ADDIS ABABA UNIVERSITY

COLLEGE OF DEVELOPMENT STUDIES

CENTER FOR RURAL DEVELOPMENT

Assessment of Camel Milk Productivity, Marketing Channel and Its Effect on Pastoralist Livelihood: The Case of Degahbour Woreda, Jarar Zone, Somali Regional State (SRS) Ethiopia

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JUNE, 2019

ADDIS ABABA, ETHIOPIA

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A THESIS SUBMITTED TO CENTER FOR RURAL DEVELOPMENT IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF ART IN RURAL LIVELIHOODS AND DEVELOPMENTS

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APPROVAL SHEET OF THESIS

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As Thesis Research advisor, I hereby certify that I have read and evaluated this thesis prepared, under my guidance, by ***Ayanle Igge***, entitled**: Assessment of Camel Milk Productivity, Marketing Channel and Its Effect on Pastoralist Livelihood: The Case of Degahbour Woreda, Jarar Zone, SRS, Ethiopia.** I recommend that it be submitted as fulfilling the Thesis requirement.

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As member of the Board of Examiners of the MA Thesis Open Defense Examination, We certify that we have read, evaluated the Thesis prepared by **Ayanle Igge** and examined the candidate. We recommended that the Thesis be accepted as fulfilling the Thesis requirement for the Degree of Master of Art in Rural livelihoods and Developments.

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DEDICATION

I dedicated this thesis manuscript to my beloved *sister, Ugaso Igge, my mother, Aisha Abib and my father, Igge Omer for their showing me the firm ground and for the gift of their values. They have my eternal gratitude and appreciation for all they had done for me.*

STATEMENT OF THE AUTHOR

I hereby declare that this thesis is my own work and that all sources or materials used for this thesis have been appropriately acknowledged and cited. This thesis is submitted in partial fulfillment of the requirement for MA. degree at Addis Ababa University and to be made available at the University's Library under the rules of the Library. I seriously declare that this thesis has not been submitted to any other institutions anywhere for the award of any academic degree, diploma, or certificate.

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Date of Submission: 16/06/ 2019

ACRONYMS AND ABBREVIATIONS

CSA	Central Statistical Authority
DDE	Dairy development Enterprises
DFID	Department for International Development
DLCRDO	Degahbour Livestock, Crop and Rural Development Office
DPPB	Disaster Prevention and Preparedness Bureau
EMU	Ethiopian Mapping Unit
ETB	Ethiopian Birr
FAO	Food and Agricultural Organization of the United Nations
GDP	Gross Domestic Product
HHHs	Household Head
ILRI	International Livestock Research Institute
Lit	Liter
LMA	Livestock Marketing Authority
M.A.S.L	Meter above Sea Level
MOA	Ministry of Agriculture
MoARD	Ministry of Agriculture and Rural Development
NGOs	Non-Governmental Organizations
SC (UK)	Save the children United Kingdom United Kingdom
SCF/USA	Save the Children United States of America
SoRPARI	Somali Region Pastoralist and Agro-pastoralist Research Institute
SRLCPB	Somali Region Livestock and Crop production Bureau
SRS	Somali Regional State
SRSS	Somali Regional State Strategy
TLU	Tropical Livestock Unit

ACKNOWLEDGMENTS

First of all thanks to ALLAH whose demand and forgiveness is always needed. Then I am really happy to thank my advisor, Dr. Alemseged Gerezgiher for his personal encouragement, suggestions, guidance and overall assistance and continuous patience. Successful accomplishment of this research would have been very difficult without his generous time devotion from the early design of the research proposal and questionnaire to the final write-up of the thesis. Thus, I am very much indebted to him for all his support, kind, willingness and tireless efforts that enabled me to finalize this thesis.

I would also like to express my gratitude and appreciate to Jigjiga University (JJU) for providing me study leave and guarantee my salary during the study time and for sponsoring this study.

My heartfelt thanks and many appreciations go to Mr. Ahmed Sheikh (SoRPARI General Director) for his encouragement and providing me with the indispensable materials and literature related to my research.

I would also like to extend my thanks to all my friends and relatives who in one way or the other helped me during thesis research work. In this regard, especial thanks go to Abdulahi Ahmed, Abdiduh Sharif, Ahmed Mahmud, Nimo Ahmed, Muna Ahmed and Maslah Mahamed for their assistance during research work, particular during the data collection to accomplish this thesis.

My special thanks go to my family, especially my beloved sisters Ugaso Igge for her moral and material support to me to successfully finalize the thesis work.

Finally, a sincere appreciation is extended to my teachers, friends and colleagues for their continuous support and promotion through the course of my education and their continuous encouragement.

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ABSTRACT

This study was conducted in Degahbour Woreda of Jarar Zone, Somali Regional State, Ethiopia with the objectives of *assessing camel milk productivity, marketing channel and its effect on pastoralist livelihood. The study employed a combination of descriptive and explanatory followed with cross sectional design. Multi stage sampling techniques were used to select 155 household heads. In order to achieve the objectives of the study and thereby give answers for the basic research questions, mixed research approach was used. Both primary and secondary data sources were used to collect a data. Structured questionnaires and check lists were used to collect the primary source of the data. The data were entered, manipulated, organized and analyzed using SPSS version 23 and Excel. Both descriptive and inferential statistics were used to identify and determine the household income. According to the study findings some of the explanatory variables including age of the household head, amount of camel milk produced per camel in wet season, amount of camel milk produced per camel in dry season, number of lactating camels owned and price of camel milk in dry season are linearly associated with the income of household and statistically affect the household income with a 0.05 level of significance. Pastoralist respondents well-known that the income they get from camel milk sales allows them to cover most of their daily household needs and expense. Camel milk is means of income especially for the pastoralist community that plays a great economic contribution and livelihood for pastoralist households. Different camel milk production constraints and marketing were identified, especially shortage of forage, diseases and parasites and scarcity of water were the major constraints of milk production, whereas lack of transportation and poor infrastructures were the main milk marketing during the study, therefore the Woreda, livestock and pastoralist development office along with its partners should have to improve the above mentioned problems, in order to improve the milk production and marketing of the pastoralist in the study area.*

Key words: Camel milk, productivity, marketing channel, livelihood.

CHAPTER ONE
1. INTRODUCTION

1.1 Background of the study

Livestock constitute 40% of global value of agricultural output and support the food security and livelihood of billions of people (Caceres, 2011). In Africa, livestock-derived food items contribute up to 30% of agricultural Gross Domestic Product (GDP). Livestock form an integral part of the mixed farming system play important role such as provision of employment and store of wealth, being form of insurance and contribution of gender equality by generating opportunities for women. With such significant socio-economic and cultural importance, livestock are key enhancers of livelihoods, food security and poverty reduction in the continent (Randolph *et al*., 2007).

Hence, livestock is critical to the wellbeing of the lowland households in terms of savings, income, food security, employment, traction, fertilizer and fuel (Blench, 2001). Despite its huge number, the livestock sub-sector in Ethiopia is less productive in general, and compared to its potential, the direct contribution to the national economy is limited. Poor genetic potential for productive traits, along with the sub-standard feeding, health care and management practices that animals are exposed to the main contributors to the low productivity (Zegeye, 2003).

In low lands of Ethiopia, the primary livelihoods of the pastoralists are the rearing of livestock such as cattle, goats, sheep and camels. Hence, livestock and livestock production are critical to the wellbeing of the arid and semi-arid pastoral society in terms of income, savings, food security, employment, traction, fertilizer and fuel (Blench, 2001). Generally, livelihoods of the pastoralist entirely depend on livestock and livestock production (PADS, 2003).

The Somali Regional State (SRS) is one of the administrative regions of Ethiopia, which is occupied by large population of pastoralists. The region has huge livestock potential and a wide range of geographical coverage for livestock rearing (IPS, 2002). The majority of the population in the SRS (more than 85%) is pastoralist and agro-pastoralist whose livelihoods depend on animal husbandry (SRSS, 1997). The livestock production system and diversity of the agro-pastoralists and pastoralists depend on climatic, vegetation and animal type. Moreover, pastoralists keep a diversified collection of herds based on variation in quality, quantity and types of feed, sensitivity to drought and diseases, suitability and complementarity's (SRSS, 1997). The livestock sector of

the region has been badly affected by inadequate and poor quality of feed situation, weak sectorial support and poor marketing services (SRSS, 1997).

According to FAO, (2013), the total population of camel in the world is estimated to be 25.89 million, spread across 47 countries; where Somalia has the biggest population of 7 million followed by Sudan 4.25 million and Ethiopia 2.4 million, of which 89% are one-humped dromedary camels (*Camelusdromedarius*) and the remaining 11% are the two-humped (*Camelusbactrianus*). Ethiopia ranks third in the world by the number of camel herd after Somalia and Sudan (Simenehk*etal*, 2015).

Camels are of great interest for the lowland peoples and pastoralists in particular; they are uniquely adapted to the lowlands of Ethiopia, and contribute significantly to the food security of pastoral households. Their most important use is for milk and transport of household and commercial goods. The protein, fat and vitamin-C content of camel milk is vital for pastoralists living in an environment that lacks vegetables. Pastoralists use camels for travel and/or commercial operations. Domestic uses of camel include carrying grain, commodities from market, large quantities of drinking water from wells both for people and calves in dry season and ploughing. Most pastoral campmates have at least one camel. Members of different communities exchange male camels for transport and female camels for milk (Alemayehu, 2003).

FAO, (2012) indicated that with savvier packaging and more investment in camel milk production, camel's milk could became a $10-billion annual global industry and that camels produce more milk when matched with cattle and small stocks under the same punitive environmental conditions and its lactation persists well into the dry seasons and infrequently ceases even during extended dry spells.

Currently, camel milk production is in development in many countries in both Asia and Africa due to increased demand. Raw and sterilized milk and other dairy products made from camel milk are available in the markets of Gulf area and other countries (El-Agamy, 2006).The milk industry has moved a long way from when milk was either consumed as soon as it came from the cow or churned to produce cream and then butter. The modern dairy industry designed to increase and make best use of the value of all the solids in milk and a vast array of technological developments have enabled sophisticated products to be made from the same essential whole milk.

The pastoralist production system is not market oriented and most of the milk produced in it is retained for home consumption (Ahmed *et al.,* 2003) or household processing. Processing is usually done using traditional technology in to products such as butter, ghee, *ayib* and sour milk. Milk and milk products are usually marketed through the informal market after the households satisfy their needs (Tsehay, 2002).

Ethiopia ranks 2nd in camel milk production in the world next to Somalia that possesses about 2.4 million heads camels The annual camel milk production in Ethiopia is estimated as 75,000 tones (Asresie and Yusuf, 2014).

In Somali pastoralist camel milk is much preferred by Somali to other types of milk due to the fact that pastoralists believe that camel milk is nutritious, thirst quenching, easily digestible and can be preserved much longer (Tezera, 1998). It is considered the highest delicacy given to distinguished guests. It is consumed either fresh or in varying degrees of sourness (Kaufmann and Binder, 2002). For the Somali camel pastoralists in particular, camel milk is principal diet. Therefore, most of the husbandry and management practices of the Somali camel herders are geared towards the improvement of camel milk production and the continuous supply of milk for the family's needs throughout the season (Mohamed, 1993).

Jarar Zone which the current study undertaken is an important and potential area of camel production and camel milk production in Somali region. However, few study were undertaken to examine the camel milk production, therefore this study was conducted to assess the camel milk productivity, market channel and it is effect on pastoralist livelihood, since the camel is the main asset of the pastoralists compared to other livestock to manage their livelihoods.

1.2. Statement of the problem

According to FAO (2011), Ethiopian livestock producers are smallholders who are characterized by lack of the required technological, organizational as well as institutional capacities. Similarly, Lemma *et al*. (2008) reported to be less organized and distant from market outlets, lack economies of scale and institutions for risk management and face higher transaction costs.

Pastoralism is the major system of milk production in lowlands. However, because of the low rainfall, shortage of feed and water availability, milk production is low and highly influenced by season variability (IPS, 2000; Tsehay, 2002). The pastoralist production system is not market oriented and most of the milk produced in it is retained for home consumption or household processing(Ahmed *et al.*, 2003). Processing is usually done using traditional technology in to products such as butter, ghee, *ayib* and sour milk. Milk and milk products are usually marketed through the informal market after the households satisfy their needs (Tsehay, 2002).

Despite the potential and hugeness of livestock in Ethiopia, its subsector contributes to national economy less compared to its potential because of poor genetic potential for productive traits along with poor feeding, management practices health care to which livestock are exposed are the main contributors to the low productivity (Zegeye, 2003).
In Ethiopia, fresh milk is distributed through the informal and formal marketing systems. The informal market involves direct delivery of fresh milk by producers to consumers in the immediate neighborhood and sales to itinerant traders or individuals in nearby towns (Siegefreid and Brhan, 1991).

Market orientation of the livestock production system especially milk would secure the livelihoods and food supply to the rapidly growing non-farming community, create employment opportunities and promote economic development in pastoral societies. But, in Ethiopia milk marketing system is not well developed (Ahmed *et al.*, 2003) particularly, market access in pastoral production system is a critical factor (Tsehay, 2002).

Improving and enhancing the development of smallholder pastoralists to reach markets and involve them in marketing activities poses a pressing development challenge. Due to harsh and remoteness results in reduced production area prices increased input costs and lower returns to labor and

capital. This in turn, decreases incentives to contribute in economic transaction and marks in subsistent rather than market oriented production systems (Ahmed *et al.,* 2003).

Somali Regional State (SRS) is home to pastoral and agro-pastoral peoples who are largely depend on livestock production for their livelihood. On the one hand, the ecology in the area is fragile with an increasing trend of natural resources degradation and on the other hand rainfall pattern is changing from time to time and temperature is generally increasing. Such variability in the climate is exposing the people to the risks of several climate related hazards (SRS, 2011).

The dispersed nature of the production units, the lack of market information system, the low rate of urbanization and poor infrastructure to facilities may also not warrant the establishment of processing plants (IPS, 2000). Somali region, milk is the main diet to households and also it is affected by season of the year, and even during the rainy season this production system is affected by the absence of transport facilities to markets (IPS, 2000).

Based on the literatures reviewed, as an enquirer, the most reviewed literatures focus on dairy production of the country, though some research were conducted about camel milk production and marketing, particular production (Tezera1998; Bekele et al. (2002), Kedija (2007, Mohamed, 2014 and Kedir *et al.,* 2016), it appears that this sector is under researched particularly on camel milk marketing in area in which current study under taken. What makes this study unique from other studies is that, it has been assessing the camel milk productivity, marketing channel ant its effect on pastoralist livelihoods (income).

1.3. Objectives of the study

1.3.1. General Objective

The general aim of this study was to assess camel milk productivity, marketing channel and its effect on pastoralist livelihood in the Dagahbour Woreda of Ethiopia Somali regional state.

1.3.2. Specific objectives of the study

Based on the above general objective, the following specific objectives were derived:

- To examine the camel milk productivity in the study area
- To identify camel milk marketing channels in the study area
- To analysis the effect of camel milk marketing on household income in the study area.

1.4. Research Questions

1. How much camel milk is produced at household level?
2. How much milk supplied to market in the study area?
3. What is the effect of revenue from the milk marketed on income in the study area
4. What is the nature of camel milk marketing channels in the study area?

1.5. Significance of the Study

Improvement of camel milk production and marketing enables households to enhance their income and livelihoods. The findings from this study would generate valuable information on households' camel milk production and marketing. The information altogether would assist producers, extension workers, community based organizations, international organizations, regional as well as national investors. Likewise, it would help policymakers in designing appropriate policies for intervention in the sector. The findings from the study would also serve as a reference document for researchers to embark on studies of the same or related kinds in other parts of the region.

1.6. Scope of the Study

In order to make the study more manageable, it was delimited in concepts or issues, geography and time. Regarding the concepts, it was delimited to camel milk production, marketing channel and its impact on pastoralist livelihood. Marketing channel can encompass people occupying various roles and functions such as brokers, rural milk collectors, retailers, and informal pastoral women milk delivery cooperatives. But, in this study marketing channel refers to only on the dimensions of the household members. Geographically the scope of this study was also delimited to Degahbor Woreda of Somali regional state, on 93 Woredas in the zone. Concerning the time, as the study was cross sectional in design it confined to camel milk productivity in the specific two months period of this study where applied.

1.7. Limitation of the study

The limitation of this study could be the fact that the findings cannot be generalized for all kinds of milk productivity in the zone, because the study emphasized only on camel milk productivity regardless of cattle, goat, and sheep etc. unwillingness of the respondent to provide the full information. Time, temperature of the area, logistic and financial constraints were also the limitations of this study. In addition, most of the information was questionnaire-based; so, questions that required a good memory were vulnerable to recall bias.

1.8. Definitions of Key Terms

Pastoralists: "defines pastoralism as "a system of production devoted to gaining a livelihood from the care of large herds of animals based on transhumance an adaptation to a particular habitat: semi-arid open country or grasslands, in which hoe or digging-stick Cohen (1974, p. 261)"

Market: It may be defined as a particular group of people, an institution, and mechanism for facilitating exchange. The market concept has also been linked to the degree of Communication among buyers and sellers and the degree of substitutability among goods (John and Shahran, 1998).

Marketing: Is the performance of all business activities involved in the flow of goods and services from the point of initial production until they are in the hands of ultimate consumers. Marketing System: Is a collection of channels, middlemen, and business activities, which facilitate the physical distribution and economic exchange of goods and services (Kohls and Uhl, 1985**).**

Marketing channel: Formally, a marketing channel is a business structure of interdependent organizations that reach from the point of product origin to the consumer with the purpose of moving products to their final consumption destination (Koler et al., 2003). This channel may be short or long depending on kind and quality of the product marketed, available marketing services, and prevailing social and physical environment (Islam et al., 2001).

A marketing chain: Defines the flow of commodities from producers to consumers that brings into place economic agents who perform complementary functions with the aim of satisfying both producers and consumers (Islam et al., 2001). A marketing chain may link both formal and informal market agents. A marketing chain may connect one or more milk or dairy sheds.

Marketable and Marketed Surplus: Marketable surplus is the quantity of the produce left out after meeting the farmers' consumption and utilization requirements for kind payments and other obligations such as gifts, donation, charity, etc. Thus, marketable surplus shows the quantity left out for sale in the market. The marketed surplus shows the quantity actually sold after accounting for losses and retention by the farmers, if any and adding the previous stock left out for sale. Thus, marketed surplus may be equal to marketable surplus, it may be less if the entire marketable surplus is not sold out and the farmers retain some stock and if losses are incurred at the farm or during transit (Thakur *et al.,* 1997*).*

1.9. Organization of the Thesis

This study was organized with five chapters. The first chapter deals with the introduction which comprises of the background of the study, the statement of the problem, basic research questions, objectives of the study, significance of the study, delimitation of the study, limitation of the study, definition of key terms and organization of the study. Chapter two reviews the literature which leads to the development of conceptual framework. Chapter three also deals with the method of the study. Sources of data and variables, methods of data analysis are described in this part. Chapter four discusses the results and analysis. Chapter five provides the conclusions and recommendations of the study.

CHAPTER TWO

2. REVIEW OF RELATED LITERATURE

2.1. Introduction

The chapter has discussed discuss literature on camel production system, camel feeds and watering, camel milk yield and lactation length, camel milk marketing, camel milk marketing channel, constraints of camel milk production and marketing, contribution of camel milk on pastoralist livelihood. The chapter would also address concept of livelihood.

2.2. Camel production systems

The world camel population is estimated at 19 million, with the vast majority of these (about 15 million) being found in Africa and 4 million in Asia (Farah et al., 2007). Somalia (with over 6 million camels) has the largest camel population in the world, perhaps representing one-third of all dromedary camels (Farah et al., 2007). They are found mainly in arid and semi-arid areas where the average rainfall is less than 350 mm per year. The four neighboring countries ; Somalia, Sudan, Ethiopia and Kenya have a combined camel population comprising 99% of the camels in the Greater Horn of Africa, 97% of all camels in Africa and 75% of all camels in the world (Field, 2005).

The dromedary camel is a multipurpose animal primarily kept for milk and meat production as well as transportation. It is also a financial reserve (asset) and security (against drought related losses) for pastoralists and plays an important role in social status and wealth (Guliye et al., 2007). For example, customarily, camels are the most important indicator of wealth and a determinant of status within the Somali society (Mahmoud, 2010).

Production systems involving camels have traditionally been very extensive and highly mobile. Consequently, nomadism, far from being an inefficient land use system, is a sophisticated response to the use of resources that are temporally and spatially highly variable in quantity and quality (Wilson, 1998). Pastoral resource use pattern is predicated upon risk spreading and highly flexible mechanisms such as mobility, communal land ownership (a prerequisite for mobility and, therefore nomadism), large herd sizes that are diversified, and herd separation and splitting (Farah, 1996a). Camel producers in northern Kenya adopt herd splitting as a risk spreading strategy.

2.4. Camel Feeds and watering in pastoralist

According to Alemayehu (2003), Ethiopia's Livestock feed resources are mainly natural grazing and browse, crop residues, improved pasture, and agro-industrial byproducts. The feeding systems include communal or private natural grazing and browsing, cut and carry feeding, hay and crop residues. At present, in the country livestock are fed mainly on natural pasture and crop residues. The availability and quality of forage are not favorable year round.

The camel is, by preference, a browser of a broad spectrum of fodder plants, including trees, shrubs, and sometimes hard-thorny, bitter and halophytic (salty) plants that grow naturally in the desert and other semi-arid areas (Coppock et al., 1986a; Wilson, 1989; Field, 1993). They generally browse leaves, young twigs/shoots, fruits, flowers and pods. Under natural conditions camels have the capacity to choose their silages efficiently, forage trees than grasses (Field, 1993). An important feature of camel browsing habits is that they are not in direct competition with other domestic animals either in terms of the type of feed eaten or in the height at above the ground (Wilson, 1989). Goats are the only livestock type compete the feed sources with camel, with 47.5% dietary overlap in the dry season and 12.4% in the green (wet) season (Wilson, 1998).

Field (1995) noted seasonal variations such that trees, shrubs and dwarf shrubs dominated camel diet in wet season but the percentage of trees and shrubs noticeably declined during the dry season when most of these species shed off their leaves.

According the Ahmed (2001**)**.The main feed of camel during the wet season is natural browsers while grazes are the main feed sources of camel during the dry season.

According to Tekel, (1989) reported that Ogaden camels prefer to browse species such as acacia and Zizphus especially in Dagahbour area. Field, (2003).Natural browser such as, trees, shrubs, and sometimes hard-thorny, bitter and halophytic (salty) that grow naturally in the desert and other semi-arid areas are feeds preferred by the camel. Quality of forage influences feeding activity patterns in camel and under adverse pasture conditions, the time available for grazing would be a limiting factor for their total dry matter and nutrient intake (Kassily, 2010).

According to Farah et al (2004) increasing human population pressure on pastoral grazing areas have almost certainly resulted in environmental degradation and dwindling of feed resources

According to Farah *et al* (2004).The distance to the nearest watering point and the labor required to water herds may also constitute major constraints to watering frequency in camels

As camel can stay for many days with our water, that can graze over areas very far away from water sources, this helps the pastoralists to live and use camel very remote pastures areas. Kohler-Rollefson,(2005). Since camels can minimize water expenditure for cooling and excretion, they yield milk with high water content even if they are dehydrated. Even under situation of extreme drought, a camel continues to produce milk.

According to Tezera (1998).During wet season, camel herders in Shinile area water their camels every 1 to 7 days whereas most herders in camel herders in Jijiga water their camels every 8 to 15 days.

2.5. Camel Milk Production in Ethiopia

2.5.1. Camel milk yield and lactation length

The proportion of camel milk has stated to the total milk production by all dairy species is almost 10% in Eastern Africa in spite of the significant cattle population in those regions (Faye and Bonnet, 2012).

According to Farah et al (2004), reported that camels are usually milked twice a day (morning and evening); but, if the feeding system improved they can be milked every 2 – 3 hours. The average lactation length of camel (*Camelusdromedarius)* 12, 13.38, 13 and 13.76 months was reported (Dejene, 2015; Yosef*et al.*, 2015) for arid and semi-arid regions of Ethiopia, respectively.

This variation in camel milk yield might be attributed to the high genetic variation between individuals, breed, feeding and management conditions, type of work, milking frequency, age of animal, persistency of lactation, lactation number and stage of lactation (Sisay and Awoke, 2015).

According to Bekele et al. (2002) reported that under traditional pastoral management number of milking per day ranged from 1 to 4 for camels. Wernery (2003) states that camels must be milked 4 to 6 times a day to gain optimal milk yield. Tezera and Hans (2000) reported that Jigjiga and Shinile camel lactation period was 15 months and 13 months. Farah et al, (2004) the Peak milk yield production of Somali camels can potentially produce more than 15 liters.

Study carried out (Abdulahi, Kibru.and Kefyalew, 2015) in Jigjiga Woreda, Fafan zone, somali region stated that majority (80%) of the respondents camel milking time were 3 times and more, where only 20% of the respondents responded that 2 times or greater than can be used for milking time. Schwartz and Dioli, (1992).Lactation period of camel was 14-16 months with continuous milk production throughout long dry spells when milk from cattle and goats is scarce. The average length of the lactation period in the camel is 12 months (Shalash, 1979).

Table 2.1: Milk yields of camels reported from various countries

Country	**Average daily yields in Kg**	**Lactation length in month**	**Calculated yield in Kg per 365 days**
Algeria	4	9-16	1460
Ethiopia	5	12-18	1825
India	6.8	18	2482
Kenya	4.5	11-16	1643
Pakistan	8	16-18	2920
Somalia	5	9-18	1825
Tunisia	4	9-16	1460

Source: Farah (2004b).

2.6. Camel Milk marketing in Ethiopia

Market refers to a set of buyers and sellers who interact and influence price. However, the existence of the market by itself does not ensure an exchange to take place. There should be a channel. In pastoral area milk production is seasonal while consumption is throughout the season (IPS, 2000).

As it is common in other African countries (e.g., Kenya and Uganda), dairy products in Ethiopia are channeled to consumers through both formal and informal dairy marketing systems (Ahmed et.al., (2004). Until 1991, the formal market of cold chain, pasteurized milk was exclusively dominated by the DDE (Dairy development Enterprises) which supplied 12 percent of the total fresh milk in the Addis Ababa area (Holloway et al. 2000). Unlike the early phases, the formal market appears to be expanding during the last decade with the private sector entering the dairy processing industry. In recent times, private enterprises have had begun gathering, processing,

packing and distributing milk and other dairy products. The sale price of pasteurized milk changed from time to time.

The camel (Camelus dromedaries) is an important livestock species uniquely adapted to hot arid environments. Approximately 11.5 million animals in this region represent over 80% of the African and two thirds of the world's camel population. With increasing human population pressure and declining per capita production of food in Africa, there is a decisive requirement to develop previously marginal resources, such as the semi-arid and arid rangelands, and to enhance their utilization through suitable livestock production systems in which camel production is certainly the most appropriate one (Schwartz 1992).

In recent years, camel milk commercial mistreatment in Kenya has amplified extremely (Matofari et al., 2007). In the context of urbanization, camel milk is increasingly commercialized and consumed in urban areas where the population is growing tremendously. But, lack of hygiene quality, poor processing technologies to improve shelf life and expand production and sales arethe key limitations of this emerging milk market are; (Matofari*et al*., 2007; Matofari*et al*., 2013). Only about 12% of the Kenyan camel milk is marketed, the bulk of which is sold in raw form to rural consumers (10%) and only 2% reaches the urban consumers (Akweya*et al*., 2010).

The major ethnic groups owning camels in Ethiopia are the Beja, Rashaida, Afar, Somali and Borana (Workneh 2002). Although camel contributes significant to the livelihoods pastoralists societies who do have a limited alternatives modes of production system, up till recently the camel is one of the neglected domestic livestock by scientific society in Ethiopia (Yesihak and Bekele, 2003).

The one-humped camel (Camelusdromedarius) is the most precious asset to Somali pastoralists, as it represents the vital 'technology' that allows the production of food in these environments by converting browse forage into quality and nutritious products. The economic potential of camels in arid and semi-arid lands is increasingly being recognized, together with their comparative advantages when compared to cattle and small ruminants in terms of their adaptability to harsh climatic conditions (Han, 2004).

The camel’s milk is a rich source of proteins with potential antimicrobial and protective activities; these proteins are not found in cow’s milk or found only in minor amount, moreover camel’s milk is used in some parts of the world as a cure for certain diseases (Wernery, 2003).

A case study in the Ogaden-traditionally a food insecure area in the Somali region shows that the sale of livestock milk products generates more than 80 percent of the income needed to satisfy basic needs among pastoral households in dry periods, while it contributes about 40 percent during the rainy season, when milk is in surplus (Abdi Abdullahi, 1999 on Michael, *et al.*, 2006).

2.6.1. Formal vs. informal dairy marketing

The term 'informal' is often used to define marketing schemes in which governments do not arbitrate substantially in marketing. Such marketing systems are also referred to as parallel markets. The term 'formal' is thus used to define government (official) do arbitrate substantially in marketing (Debrah, 1990). Reliable system has not been established to market milk and milk products in Ethiopia (Zegeye 2003). Fresh milk is channeled through the informal and formal marketing ways. Milk is marketed from producers through the informal (traditional) means in both rural and urban parts of the country. This informal market involves direct delivery of fresh milk by producers to consumers in the immediate neighborhood or to any interested individuals in nearby towns (Debrah and Berhanu1991).

Early intervention to endorse formal dairy marketing started with the establishment of a 300 dairy farm and a small milk processing plant under the UN Relief and Rehabilitation Program in 1947 in the premises of the now Dairy Development Enterprise (DDE) (Sintayehu 2003). The same report reported that in 1959 UNICEF supported establish a processing plant with a processing capacity of 10 thousand liters per day with milk collection and purchasing centers around Addis Ababa. The range of milk gathering was later expanded to 70 km in Addis Ababa. Capacity of the processing plant was enhanced to 30 thousand litres in 1969. In 1979 the DDA (Dairy Development Agency) was transformed to the DDE when processing capacity was increased to 60 thousand litres/day and the radius of collection expanded to 150 km with donor assistance.

The only prearranged and formal milk marketing and delivery system comes from the two milk-processing plants which are both positioned in the capital Addis Ababa (Zegeye 2003). As reported by many authors, farmers' milk marketing collections and dairy cooperatives play a key role for milk marketing outlets, which as a result encourages farmers to produce more (Zegeye 2003).

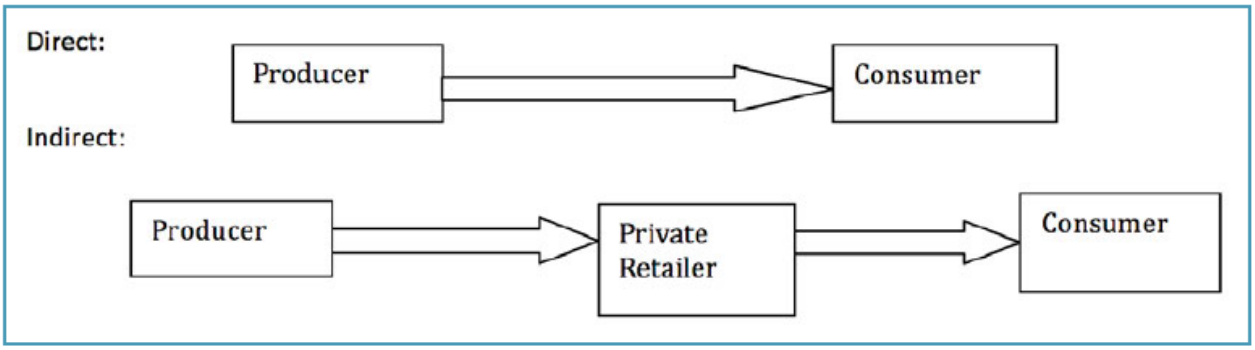
2.6.2. Milk Marketing Channel

Marketing channel is a prearranged network of different agencies and institutions which in combination perform all the activities required to link producers with consumers for accomplishing

marketing tasks (Bennet, 1988; as cited by Jaleta, 2011). Marketing channels designate how market performers are set to attain the movement of a product from producer to the consumers. The actors who involved in numerous of marketing channels have strong influence on marketing margins. Only a minor portion of goods and services are consumed at the idea of production and only a small portion of any yield is bought by the end users directly from the primary producers(farmers) because a numbers of intermediaries exist in channel arrangements to perform marketing functions that donate to the product flow (Jaleta, 2011).The channel follows a vertical structure where products flow from producer to the end users and in which actors encounter at each market for performing numerous roles by linking the gap between producers and end users.

Milk products are distributed to end users through both formal and informal marketing systems in Ethiopia. At national level, around 95 % of the marketed milk is distributed through the informal system. Milk can be collected either by the producer or taken by the buyers to the sales point, but generally, with the exception of a few commercial farms, farmers are responsible for the delivery of their milk into the market chain (Reddy and Kanna, 2016). A combination of these activities (network) of market channels gives rise to the market chain. These included:

Figure 2.1.: Camel milk market channel



Sources: Kedir,(2016)

2.6.3. Marketing Information

Marketing information is the service that is periodically collected concerning all information relating to wholesale and retail pricing practiced in rural markets and brought regularly and in good time to the knowledge of farmers, traders, officials of the administration, governors and other economic players by disseminating it through the various available media (Samuel, 2001).

Access to information varies depending upon a number of factors including 1) distance to markets; 2) cost of collecting and analyzing the data 3) cost of disseminating the information; 4) availability, access, and cost of information from other sources and 5) communication infrastructure. The present improvement of the networking and better access to communication technology have an advantage in obtaining market information regardless huge challenges in stability and regularity of market monitoring compounded by a high turnover rate for the market monitors/staff, partly attributed to frequent restructuring within the institutions involved in livestock market monitoring program, places a huge challenge on regular livestock market data collection activity (Abdi Jama, *et al*; 2006).

2.7. Contribution of camel milk in to pastoralist livelihoods

Cohen (1974, p. 261) "defines pastoralism as "a system of production devoted to gaining a livelihood from the care of large herds of animals based on transhumance an adaptation to a particular habitat: semi-arid open country or grasslands, in which hoe or digging-stick" "Practiced on 25% of the world's land area, pastoralism provides 10% of the global meat production" (FAO, 2001).

livestock production and productivity is source of cash income of pastoralists and plays great role in terms of livelihood for large populations (Millar &Photakoun, 2008), it also economically to provide for the increasing demand for animal protein in the developing world in the face of population growth, and income growth (e.g., Delgado et al., 1999; Delgado, 2003). However, concerns with the pastoralist system have also been voiced, and primarily so, on the ecological implications of the system.

Livestock are also the crucial economic elements the agro-pastoral people in the Somali region. With a mix of livestock types including camel, cattle goat and sheep, the Ethiopian Somali region livestock population is estimated to exceed 23 million. Regionally, livestock and livestock products are the important sources of income, food and foreign exchange. Agro-ecologically since the most parts of the region are arid and semi-arid, pastoralism and agro-pastoralism livelihood systems are long recognized and adapted way of life for the vast majority of the people (SC-UK & DPPA, 2008; ESRS-EPEMRDA, 2011).

In many arid areas, camels play a lion role for pastoralist livelihoods as milk suppliers. The lactation period of camel is longer and comparative advantage over the other species in the same environment. Camel has capability to adopt the harsh and fragile environment, this gives for

pastoralist to survive their livelihoods. Despite the harsh and hot area of pastoralist camel produces more milk comparable to other livestock held under the same environment; however, it is widely comprehended that in absolute term, (Farah, 1996; Kaufmann and Binder, 2002).

Camels have an important role for Somali pastoralist economy. It contributes milk and meat within the subsistence economy and it also used for transportation for milk to market, water from wells, used as beast of burden for transporting milk to the market, water from wells and household belongings (Farah *et al*., 2004). Camels are the only means of payment of blood money to the lineage of the deceased during feuds (Hussein, 1993; Farah *et al*., 2004).

Camel is a main asset, insurance against unexpected events; spiritual and social values in pastoralists. Milk is a main source and very important feeding pastoral and agro-pastoral of Ethiopia and has high nutritional value. In pastoral area milk produced daily and sold for cash or processed.

Camel milk is a source of cash that enables the pastoralist families to buy or exchange the goods and food stuff and it significantly contributes the food security of the household (MOA, 2001).

For the Somali camel pastoralists in particular, camel milk is principal diet. Therefore, most of the husbandry and management practices of the Somali camel herders give more attention for improvement of camel milk production and the continuous supply of milk for the family's needs throughout the season (Mohamed, 1993).

The recurrent droughts are the main challenges that severely affect the regional economy and panacea to both pastoral and agro-pastoral people. According to various studies, every year drought in the Ethiopian Somali region affects large numbers of people and causes wider livestock loss and crop failure. This again resulted to reduced food production and larger number of people suffered from food insecurity and malnutrition. In this regard, Degahabour Woreda is among the drought prone and vulnerable Woredas in the region. In this Woreda, agro-pastoralism is the dominant livelihood system for the vast of rural people. Both at a zonal and Woreda level Degahabour area and its community are among the nine zones that had severely affected by the Elnino drought since the 2015.

2.8. Milk production and marketing constraints

There are numerous animal or livestock management problems including, prevalence of major endemic diseases, poor feeding and high stocking rate on grazing lands that encountered to livestock producers (Land O'Lakes, 2010).

Shortage of grazing land, parasites, diseases and limited veterinary extension services to control and prevent the outbreak diseases are the major constraints of milk production of the farmers in AletaChukko Woreda of Southern Ethiopia reported by Kibru et al. (2015)

According to Abebe B. et al., (2014) funding showed that limited or lack of knowledge on the conservation of seasonal available forage and limited grazing land and cultivation of improved forage are most of the dairy producers, milk production is constrained. Similar funding by Azage T et al. (2013) shortage of feed production is a major constraints in urban and per-urban dairy farming system of Shashemene–Dilla milk shed.

Study conducted by Aleme Asresie and Lemma Zemedu (2015) reported that, challenges that effect livestock development can be broadly classified into environmental, technical, infrastructural, institutional and policy making. Based on the report, under nutrition and malnutrition, high prevalence of diseases, poor genetic resource management and poor market infrastructure are the major technical constraints.

One of the most important factors of camel milk marketing is market access, as the area in which pastoralist keep their camel is far away from the markets. The Ethiopia population grow is estimated 2.9% per year, urban population increases at a rate of 4.4%. Therefore, income is expected to increase fluid milk demand when population growth increases (Gatwech Tang, 2012).

Deficient extension and training service, poor market access constraints, limited accessibility of credit, and shortage of land are main production challenges (ZelalemYilma*et al.*, 2011).

According to Jabbar *et al.,* (*1997*), poor preservation and processing techniques and physical infrastructure like road and market facilities are limited camel milk marketing.

According to Ahmed (2002) lack of road infrastructure to transport milk from pastoralist areas (remote areas) was the major constraints in Afder zone. The major problems of camel production as

reported by the pastoralists (Afar and Kereyu) include disease, feed and water shortage, marketing problems and poor genetic potential of camels (Alemayehu, 2001).

2.9. Concept of Livelihoods

Many scholars defined livelihood in various ways but the most familiar definition of livelihood is defined as, a livelihood comprises the capabilities, assets (stores, resources, claims and access) and activities required for a means of living (Chambers and Conway, 1992).

Ellis in 2000 "defined, a livelihood comprises the assets (natural, physical, human, financial and social capital), the activities, and the access to these (mediated by institutions and social relations) that together determine the living gained by the individual or households". It is estimated that Ethiopia is home for more than 12-15 million pastoralists and agro-pastoralists who reside in 61% of the nation's landmass (PFE, 2002) the pastoral areas are estimated to comprise 42% of the national total livestock population, livestock and livestock products provide about 12-17% of Ethiopia's foreign exchange earnings, out of which hides and skins contribute about 90%. It contributes about 33% to the agricultural GDP and 16% to the national GDP. It makes a significant contribution to the national economies both in terms of supporting their own households and export earnings (PFE, 2008).

According to DFID (2000) "livelihood aims to understand how people source, develop and use assets within a complex set of trends, shocks, formal, informal policies and institutional arrangements. Such analysis is commonly based on livelihood frameworks which categorize assets in terms of five main types of capital (social, physical, human, financial, and natural)".

2.9.1. Livelihood Assets

Ellis and Allison (2004) "reported, the members of a household combine their capabilities, skills and knowledge with the different resources at their disposal to create activities that will enable them to achieve the best possible livelihood for themselves and the household as a whole. Everything that goes towards creating that livelihood can be thought of as a livelihood asset." Generally different toes of livestock are the main pastoralists livelihood asset in both cash and in kind.

According to DFID (2000) livelihood aims to understand how people source, develop and use assets within a complex set of trends, shocks, formal, informal policies and institutional

arrangements. Such analysis is commonly based on livelihood frameworks which categorize assets in terms of five main types of capital (social, physical, human, financial, and natural).

Social capital: It is a system that enables individual or household to have a relationships or interaction with their community, social capital increase people's ability to work together; for instance, formal groups (like: modern cooperatives and so on) and informal groups (idir, ikub). In pastoralists where relationships among is high have different relationships for instance: Somali pastoralist have a social relations generated by networks of relationships, reciprocity, trust, and social norms such as: milk cooperatives, Kalo(paying dowry together during marriage) and so on.

Physical capital: It encompasses all the basic infrastructures and producer goods needed to support livelihoods, including transport - roads, vehicles,secure shelter & buildings water supply and sanitation energy communications that changes the physical environment to helps people to meet their basic needs and to be more creative and technologies the tools and equipment that people use to function more productively. In pastoralist where there is lack or limited access of physical infrastructure affects the production and marketing of pastoralists area.

Human capital: Human capital in the context of sustainable livelihood framework is defined as "the skills, knowledge, ability to labor and good health that together enable people to pursue different livelihood strategies and achieve their livelihood objectives" (DFID, 2000).

Study conducted by Fang (2014), "human capitals presented a positive relation with the household farm livelihood strategy." Similar study Soban (2014) stated on his study that fishing, households in Ghana showed that households with larger family size enable to have more family labour for their work and to be recruited when the need arise to increase their human capital.

Financial capital: financial resources comprise the inflows of cash from income, gifts, or other sources, as well as stocks and savings held by a family or household in which are used to attain positive livelihood outcomes include the availability of cash or its equivalent that allows people to implement various livelihood strategies. In pastoralist livestock and livestock productivity plays a great role for financial resources, camel and camel milk is main financial resources for pastoralist households.

Natural capital: Natural capital are resources from the nature stock that flows including the forests, rivers, rainfall, environment, air quality and services useful for livelihoods. Most of the world's poor are rural and most of the rural poor depend on agriculture or are otherwise dependent

on natural resources in generating their livelihoods; which creates strong linkage between rural poverty and natural resources (Lee and Neves, 2010).

Grazing lands, shrubs and water are major natural capital of pastoralist that has direct and indirect effect on their production, in such kind of natural assets which is seasonal based determines the production and productivities of the pastoralist particular camel milk production and marketing?

2.9.2. Livelihood Outcomes

Livelihood outcomes is end result women and men's livelihood strategies and feed back into the vulnerability context and asset bases, with successful strategies allowing them to build asset bases as a buffer against shocks and stresses, as opposed to poor livelihood outcomes which deplete asset bases, thereby increasing vulnerability. In most cases, Livelihood outcomes can be thought of as the inverse of poverty (DFID, 2000).

2.9.3. Policies, Institutions and Processes

In livelihood analysis, policies and institutions can be formal and informal and can deliver permitting or restricting environments for household level management of assets. The vulnerability context is directly inclined by policy and institutional arrangements at different levels. Livelihood analysis can show how formal policies might not be implemented due to informal professional norms or attitudes, the potential for personal gain, or due to cultural or behavioral factors within the communities. This approach can be particularly useful when analyzing pastoral and agro-pastoral areas, because informal processes often offset formal policies. Inopportunely, many of these informal elements are also politically sensitive and can relate to security agendas, border and sovereignty issues, and the political economy of contraband trade (Alula and Cately, 2010).

2.10. Empirical Review

According to (Alemayehu, 2003) feed shortages and nutrient deficiencies become more acute in the dry season in both the highlands and lowlands. Similar study carried out Kibru *et al*. (2015) reported that shortage of grazing land, parasites, diseases and limited veterinary extension services to control and prevent the outbreak diseases are the major constraints of milk production of the farmers in AletaChukko Woreda of Southern Ethiopia.

CSA (2005) reported that average milk production per cow per day in Western Gojam Zone is about 1 litter per day, resulting in an estimated milk production of 46,710,335 liters per lactation for all lactating cows.

Study conducted by Kedir *et, al*. (2016) in Shebele and Jarar zones in Somali region reported that, average camel milk production in wet season was 2.25 liters, whereas 1.5liters in dry season and Ninety-six percent of milking and 100 percent of marketing are undertaken by women . The income accrues to the females in the household who are responsible for 96 percent of the labor in the pastoralist milk sector.

Research done by Holloway *et al.,(* 2002) reported that number of dairy cows, education level of household head, visits by extension agents and distance from nearest market canters significantly affected milk market participation decision and level of supply.

Study conducted by Musinga *et. al.* (2008), relates to camel milk in Isiolo, Kenya reported that an average camels milk required by the pastoralist household is about 7/17litres (41%) of milk per day, for their own need as a major part of their diet. Similar study carried out Sadler and Catley (2009) pointed out that milk in the pastoralist set up provide about 67% of the children's energy and 100% of their protein requirement in pastoralist household.

Similar study carried out by Gizachew (2005) reported that dairy cow breed, loan, income and extension visit, education level of spouse and distance from milk market were related to marketed surplus positively.

Justus, (2016) reported that, an analysis of Kajiado during the dry season revealed that there was a significant effect of milk sales on the household monthly income.

Study conducted by Scott (1995) on potato marketing using marketing margin analysis in Bangladesh indicated that producer's price and margin were 1.27 and 67 %, respectively. Similarly, study conducted by Pomerory (1989) on four fish market using concentration ratio (market share ratio) in Philippines found that 50% of the industry made 80% of the fish purchases.

study conducted by Vedamurthy and Chauhan (2005) conducted a study on Economics of milk marketing in Shimoga district of Karnataka, India stated that the price received by the household was highest (Rs.11) when they sold directly to the consumers it was lowest whenever the chain of market increases.

Mohamed *et al*. (2004) reported that milk products in Ethiopia are channeled to consumers through both formal and informal milk marketing systems. The informal market involves direct delivery of fresh milk by producers to consumers in the immediate neighborhood and sale to itinerant traders or individuals in nearby towns.

Study carried out Woldemichael, (2008) in Hawassa, Shashemane and Yirgalem reported that, a network (combination) of market channels gives rise to the market chain. Marketing survey in depicted that milk producers sold milk through different principal marketing channels.

Study conducted by Serna, (2011) in Kenya reported that drought has a devastating effect on pastoral livelihoods arising from animal wasting and malnutrition, leading to a high mortality rates of livestock of between 40% and 70% in some areas in Kenya.

2.11. Conceptual framework of the study

The primary focus of this study was to assess camel milk productivity, marketing channel and its effect on pastoralist livelihood in terms of income. The conceptual framework of this study contains different variables that would contributes to dependent variable such variables are socio-demographic variables and socio-economic variables that were selected to prove the hypotheses set for this study and to address the objectives the study, as they are presented the figure below.

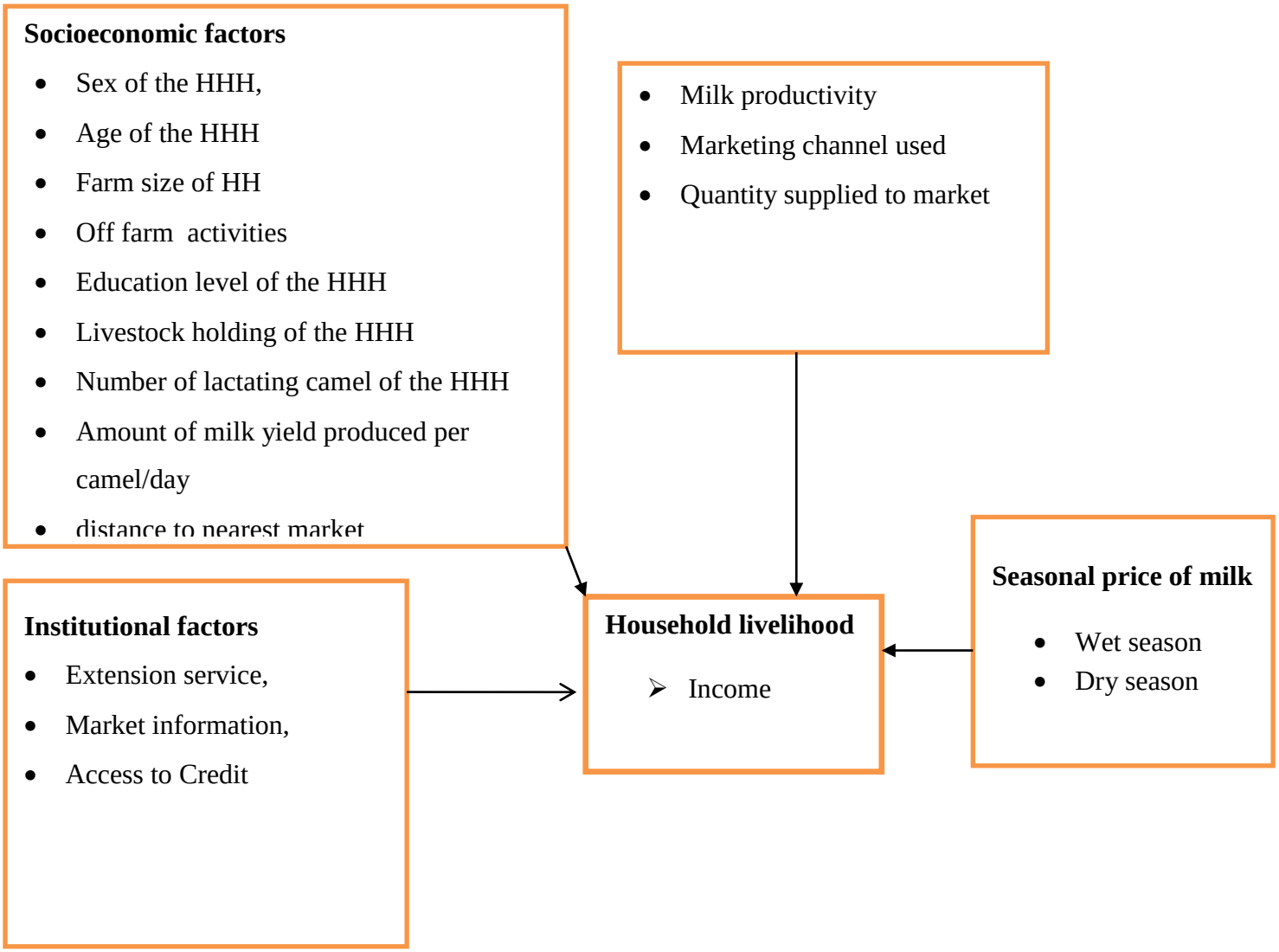


Figure 2.2: Conceptual framework of the study.

CHAPTER THREE

3. METHODS OF RESEARCH

This chapter covers description of the study area especially it deals with overview of Degahbour Woreda, map of the study area, research design and approach, sampling technique and procedure, methods of data collection, types of data and their sources, methods of data analysis such as descriptive, inferential statistics and definition of variables hypothesis was discussed.

3.1. Description of the Study Area

Location: Degahbour Woreda is one of the 93 Woredas in Somali Regional State and it is under the Jarar Zone Administrative. The Woreda is located at the eastern part of agro-pastoral areas of ESRS. It shares border on the North by Ararso, south by Birqod, on the west by Bilcil-Buur, south-east by Gunagado and east by Yoale and Aware Woredas.

Population: According to the 2007 National Census report of the Central Statistics Agency (CSA, 2007), the Woreda has a total population of 115,555 of whom 65,081 are men and 50,474 are women; 74.015% (85,528) are rural and 25.985% (30,027) are urban dwellers. The average family size for rural and urban areas is 6.7 and 6.8 persons respectively.

Climate is generally hot and dry in Dehagbour area. Average annual rainfall is 300- 400mm from two rainy seasons: 'Gu' (April–June) and 'Deyr' (October–December). Sometimes it receives 'Karan' rains (July–September). Livestock and livestock products are sources of the pastoralists' livelihood in the Degahbour area. Wealth is determined by livestock ownership in the Degahbour area. Land is owned by clans, but access to pasture in somehow is free in rainy seasons but not in dry seasons due to recently area enclosures privately owned by individual households. Water is mainly accessed through shallow drilling-well in the Degahbour area. Soil is predominantly sandy, with little moisture retention capacity limiting crop production possibilities. Main vulnerabilities are recurrent drought; extreme water shortage; livestock export restrictions and general market shocks; animal and human diseases; poor transport and communication infrastructure.

Infrastructure and Social Services: In the pre-livestock ban period, the most important market for all types of livestock species was the Degahbur town market, where many livestock traders would come to buy livestock for export. This market is more accessible than any other in the Zone and

had a good supply of all livestock species. Degahbur market used to be a marketing hub for livestock from all of Jarar Zone as well as the neighboring Zones of Nogob, and parts of Sh1abele and Korahe Woreda. In recent times (post livestock ban periods), Babile market has taken over this „hub" role, but only for cattle and camels. Nevertheless, pastoralists and agro pastoralists in the Zone still market their livestock in Degahbour market, although demand is much below what it used to be in the pre-ban times (SC-UK/DPPB, 2004). Degahbour Woreda market is also the most important market for cereals and other commodities, which supplies the agro-pastoral, pastoral and other population groups within the Zone. However in difficult times both the pastoral and the agro-pastoral communities mainly in Degahbour and Degahmadow Woredas turn to the neighboring Fafan Zone for cereal supply and people go to markets as far as Babile. In such times the southern part of the Jarar Zone will resort to Korahe markets for supplies. In normal times Jarar zone would rely on Jijiga markets for vegetables like potatoes, onions, petroleum products, and chat (SC-UK/DPPB, 2004).

Vulnerabilities and Risks: The livelihood system of the majority of pastoral and agro-pastoral communities is normally uncertain and vulnerable to a number of risk factors. They frequently experience „shocks" (events with adverse effects) that erode their ability to cope and this makes them more vulnerable to further shocks. Usually one rain failure is enough to cause a „drought" situation and the poorer of such communities easily find themselves in situations in which they need external assistance. However if these shocks do not cause substantial mortality of livestock a few consecutive rains would normally help them recover quickly. The rural livelihood of Degahbour woreda is not different. Livelihood in the area is entirely dependent on animal rearing and small scale rain, fed farming; therefore agro-pastoralists are highly dependent on seasonal rains, which are frequently insufficient for successful farming. The identified vulnerabilities in this particular Livelihood Zone are: Recurrent droughts that reduce livestock production or cause mortality, as well as cause crop failure. In such cases agro-pastoralists have to depend on the market to get all their food supplies and yet livestock prices in such times plummet due to their poor physical condition and oversupply to the market. Whereas severe droughts come only once in a while, drought-like conditions resulting from delayed rains and below-normal rains are the most common.

Figure 3.1: Map of Ethiopia, Showing Somali Region

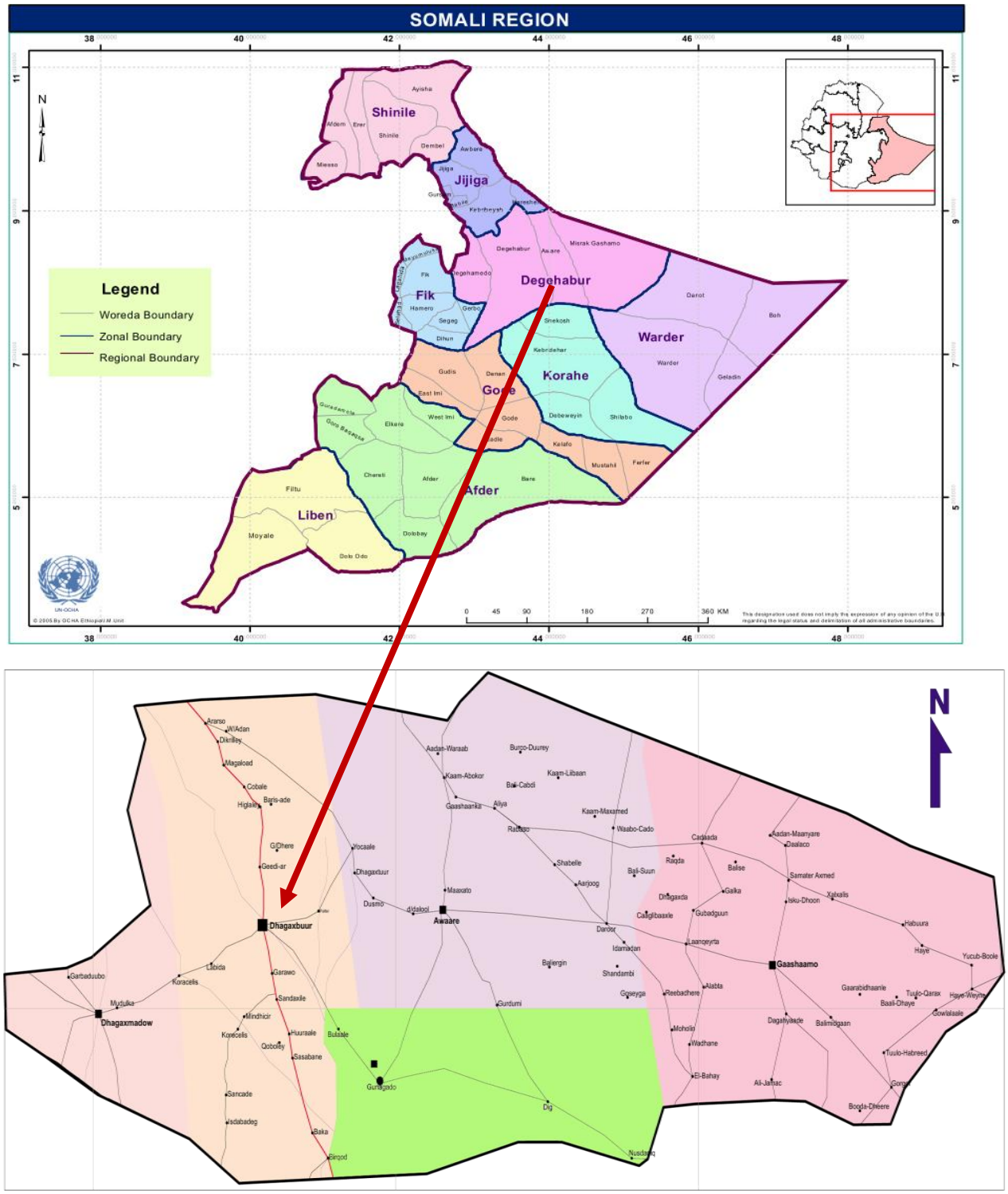


Figure 3.2: Location Map of Degahabour Woreda **Source:** OCHA, 2005**,** EMU

3.2. Research Design and Approaches

The study employed a combination of descriptive and explanatory design. In terms of time, it is cross sectional study design. Data was collected once and the period was served as reference period. Moreover, the study had features of key informant interview and survey designs in terms of coverage.

The study was tried to assess camel milk productivity, market channel and its effect on pastoralist livelihoods, in terms of income, in Degahbour Woreda. In order to achieve the intended objectives it was used mixed research approach. This is because the study collecting data using questionnaires, key informant interview, observation, and focus group discussion; which mean it uses both qualitative and quantitative approach to analyze the data which was obtained from sample household heads. The adoption of positivist paradigm entails that measurement remains an essential element since its basic assumption is social phenomenon can be measured. This quantitative method is supplemented by a qualitative method to complement or validate information gathered from the quantitative survey, to gain deeper insights on the issue, to strengthen the analyses and thus enhance confidence in the conclusions.

The subsequent discussions present the basic features of quantitative, qualitative and mixed methods research approaches in an orderly manner. Quantitative research is the one in which the investigator primarily uses positivist claims for constructing knowledge. Positivists believe that reality is stable and can be observed and described from an objective viewpoint i.e. without interfering with the phenomena being studied (Philips, 1990).

Well designed and implemented quantitative research has the advantage of making generalizations to a wider population from the sample. To enhance the generalization of findings, quantitative research approach follow standardized procedures in sample selection, instrument design, implementation and analysis. Despite these advantages, quantitative research design has a number of limitations: lack flexibility in design, standardization can cause bias or hinder exploitation of new ideas, and lack interpretive and exploratory examination of a research problem (Creswell, 2003).

A quantitative research approach employs strategies of inquiry such as experiment and survey; collects information using preset standardized instruments; and uses statistical methods in describing patterns of behavior and generalizing from sample to populations.

Marshall and Rossman (1999), noted that qualitative research emphasizes meanings (words) rather than frequencies and distributions (numbers) when collecting and analyzing data.

Qualitative research approach is the one in which the investigator often makes knowledge claims based on the multiple meanings of individual experiences, socially and historically constructed meanings, participation in issues, collaboration or change oriented with an intent of developing a theory or pattern. In contrast to quantitative research design, qualitative approach is rooted on the philosophy constructivist. Constructivists contend that only through the subjective interpretation of and intervention in reality can that reality is fully understood (Mertens, 1998).

3.3. Sampling technique and sample size determination

3.3.1. Sampling techniques and procedures

In this study, multiple stage sampling technique was applied to select sample households. First Degahbour woreda was selected purposively since it is a one of the most potential area for camel and camel milk production in Somali pastoralist second stage four pastoralist Kebeles namely Garawo, Higlaley, Gediaar and Hodale of Degahbour Woreda were selected purposively since they are the most camel potential area in the Woreda out of the total 16(sixteen) Kebeles. Third stage sample households from each Kebele were selected by using proportional simple randomly sampling.

3.3.2. Sample Size Determination

This study was used a simplified formula provided by Yamane (1967) to determine the required sample size at 95% confidence level, 0.5 degree of variability and 8% level of precision.

$$n = \frac{N}{1 + N\left(\varepsilon^2\right)} \quad \text{.....1}$$

$$n = \frac{16{,}993}{1 + 16{,}993\left(0.08^2\right)} = 155 HHS \quad \text{.....2}$$

Where ***n*** is the sample size, ***N*** is the population size (total number of households), and ***e*** is the level of precision (sampling error) at 5% significance level. The number of respondents from each Kebele was determined by using probability proportional to sample size as summarized Table 3.1. Below.

Table 3.1: Total Number Distribution of Rural Sample HHs by Kebele

S/N	**Kebeles**	**Total Households**	**Sample Size**		**Sample %**
			Male	**Female**	
1	Garawo	991	10	15	15.6
2	Higloley	840	8	13	12.5
3	Geediaar	672	6	10	10.6
4	Hodale	3731	34	60	61.3
Total		**6,144**	56	99	100
			155HHs+10% contingency		

3.4. Data Types and Sources

This study used both primary and secondary data. The primary data was collected from a sample of pastoralist households through a questionnaire, focus group discussion, and key informant interview prepared for the study.

Secondary data were collected using available sources of information such as published and unpublished documents. This includes data extracted from publications and annual reports of livestock and pastoral development office, at Woreda and regional level and University and Public Libraries.

3.5. Methods of Data Collection

To get more reliable information from the selected sources, the researcher used the following data collection tools:

3.5.1. Questionnaire

The household and market survey was carried out using sample households drawn from the population in each Kebele. To carry out the questionnaire, close ended and open ended format questions was prepared and distributed to the sample households. The major issues which were

addressed in the questionnaire include household demographic characteristics, socio-economic characteristics information about camel milk productivity and marketing on the study area.

3.5.2. Focus group discussion

Focused group discussion helps to generate data at community level and involves a small group of respondents to discuss on issues forwarded by the facilitator who is a skilled moderator focusing on key issues of the research topic (Mwanje, 2001). In this study focus group discussions were based on the checklist and were facilitated by the researcher. The researcher held two FGDs; number of participants per FGD was 8 including, producers and traders. The outcome of the FGD also enabled to refine the questionnaire used for household survey. The main purpose of the focus group discussions was to get insights on and understand the camel milk productivity and marketing channel of the study area and how it contributes the their livelihoods(income).

3.5.3. Key informant interviews

The researcher used unstructured interview method because of its flexibility and makes clear any time when there is indistinctness. The key informant interview was conducted from development agents, local leaders, experienced pastoralists who had long history for camel milk production and marketing in the area, market channel actors such as producers, rural collectors, retailers, and others who involves to camel milk market chain in the area and livestock and pastoral development Office in the study area. The important issues included in this interview was the dynamics in camel milk production and market opportunities available which support them to again income.

3.5.4. Field Observation

Observation was made as helpful and additional tool to collect data that can accompaniment the data obtained by other means. During the researcher's stay in the study area, the researcher had to visit the market area, observe numerous livestock production especially camel milk, production and their marketing. The researcher also observed the environmental implication of the study area, particular water and range problems, infrastructures, transportation and marketing problems, other environmental features and development interventions on livestock and livestock production, more emphasis on camel.

3.6. Methods of Data analysis

3.6.1. Descriptive Statistics

In this study two types of data analysis technique were used. These were descriptive statistics and inferential data analysis. The qualitative data collected via questionnaire was first coded, arranged, edited and analyzed using SPSS version 23. Descriptive statistics such as frequency, percentage, graphs, tables, mean and standard deviation were used to summarize and present the result on demographic and socioeconomic characteristics of pastoralists.

3.6.2. Econometric Analysis

Multiple linear regressions are an extension of simple linear regression. It is used when the user wants to predict the value of a dependent variable (target or criterion variable) based on the value of two or more independent variables (predictor or explanatory variables). Multiple regressions allow determining the overall fit (variance explained) of the model and the relative contribution of each of the predictors to the total variance explained.

In the multiple linear regression model, there are a lot of assumptions such as E[Y|X] changes linearly with each continuous predictor and that the errors (e) are independently multivariate normal with mean zero and constant variance. Violations of these assumptions have the potential to bias regression coefficient estimates and undermine the validity of confidence intervals and p-values, and thus may motivate the use of non-linear models. Residuals are central to detecting violations of these assumptions and also assessing their severity.

According to Gujarati (2003), there are two measures that are often suggested to test the existence of multicollinearity. These are: Variance Inflation Factor (VIF) for association among the continuous explanatory variables and Contingency Coefficients (CC) for dummy variables. Statistical package for Social Science (SPSS) of version 23was used to compute multicollinearity of both variables. To detect multicollinearity problem for continuous variables, variance inflation factor (VIF) was used. The larger the value of VIF, the more troublesome or collinear is the variable. As a rule of thumb, if the VIF greater than 10, which would happen if correlation is greater than 0.90, that variable is said to be highly collinear (Gujarati, 2003).

Mathematically, the multiple regression model is represented by the following equation:

$$Y_i = \alpha + \beta_1 x_{1i} + \beta_2 x_{2i} + \beta_3 x_{3i} + \beta_4 x_{4i} + \beta_5 x_{5i} + \beta_6 x_{6i} + \beta_7 x_{7i} + \beta_8 x_{8i} + \beta_9 x_{9i} + \beta_{10} x_{10i} + \beta_{11} x_{11i} + \beta_{12} x_{12i} + \varepsilon_i$$

Where,

Y_i is dependent variables;

α is Constant term;

x1-x15 are explanatory/ independent variables

b1 – b15 are the coefficients of independent variables and

e is the error terms.

3.7. Definitions of variables

The variables used in the analysis were operationalized as follows:

Dependent Variables

Household income: a continuous variable to be measured in monetary value. It is an income from milk being marketed through different channels.

Explanatory Variables (Xi)

Explanatory variables are the independent variables of the econometric models that are assumed to have an influence on the dependent variable, and these include:

Age of the household head: Age is a continuous independent variable measured the number of years the respondent has completed.

Sex of the household head: sex is dummy variable of being respondent.

Household family size (HHFS): Family size is a continuous independent variable to the number of members in the family.

Household head education level (HHEL): It is measured in terms of formal years of school ship in primary school, secondary school and others.

Number of milking camel heads (NMCH): This variable is continuous and is measured in number of milking camels owned by the household.

Amount of milk yield (AMY): It is continuous variable measured in liter per head of camel.

Amount of milk supplied to market channel: A continuous dependent variable which is measured in litters supplied to market.

Total Livestock holding: It continuous variable measured in a number of livestock that the household owns.

Access to credit (ACC): It is a dummy variable which have a value of 1 if the household do have an access to credit and a value of 0 otherwise.

Access to Extension service (ACCES): A dummy variable taking a value of one if the camel household has access to veterinary service and zero otherwise.

Access to milk market information (AMMI): It is a dummy variable which have a value of 1 if the household do have an access to market information and a value of 0 otherwise.

Distance to market: A continuous variable which refers to the immediate product market place and measured in kilometers.

Table 1.2: Description of the selected variables

NO.	Variables	Description	Types	Values	expected sign
1	AHH	Age of household head	Continuous	Number of years	+
2	SHH	Sex of the household head	Dummy	0=female, 1= male	+/-
3	HHEL	household head education level	Continuous	Years of schooling	+
4	HHFS	Household family size	Continuous	Man equivalent	+
5	MMV	Marketed Milk Volume	Continuous	Litter	+
6	AMY	Amount Milk yield (produced)	Continuous	litter	+
7	LH	Livestock holding (TLU)	Continuous	number	+
8	NMCH	Number of milking camel heads	Continuous	number	+
9	OFA	Off-farm activity	Dummy	0= yes 1= NO	+
10	AC	Access to credit	Dummy	0= yes 1= NO	+
11	ACES	Access to Extension service	Dummy	0= Yes 1=NO,	+
12	AMMI	Access to milk market	Dummy	0= Yes,1= NO	+
13	DM	Distance to market	Continuous	Kilometer	-

CHAPTER FOUR

4. RESULTS AND DISCUSSIONS

Introduction

This chapter presents the results of the findings obtained from the field and also the discussions resulting from the findings. These results and discussions were based on responses obtained from 155 respondents. To this end, a total of 155 (100.0%) of questionnaires were distributed to the selected households. So, due to a serious supervision all of respondents gave appropriate response for the given inquires. That is, there is no any response error in the sapling selection. The data of the study was analyzed using descriptive statistics and inferential statics.

Table 4.1: The actual and expected sample of respondents

HH statues	Selected units			
	Population	Expected	Collected	%
Male	62	62	62	100%
Female	93	93	93	100%
Total	155	155	155	100%

Source: Survey result, 2019

4. 1. Description of Demographic characteristics of the Respondents

Demographic characteristics that are related to household head characteristics such as, sex, marital status, level of education, age, family size, and others were analyzed. The distribution of sample respondents based on their demographic characteristics is tabulated in Table 4.2 below:

Table 4.2: General information about the study participants

Variables		Frequency	%
Sex of the respondents	Female	93	60.0
	Male	62	40.0
Marital status of the HH	Married	112	72.3
	Unmarried	0	0.0
	Divorced	19	12.3
	Widowed	24	15.5
Education Status of the respondent	Literate	19	12.3
	Illiterate	136	87.7

Source: Survey result, 2019 %= percentage

Table4.2indicated that about, 93(60.0%) of the respondents was female whereas 62(40%) was male. This result revealed that milk handling and marketing are carried out by women than male in pastoralist's area. Regarding the marital status of the respondents 112(72.3%) of them were married, 34(15.5%) were widowed and 19(12.3%) were divorced. In other way, the result of the survey revealed that large proportion of the respondents did not attended formal education. The result showed that only 19 (12.3%) of the respondents were literate; whereas, 136 (87.7%) respondents were illiterate. The present finding in line with the result reported in many pastoral areas of Ethiopia (Beruk and Tafesse, 2000).

Table 4.3: Average household size with age of the household head

Variables	**Mean ± SD**
Total family size	6.54±2.76
Number of male family members	3.29±1.77
Number of female family members	3.22±1.65
Age of the household	45.08±9.87

Source: Survey result, 2019SD= Standard Deviation

The larger family size has a positive influence on livestock production and market participation because they contribute more labour on production and management and marketing of livestock and livestock production. Sample respondents stated that, larger family size has its own contribution for relocating livestock to where good pasture and water are available and participation of milk marketing activities in a way of labour division.

The mean family size (Mean ± SD) in the studied households was 6.54±2.76. The average family size of the surveyed households in the present study was in line with or approaches the average family size of Somali region, which was about 6.7 persons per household (CSA, 2007).

The survey finding shows that, age of the respondents interviewed ranged from 25 to 75years. The mean age of respondent was 45.08 ±9. 87 years. This shows most of respondents are found in economically active rang in the camel milk production and marketing. During the focus group discussion, the participants stated that, larger family size has its own contribution livestock production and productivity management especially, in dry season where there is no good pasture and water available around and as well as the involvement in milk marketing activities.

4.2. Household socio-economic characteristics

Table 4.4: The study participant socio-economic and livestock status

Variables		Frequenc	%
Occupation of the HH	Pure pastoralist	111	71.6
	Semi pastoralist	44	28.4
Sold live camel	Yes	133	85.8
	No	22	14.2

Source: Survey result, 2019

The survey result revealed that the most of the respondents were pure pastoralist that accounts 111(71.6%), while agro-pastoralist were 44(28.4%), this show that, most of the respondents were pure pastoralist than agro-pastoralist.

The survey result indicated also that 85% respondents were sold their live camel for the last three years for household need. When the respondents stated the reason why sold their camel some said to purchase food for the household; and others said for some social obligations such as wedding ceremonies, composition for life lost in conflict among the pastoralists clans or outside the clans.

4.3. Livestock holding and herd composition

The total livestock unit of the household in Degahbour Woreda is summarized in Table 4.5**.** Pastoralists in the study area owned different class (diversified) of livestock species that includes camels, cattle, sheep, goat, and donkeys. The present finding support the previous literatures, Scoones (1995) and Nigatu *et al.* (2004) reported that diversified livestock species or keeping mixed stock is common among pastoralists. During the focus group discussion the participants stated that, diversifying of livestock species is due to that of different species have different feeding habits and appropriate for better use of resources. The other reason of diversifying livestock species in pastoralists is that to cope with climate change, drought and disease outbreaks.

Table 4.5: Average livestock kept and sold in the household

Livestock species	Mean ± SD of the livestock kept by the HH	Breed Type
Camel	22.85±13.61	Local
Cattle	7.76±7.51	Local
Goats	18.95±14.40	Local
Sheep	16.43±10.60	Local
Poultry	0.00±0.00	Local
Horses	0.00±0.00	Local
Donkey	1.59±1.07	Local
Number of camel sold	1.68±1.04	
Unit price of a camel	11,022.22±2,499.9	

Source: Survey result, 2019 Mean SD= Standard Deviation

The survey result showed that the number of small ruminants along with camel; i.e., head per household were higher than other large ruminants with mean of 22.85±13.61 camel and 18.95±14.40 of Goat, 16.43±10.60 sheep , 7.76±7.51 cattle and 1.59±1.07 donkey respectively possessed. As indicated in Table 4.5, the herd structure is diversified to drought tolerant species, especially goat and camel as an adaptation mechanism to drought and climate change. This study finding is in line with Amaha (2006), Kedija (2007) findings. According to the FGD, majority of the participants reported that, In the past 5 years the community altered to increase rearing of camel and goat. Small ruminants dominated livestock holding.

4.4. Land Holding and land use Patterns

Land is one of the most important for grazing in pastoralist and agro-pastoralist area whose livelihood depends on livestock and livestock productions. The result of this study showed that the average land holding size of sample households were3.26 ± 1.23 hectares.

Table 4.6: Landholding and land use patterns

Variables		**Frequenc**	**%**
land size of the household	Mean ± SD	3.26 ± 1.23	
The major usage of land	For Cultivated	21	13.5
	For Fallow	22	14.2
	For Grazing	112	72.3
	For Rented for Woodlots	0.0	0.00
Land ownership type	Peasant Association gave	0.0	0.00
	Inherited from parent	155	100.0
	Rented in land	0.0	0.00
The land is enough for grazing	Yes	30	19.4
	No	125	80.6

Source: Survey result, 2019 SD= Standard Deviation

The average land size of the study participants was 3.26 ± 1.23 hectares. The survey result revealed that the mainland use of the study area were 112(72.3%) grazing and 22(14.2%) fallow; while, 21(13.5%) were cultivated land. Cultivation land holding was smallest as compared to other land use types. The average size of grazing land (closure of grazing land) per household was highest compared to other land use types of the Woreda. The mean holding of crop land and grazing land of Degahbor was far greater than that of Meiso Woreda of Oromia regional state, which has an average pastureland of 1.32 ha and crop land holding of 1.76 ha (Kedija, 2007). During the focus group discussion (FGD) the participants reported that, Drought frequency has increased and the pasture has decreased every year, it is just too difficult to rear livestock, particular cattle and sheep species in these times.

4.5. Camel Feed and watering

The amount of milk produced by the camel depends on the availability of feeds and water. the researcher assessed the feeding habits commonly used by the camel milk producers, availability of feed and water, main feed sources, pasturelands owner ship trends of pastureland for last five years, frequency of watering camel and availability of water during the dry season grazing system used by the respondents and the following information realized is as shown in the Table 4.7.

Table 4.7: Grazing and watering system used

Variables		Frequency	%
Do you have enough feed for animal	Yes	35	22.6
	No	120	77.4
Main feed sources for camel	Natural browses (Trees and	106	68.4
	Natural shrubs	49	31.6
Feed for livestock during wet season	Communal grazing land	91	58.7
	Purchased hay	31	20.0
	Improved pasture/forage	21	13.5
	Crop residue	12	7.7
	Industrial by-products	0	0.00
Pasturelands owned in the study area	Communally	91	58.7
	Individually & Communally	64	41.3
Trend of pastureland for the last 5 years	Increased	0	0.00
	Decreased	149	96.1
	Remain the same	6	3.9
Main problems of grazing land	Over stocking	45	29.0
	Low productivity of grasses land	94	60.6
	Shortage of land	16	10.3
Frequently of watering camel	Every day	4	2.6
	Every other five days	89	57.4
	Every other ten days	62	40.0
Does the Availability of water is a major constraint during the dry period	Yes	155	100.0
	No	0	0.00

Source: Survey result, 2019 % = percentage

In both wet and dry season, livestock were allowed to graze on natural pasture on communal and individual grazing land. Feeding systems were communal and individual natural browsers and natural grazing in the study area. As result revealed, about 91(58.7%) pasture land owned

communal; while, 64 (41.3 %) respondents responded that they had owned pasture land both individual and communal. During the focus group discussion (FGD), the participants stated that rangeland is communally owned in Somali clans that makes difficult to undertake appropriate range development. As indicated in Table 4.7, about 149(96.1%) of the respondents convinced that pasture was decreasing for last five years due to drought, shortage or erratic rain, low productivity of the pasture and deforestation. About, 45(29.0%) respondents suggest their reason why the productivity of the pastor reduced, they said due to overstocking, 94(60.6%) low productivity of grazing land and 16(10.3%) shortage of forage. this result is in line with the previous literature Field (1995)

The majority of the respondents, 89(57.4%), convinced that frequency of watering their camel is every ten days, 62(40.0%) water every fifteen days and 4(2.6%) said for every five days. Naturally camel can stay without water around a month, but in the study area watering interval of camel was all most all every ten days, this result is in line with the previous literature Tezera (1998).
During the focus group discussion, the participants stated that, pasture was decreasing for the last five years due to climate change and drought, this led a loss of huge number of livestock which effects the livelihood of pastoralist whose livelihoods depends on livestock and livestock production.

As table 4.7 shows, all respondents reported that during the dry season water scarcity was major problems in the area. During the dry seasons, the lineage groups are normally at their thickest concentration and the ranges near permanent water are most heavily stocked. However, the separation between camels and other animals is most marked because of the differences in water requirements of the species. During the focus group discussion, most participants stated that, when there is good pasture and green forage camel can stay without water between 25 days up to 30 days, but due to feed shortage and drought, frequency of watering camel increased.

4.6. Water sources and seasonal availability

Water is crucial for pastoralist; basically pastoralist community settles where water sources are available, since the major sources of water use of pastoralist area are domestic and their livestock. Therefore, the researcher tried to identify the water sources and their seasonal availability of the study area.

Table4.8:Type of water sources on seasonal availability together with the average distance

Type of water source	**Season of availability of the water source**	**Average distance to the water source(Km) [mean ±SD]**
River	Both wet and dry season	42.92 ± 7.54
Well	Both wet and dry season	21.00 ± 4.50
Spring water	Wet season	4.70 ± 1.74
Pond	Dry season	1.54 ± 0.54

Source: Survey result, 2019SD= Standard Deviation

There are several of water sources for both human and livestock in the study area (Table 4.8). According to the respondents response, water sources include rivers, well, springs and ponds and travel to average distance of 42.92 ± 7.54, 21.00 ± 4.50, 4.70 ± 1.74 km and 1.54 ± 0.54km respectively. During the focus group discussion the participants stated that Frequency of camel watering depends on the seasons and obtainability of water sources.

4.6.1. Major challenges of water

As figure 4.1 shows water related problems in the study area were distance, scarcity and sanitation which influence the camel milk productivity in the study area. As the survey result revealed, majority of the respondents 52.30% complained that water shortage, 29.70% distance of water sources and 18.10% sanitation and unhygieniness of water.

Water scarcity was the most series factor livestock and livestock production as per the majority of the respondents' opinion. It is a critical problem during the short rainy/dry season due to the fact that most of the family members became busy for searching water for their livestock and their home consumption. So, the pastoralist community as well the livestock supposed to move far distance to search and access to water, this result is in line with the previous literature report of (Wilson, 1998).

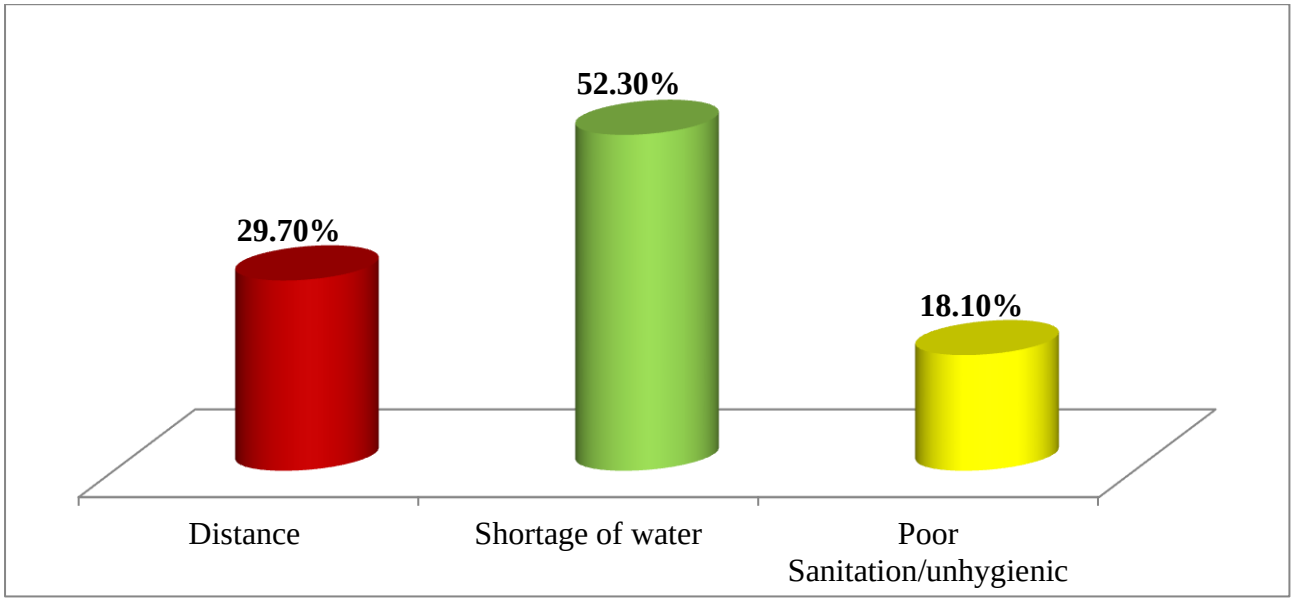


Figure 4.1: Water related problems

Abdulahi Malin is one of the Hodale Kebele elders, when he was participating water related question in key informant interview he said!

> *... Water scarcity is the most problem in our area we move around 45Km away from our homes early of the morning without taking such energy, to day morning even I missed a water for ablution in Masjid to pray, our children and wives suffer this problem. He said that water scarcity is not only the problems, but also lack of cleanness and unhygienic, therefore we are requesting from the government and any other institutions and organization who involves water sector or affairs to help us and dug underground water, because in our area underground water can be reached in less meters ...*

4.7. Camel milk production performance

Camel milk is a vital and favorite food for Somali pastoralist. The frequency of camel milking by the pastoralists vary and it depends on availability of feed, water, number locating camel owned by the household and seasons(wet and dry seasons). In the study area mostly the camels are milked two to three times per day, as shown table 4.9.

Table 4.9: The camel milk production performance

Variables		Frequency	%
frequency of milking camel	Morning	4	2.6
	Morning and evening	145	93.5
	Morning, midday and	6	3.9
Does the camel milk consumption increase at home	Yes	21	13.5
	No	134	86.5
Household members use the camel milk	As fresh	106	68.4
	As soured	0	0.00
	Bothe fresh and soured	49	31.6

Source: Survey result, 2019 % = Percentage

As shown in the above table, majority 145(93.5%) of the respondents informed that they milking their camel two times (morning and evening), 6(3.9%) said milking three times (Morning, midday and evening) and 4(2.6%) said one time (morning) per day. This result indicates that, majority respondents milk their camel more than one times. In fact this finding is in line with Farah *et al* (2004) and Wernery (2003) study findings. As shown in Table 4.9, there was decreasing of camel milk consumption in the study area due to low productivity of camel caused by shortage of pasture and water. About 134 (86.5%) of the respondents reported that camel milk is not increasing for the last three years, rather decreasing for the sake of different factors.

According to the response of the producers, about 106(68.4%) of respondents consume fresh milk while 49(31.6%) consume both fresh and soured milk. This indicates that most of the respondents consume fresh milk compared to soured or fragmented milk in the study area.

4.7.1. Camel milk yield and productivity

The yield of milk produced by the camels is depended on the availability of feeds. The study tried to find out the camel milk production on wet season and dry season, length of lactation, number of lactating owned by the household and camel milk consumption at household level used by the camel milk producers and the results are displayed in the Tables 4.10.

Table 4.10: The camel milk yield and productivity

Variables	**Mean ± SD**
Average milk produced / camel /per day in wet season	5.01 ± 1.15
Average milk produced/ came/ per day in dry season	2.68 ± 0.67
Months of lactation	11.67 ± 0.74
Number of lactating camel	2.97 ± 1.26
Amount of milk the HH consume/day	1.19 ± 0.52
Number of times the HH use camel milk/day	1.74 ± 0.45

Source: Survey result, 2019 SD= Standard Deviation

Based on availability of feed and water sources the daily milk yield per camel per day ranges from season to season. As the survey result revealed, on the average each camel milked per day in wet season (5.01 ± 1.151) liters and on the dry season (2.68±0.674) liters. This illustrated the yield decreases during the dry season when it compared with the wet season. The average milk yield of camel per day in dry and wet season in this study is in agreement with previous findings of Bekele *et al* (2002) and Simenew *et al* (2013).

The study result also indicated that, the average lactating duration of camel was 11.68±0.738 months. The lactation length in this study is in line with the previous findings of Kedija, (2007), Ishag and Ahmed (2011) and Tezera and Hans (2000).

The total lactating camels of the respondents were 460 that accounts on the average every household had 2.97± 1.26 lactating camels. Jointly, the study wants to know how many times the camel owners consume milk per day. This result shows that the average household consumed was 1.19 ± 0.52 litter camel milk/day. This implies that majority of the households consume around one liter of camel milk per every day.

4.7.2. Constraints of camel milk productivity

Camel milk production problems were real problems of the study area. The most important constraints influencing camel milk production specified by the sample respondents were feed shortage, water scarcity and diseases and parasites. The result is displayed in the table below.

Table 4.11: Rank the most important constraints influencing camel milk production

problems	Rank based on their severity
Feed shortage	1
Diseases and parasites	2
water scarcity	3
Inadequate of extension service	4
low productivity of grazing land	5
High medicament costs	6
unviability of credit service	7

Source: Survey result, 2019

According to the respondents, there were different constraints in camel milk production in the din the study area. These include shortage of forage and water scarcity, disease and parasites, high medicament cost, low productivity of grazing land, inadequate access to extension services and services, and unavailability of credit services (Table 4.11). Among these problems, feed shortage, water scarcity, diseases and parasites, and limited access to credit services were the major problems identified.

The current study agree with the previous literatures Kibru *et al*., (2015) reported, shortage of grazing land, parasites, diseases and limited veterinary extension services to control and prevent the outbreak diseases are the major constraints of milk production of the farmers in AletaChukko Woreda of Southern Ethiopia. Abebe *et al.*, (2014) limited or lack of knowledge on the conservation of seasonal available forage and limited grazing land and cultivation of improved forage are most of the dairy producers, milk production is constrained and Jabbar *et al.,* (1997) indicated that shortage of feed and water are major problems in all traditional livestock production systems that are characterized by low input, feeding and management requirements and the use of indigenous genotypes..

4.8. Camel Milk Marketing

Market service is an important for livelihood improvement because it is a place where the products of both animal and farm exchanges, which give hand and motivation to the producers, and also help them to exchange what household need. Camel milk marketing and performance were assessed and the results tabulated in table 4.11.

Table 4.12: camel milk marketing

Variables		**Fr**	**%**
Do you Sell your camel milk	Yes	155	100.0
	No	0	0.00
Who sold the milk product	Male	0	0.00
	Female	155	100.0
Market selection criteria to sell camel milk	Price of milk per liter	20	12.9
	Distance of market for milk	63	40.6
	Market reliability	72	46.5
Does the market price of milk is reasonable	Yes	23	14.8
	No	132	85.2
Distance from the nearest market (Km)	1-5 Km	11	7.1
	5-10 Km	68	43.9
	10-15 Km	49	31.6
	Above 15 Km	27	17.4
Means of transportation for camel milk marketing	Household labor	60	38.7
	Vehicle	4	2.6
	Donkey	91	58.7
Use of income earned from camel milk	Food for household	86	55.5
	Schooling for children	33	21.3
	For buying additional livestock	2	1.3
	Animal feed and watering	34	21.9

Source: Survey result, 2019 % = Percentage

The result of this study shows that all most all of the respondent were participating camel milk marketing to get income for other needs, such as food , health for both human and animal, social obligations, wedding and clothes and so on.

The survey result revealed, about 100% of the respondents were involving camel milk marketing during the study, although access of market was difficult because of poor infrastructure, lack of transportation and distance of market.

Table4.12. the survey result revealed that in the study area, about 100% of the sample household's female members of the household controls the income from the product. Further, during a focus group discussion with dairy camel producer's household heads stated that the women involve the camel milk marketing while the male involve the camel milk marketing only when camel moves away from their normal settlement. They further justified if men had controlled the income the propensity to spend the income for chat, cigarettes, invitation, other unnecessary needs would have been significant, and its household food security contribution would have been lower. This result agrees with the previous report of Kedir *et, al.* (2016).

Also the survey result shows that, most criteria of camel milk marketing selection of the study area were price of milk per liter, distance of market and market reliability which about, 12.9%, 40.6% and 46.5% respectively. This shows that the most criteria of camel milk marketing selection were market reliability because of perishable of milk, this finding disagree with the previous literature report of Mohamed, (2014), the criterion mostly used in selecting milk marketing out let revealed that camel milk farmers used price of milk per liter, this may be due to market distance or availability transportations.

The result shows that majority of the respondents were using as means of transportation for donkey which were accounts 58.7%, while 38.7% and 2.6% were used for household labor and vehicle methods respectively. Based on this survey result shows there were limitation of transport, although donkey and human back were major means of transportations.

The closer the market, less milk spoilage would be incurred, less time it takes to travel. This may reduce losses due to energy, time and access to market information and producers would get fair price for their milk. As shown in table 4.12, interviewed respondents far away from nearest market about 1-5km, 11 (7.1%), 5-10km 68 (43.9%), 10-15km 49 (31.6%) and above 15km 27(17.4%) respectively. This shows that most of the producers were travel along distance to market their camel milk. This finding agrees with previous finding of Kurtu, (2004).The differences in distance to different milk market places affect the price of milk.

As is indicated in table 4.12, Majority of the respondents were expend their income gained from camel m ilk marketing were 86(55.5%) food for household, 33(21.3%) Schooling for children 2(1.3%) For buying additional and 34(21.9) animal feed and water, this implies the household food depends on income from camel milk marketing in the study area.

Hassan Abdi is one of the DAs of Gediaar kebele in Degahbour Woreda during the key informant interview he reported that:

> *…Before the frequent droughts happened in our area and affected the our pastoralist livelihoods most of the pastoral milk production system was largely for subsistence (consumption) and calf feeding, but current camel milk marketing is the most economic sources of their area that they use as a resilience of drought and poverty…*

4.8.1. Seasonal price of camel milk marketing

Milk is a substantial part of pastoralists household food and income. Sale of live animals and its products, especially sales of milk are the main sources of income for pastoral community. In pastoralist area milk production depends on season and availability of feed and water.

Table 4.13: Seasonally marketing price of camel milk

Variables	**Mean ± SD**
Sale volume of camel milk/ day	7.29 ± 3.25
Price per liter in wet season	12.05 ± 2.14
Price per liter in dry season	22.55 ± 2.51
Average revenue earned from camel milk	1,249.35 ± 568.52
Distance from nearest market (Km)	2.59 ± 0.86

Source: Survey result, 2019 Mean SD= Standard Deviation

As shown in Table 4.13, the average sale volume of camel milk of the households was 7.29 ± 3.25 during the wet and dry season. During the focus group discussion participants stated that the amount of camel milk sale increases during the wet season because of high surplus production, however, amount of camel milk sale decreases during the dry season due to low surplus production.

The survey result shows that mean sell volume of camel milk in the study area were7.29 ± 3.25, further, during a focus group discussion with dairy camel producer stated that the sell volume of camel milk depends on the seasons and availability of forage and water.

Survey result revealed that range milk price of milk in wet season was 10-15 ETB, while 20-25ETB in dry season. This shows that the mean average price per liter in wet season was 12.05±2.14.ETB and dry season 22.55±2.51. This indicates that the lowest price occurs in wet

season, because of more supply of milk to markets, whereas maximum price occurs during dry season when there is low supply of milk in the market. In the dry seasons since the supply of camel milk is low and the demand for it is high.

Survey result indicated that that the average income gained by the respondents from camel milk sale was 1,249.35 ± 568.52.Birr. During the focus group discussion (FGD) with dairy camel herds, told that income gained from the camel milk depends on seasons, price per liter and market accessibility. As shown in Table 4.13, the mean distance of pastoralist women travel to access and sell milk was 2.59 ± 0.86km.

During the key informant interview the one of the participants said that:

> *...Seasons determine the amount of camel milk sale. During the dry season the sale volume of camel milk decreases comparable to wet season, camel milk marketing is not well organized and most households and milk traders are individual sellers, buyers set the milk prices…*

4.8.2. Access to market information and problem encountered during marketing

Access to marketing information is a crucial factor that allows the producers to get their products a fair price, market information is central element of any marketing activities. The researcher consequently tried to see access of market information, sources of market information and the problems affecting marketing of camel milk and the following results were obtained in table4.14

Table4.14: Market information and problem encountered during marketing

Variables		**Frequency**	**%**
Access of market information	Yes	135	98.1
	No	20	12.9
Main information source	Milk group	35	25.93
	Neighbor from the market	100	74.07
Problem encountered in milk marketing	Price related	23	14.8
	Buyer related	8	5.2
	Transport related	77	49.7
	Infrastructure related	35	22.6
	Milk handling related	12	7.7

Source: Survey result, 2019 % = Percentage

Survey result revealed that 133(98%) of the respondent had an access of market information, while 20(12.9%) out of the respondents did not get access of market information. As result presented

main market information sources were neighbor who came from the market and milking groups, which were 74.07% and 25.93% respectively. In culturally Somali pastoralist information is traditional part that they exchange the information about the rain, peace, pasture and market condition of their areas.

As the result presented the hardly in market access limits chances for generation income due to poor access of transportations, infrastructures, price fluctuation, milk handling materials and buyers problem. Harshness of the environment limited that farm gate prices remain low and lower returns to labour and capital. Such challenges remarked in difficulties of fresh milk marketing, where transportations and infrastructures are extremely limited. This result shows that most respondents stated that transportations, infrastructures, price, milk handling technologies and buyers were the most problems which accounts in 49%, 22.60%, 14.80%, 7.70% and 5.20% respectively. During the focus group discussion the participants reported that during the rained season most of their surplus production goes to waste, due to lack of transportation. This finding agrees with that of Muliro (2007), reported that during the rainy season, much of the surplus camel milk goes to waste. IPS (2000), scattered nature of the production units, the poor communication system, and the low rate of urbanization and low infrastructure of road facilities may also not warrant the establishment of processing plants.

Halimo Omer is one of the Garawo kebele women who rears camel and markets camel milk, when she was participating market related questions in KII she stated that!

> *…market is very vital to our livelihood and our livestock and livestock productions because we market our milk so as to exchange food and other household needs. During the rained season it is too difficult for us to access it, particular if rain rained morning no one comes to buy and no one goes to sells our milk due to poor infrastructure and transportation that leads to our surplus milk to leftover. She also said that we market all our milk to Dagahbour market and we don't have alternative market buyers set price, especially during the spring season when there is surplus production. Therefore we are kindly requesting honorable government, NGOs and investors to us a hand and facilitate to sell our milk at farm gate with fair price…*

4.9. Off/non-farm activities

The survey result revealed that, 57(36.8%) were involved off/non-farm activities as their second income source whereas, 98(63.2%) of the respondents were not involved. According to focus group discussion most of the respondents that involve off -farm activities increases during the dry season to utilize the scarcity resources. The most commonly off/nonfarm activities in the study area were charcoal and wooden construction material sale, small business activities in the village like inks(selling tea, sugar, teal leaf, biscuits, candy, cigarettes), etc.

Table 4.15: off/non-farm activities participation

Description	Frequency	%
Yes	57	36.8
No	98	63.2
Total	155	100

Source: Survey result, 2019

During the focus group discussion participants reported that, households with large family size send some of the family members, particular sons to towns like Degahbor Jigjiga, Wajale, Kebridahar and some neighboring countries like, Somaliland, Djibouti to work and financially support to household in terms of remittance. This helps them not to sale the remained livestock and to cover household needs.

4.10. Access to credit

Credit is crucial for pastoralist for purchasing livestock inputs like feed, animal drug, watering and to participate dairy marketing. In the study area there was no access to formal credit, because credit services did not reach, but as respondents stated during the focus group discussion they said that there is no

Table 4.16: Distribution of respondents access to credit (N-155)

Description	Frequency	%
Yes	39	25.2
No	116	74.8
Total	155	100.0

Source: Survey result, 2019 % = Percentage

The survey result revealed that, majority 116(72.8%) of the respondent had no access to credit service, whereas 39(25.2%) of the respondents had an access to credit. Those who access to credit is almost all from informal credit as respondents stated during the focus group discussion. Sources of credit in the area include informal sources like friends, relatives, local money lenders locally called *Dilal*and the formal sources such as micro-finance institutions like Somali microfinance institution (SMI), but this work Woreda and around the Kebels this mean in the study kebeles there was no formal credit institutions.

4.11. Access to extension services

Access to extension service is an important for pastoralist communities whose their livelihood depend on livestock and livestock production. In the study area diseases and parasites were the livestock production problems. The researcher attempted to know the access and availability of extension service in the study area. the result displayed the table below.

Table 4.17:Distribution of respondents access to extension services (N=155)

Variables		Frequency	%
Access to extension service	Yes	114	73.5
	No	41	26.5
Is the vaccination practices in your area	Yes	114	73.5
	No	41	26.5
Frequency of visit to extension service	Once a year	123	79.4
	Twice a year	32	20.6

Source: Survey result, 2019

Access to extension service is a vital capital which enhances quality and quantity livestock production and productivities and improves the skill of the producers. In the study area there is no cross breeding practices to improve livestock production, as shown table 4.17,livestock breed type of the study area was local there was no exotic, and cross breed livestock types in the study area. Such kind of breed type and technical skills support for the pastoral community is not yet introduced in the study area on the part of the government and NGOs, reported by the respondents. In addition to this, even individual or group of persons had not yet started their own initiatives of introducing exotic breeds and cross breed camel and modern feeding systems in the in the study area.

As depicted in table 4.17, 114 (73.5%) of the respondents had an access of extension service, whereas 41 (26.5%) had no access to extension service. the frequency of respondents access to extension services was 123 (79.4%) of the respondent acquired the extension services once a year

and those acquired the services twice a year were 32(20.6%). vaccination of animal given in the form of campaign was most of the service provided in the study area by the bureau of livestock and pastoral development. The extension service providers were not focused livestock breeding to improve the quality and quantity of livestock production. In addition to these, during the survey, pastoralist reported that extension providers do not give attention for forage and grass land improvement. During the survey, pastoralists reported that they move far distance to search water and feed for their livestock, but what happens some time they came across new diseases when they move to new places. This finding agree with the previous literatures report Zinash (2004).Such livestock movements could be the cause of direct or indirect transmission of varies economically important camel diseases.

4.12. Contribution of camel milk on pastoralist livelihood (income)

Camel milk has great contribution of pastoralist household economic and camel milk traders. Pastoralist respondents known were the income they get from camel milk sale allows them to cover most of their daily household needs and expense. Also pastoralist use camel milk for sale and household consumption in the study area. The result of this study revealed that sale of camel milk was the major source of household income.

Camel milk herders and camel milk traders were not much involved in other types of work. They are mainly bank on the camel milk trade, in the study respondents camel milk contributes about 95% of their income. Camel milk is the main income and food sources of the study area. Their mean monthly income from the camel milk sale was1,249.35 ± 568.52 birr (Table 4.13). In the study area, camel milk is the major livelihood sources for pastoralists and camel milk traders other than other income sources. As the current study indicated, food, social obligation, feed and watering of livestock, clothes and other basic needs of the respondents were depend on the income from the sale of camel milk. Current result indicates about, 155 surveyed camel milk producers and their families were bank on camel milk for food and income. This result agrees with previous literature reports, Beruk and Tafesse (2000). Food security in most of the Ethiopian lowlands is highly associated with livestock and livestock products

This result agrees the previous literature reports, Camel milk is a source of cash that enables the pastoralist families to buy or exchange the goods and food stuff and it significantly contributes the food security of the household (MOA, 2001). Mohamed,(1993). Husbandry and management

practices of the Somali camel herders give more attention for improvement of camel milk production and the continuous supply of milk for the family's needs throughout the season

Despite the harsh and hot area of pastoralist camel produces more milk comparable to other livestock held under the same environment; however, it is widely comprehended that in absolute term, (Farah, 1996; Kaufmann and Binder, 2002).

Abdulahi mahamud is one of the Higloley kebele elders member, when he was participating in key informant interview he said!

> *...To sustain the livelihood of his family members which depend on him, I took a decision to change or transform his sheep and cattle to camel and goat since these two type of herds are able to resist and adapt climate change, I also sent two of my sons to involve in casual labor activity to feed his family without selling the remaining herds. He said, despite impermanent of the casual labor activities of my sons and far distances of my sub-village from town they work, involving in casual labor which can sustain family livelihoods during critical periods of drought…*

4.13. Camel milk production and marketing constraints

As table4.11, shows feed shortage, diseases and parasites, high feed price high medical cost, shortage of land grazing were the major constraints of camel milk production in the study area. This result in line with the previous literatures Kibru et al. (2015) Shortage of grazing land, parasites, diseases and limited community animal health workers services to control and prevent the outbreak diseases are the major constraints of milk production of the farmers in AletaChukko Woreda of Southern Ethiopia reported. Abebe B. et al., (2014) limited or lack of knowledge on the conservation of seasonal available forage and limited grazing land and cultivation of improved forage are most of the dairy producers, milk production is constrained.

As the result of table 4.13, indicates lack of transportation, poor infrastructure, price, and poor milk handling (traditional) technologies were main challenges remarked in difficulties of fresh milk marketing. During the focus group discussion the participants stated that, during the wet season a large amount of milk surplus wasted due to lack of transportation. This result agrees with previous literature, Ahmed (2002) lack of road infrastructure to transport milk from pastoralist areas (remote areas) was the major constraints in Afder zone.

In general the most important constraints facing camel herders in Degahbour Woreda are:

- Feed shortage
- Drought
- Diseases and parasites that limits the camel milk productivity
- Traditional milk handling technology and their storing materials
- Lack of transportation facilities
- Lack of infrastructure
- Distance of market by traveling sometimes around 15 Km
- low selling prices for camel milk
- Distance of water source, water scarcity, and poor sanitation/hygienic water
- Lack of access to credit.

Abdulahi Jama is one of the elders in Higloley Kebele, Degahbour woreda, during the key informant interview he narrated that:-

> *…Before the seven sequences of drought years (2010-2017) I missed 70 of my livestock including the cattle, sheep, goat and camel, particular I missed a number of my cattle. He said look me I am 75 years old and I have never got sick even one night but my appearance looks like patient this is not sickness, but its famine and lack nutrition caused by drought and climate change. He also narrated that drought reduced livestock production, particular milk were the major income of the household depend on. Unpresented or unknown diseases and parasites seen in our livestock that was not existing before, such diseases and parasites caused by drought, shortage of forage, water scarcity and inadequate of extension service…*

4.14. Camel Milk Marketing Channels

In this section an attempt was made to identify the camel milk marketing channel in the study area from the time milk flow from the pastoral area to final consumer through different channels. In any marketing process there is a chain/sequence of steps through which a given product passes starting from production area until it reaches the final consumer. Likewise in the study area camel milk as a product passed through hands of different market intermediaries to reach their final end users. The camel milk flow begins with the producers, who sell to rural assembler, urban assemblers, retailers, wholesaler and consumers in order to generate cash to settle various family expenses. According to the result around seven camel milk marketing outlets were identified, as the respondents reported the least beneficiaries are the producers due to lack of transportation and infrastructure. The hierarchy of the camel marketing system from pastoralist producers at the top to the final consumer at the bottom involved a number of different types of milk traders (Fig 4.2).

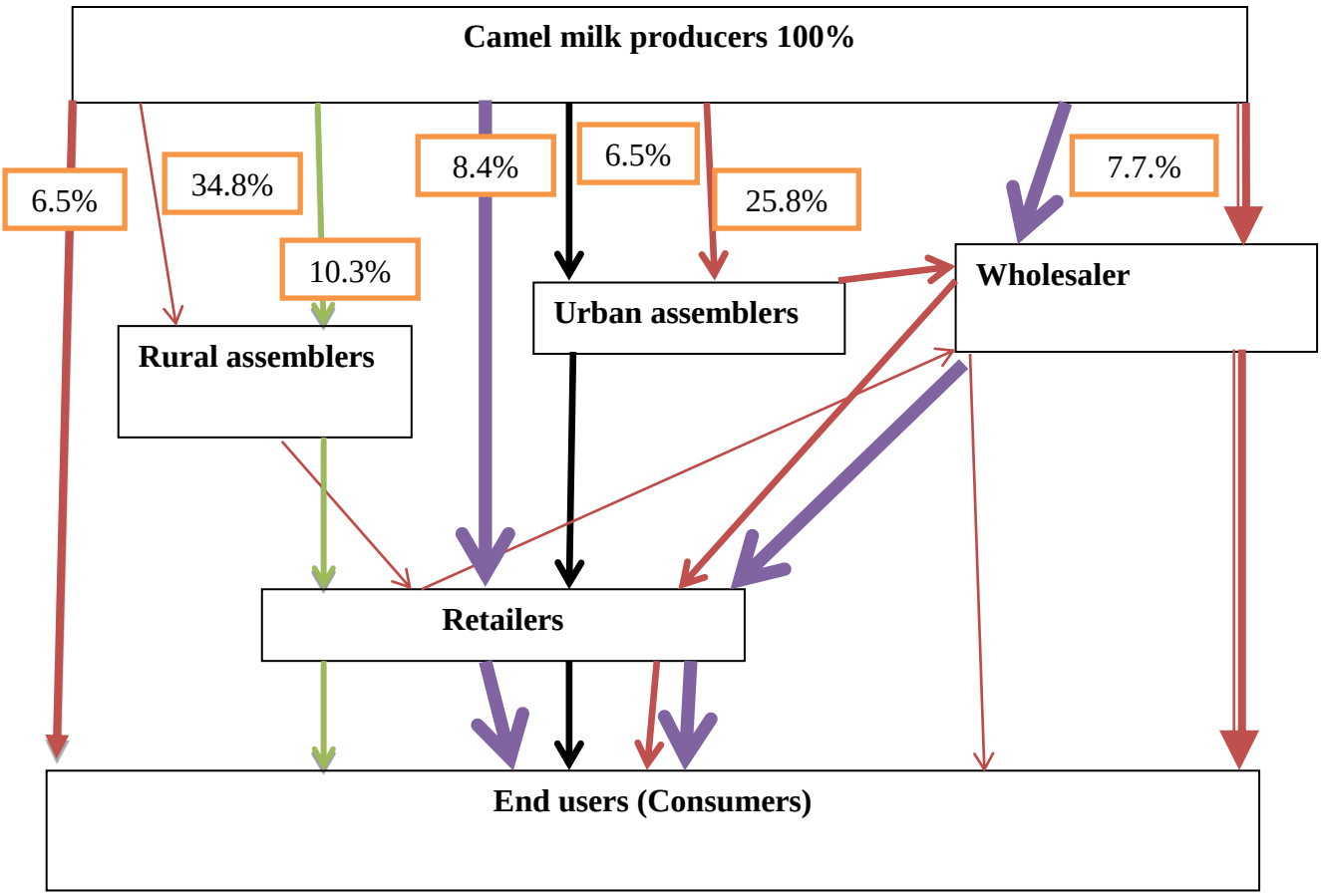


Figure 4.2: Flow diagram of camel milk marketing channels

Source: own formulation

Table 4.18: Camel milk marketing channels (outlets) in Degahbour market

No. of channels	Channels	%
Channel I	Producer –Consumer	6.5
Channel II	Producer –Retailer- Consumer	8.4
Channel III	Producer- wholesaler- -Retailer- Consumer	7.7
Channel V	Producer -Rural assembler- wholesaler- Retailer-Consumer	34.8
Channel VI	Producer-Rural Assembler- Retailer-Consumer	10.3
Channel VII	Producer -Urban assembler- wholesaler- Retailer- Consumer	25.8
Channel IV	Producer-urban assembler-retailer-consumer	6.5

Source: Survey result, 2019

The survey result identified that there were different types of milk marketing channels in the study area during the survey period, as indicated table 4.18.

Producer –Consumer: This channel accounts for 6.5% of total camel milk marketed per day in in Degahbour market, as indicated (Table 4.18). The channel was found to be the shortest of all camel milk channels identified during the study period. As stated the respondents during the focus group discussion it is the most important channel for producers, if access and availability of transportation exists.

Producer –Retailer- Consumer: The channel represents average of 8.4% of camel milk marketed per day in the Degabour market. This channel was identified to be the most important alternative channel of camel milk sale out let for camel milk producers as well as for retailers, in this channel the camel milk producers and retailer are the most beneficiaries.

Producer- wholesaler- -Retailer- Consumer: The channel represents average of 7.7% of camel milk marketed per day in the Degabour market. This channel was identified that wholesalers and retailers are the most beneficiary whereas the producers are the less beneficiaries.

Producer -Rural assembler- wholesaler- Retailer-Consumer: This channel represents 34.8% of total milk marketed per day in Degahbour. This channel was identified the longest of all camel milk-marketing channels identified during the survey period .during the focus group discussion the participants reported that, this channel is the most reliable in which usually camel milk flow

Producer-Rural Assembler- Retailer-Consumer: This channel is found that rural assemblers and retailers are the most intimidators that retail the bulk of camel milk and provide to consumers. This channel represents 10.3% of total camel milk marketing per day in Degahbour market. This channel rural assemblers and retailers are the most intermediaries that retail the camel milk. As the FGD participants stated, this channel rural assemblers and retailers sale the milk highest price whereas the producer sale the lowest price.

Producer -Urban assembler- wholesaler- Retailer- Consumer: This channel accounts for 25.8% of total camel milk marketed per day in Degahbour market, as indicated (Table 4.18). The channel was found to be the second longest channel of all camel milk channels identified during the study period. based on the above table, channel I was the most important that pastoralist of the study area was very interesting but, due to transportation and infrastructures problems it was the least channel used by the pastoralist producers, whereas, channel V, Producer -Rural assembler- wholesaler- Retailer-Consumer was the most practiced channels in which producers are the least beneficiary. Therefore, if access of transportation and infrastructure would improve, it would give the producers to sale their milk direct to consumers with fair price.

4.15. Analysis of inferential statistics

4.15.1. Assessment of ordinary least square assumptions

4.15.2. Detecting of Outliers

Primarily, the existence of outliers is detected by using a Cook's distance. If the distance greater than one, the extreme value which capable to affect the distribution exist. Otherwise, the outlier who capable to interrupt the outcome is not detected.

Table 4.19: Tests of outliers by using a Cook's distance

	Minimum	Maximum	Mean	Std. Deviation	N
Cook's Distance	.000	.107	.008	.01	155

Source: Survey result, 2019

Therefore, as the result reviled, the minimum Cook's distance value is 0.000; while, the maximum is 0.107. Thus, the estimated distance is less than expected threshold value 1, so the problem of outlier is not obvious in this study.

4.15.3. Assessment of Multicollinearity

Multicollinearity exists when there are strong correlations among the predictors. If the tolerance value below 0.10 or the variance inflation factor (VIF) greater than 10, Multicollinearity problem would be a serious problem for the distribution (Field, 2009). Tolerance is a test statistics used to indicate the variability of the specified independent variable whether explained by other independent variables in the model or not.

As a general rule, if the VIF of a variable exceeds 10, there is multicolinearity. According to Gujarati (2003) to avoid serious problems of multicollinearity, it is quite essential to omit the variable with value 10 and more from the linear analysis.

Table 4.20: Collinearity statistics

Variables	Tolerance	VIF
Age of the household head –years	0.716	1.397
Amount of milk produced per camel per day in wet	0.570	1.754
Amount of milk produced per camel per day in dry	0.342	2.926
Number of lactating camels of the household	0.454	2.304
Price per liter in a day in wet season	0.414	2.415
Price per liter in day in dry season	0.369	2.710
Means of transport	0.775	1.290

Source: Own data, 2019

As the study result illustrated in the table above, the entire variables tolerance are greater than 0.10 and their VIF values also lower than 10. So, there is no Multicollinearity problem that alters the analysis of the regression model (Table 4.20).

4.15.4. Pearson's coefficient of correlation analysis of dependent and independent variables

A correlation analysis was used to examine the relationships and strengthens between independent and dependent variables. The below table indicates the correlations between explanatory and dependent variables:

Table 4.21: Association of independent variables with dependent variable

Independent variables	Pearson' coefficient of correlation	Sig. (2-tailed)	N
sex of the Respondent	-.153	0.057	155
education of the HH	-.089	0.271	155
family size	.120	0.137	155
Age of HH	.193*	0.016	155
TLU	.054	0.507	155
Amount of camel milk produced in wet season	.525**	0.000	155
Amount of camel milk produced in wet season	.631**	0.000	155
No. of lactating camel of the HH	.588**	0.000	155
Price per liter in wet season	.641**	0.000	155
Price per liter in dry season	.690**	0.000	1555
Distance to nearest market	-.014	0.862	155
Means of transportation	.374**	0.000	155
Access to market information	0.142	0.078	155
Access to extension service	-.184*	0.022	155
Access to credit services	-0.11	0.175	155

**, Correlation is significant at the 0.01 level (2-tailed)

*, Correlation is significant at the 0.05 level (2-tailed)

Source: Survey result, 2019

Basically, the test helps to identify important factors which capable to affect the dependent variable income of the household. As correlation analysis results indicated, the majority of the explanatory variables except sex of the respondents, educational level of the household, family size, TLU, distance to the nears market, access of market information, and access to credit services were

linearly associated with the income of the household with a 0.05 level of significance. Moreover, some of the variables indicated a negative association; whereas, the other develop positive association.

4.15.5. Normality of the Error Term

The error term should be normally and identically distributed with a mean of zero and standard deviation of one. This test can be done by using histogram with a normal curve. As a result indicates the assumption is achieved, because the mean of the error term is $4.15*10^{-16}$ which is approaching to zero and the standard deviation 0.980 which is nearest to one. Therefore, the distribution of the random error term is standardized normal.

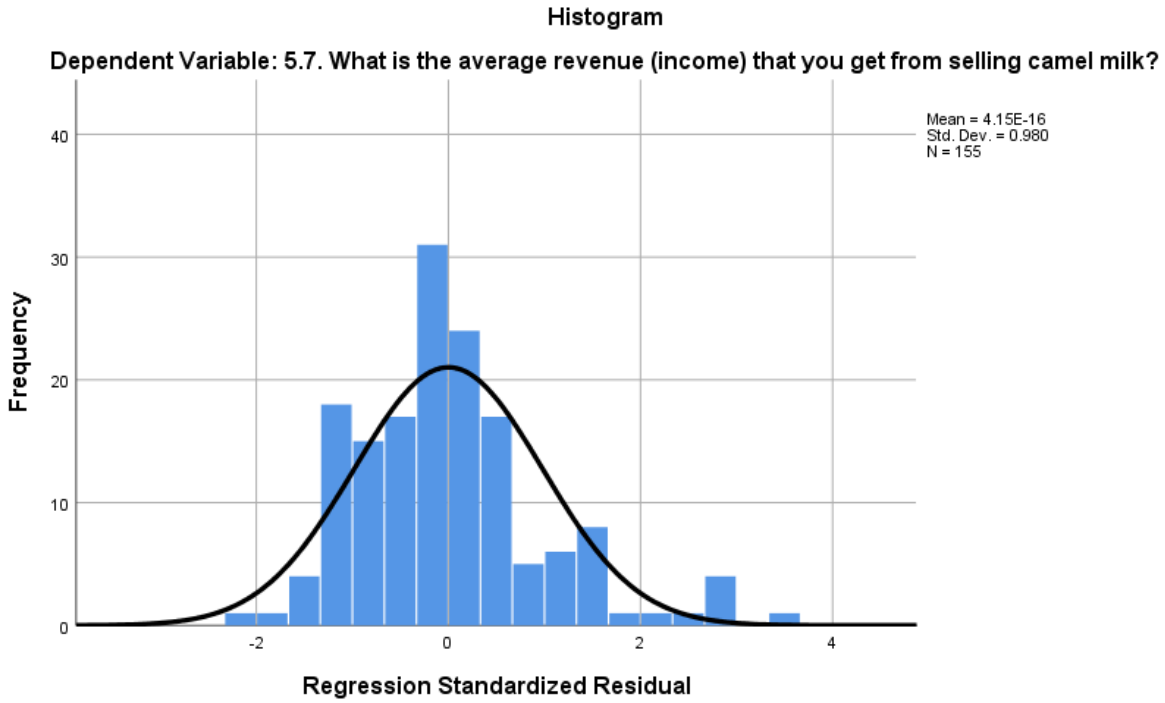


Figure 4.3: The normality tests of the error term
Source: Survey result, 2019

4.15.6. Assessment of Heteroscedasticity

When the error term varied with the independent variables, the problem of Heteroscedasticity could be occurred. This is tested by drawing a graph with standardized predicted values versus standardized residual curve. In the curve if any continuity trend can be observed, i.e., if standardize predicted value going in line with the standardized residual; i.e., if the curve indicate an increment

or decrement trend over the standardized residual, the problem is detected otherwise it is safe from the problem. Taking this consideration into account, if any one observe the below pictorial presentation, it didn't show any serial trained. Hence, the Heteroscedasticity problem is not real in the distribution (Fig 4.4).

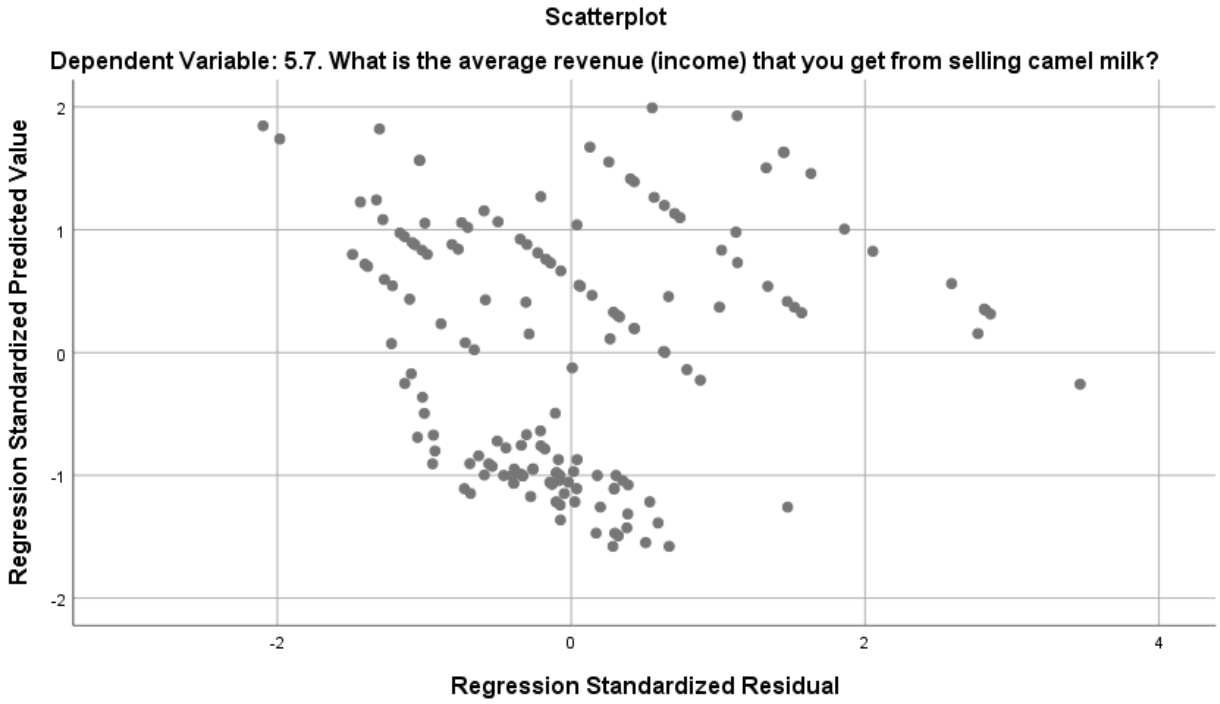


Figure 4.4: Hetroscedasticity Test

Source: Survey result, 2019

4.15.7. Factors which mostly determine the income camel milk sale

Regression analysis was conducted to examine the causal and strengthens of a relationships between the dependent and independent variables. A regression model was formulated and tested where the dependent variable, income from sale of camel milk(Y_i), represented the independent variables: Age of HH, Amount of camel milk produced in wet season, Amount of camel milk produced in wet season, Number of lactating camel of the HH, Price per liter in wet season, Price per liter in dry season ,Mines of transportation, and Access to extension service.

Basically, the regression analysis is used to test how the model fits and investigate the determinant variables from the given explanatory variables. Finally, the research questions were got their proper answer based on the proposed specific objectives and the regression output results.

The regression result explores whether all the above independent variables equally affect the income or not.

The study before giving more explanation about the determinant factors, primarily, has to test whether other misspecification problems those hindered the quality of the model, due to the formulated frame work, occur or not should be chicken by using ANOVA test. As the result illustrated in the table below, the F-test of the p-value is 0.000 and the significant value is 0.05. Hence, the significance (sig.) value is greater than that of the p-value; therefore, accept the hypothesis which is stated that the model is fitted or good.

Table 4.22:Model determination (ANOVA)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	27004092.563	6	4500682.094	29.253	.000[b]
	Residual	2270642921	148	153855.695		
	Total	4977475.484	154			

a. Dependent Variable: Average revenue(income)
b. Predictors: (Constant), Age of the HH, amount of milk produced for both wet and dry season, price per liter in dry season, number of lactating camel of the HH

Survey result, 2019

Having the above concept in mind, the next question which follows would be how much is the model good. The answer is given by the goodness of fit test (R^2) value. That is, the value of R square used to measure how much of the variation in the dependent variable, income, identified by the repressors. The larger the value of R square, the better it fits.

So, Table4.22displays R, R square, adjusted R square, and the standard error of the estimate. R is the multi-correlation coefficient which is measuring the relationship between the dependent and predictor variables. The values of R range from -1 to 1. The sign of R indicates the direction of the relationship (positive or negative). The absolute value of R indicates the strength, with larger absolute values indicating stronger linier relationship. So, the value of R is 0.737which implies the dependent and the predictors have developed strange positive linear association.

Moreover, as discussed in the above portion, R square is helped to quantify the proportion of variation in the dependent variable explained by the regression model. It is ranged from 0 to 1. Small values indicate that the explainable level of the independent variables to determine the dependent variable is weak. The sample R squared tends to optimistically estimate how well the

models fit for the population. Both R squared and adjusted R square somehow has the same meaning and purpose. But, adjusted R square is applicable for the small numbers of observation (n<30) or numbers of variables (No. of variable <5) (Julie, 2011). So, in the case of this study, the researcher used R square, because the sample size as well the numbers of variables involved in the study were more. In that regard, the R square value in this case is 0.543. This indicated that the eight independent variables of the model accounted 54.3% of the variation over the average revenue (income) (the dependent variable); whereas, the rest 45.7% of the variation can cover by other unknown variable which is not included in the study.

The other misspecification problem which capable to affect the model be identified by the t-test statistics. That is, the researcher checked whether all the factors are equally important to affect the dependent variable or not, by using t-test statistics. If the p-value is lesser than the sig value (0.05), the factor/s are important to determine the model otherwise the factor should be rejected in the model. So four of the independent variables in the model are statistically significance to their unique contribution and they are age of household headed, Amount of camel milk produced per camel in dry season, Number of lactating camels owned HH, Price of camel milk in dry season, where the rest of independent variables are not statistically significant to their unique contributions..

Table 4.23: The determinant income from the sale of camel milk marketing

R = 0.737	**R^2 = 0.543**		**Adjusted R^2 =0.524**	**SE =-392.244**	
Variables	**Unstandardized Coefficients**		**Standardized Coefficients**	**t-value**	**Sig.**
	Beta	**SE**	**Beta**		
Constant	-498.898	233.222		-2.139	0.034**
Age of the household head	-9.009	3.785	-.156	-2.380	0.019**
Sex of the household head	-10.773	72.717	-.009	-.148	0.882
Education level of the household head	-78.076	98.273	-.0045	-.794	0.428
family size	-19.553	17.624	-.095	-1.109	0.269
Amount of camel milk produced per camel in wet season	57.398	37.546	.116	1.529	0.129
Amount of camel milk produced per camel in dry	257.775	75.425	.305	3.418	0.001***

season					
No. of lactating camels owned HH	106.747	35.891	.236	2.974	0.003***
Price of camel milk in wet season in ETB	36.064	22.797	.136	1.582	0.116
Price of camel milk in dry season in ETB	65.734	21.976	.247	2.991	0.003***
Distance to nearest market place (in km)	65.836	37.170	.099	1.771	0.079*****
Access to market information	87.148	100.171	.050	.870	0.386
Access to extension service	-42.963	63.844	-.037	-.673	0.502
Access to credit	-89.959	77.205	-.069	-1.165	0.246
Off/non-farm activities	2.959	69.565	.003	.043	0.966

Source: Survey result, 2019. Note: *** 1% significance level ** 5% significance level *10% significance level.

Dependent variable: Average revenue (income) from sale of camel milk (Y_i)

* Regression is significant at the 0.05 level (2-tailed).

Result of regression analysis presented in table above also provides more comprehensive and accurate examination of the research questions. Therefore, the regression analysis is used to test the developed questions based on the specific objectives and investigate the contributions of the independent variables over the dependent once.

Primarily, the researcher wants to check whether above the independent variables (Age of the household head, Amount of camel milk produced per camel in wet season, Amount of camel milk produced per camel in dry season, No. of lactating camels owned HH and Price of camel milk in dry season), are statistically significant determinant of the average revenue/ income (Y_i) or not. Hence, the result indicated, all are statistically significant associated with the dependent variable average revenue/ income (Y_i) (p-value = 0.001 up to 0.003, < sig. value = 0.05). Therefore, the assumed hypothesis which is stated that the age , amount of milk produced and number of lactating camel are significant important to determine the average revenue or income from the sale of camel milk , i.e., there is evidence that the these variables associated to each other.

As indicated in the previous sections, a number of independent explanatory factors (demographic, socio-economic variables) were postulated to influence of income from camel milk marketing. Out

of fourteen explanatory variables hypothesized to income from the sale of camel milk six were found to be statistically significant when it run to model. These factors include Age of the household head, Amount of camel milk produced per camel in dry season, No. of lactating camels owned HH and Price of camel milk in dry season.

Age of the household head: This variable was related negatively and significantly with income from the sale of camel milk with a 0.05 level of significant. So, after taking the remaining variables as a constant, for a unit increment of age the income from sale of camel milk of the household would decrease by 9.009 Birr.

Amount of camel milk produced per camel in dry season: This variable was related positively and significantly with income from the sale of camel milk with a 0.05 level of significant. So, after taking the remaining variables as a constant, for a unit increment of amount milk produced per camel in dry season the income from sale of camel milk of the household would increase by 257.775 Birr.This finding agree with the previous literatures report Justus, (2016) reported that An analysis of Kajiado during the dry season revealed that there was a significant effect of milk sales on the household monthly income. This could be due to: increased milk sales to meet other basic household needs and the low milk supply attracting a higher milk selling price.

No. of lactating camels owned HH: This variable was related positively and significantly with income from the sale of camel milk with a 0.05 level of significant. So, after taking the remaining variables as a constant, for one lactating camel increment of the household the income from sale of camel milk of the household would decrease by 106.747 Birr.This finding agree with the previous literatures report Holloway et al.,(2002)

Price of camel milk in dry season: This variable was related positively and significantly with income from the sale of camel milk with a 0.05 level of significant. So, after taking the remaining variables as a constant, for unit increment of the price per liter in dry season the income from sale of camel milk of the household would decrease by 65.734 Birr.

CHAPTER FIVE

5. Conclusion and Recommendation

5.1. Conclusion

The study was carried out in Degahbour Woreda, Jarar Zone, and Somali Regional State with the objectives of assessment of camel milk productivity, marketing channel and its effect on pastoralist livelihood in terms of income. Multi stage sampling was used to determine the sample size, the first stage, Degahbor Woreda was selected purposively, second stage, four pastoralists Kebeles were purposively selected and third stage 155 household heads through simple random sampling technique.

Both primary and secondary data were collected for the purpose of this study. The primary data were collected from pastoralist household who involve camel milk production and marketing. Secondary data were collected from internet, reports, books, journals, articles, and public libraries. The data was collected through questionnaire, FGD, KII, field observation. The method of data analysis and interpretation were done by using SPSS and Excel.

Camel milk is means of income especially for the pastoralist community. Therefore, it plays a great economic contribution for pastoralist households. Based on the present finding shows camel milk is source of income and food. In the study area the average camel milk production per day depends on the seasons and availability of feed and water.

The amount of milk productivity in the dry season has a significant impact on the income gained from sale of camel milk. When the pastoralists have more camels those are given a milk product, there are more opportunity to get market demand and fair price.

The main challenges influencing camel milk production included shortage of forage and water scarcity, disease and parasites, high medicament cost, low productivity of grazing land, inadequate access to extension services, and unavailability of credit services. Among these problems shortage of forage, water scarcity and disease and parasites were the extremely savior problems due to depleted drought, erratic rainfall and inadequate animal health extension services.

Camel milk marketing problems were also the real problems in the study area, such problems were lack of transportations, poor infrastructures, price, traditional milk handling technologies and buyers related problems.

5.3. Recommendation

In order to improve the milk sector in in the study area and sustenance pastoralist livelihood development, the researcher suggests the following:

- Development strategies in improving livestock feed should be seen by different stakeholders and NGO's towards improving the quantity and quality of the existing feed resources.
- To improve and enhance the camel milk production, the Woreda livestock and pastoralist development office and other stakeholders should jointly move shoulder to shoulder to introduce a new technology and strength the capacity of pastoralists and agro pastoralists in feed conservation like hay making and silage.
- To eradicate or reduce the prevalence of diseases and parasites in the study area development actors and partners should give due emphasis in improving the veterinary services and provision of quality veterinary drugs for the major diseases.
- Water scarcity was the main problem for both human and livestock in the study areas, therefore community based dams or ponds should be done to reduce water shortage.
- Poor infrastructure, lack of transportations and tradition camel milk handling were the main milk marketing problems in the study area, therefore proper intervention on infrastructure, transportation and providing producers with the necessary equipment and materials for milk handling, processing and storing could help to solve these problems.
- Strengthening marketing information mechanism in a better structured way would enable them to better link with the consumer market.

5.3. Implication for future studies

- The study was conducted in Degahbour Woreda only. There is a need to conduct such studies in other pastoralist Woredas of Somali regional state, which may be quite pertinent and interesting.
- Challenges of camel milk production and marketing in Somali pastoralist should also be investigated.
- Infrastructures and its effect on pastoralist production and marketing should also be investigated.

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7. APPENDICES

APPENDIX 1: HOUSEHOLD SURVEY AND MARKET QUESTIONNAIRE

Enumerator's name----------

Date of interview ----------Starting time ----------

Respondent number ----------

My name is Ayanle Igge, Master student at Addis Ababa University, College of Development Studies. I am conducting a research concerning about **Camel Milk Productivity, Marketing channel and Its Effect on Pastoralists livelihoods: Case of Degahbur Woreda, Somali Regional State.** The purpose of the research is for academic only (fulfillment of the requirement of Master's degree in Rural Livelihoods and Development); hence, your response and collaboration will help me in successful completion of this research. Your answer will not be related to your name and so, it makes you confidential.

I kindly request you to take a few minutes of your time and fill out the questionnaire. Any kind of clarification or correction, do not hesitate to communicate me.

Thank you for your collaborations.

Location Information

1. Woreda/District name ----------
2. Kebele name----------
3. Agro ecology zone----------

APPENDICES

APPENDIX 1: HOUSEHOLD SURVEY QUESTIONNAIRE

Part I

Household demographic characteristics

1.2. Sex of the respondent:

1. Male 2. Female

1.3. Marital status of the HH:

1) Married 2) Unmarried

3) Divorced 4) Widowed

1.4. Education Status of the respondent:

1) Literate 2) Illiterate

1.5. Family size in number:

A. Total family size ---------

B. Number of Male --------

C. Number of Female: ---------

1.6. Age of the household head ---------- years

Part II

Household socio-economic characteristics

2.0. Occupation of the HH?

1. Pure Pastoralist 2. Semi pastoralist (mixed Crop and animal production)

2.1. Number of Livestock kept

S/N	A. Livestock species	B. No. of Livestock	C. Breed Type		
			1. Local	2. Exotic	3. Crosse
1	Camel				
2	Cattle				
3	Goats				
4	Sheep				
5	Poultry				
6	Horses				
7	Donkey				
8	Others				

2.2. Do you sale live camel?

1. Yes 2. No

2.2.1. If yes, what is the reason? _____

2.3. How many live camels did you sale for the last year? _____ (number)

2. 4. What was the unit market price of the live camel during you sold? _____ETB

2. 5. How you spend the income from sale of life camel? _____

2.6. Land Use of Pastoralists

2.6.1. How many hectare of land do you have? Own land _____ (ha),

2.6.2. What is the major usage of your land?

1. For Cultivated 2. For Fallow

3. For Grazing 4.For Rented for Woodlots

2.6.3. Land ownership type

1. Peasant Association gave land 2. Inherited from parent

3. Rented in land 4.Others (specify) _____

2.6.4. Does the land you own is enough for grazing of your livestock?

1. Yes 2. No

2.6.5. If no, what is the reason? _____

Part III

Camel Feeds and watering

3.1. Do you have enough feed for your animal?

1. Yes 2. No

3.2. What are the main feed sources for your Camel?

1. Natural browses (Trees and shrubs) 2.Natural grasses

3. Traditional plant roots, tubers and leaves 4. Non-traditional feed resources

5. Purchased commercial feeds 6. Others specify_____

3.3. What is the source of feed for your livestock during wet season?

1. Own grazing land 2. Communal grazing land

3. Purchased hay 4. Improved pasture/forage

5. Crop residue 6.Industrial by-products

3.4. How are pasturelands owned in your area?

1) Individually owned 2) Communally owned

3) Both

3.5. What was the trend of pastureland for the last 5 years?

1). Increased 2). Decreased

3) Remain the same

3.5.1. If the answer of Q3.5is increase or decrease, state the major reasons. ----------

3.6. What are the main problems of your grazing land to feed your camel?

1) Over stocking 2) Low productivity of grasses land

3) Shortage of land 4) Utilization by other livestock type

5) Grazing land degradation 6) other----------

3.7. What type of water sources you use for camel watering, specify the type of water source, the average distance to the water source?

S/n	type of water source	A. Season of availability ofthe water source: 1. Summer 2. Winter 3. Both	B. Average distance to the water source(Km)
1	River		
2	Well		
3	Supplied tank, pipe		
4	Spring water		
5	Pond		

3.8. How frequently watering your camel?

1) Every day 2)Every other five days

3) Every other ten days 4)Once in month

5) Other specify _____

3.9. Do you think availability of water is a major constraint during the dry period?

1. Yes 2.No

3.10. If the answer for Q3.9 is yes, how did you alleviate the problem? _____

Part IV

Camel milk production and performance

4.1. How many times do you milk your camels per day?

1. Morning only 2. Morning and evening

3. Morning, midday and evening

4.2. How much litter of milk is produced per camel per day in wet season? _____ (liter)

4.3. How much litter of milk is produced per camel per day in dry season? _____ (liter)

4.4. How many months of lactation do you normally have? _____

4.5. How many lactating camel do you have? _____

4.6. How much camel milk you use for household consumption per day in liter? _____

4.7. Does the camel milk consumption increase at home in last year?

1) Yes 2) No

4.7.1. If yesfor Q5.6,what is the reason? _____

4.8. How many times do you use camel milk per day? _____

4.9. How household members use the camel milk?

1) Fresh 2) soured

3) Mixed with other milk 4) Others (specify)……

4.10. Please rank the following most important constraints influencing camel milk production

(1 most important and 7 least important)

No.	**problems**	**A. Rank based on their severity**
1	Feed shortage	
2	water scarcity	
3	Diseases and parasites	
4	High medicament costs	
5	low productivity of grazing land	
6	inadequate of extension service	
7	inadequate of credit service	

Part V

Camel Milk Marketing and Access to Market

5.1. Do you sell your camel milk?

1. Yes 2. No

5.1.1. If your answer for Q5.1is Yes, What is the sale volume in a day? _____ (liters)

5.1.2. If yes Q.5.1. To whom do you sell your camel milk?

1. Rural assembler 2. Retailers

3. Whole sellers 4. Processers

5. Through service cooperatives 6. Others specify _____

5.2. Who sold the milk or milk product at home or market?

1 Male 2. Female

5.3. What is/are the criteria you mostly select the market to sell your camel milk?

1. Price of milk per liter 2. Distance of market for milk

3. Market reliability

5.4. Is the price you sell your milk per liter reasonable price for wet season and dry season?

1. Yes 2. No

5.5. If nofor Q6.4, what are the reasons?

1. No demand for the produce 2.More supply of the produce

3. Lack of access to market 4. Lack of market information

5. Others (specify) _____

5.6. How much do you sell per liter in day? _____ETB

5.7. What is the average revenue (income) that you get from selling camel milk? _____ ETB

5.8. Distance from the nearest market place (in km) _____

5.9. What means of transport do you use to transport your camel milk?

1. Household labor 2. Vehicle

3. Donkey 4. Other, specify_____

5.10. How do you use the income you get from your camel milk?

1. Food for household 2. Schooling for children

3. For buying additional livestock 4. Animal feed

5.11. Do have access of market information?

1. Yes 2.No

5.11.1 If the answer is yes for Q5.11, what is the main information source?

1) Mass media 2) milk-group

3) Neighbor who come from market 4) Others, specify_____

5.12. What other problems did you encountered during your engagement in milk marketing?

1) Price related 2) Buyer related

3) Transport related 4) Infrastructure related

5) Milk handling related 6) others, specify____

Access to Extension Services

6.1. Do you have access to livestock extension services?

1. Yes 2. No

6.2. Do you have access to veterinary?

1. Yes 2. No

6.2. How many times you visit per year?.....

1. Once a year 2. Twice year 3.Three time in a year 4. Above three times ayear

Access to Credit Services

7.1. Have you received any type of credit in last year? _____

1. Yes 2. No

7.2. If yes Q 7.1, for what purpose did you borrow?

1. Livestock purchase 2.To start up new business

3.Household consumption 4. Livestock treatment

5. Social obligation 6. Other, specify….

8.1. Do you use different marketing channels

1.Yes 2. No

8.2. If yes, Q8.2. Which channel do you use?

Channel I**:** Producer –Consumer

Channel II**:**Producer –Retailer- Consumer

Channel III**:**Producer- wholesaler- -Retailer- Consumer

Channel V:Producer -Rural assembler- wholesaler- Retailer-Consumer

Channel VI**:** Producer-Rural Assembler- Retailer-Consumer

Channel VII: Producer -Urban assembler- wholesaler- Retailer- Consumer

Channel IV: Producer-urban assembler-retailer-consumer

Q9.9. Do you involve off/non-farm activities

1. Yes 2.No

APENDIX II

I. FOCUS GROUP DISCUSSION GUIDE

1) What is the main source of livelihood in this area?

2) How is the situation of food availability (main food and frequency)?

3) How is camel herd managed, in terms of grazing, watering, and health?

4 How is herding the camel herd? (Pastoralists or Nomadic)

5) What is the average of camel milk production during the wet season and during the dry season? Do you consume camel milk at home, if yes how many liters per day?

6) What was the major challenge faced in camel milk production last year?

7) How many liters in average do you sale in wet and dry seasons?

8) At what price did you sell your camel milk? Does the price vary between dry and wet season? What are marketing channels you use and how do you select the channel?

9) What are challenges faced in camel milk marketing? How did you overcome them?

10) What is required to make camel milk production and marketing better?

11) What are the possible lists of camel milk marketing channels of your Woreda?Which channel of marketing do you prefer for selling camel milk?

12) What is the average revenue (income) do you gain from selling of your camel milk? And how you expend?

II. KEY INFORMANT INTERVIEW GUIDE

1) What is the situation of livestock production in this area? How is the subsector organized?

2) What institutions exist to support the livestock subsector in area?

3) Is there any specific organization that supports you camel and camel products?

4) Are there any policies or laws that address camel and camel products in terms of regulations?

5) What is the extent of milk production in this area? How milk production is organized?

6) How is milk marketing organized in your area? Who are the actors of the camel milk market?

7) Are there any programs to link producers with the market? Mention them?

8) How can milk production be strengthened and formalized with retailers and milk traders?

9) What challenges are there in camel milk production? What challenges are there in camel milk marketing?

Appendices IV: field observation photos

Field observation

Focus group discussion one

Field observation on water sources

Focus group discussion two