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DEPARTMENT OF PASTORAL DEVELOPMENT STUDIES

**DETERMINANTS OF PASTORAL HOUSEHOLDS' CAMEL MILK MARKET SUPPLY
IN ARARSO DISTRICT, SOMALI REGIONAL STATE**

By:

DEK HUSSEIN MAHAMUD

ADVISOR:

Abebaw Shimeles (PhD)

AUGUST, 2022

JIGJIGA, ETHIOP

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**THIS THESIS SUBMITTED TO THE DEPARTMENT OF PASTORAL
DEVELOPMENT STUDIES, SCHOOL OF GRADUATE STUDIES, JIGGIGA
UNIVERSITY IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE
DEGREE OF MASTER SCIENCE IN PASTORAL ECONOMICS & DEVELOPMENT
STUDIES**

BY:

DEK HUSSEIN MAHAMUD

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AUGUST, 2022

JIJIGA, ETHIOPIA

APPROVAL SHEET OF THESIS JIGJIGA UNIVERSITY

DEPARTMENT OF PASTORAL DEVELOPMENT STUDIES

As thesis research advisor, I hereby certify that I have read and evaluated this thesis prepared, under my guidance, by **Dek Hussein**, entitled with: **Determinants of Pastoral Households' Camel Milk Market Supply in Ararso District, Somali Regional State**. I recommend that it can be submitted as fulfillment of the Thesis requirement.

Abebaw Shimeles

Principal Advisor

Signature

Date

As member of the Board of Examiners of the M.Sc. Thesis open Defense Examination, we certify that we have read, evaluated the Thesis prepared by **Dek Hussein Mahamud** and examined the candidate. We recommend that the Thesis be accepted as fulfilling the Thesis requirement for the Degree of Master of science in Pastoral Development Studies.

Chair Person

Signature

Date

Internal Examiner

Signature

Date

External Examiner

Signature

Date

DEDICATION

I dedicated this thesis manuscript to my beloved wife Aisha Adan Ali and my Aunt Asli Mahamud Kebile, for their showing me the firm ground, nursing me with affection and love, and their dedicated partnership in the success of my whole life.

They have eternal gratitude and appreciation for all they had done for me.

STATEMENT OF THE AUTHOR

First, I declare and affirm that this thesis is my own work and that all sources of materials used for this thesis have been properly acknowledged. I have followed all ethical and technical principles of scholarship in the preparation, data collection, data analysis and compilation of this thesis and any scholarly matter that is included in the thesis has been given recognition through citation.

This thesis has been submitted in partial fulfillment of the requirements for an advanced M.Sc. degree at Jigjig University in Pastoral Development Studies and deposited at the University Library to be made available to users or borrowers under the rules of the Library. I confidentially declare that this thesis has not been submitted to any other institution anywhere for the award of any academic degree, diploma or certificate.

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Name: Dek Hussein

Signature: _____

Place: Jigjig University

Date of Submission: 5/08/2022

BIOGRAPHICAL SKETCH

The author was born on June/21/1991 in aware woreda, Jarar Zone of Somali Regional State.

He attended his elementary and junior secondary education at Degahbour and transferred to jigjig senior secondary School to continue his study from where he finally finished his preparatory education, upon his successful completion of his high school education then he joined Hawassa University in 2011/2012 and graduated with BSc degree in Animal and Range Sciences (ARSc) in 2014.

After long time of his first degree graduation, he joined in Jigjig University to pursue M.Sc. in Pastoral Economics & Development Studies in 2019/2020.

Before he joined Jigjig University for post graduate study in Pastoral Development Studies October, 2019 he was working as Mobile Support Team leader at Pastoral Community Development Project (PCDP-III)



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LIST OF ACRONYMS AND ABBREVIATIONS

ASALs	Arid and Semi-Arid Lands
AWAO	Ararso woreda administration office
AWLRPDO	Ararso Woreda Livestock Resources and Pastoral Development office
BoFED	Bureau of Finance and Economic Development
CSA	Central Statistical Agency
CMM	Camel milk marketing
DRSLP	Drought Resilience and Sustainable Livelihoods Programme
ERCS	Ethiopian Red Cross Society
EMMI	Ethiopian Meat and Milk Institute
FAO	Food and Agriculture Organization
FGD	Focus group discussion
GDP	Gross Domestic Product
HHs	Household Head
IBC	Institute of Biodiversity Conservation
ILRI	International Livestock Research Institute
IPS	Industrial Project Service
KIIs	Key informant interview
MOA	Ministry of Agriculture
PRIME	Pastoral Resilience Improvement through Market Expansion
SC (UK)	Save the children United Kingdom United Kingdom
SPSS	Statistical Package for Social Science

ABSTRACT

The study was carried out in Ararso woreda, Jarar zone of Somali Regional State with the objectives of identifying the factors determining the volume of camel milk market supply, effect of marketing support or institutional factors on volume of supply in the camel milk market and assessing the constraints and opportunities in the camel milk marketing of pastoral households. Multiple stage sampling technique was applied to select the sample. In order to achieve these objectives, cross-sectional data on socio-economic factors, market and institutional factors aspects were collected from 150 sample households heads drawn from four purposively selected kebeles through structured interview schedule and focus group discussion during October and November 2021. Both primary and secondary data were collected for the purpose of this study. The data were entered, manipulated, organized and analyzed using SPSS version 20 and Excel. Both descriptive and econometric statistics were used to identify and determine the household's camel milk market supply. According to the study findings some of the explanatory variables including Household Family size, Age of the household head, number of lactating camels owned by HH, Price of camel milk in wet season and Access to credit services are linearly associated with the volume of camel milk supply to market of pastoral households and statistically affect the household milk supply with a 0.05 level of significance.

Based on the present finding camel is source of income and food. In the study area camel milk marketing for pastoral households plays a great contribution to their life as food and income generating activity. The major constraints of camel milk marketing in the study area were: most pastoralist households travel long distance to sell their milk in the market, lack of transportation facility, shortage of milk packaging materials, lack of demand and lack of market or collection center. On the other hand, during the focus group discussion the participants stated that, there are other problems which were encountered during engaging in milk marketing like: lack of access to market, price fluctuation, and poor access of transportation, infrastructures, and milk handling materials and buyers related problem.

Key words: Camel milk, constraints, camel milk market supply, Pastoral Households, opportunities.

CHAPTER ONE

1. INTRODUCTION

1.1 Background of the study

Camel dromedaries are the most efficient animal species for using marginal areas in arid and semi-arid regions, and they thrive and produce better than other livestock species in these environments. Many pastoral communities in a variety of eco-zones across the world rely on camels for their livelihood. This dependency is based on household consumption of camel meat, milk, leather, and wool, as well as the use of camels as packing, transport, and riding animals (Tadesse et al., 2014).

Pastoralism is a culture and a production style in Africa, especially in the Horn of Africa, in which pastoralists rely on their livestock (camels, sheep, goats, and cattle) and migrate seasonally depending on rainfall and pasture availability. Many researchers have described pastoralism as a proud livestock-based production system that is largely comprehensive in nature (HATFIELD & DAVIES, 2006; MUKHERJI et al., 2017).

Camels are multifunctional animals used in East African pastoral production systems to provide milk, meat, blood, hides and skins, transportation, barter trade (sale and exchange), and social and cultural roles (Kaufman and Binder, 2002). According to the Food and Agriculture Organization (FAO, 2012) reports, camel milk could become a \$10 billion annual global market with improved packaging and more spending, and that camels yield more milk as compared to cattle and small stock in the same harsh environmental conditions, and that lactation continues long into the dry seasons and seldom ends even during the rainy season.

Ethiopia is home to Africa's largest livestock population, and it is the continent's top livestock producer and exporter. While domestic demand for animal products is growing in Ethiopia, led by the urban middle and upper classes, export capacity is the driving force behind livestock expansion and intensification (MacDonald et al., 2011). The one-humped camel (*Camelus dromedarius*) plays an important role as a primary source of subsistence in the lowlands of Ethiopia, where it inhabits arid and semi-arid environments that are unsuitable for crop production and where other livestock species struggle to survive (Seifu, 2009).

The livestock subsector in Ethiopia is less productive in general, and its direct contribution to the national economy is small compared to its capacity. The key contributors to low productivity are the animals' poor genetic capacity for productive characteristics, together with the animals' susceptibility to substandard feeding, health care, and management activities (Zegeye, 2003). The lowlands are primarily characterized by low rainfall, high temperatures, low forage yield, common plant connections, livestock and human carrying ability, and the occurrence of important livestock diseases and parasites. In the past, most dairy sector development interventions focused on increasing production, especially in so-called high-potential areas, with less attention paid to input supply and marketing systems, and government engagements focused on input supply-oriented services aimed at addressing problems limiting increases in milk production, with little attention paid to the development of a dairy industry as a whole. In general, enhancing the marketing system is vital to increasing production (Tsehay, 2002).

Camels play a central role in providing draught power, meat, milk, and determining pastoralists' wealth and social status (R. Behnke, 2010). More than 80% of the camel population inhabits Africa, with 60% in the eastern African countries (Sudan, Somalia, Ethiopia, Kenya), which are important exporters of dromedary camels to the Arabian Peninsula and Egypt (Faye, 2015). Ethiopia hosts about 4.8 million heads of camels found in the arid and semi-arid regions of the country. This number ranks third in Africa after Somalia and Sudan, and fourth globally (FAO, 2019).

Afar, Somali, Oromo (Karayu, Gabra, Boran, and Guji groups), Kunama, and Irob people are some of Ethiopia's major camel-keeping communities. Over generations, the Afar and Somali peoples have been recognized for their camel-keeping traditions. On the other hand, the Boran and Guji pastoralists have just lately begun camel rearing. The Gabra and Somali people, who have kept camels for generations, are said to have played a key role in bringing camels to the Borana Plateau (Coppock, 1994).

Agriculture dominates Ethiopia's economy, accounting for nearly 42% of GDP, 85% of exports, and 90% of the labour force (CSA, 2018). The livestock sub-sector is a vital component of agricultural production that has contributed a substantial portion of the country's economy and continues to pledge to rally around the country's economic growth. Livestock accounts for about 39% of agricultural GDP, 17% of overall GDP, and 13 % export earnings (Shapiro et al., 2017).

Livestock production contributes greatly to pastoral livelihoods, consumption goods, household income, and increased food security. Camels, among other animals, are a valuable commodity in Ethiopia's drylands, where they are used to improve people's lives and livelihoods. Because camels are the large mammals capable of surviving in the arid lowlands, Somali pastoralists rely on them for milk, meat, transportation, and wealth. Despite the fact that Ethiopian pastoralists raise a substantial number of camels, official polls estimate that Ethiopia's overall camel population is possibly underestimated. Since pastoralists have been overlooked in the past, the unique geographical, fiscal, social, and cultural fabric of this biosphere is less well known to the outside world, even to many Ethiopians (TEFERA et al., 2013).

Livestock production is important to pastoralists' economies because it is a major source of household resources and provides end products such as milk, meat, hides and skins, as well as transportation. On the other hand, camel producers' problems are very dynamic and complicated with policies and organizations relevant to the sector; these are not technological challenges (Too et al., 2015). Camels produce an extraordinary amount of milk considering the harsh environments under which they are housed. Compared to cattle and small stock in the same harsh environmental conditions, camels yield more milk, and their lactation lasts well into the dry seasons, rarely ceasing even during long dry spells. Camel milk is favoured over milk from other animal species due to its flavor, nutritional value, and health benefits. It is often claimed that camel milk protects people from being thirsty even while walking long distances. Surplus camel milk is often exchanged for cash by members of the family, depending on the market's accessibility (Kaufman and Binder, 2002).

The Somali regional state has vast lowland, arid to a semi-arid climate where pastoral and agro-pastoral livelihoods are dominant. The region is one of the richest in terms of livestock resources, and livestock is the main source of food and means of income for the majority of the people. The region has huge livestock resources, estimated to have 23.6 million heads of livestock like Cattle, sheep, goats, and camels are the main productive livestock reared. Livestock and their production are the major sources of income and the major source of livelihood base of the population in the region. However, the production is very traditional and not market-oriented. Moreover, widespread diseases, the inadequacy of animal health structures and professionals, range land degradation, lack of adequate livestock markets, livestock trade

bans, and the absence of abattoirs and quarantine systems are still the major challenges for the development of the livestock sector(ERCS, 2013).

Somali pastoralists much favour camels' milk over other animal of milk because pastoralists claim that camel milk is healthy, thirst quenching, readily digestible, and can be stored for a longer period (Tezera, 1998). Camel milk is the main source of nutrition for Somali camel pastoralists. As a result, the majority of Somali camel herders' husbandry and management activities are oriented toward increasing camel milk production and ensuring a steady supply of milk for the family during the season(Mohamed, 1993).

1.2 Statement of Problem

Pastoralism is the most common milk-producing method in the lowlands. Milk production is poor and strongly affected by seasonal fluctuations due to low rainfall, feed shortages, and water supply(IPS, 2000; Tsehay, 2002). The pastoralist production scheme is not market-oriented, and the majority of the milk produced is kept for domestic consumption or processing(Ahmed et al., 2003). Traditional technology is commonly used to process things like butter, ghee, ayib, and sour milk. After households have met their needs, milk and milk products are typically sold on the local market(Tsehay, 2002).

The level of camel milk production, and thus the availability of milk for sale, depends heavily on rainfall and pasture conditions and varies strongly between seasons and years. Moreover, the decision to sell camel milk is influenced by availability of cow and goat milk for household consumption, and on the availability of alternative sources of cash income (migrant labour, sale of livestock and grain). In the area, there is only a market for camel milk, but cow milk can be processed into ghee (subag) for sale(Herren, 1990).

Camel milk has a high nutritional value and plays an important role in feeding Ethiopia's agricultural, ago-pastoral, and urban populations. Milk and milk products are produced on a daily basis and either sold or processed for cash. It is a source of cash in milk shed areas that allows families to purchase other foodstuffs, thus contributing significantly to household food welfare(MOA, 2001). The Ethiopian milk marketing scheme, on the other hand, is underdeveloped (Holloway et al., 2002; CSA, 2005;Woldemichael, 2008). This can be seen in the fact that only 5% of milk produced in pastoral areas is sold as liquid milk. This has made it

difficult to sell fresh milk in areas where transportation and related resources are scarce and market networks are yet to be established(Getachew, 2003).

Pastoralists in Ethiopia's eastern lowlands depend on camels for their subsistence, and the majority of these camels are found in the country's east. Despite a large number of camels in Ethiopia, camel productivity is generally poor, and the camel has received little attention in terms of research and development. Until recently, there has been no development initiative in the world that includes the camel, nor has it received any recognition in conjunction with other livestock development programs(FAO, 2002).

Pastoralists and agro-pastoralists in Somali Regional State depend on livestock and livestock production for their livelihoods, with livestock production being the primary occupation of pastoralists, who make up a large portion of the region's population. However, livestock production was disrupted by a feed shortage caused by recurrent droughts, which impaired both feed quality and quantity, resulting in body weight loss, disease tolerance, and animal injury. Among other things, promoting camel husbandry has increased food security for many pastoralists. The problem was and continues to be providing affordable services to a community that is constantly on the move. Only lately has there been a greater focus on study in the field of rangeland and pastoral development systems(Tilahun et al., 2020).

Camel milk is one of the basic income, food, and other socio-economic and cultural needs for pastoral and agro-pastoral dwellers in the region. Despite camel milk's considerable contribution to food security in the semi-dry and dry zones, it is a major component of the pastoral systems in vast pastoral areas in the Somali regional state. Based on the literatures reviewed as researcher, the most reviewed literature pay particular attention cow dairy production of the country but there are some researches were conducted about camel milk production, productivity, marketing, marketing channels, camel milk value chain of the region (Simenew et al., 2013, Gebremichael et al., 2019, Igge, 2019), till it seems there is limited information on the determinants of Pastoral Households' Camel Milk Market Supply, especially in the Ararso District, was very limited. Therefore, considering this gap, the study was aimed to generate information for policy makers, development planners, and others for a focused intervention to improve the welfare of pastoral households through increasing the milk market participation of camel producers and camel milk supply.

1.3 Objectives of the study

The general objective of this study was to identify the factors influencing pastoral households' camel milk market supply and examine camel milk marketing constraints and opportunities in the Ararso district, Somali Regional State.

Specific objectives of the study were:

Based on the above general objective, the study has the following specific objectives:

- ❖ To identify the factors determining the volume of camel milk market supply of pastoral households in the study area.
- ❖ To examine the effect of marketing support or institutional factors on volume of sales in the camel milk market in the study area.
- ❖ To assess the constraints and opportunities factors in camel milk marketing in the study area.

1.4 Research Questions

1. What are the factors that influence camel milk market supply of pastoral households?
2. What are the major constraints and opportunities of camel milk marketing in the study area?
3. What are the effects of marketing support or institutional factors on volume of camel milk market supply in the study area?

1.5 Research hypothesis

The following hypotheses were formulated for the study.

Hypothesis 1: There is no significant relationship between marketing factors and volume of camel milk supply in the market.

Hypothesis 2: Socio-economics factors have a negative effect on the Volume of camel milk supply in the market

Hypothesis 3: marketing support or institutional factors have a positive effect on the Volume of camel milk supply in the market.

1.6 Significance of the study

The result of this study is very important to camel producers of the region in general and Ararso District in particular. It will help other researchers as a source of information and also will help invertors engaged in this production sector, government policy makers to undertake different projects that can enhance the sustainability of camel milk production. Moreover, this study will help national and international organizations know more about camel milk marketing participation and sales volume in the study area.

1.7 Scope and Limitations of the study

Geographically the scope of this study was conducted only in Ararso District of Somali regional state, one of the 93 Districts of the region. Therefore, the result and data obtained through this study cannot be generalized to other districts of the region because their socio-economic conditions may be different. In addition to this scope, the study was limited due to time and financial constraints, the scope of this study was limit to determinants of Pastoral Households' Camel Milk Market Supply and it was undertake geographically four kebeles of which are delimited to the camel milk marketing in Ararso District of Jarar Zone which is located in the south-Eastern part of Somali regional state.

1.8 Definition of Key Terms

Pastoralists: production systems and communities who use them in which livestock or livestock-related activities contribute approximately 50% or more of gross household income(Noor, 2013).

Milk marketing: is the process of informing people about the value of a product or service. It's a crucial business function for acquiring new customers. Marketing is the relationship between a society's material needs and its economic reaction patterns from a social perspective. Through economic cooperation and long-term partnerships, marketing meets these requirements and goals. Positioning refers to the process of expressing the value of a product or service to customers(Dokata, 2014).

Market participation: is defined as "any market-related action that supports the sale of produce" (Key et al., 2000). In this study, however, market participation refers to the pastoral household's supply of camel milk in the milk market. As a result, camel milk market participants are households that supply camel milk to the market.

Market: The term "market" refers to a group of buyers and sellers who interact and have an impact on price. However, the existence of a market does not guarantee that an exchange will take place, and there must be a route. Milk production is seasonal in pastoral regions, while demand is year-round(IPS, 2000).

Marketing: is the practice of all daily operations involved in the flow of products and services from the stage of original production until they reach the hands of ultimate customers is referred to as marketing. A marketing system is a set of channels, middlemen, and commercial activities that make physical distribution and economic exchange of products and services easier (Kohls and Uhl, 1985).

Milk Production: the mammary epithelium secretes milk, which is referred to as milk production. The natural diet of young mammals is made up of the fluid secreted by the mammary gland(Dokata, 2014).

Household: a household is defined as a self-sufficient male or female producer and his or her dependents. Who must have shared a household for at least six months? The members report to a single individual who serves as the leader, and they all dine together (Ellis, 1993).

CHAPTER TWO

2. LITERATURE REVIEW

2.1 Pastoral Livestock Production Systems in Ethiopia

This system is broadly defined as a way of life and as a socio-economic entity based primarily on livestock production by utilizing the available scarce range resource. This is also the cyclical seasonal movement of herds in synchrony with the rainfall regime to exploit the forage and temporary water resources in an agrarian area whose stockmen have the technical mastery by custom certain rights(Pagot, 1992).

It's difficult to generalize about livestock production systems in Ethiopia because of the country's diverse geography, climate, and cultural conditions(Alemayehu, 1987). Several researchers used several criteria to define livestock production systems in Ethiopia. However, based on the integration of livestock and crop production, amount of input and intensity of production, agro-ecology, and market orientation, roughly five production systems have been identified. The systems described below have been defined: Pastoral, agro-pastoral, mixed crop-livestock farming, urban and peri-urban dairy farming, and specialized intensive dairy farming systems are all examples of specialized intense dairy farming systems (Mohamed et al.,2004; Yitaye, 2008).

In the lowland agro-ecological setup with pastoral production system, livestock do not provide inputs for crop production but they are various backbone of life for owners, providing all of the consumable saleable outputs and, in addition, representing a living bank account and form of insurance against adversity(Coppock, 1994).Pastoralists' livelihood is mainly dependent on livestock and livestock products under this system, which is characterized by sparsely inhabited pastoral rangelands. Goats, cattle, sheep, and camels are the most common livestock in this system. Because milk is the primary source of nutrition, pastoralists seek to manage large herds to assure a constant supply of milk and gain income(IBC, 2004).

2.2 Camel Production System

Camels have traditionally been used in big and transportable production operations. As a result, rather from being an inefficient land use system, nomadism is a smart solution to the usage of resources that are extremely changeable in quantity and quality through time and space(Wilson, 1998). Pastoral resource use patterns are based on risk spreading and highly flexible mechanisms

such as mobility, common land ownership (a necessity for mobility and, hence, nomadism), big varied herd sizes, and herd separation and splitting, among others(Farah, 1996a).

Traditional livestock production systems (pastoral nomadic, pastoral transhumant, agro-pastoral, and smallholder mixed crop-livestock) and modern livestock production systems (ranching, intensive/semi-intensive peri-urban/urban, feedlot, and commercial production) can be broadly classified in Ethiopia. Camels are mostly used in pastoral and agro-pastoral production systems, with only a few males found in mixed crop-livestock systems(Mirkena et al.,2018).

Pastoralists preserve indigenous breeds/types and rely on livestock and livestock products for more than half of their income. The method is easier than the highlands' mixed crop-livestock systems, and it requires very little inputs aside from labor. Herd and flock composition is managed to some extent (just a few breeding males are kept); pasture management and herd movement are determined by seasonal rainfall patterns and water availability. Crop cultivation has little or no impact, and while a variety of livestock species are managed to decrease risk, one or two species dominate. Camels and goats, for example, are the most common animals in Afar and Somalia, but cattle are still the most common in the Borana zone. Camel populations have increased in pastoral regions by at least 10, 20,25,15,25, and more than 200 percent in Gode, Jijiga, Shinille, Mille, Amibara districts, and Borana zone, respectively, during the last 20 years. During the same period, the cattle population in these regions fell by 50 to 70 percent(Tadesse et al., 2013).

2.3 Milk Production in Ethiopia

Milk production systems in Ethiopia can be divided into two categories: commercial and subsistence. Commercial milk is produced primarily for the consumer, while subsistence milk is produced primarily to satisfy household demands for milk products. The commercial scheme exists mostly in urban and peri-urban areas, with or without feed production land holdings. Pastoralists, agro-pastoralists, and mixed crop-livestock farmers make up the rural milk production system, which is part of the subsistence farming system. They are divided into four main structures. There are four types of milk production systems: pastoralist, highland smallholder, urban and peri-urban, and intensive milk production(Azage et al., 2003).In Ethiopia, cow milk is the primary source of milk production, but small amounts of goat and camel milk are also used in some areas, especially in pastoralist areas(IPS, 2000).

2.3.1 Pastoral Milk Production System

Pastoralist milk production is a method mostly seen in rangelands, where people adopt animal-based lifestyles that cause them to travel from place to place seasonally depending on feed and water availability. Despite the fact that data on actual numbers and distribution varies, it is believed that pastoral regions house roughly 30% of livestock populations. The pastoralist livestock production system, which sustains an estimated 10% of the human population, covers 50- 60% of the total land, with most of it located below 1500 meters above sea level(Belete, 2006).

Pastoralism is the most common milk production system in the lowland areas, but milk production is poor and highly seasonal and range situation-dependent due to the rainfall pattern and associated lack of feed availability (Zegeye, 2003;Ketema and Tsehay, 2004). Pastoralists traditionally rely on milk for food and also save money through the use of livestock. This system is not market-oriented, and the majority of the milk produced is kept for home consumption. The amount of milk surplus is determined by the household's and its neighbours' demand for milk, the herd's ability to produce milk, the production season, and proximity to a local market(Getachew, 2003).After households have met their needs, the surplus is mainly processed using traditional methods, and processed milk items such as butter, ghee, cottage cheese, and sour milk are typically sold via the informal market system(Tsehay, 2001).

2.4 Camel Milk Production in Ethiopia

Camel milk is one of the most significant dairy products traded in pastoral and agro-pastoral areas of Eastern Ethiopia; camel products have a global market potential of \$10 billion per year. Ethiopia, however, while being the third-largest country in terms of camel population and milk production after Somalia and Sudan, is unable to fully profit from worldwide camel product marketing(FAO, 2011).

Their significance as a source of milk is especially important during droughts, which deplete the milk production of most other animal species. Camel milk is extremely nutritious containing niacin, Vitamin C five times higher than cow's milk, ten times the iron and very high calcium level. It also includes only 2% fat molecules bound to protein, so there is no stress on the liver to process fats. Camel milk is considered a complete food and can be consumed exclusively meeting all nutritional requirements for the pastoralists(Agrawal *et al.*, 2005).

2.4.1 Camel milk yield and lactation length

Camels produce more milk for a longer time than any other milk animal kept in the same severe conditions (Farah et al., 2007). Milk is the most significant camel product in Eastern Africa's arid and semi-arid environments, and camel milk is a good food source for humans in this area, with a total dry matter content of 30%. Camel milk contains 12 to 15% fat, 2.7 to 4.5 percent protein, 2.9 to 5.2 percent fat, and lactose up to 5.5 percent. It also has a high amount of vitamin C, which may reach 2.9 mg/100g, which is especially important in areas where plant-based foods are scarce. Milk yield estimates, whether daily yields or lactation yields, vary greatly. Daily yields range from 3.5 to over 20 liters, with yearly lactation outputs ranging from 800 to over 4000 liters and lactation durations ranging from eight months to over two years (Schwartz and Walsh, 1992).

Mirkena *et al.* (2018) reported that lactation lengths can be easily recorded or estimated under any production conditions and Camels are known for their longer lactation periods even in the worst years. Estimates abound for all Ethiopian camel populations and estimates of mean lactation periods are about one year almost for the entire populations and values ranging from as low as six months to as high as two years. Estimated daily milk yields for camel populations in various Ethiopian areas range from 1 to 10 kg, with lactation yields ranging from 1,244 kg for the Shinille population to 2,040 kg for the Jijiga population see (Table 2. 1).

Table 2.1: Estimates of Camel milk yield and lactation length of Ethiopian camel ecotypes

Parameter	Estimates	Location	References
Milk yield, kg/day	8 to 10	Ogaden, Somali	Wolde1991
	2.92 (2.7 to 4.92)	Afar and Somali	Tadesse et al. 2015a, b
	4.14 (1.26 to 6.77)	Erer, Somali	Bekele et al. 2002
	5.2 (1 to 10)	Jijiga and Shinille, Somali	Eyasu 2009
	6	Borana	Megersa et al. 2008
	4 (3 to 5)	Jijiga, Somali	Sisay et al. 2015
	6.57	Borana, Oromia	Dejene 2015
	3.75	Erer valley, East Hararghe	Mekuriaw 2007
Milk yield, kg/lactation	2009	Jijiga, Somali	Tezera and Belay 2002
	1244	Shinille, Somali	Tezera and Belay 2002
	1585	Afar and Somali	Tadesse et al. 2015a, b
	1422	Erer, Somali	Bekele et al. 2002
	2040	Babille and Gursum, Somali	Sisay et al. 2015
Lactation length, months	14	Ogaden, Somali	Wolde 1991
	13.76 (10.75 to 19.4)	Afar and Somali	Tadesse et al. 2015a, b
	11.51 (6 to 24)	Somali	Keskes et al. 2013b
	12	Afar	Keskes et al. 2013b
	12 (7.5 to 18.9)	Erer, Somali	Bekele et al. 2002
	12.7 (6 to 24)	Jijiga and Shinille, Somali	Eyasu 2009
	13.85	Babille, Somali	Sisay et al. 2015
	12.53	Gursum, Somali	Sisay et al. 2015
	13.38	Borana, Oromia	Dejene 2015

Source: Mirkena et al.(2018)

2.4.2 Camel Milk Utilization

Camel milk is an essential element of a household's diet in an environment that can be accurately described as unfriendly in terms of temperature, and its contribution to a good nutritional status, particularly during droughts and pasture shortages, is undeniable (Demissie et al., 2017).

Nomadic pastoralists in Ethiopia's eastern lowlands raise a variety of livestock species, each for a specific purpose. Camels, cows, goats, and sheep are among the domestic animal species kept by pastoralists for milk production in the studied area. Camels and cows are the most common milk-producing animals in the area, with cow, camel, sheep, and goat milk ranking first, second, third, and fourth, respectively, in terms of preference (Seifu, 2007).

According to pastoralists, each species' milk has its own distinct characteristics and qualities. Pastoralists argue that camel milk is preferable than other animals' milk. They offered a variety of reasons for preferring camel milk to milk from other household animals. Cow's milk makes humans fat; in other words, it produces obesity; nevertheless, camel milk provides strength, endurance, and stamina, which pastoralists require to live a nomadic lifestyle. Camel milk, unlike cow's milk, contains therapeutic properties and may be used to cure a variety of human ailments. Furthermore, pastoralists think that camel milk has a long shelf life, is nutritious, contains more vitamins, is simpler to digest, and quenches thirst. Cow and sheep milk, according to the informants, is sweeter and has a higher fat content than camel milk, making it appropriate for butter production (Knoess, 1979).

The utilization of the milk is primarily determined by community needs and other cultural traditions, however selling camel milk was not a widespread practice in Afar culture. Milk is a basic meal for the majority of Ethiopian pastoralists, indicating the camel's importance in the region. As a result, compared to other animal products, camels made a little contribution to immediate and direct household income. Despite the importance of camel milk to pastoralists' lives in Afar, the government and commercial sectors have yet to fully explore the potential and marketing of camel milk in comparison to cow's milk (Tadesse et al., 2013).

The proportion of household camel milk consumed is determined by pastoralists' access to the market, the number of milking animals, seasonal climatic fluctuations, the amount of milk produced, and the number of neighbors and relatives with inadequate numbers of milking

animals. Camel milk is solely consumed by Muslims in Ethiopia; no Christians consume it. As a result, the Muslim pastoral populations of Afar and Somalia make extensive use of it (Tefera et al., 2012).

Camel milk has been used to cure diseases caused by chronic liver problems like jaundice, oedema and swelling of the belly (Haddad, 2006). Camel milk is used against gastritis, asthmatics, tuberculosis, urinary problems, hepatitis, jaundice, constipation and diabetics in Ethiopia (Mehari et al., 2007).

2.5 Camel Milk marketing in Ethiopia

Pastoral camel production systems are mostly based on subsistence-oriented. Milk is the traditional product, which is mostly utilized within the family. The scenario enables for some milk sales to be used to buy cereals and other essential foods (Noor, 2013).

In Ethiopia, almost all milk and milk products are sold locally, and there is no significant export market. Dairy products are imported from other countries, and import values increased from around \$5.6 million in 2005 to 10.3 million in 2009 (Yilma et al., 2011).

Market service is critical for every community's livelihood improvement since it is a place where animal and agricultural goods are exchanged, giving producers a hand and inspiration while also allowing them to exchange what their households require. Camel milk production is a source of income for farmers, as the majority of them rely on it for their daily bread. Milk is an important source of food and income for pastoralists and agro-pastoralists. The sale of live animals and its products, especially sales of milk are the main sources of income for pastoral community. In pastoralist milk production depend on season and availability of feed and water (IGGE et al., 2020).

Camels are the most important signifier of wealth and determinant of status in pastoral communities; their milk has been mostly used for domestic purpose. Sale of milk was considered as "*Haram*" a taboo. However these days the sale of camel milk is on the rise partly due to settlement of pastoralists and consumer demand for camel milk, by economic factors and a break in traditional beliefs that selling camel milk causes a decline in milk production of the herd. Milk marketing is traditionally done by women and the key actors involved in the milk market chain are the producer, the trader and the consumer and all sectors are dominated by women and their

organization is along kinship lines. Milk products found in the market include fresh camel milk and fermented camel milk (Susac). Milk is not processed except ghee made out of goat or cow milk. Camel milk is the most preferred in Afar and Somali regions and it fetches the highest price and has the highest turnover irrespective of the season(Tefera & Abebe, 2013).

When it came to buying and selling camel milk, there was no systematic standard or grading system. Local camel milk merchants, on the other hand, can distinguish quality by testing the milk. The milk marketing system for camel milk was mostly traditional, fragmented, seasonal demand was weak, the price was poor, and there was little value added throughout the milk chain. Furthermore, camel milk was of low quality, and microbial contamination of camel milk occurred along the value chain while being transported in Eastern Ethiopia(Mulugojjam et al., 2013).

In Ethiopia, the camel milk sector is not that developed. Some agents involved in camel milk production and marketing such sectors are found in Somali and other pastoral areas. However, there are no agents in the camel milk sector in the Afar region, and the production and marketing activity is not well developed yet. Most of the camel milk sold to restaurants, cafes, householders and drivers for making tea or for direct consumption by their customers. In addition, to that, the producers also used the milk for personal home consumption. The camel milk marketers gather an income by selling their milk to consumers. Selling and gathering an income can make camel milk producers and marketers better living standards(Mebrahtu et al., 2017).

Camel fresh milk is distributed through both 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(Siege Field, 2001).

Recently, Camel milk marketing (CMM) is a developing women's enterprise to ensure food security, generate some income, and provide a buffer to cope with critical situations. It is an entirely private enterprise revolving around a trust system (money is paid after milk is sold) and operating without any formal institutional frame. CMM relies upon networks of people and organizations (the marketing agents) that create complex relationships and engage in a variety of socio-economic activities. These milk marketing networks materialize in specific 'corridors'

through which commodities, services, information and people are flowing in combined but contrasting directions so as to satisfy the needs of both pastoral and urban communities (Abdi, 2010). 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 Hussein Abdullahi, 1999 on Michael, et.al 2006).

2.6 Major Constraints of Camel Production

A 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.

Camel production is still facing several challenges to flourish as it should be. Among the major challenges emerging and re-emerging disease, feed and water shortage, encroachment of vegetation with non-edible bushes, calf mortality, abortion storm, recurrent drought, tribal conflicts, civil wars in the camel rearing areas, a human settlement which limits free movement of the camels played significant hindrance to the camel production sector. Land degradation in arid and semi-arid areas resulting from various factors, including climatic variation and human activities is creasing. Rangelands are severely degraded with most of its palatable perennial grasses and shrubs dramatically reduced. It is important to reverse the degradation processes by adopting a strategy for natural resource management systems. This strategy should be holistic and promote self- sufficiency of the desert people and provide means that ecosystems may be fully utilized on a sustainable basis (Melaku, 2014).

In Ethiopia, studies have been conducted pertaining to the production constraint and reported long lists of diseases as the main bottle neck among the camel rearing pastoral society. The diseases include trypanosomiasis, camel pox, ecto-parasite and balantidiasis (Tefera and Gebreah, 2001).

There are also other emerging and re-emerging diseases, including sudden death syndrome and Middle East respiratory syndrome, which affect many camels in Ethiopia (Dawo, 2010). Today,

livestock grazing affects more than 90% of the land on the Arabian Peninsula and rangeland degradation takes place (Peacock et al., 2003; Gallacher and Hill, 2006). A shift from nomadic to sedentary farming led to an increasing demand for natural fossil water resources because the number of camels and the fresh water irrigation of camel fodder plants increased with unchanged grazing areas of the natural vegetation in the pastoral areas of Ethiopia.

Despite the benefits that African pastoralists get by producing camels, their camels are vulnerable to different challenges such as camel diseases, drought, rustling and predation which expose the pastoralists to risks of losing their camels which are sources of their livelihoods (Selamawit, 2014). For instance, Njuki et al., (2011) has stated the major challenges associated with camel production in the pastoral areas of east Africa to be predation, drought and camel diseases.

As a major challenge to camel production, drought can be attributed to loss of pasture and drying up of water sources during dry periods, which results in the camels suffering from dehydration, starvation, and eventually, they would die. It may also lead to encroachment of wildlife protected areas leading to increased camel predation, especially at the grazing fields and watering points (Onono et al., 2010). Similarly, Eyassu (2009) has also found the major constraints associated with camel production in his study areas: feed shortage and prevalence of the disease. Furthermore, he stated that, as a consequence of these problems, camels in the study areas feed exclusively on unimproved perennial natural vegetation of low nutritive value and they are not given supplementary feed.

According to IGGE et al. (2020), the primary problems impacting camel milk production are a lack of fodder and water, disease and parasites, high medicament costs, low grazing land productivity, insufficient access to extension services, and the lack of finance services. The highly serious issues attributable to depleted drought, irregular rainfall, and poor animal health extension services included shortages of feed, water scarcity, and disease and parasites.

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).

2.6.1 Camel Milk Marketing Constraints

Though pastoralists are generating their income from milk and milk products, the milk product supplied to the market is very limited. In addition, milk collection, processing and marketing are not yet developed to increase pastoralist's income. Lack of access to markets for pastoralists due to their remote location also limits their incentives to supply fresh milk for the market. The absence of modern dairy processing technology in pastoralist areas has limited the value adding option of pastoralists on milk and milk and milk products to enhance their income and minimize milk spoilage and loss. In general, the existing milk and milk products marketing chains in pastoralist areas are often characterized by poor marketing facilities and services that limit pastoralists' market integration and marketability of their milk products(Land O'Lakes Inc, 2010).

No transport service satisfies the demand of camel herders to deliver their milk long distances to markets. Hence, camel herders are obliged to sell their goods at the farm gate. Underdeveloped marketing infrastructure has compelled the women in the Somali region to sell their milk along the roadsides. Poor infrastructure also contributed to the absence of traditional milk value addition as compared to the Kenyan pastoral systems(Noor et al., 2013).

Lack of quality control of milk, lack of cooling and storage facilities at milk vending sites, poor quality of milk supplied from rural areas, sale of raw milk, inappropriate milk handling and storage vessels and spoilage of milk due to lack of preservation and processing facilities are constraints related to milk (Eyassu and Doluschitz, 2014). Similarly, (Lumadede et al., 2010)reported that seasonality of milk production, milk spoilage, lack of milk collecting facilities and processing, and poor hygienic standards are major challenges in raw milk marketing. Seasonal variation in camel milk production in pastoral production systems is great and it is believed that some surplus milk is wasted during the rainy seasons when production is high(Agrawal et al., 2013).Despite some awareness of the risks, unhygienic practices along the chain frequently lead to spoilage of milk, rejected by traders and consumers(Lumadede et al., 2010).

Some constraints to milk marketing are poor infrastructure (roads, transport, market building) and lack of cooling systems. There is no value addition in the market chain, like pasteurizing, packing and churning(Tefera et al., 2013).

Farah et al., (2004b), identified the main constraints of this emerging milk market as, (i) poor hygienic quality of the commercialized milk, and (ii) lack of milk processing technologies to improve shelf life and expand production and sales.

Access to marketing is an important factor that allows producers to obtain a fair price for products, and market information is a critical component of any marketing effort. As a result, the researcher looked at modes of transportation, storage facilities, and material-related issues that impact camel milk marketing. Due to limited transportation access, a shortage of energy and storage resources (handling and storage materials), a lack of market knowledge, and price instability, market access severely limits opportunities for income generation. Because of the harshness of the environment, farm gate prices have remained low, with reduced returns on labor and capital. Such problems may be seen in the difficulty of fresh milk marketing, where transportation and infrastructure are severely constrained (IGGE et al., 2020).

The level of milk spoilage was very high in the study areas. As a result, on average milk producers had been facing milk spoilage and loss of milk supplied at a rate of 1.14 and 1.08 times in every month, respectively. In a southern cluster, pastoralists faced more serious marketing related problems in terms of milk spoilage (1.26 times per month), delayed payments by traders (1.50 times per month), loss of money while sending through informal channels (1.53 times per month), low price of fermented milk (1.30 times per month), milk rejection by customers due to quality problems (once per month), loss of milk supplied to customers (twice per month), milk not supplied due to insecurity (once per month) and lack of buyers (once per month) (Desalegn et al., 2016).

According to Jabbar et al., (1997), poor preservation and processing techniques and physical infrastructure like road and marketing facilities are limited camel milk marketing. Similarly, Ahmed (2002) conducted a study that indicated lack of road infrastructure to transport milk from pastoralist areas (remote areas) was the major constraint in the Afder zone.

Technical training and financial support are provided by the Ethiopian Meat and Milk Institute (EMMI) and the Pastoral Resilience Improvement through Market Expansion (PRIME) initiative to help pastoralists improve their milk handling marketing capacity and competence. However, our research in the Afar area found that camel herders and intermediaries receive little help in

terms of camel health, milk safety, and better technical facilities. Camel herders and informal cooperatives were seen selling their milk on the side of the road in plastic containers, which are very susceptible to contamination and spoilage. Similarly, in Somali region, inadequate milk storage and processing facilities resulted in milk loss (Kebede et al., 2015).

Although Muslims are the primary consumers of camel milk, some people avoid it out of fear of diarrhea. Christian Ethiopians, on the other hand, are prohibited from drinking camel milk. On the other hand, some camel herders are still hesitant to sell camel milk because they believe that if they do, their camel milk production will decline and they will eventually die. They didn't allow milk to be sold because they were afraid of boiling it, which would reduce its nutritional and therapeutic qualities (Gebremichael et al., 2019).

2.7 Contribution of Camel Milk to pastoralist livelihoods

Livestock production and productivity are sources of cash income for pastoralists and play a great role in the livelihoods of large populations (Millar & Photakoun, 2008). It also economically provides for the increasing demand for animal protein in the developing world in the face of population and income growth (Delgado, 2003). However, concerns with the pastoralist system have also been voiced, and primarily so, about the ecological implications of the system.

Camels play diverse roles in the livelihood of the poor pastoralists, including the building of assets, insurance against unexpected events; have spiritual and social values, traction and movement of goods, food supply income generation in Ethiopian pastoralists and very recently it plays a pronounced role in the export revenue of the country in both live animal and carcass (SOS-Sahel Ethiopia, 2007; Ali et al., 2004).

Camels are important sources of cash for pastoralists. In addition to the sale of milk and milk products, sales of live camels (usually males and unproductive females) to generate cash for various purposes is common in Ethiopia and other East African countries (Schwartz and Dioli, 1992). Most of the camels sold were males and old females; this suggests they are reluctant to sell females and valuable younger camels. This confirms that camels in eastern Ethiopia are mainly used for milk production (Schwartz, 1992; Zeleke and Bekele, 2000). Sales of animals by pastoralists are basically a function of their basic needs, such as food grains, clothing, health care and fallback during periods of drought. As camels are lifesaving resources, they are the last to

market, i.e. when other livestock failed to offer good value because of loss of body condition during droughts and the proportion of sold camels' increases during the drought period(Ahmed, 2002).

Milk has a high nutritional content and plays a vital role in feeding Ethiopia's pastoral, agro-pastoral, and urban populations. Milk and milk products are produced on a regular basis and either sold or processed for cash. It is a source of income in the milk shed regions that allows families to buy or exchange products and consumables, therefore contributing considerably to family food security(MOA, 2001).

In many arid areas, camels play a lion role for pastoralist livelihoods as milk suppliers. The lactation period of the camel is a longer and comparative advantage over the other species in the same environment. Camel has the 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; Kaufman and Binder, 2002).

Camel is the main asset, insurance against unexpected events; spiritual and social values in pastoralists. Milk is the main source and very important feeding pastoral and agro-pastoral of Ethiopia and has high nutritional value. In pastoral areas milk is produced daily and sold for cash or processed(Igge, 2019).

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 (Abdi Hussein Abdullahi, 1999; (Farah et al., 2004).

2.8 Use Values of Camels

Camel is a livelihood asset for food security and wealth creation in the ASALs. Camel provides income to the household through sale of milk, meat, hides, and transport services, riding and tourism which is essential to pastoral subsistence economy (Glücks, 2007; Njanja, 2007). Milk

from camel is highly ranked as an important utilization at the household level as a source of food and income(Njanja, 2007;Guliye et al., 2007). Camel also plays an important social cultural role in dowry payment and settlement of fines to compensate injured parties(Guliye *et al.*,2007). In Somali pastoralists camels act as security against drought and diseases (Farah *et al.*, 2004). Pastoralist more often sell camels when there is urgent need for cash and not when prices are optimal as they meet to satisfy finance, insurance and status roles. Behnke (1985) states in a discussion on the price of camels, “richer Bedouin continued to sell a limited number of animals in order to meet their perceived essential rice requirements”. Therefore, livestock keepers’ sell livestock when faced with pressing cash needs(Moll, 2005).

Camel hide, wool and dung are also products used by human in different ways. The processing of camel hides is common in Northern Africa and the Middle East(MacNamara *et al.*, 2003). Italy and United states are the major market destinations for camel leather products. The good news from camel hide industries is the natural scarring effect does not diminish a hide’s quality as it makes each one unique. In Ethiopia, no body collects and process camel hide and the nation losses quite considerable income from this resource. In Kenya the price of one camel hide is equal to four oxen hides. This indicates that camel hide processing is a good venture to take part as business for any interested body in East Africa where there are huge resources. Camel wool is harvested and processed for making padded cloths, quilts and mattresses(Goulding *et al.*, 2007).

2.9 Empirical Review

The proportion of camel milk has reported 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). Several authors (Zelege, 2007; Bekele, 2010;Yosef et al., 2015), have been reported the overall average daily volume of camel (*Camelus dromedarius*) milk throughout the entire lactation period was 3.75, 4.14, 3.22, and 2.92 liters, respectively, in different arid and semi-arid regions of Ethiopian. In the country camels, no significant reduction in milk production was reported until the ninth month of lactation, due to the high persistency observed in camel(Zelege, 2007). However, higher average daily milk off take (yield/day), 6 litres was reported from Northeast Ethiopia(Tekle and Tesfay, 2013). 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, and age of animal, persistency of

lactation, lactation number and stage of lactation(Sisay and Awoke, 2015).The average lactation length of camel (*Camelus dromedarius*) 12, 13.38, 13 and 13.76 months was reported(Dejene, 2015; Bekele, 2010; Yosef et al., 2015) for arid and semi-arid regions of Ethiopia, respectively.

The overall lactation length of local cows in the Gambella region is estimated to be 7 months with average daily milk of 2.07 liters(CSA, 2008). The average milk yield of local cows found in the Somali region is less than two liters per day, reaching up to 488 liters over a 249 days lactation period in all pastoral areas elsewhere (IPS, 2000).

In drylands under average grazing conditions, a camel can produce 1,900 litres of milk a year for human consumption (Stiles, 1995). Under the same conditions, it is estimated that a cow, a sheep and a goat would produce 300, 59, and 88 litres, respectively. Schwartz and Walsh (1992) estimated lactation yield for East African camels at between 1,500 and 2,500 litres.

According to Lumadede et al.,(2010), Major milk production is in the rainy seasons of Guu and Deyr. Of the studied a household produces on average 11 ltrs goat milk and 18 ltrs camel and cow milk in the Guu season and 8 ltrs goat milk and 11 ltrs camel and cow milk in the Deyr season per day. Production reduces considerably during the dry season and is dominated by camel milk with 6 ltrs in Haggaa and 5 ltrs in Jilal season, while both goats and cows produce only 5 ltrs and 3 ltrs in Haggaa and Jilal, respectively. Milk sales constitute a regular income for pastoralist communities in the ASAL. The average daily income from the study group at pastoralist producer level during the dry season from milk sales is Birr 23.5, while it almost triples during the rainy season to Birr 65.88. At trader level the average daily income does not vary much between the seasons and is with Birr 46.2 slightly higher during the dry season as compared to Birr 44.75 during the rainy season. The average daily volume sold during Jilal, Guu, Haggaa and Deyr season is 8ltrs, 33ltrs, 12ltrs and 24ltrs at producer level and 16.9ltrs, 44.5ltrs, 23.7ltrs and 36.6ltrs at trader level, respectively. The estimated total volume of the milk sold in the mentioned markets on a daily basis varies from 1,740 ltrs in Jilal, 4,583 ltrs in Guu, 2,441 ltrs in Haggaa and 4.037 ltrs in Deyr season. This represents a market value of Birr 8,469, 14,364, 11,996 and 12,535, respectively.

Milk is a major element of the pastoralist and agro-pastoralist diets in Shinelle, Somali Region, and children are fed milk from an early age. The percentage of children over the age of 6 months

who had drunk milk the day before ranged from 68 to 94 percent. This consumption pattern is linked to livestock health and animal migration, resulting in a lack of food security at the time(SCUK, 2007).

2.10 Conceptual framework of the study

The conceptual framework in Figure 1 illustrates the interrelationships in the study, the key variables involved and how they are interrelated. Socio-economic characteristics are the background factors like (age of household, household head, education level, gender, household income, frequency of milking, Household size, number of lactating camel and amount of milk yield produced per camel/day), institutional factors like (group marketing, access to extension service, contract marketing, and road infrastructure) and market factors like (prices of output, price information, marketing experience, and distance to the market) had an influence on market participation.

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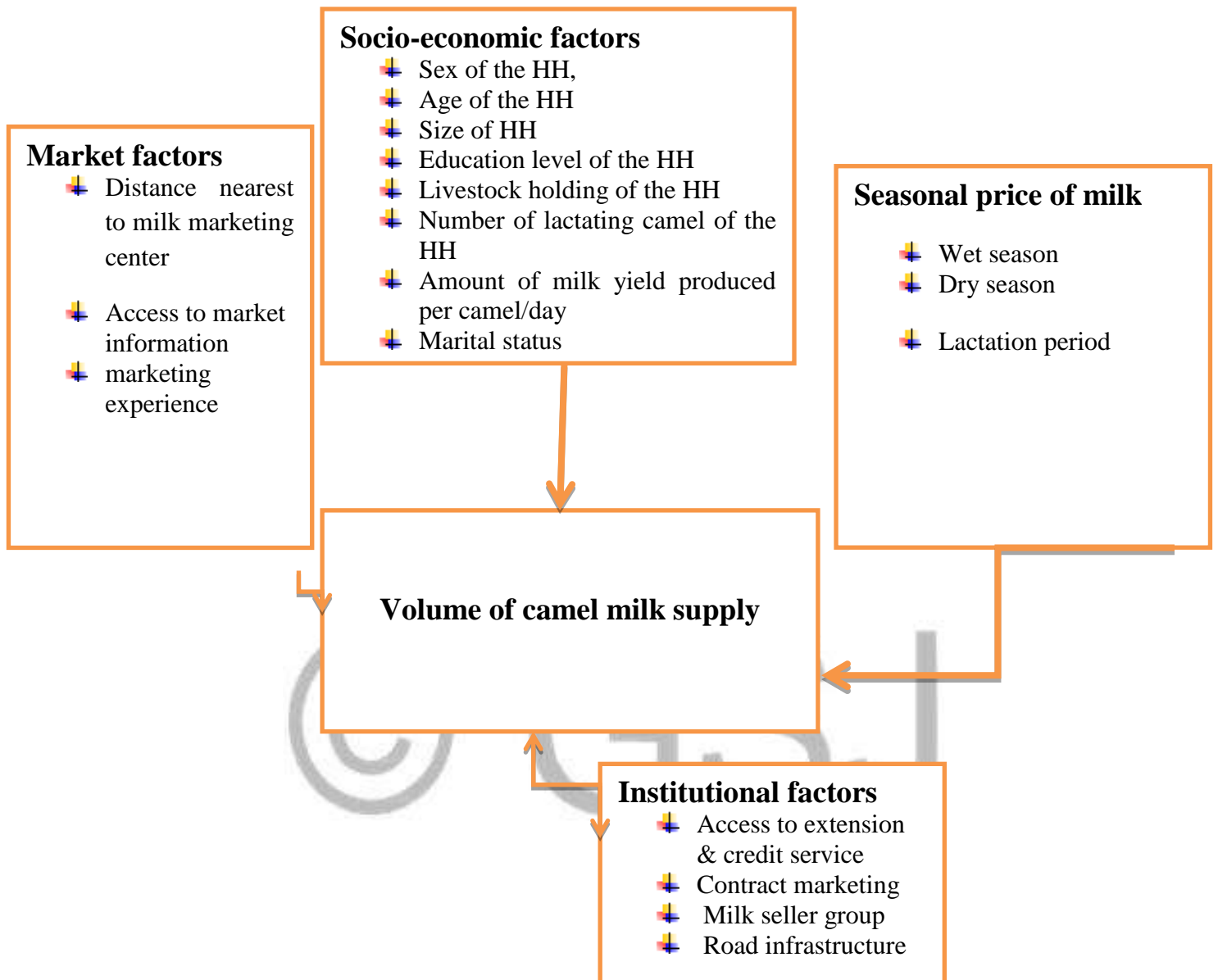


Figure 1: Conceptual framework of the study

Source: own conceptualization

CHAPTER THREE

3. METHODS OF RESEARCH

This chapter of the thesis focused on a detail explanation and discussion of the methodology that was applied in the study. Thus, the topics related to methodology covered in this chapter are the general description of the study area, research design, data collection methods, data analysis procedures, sampling technique, and sample size determination.

3.1 Description of the Study Area

Location

The study was conducted in Ararso district, one of the eleven districts administrative in the Jarar zone of the Somali regional state(Figure 2). The district is geographically situated in the eastern part of Somali Regional State at 8°and 45' N latitude and 43 ° and 22' E longitude. It shares boundaries on the north by Kabribayah, on the northeast by Harshin and in the east by Yocale, east-south by Degahbour and on the west Bilcilbour woreda. It is far from the regional capital Jigjiga by 93km towards the East direction. Ararso district has agriculturally suitable land in terms of topography which is located 1507 meters above sea level, and there are perennial rivers, including Fafan and Jarar(BoFED, 2014).

Climate

Ararso is climatically characterized as arid agro-ecological, which is generally hot and dry in the area. The area has a bimodal rainfall pattern with two main rainy seasons which the first is 'Gu' that occurs from mid-April to the end of June. The second rainy season, known as 'Deyr' occurs from early October to late December, and Average annual rainfall is 300- 400mm from two rainy seasons. Sometimes it receives 'Karan' rains (July-September).The area's mean maximum and minimum temperature is 34.4⁰c and 16.6⁰c, respectively (DPPB, 2001).

Jilal is the dry period from December to March with a reduced volume of milk production.

Guu is the main rain period from April to July, when high milk yields are expected.

Hagaa is the cold and dry period from July to October again with lower milk production and

Deyr is the second main rainy season from October to December with high milk production.

Human population

According to Ararso woreda administration office report (AWAO, 2020), the total human population of the district is estimated at 89,174 of whom 46,685 are men and 42,489 women.

Livestock resource

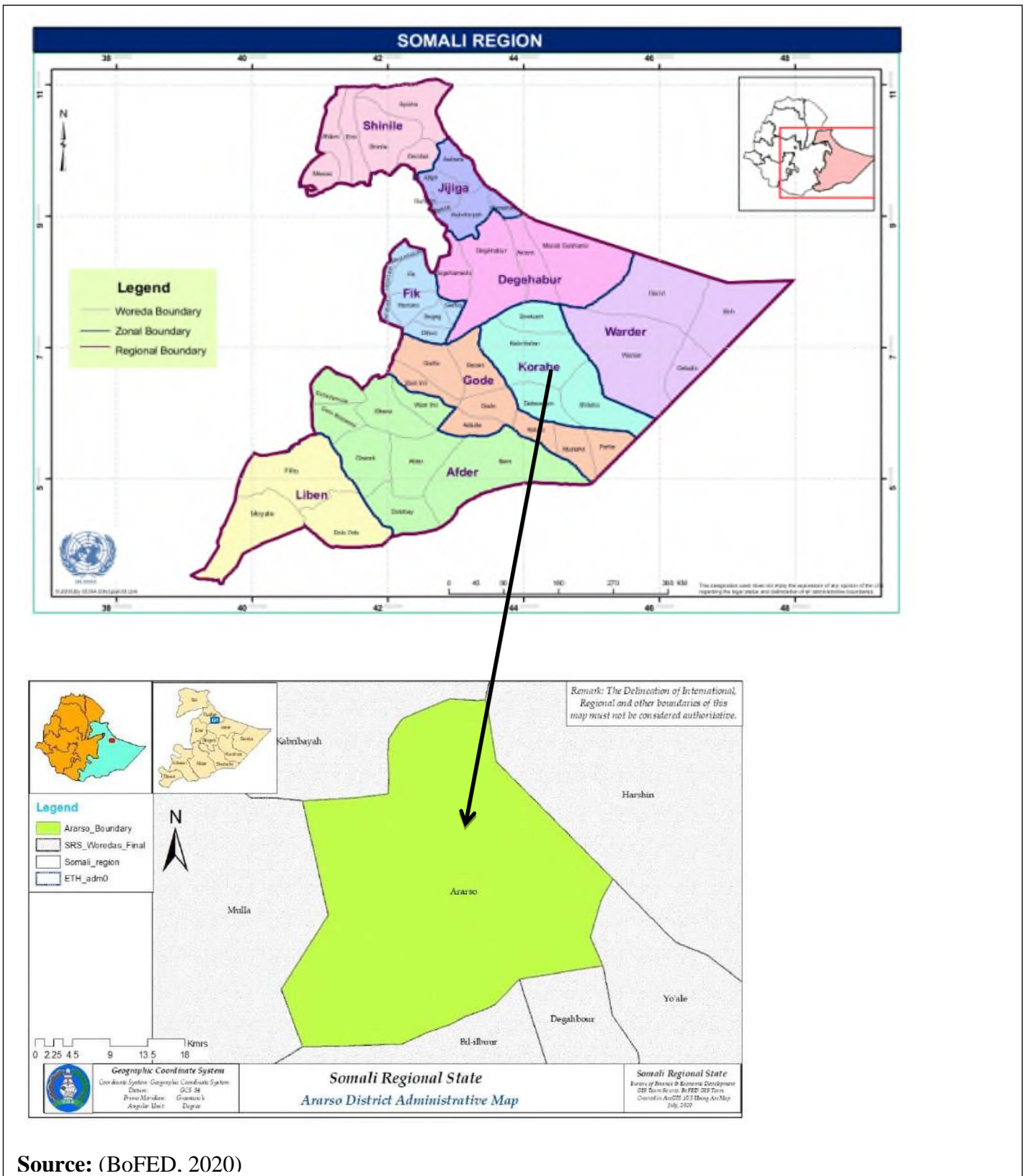
Livestock and livestock products are sources of the pastoralist livelihood in the Ararso area. Livestock production is an integral part of the production system. Production of camel like milk and meat is a common practice.

Based on Ararso Woreda Livestock Resources and Pastoral Development office report (AWLRDO 2020), the district has a total Livestock population of 480,455, of which 326,684 are shoat, 68,731 cattle, 80,053 Camel and 4,987 Donkey.

Main vulnerabilities are recurrent drought; extreme water shortage; livestock export restrictions and general market shocks; animal and human diseases; poor transport and communication infrastructure

Farming system

The farming system of the district is characterized by ranching farming system since the area is pastoral and agro pastoral area i.e. practicing of grazing animals as well as browser animals such as camel and these ranching is communal that the community utilize as a whole. In some parts of the district there was mixed crop and livestock farming system and the most important crops grown in the area were maize and sorghum.



Source: (BoFED, 2020)

Figure 2: Map of study districts in Jarar Zone of Somali region

3.2 Research Design and Approaches

This study adopted a cross-sectional study design and applied quantitative and qualitative methods to clarify concepts, characteristics, descriptions, counts and measures. To achieve the intended objectives, a mixed research approach was used and questionnaires, key informant interviews, observation, and focus group discussion were used to collect the data. Generally both qualitative and quantitative approaches were used to collect and analyze the data.

3.3. Sampling technique and sample size determination

3.3.1. Sampling techniques and procedures

In this study, a multiple stage sampling technique was applied to select sample households. First, Ararso District was selected purposively since it is one of the most potential areas for camel milk production, marketing and accessibility in Somali pastoralists. In the second, stage four pastoralist Kebeles, namely Ubahle, Haljid, Magalo-ad and Dinta'ab of Ararso District, were selected purposively since they are the most camel potential area in the district out of the total 17(seventeen) Kebeles. In the third, stage sample households from each Kebele were selected using a simple random sampling method and probability proportional to the size of the population of the sample kebeles. Simple random sampling was applied to select the representative sample households as the population is homogenous and all households in the sampled kebeles supply camel milk to the market.

On the other hand, purposive sampling was used to select two focus group discussion (FGD) participants with the potential to provide rich data and thick descriptions. The FGD participants were the elders, religious leaders and community leaders. Similarly, two KII were held, one from each sample Kebele and one from the district.

3.3.2 Sample Size Determination and sample size

The sample size was determined using the simplified formula provided by Yamane (1967:886) to determine the required sample size at 95% confidence level, 0.5 degrees of variability and 8% level of precision. The numbers of respondents from each kebele was determined by using probability proportional to sample size, as shown below.

Therefore, 150 respondents were chosen from a total population of 4055 pastoralist households in the four kebeles of Ararso district.

$$n = \frac{N}{1+N(e)^2} \dots\dots\dots 1$$

$$n = \frac{4055}{1+4055(0.08)^2} = 150 \text{ HHs} \dots\dots\dots 2$$

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

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

S/N	Kebeles	Total Households	Sample Size	Sample %
1	Ubahle	1067	39	26
2	Haljid	853	32	21
3	Magala'ad	1068	40	27
4	Dinta'ab	1067	39	26
Total		4055	150	100

Source :(AWAO, 2020)

3.4 Data Types and Sources

The data source of this study was both primary and secondary. The primary data were 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 District and Regional and University and Public Libraries. The primary data sources were Key informants, FGD participants and questionnaire respondents who have the knowledge and information on the proposed topic and took part in the study. In all cases, both open-ended and closed-ended questions were asked, allowing for the development of natural interactions with informants to touch on areas that the researcher might be aware of.

3.5 Data Collection Methods and Tools

The population for this study was camel owners engaged in camel production in the study district. To get more reliable information from the selected sources, the researcher used the following data collection tools:

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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 household survey, close-ended and open-ended format questions were prepared and enumerated the sample households through trained enumerators. The major issues which were addressed in the questionnaire include household demographic characteristics, socio-economic characteristics, information about camel milk productivity and marketing in the study area.etc.

3.5.2 Focus Group Discussion

In this study, focus group discussions were based on the checklist prepared for the purpose. The participants in the focus group discussion was selected purposively and it has included local leaders, experienced pastoralists who had a long history for camel milk production and marketing, producers, rural collectors, retailers in the area. The researcher organized two FGDs; the number of participants per FGD was on average terms 8. The outcome of the FGD also enabled to refinement of the questionnaire used for the household survey.

3.5.3 Key Informant Interview

The researcher also used an unstructured interview method for the key informant interviews the number of KIs was 14. The key informant interview (KIIs) was conducted with development agents, local leaders, experienced pastoralists who had a long history for camel milk production and marketing in the area, market channel actors such as producers, rural collectors, retailers, and others who involve to camel milk market chain in the area and livestock and pastoral development Office in the study area and participants of this interview were selected purposively. The important issues included in this interview were the dynamics in camel milk production and market opportunities available which support them to gain income and the milk market constraints as well.

3.5.4 Field Observation

Observation was made as a helpful and additional tool to collect data that can accompany the data obtained by other means. During the researcher's stay in the study area, the researcher visited the market area and observe numerous livestock production, especially camel milk, production, and marketing. The researcher also observed the study area's environmental

implication, particularly water and range conditions, infrastructures, transportation and marketing problems, other environmental features and development interventions on livestock and livestock production and livestock product marketing.

3.6 Methods of Data Analysis

Two types of data analysis, namely descriptive statistics and econometric models, were used to analyze the data collected from households. Both quantitative and qualitative methods were employed to complement each other in the study. The data collected via questionnaire was first coded, arranged, edited and analyzed using appropriate analytical tools like SPSS version 20.

3.6.1 Descriptive Statistics

In this study, one type of data analysis techniques was used. These were descriptive statistics data analysis. The qualitative data collected via questionnaire is first coded, arranged, edited and analyzed using SPSS version 20. Descriptive statistics such as frequency, percentage, graphs, tables, the mean and standard deviation were used to analyze the data, summarize and present the result on demographic and socio-economic characteristics of pastoralists, camel milk production and marketing.

3.6.2 Econometric Analysis

In order to achieve the second objective of the study multiple linear regression model was used.

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.

According to Gujarati (2003), there are two measures that are often suggested to test the existence of multicollinearity and there 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 20 was used to compute multicollinearity of both variables. As a rule of thumb, if the VIF greater than 10, which would happen if correlation is greater than 0.9, that variable is said to be highly collinear.

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

$$Y_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \beta_3 X_{3i} + \beta_4 X_{4i} + \beta_5 X_{5i} + \dots + \beta_n X_{ni} + \varepsilon_i$$

Where,

Y is dependent variables (Volume of camel milk marketed or soled measured in liter);

X s are explanatory/ independent variables (Sex of the HH, Age of the HH, Size of HH, Education level of the HH, Livestock holding of the HH, Number of lactating camel of the HH, Amount of milk yield produced per camel/day, Distance nearest to milk marketing center, Access to market information, and marketing experience, Access to extension service, Contract marketing, camel milk marketing cooperative and Road infrastructure)

Y_i is dependent variables

β_0 is intercept/Constant term

β s are the coefficients of independent variables

X s are explanatory/ independent variables

ε is the error terms

3.7 Definitions of variables

The variables used in the analysis were operationalized as follows:

Dependent Variable

Volume of Camel Milk Market supplied or Sold measured in liter: In this study, the dependent variable "volume of camel milk market supply" is operationalized in two dimensions, that is, the involvement in the required activities in milk marketing such as milking, colleting, and shortage of milk packaging materials, transporting, handling, supplying, and increased sales volume of camel milk.

Description of Explanatory Variables (Xi) and their hypothesized effect on the dependent variable

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

Sex of the household head (SHH): Sex is dichotomous independent variable of being either male or female. In culturally pastoral production system most of time milk selling is the major task of women especially married women. However, lack of capital and access to institutional support may affect women participation and efficiency in camel production. Therefore, it is postulated to have a positive effect on volume of camel milk marketed.

Age of the household head (AHH): Age is a continuous independent variable which is measured in terms of number of years completed household head at time of interview. Aged household are believed to be wise in resource allocation and use, and it is expected to have a positive effect on the camel milk supplied or sold.

Household family size (HHFS): Family size is a continuous independent variable to the number of members in the family including children, adult and dependent. Families with more household members tend to have more labour. Production in general and marketable surplus in particular is function of labour. Thus, family size is expected to have positive impact on camel milk production but large family size requires larger amounts of milk for consumption, reducing marketable surplus. Hence its effect on camel milk supply might be negative

Household head education Level (HHEL): it is measured in terms of formal yeas of school ship in primary school, secondary school and others. The educational level of the individual is one of the important factors preparing the individual to receive and utilize new information to be productive. Intellectual capital or level of education of the household head is assumed to have positive effect on camel milk marketed.

Total Livestock holding (TLH): It is a continuous variable measured in a number of livestock that the household owns other than camel. This variable is expected to have positive effect on the volume of camel milk supplied or sold because the likelihood to have lactating cow or goat in the herd may be larger in a large livestock holding.

Number of milking camel heads (NMCH): This continuous variable and it is measured in number of milking camels owned by the household. The larger the number of lactating camel in the herd the larger will be the volume of milk supply. Hence it will have positive effect on the volume of milk supply or sale.

Price of camel milk in wet season (PCMW): It is continuous variable measured in Birr per liter of camel milk sold in the market during wet season. In theory quantity supplied has positive relationship with price. So the higher the price is expected to have positive influence on camel milk supply.

Price of camel milk in dry season (PCMD): It is continuous variable measured in Birr per liter of camel milk sold in the market during dry season. In theory quantity supplied has positive relationship with price. So the higher the price is expected to have positive influence on camel milk supply.

Average of income gains from selling camel milk during wet season (AISCW): it is a continuous variable which is measured in Birr and represents actual amount of income per household per day in wet season. The higher the income from the sale of camel milk motivates the suppliers to supply more and get more income. So, it is expected to have positive influence of the volume of camel milk sold.

Average of income gain from selling camel milk during dry season (AISCW): it is a continuous variable which is measured in Birr and represents actual amount of income per household per day in dry season. The higher the income from the sale of camel milk motivates the suppliers to supply more and get more income. So, it is expected to have positive influence of the volume of camel milk sold.

Access to milk marketing information (AMMI): It is a dummy variable which have a value of 1 if household do have an access to market information and a value of 2 otherwise. It refers getting the required and useful information about the price and other conditions related to camel milk marketing and information is the driving force of marketing activities. Therefore, to be well informed about camel milk marketing ahead of time is expected to have its own positive impact on volume of milk marketed.

Distance to market (DM): It is a continuous variable which refers the distance from the home of the respondents to the nearest camel milk market in kilometer. The closer the market, the lesser would be the transportation charges, reduced transaction costs, reduced trekking time, reduced loss due to spoilage, and reduced other marketing costs, better access to market information and facilities. This improves return to labor and capital and increase farm gate price and the incentives to supply more.

Membership of camel milk marketing cooperative (milk seller group): It is dummy variable taking value of 1 if household is member camel milk marketing cooperative and a value of 2 otherwise. This type of milk seller group saves time and money. Therefore, Membership to cooperative is hypothesized to affect accessing cooperative market outlet positively as compared with accessing other milk market outlets.

Access to extension service (ACCES): A dummy variable taking a value of 1 if the respondent household has access to veterinary service and a value of 2 otherwise. The availability of extension support in advice and input support on camel milk production has effect on increasing camel production and efficiency which enables to engage in marketing. Support encourages and derives them to supply and sale more milk.

Access to credit (ACC): It is a dummy variable which have a value of 1 if the household do have access to credit and a value of 2 otherwise. It helps to ease the liquidity problem of transportation and other expenses and encourage producers to supply and sale more camel milk.

Table 3.2: Description of the selected Variables

No	Variables	Description	Types	Values	Expected sign
1	SHH	Sex of household head	Dummy	1=male, 2=female	+/-
2	AHH	Age of household head	continuous	number of years	+
3	HHEL	Household head education Level	continuous	years of schooling	+
4	HHFS	Household family size	continuous	man equivalent	+/-
5	TLH	Total Livestock holding (TLU)	continuous	numbers	+
6	NMCH	Number of milking camel heads	continuous	numbers	+
7	PCMW	Price per liter of camel milk in wet season	continuous	Ethiopian Birr	+
8	PCMD	Price per liter of camel milk in wet season	continuous	Ethiopian Birr	+
9	AISCMW	Average of income gains from selling camel milk during wet season	continuous	Ethiopian Birr	+/-
10	AISCMD	Average of income gain from selling camel milk during dry season	continuous	Ethiopian Birr	+/-
11	AMMI	Access to milk market information	Dummy	1=yes, 2=No	+
12	DM	Distance to market	continuous	kilometer	+/-
13	MCMC	Membership to cooperative	Dummy	1=yes, 2=No	+
14	ACCES	Access to extension service	Dummy	1=yes, 2=No	+
15	ACC	Access to credit	Dummy	1=yes, 2=No	+

CHAPTER FOUR

4. RESULTS AND DISCUSSION

This chapter presents the results obtained from the field and also the discussions resulting from the findings. These results and discussions were based on responses obtained from 150 respondents. A total of 150 (100%) of questionnaires were distributed to selected households for this study. As a result of the strict supervision, all the respondents appropriately responded to the questions. That is, there is no response error in the sampling selection. The data of the study were analyzed using descriptive statistics and econometrics model.

4.1 Description of Demographic characteristics of the Respondents

Demographic characteristics are variables which are related to household's characteristics such as, sex, marital status, age, level of education, family size, and others were analyzed. The distribution of sample respondents based on their demographic characteristics is presented in Table 4.1 below:

Table 4. 1: Distribution of household heads by marital status, Sex and Education status

Variables	n=150	Frequency	%
Sex of the respondents	Female	88	58.7
	Male	62	43.3
Marital status of the Household head	Married	115	76.7
	Divorced	18	12.0
	Widowed	17	11.3
Education Status of the respondents	Illiterate	126	84.0
	Read and write	21	14.0
	Primary level	3	2.0

Source: Survey result, 2022 %= Percentage n=Number of household interviewed

The above Table 4.1 reveals that about, 88(58.7%) of the respondents was female whereas 62(43.3%) was male. In Somali society male is the traditional head of the family and women can take this responsibility in case of husband death or divorced. It is also normal for women to act as the head of the family in the absence of husband or respond when issues of domestic affairs are in place such as milk marketing. This result revealed that came milk handling and marketing

are carried out by women than male in pastoralist’s area but Males are involved in the activities of milk marketing usually when herds are taken away from the principal residence of the family and this study finding is in line with Igge (2019) and Abdi (2010) findings. Concerning the marital status of the Household head the majority of the respondents 115(76.7%) of them were married, while 18(12%) and 17(11.3%) of the respondent household heads were divorced and widowed respectively. In the other way, the result of the survey indicated that about, 126(84%) of the sample respondents were categorized as illiterates, while 21(14%) of respondent were fall under those who can able to read and write, and 3(2%) were grouped as those who completed primary school education. Therefore, the result survey showed that large proportion of the respondents did not attended formal education. This indicates that more risks are likely to occur at the herd level where the herdsmen are involved of camel milking and handling of milk. The present finding in line with the result reported in many pastoral areas of Ethiopia (Beruk and Tafesse, 2000).

Education is one of the important variables in this study, which increases pastoralists’ ability to acquire process and use pastoral production related information. Lack of access to education and high illiteracy rate are common phenomena of developing countries like Ethiopia and also Somali region is one of the regions named by the World Bank funded projects in Ethiopia as “access deficit regions”. This is an indicator of poor access to intellectual-capital. In fact, education level of pastoralists is assumed to increase their ability of participation in milk marketing activities in a better way.

Table 4.2: Average household size with age of the household head

Variables	Minimum	Maximum	Mea ± SD
Total Family size in number	2.00	15.00	7.45 ± 2.64
Number of male family members	1.00	8.00	3.95± 1.56
Number of female family members	1.00	8.00	3.49 ± 1.60
Age of the household head	25.00	70.00	47.10 ± 11.65

Source: survey result, 2022 SD=Standard Deviation

The age of the respondents interviewed in the study ranged from 25 to 70 years. The mean age of the respondents was 47.10 years with the standard deviation of 11.65. This shows most of

respondents fall under working force category of age 25-61 which are economically active range in the camel milk production and marketing. Because camel milk production and marketing management are labour intensive, it needs to be capable of both physical and mentally.

The mean family size of respondents was 7.45 with the standard deviation of 2.64. The average family size of the surveyed households in the present study was lately approaches the average family size of Somali region, which was about 6.7 person per household (CSA, 2007).

The larger family size is assumed to increase the consumption of camel milk which has a negative impact on sale volume of milk supply and marketing, particularly; if household members are small children but the larger family size has a positive influence on livestock production and market participation because they contribute more labour on production, management and marketing camel milk.

4.2 Socio-economic and Livelihood characteristics

Table 4.3: Socio-economic and Livelihood characteristics

Variables	n=150	Frequency	%
Occupation of the household head	Pure Pastoralist	122	81.3
	Semi pastoralist (mixed Crop and animal production)	28	18.7
Other sources of earning income for household (excluding camel milk)	Shoat selling	95	63.3
	Charcoal production	32	21.3
	Small Business	23	15.3
How did you acquire starting Camel rearing	Inherited from family	104	69.3
	Purchased	34	22.7
	Received as bride price	12	8.0
main purpose of camel rearing (Keeping)	For milk production	103	68.7
	Social and cultural role	32	21.3
	Transport purposes	14	9.3
	Meat and milk purposes	1	.7

Source: Survey result, 2022 % = Percentage n = Number of household interviewed

The livelihoods of majority of the respondents were pure pastoralist that accounts 122(81.3%), while Semi- pastoralist (mixed Crop and animal production) were 28(18.7%), this show that, most of the respondents were pure pastoralist than semi-pastoralist, this means in study kebeles of Ararso districts are pure pastoralist than semi-pastoralist. On the other hand, all the

respondents in the studied area indicated that, generating income from selling of camel milk and also there are other sources of earning income for household (excluding camel milk). About 95(63.3%) of the respondents were generating income from Shoat selling, while 32(21.3%) and 23(15.3%) of the respondents households earn income from Charcoal production and Small business respectively. This study shows that the main reason for selling shoats was family need cash to purchase their basic needs. This result of study agreed with the findings of Kedija et.al (2008).

The livelihood of the pastoral households was dependent on livestock herding as the sole source of employment and income as well as consumption. The following is a quotation taken from an interview with a community elder in Dinta'ab kebele which better illustrate the case;

“Our livelihood is dependent on the livestock and livestock products. And we could have the option to engage in some agricultural activities though settlement within rain- fed method. However according to our tradition we are a people that marry up to four wives and have the responsibility to fulfill the need of all these wives with their children. With engagement in agricultural production which we are less familiar with, we don't believe we could feed and manage these type of extended family of ours. However through herding we can manage them properly. Pastoralism is our way of life in which we have lived for years since our forefathers” (Interview with a community elder in Dinta'ab kebele, 2021)

The majority 104(69.3%) of the respondents households indicated that, camel acquired inherited from family, whereas 34(22.7%) and 12(8%) of the respondents were Purchased and Received as bride price for camel respectively and main purpose of camel rearing (keeping) in the study area was for milk production 103(86.7%), Social and cultural role 32(21.3%), Transport purposes 14(9.3%) and Meat and milk purposes 1(0.7%).

4.3 Livestock owned and herd composition

The livestock ownership is an indicator of household's wealth and social status in the study pastoral community. Besides, it is the main source of food, income, draft power, live asset, social security and means of livelihood diversification (coping mechanism during drought and hardship seasons) for pastoralist community. Based on the aforementioned premise, livestock ownership was hypothesized to have positive and significant relationship with camel milk market supply.

During the focus group discussion the participants stated that, livestock production and rearing is major source characterizes the livelihood of the district and livestock types kept by the pastoralist in the study area owned include: goat, sheep, cattle and camel are the most dominant species.

The total livestock unit of household in the study area is summarized in Table 4.4, using Tropical Livestock Units (TLU) as standardized animal unit obtained by multiplying total number of animals with conversion factors that takes into account “equivalent” for animals as stated in Storck et al.(1991). 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.

Table 4 4: Average livestock kept by HH in the Study Area

Livestock Species	Minimum	Maximum	Mean ±SD	Number of livestock owned by household in Tropical Livestock Unit (TLU)
Camel	6.25	50.00	19.88±8.59	
Cattle	.00	17.00	4.18±2.83	
Goats	1.30	13.00	5.72±2.32	
Sheep	.00	7.80	3.29±1.53	
Poultry	.00	.08	0.01±0.02	
Donkey	.00	3.50	1.83±0.65	

Source: Survey result, 2022 SD=Standard Deviation

As indicated in the Table 4.4, the average livestock holding per household in the study area was 19.88±8.59 camel, 5.72±2.32 goats, 4.18±2.83 cattle, 3.29±1.53 sheep, and 1.83±0.65 donkey respectively possessed. The survey results showed that number of small ruminants along with camel head per household were smaller than other large ruminants and this result contrary with findings of Igge (2019). The herd structure is diversified to drought tolerant species, especially goat and camel as an adaptation mechanism to drought and climate change. This study result also agreed with Amaha (2006) and Kediji (2007) findings.

4.4 Camel Milk Production Performance

Livestock production especially camel production plays important roles in cultural, economic, food security and social development of Somali pastoral communities. Camel herding for Somali communities indicated as a basic way of life, insurance against natural disaster, wealth status,

prestige, and highly valued cultural heritage. The camel is an important livestock species uniquely adapted to hot and arid environments therefore; Somali pastoralists are a camel community mainly because of the dry and harsh environment they live in;

Maktal Awil Samatar is one of the Haljid kebele elders, he was one of KII participating in camel milk related questions and during the key informant interview he said:

.....Camel milk is the most important camel product and it is a valuable human food source and income generating activities in our kebele, during wet season when the condition of pasture is good and green forage is available, freshly lactating camels are usually kept near the temporary family settlement to produce milk for households and it is common practice to share out the milk between families. Camel milk may account for half of the pastoralist's nutrient intake during the growing seasons and daily milk yield of camels per day depends on feed availability, season and water access.....

Table 4.5: Camel milk production performance and lactation length

Variables	N=150	Frequency	%
Frequency of milking camel	Morning and evening	148	98.7
	Morning, midday and evening	2	1.3
Does the camel milk consumption increase at home in last years	No	95	63.3
	Yes	55	36.7
Litter of milk produced per camel per day in herd on the average presently	1-5 liters	144	96.0
	6-10 liters	6	4.0
Months of camel lactation	12 months	144	96.0
	13 months	6	4.0
Type of camel milk household members used mostly	As Fresh	61	40.7
	As soured	5	3.3
	Bothe fresh and soured	84	56.0

Source: Survey result, 2022 %= Percentage n=Number of household interviewed

As indicated in the above table 4.5, majority 148(98.3) of the respondents informed that they milk their camels two times (morning and evening), 2(1.3%) said they milk three times (morning, midday and evening) per day. This result indicates that, majority of respondent's milk their camel more than one times. In fact current finding is in line with Farah et al (2004) and

Wernery (2003) result findings. During the focus group discussion the participants stated that, frequency of camel milking by the pastoralists vary and it depends up on the following factors: amount of milk produced per camel, extent of demand for milking, season, number of milking camel present in the herd and availability of other food for the camel owners. This study result is in line with Simenew et al (2013) finding.

Out of the total sampled households, 95(63.3%) of the respondents reported camel milk consumption at home is not increasing for the last five years, rather decreasing for the sake of different factors like low productivity of camel caused by shortage of feed, decreasing of grazing land and marketing of more camel milk rather than consuming at home in the study area.

According to the response of the producers, about 84(56%) of the respondents mainly consumed camel milk in its Bothe fresh and soured, while 61(40.7%) and 5(3.3%) consumed as fresh and soured milk respectively. This indicates that most of the respondents consume both fresh and fragmented milk compared to fresh milk in the study area. This current result study is contrary with finding of Igge (2019).

The survey result revealed that majority of the respondents, 144(96%) camel can produce per camel in herd during conducting the study was 1-5 liters of milk per day, while 6(4%) of the respondents households their camel produce 6-10 liters per camel per day. This present study is in line with previous finding of Mebrahtu et al (2017).

Majority of the respondents 144(96%) in the studied area indicated that, camel lactation length is 12 months in the most of the cases, while 6(4%) of the respondents said camel lactation length is 13 months but there are factors affecting lactation length include season of the year and demand for milk for more prolonged time and camel lactation length can be prolonged when there is good feed availability and if demand for milk by the owners is increasing and not pregnant. The current study agrees with the previous findings of Simenew et al (2013) and Eyasu (2009).

4.4.1 Camel milk yield and productivity

The estimated camel milk yield performances, household consumption during wet and dry season and number of lactating camels are indicated in Table 4.6, the milk yield obtained from this study indicates that camel milk is an important source of food and income generating for the pastoralists in the study area and the pastoralists rely mainly on camels for their livelihood.

The milk yield obtained from pastorally managed camels in the study area depends mainly on environmental factors such as availability and quality of feed, water availability, the climate and the level of management. The study tried to find out the camel milk production on wet season and dry season, number of lactating camel owned by the household and camel milk consumption at household level used by the camel milk producers.

Table 4.6: Milk yield performance, household consumption during wet and dry season and number of lactating camel in the study area

Variables	Minimum	Maximum	Mean ±SD
Average milk produced / camel /per day in wet season	2.00	5.00	3.25±0.639
Average milk produced/ came/ per day in dry season	1.00	2.50	1.61±0.39
Number of lactating camel	2.00	13.00	5.89±2.64
Average of camel milk used for household consumption per day in wet season	2.00	6.00	3.80±1.01
Average of camel milk used for household consumption per day in dry season	1.00	3.00	1.73±0.55

Source: Survey result, 2022 SD=Standard Deviation

Based on availability of feed and water sources the daily milk yield per camel per day ranges from season to season. Among the 150 study households, each produces an overall daily average (plus Standard Deviation) of milk yield per camel per day in wet and dry seasons of the study area was (3.25±0.639) liters and (1.61±0.39) liters respectively. This illustrated the yield decreases during the season when it compared with the wet season. The average milk yield of camel in dry and wet season in the current study is lower than average daily milk yield reported by Eyasu (2009) and Igge (2019) who stated that, average milk yield of camel was (5.2±2.2) , and in wet season (5.01±1.151) and dry season(2.68±0.674) respectively.

The total lactating camels of the respondent households were 883 that accounts on the average of every household had 5.89±2.64 lactating camels. Jointly, the study wants to know how many litters of camel milk consumed by sampled households in the wet and dry season. This result shows that the average of camel milk used for household consumption per day in wet and dry season was 3.80±1.01litters and1.73±0.55litters respectively.

4.4.2 Major constraints influencing camel milk productivity

The most constraints that influencing the productivity of the camel milk in the study area are indicated in Table 4.7. The major constraints that hinder camel milk production in the study area were feed shortage, shortage of grazing land with low productivity, disease and parasites, and high medicament costs. In this area is characterized by high ambient temperature, low and erratic rainfall with less precipitations per annum in most times. The vegetation in the area is dominated by sparsely distributed perennial shrubs and trees species the majority of which are less palatable. The result is displayed in the table below.

Table 4.7: Rank the most important constraints influencing camel milk production

Major Constraints	Rank based on their severity
Feed shortage	1
Shortage of land for grazing with low productivity	2
Diseases and parasites	3
High medicament costs	4

Source: Survey result, 2022

According to the respondents, there were different constraints in the camel milk production in the study area. Among these constraints, feed shortage was the first most problem identified. Most of the respondents reported that since there is feed shortage in the area the only main feed which camels feed during dry season was cactus which caused ulcerative lesions then mortality and poor production for the camels and also respondents mentioned that there will be no camels in the area after fifteen years due to cactus intervention if measures are not implemented. Besides, the majority of the rangelands in the area are being invaded by poisonous and unpalatable plant species.

Shortage of grazing land with low productivity was the second most important problem that limits the productivity of camel milk production the study area. Lack of grazing land and bush encroachments on the pastoral rangeland further compound the problem of feed shortages in the area. Increasing trend of sedenterization and introduction of crop farming in the area has been causing shrinkage of grazing lands of the pastoralist herds.

Diseases and parasites are the third most constraints that restrict the productivity of camels in the study area. In the area, camels are affected by outbreaks of various contagious and parasitic diseases and this situation is worsened due to lack of sufficient and appropriate veterinary services. In addition to the above main problems for the respondent pastoralists, lack of veterinary services, lack of governmental or private drug stores and lack of professional support towards improvements of production and productivity of their camels were also reported. The current study agrees with the previous findings of Simenew et al (2013) and Eyasu (2009).

4.5 Characterizing Camel Milk marketing in the study area

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. Camel milk marketing is an income generating activity to the producers as most of them depend on it as their source of daily bread. The researcher therefore attempt to find the factors determining the volume of camel milk market supply of pastoral households in the study area and the following results were obtained in below table 4.8.

During the key informant interview (KII) in Magalo'ad kebele, one of the participants said that:

“Market is very vital to our livelihood, our livestock and livestock productions because we market our camel milk so as to exchange food and other basic needs of households. Camel milk production and marketing contributes immensely to the local economy at pastoral household and community levels. Camel milk is the prime source of income and food in household, who use the cash generated from milk sales to ensure food security throughout the year. The cash return from camel enables most households to preserve their assets such as livestock, which they would otherwise have to sell to access food and basic necessity of household. This enables asset accumulation and sharing, which plays a huge role in enhancing the economic wellbeing of pastoralist households in the study area.”

Table 4.8: Camel milk marketing and factors that influence amount of camel milk supplies to the market

Variables	n=150	Frequency	%
Do you Sell your Camel Milk	Yes	150	100.0
	No	0	0.0
Among your household who sold camel milk	Women	133	88.7
	Men	17	11.3
What are the factors Determining amount of camel milk supplied to the markets	Market factors	69	46.0
	Socio-economic factors	51	34.0
	Seasonal price of milk	16	10.7
	Institutional factor	14	9.3
How often you sale the camel milk	Specific days	87	58.0
	Daily basis	63	42.0
Market selection criteria to sell camel milk outlet	Price of milk per liter	108	72.0
	Market reliability	32	21.3
	Distance of market for milk	10	6.7
Does the market price per litter of camel milk is reasonable in wet and dry season	No	146	97.3
	Yes	4	2.7
Distance from the nearest market for camel milk marketing (Km)	1-5km	8	5.3
	5-10km	16	10.7
	10-15km	52	34.7
	Above 15km	74	49.3
To whom do you sell your camel milk	Directly to consumers	96	64.0
	Retailers	11	7.3
	Through service cooperatives	43	28.7
Use of income earned from camel milk sold	Food for household	129	86.0
	Schooling for children	21	14.0
Level of camel milk marketing participation in the study area	High	11	7.3
	Medium	81	54.0
	Low	58	38.7

Source: Survey result, 2022 %= Percentage n=Number of household interviewed

The result of this study displayed that all of the respondents were participating camel milk marketing to get income for their other needs, such as food, health for human and animals, social obligation, wedding and clothes etc.

The survey result revealed, about 150(100%) of the respondents were involving camel milk marketing during the study conducted, although access of market to supply their camel milk was

difficult because of distance of market, lack of transportation and poor infrastructure of the study area.

The survey result revealed that in the study area, about 133(88.7%) of the sample household's said that women involved the camel milk marketing and most of households female members controls the income gained from marketing of milk, while 17(11.3%) of the sample respondents said that men involved the marketing of camel milk only when camel moves away from their normal settlement. This result agrees with the previous report of kedir *et al* (2016).

Camel milk selling actors in the study area included individuals and groups who have participated from production up to consumption. In this study camel milk selling core actors were found to be camel herders, traders, formal cooperatives and end consumers.

The majority 96(64%) of respondents sold their camel milk to directly household consumers, and tea café, 43(28.7%) sold to through cooperative service and 11(7.3%) sold to retailers at kebeles or towns and home to home selling mainly on oral/traditional contract basis (Table 4.8). This practice indicates the camel milk marketing system found in the studied area was dominantly informal marketing. According to the respondents view, the majority 87(58%) of the respondents reported that camel milk sale frequency was in specific days of the due to different marketing constraints, while 63(42%) said in daily basis.

The results of this study revealed that market factors were most, 46% determinants factors determining amount of camel milk supplied to the markets namely distance nearest to milk marketing centers, access of market and market information. Where, other determinants factors namely socio-economic factors, seasonal price of milk and institutional factors were 34%, 10.7% and 9.3% respectively, determining amount of camel milk supplied to the markets of owning camels in the study area.

Also the survey result shows that, majority 72% of respondents selected criteria of camel milk marketing outlet selection of the study area were price of milk per liter, while market reliability and distance of market for milk which about, 21.3% and 6.7% respectively. This shows that the most criteria of camel milk marketing selection were price of milk per liter because of income maximization of household. This finding agree with the previous literature report of

Mohamed(2014) , which stated, the criterion mostly used in selecting milk marketing outlet was price of milk per liter, this may be due to market distance or availability of transportation.

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 camel milk. As indicated in table 4.8, majority of the respondents were found within above 15km radius of market place center, 74(49.3%), and the rest of them were found 10-15km 52(43.7%), 5-10km 16(10.7%) and 1-5km 8(5.3%) respectively. This shows that most of the camel milk producers were travel along distance to market in order to sale their camel milk. The finding agrees with previous finding of Igge, (2019). The differences in distance to different milk market place affect the price and quality of camel milk.

Aden Omer is one of the Haljid kebele elders, when he was participating camel milk marketing and access to market related questions in the key informant interview he said that:

...In our area, the nearest market center is far from 20km. This long distance away from the market it caused many problems in our camel milk marketing like spoilage of fresh milk to fermented milk then low price of milk, lack of market access and current information, long distance to travel and time which results to decrease amount of camel milk supplied to the market and participation in camel milk marketing. Therefore, the distance of market center is important.....

Table 4.8, shows that the level of camel milk marketing participation was medium as revealed by 54% of the respondents, whereas, 38.7% and 7.3% of the respondent household were low and high camel milk marketing participation respectively, which depend on camel milk production, availability of milk for sale, and market and seasonal varies. Moreover, the decision to sell camel milk is influenced by the availability of other livestock for household consumption and alternative sources of cash income (charcoal production and small business) in the study area. On the other hand regarding reasonability of market price per litter of camel milk in wet and dry season of the respondents 146(97.3%) of them said that market price per litter is not reasonable and 4(2.7%) of them said that market price per litter is reasonable during wet and dry season in the study area.

As depicted in table 4.8, Majority of the respondents was used their income gained from camel milk marketing were 129(86%) food for household and 21(14%) Schooling for children, this implies the household food depends on income from camel milk marketing in the study area. This present finding is in line with Igge (2019) finding.

4.5.1 Transportation means used for camel milk marketing

As presented in figure 3 below, it reveals that the main means of transport methods used in transporting camel milk for sale was human back which was account 55%, while 17%, 11% and 17% were used car, animal pack, and both human and animal back respectively. Based on this survey result indicates the limitation of transportation exist in the study area, the closer the market less milk spoilage would be incurred and less time it take to travel.

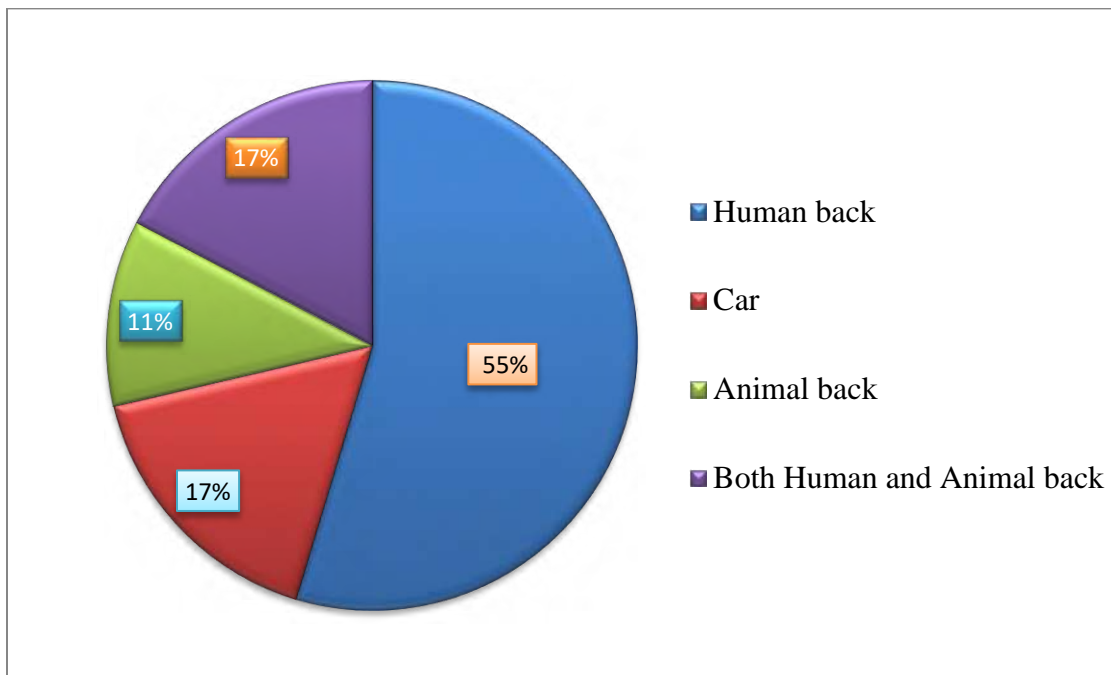


Figure 3: Transport means used to transport camel milk during marketing

Source: Survey result, 2022

4.5.2 Seasonal price variability of camel milk marketing and average income

The Somali regional state is characterized by a biannual rainfall pattern that influences camel milk production and marketing in accordance with animal feed and water availability. The fact that over two-thirds of total milk production is sold, irrespective of season and price, clearly shows that camel milk production and sale is a major source of income. The researcher noted

that due to the higher volume of camel milk in the market during the wet season, the price is reduced and consumers are able to pay for the fresh camel milk. In the dry season, when there is less volume of camel milk in the market and prices increase, most of the consumers are not able to afford it and most of them purchase the cheaper reconstituted milk made from milk powder. Only wealthier households are able to purchase fresh camel milk from the market.

Table 4.9: Seasonally marketing price of camel milk and average income gained

Variables	Minimum	Maximum	Mean±SD
Volume of camel milk marketed or soled measured in liter	3.00	12.00	6.06±2.69
Camel milk/liter selling price in the market during dry season	15.00	30.00	21.50±4.91
Camel milk/liter selling price in the market during wet season	10.00	25.00	15.17±4.15
The average income gets from selling camel milk during wet season	30.00	300.00	181.73±67.49
The average income gets from selling camel milk during dry season	45.00	450.00	278.13±96.85
The average costs incur for transporting camel milk supply	0.00	10.00	4.20±4.74

Source: Survey result, 2022 SD=Standard Deviation

As indicated in Table 4.9, the average sale volume of camel milk of the households was 6.06±2.69 during the wet and dry season. The amount of camel milk sold increases during the wet season due to high excess production, but falls during the dry season due to low surplus production, according to participants in the focus group discussion.

The survey found that the average sell volume of camel in the study area was 6.06 ± 2.69 . Dairy camel producers also noted that the sell volume of camel milk is dependent on the seasons and availability of fodder and water during a focus group discussion.

The survey result shows that camel milk price ranged from 10-25 ETB in the wet season to 15-30 ETB in the dry season. This reveals that in the rainy season, the mean average price per liter was 15.17 ± 4.15 , while in dry season, it was 21.50 ± 4.91 . This means that the lowest price is in the wet season, when there is more supply of camel milk in the market, and the highest price is in the dry season, when there is less supply of camel milk in the market. The supply of camel milk is limited during the dry season, and the demand for it is high.

As revealed in table 4.9, the survey result shows that the average income gained by the respondent from camel milk sale during wet season was 181.73 ± 67.49 Birr, while in dry season, it was 278.13 ± 96.85 birr. During the focus group discussion with dairy camel herds told that income gained from the camel milk depends on seasons, price per liter and market accessibility.

Ahmed Muhumed is one of the Ararso woreda local leaders, when he was participating seasonal variability of camel milk supply and price related questions in key informant interview he said:

.....*“Seasonality plays a major role in milk marketing as its supply, quality and transport problems change drastically from the dry to the wet seasons, with consequent price fluctuations. The long dry season (diraac) represents the most difficult time: milk suppliers are lower, distances further and milk price higher. Pastoralists carefully consider economic tradeoffs before selling their milk in these periods, although are often limited in their choice by the need for cash to face household and herd needs (e.g. the purchase of water and food)”*.....

4.5.3 Storage and safety materials used for camel milk marketing

As indicated figure 4, about 92.7% of the respondents said that the camel milk transport materials they use is plastic can/Jerri can, while 4.7% and 2.7% of the respondents use traditional can and metal can respectively. The main storage materials of camel milk during the marketing in the study area were jerikan/plastic can, traditional can and metal can respectively. This finding reveals that metal can is the most storage technology materials that pastoralist preferred to store their milk as it refrigerates at night easily.

In general the use of plastic jerry cans still dominates the market especially for transport and storage purposes, while traditional cans are mainly used for milk storage. This might be a contributing factor for the rapid spoilage of milk, as plastic jerry cans cannot be cleaned properly, due to its shape and the bacterial residues mainly in the handle. This current finding is in line with previous findings of Lumadede et al. (2010) and Gebremichael et al. (2019).

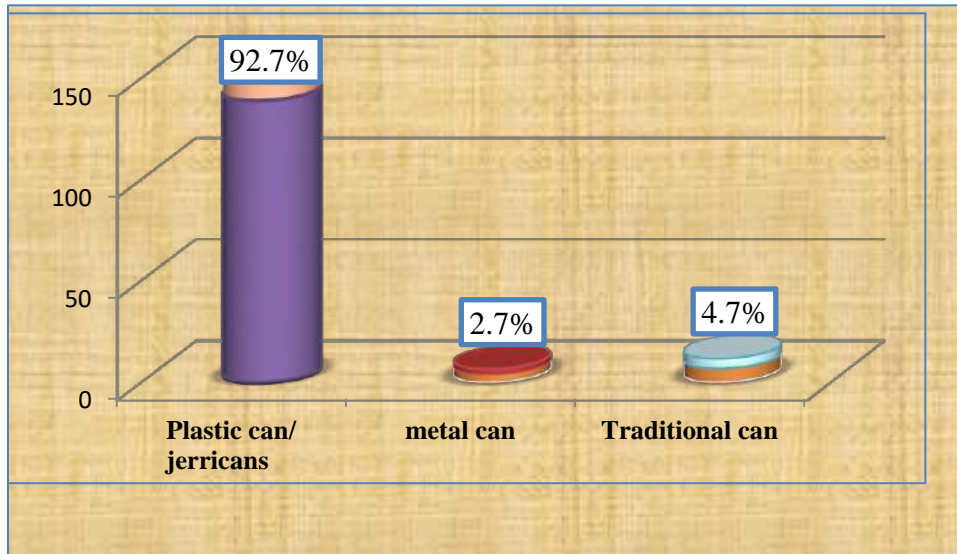


Figure 4: Storage material used for camel milk storage and safety in the study area

Source: Survey result, 2022

4.6 Access to market information

Access to marketing information is an essential element of any marketing activities. Exchange of information is traditionally part of Somali culture, if two persons coming from different direction are met along the road, they do not pass each other unless they exchange information relating peace, good pasture and rain, marketing situation of the nearby market and its information. There is one old saying of Somali “there is no hunger than being eager to get information” which means hunger for information is more serious than hunger for food.

Access to marketing information is an intrinsic factor that allows the producer to get their products a fair price, market information is principal element of any marketing activities. The author consequently tried to see access of marker information, sources of market information and where they sell their camel milk in the study area and the following results were obtained in table 4.10.

Table 4.10: Distribution of access to marketing information and other related issues

Variables	N0=150	Frequency	%
access of market information	Yes	118	78.7
	No	32	21.3
Main information source	Telephone	51	34.0
	Other milk traders	67	44.7
	No access of market information	32	21.3
Where do you sell your camel milk	At the village market	111	74.0
	At the local market	39	26.0

Source: Survey result, 2022 % = Percentage n = Number of household interviewed

As is stipulated in table 4.10, the finding against whether the respondents have access to market information was found that 118(78.7%) responded “yes” we have access to marketing information and rest of them which is 32(21.3%) of the total were demonstrated there is no access to marketing information to sell their camel milk confidently. With respect to sources of information, most 67(44.7%) of the respondents replied during interview and open discussions that they usually get through other milk traders, while 51(34%) and 32(21.3%) of the respondents were get market information through Telephone and no access of market information respectively. Those with no access to marketing information belonged to Haljidd kebele which has physical barriers of access because of no communication access.

4.7 Access to extension services

The livestock sector in Somali region plays vital roles in ensuring food security, provision of traction power, generation of pastoral income and employment at the household level as well as regional economic development through foreign exchange earnings and it’s also culturally important. However, the contribution of this resource to the regional economic is not commensurate to the huge regional potential and this mismatch is mostly caused by the widespread prevalence of many infectious and parasitic diseases which drastically reduce the production and productivity of livestock through morbidity, mortality and market restrictions. Access to extension service is a vital capital which enhances quality and quantity of livestock production, productivities and improves the skill of the producers.

Veterinary services deal with all activities concerting animal healthcare and disease control. This includes: disease outbreak control, disease prevention, disease investigation/diagnosis, drug and vaccine control and provision and therapeutic services.

The pastoral community has no stable life as it wanders from place to place following its animal in searching of feed and water. This condition makes animal health and veterinary services are presently not accessible to the vast majority livestock owners in pastoral areas of Somali region. Provision of livestock extension services become very difficult in the study area due to number of reasons including poor infrastructure, livestock population are highly mobile, limited qualified staff and inadequate animal health services. The researcher makes an effort to know the access and availability of animal health and veterinary services in the study area. The result displayed the table 4.11

Table 4.11: Distribution of respondents access to extension services (N=150)

Variables		Frequency	%
Access to Extension service	Yes	138	92.0
	No	12	8.0
Where do you get Extension service	Woreda Pastoral Development office	98	65.3
	Kebele animal health center	40	26.7
	No access of extension service	12	8.0
Availability of Animal health service	Yes	39	26.0
	No	111	74.0

Source: Survey result, 2022 %= Percentage n=Number of household interviewed

As indicated in table 4.11, about, 138(92%) of the respondents has an access of extension service, whereas, 12(8%) had no access to extension services to their livestock. Majority 98(65.3%) of respondents gets extension service from office of pastoral development which provided service by campaign vaccination, while 40(26.7%) and 12(8%) of the respondent household heads were kebele animal health center and no access of extension service respectively. Regarding the availability of animal health service of the respondents, 111(74%) of them were replied that there is no sufficient animal health services in our kebele, whereas, 39(26%) of them said that yes we had animal health service. In addition to these, during the survey pastoralists reported most of extension providers do not give attention for forage and grass land improvement except one project which is called drought resilience and sustainable livelihood project (DRSLP). Therefore, livestock move long distance to search feed and water,

but what happens sometimes they came across new diseases when they move new places. This finding agrees with the previous report of Igge (2019).

4.8 Access to credit and membership of milk marketing cooperatives

The provision of financial services at a reasonable cost, especially credit to poor pastoral households and milk cooperatives who have limited assets is crucial for promoting of a fair and non-discriminatory marketplace in the pastoral areas.

Credit received from different sources improves involvement in the activities of camel milk marketing and sales volume of the poor pastoral households and milk cooperatives. Even though; there is no any formal financial institution that provides credit facility in the study area, but among members of cooperative give loan.

The markets are penetrating deep pastoral communities creating various layers of market settings and new institutional arrangements such cooperatives and sales groups instead of an individual trekking his milk to the market by himself. Membership in milk cooperatives enables the pastoral household to obtain services provided by the milk groups such as transport facilities and input supplies and this motivates their participation in milk marketing.

Milk cooperatives buy and sell milk in bull, as they have better financial and information capacity. They collect fresh milk from milk producers, their members or bush markets and/or roadside markets in larger volumes than any other marketing actors in their area and resell it to mainly cafeterias, hotels, retail shops or final consumers.

Table 4.12: Distribution of respondents access to credit and membership of milk marketing cooperatives (N=150)

Variables		Frequency	%
Is there camel milk marketing cooperative in your kebele	Yes	79	52.7
	No	71	47.3
Household membership for camel milk marketing cooperatives	Yes	63	42.0
	No	87	58.0
Household's access to credit service	Yes	63	42.0
	No	87	58.0
Main purpose to borrow credit service	Livestock purchase	13	8.7
	To start up new business	4	2.6
	Household consumption	27	18.0
	Livestock treatment	19	12.7

Source: Survey result, 2022 %= Percentage n=Number of household interviewed

As revealed in table 4.12, out of the interviewed respondents 79(52.7%) said that camel milk cooperatives are available their kebele, while 71(47.3%) replied there is no such cooperatives which can give as an important service like selling our milk fair prices and transport facilities. Regarding membership in camel milk marketing cooperatives of the respondents, 63(42%) of them were members of these cooperatives, while 87(58%) of them were not member of camel milk marketing cooperatives in the study area.

Current result indicates about, 58% of the respondents had no access to credit service, whereas 42% of the respondents had an access to credit and the main purpose to borrow credit service was household consumption which was account 18%, while 12.7%, 8.7% and 2.7% were used livestock treatment, livestock purchase and to start up new business respectively. Those who access to credit is almost all from informal credit as respondents stated during the focus group discussion. Sources of credit in the study area is local money lenders within the among cooperative members and formal sources of credit such as micro-finance institutions are not available Ararso woreda and their kebeles this mean in the study area there was no formal credit institutions.

4.9 Constraints and opportunities of camel milk marketing

4.9.1 Constraints of camel milk marketing

In the pastoral area, camel milk marketing facing numerous constraints which are hindering economic contribution of camel milk to pastoral households. The common milk marketing constraints in Somali region includes: lack of clear milk marketing system, inaccessibility of market and lack of transport, lack of effective extension service to use newer technology and practices, lack of market information and seasonality of milk production in pastoral production system is great and it is believed that some surplus camel milk is wasted during the rainy seasons when production is high.

Table 4.13: Constraints of camel milk marketing in study area

Variable	Rank based on their severity
	1 st
Distance to market	1 st
Major constraints of	2 nd
camel milk marketing	2 nd
Lack of transportation facility	2 nd
Shortage of Milk packaging materials	3 rd
Lack of demand	4 th
Lack of market or collection center	5 th

Source: Survey result, 2022

As indicated table 4.13, according to respondents, there were different constraints in camel milk marketing. The challenges in the camel milk marketing were ranked from the most important to the least important and the major constraints of camel milk marketing in the study area were: most pastoralist households travel long distance to sell their milk in the market, lack of transportation facility, shortage of milk packaging materials, lack of demand and lack of market or collection center. On the other hand, during the focus group discussion the participants stated that, there are other problems which encountered during engaging in milk marketing like: lack of access to market, price fluctuation, and poor access of transportation, infrastructures, and milk handling materials and buyers related problem. This finding agrees with previous finding of Wolkaro et al. (2017).

Fadumo Ahmed is one of the Haljid kebele women who rear camel and markets camel milk, when she was participating market related question in the key informant interview she said that: *“Market is critical to our livelihood, and livestock and livestock productions. Because we sell our camel milk to exchange for food and other household necessities and it is extremely difficult for us to reach market during the rainy season, especially if it rains early in the morning and no one comes to buy or sell our milk due to poor infrastructure and transportation, which causes our surplus milk to go to waste. She also stated that we sell all of our milk to Ararso market which far from our kebele and we do not have alternative market. Buyers set price, particularly during the wet season when there is a surplus of camel milk. As a result, we respectfully beg that the government, NGOs, and investors provide us a hand and assist us in delivering our milk at a reasonable price at the farm gate.”*

4.9.2 Opportunities for camel milk marketing

Camel milk marketing gives a lot of opportunities for pastoral households or producers to generate regular income. Even though many constraints that obstruct the increment of milk marketing were identified in the study area, the majority of milk producers in the study area were willing to continue and expand the sector in the future. There is rapid urbanization, extensive population growth, large unmet demand, huge potential for increased supply, emerging trends in commercialization and change in the living standard of the societies in the study area which are good opportunities for camel milk marketing in the future. As demand for camel milk grows, there is a need to access adequate animal health service, new technology transfer and training services to increase the camel milk production potential in the area.

4.10 Econometric Model Results and Discussion

4.10.1 Assessment of multiple linear regression assumptions

4.10.2 Detecting of outliers

Significant outliers and influential data points can place under influence on multiple linear regression models, making it less representative of data as a whole. Therefore, the existence of outliers is detected by using of a Cook's distance. Any values over one are likely to be significant outliers, who may place undue influence on the model and should therefore be removed our data and rerun analysis. Otherwise, the outlier who capable to interrupt the outcome is not detected.

Table 4.14: Tests of outliers by using a Cook's distance

	N	Minimum	Maximum	Mean	Std. Deviation
Cook's Distance	150	0.000	0.110	0.009	0.019

Source: Survey result, 2022

As the result of table 4.14 revealed, the minimum Cook's distance value is 0.000, while, the maximum value is 0.110 and estimated distance is less than expected threshold value 1, so the problem of outlier is not obvious in this study and there is no influential case biasing used model.

4.10.3 Assessment of Multicollinearity

This is an essentially assumption that my predictors are not too highly correlated with one another.

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 the other independent variables in the model or not.

When one or more predictor variables are highly correlated, the regression model suffers from multicollinearity, which causes the coefficient estimates in the model to become unreliable.

As a general rule, if the VIF of a variable exceed 10, there is multicollinearity. 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 multiple linear regression analysis.

Table 4.15: Multicollinearity test using VIF test

Variables	Tolerance	VIF
Age of the household head-years	0.247	4.048
Family size	0.237	4.228
Average milk produced / camel /per day in wet season	0.637	1.569
Average milk produced/ came/ per day in dry season	0.656	1.524
Number of lactating camel	0.268	3.726
Average of camel milk used for household consumption per day in wet season	.502	1.991
Average of camel milk used for household consumption per day in dry season	0.718	1.392
The average costs incur for transporting camel milk supply	0.510	1.960
Camel milk price per liter selling in the market during wet season	0.227	4.411
Camel milk price per liter selling in the market during dry season	0.196	5.095

a. Dependent Variable: Volume of camel milk marketed or soled measured in liter

Source: Survey result, 2022

As the result of study shows in the table 4.15, all the variables tolerance are greater than 0.10 and their VIF values also lower than 10. Therefore, there is no multicollinearity problem that alters the analysis of the multiple linear regression model.

4.10.4 Assessment of Normality of the Error Term

Normality: is when data follows a normal distribution and it's symmetrically distributed with no skew when plotted on a graph and data follow a bell shape, with most values around a central region and tapering off as they further away from the center.

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 hypotheses of the Shapiro-wilk test as follow:

H0: the error term is normally distributed with a 95% confidence level

H1: the error term is not normally distributed with a 95% confidence level

If the p-value is greater than ($\text{Sig} > 0.05$), we fail to reject null hypothesis and reject alternative hypothesis.

Table 4.16: Tests of Normality using by Shapiro-wilk

	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Studentized Residual	0.042	150	0.200*	0.985	150	0.102

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Source: Survey result, 2022

As a result indicates in table 4.14 the assumption is achieved, the value of p-value is 0.102 which is greater than 0.05 ($\text{Sig} > 0.05$) therefore, we accept null hypothesis and the variables are normally distributed with a 95% confidence level.

4.10.5 Assessment of Homoscedasticity test

Homoscedasticity refers to the case in which the variance of the error term is not constant for all values of the independent variables. This is tested by drawing a graph with standardized predicted values versus standardized residual curve. In the curve if any continuity trend can observed that means, if standardize predicted value going in line standardized residual that means, 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 did not show any serial trained. For this reason, the homoscedasticity problem is not real in the distribution (Fig 5) .therefore, homoscedasticity assumption is satisfied.

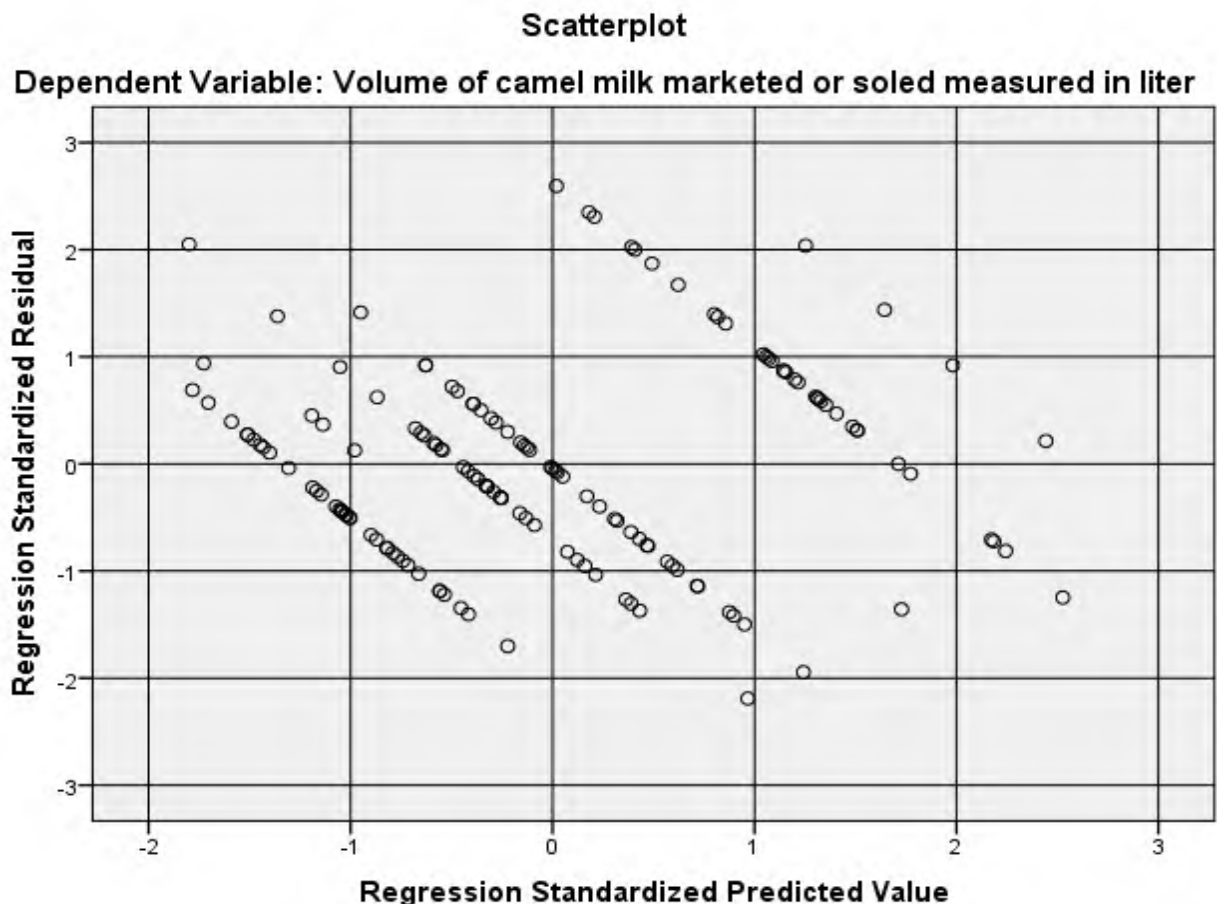


Figure 5: Homoscedasticity test

Source: own computational result, 2022

4.10.6 Pearson’s coefficient of correlation analysis of dependent and independent variables

The Pearson correlation coefficient(r) measures the strength and direction of the relationship between independent and dependent variables. Based on the designed objective of the study, Pearson correlation coefficient was used to identify the factors determining pastoral households’ camel milk market supply and below table indicates the correlations between explanatory and dependent variables:

Table 4.17: Association of independent variables with dependent variables

Independent variables	Pearson's coefficient of correlation	Sig. (2-tailed)	N
Age of the household head	0.266**	0.001	150
Sex of the Household head	-0.122	0.138	150
Family size	0.297**	.000	150
Education Status of the household head	-0.108	0.190	150
Number of Livestock kept for HH in TLU	0.694**	.000	150
Frequency of milking camel	0.171*	.037	150
Camel milk selling frequently	.204*	0.012	150
No. of lactating camels owned HH	.803**	0.000	150
Camel milk price per liter selling in the market during dry season	.236**	0.004	150
Camel milk price per liter selling in the market during wet season	.283**	0.000	150
Distance to market for camel milk marketing	.151	0.066	150
Access of market information	-.137	0.095	150
Membership of household in milk marketing cooperative (milk seller group)	-.106	0.197	150
Access of Extension service	-.062	0.451	150
Access to credit services	-.106	0.197	150

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

Source: Survey result, 2022

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

Fundamentally, the test helps to identify important factors which capable to affect the dependent variable volume of camel milk marketed for pastoral households'. As correlation analysis results indicated, the majority of the independent variables except sex of the households, educational level of the household, average milk produced per camel per day in wet and dry season, distance

to the nears market, access of market information and, access to credit and extension service were linearly associated with the volume of camel milk marketed for pastoral households' with a 0.01 level of significance. Besides, some of the variables indicated a negative association; while, the other develop positive association.

Age of the household head: as indicated in table 4.17, of Pearson's coefficient correlation analysis, the output of age of the household heads has got a positive association with the volume of camel milk market supply of the pastoral households and significant at exactly 0.01 level at 2-tailed significance. This output implies that the ages of the household heads statistically significant in relation to the dependent variable. So its indicates that as the age of household head increases amount of camel milk marketed increases, because they can economically manage the camel milk production with dramatically increases their camel milk supply volume.

Sex of the Household head: the output of the sex of the respondents has got a negative association with the dependent variables having the value of 0.138 level of 2-tailed significance. This output shows that sex of the household heads statistically not significant in relation to the dependent variable.

Household family size: as far as family size concerned, the output of the Pearson's coefficient analysis shows that there is positive association with the dependent variables and statistically it is significant at 0.01 level showing value of 0.000 at 2-tailed significance. This result implies that the number as the number of the household members increases, their supply in milk market increases which has a positive impact on the level of volume in the supply of camel milk to market.

Education Status of the household head: the result shown in the table 4.17, regarding the correlation of education status of the household heads with the dependent variable indicated that there is negative association having the value of 0.190 level of 2-tailed significance. This output implies that education status of the household heads statistically not significant in relation to the dependent variable.

Number of Livestock kept for HH in TLU: concerning the relationship of number of livestock holding for households in tropical livestock unit with the dependent variable, the result indicates that there is positive association and significant at 0.01 level having value of 0.000 at 2-tailed

significance. This implies that when ownership of different livestock species increases the household's volume of camel market supply increases.

Frequency of milking camel: the output for frequency of milking camel reveals that there is positive relationship with dependent variable and it significant at exactly 0.05 level having value of 0.037 at 2-tailed significance. This result implies that the increment of frequency of milking camel was dramatically increases the volume of camel milk market supply of the household.

Camel milk selling frequently: with regard to camel milk selling frequently, the result of the Pearson's coefficient correlation analysis indicates that positively relationship with dependent variable and it significant at 0.05 level having the value of 0.012 at 2-tailed significance.

No. of lactating camels owned HH: as indicated in the table above, number of milking camel heads owned by household has positive association with the dependent variable and significant at 0.01 level having value of 0.000 at 2-tailed significance. This result indicates that owning more lactating camel heads increases the household's volume of camel milk market supply.

Price of camel milk in wet season: as reveal in table 4.17, the output of this variable association positively and significantly with volume of camel milk supplied to market for pastoral households with a 0.01 level of significant having value of 0.000 at 2-tailed significance. This implies an increment of price per liter in wet season increases the volume camel milk market supply of the household.

Price of camel milk in dry season: as reveal in table 4.17, the output of this variable association positively and significantly with volume of camel milk supplied to market for pastoral households with a 0.01 level of significant having value of 0.004 at 2-tailed significance. This implies an increment of price per liter in wet season increases the volume of camel milk supply of the household in camel milk market supply.

Membership of camel milk marketing cooperative (milk seller group): as far as the relationship of membership in milk seller group with the dependent variable is concerned, it has got negative association with the dependent variables having the value of 0.197 level of 2-tailed significance. This output shows that membership to cooperative statistically not significant in relation to the

dependent variable. This shows that being a member of the milk group is not a driving force of participation in milk marketing for low milk producing households.

Distance to market for camel milk marketing: as indicated by Pearson's coefficient analysis, it has positive association relationship with the dependent variable having the value of 0.066 level of 2-tailed significance and statistically not significant. This output shows that distance to market statistically not significant in relation to the dependent variable.

Access to milk marketing information: with regard to marketing information, the output indicates that there is a negative relationship with volume of camel milk supplied to market having the value of 0.095 level of 2-tailed significance and not statistically significant. This implies that exposure to marketing information will not automatically increase the participation of the household in the activities of milk marketing.

Access of extension service: as indicated by Pearson's coefficient correlation analysis, the output of access of extension services shows that there is negative association with dependent variable and not statistically significant having the value of 0.451 level of 2-tailed significance. This implies that getting access of extension service is not promotes the participation of camel market supply.

Access to credit services: with regard of access to credit households, the result of the output indicates that the relationship between accesses to credit with dependent variable is negative association and not statistically significant having the value of 0.197 level of 2-tailed significance. This implies that the providing credit access have no any contribution for volume of camel milk market supply of the study area.

4.10.7 Factors which mostly determining volume of camel milk market supply

The multiple regression model was used to determine the factors influencing the volume of camel milk market supply in the study area. The variables of regression model was formulated and tested where the dependent variable was volume of camel milk marketed or soled (Y_i) and independent variables included in the estimation were: The average income gains from selling camel milk during dry season, Number of lactating camel of the HH, Camel milk/liter selling price in the market during dry season, Household family size , Number of Livestock kept for HH in TLU, Age of the household head, Camel milk/liter selling price in the market during dry

season, The average income gains from selling camel milk during wet season. The results are presented in Table 4.18 below.

Fundamentally, the regression analysis is used to test how the model fits and investigate the determinant variables from the given independent variable. Finally, the regression questions were got their suitable answer based on the proposed specific objectives and regression output results and it's explores whether all the above explanatory variables equally affect the volume of camel milk supplied in the market or not.

The R-square (coefficient of determination) in the model summary table can be interpreted as the proportion of variation in the dependent variable accounted for by the test of predictors. Multiplying by 100% allows me to interpret as percentage of variation accounted for.

We can see here, that the set of predictors accounted for approximately 74.3% of the variation in test of volume of camel sold; whereas, the rest 25.7% of the variation can cover by other unknown variable which not included in the study.

According to Cohen (1988), suggested the following standards for judging the size of the effect of the set of predictors and dependent variable using R-square: $R^2=0.02$ (small effect); $R^2=0.13$ (medium effect); $R^2=0.26$ (large effect). Using these standards the size of the effect of the predictors on the dependent variable can be described as large effect.

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 checked by using **AVOVA** test. As the result indicated 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; for that reason, accept the hypothesis which is stated that the model is fitted or good.

Table 4.18: Model determination (ANOVA)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	798.785	8	99.848	50.850	.000 ^b
	Residual	276.864	141	1.964		
	Total	1075.648	149			

a. Dependent Variable: Volume of camel milk marketed or soled measured in liter

b. Predictors: (Constant), The average income gets from selling camel milk during dry season, Number of lactating camel, Camel milk/liter selling price in the market during wet season, Family size in number, Number of Livestock kept for HH in TLU, Age of the household head, Camel milk/liter selling price in the market during dry season, The average income gains from selling camel milk during wet season.

Source: survey result, 2022

As revealed in table 4.18, 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 is 0.862 which 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.

Large values indicate that the explainable level of the independent variables to determine the dependent variable is strong. The sample R squared tends to optimistically estimate how well the models fit for the population. The results given in the ANOVA table are used to test whether the R-square computed from one's data differs significantly from a population R-square of 0. That means, a population R-square of 0 is the null for this test. This test relies on the F-distribution for df_{reg} and df_{res} and assuming a given alpha level of 0.05.

Based on the result provided in table 4.18, we can infer that the population R-square is greater than zero [$R^2=0.743$, $F(8,141)=50.850$] and statistically significance at 0.05level.

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 factors are important to determine the model otherwise the factor should be rejected in the model. Therefore, five of the independent variables in the model are statistically significance to their unique contribution and they are Household Family size, Age of the household head, Number of lactating camel of the HH, Price of camel milk in the wet season and Access to credit service, where the rest of independent variables are not statistically significant to their unique contributions.

Table 4.19: The determinant volume of camel milk market supply

R=0.862	R²=0.743		Adjusted R²=0.728	SE=1.401	
Variables	Unstandardized Coefficients		Standardized Coefficients	t-value	Sig.
	B	SE	Beta		
Constant	3.430	1.403		2.446	.016
Sex of the Household head	-.455	.259	-.084	-1.756	.081
Education Status of the household head	.243	.337	.033	.722	.472
Household Family size	.191	.083	.188	2.306	.023**
Age of the household head	-.051	.018	-.223	-2.812	.006**
Number of Livestock kept for HH in TLU	.039	.020	.158	1.970	.051**
Number of lactating camel of the HH	.706	.069	.694	10.255	.000**
Average of income gains from selling camel milk during wet season	-.008	.004	-.193	-1.758	.081**
Average of income gain from selling camel milk during dry season	-.001	.003	-.020	-.185	.853**
Camel milk/liter selling price in the market during wet season	.126	.056	.195	2.256	.026**
Camel milk/liter selling price in the market during dry season	-.084	.061	-.153	-1.372	.172**
access of market information	.515	.587	.079	.877	.382
Distance to market for camel milk marketing	.245	.228	.078	1.076	.284
Access of Extension service	-.163	.461	-.017	-.353	.724
Access to credit service	-.791	.365	-.146	-2.170	.032

Source: survey result, 2022.

Not: **1% significance level * 5% significance level.

a. Dependent Variable: Volume of camel milk marketed or soled measured in liter (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. For that reason, the regression analysis is used to test the developed questions based on the specific objectives and investigate the contributions of the independent variables over dependent once.

Mainly, the researcher wants to check whether above the independent variables (Household Family size, Age of the household head, Number of lactating camel of the HH, Price of camel milk in the wet season and Access to credit service), are statistically significant determinant of the volume of camel milk marketed or soled measured in liter (Y_i) or not.

Hence, the result indicated in table 4.19, all the variables are statistically significant associated with dependent variable volume of camel milk marketed/sold (Y_i) where (p -value=0.000 up to 0.032, $<sig$ value=0.05). therefore, the assumed hypothesis which is stated that the Household Family size, Age of the household head, Number of lactating camel of the HH, Price of camel milk in the wet season and Access to credit service are significant important to determine the volume 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 (socio-economic, seasonal price of milk, institutional variables) were postulated to influence volume of camel milk supplied in the market. Out of fifteen explanatory variables hypothesized to volume of camel milk supplied in the market eight were found to be statistically significant when it run to model. These factors include: the Household Family size, Age of the household head, Number of lactating camel of the HH, Price of camel milk in the wet season and Access to credit service.

Household Family size: This variable was related positively and significantly with volume of camel milk supplied to market with a 0.05 level of significance. So, after taking the remaining variables as a constant, for a one person increment of household family size the volume of camel milk supplied to market increases by 0.191 liter.

Age of the household head: This variable was related negatively and significantly with volume of camel milk supplied to market with a 0.05 level of significance. So, after taking the remaining variables as a constant, for a unit increment of Age of the household head the volume of camel milk supplied to market decrease by 0.051 liter.

Number of lactating camels of the HH: This variable was related positively and significantly with volume of camel milk supplied to market with a 0.05 level of significance. So, after taking the remaining variables as a constant, for one lactating camel increment of the household the volume of camel milk supplied to market increases by 0.706 liter.

Price of camel milk in wet season: This variable was related positively and significantly with volume of camel milk supplied to market with a 0.05 level of significance. So, after taking the remaining variables as a constant, for unit increment of the price per liter in wet season the volume of camel milk supplied to market increase by 0.126 liter.

Access to credit services: This variable was related negatively and significantly with volume of camel milk supplied to market with a 0.05 level of significance. So, after taking the remaining variables as a constant, for a unit increment of Access to credit services of the household the volume of camel milk supplied to market decrease by 0.791 liter. This implies that when household receive Access to credit services they prefer other small business trade rather than marketing camel milk which means credit does not promote participation in milk marketing in the study area.

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CHAPTER FIVE

5. CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusion

The study was carried out Ararso woreda, Jarar zone of Somali Regional State with the objectives of identifying the factors determining the volume of camel milk market supply, effect of marketing support or institutional factors have on the level of participation (volume of sales) in the camel milk market and assessing the constraints and opportunities in the camel milk marketing of pastoral households. Multiple stage sampling technique was applied to select sample size, the first stage; Ararso woreda was selected purposively since it is one of the most potential areas for camel milk production, marketing and accessibility in Somali pastoralists. In the second stage, four pastoralist Kebeles, namely Ubahle, Haljid, Magalo-ad and Dinta'ab of Ararso District, were selected purposively since they are the most camel potential area in the district out of the total 17(seventeen) Kebeles. In the third stage, 150 household's heads were selected using a simple random sampling method and probability proportional to the size of the population of the sample kebeles.

Both primary and secondary data were collected for the purpose of this study. The primary data were collected from pastoralist's households who involve camel milk marketing through a questionnaire, focus group discussion, field observation and key informant interview prepared for the study. Secondary data were collected using available sources of information such as published and unpublished documents. The data analysis and interpretation were done by using SPSS and Excel.

Livestock production especially camel production plays important roles in cultural, economic, food security and social development of Somali pastoral communities. Camel herding for Somali communities indicated as a basic way of life, insurance against natural disaster, wealth status, prestige, and highly valued cultural heritage. The camel is an important livestock species uniquely adapted to hot and arid environments therefore; Somali pastoralists are a camel community mainly because of the dry and harsh environment they live in;

Based on the present finding shows camel is source of income and food. In the study area camel milk marketing for pastoral households plays a great contribution to their life as food and income

generating activity. The survey found that the average sell volume of camel in the study area was 6.06 ± 2.69 and the average camel milk production per day depends on the seasons and availability of fodder and water participants stated during a focus group discussion.

The major constraints that hinder camel milk production in the study area were feed shortage, shortage of grazing land with low productivity, disease and parasites, and high medicament costs. In this area is characterized by high ambient temperature, low and erratic rainfall with less precipitations per annum in most times. The vegetation in the area is dominated by sparsely distributed perennial shrubs and trees species the majority of which are less palatable.

The major constraints of camel milk marketing in the study area were: most pastoralist households travel long distance to sell their milk in the market, lack of transportation facility, shortage of milk packaging materials, lack of demand and lack of market or collection center. On the other hand, during the focus group discussion the participants stated that, there are other problems which encountered during engaging in milk marketing like: lack of access to market, price fluctuation, and poor access of transportation, infrastructures, and milk handling materials and buyers related problem.

On the other hand, results of the econometric model indicated the influence of different variables on the level of participation/volume in the supply of camel milk to market. A total of fifteen explanatory variables were included in the model out of which eight variables had shown significant relationship with volume of camel milk supplied in the market.

Accordingly, The average income gets from selling camel milk during dry season, Number of lactating camel, Camel milk/liter selling price in the market during wet season, Family size in number, Number of Livestock kept for HH in TLU, Age of the household head, Camel milk/liter selling price in the market during dry season, The average income gains from selling camel milk during wet season were found to have positive and significant influence on volume of camel milk supplied to market.

5.2 Recommendations

Based on the results of the study, there are different constraints of camel marketing in the study area which are most pastoralist households travel long distance to sell their milk in the market, lack of transportation facility, shortage of milk packaging materials, lack of demand and lack of market or collection center. On the other hand, during the focus group discussion the participants stated that, there are other problems which encountered during engaging in milk marketing like: lack of access to market, price fluctuation, and poor access of transportation, infrastructures, and milk handling materials and buyers related problem. Therefore, to improve the milk sect in the study area and sustenance pastoralist livelihood development, the researcher recommends the following:

- ✚ Strengthening marketing information mechanism in a more structured way will enable them to better link with the consumer market.
- ✚ To develop modern range land management and conservation of natural pasture (indigenous grass species) is an important to avert the problem of cactus and congress weed infestation “kalgii noole”.
- ✚ To improve 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 and it takes livelihood and income source of the study pastoralists into account.
- ✚ To increase accessible and quality Animal health services in the pastoral areas: in order to eradicate or deduce 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.
- ✚ To improve and enhance the camel milk production and marketing: the woreda pastoral development office and other stakeholders should jointly move shoulder to shoulder to introduce a new technology and strength the capacity of pastoralists in feed conservation and milk handling equipment.
- ✚ To develop milk market development strategies for pastoral and agro-pastoralist communities.

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2.1. Number of Livestock kept

S/N	A. Livestock species	B. No. of Livestock
1	Camel	
2	Cattle	
3	Goats	
4	Sheep	
5	Poultry	
6	Donkey	
7	Others	

2.2 What are the other sources of earning income in your household (excluding camel milk)?

1. Cow Milk marketing 2. Charcoal production 3. Shoat selling 4. Small Business

2.3 What is the amount of income earned from other sources (excluding camel milk)? _____ birr

2.4 How did you acquire your starting rearing camel?

- 1) Inherited from family 2) Purchased 3) Received as a gift 4) Received as bride price

2.5 Camel ownership and production objectives

2.5.1 Rank the importance of different sources of livelihoods to your household's needs:

Camels	Cattle	Sheep & goats	Business	Formal employment	Crop farming	Remittances from relatives

3 = Highest importance; 2 = Average importance; 1 = Low importance; 0 = No importance

2.5.2 Rank the relative contribution of each of the following uses of camels to your household's needs:

Camel contribution to your household's	Rank
1. Sale of milk	
2. Sale of offspring (Progenies)	
3. Use for transportation needs	
4. Socio-cultural needs (e.g. paying dowry, blood compensation, slaughter for ceremony)	
5. Keep as form of wealth	

3= Highest importance; 2 = Average importance; 1 = Low importance; 0 = No importance

2.6 What is the main purpose of camel rearing (Keeping)?

1. For milk production 2. Meat purposes 3. Meat and milk purposes 4. Transport purposes
5. Social and cultural role 6. To sell

2.7 What are the factors Determining amount of camel milk supplied to the markets?

- 1) Socio-economic factors 2) Market factors 3) Institutional factor 4) Seasonal price of milk
4) others specify _____

Part III

Camel milk production and performance

3.1 How many times do you milk your camels per day?

1. Morning only 2. Morning and evening 3. Morning, midday and evening

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

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

3.4 How many lactating camel do you have? _____

3.5 How much camel milk you use for household consumption per day in wet season?(liter)_____

3.6 How much camel milk you use for household consumption per day in dry season?(liter)_____

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

1. Yes 2. No

3.7.1 If your answer for Q3.7 is yes, what are the reasons? _____

3.8 In which type of camel milk your household members use mostly?

- 1) Fresh 2) soured 3) Bothe fresh and soured 4) Mixed with other milk

3.9 How much milk is produced per camel per day in your herd on the average presently?

1. Less than 1 litre 2. 1-5 litres 3. 6-10 litres 4. More than 10 liters

3.10 How many months of lactation do you normally have?

1. 6 months 2. 9 months 3. 12 months 4. 13 months

Part IV

Camel Milk Marketing and Access to Market

4.1. Do you sell your camel milk?

1. Yes 2. No

4.1.1. If your answer for Q4.1 is Yes, What is the sale volume in a day? _____ (Liters)

4.1.2. If your answer for Q4.1 is Yes. To whom do you sell your camel milk?

1. Directly to consumers 2. Retailers 3. Whole sellers 4. Private collectors
5. Through service cooperatives 6. Others specify _____

4.2 Who among your household members is engaged in camel milk selling?

1. Men 2. Women 3. Children

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

1. Price of milk per liter 2. Distance of market for milk 3. Market reliability

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

1. Yes 2. No

4.5 If no for Q4.4, 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

5.3. 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 _____

5.4 Please rank the following most important constraints influencing camel milk production (1 most important and 4 least important)

Major constraints of camel milk production Rank

1. Feed shortage
2. Diseases and parasites
3. High medicament costs
4. Shortage of land for grazing

Part VI

Infrastructure, Access to Extension and Credit Services

6.1 Is your village (road) accessible to car?

1. Yes 2. No

6.2 Is animal health service available in your kebele?

1. Yes 2. No

6.3 Do you get extension service?

1. Yes 2. No

6.4 If your answer for Q6.3 is yes, from where do you extension service?

1. Woreda Pastoral Development office 2. Kebele animal health center
3. NGO/GO support 4. No access of extension service

6.5 Is there camel milk marketing cooperative in your kebele?

1. Yes 2. No

6.6 Is your household a member of any of milk marketing cooperatives?

1. Yes 2. No

6.7 Does your household have access to credit service?

1. Yes 2. No

6.8 If yes Q 6.7, 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....

Appendix 2: Key Informant Questions check list

1. How many households exist within this community?
2. How many of the households rear camels?
3. What are the main sources of livelihoods for the people in this community?
4. What institutions exist to support livestock sub-sector in the area
5. Is there a specific organization that deals with camels and camel products?
6. Are there any bye-laws that address camel and camel products?
7. What camel products are traded in the area?
8. What are the main markets for these camel products?
9. How is the extension services organized to reach camel farmers?
10. What extension services do they offer?
11. What are the challenges/constraints to camel milk production in the area?
12. What are the challenges/constraints to camel milk marketing?
13. How can camel milk production be strengthened and formalized with retailers and milk traders?
14. What are the factors Determining amount of camel milk supplied to the markets?

APENDIX 3: 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 Agro-pastoralists)
- 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 is the average income do you gain from selling of your camel milk? And how you expend?
- 12) What are the roles of governmental and non-governmental institutional in volume of sales in the camel milk market supply?
- 13) What are the problems you faced during your involvement in milk marketing activities in relation to access to market, distance, road infrastructure, transport facility, input supply, extension services, and marketing information?

Appendices 4: field observation and Focus Group Discussion photos



Focus Group Discussion

Household Interview

Appendices 5: Conversion factors used to estimate tropical livestock unit (TLU) equivalents

Animal Category	TLU
Calf	0.25
Donkey (young)	0.35
Weaned Calf	0.34
Camel	1.25
Heifer	0.75
Sheep and goat (adult)	0.13
Cow and ox	1.00
Sheep and goat (young)	0.06
Horse	1.10
Chicken	0.013
Donkey (adult)	0.70

Source: Storck et al. (1991)