shown increment. The present findings revealed that the price of milk is reduced by 1.14% and 1.48% during the fasting period in urban and peri-urban dairy farming, respectively. In the peri-urban dairy farming system, a slight (1.14%) drop in butter price is noted during the fasting period. Whereas the case of urban dairy farming, butter making is exclusively practiced during the fasting period.

Table 8: Milk and butter pricesin the study area

Dairy products	Production system				T-test	Total	
	Urban		Peri-urban				
	(N=60)		(N=60)			(N=120)	
	Mean	SD	Mean	SD	P-value	Mean	SD
Milk sold/litter/day/HH							
Non- fasting	13.68	9.09	2.93	1.22	0.000***	8.31	5.16
Fasting	11.7	7.5	1.05	1.69	0.000***	6.38	4.6
Total milk sold /year	2664.9	1742	716.4	431.2	0.000***	1690.65	1086.6
Milk price (ETB)							
Non-fasting period	14.82	2.22	12.77	2.4	0.000***	13.8	2.31
Fasting period	13	1.42	8.61	2.69	0.000***	10.5	2.05
Butter sold/kg/week/HH							
Non- fasting	-	-	0.36	0.27	-	0.36	0.27
Fasting	0.61	0.51	0.75	0.37	0.221	0.68	0.44
Total butter sold/year	16.5	8.25	18.8	13.78	0.052	17.65	11.02
Butter price (ETB)							
Non-fasting period	-	-	228	24.77	-	228	24.77
Fasting period	204	17.92	200	14.14	0.503	202	16.03

Where: ***= (p<0.01) N= Sample size SD= Standard deviation

Processers (Restaurant and Café)

This stage is the last link in the milk value chain that is engaged in buying, processing and selling milk to any consumer coming to their service area. They are sometimes considered as processors and retailers of milk. There was significant (P<0.01) difference in the purchased quantity and buying unit price of fresh milk between fasting and non-fasting period by retailers. Consequently, during fasting period the quantity of daily purchased milk and purchasing unit price of fresh milk by the retailer plummeted by 1.45% and 1.15%, respectively. Processors purchase high amount of milk volume during non-fasting than fasting period. Café and restaurants with the value addition of the collected milk, it is sold either in boiled and/or cooled milk or yogurt form and its selling price varies between 30 to 35 ETB per liter at café and restaurants.

Table 9: Milk purchasing and selling capacity of traders in the study area

Variables	Non-Fasting period		Fasting period		T-test	Total	
	N=20		N=20			N=40	
	Mean	SD	Mean	SD	P-value	Mean	SD
Milk purchased (liter per day)	9.4	2.91	6.5	2.06	0.001***	7.95	2.89
Milk price (ETB/liter)	14.1	1.7	12.3	1.6	0.002***	13.2	1.91
[1]Purchasing cost(ETB)/day	11.5	2.05	9.6	1.57	0.011**	10.38	1.97
Milk sold (liter per day)	9.4	6.5	2.91	2.06	0.001***	7.95	2.89
Milk Selling price (ETB per liter)	35	2.05	31	2.05	1.000	33	2.05
Net profit from sold of milk ETB/day	185	31.3	112	21.45	0.000***	148.5	26.4

Where: Purchasing cost[1] (consumables, electricity, labour, transport cost) ***= (p<0.01), **= (p<0.05) N= Sample size SD= Standard deviation

Dairy products processing: The survey showed that there is no formal milk collection and processing activities existed in both study sites. Dairy farmers and catering service providers are the main actors who process milk into various milk derivatives (yogurt, butter, cottage cheese, boiled milk, and *Macchiato*). In the value chain of dairy products processing, butter production is mainly carried out by dairy farmers (producers) using traditional technologies made from local materials *(kil).* The by-products of butter making 'buttermilk' is directly consumed or processed into cottage cheese. On the other side, cafeterias and restaurants involved in the value addition of fresh milk into boiled plain milk, *Macchiato* (amixture of milk and coffee) and yogurt.

Consumer

Consumers are the final users and the most important actor of the dairy value chain. Accordingly, the survey results from both production systems showed that all of the respondents consume dairy products. Socio-cultural and economic aspects of the society have substantial influence on the frequency of dairy products consumption pattern. About 50, 30 and 20% of the urban consumer have consumed dairy products always, sometimes and occasionally per week, respectively. While in the peri-urban respondents 40, 50 and 10% of the consumer areconsumedalways, sometimes and occasionallyper week, respectively.

Table 10: Frequency and dairy products consumption in the study area

Variables	Production system			
	Urban		Peri-urban	
	N=10		N=10	
Consumption of dairy product	**Frequency**	**(%)**	**Frequency**	**(%)**
Yes	10	100	10	100
Consuming frequency				
Always	5	50	4	40
Some times	3	30	5	50
Occasionally	2	20	1	10

N= Sample size, % = Percent

Support service providers

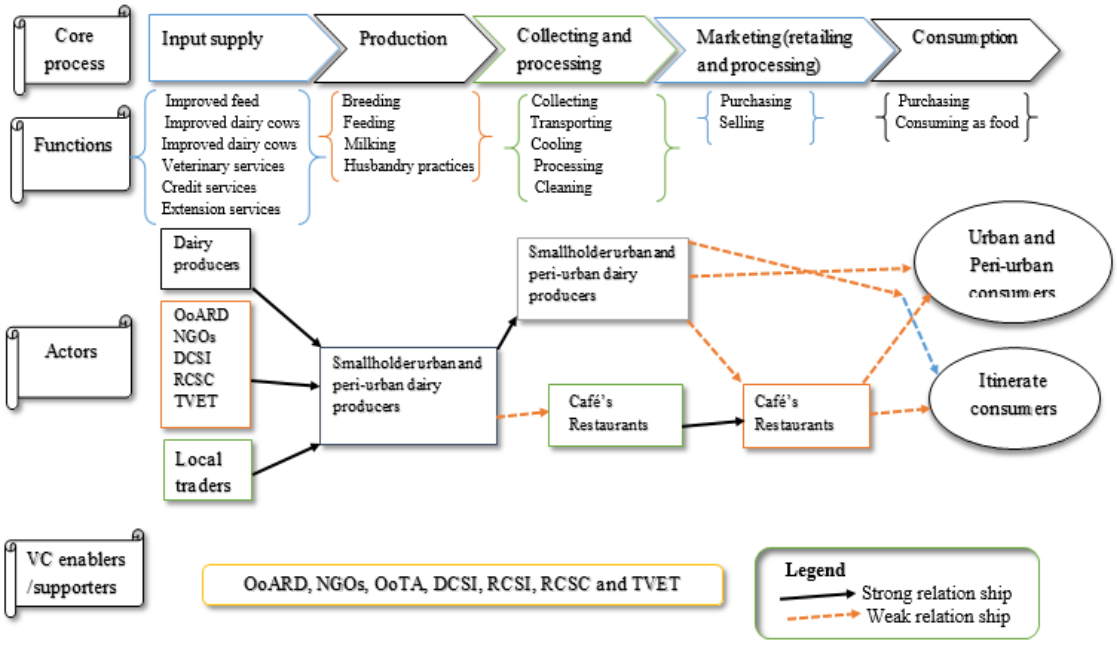
Service provision is necessary for value chain actors to perform the activities that add value and reduce transaction cost. Support services do not directly perform the basic functions in a value chain. Typical facilitation tasks include creating awareness, facilitating joint strategy building and action and the coordination of support activities (such as training and credit). In the study area, the support service providers in the dairy value chain are an extension and credit services provider institutes.

Extension service provider: Dairy producers obtain extension services from the experts of OoARD, and Technical Vocation Education and Training (TVET) at individual and group level.

Credit service provider: Those organizations which provide credit for milk production and other related activities. The existing credit organizations in the study area are Dedebit Saving and Credit Institute and Rural Credit and Saving Cooperative.

Value chain governance along dairy value chain

Governance indicates the power dynamics applied by different kinds of actors along the value chain. Governance ensures that interactions among actors along a value chain reflect organization. The governance of value chain arises from the requirement to set product, process, and logistic standards, which then influence upside or downsides chain actors and results in functions. But smallholders at both sites due to the lack of a proper market information system and minimal negotiating power, farmers are forced to sell their product at the price offered by traders (processors and local collectors) and direct consumers. Smallholder dairy farmers have poor coordination among each other, as well as they have poor coordination among traders and direct consumers thereby they provide less quality dairy products. Generally, the coordination and interaction among the actors along the dairy value chain are very poor in study area because of extension service gap. In the study areas, there is also power asymmetry among the actors.



***Sources*:** Own computation from survey result, 2016

Figure 1: The current dairy value chain map in the study area

Marketing channel and economic analysis of dairy value chain

Marketing channel

Dairy market channels connect producers, local collectors and hotels/restaurants and café to consumers as indicated in Figure 1. Only small amount of dairy product is consumed at the point of production, and another dairy product is purchased by ultimate consumers directly and indirectly from the producers. The number and type of market participants are different along the different market channels.

Marketing channel of raw milk: Three types of milk market outlets were identified in the study area and the starting point in the milk market channels is the producers and the final users of the products are the consumers. Generally, milk is channeled either to direct consumer and /or and café and restaurants and local milk collectors. It was estimated that 1690.65liters/year dairy producer were marketed to local consumers[1].

Channel I: Producer → Consumer (58.8%)

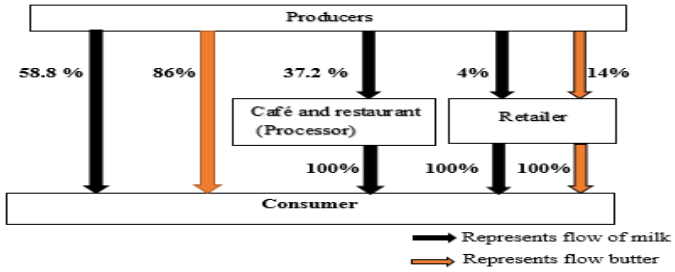
Channel II: Producer → Café and restaurant (processor) (37.2%) → Consumer

Channel III: Producer → Local milk collectors (4%) → Consumer

Marketing channel of butter: The butter market was channeled from producer to a consumer and/or local butter collectors. It was estimated that 17.65kilograms of butter was marketed annually to the local market. The main marketing channels starting from production point, intermediate market actors, and consumer were presented as shown below.

Channel I: Producer → Consumer (86%)

Channel II: Producer → Local collectors (14%)→ Consumer



***Sources*:** Own computation from survey result, 2016

Figure 2: Market and butter channel in the study area

Economic analysis

The study identified the major marketing cost of dairy product starting from the producer to end consumer. Profit margin or the value added to a product at each stage of the value chain is calculated as the selling price minus the total production and marketing costs. The proportion of value addition at each stage relative to the value added along the value chain is also calculated for each actor in the different channels. The major producer's expense cost belongs to feed. As indicated in Table 11, the average milk production cost was estimated at 6.5 and 3.2 ETB/liter of urban and peri-urban households, respectively. Producers selling price was 13.91 and 10.7 ETB/liter to the retailer of urban and peri-urban households, respectively. Marketing cost of producers was estimated as 0.46 and 0.36 ETB per liter making the producers profitable about 6.99 and 7.14 ETB/liter of urban and peri-urban households, respectively. Value chain actors added a total value of 26.9 and 23.48 ETB/litter milk in urban and peri-urban households, respectively. Producers added 39.7 and 38.2% of the total value of milk in urban and peri-urban households, respectively. While traders added around 60.3 and 61.8% in urban and peri-urban households, respectively. This value addition process was depending on the differences in sales price and cost of inputs at each stage of the value chain.

[1]***Local market**: the locally available of cafeteria, restaurant and neighbors consumers.*

Table 11: Milk marketing margin of producers and retailers

S/No	Items (Birr/liter)	Production system					
		Urban			Peri-urban		
		Milk			Milk		
		Producer	Retailers	Total margin	Producer	Retailers	Total margin
1	Cost of production[1] (ETB/liter)	6.5	-	-	3.2	-	-
2	Purchasing cost (ETB/liter)	-	13.91	-	-	10.7	-
3	Marketing cost (ETB/liter)	0.42	1.18	-	0.36	0.96	-
4	Total cost (ETB/liter)	6.92	15.09	-	3.56	11.66	-
5	Selling prices (ETB/liter)	13.91	35	-	10.7	28	-
6	Profit Margin or value added (ETB/liter)	6.99	19.91	26.9	7.14	16.34	23.48
7	Percentage of value added/Share/	39.7	60.3		38.2	61.8	-

[1]The cost of milk production includes Feed, labour, house rent, AI and veterinary services, and local retailers [2] it includes transport cost, operational cost, and labour cost.

As the result indicated in Table 12, producers are incurred 130 ETB to produce one kg of butter from crossbreed dairy cows averagely in the urban dairy producers. Producers selling prices is 214ETB/kg butter to consumers directly and marketing cost of producers was estimated as 4.35 ETB/kg getting79.65 ETB/kg. Producers' added/share/100% of the total value of butter in the urban households. Whereas in the peri-urban dairy producers the butter production cost is estimated at 54.4 ETB/kg. Producers selling prices is 227 ETB/kg to retailers and marketing cost of producers was estimated 1.95 ETB/kg getting 144.74 ETB/kg. Producers added 89.87% of the total value of butter. While trader's added around 10.13% in the peri-urban dairy farming sites.

Table 12: Butter marketing margin of producers and retailers

S/No	Item (Birr/liter)	Production system				
		Urban			Peri-urban	
		Butter			Butter	
		Producer	consumer	Producer	Local collector [2]	Total margin
1	Cost of production[1](ETB/kg butter)	130	-	54.4	-	-
2	Purchasing cost (ETB/kg butter)	-	214	-	204	-
3	Marketing cost(ETB/kg butter)	4.35	-	4.86	1.95	-
4	Total cost (ETB/kg butter)	134.35	-	59.26	206	-
5	Selling prices (ETB/kg butter)	214	-	204	227	-
6	Profit Margin or value added (ETB/kg butter)	79.65	-	144.74	21	165.74
7	Percentage of Value added/Share/	100		89.87	10.13	

[1]The cost of butter production includes the total quantity of milk required to produce a butter, and local collectors [2]includes:transport cost and packing material cost.

DISCUSSIONS

Dairy value chain mapping: According to [19], value chain mapping enables to visualize the flow of the product from the conception of product design to end consumer through various actors. The value chain map depicts the flow of dairy products in the market, activities carried out at each stage of the value chain, the structure of actors and the support involved in the value adding process. The direct actors play a crucial role in the dairy value chain and their major activities were identified as follows.

Input supply: The study shows that there were no formal and well-structured improved feeds, improved dairy cows and processing equipment supply system in both study sites of urban and peri-urban dairy production system. The present finding was in agreement with the report of [20] which was conducted in the two peri-urban sites in Western Oromia, Ethiopia. Overall, the feed supply for dairy cows in the study sites was not adequate enough and the price of feeds highly fluctuates among different seasons. The provision of artificial insemination and veterinary services in the urban production system was well practiced whereas, in a peri-urban production system, the AI service was found discouraging. This finding was in line with the report of [20] which was conducted in two peri-urban sites of western Oromia, Ethiopia. The study showed that shortage of land in urban dairy producers was a priorityconstraint than peri-urban dairy producers. The larger proportions of urban dairy farmers keep the animals in their residential compound. Besides, the majority of the urban dairy farmers did not have sufficient land for forage cultivation. The credit services provision system was not satisfactory in both dairy production systems. The maximum allowable credit amount is limited to 30,000 ETB/household which is not sufficient enough to transform the existing dairy farms into commercialized dairy farming systems. But it needs more than 150,000 ETB/households to expand their farms.

Dairy production: The average daily milk production of crossbreed and local bred cows were 7.13 and 2.63 liters, respectively. The daily milk yield result of local cows was greater than the daily milk yield reported by [10] who reported 2.03 liters/cow/day in Dangila town, Western Amhara region, Ethiopia. However, the average daily milk yield of crossbred cows was found to be less than the finding of [21] who reported 9.14 liters in west shoa zone. These differences could be due to variation in husbandry practices (feeding, watering, breeding and milking practices) and extent of the blood level of the milking cows. The average daily milk production of a crossbred cow had shown a slight reduction

during the fasting period as compared to non-fasting period. The variation was associated with farmer feeding management practices of reduction of concentrate feeds such as wheat bran to be given to cows because of low market demand for the produced milk.

Marketing, processing and consumption stages: The absence of formal milk marketing system in the study area was in agreement with reports from other parts of the study. For instance, around 95% of the milk marketed at the national level was reported to be channeled through informal market outlets [22, 23]. A system characterized was by direct delivery of fresh milk to immediate neighborhood customers, or catering service providers. Both production systems were marketing their dairy products informally. In the peri-urban production system 35 and 57% of the produced milk and butter were totally consumed at home, respectively which might be associated with far distance from market places, low milk market demand and price, low milk productivity of dairy farms, and non-market-oriented production system, and traditional belief of no selling of raw milk. Also, the majority of peri-urban dairy farmers are not specialized in dairy farming rather they used to practice mixed crop-livestock farming. On the other hand in the case of the urban production system, few of the households started own catering services and processing own produce into other milk products to have better market accessibility.

Dairy value chain actors and service providers: The current study revealed that main actors in the dairy value chain were identified as input suppliers, dairy producers, retailers, and consumers. The major input suppliers in the study area were the office of agriculture and rural development, private sectors (feed and drug suppliers) and non-governmental organization to encourage dairy value chain upgrading. The second stage of actors in the dairy value chain was producers and the first most important direct actors along the dairy value chain. A large proportion of dairy products were produced and processed by smallholder dairy farmers in the study area. Farmers in study area use their own land and rented to keep their animals and cultivate crops for feed purpose, and also they have been using family labor and hired labour for feeding, watering, barn cleaning, milking, processing, and marketing of their products.

The third actors of the processors (restaurants and café) and collectors directly purchase raw milk (morning and evening milk) from the producers based on contractual agreements. Those are who providing services to the customers directly. Finally, consumers are the end users of dairy products. In dairy value chain from the design of production to the distribution of dairy products to consumers, it is important to carry out the demand of the products based on consumers' preference. This implies consumers are one of the most important customers of producers and processors.

These are the office of agricultural and rural development, trade and industry office, youth association affairs, Dedebit Credit and Saving Institution (DCSI), Rural Credit and Saving Cooperatives (RCSC), Tigray Agricultural Research Institute, Technical Vocational, and Education Training and private veterinary services, providers. They provide training on dairy cows feeding, management practices, and quality improvement of dairy products, milk value addition, market information, artificial insemination, improved feed and cross breed dairy cows. DCSI play role in accessing credit for farmers in the study area. Farmers' and traders accessing credit from DCSI and informal lenders like relatives. This is in line with [24], who reported farmers and dairy products traders in Atsbi-Wenberta and Alamata Woreda obtained credit from micro-credit institutions, and informal lenders (dairy producers and traders).

CONCLUSIONS AND RECOMMENDATIONS

Urban dairy producers are market oriented and generate a better source of income than peri-urban producers. The main dairy value chain segments identified were: input supply, production, marketing, processing, and consumption. Key inputs/services used in both dairy production system activities were improved feed, artificial insemination and veterinary services, extension services and labour. Smallholder dairy producers, the office of agricultural and rural development, TVET, the office of trade agency, private feed and drug suppliers are the main actors involved in the production and input supply activities. Processors (café and restaurants) and local collectors purchase milk from producers and sell by adding value and/or as steady to consumers. There are also public and private supportive services that support dairy value chain directly or indirectly. Value chain supporters or enablers provide facilitation activities like creating of awareness and coordination of support. Producers had strong direct milk market linkage with the consumer as compared to other value chain actors. In the marketing margin of dairy value actors, producers are lower value added than with traders about 39.7 and 38.2% of the total value of milk in urban and peri-urban households, respectively. However, the butter percentage of value added was higher in peri-urban dairy producers than traders.Fasting period influenced the milk price, demand and type of dairy product to be produced. Most of the smallholder dairy producers in the study sites have been using traditional dairy production technique that results in low milk production. Creating awareness and other capacity building intervention of smallholder dairy producer for quality and quantity milk production are one of the ways to assist dairy producers in building on their resources to create more income by managing their dairy farm skillfully and get a good price in the market. Hence, all concerned organizations (chain enablers) should focus on the provision of appropriate training for both dairy producer farmers and extension agents on how to manage improved breed dairy cattle and incorporate new technologies profitably into farm level production strategies.

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