ANALYSIS OF CAMEL MILK SUPPLY CHAINS AND THE POTENTIAL FOR COMMERCIALIZATION IN ISIOLO COUNTY, KENYA

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A Thesis Submitted to the Graduate School in Partial fulfillment for the requirements of the Master of Science Degree in Agricultural and Applied Economics of Egerton University

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DECLARATION AND RECOMMENDATION

Declaration

I declare that this thesis is my original work and it has never been presented for an award of a degree, diploma or certificate in this or any other University.

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DEDICATION

This work is dedicated to my late grandmother mama Ludia who took me through school to this level, my entire family, wife and children.

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ABSTRACT

Pastoral communities in Isiolo county of Kenya inhabit the Arid and Semi Arid areas where the climatic conditions provide limited effective and sustainable options for land use other than mobile livestock rearing and in particular camel keeping for their livelihoods. Trends of population growth, climate change, globalization as well as political and socio-economic changes are placing growing pressures upon these communities and thereby reshaping rural livelihoods in many parts of the world including Kenya. This study done in the arid and semi-arid areas of Isiolo county, Nakuru and Nairobi undertook to analyze the characteristics of the current camel milk supply chains, socioeconomic factors that drive commercialization, traditional consumers' perceptions on camel milk and the factors that influence willingness to pay for a premium for camel milk amongst potential consumers. A multistage sampling technique was used for data collection. Data were collected using structured questionnaires and augmented by a focus group discussion. Data were entered into SPSS Version 15 data base and analyzed using STATA computer software. A linear multivariate regression model, logistic regression model and likert scale scoring technique were used to analyze the degree of commercialization, willingness to pay and traditional consumer satisfaction respectively. Descriptive statistics were used to analyze the socioeconomic characteristics of the value chain players. Results show that the producers sell 84.7% and 85.5% of their milk in dry and wet seasons respectively. The main buyers of milk are the bulkers, mainly comprising of women. They handle on average 2000 litres per day in dry seasons and 5000 - 7000 litres per day in wet season. The retail market reported inability to satisfy demand especially during the dry seasons. There are four supply channels through which the final consumers are reached. Experience and labour size are positively related to the degree of commercialization and significant while age and education level are negatively related to the degree of commercialization and significant. The consumers expressed slightly more dissatisfaction with the prices and packaging of milk than other attributes. Awareness plays a big role amongst potential consumers in their willingness to pay a premium for camel milk. The implications of these results are that promotion of camel milk should be done to raise awareness, packaging improvement is required and camel milk pricing should be done in consideration of cow milk prevailing prices to enhance commercialization.

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LIST OF ACRONYMS AND ABBREVIATIONS

AFCO: Armed forces Canteen organization

ASAL: Arid and semi arid lands.

AIDS: Acquired Immune deficiency syndrome

CMAAE: Collaborative Masters in Agricultural and Applied Economics

CV: Contingent Valuation.

FAO: Food and Agriculture Organization.

G.O.K: Government of Kenya.

GDP: Gross Domestic Product

KCC: Kenya Cooperative Creameries

KAPP: Kenya Agricultural Productivity Project

Kg: Kilogram.

M.a.s.l: Metres above sea level.

MT: Metric Tonnes

MOLD: Ministry of Livestock Development

OLS: Ordinary Least Squares

SPSS: Statistical Packages for Social Sciences.

TLU: Tropical Livestock Units

UAE: United Arab Emirates

WTP: Willingness To Pay

CHAPTER ONE
INTRODUCTION

1.1 Background

Kenya's total land area is estimated at 569,140 Km^2 (FAO, 2007) of which only about 20% is suitable for arable agricultural production (Ngugi and Nyariki, 2005).The rest which is 80% is classified as arid and semi arid Lands (ASALs) characterized by low, unreliable and poorly distributed rainfall. This expansiveness of Kenya's ASALs suggests their economic importance for the country. Indeed it is estimated that ASALS support about a quarter of the country's total human population of 38.6Million (GOK, 2010). The ASALs are also home for 60% of the livestock population and the largest proportion of wildlife (GOK, 1994 cited in Ngugi and Nyariki, 2005).

Kenya is an agricultural based economy, with agriculture accounting for over 25% of the total gross domestic product. Livestock production is an important component of the agriculture sector accounting about 47% of the agricultural GDP, or an equivalent of 12% of the National GDP. Based on the census results of 2009, there are 3.36 million exotic cattle, 14.1 million indigenous cattle, 17.1 million sheep, 27.7million goats and 2.96 million camels in kenya, (GOK, 2010). According to the draft sessional paper of 2006 on dairy industry development (GOK, 2007) Kenya is one of the largest producers of dairy products in Africa, with cattle accounting for 88% of the milk produced whereas camels and goats account for the rest.

Globally, FAO, (2008) estimates that there are about 25 million camels in the world, of which 21 million are found in Africa. Of this, 89% are believed to be one-humped dromedary camels (*Camelus dromedarius*) and 11% are two-humped (*Camelus bactrianus*) (Payne and Wilson ,1999 cited in Muhammad and Akpan, 2008). From a global perspective, the economic significance of camel production is minimal in comparison with that of other domestic animals. Nevertheless, in Africa, especially in East Africa and Sahel countries, the camel population makes a significant contribution to national economies.

As stated earlier, the camel population in Kenya is 2.96 million (GOK, 2010). Most of these animals are kept by pastoralists in subsistence production systems. The pastoral land is mainly covered with annual grass, acacias, and dwarf bushes. The annual rainfall varies between 100 and 400 mm, the amount of rain varying from year to year. This type of climatic conditions

permits only extensive system of animal production. Because of their high mobility, ability to survive on modest fodder and water regulation that is perfectly adapted to ASAL, the camel is better suited than any other domestic animal to use this type of environment. According to the nomads, camels can survive in times of extreme drought for up to 30 days without water. They are very reliable milk producers during dry seasons and drought years when milk from cattle, sheep, and goats is scarce. At such times camel can contribute up to 50% of the nutrient intake of the pastoralists. The volume of camel milk produced per annum in the world is 1.64 Million tones of which Africa contributes 1.46Million tones with Kenya alone producing 0.027Million T (FAO, 2008). The draft sessional paper of 2006 on dairy industry development noted that previous dairy policies and other interventionary initiatives placed too much emphasis on dairy cattle and too little to other milk producing livestock species such as goats and camels despite their potential to provide milk of high nutritive value and to adaption to ASALs (GOK, 2007).

Camel milk is traditionally consumed raw by pastoralists. For a long time, camels were kept for subsistence and only a limited amount of milk was being sold. Due to the changing lifestyles in the ASAL communities as a result of urbanization, population increase and insecurity in the lowlands where camels are concentrated, the demand for camel milk has increased especially in urban towns. The pastoralists now sell camel milk as an income generating activity (Farah, 1996). The bulk of marketed milk reaches the consumers through informal marketing channels (Matofari, 2007). In such system of marketing, milk is usually sold raw and in small quantities over varying distances from source to the market, ranging from 20km to 400 km, especially by middlemen supplying Nairobi market.

Camel milk production in Kenya is in transition from production for household consumption under the traditional management in the pastoral areas to production for income generating systems in the peri- urban areas and also in ranches where superior bulls have been imported from Pakistan to improve the genetic potential of milk production (Trevor,1998 cited in Matofari, 2007). As at 1992, camel milk contributed up to 12% of the 3 billion litres of total domestic milk production, and about 70% of the camel milk was consumed by pastoral communities in northern Kenya (Schwartz, 1992).

The herds supplying camel milk to the urban centres are concentrated around Moyale, Isiolo, Garrissa, and Nanyuki in Laikipia district. Isiolo supplies about 600 litres, Garissa 500 litres and Nanyuki 500 litres to Nairobi market daily (Field 2001).

The draft sessional paper of 2006 on dairy industry development proposes to examine how the product chain can best meet consumer needs at affordable prices while ensuring acceptable returns to the industry players (GOK, 2007).

This study aimed at analyzing camel milk supply chain and consumer perception with a view to improving camel milk production and marketing to make it a sustainable, commercially oriented economic activity for enhanced household incomes, food security and employment creation.

1.2 Statement of the problem

The demand for camel milk has increased. Consequently, the pastoralists especially near towns now handle camel milk as an income generating activity. However, the information on the degree of commercialization and the forces driving this commercialization process is limited.

Recent studies on camel milk have dwelt on microbial aspects and hygiene with little mention of supply chain issues. Though it is observed that the marketing arrangements are informal, the specific players in the supply chain, quantities handled, value added at each stage have also not been established.

Camel milk that is marketed informally is usually sold raw to the niche market of Nairobi. In this type of marketing system, consumers are highly vulnerable to being cheated with respect to quality, quantity of the milk being delivered as well as other contractual terms of delivery because the contracts are oral and there is no standardization of the milk.

The draft sessional paper of 2006 on dairy industry development seeks to repeal the 1958 dairy policy (GOK, 2007). This if passed into a new dairy policy will recognize camel milk as one of the dairy products. The enactment of this policy will create a legal environment in which the marketing agents will have incentives to operate extensively reaching out to new consumers. There is limited information on the willingness to pay for the camel milk by the potential consumers that is important in informing the marketing process.

1.3 Objectives

1.3.1 General objective

To make a contribution in generation of reliable information on camel milk market structure and demand that is necessary to facilitate commercial marketing of the milk for increased income and better livelihoods.

1.3.2 Specific objectives

i) To analyze camel milk production in Isiolo county and marketing supply chains.

ii) To identify and evaluate factors influencing the degree of commercialization of camel milk at household level.

iii) To determine the perceptions on camel milk quality and marketing attributes by traditional consumers.

iv) To identify factors that influence the willingness to pay for camel milk by potential consumers

1.4 Research questions

i) What is the structure and performance of the camel milk supply chain in Isiolo County?

ii) What socio economic factors influence the degree of commercialization of camel milk at producer level?

iii) What are the perceptions on camel milk quality and marketing attributes of the traditional consumers.

iv) What socio economic factors influence willingness to pay for a premium for camel milk?

1.5 Justification

The consumption of camel milk is no longer limited to pastoral areas, but has spread to urban areas in the recent years. Camels are therefore increasingly becoming important milk animals especially in the ASAL areas where they are able to produce milk almost all year round and in quantities greater than any other milk animal under the same conditions. Hence understanding camel milk production and marketing chains will help in the commercialization of

camel milk. Increased camel milk marketing will lead to increased incomes for producers and traders hence resulting in improved food security.

Isiolo is an important county in terms of camel keeping in Kenya. Nakuru district is also selected because it represents an urban centre with predominant dairy cattle keeping that is still the main source of cow milk to the town dwellers and also it is away from the camel milk production zone. Since there is no related study done in theses areas, the information generated will be useful for policy formulation and planning purposes in the newly created Ministry of state for the development of Northern Kenya and other arid lands

1.6 Scope and limitations of the study

This study was designed to capture camel milk production and marketing and the degree of commercialization of camel milk. The study covered parts of Isiolo County out of the many counties in Kenya's ASAL. Although there are issues of hygiene and quality aspects of the camel milk, this study confined itself to camel milk production and marketing. Camel herein is the one humped camel referred to as *camelus dromedarius.*

The study acknowledges that during dry seasons in other camel keeping areas, Isiolo County sometimes receives huge herds of migratory camels from Garissa which come in search of pastures. Such herds may impact significantly on the volumes of milk produced and marketed in the supply chain. Effects of migratory camels on camel milk supply chain merits keen study. However, such analysis is beyond the scope of this study. The study focuses only on the camels confined within the county. Further, the study is limited to individual camel keepers within the county. Institutions engaged in camel keeping like Ewaso Nyiro North Development Authority are not covered in the study. The study was based on cross sectional data collected in Isiolo County from October 2008-January 2009. Though the study targeted sample sizes as determined by the formula, it in a number of cases fell short of this target because of non willing respondents, limited numbers of targeted actors in the various categories and also because it was not feasible to reach some areas given the insecurity, expansiveness and the poor infrastructure of the area.

1.7 Definition of terms

Household: All individuals who live in the same residential unit in which economic production and consumption decisions are taken.

Potential consumer: Any individual consuming cow milk but has not had a chance to buy camel milk.

Premium: The maximum amount of money in Kenya shillings the potential consumer is willing to pay for a unit of camel milk over and above the price of an equal unit volume of cow milk.

Commercialization index: Proportion of camel milk sold by the household out of the total produced in a day.

Contract: Any market transaction that need not to be formal or explicit but with mutual obligation for both transacting parties.

Traditional consumers: People who are currently consuming camel milk.

CHAPTER TWO

LITERATURE REVIEW

2.1 Overview of Camel production

2.1.1. Camel populations and distribution

The camel population in Kenya is 2.96 million (GOK, 2010). Most of these animals are kept by pastoralists in subsistence production systems. The distribution of the camels in Kenya per province is as shown in Table 1. North Eastern province has the largest population of camels.

Table 1: *Distribution of camels in Kenya*

Province	Central	Coast	Eastern	North Eastern	Nyanza	Rift valley	Western	Nairobi	Total
No. of camels	231	51,045	248,634	1,700,893	59	968,192	2037	20	2,971,111

Source: 2009 Population and housing census report, 2010

Table 2 shows camel population distribution in Isiolo County over the last four years. It is clear that central Division leads in camel population.

Table 2: Population distribution of camels in Isiolo County

Division	2004	2005	2006	2007
Central	10400	8,700	10100	10,400
Kinna	8,300	7,300	8,060	6,200
Merti	4,160	3,900	4,000	4160
Sericho	5,200	5,600	5,040	5,200
Garbatulla	6,200	5,600	6,050	6,200
Oldonyiro	3,640	3,200	3,530	8,300
Total	**37,900**	**34,300**	**36,800**	**40,460**

Source: MoLD, Isiolo County Annual report, 2007

2.1.2. Camel breeds and reproductive characteristics

Breeds of camels are not as differentiated and classified as breeds of other domestic livestock species. In most camel rearing societies, breed classifications are based on names of the ethnic group, clan, or the geographical localities where the camels are raised, rather than upon phenotypic characteristics. In Kenya for example, there are three main types of camels classified as Somali breed, Rendille/Gabbra breed, and Turkana breed (Matofari, 2007). However, in recent years camels from Pakistan have been introduced in some camel farms in Kenya in order to improve milk production through cross breeding.

Camels are slow reproducers. A female camel is sexually mature at the age of 4 to5 years. Pregnancy is just over 12 months and the calving interval in pastoral production systems is normally 18 months or more. Female camels can remain fertile up to the age of 25 years and it is often reported that they produce 8–10 calves during a lifetime. In pastoral production systems, only a small proportion of the breeding females can reach this production age.

2.1.3. Economic importance of camels and milk production.

The camel has been reported to be useful in shaping and supporting the pastoral economy and culture of the Somali people in northern Kenya (Guliye *et al.* 2007). The main economic value of camels is derived from their milk, meat, blood, transport, and for riding in sports and tourism. Milk for both urban dwellers and pastoralists is said to be the most important reason for keeping camels in the Somali community in Kenya.

Based on quantity of camel milk produced in the year 2006, Kenya is ranked number eight globally, falling behind Somalia, Ethiopia, Sudan, Mali, Saudi Arabia, Niger and UAE (FAO, 2008). The demand for camel milk among the urban Somali is increasingly bringing a steady income for the camel herders (Guliye *et al.* 2007). Baars (1999) observed that the camel was the main source of milk in both the wet and dry seasons in eastern Ethiopia. This means that the camel is an animal of all seasons and it is relied on for livelihoods by diverse pastoral communities. For communities that value camel milk highly, they can only sell in situations when there is more than the amount required for household use. According to Tezera (cited in Mehari *et al.* 2007) majority of the households in one region in east Ethiopia divide part of the milk for home consumption and another part for sale, while in one region they use all the milk for home consumption. Mehari, (2007) found that many respondents in Somali region of

Ethiopia preferred camel milk to the milk from other livestock animals because they believe that camel milk has medicinal value, best quality, nutritious, easily digestible, whitens tea more and lasts longer. These are consumer perceptions which may differ from one region or community to another and therefore need to be established for better understanding of the market.

2.1.4. Milking practices

The milking of camels is a process that varies according to the different pastoral groups. Camels may be milked once or several times a day. Frequency of milking influences milk production and may be responsible for the observed differences in production (Farah and Fischer, 2004; Ramet, 2001). Baars (1999) while working with pastoral herds in eastern Ethiopia observed that pastoralists in general milked their camels more than twice a day. Bekele *et al.* (2002) in the same region found that milk extraction for human consumption commences three days after calving. The calves are allowed to suckle for a few seconds to stimulate milk let down. After milking, the calf is allowed to strip the udder. In general, it is normal practice among most nomadic tribes to milk their camels in the early morning before animals are taken to grazing and at night when they return from grazing.

In terms of nutrient composition, camel milk is similar to milk from cattle and goats. However it is richer in vitamin C with levels of 5mg/100ml (Konuspayera *et al.* 2009). It is higher in iron, copper, manganese, carotene and vitamin E than cow milk. It is similar to sheep and cattle in calcium but lower in phosphorous compared to dairy cow (Raymond, 1984).

2.1.5. Management systems and off take rates

The extensive work done by Bekele *et al.* (2002) on milk production potential of camels to understand the lactation characteristics of camels in selected pastoral herds in eastern Ethiopia were based on traditional system. The system entailed:

- Equal feeding treatments irrespective of age groups and sex.
- Adults and the young stock travel to the hills to browse daily.
- Salt supplement once every month.
- Watering through-fodder during wet season or water given once per week.
- Housing –At night camels are kept in structures made of thorny branches, no different housing for different sexes, or age groups, except for suckling calves.

- Milking –if the calf died, the skin of dead calf is used to stimulate milk let down.
- Weaning –Done at age 12-18 months depending on when the dam conceives.

The Somali communities in Kenya also have extensive knowledge on livestock keeping in a nomadic pastoral production system. Raymond (1984) observes that lactation records for camels vary both with species, breed, country, habitat and management. Bekele *et al.*(2002) observed that the mean daily milk off take was about 4 kg per day and varied with the number of daily milkings with single milking giving about 1kg per day and 4 milkings giving about 7kg. Herren (1990) notes that in the driest season, daily off take per dam can be as low as 1 kg while in the peak season it can be as high as 5 kg per day. From the wide differences between seasons seen in Somalia, it can be a challenge when it comes to satisfying consumer requirements over different season.

According to Bekele *et al.*(2002), lactation lengths of camels varies from 224 to 567 days and a mean of 353±14 days and a mean lactation off take of 1422±74 kg. Camels that calved in the long dry season gave milk for a longer period and had a high lactation off take than those that calved in the short rain season. This is an important variable that is useful both in computing total milk production of a given population with a given herd structure and planning supply.

Herd structure is the composition of a given herd in terms of sex, age groups and lactation status. How this is structured determines the breeding stock and milk production. Some studies have established this in the herds of camels they were working with. For example, Herren (1990) while tracing camel sales from pastoral households found that 15-20% of the herds comprised of lactating females at any time of the year. On the other hand, Baars (1999) reported that in eastern Ethiopia the proportion of female camels in milk was 38-45%.

2.1.6. Camel ownership and gender issues

Issues of ownership, access and control of resources and benefits play a major role in the success of production and marketing systems in the agricultural sector. In a situation where the participants in a production process do not benefit fully, the system is bound to fail. Guliye *et al.* (2007) reported that in the Somali community of northern Kenya, the men milk while the women utilize and sell surplus milk. Herren (1990) similarly established the same arrangement in Somalia. Camel milk production and marketing process, as practiced in various communities,

needs to establish who does the rest of the productive work and how the benefits are shared and utilized. Besides, the nature of constraints faced by women in the process should be identified. In Somalia, only one sixth of the households own camels solely, majority camel owning households combine them with small stock (Herren, 1990).

2.1.7. Camel milk and consumer perception

Camel milk is described as opaque, white, sweet, and sharp tasting and sometime salty depending on the type of fodder consumed and water availability, sours slowly compared to cow milk and can be kept for long without refrigeration (Farah and Fischer, 2004). The evaluation of camel milk as a product in terms of these attributes and other value chain aspects needs to be done so as to ascertain consumer satisfaction and system in efficiencies for a better delivery and a commercialization of the system. So far there is limited information on consumer perception that could help in stimulating demand.

2.1.8. Value chains and actors

Mehari (2007) describes a form of value chain in Ethiopia where pastoralists sell their milk to nearby towns and in open air markets and collection centres. From there, milk is collected by a number of pick ups and trucks to milk selling places. Herren (1990) observes that where camps of pastoralist are usually far from sale points and distance covered for milk sales are considerably far, lack of labour to carry the milk is a constraint. Identifying the presence of these constraints within the milk marketing chain is important in making it become commercial. An example, drawn from Somalia, outlines a commercial 'milk-chain' collecting camel milk for consumption in Somalia's capital, Mogadishu. This chain is entirely local and in the hands of women milk traders. They manage to handle between 1.5 and 5 tons of camel milk daily, reliably, and at an affordable price, from highly mobile nomadic camel herds 100-150 km away from Mogadishu. Initially, the area of supply was limited due to bad road infrastructure. The opening of a new road in 1973 in the area opened the Somali hinterland to the professional women milk traders. Besides, the formation of milk traders cooperative opened up commercially the areas with considerable camel population and along the major roads in Mogadishu.

Besides the professional women milk traders 'Abakaar', another category of actors in the value chain were identified as the informally organized freelance traders. They buy camel milk on a considerably small scale than the organized Abakaar.

The mode of operation of professional milk traders is by use of a truck which they rent daily while going to the milk producing areas. They negotiate a fixed rate of hiring. The women do the trips in turns to allow every member a chance. Back in Mogadishu, they sell their milk in bulk to other urban women milk traders who then distribute to the milk consumers. The professional milk traders have a close and detailed knowledge of the state of milk supply. The women have through agreements restricted areas where freelancers can purchase milk. This restriction explains the poor performance of the freelancers. Ngigi (2003) found out that the existing institutional arrangements may favour one group of actors. This was the case when the commission of inquiry in the Kenyan dairy industry found that the existing institutional arrangements favoured the large scale producers over the small scale dairy producers and was therefore the reason behind the dismal performance of the small scale dairy producers.

In a nutshell, the attributes of the actors in the value chains, coupled with the existing institutional arrangements, will determine the kind of outcomes in terms of commercial sales of camel milk.

2.2 Determinants of commercialization in agriculture

Agricultural technology and commercialization are complementary stimulators of the rural economic growth process. Specialization and commercialization of farming households within a more diversified economy is part of the development process.

At the national level, the principle driving forces of the commercialization process include a conducive macroeconomic environment, non-distortive trade policies, and infrastructural development, as well as a legal and contractual environment in which farmers and processors may operate efficiently. Policies related to these driving forces will very much influence the nature and speed of the agricultural commercialization process. Von and Kennedy (1994) point out that the most important determinants of commercialization are population change, availability of new technologies, infrastructure and market creation, and macroeconomic and trade policy.

In a study to identify the factors influencing the marketable surplus out of total farm household production in Oyo state in southern Nigeria, Rahji (2002) established that age of the household head, farm size, hired labour, distance to market, access to motor vehicle transport, and ownership of livestock were found to be significant factors influencing agricultural commercialization in the state.

Commercialization is calculated as percentage of the total produce sold from a household or as a percentage of cash crops as compared to all crops cultivated by a household (Von and Kennedy 1994). A similar index can safely be adapted for livestock products including camel milk.

While carrying out a study on identification of the spatial determinants of food grain commercialization in Ethiopia, Alemu (2006) established that productivity was the most important and significant determinant of commercialization where more that 77% of the variation in commercialization was explained by productivity. However, productivity reduced commercialization in areas which have low market infrastructure. Population density was also an important factor determining commercialization in Ethiopia. Population density has negative impact on commercialization in some areas and positive impact in others depending on the level of resources which determine the labour productivity. Many authors show that, subsistence agriculture is also driven by a lack of alternative income sources, mainly in rural areas but also in urban areas.

Mathijs and Noev (2002) carried out a study to analyze the determinants of the decision to sell among individual farmers in four Central and Eastern European countries. They found that sellers are characterized by more animals. Sellers also command a larger pool of potential family labor, and a significantly higher percentage of the heads of household work full time on the family farm. Finally, sellers allocate much larger amounts of money to payment for mechanical field services (both in absolute terms and per hectare). Some variables that would appear relevant to the decision to sell in the priori assumption were to be not significantly different between the two categories of households who sell and those who do not sell. For example, in Armenia, Lerman and Mirzakhanian (2001) found that farmers' formal education did not have a significant effect on the decision to sell. This result was probably attributable to the generally low variability in the educational attainment of farmers. The specific factor results vary from country to country, because of local differences. Education and human capital in general are extremely important for

the successful operation of a farm. After all, farms in market economies grow until the owner reaches the limit of his or her managerial capacity, which is clearly determined by a combination of personal intelligence, experience, and education.

In a nutshell, farmer and farm characteristics, economic, institutional, and infrastructural characteristics drive the process of commercialization of agricultural enterprises. The direction and magnitude may vary depending on the prevailing conditions on the area.

2.3. Willingness to pay for agricultural commodities and services

Willingness to pay (WTP) is the maximum amount a consumer is willing to pay in form of a premium for a given good. It is an indicator for perceived value of a good, an attribute or information, typically a non-market good. Contingent valuation (CV) is a survey-based method used to elicit consumers' valuation of non marketed resources. Two main types of questions can be used to elicit consumers' valuation of a product.

Type1 question is where the consumer is asked to tell if he is willing to pay a specified amount for the good while Type 2 question is where the consumer is asked to tell the maximum amount he is willing to pay for a given good. In both cases a detailed description of the product is given. Type1 question is closed-ended and is usually followed by a follow-up question .An example of this is: Are you willing to pay X Ksh for this product? (Yes/no). If yes, are you willing to pay (X+Y) Ksh. for this product?. If no, are you willing to pay (X-Z) Ksh. for this product?. Note: X, Y and Z may vary across respondents. Type 1 question without a follow up question is a single-bounded dichotomous choice CV. Although Type 1 question is easier to answer, the information obtained from the single-bounded CV question is quite limited in that the researcher only knows that, the respondent's willingness to pay (WTP) for the proposed policy is greater or smaller than the threshold. In order to overcome this inefficiency a follow-up question to the single-bounded CV question is used making it double-bounded CV question. Contingent valuation usually provides a policy that represents an improvement upon the status quo (Kaneko and Chern, 2003).

An individual's willingness to pay (WTP) for an item or a product can be used as a measure of the utility he/she derives from the product or a measure of the expected benefits received. Theoretical models show that if a consumer pays a premium above the market price of a product, it demonstrates a willingness to pay. Several factors that are known to influence WTP

include the perception of risks and benefits and socio demographic variables. From the study by Keter (2006) on estimating consumers willingness to pay for genetically modified maize meal in Kenya using the double bounded CV survey design and double bounded logit model to estimate the mean WTP, it was observed that gender, years of education, and farm size had no significant impact on the WTP. Age had a negative influence on the WTP and was significant at 5 % level. These implied younger respondents tend to have higher willingness to pay. The results further indicated that GM awareness variable was not significant and it did not influence the WTP. Benefit perception variables were significant.

Studies on livestock products that have been done to determine willingness to pay include the WTP for bovine somatotropin (rBST)-free milk in Vermont,USA. This is milk produced without the use of hormones that stimulate milk synthesis. The results showed that 37.4% of the respondents were willing to pay any premium while half of the respondents were willing to pay for a premium of 40 cents per gallon (Wang *et al.,* 1997 cited by Kaneko and Chern, 2003). The authors also noted that other variables affecting WTP include income, education and gender. Ahuja, *et al.* (2003) while studying the willingness of the poor to pay for livestock services in India presents estimates of WTP for curative veterinary services based on a split sample design and using anon parametric estimator called turn bull estimator. To analyze the determinants of WTP the binary choice responses were analyzed using the probit model specified as a linear function of socioeconomic variables. A significant positive relationship is found between income and WTP in one of the states for one of the services. In two of the states, households with larger bovine stocks were willing to spend more on veterinary services. Similarly households who undertook larger number of extension visits during the preceding year were willing to pay more for veterinary services.

In the Venda region of the Northern Province of South Africa, Randela *et al.* (2000) while analyzing factors influencing farmers willingness to pay for dipping services using the multivariate and the logistic regression models showed that liquidity, human resource, satisfaction with the programme and structure of the production significantly influences farmers willingness to pay.

2.4 Conceptual framework

This study used a framework conceptualized from the information obtained from the literature. The framework is shown in Figure1. It is a two pronged framework which on one hand explains how various broadly categorized endogenous factors influence commercialization at producer level. They include institutional, economic, farmer, and farm factors. The direction and magnitude of these factors on the proportion of camel milk sold will determine the effect on commercialization. On the other hand, willingness to pay for a premium on camel milk will also determine demand for camel milk which will in turn influence commercialization.

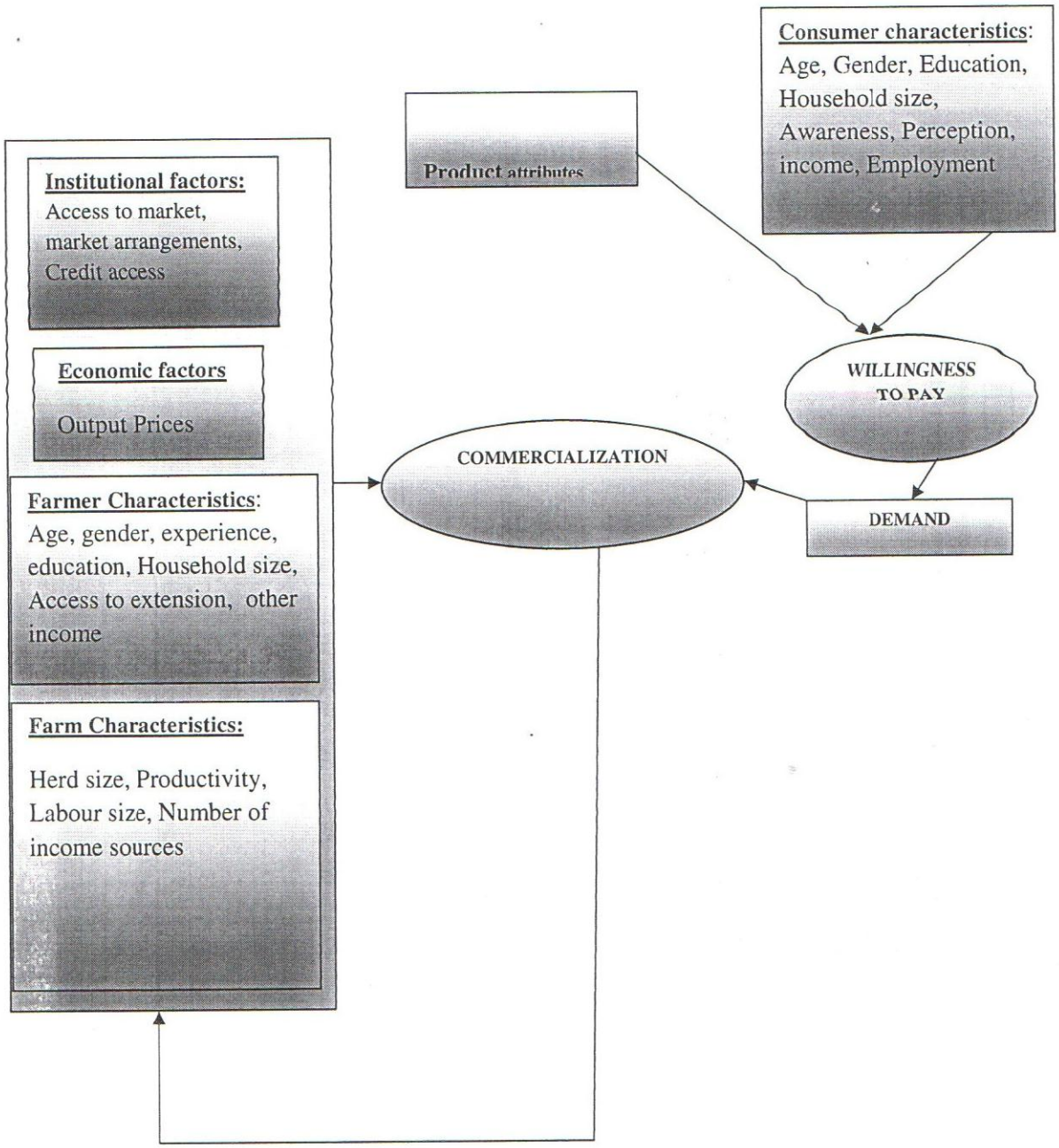


Figure 1: Conceptual framework

CHAPTER THREE
METHODOLOGY

3.1 Study area

The study involved camel milk producers in parts of Isiolo county in Eastern Province of Kenya. Nairobi (Eastleigh) and Nakuru municipality were surveyed as representatives of traditional and potential consumers respectively.

Isiolo County: Is in Eastern province and bordered by several counties namely Marsabit to the north, Wajir to the north east, Samburu to the west, Garrisa to the east, Laikipia to the south and Meru to the south east.

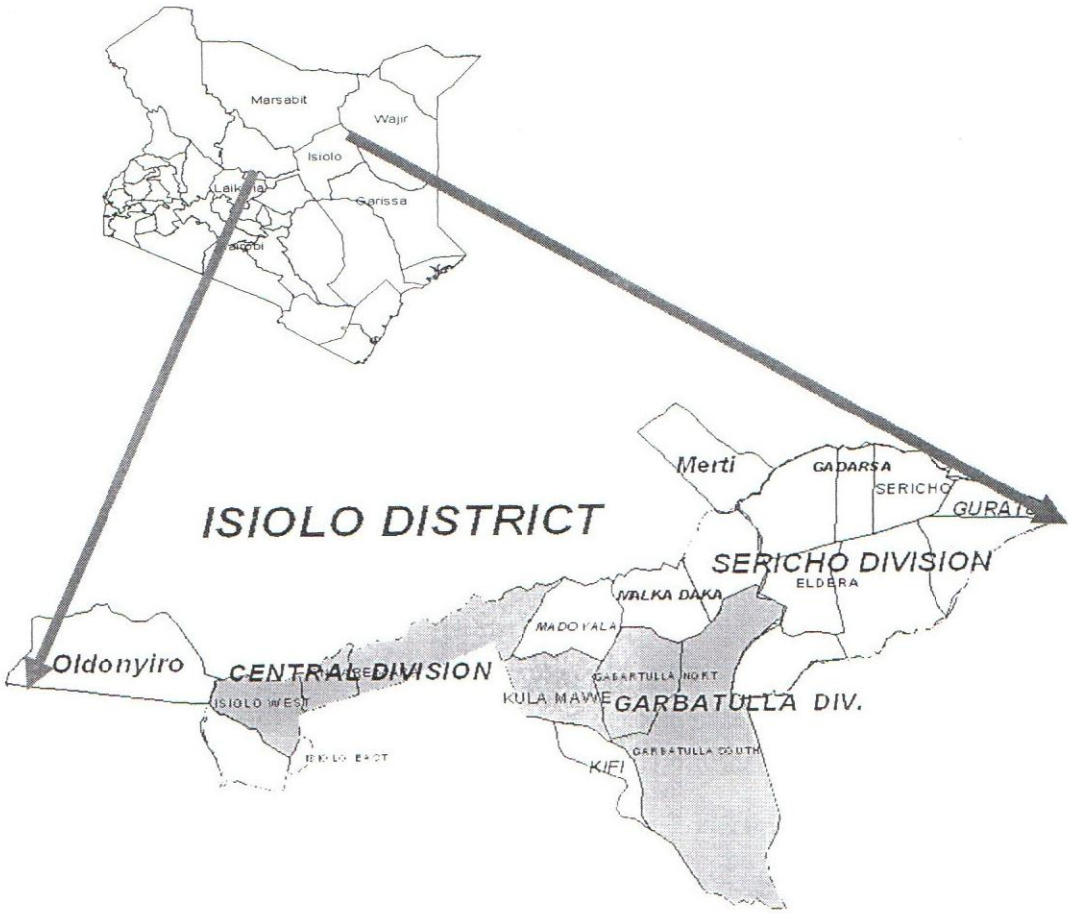


Figure 2: Map of Kenya showing the study area

Isiolo county is located between longitude 36°60ª East and 39°50ª East and latitude 0°05ª North and 2° North. It covers an area of 25,605 sq km and is administratively subdivided into six divisions namely Kina, Oldonyiro, Merti, Garbatulla, Central, and Sericho (GOK, 1996).

It is characterized by hot and dry conditions most of the year. It has two rainfall seasons, short rains come between October and November while long rains come between March and May. The county is basically arid with average annual rainfall of 580.2mm.The mean annual temperature for Isiolo station at an altitude of 1104 m above sea level is 26.6 °c while Merti which is 300m above sea level is 27°c.

Isiolo is one of the least populated counties in Kenya. The human Population according to the 2009 census is 143,294 people disaggregated into 73,694 males and 69,600 females (GOK, 2010). Isiolo County can be divided into three major agro ecological zones (GOK, 1996). These are: (i) semi arid IV-The zone is found in Isiolo town and surrounding areas. It covers 5% of the total area of the county. (ii) Zone V-(Arid) covers parts of Isiolo central and Garbatulla divisions. It occupies a total of 30% of the total area of the county. Livestock is the main activity of these zones. (iii) Zone VI (Very arid)-Mainly in Merti and Sericho divisions and occupies 65% of the area of the county. Main activity is livestock keeping.

The County is a net importer of food from neighbouring Meru, Nyambene and Laikipia counties. The major economic activity for the inhabitants of the county is nomadic pastoralism where cattle (Boran), camels, sheep, goats and donkeys are kept. There is high concentration of livestock in Sericho, followed by Merti, then Central/Oldonyiro and finally Garbatulla/Kina divisions. By 1995, livestock numbers by type were, Cattle(11800), camels (31900), sheep (298,500), Goats (312,500) and donkeys (14300).

3.2 Data types and sources

Data for this study covered the producers, middlemen (bulkers and retailers), traditional consumers and potential consumers. Primary data were collected at all levels through interviews. The specific data obtained from the producers included, location details, socio economic characteristics of the respondents, activity identification, levels of production and use of camel milk and prevailing constraints. At traditional consumers' level, data that were gathered included respondents' household details, consumption levels and attitudes and retail outlets, while at the potential consumers' level, data that was obtained included respondents' socio economic

characteristics, current outlet or source of milk, quantities consumed, and awareness levels of camel milk processing and sale for consumption. Secondary data were gathered from the ministry of livestock development (MOLD) offices both at Isiolo and Ministry headquarters in Nairobi. The data gathered were mainly on camel populations and distribution.

3.3 Research design

3.3.1 Population description

At the producer level, the population comprised of pastoralists who have at least one camel. At the traditional consumer level, the population consisted of the households in Eastleigh estate in Nairobi who consumed camel milk from the production area of Isiolo County or from elsewhere, while the potential consumers consisted of households who were at the time consuming only cow milk in Nakuru municipality.

3.3.2 Sampling frame

Lists of household heads of camel producers and consumers were obtained from Key informants and the local administrative personnel at the locational levels for purposes of this study. Where the list had more names individual respondents were selected from this list.

3.3.3 Sampling unit

The sampling unit was the household where we had the main decision makers in production decisions and purchasing decisions at producers and consumer levels.

3.3.4 Sample selection technique

At the producer's level, a multistage sampling approach was used whereby Isiolo County that keeps camels was purposively selected. Two divisions namely Central and Garbatulla predominant camel keeping for milk production activities were purposively selected. Isiolo town west and Kulamawe locations were purposively selected in Central and Garbatulla divisions respectively. Finally the camel milk producing households were selected through simple random sampling proportional to size.

At the traditional consumers' level, a two stage sampling approach was used whereby Nairobi city was purposively selected due to the presence of a niche market for camel milk. The specific estate of Eastleigh was also purposively selected as it was the exact point of sale and

consumption of the camel milk. The consumer households were then selected through simple random sampling but subject to accessibility of the homes and willingness of the household respondents to be interviewed.

At the potential consumers' level, Nakuru municipality was purposively selected as it was away from Nairobi which is the current area supplied with camel milk and therefore increasing likelihoods of getting the views from respondents who have not consumed this milk before. Here, the area of study was sub divided into three strata based on the housing standards of the residential areas as implied by the building materials of the housing structures inhabited. Then from each stratum, households were sampled by simple random sampling proportional to size and accessibility of the homes and willingness of the household respondents to be interviewed.

3.3.5 Size of samples

The formula: $n = K^2R\ (1-R)/D^2$ as given by Kothari (2004) was used to determine the sample sizes.

Where:

n = sample size

R = Proportion of the population containing the major attribute

D = Margin of error in percentage.

K = Confidence level. (Z-value)

Without the prior knowledge of the proportion of producers selling milk, R= 0.5, and confidence level of 95%, Z =1.96, With D= 0.1, n = 96.

Since the proportion of current and potential consumers is not known, a value of R was taken as 0.5 in both cases .This gives sample sizes of 96 for each.

However, this target fell short in some categories. The actual sample sizes were 89,125, 108, 45 and 49 for producers, traditional consumers, potential consumers, bulkers and retailers respectively.

3.4 Methods of data collection

Personal interview method was employed using a structured questionnaire at all levels. This was augmented by observations. A focus group discussion was done in Isiolo with Key stakeholders and informants to have an overview about the camel milk production and marketing chain. The information generated during the focus group discussion was used for the final

preparation and development of questionnaires for a formal survey. The questionnaire was pre-tested and modified as necessary. Finally, the formal survey was conducted by trained enumerators under close supervision and participation of the researcher.

3.5 Data analysis

To achieve the objectives of the study, several statistical soft wares were used. SPSS (Version 15) was used for data entry, STATA(version 9) was used for analyzing degree of commercialization and factors influencing willingness to pay for camel milk and Excel computer soft wares was used for analysis of consumer perceptions and attitudes.

Objective 1: To characterize production and marketing systems - Descriptive statistics was used.

Objective 2: To reveal factors that influence the degree of commercialization, the proportion of milk sold out of the total was used as an index of commercialization.

A linear multivariate regression model was used to estimate the parameters.

$$Y_i = \alpha_0 + \sum_{i=1}^{n} \alpha_i X_i + \varepsilon_i \text{ ----------(1)}$$

Where: Y_i – Is proportion of milk marketed out of total production in a day per household.

X_i - Vector of independent variables defined in the table 3.

ε_t - Error term.

α_i - Vector of parameters to be estimated.

Table 3: Definition of variables influencing the degree of commercialization

Variable	Variable definition	Priori assumption
Distance to milk selling centre	Distance to milk selling centre(Km)	-ve
Age	Age in years of household head	+ve
Gender	Gender of household head(categorical)	Indeterminate
Experience	Experience in years of keeping camels	+ve
Household size	Number of household members	-ve
Total livestock units	Total livestock units based on camels owned	+ve
Access to veterinary extension services	Categorical(whether accessed veterinary services in the last one year or not	+ve
Productivity	Yield /camel per day in litres	+ve
Education level	Categorical(Whether a producer has formal education or not)	Indeterminate
Labour	Total number of workers employed to undertake camel activities	+ve
Income	Total income in dollars from other sources	+Ve

A focus group discussion was done to reveal more constraints to and opportunities for commercialization.

Objective 3: Likert scale scores that measure consumer satisfaction with camel milk and its attributes were generated. Five preselected camel milk marketing attributes presented to consumers for scoring were: packaging, taste, timeliness of delivery, availability and price. Satisfaction was measured on a four point scale ranging from "very disatisfied" (A) to"very satisfied" (D). Letters were used rather than numbers to avoid suggesting specific quantitative relationship between points on the scales. Raw scores (RS) which presupposes equidistant spacing between adjacent points on the scale were assigned from numbers one through four to the letters A to D. The index for consumer satisfaction of any single attribute 'k' of camel milk was computed by:

$$ICS_K = \frac{1}{N}\sum_{i=1}^{N} a_{ik} \cdots \quad \text{..... (2)}$$

Where: a_{ik}= Vector of raw scores for marketing attribute *k* for the i^{th} individual.

Where, i=1, 2, ------N observations. The same equation was used to determine the level of agreement on the various camel milk quality attributes.

Objective 4: To analyze the determinants of willingness to pay (WTP) for the premium for camel milk, the price the potential consumers were willing to pay for camel milk was made the dependent variable.

$$Y_i = \alpha_0 + \sum_{i=1}^{n} \alpha_i X_i + \varepsilon_i \text{----------(3)}$$

Y_i = Dependent variable, X_i are the explanatory variables which include both dichotomous and continuous variables.

This dependent variable was then transformed into binary variable to generate binary responses whereby the price potential consumers were willing to pay was made 1 when it is higher than what they were paying for a unit of cow milk and 0 if it was lower than what they were paying for a similar unit of cow milk. A logistic regression model expressed as in equation 4 was used to establish the factors that determine whether a potential consumer was willing to pay more for the camel milk than he was paying for the cow milk at the time.

$$In\{\frac{P(Y=1)}{1-P(Y=1)}\} = \beta_0 + \sum_{i=1}^{n} \beta_i X_i \text{----------(4)}$$

Where P is the probability that Y = 1 and X_i are the set of explanatory variables.

Table 4: Definition of variables influencing willingness to pay

Variable	Variable Description	Priori assumption
Willingness to pay	Ca:egorical	-
Age	Age of HH head	-ve
Gender of household head	Categorical	Indeterminate
Awareness	Categorical	+ve
Education	Number of years in school	+ve
HH size	Number of household members	Indeterminate
Income	Total annual earnings	+ve
Employment	categorical	+ve
Price paid for camel milk	Price in Ksh.	+ve
Quantity of cow milk Purchased	Amount in litres per week	+ve
Total household expenditure	Amount in Ksh per month	+ve

CHAPTER FOUR

RESULTS AND DISCUSIONS

4.1 Descriptive results of the camel milk value chain.

4.1.1 Camel milk production systems and characteristics

Majority of the households producing milk are headed by males. With respect to schooling, slightly more than half of the household heads have no formal schooling. Table 5 provides a summary of the qualitative socio economic characteristics of producer households.

Table 5: Qualitative socio economic characteristics of producers

Variable	Isiolo town (n=59)		Kulamawe (n=30)		All (n=89)	
	No	%	No	%	No	%
Gender						
Male	58	95.1	27	96.4	85.0	95.5
Female	3	4.9	1	3.6	4.0	4.5
Level of education						
No formal schooling	34	56.7	16	57.1	50	56.8
Primary level	17	28.3	7	25	24	27.3
Secondary level	9	15	5	17.9	14	15.9
Whether household employs labour						
Yes	58	95.1	12	42.9	70	78.7
No	3	4.9	16	57.1	19	21.3

Source: Authors survey, 2009

Table 6 summarizes key quantitative socio economic parameters of the pastoralists households. There is a significant difference in terms of mean distance to the milk selling centre of Isiolo and Kulamawe. This has called for an organized arrangement of delivering milk to buyers whereby a private vehicle picks milk on regular basis and delivers it to buyers in Isiolo compared to Kulamawe who mainly use donkey.

Table 6: Quantitative socio economic characteristics of producers

Variable	Isiolo (n = 59	Kulamawe (n = 30)	
	Mean(±SD)	Mean(±SD)	ρ
Age of household head in (years)	45.02±11.3	41.1±9.9	0.12
Experience in keeping camels(years)	7.89±4.4	10.7±7.3	0.26
House hold size	8.28±3.7	6.9±2.8	0.07
Number of labourers	1.28±0.5	1.0±0.0	0.07
Distance to all weather road (Km)	2.68±0.9	2.8±2.7	0.85
Distance to milk selling centre(Km)	31.9±8.7	8.2±4.7	0.00

Source: Authors survey, 2009

As shown in Table 7, there are more camels in milk during the wet season than the dry season. The yield per camel per day in dry season is lower than in wet season. This is consistent with the findings of (Kedija *et. al.* 2008). The average amounts of milk consumed by households during the wet season are higher than the volumes consumed during dry season. All the respondents interviewed relied on camel milk for consumption. This observation differs with the findings made by Kedija *et al.* (2008) in Ethiopia. They observed that only 9.2 % of the households consumed camel milk. This is because they had cow and goat milk and the cow milk was preferred for use at home as it could also be processed into other products. The volume sold per day per household during wet season is more than the amount sold during the dry season. The mean amount sold per household per day is 13.2 and 23.3 litres in dry and wet seasons respectively. This translates to 84.7% and 85.5% of the milk produced per day per household respectively. There are significant differences in prices offered by the buyers in Isiolo town and Kulamawe during both dry season and wet seasons. This may be attributable to the high demand within the town arising from large population of people who have come to settle in the urban areas due to security reasons and the search for better social amenities.

Table 7: Household camel milk yields, consumption and sales

	Isiolo (n=59)	Kulamawe (n=30)	All (n =89)	
Variable	**Mean(±SD)**	**Mean(±SD)**	**Mean(±SD)**	**ρ**
Tropical livestock units per household	89.65±22.5	67.07±16.75	82.47±20.77	0.13
Number of camels in milk during dry season	6.75±1.86	5.86±1.18	6.47±1.30	0.39
Number of camels in milk during wet season	9.00±1.8	6.18±1.24	8.11±1.62	0.10
Average yield per camel per day in wet season	4.05±0.80	3.18±0.64	3.78±0.76	.002
Average yield per camel per day in dry season	2.71±0.54	2.04±0.41	2.50±0.50	.001
Quantity in litres sold in dry season per day	15.59±3.9	8.00±1.6	13.20±3.30	.003
Quantity in litres sold in wet season	28.75±8.63	11.32±2.83	23.26±6.99	0.003
Price per litre in wet season (Ksh)	36.56±6.4	20.00±0.00	31.23±9.41	.000
Price per litre in dry season(Ksh)	42.46±10.3	20.00±0.00	35.23±13.53	.000
Average camel milk consumed in wet season	3.52±0.70	4.89±0.98	3.96±0.792	0.003
Average camel milk consumed in dry season	2.43±0.49	3.11±0.62	2.64±0.53	0.02

Source: Author's survey, 2009

Figure 3 shows a trend in the evolution of commercial camel milk production for sales. Camel keeping for milk sales began in earnest from 1992 as indicated by the upward trend in terms of percentage of farmers joining. Information from knowledgeable informants in the camel milk subsector attribute the emergence of many entrants to the 1991 fall of the central government in Somalia and the continued conflict in the country that displaced many Somalis into Kenya who ended up in Nairobi Eastleigh estate. This in turn created a great demand for camel milk in Nairobi.

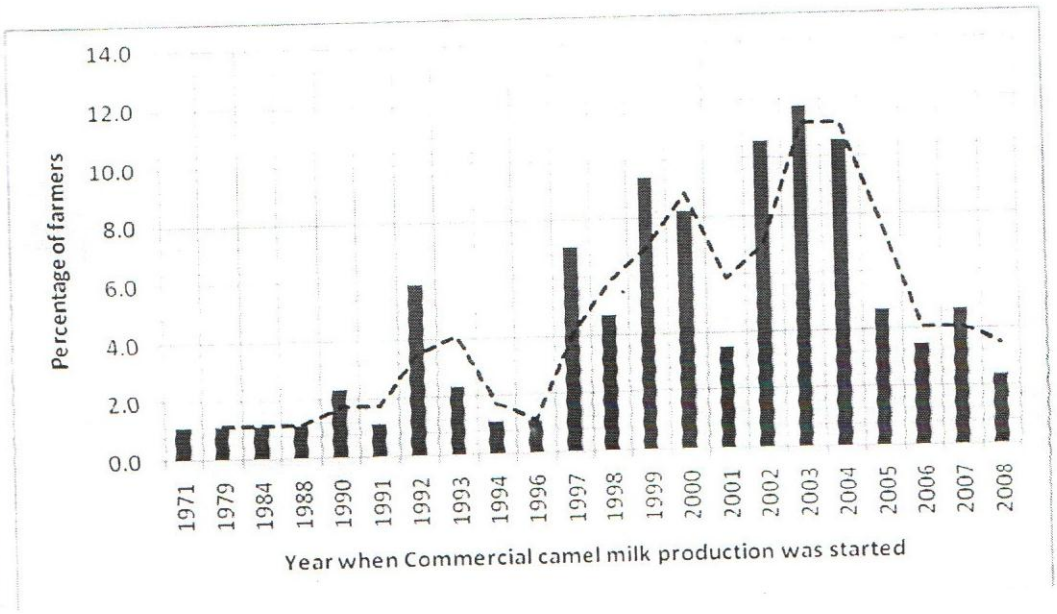


Figure 3: Trend of commercial camel milk production in Isiolo County.

Source: Author's survey, 2009

Figure 4 shows sources of income and average amounts from each source per month for the producer households. Camel milk sale is the first in terms of average amounts earned with a mean of Ksh 15,982 per household per month followed by wages and salaries. Camel milk therefore remains the most important livelihood strategy for the pastoralists. Income from sales of live camels is the lowest implying that the producers prefer preserving the live camels for milk rather than sell.

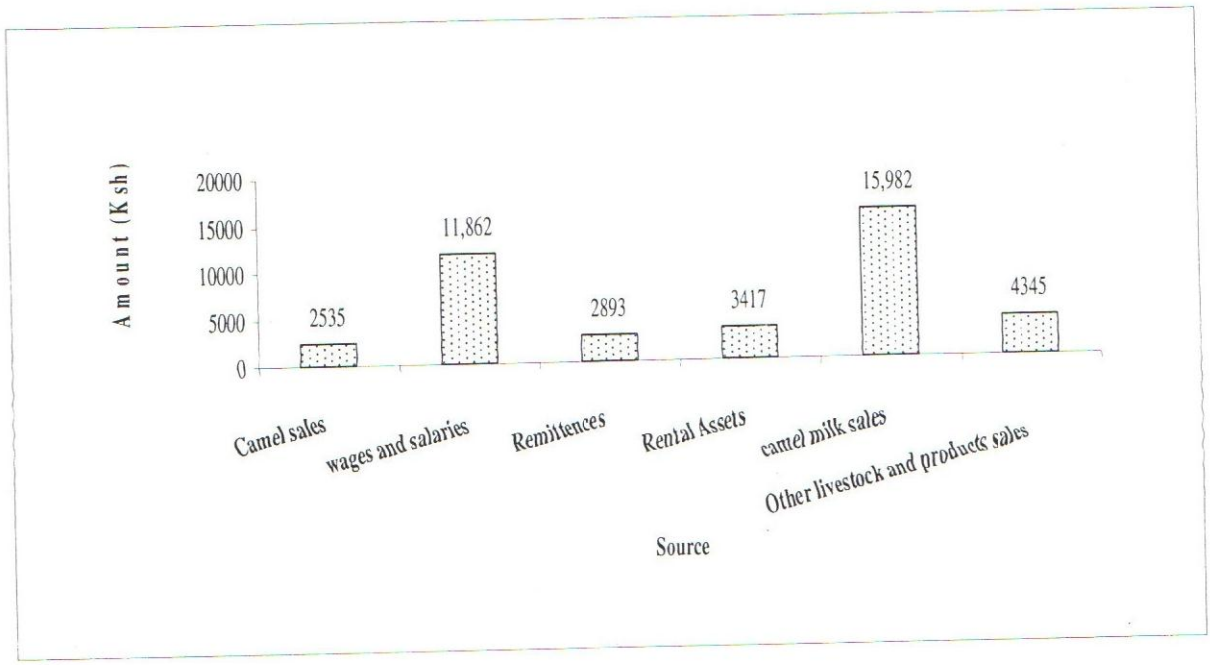


Figure 4: Household mean monthly incomes in Isiolo county

Source: Author's survey, 2009

Table 8 summarizes the roles of various household members with respect to camel production. From the table, labourers are mostly responsible for herding and milking. They also do other husbandry practices such as pest control and watering of the camels. Camels are milked while the milker is standing. Almost all the producers milked their camels twice a day. It was also observed that the milker does not wash the udder when beginning to milk.

Browsing was reported as the main mode of feeding camels in the study area. However, majority of the respondents indicated that feeds were not sufficient throughout the year. The two main copping strategies used by the producers are moving to places where fodder is available (Nomadism) and purchasing of forage especially Euphorbia. In Ethiopia, Kedija *et al.* (2008) reports that agricultural by-products such as crop residues, mainly obtained from sorghum and maize stovers are also used as feed.

Despite men being the household heads, women do more of the marketing of milk. Kedija *et al.*2008) also observed the same in Ethiopia when he established that milk marketing is a specialized activity for female members of the household.

Table 8: Persons responsible for camel production activities

Person responsible for herding(n=88)	**Frequency**	**Percentage**
Household head	12	13.5
Daughters	1	1.1
Sons	6	6.7
Laborers	69	77.5
Person responsible for milking(n=88)		
Household head	12	13.5
Wife	1	1.1
Daughter	1	1.1
Son	9	10.1
Laborers	65	73.0
Relative	1	1.1
Person responsible for marketing of milk(n=81)		
Husband	12	14.8
Wife	56	69.1
Daughter	10	12.3
Son	1	1.2
Labourer	2	2.5

Source: Authors survey, 2009

Water is also a main challenge for the producers. As shown in figure 5, majority of the pastoralists usually water their camels once a week (68.5%) in the dry season, followed by twice a month (15.7%). In Mieso district of Ethiopia, during the dry season, about 21% of the respondents do it once in three days, 30% of the respondents water their camels once a week and 9% do it twice in a month (Kedija *et al.* 2008).The seasonal availability and distance of the water sources have implications on the watering frequency and therefore accounting for the differences in frequencies. In Isiolo, water is obtained from Ewaso Nyiro river, other seasonal rivers, dams, boreholes and water pans.

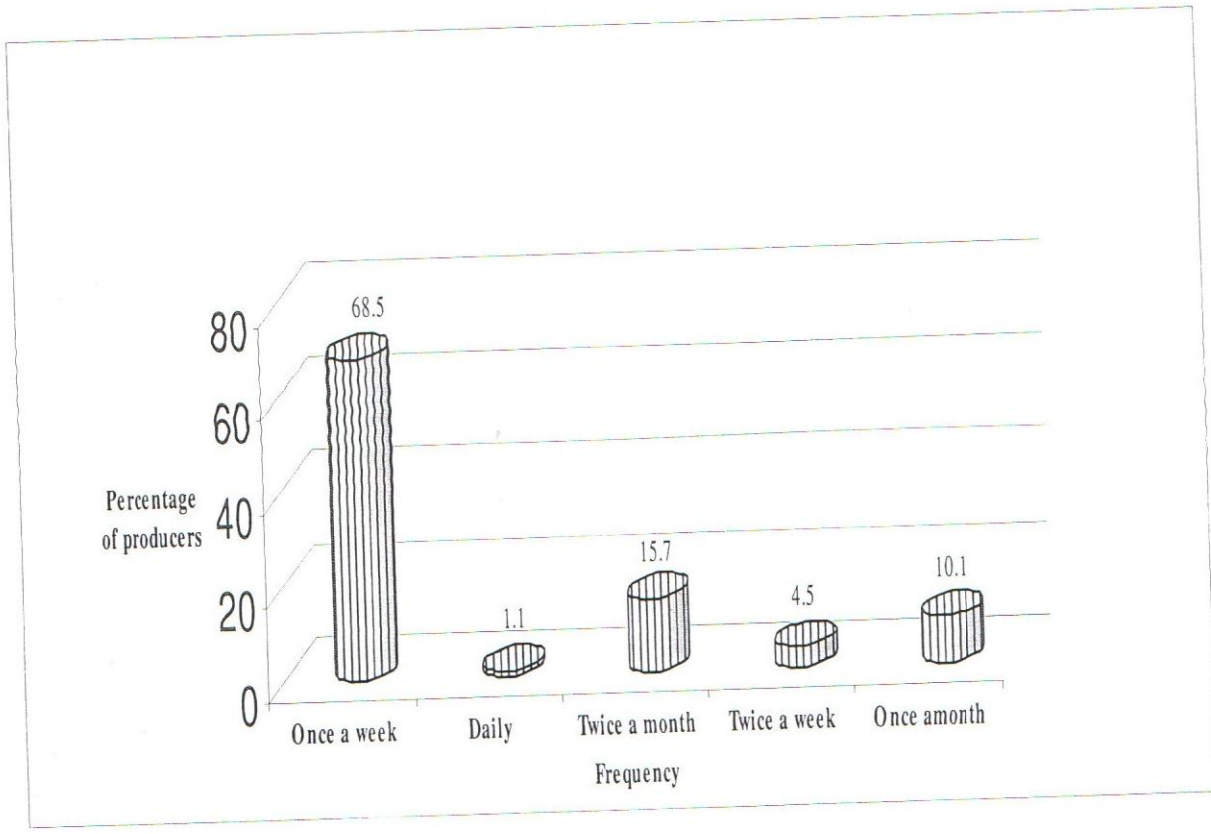


Figure 5: Frequency of watering camels

Source: Author's survey, 2009

Most of the respondents indicated that they owned some means of transport. As indicated in Figure 6, 95% of the producers use donkeys. Most of the donkeys are owned by the producers. The donkeys are used for delivering milk directly to the buyers or for taking milk to collection centres that are not more than 10 km away from where the milk will be subsequently be transported using the transport trucks or lories. The transport trucks are individual vehicles run as private businesses to offer public transport to both human passengers and other goods including milk. The use of donkeys for longer trips has negative implication on milk shelf life upon delivery to the consumers.

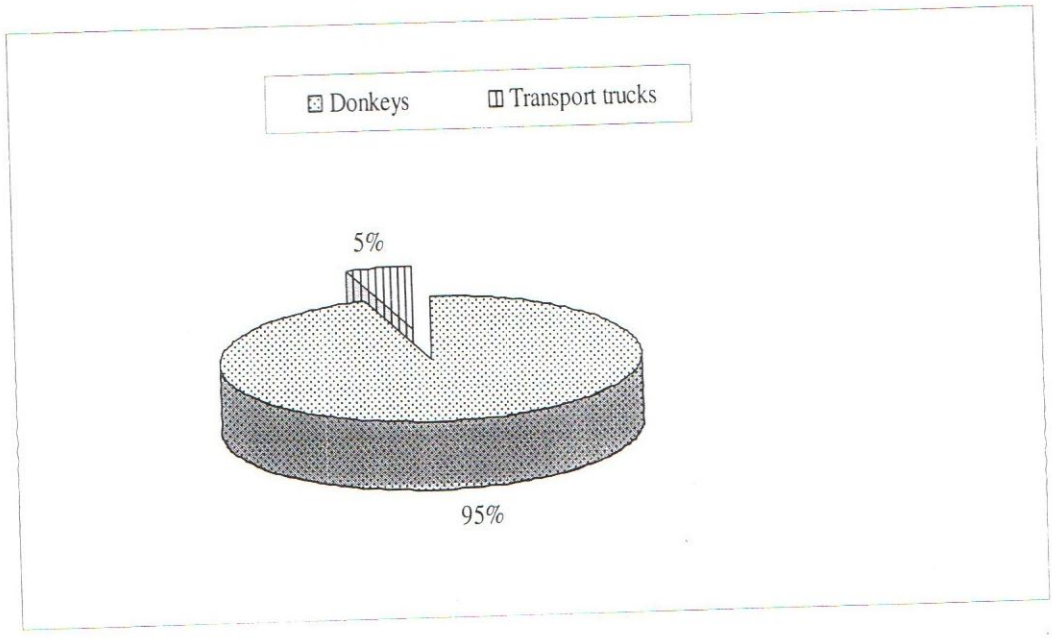


Figure 6: Modes of milk transport by producers

Source: Author's survey, 2009

As shown in Figure 7, the majority of the individual producers use own males for breeding purposes. This implies that there are high chances of inbreeding and therefore lowering the potential of milk production.

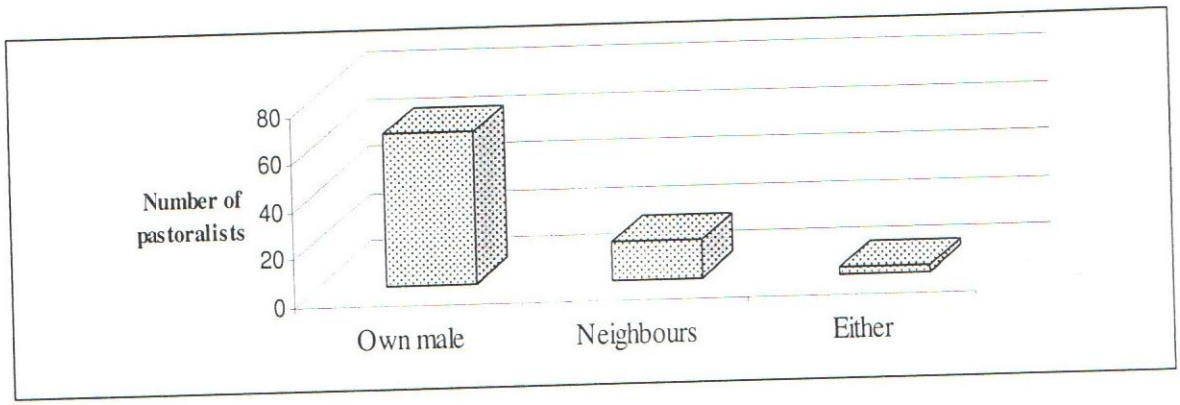


Figure 7: Sources of breeding males

Source: Authors survey, 2009

Generally Producers had not accessed credit as an institutional service. The reasons for not receiving credit are indicated in Figure 8. Most of the pastoralists have not accessed credit

because they have not heard about credit provision from any source. Like any other livestock enterprise, the camel sub sector will stand to benefit if the producers accessed credit in any form that will enable the poor to increase their stocks. Whereas Muslim religious beliefs prohibit Muslims from engaging in taking loans, Islamic banks that are sharia compliant should be scaled up to target pastoralists wishing to expand their camel keeping activities but are limited by finances.

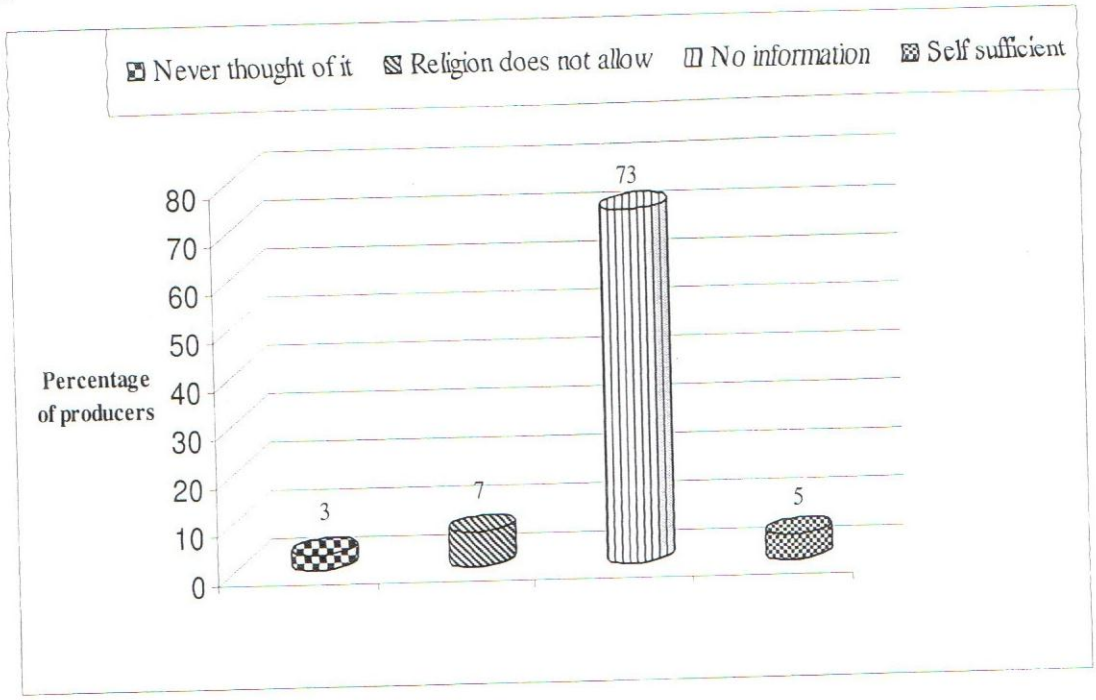


Figure 8: Reasons of not accessing credit.

Source: Author's survey, 2009

Table 9 summarizes the percentages of producers with different views on the availability of livestock and veterinary extension services. Very few respondents admitted having available services from the government departments. Majority of the respondents sighted the availability of the private veterinary services which are actually Agro vets. This means that private service providers have a big contribution to make in supporting the pastoralists. In terms of visits to the service providers in a year, the private veterinary providers were visited by more producers than the government veterinary offices. The low numbers of visits to the government service providers in a year are explained by the fact that the pastoralists do not use state veterinary

services as pastoralists feel that they have more knowledge than the government personnel and also the government veterinary personnel in the county have little knowledge on camel diseases.

Table 9: Visits and producers' views on availability of extension services

Variable	Frequency	Percent
Availability of government extension services (n=89)		
Yes	13	14.6
No	76	85.4
Availability of government extension services (n=89)		
Yes	5	5.6
No	84	94.4
Availability of private veterinary services (n=89)		
Yes	71	79.8
No	18	20.2
Availability of private extension services (n=89)		
Yes	2	2.2
No	87	97.8
Visits to extension providers in the last 12 months (n=89)		
Government livestock extension office	8	11
Government veterinary offices	3	4
Private veterinary providers	62	84
Private livestock extension service providers	1	1

Source: Author's survey, 2009

4.1.2 Camel milk bulking participants and processes

Table 10 shows the socio economic characteristics of the bulkers and other transaction details.

Table 10: Qualitative socio economic characteristics of bulkers

	Isiolo (n=30)		Kulamawe (n=15)	
	Frequency	**Percent**	**Frequency**	**Percent**
Number of agents	30	66.7	15	33.3
Gender				
Male	6	20.0	4	26.7
Female	24	80.0	11	73.3
Suppliers to the bulkers				
Producer	29	96.7	15	100.0
Own camels	1	3.3	0	0
Customers of bulkers				
Processors	0	0	1	6.7
Retailers	2	6.7	0	0
Retailers in other towns	28	93.3	0	0
Bulkers of Isiolo	0	0	14	93.3
Mode of delivery to customers				
Bus	28	100.0	0	0
Public lorry	0	-	15	100.0

Source: Authors survey, 2009

The bulking process is dominated by women both in Isiolo town area and Kulamawe. The main source of milk handled by the bulkers is the producers. Little milk is also supplied by some bulkers that have their own camel herds in the peri-urban areas of the town from which they receive milk as delivered by their workers. Some bulkers from Kulamawe centre also supply milk to Isiolo bulkers. Thus the milk that comes to Isiolo town is from two major areas namely central division cluster (Mlango-Ngarentare-Burat) and Kulamawe cluster. One group of women bulks milk in Isiolo town. According to the chairlady of the group, they handle an average of 2000 litres per day in dry season and 5000- 7000 litres per day in wet season. These volumes are much higher than the 600 litres reported in the year 2001 (Field, 2001). A visit made to the group established that there are about eight group premises within Isiolo town centre with a total of 48 fridges with an average capacity of 160 litres of milk each, giving total capacity of 7680 litres in which cooling and temporary storage takes place.

The main mode of delivery of milk to the bulkers is by public transport. This is a special joint arrangement by producers coordinated by the bulkers to achieve economies of scale in the process. A public transport lorry is used from Kulamawe to Isiolo. The donkeys are also used to deliver milk to bulkers in areas closer to town mainly within the radius of 10 Kilometers. Four land cruisers deliver milk to Isiolo town from surrounding areas, each land cruiser carrying about 1000 litres of milk. The quantity to be received by each bulker is documented in a book held by the vehicle crew. Upon receiving the milk, most of the milk bulkers in Isiolo boil and cool before transporting to Nairobi. A few bulkers boil and sell the milk locally. For delivery of milk to distant customers by the bulkers public transport bus is used. Transportation to Nairobi is done using four buses that go to Nairobi from Isiolo on daily basis. These buses depart from Isiolo between 6-6.45am and arrive in Nairobi by 11am.

The main customers sold to in Nairobi are their agents who over a long period of time have engaged in a friendly relationship in the chain. The mode of operation is both at an individual level where milk is sent to a personal customer in Eastleigh in Nairobi and also at group level where some stocks are delivered as a group to a recipient in Nairobi. The main suppliers who are mainly producers are paid after one or 2 days while the bulkers themselves are paid by their main buyers after two days. Table 11 shows sales details of the bulkers. The average margin per unit litre in prices is Ksh10.60 after deducting transport costs.

Table 11: Camel milk sales price and transport costs

	N	Mean	SD
Buying price per litre by bulkers (Ksh)	45	35.8889	11.74003
Volume in litres handled per day by bulker (Ksh)	45	125.044	121.3326
Average selling price/litre by bulker (Ksh)	45	50.8667	12.86574
Transport costs per litre of milk(Ksh)	43	4.3740	1.35878

Source: Authors survey, 2008

4.1.3 Camel milk Retail systems

Within the camel milk value chain, we have the retailers. Table 12 gives the details of the transactions along the main points in the chain and the socio economic characteristics for the retailers.

Table 12: Socio economic characteristics of retailers

	Isiolo Town (n=18)		Nairobi (n=23)		Kulamawe (n=11)	
	Freq.	%	Freq.	%	Freq.	%
Gender of retail agents						
Male	4	22.2	1	5.0	6	54.5
Female	14	77.8	19	95.0	5	45.5
Customers of retailers						
Individual consumers	17	94.4	20	87.0	10	90.9
Hotels	1	5.6	2	8.7	1	9.1
Other small retailers	0	0	1	4.3	0	0
Whether demand is met						
Yes	0	0	13	56.5	11	100.0
No	18	100.0	10	43.5	0	0

Source: Authors survey, 2009

Majority of the retail business participants were women. Depending on the level of operation, the suppliers to the retailers vary. In general, the retailers in Isiolo are supplied by producers and while those in Nairobi are supplied by bulkers. In Mieso district of Ethiopia, Kedija *et al.* (2008) reports of different arrangements where there are traditional milk producer associations or groups locally called '*Faraqa Annanni*'. These are self-organized groups, which involve women who have milking camels. The number of women that participate in *Faraqa Annanni* ranges from 2 to 10 per group. Members are organized on the basis of selling whole fresh camel milk. They contribute an agreed amount of milk on a weekly basis and this is allocated to an individual woman on a shift basis. The woman sells the milk and the daily income belongs to her. The cycle continues until every member gets her share of the milk income.

In terms of meeting demand, there is a large unmet demand in Isiolo than Nairobi according to the retailers. This is attributable to the fact that most of the milk in Isiolo is taken to Nairobi creating a larger shortage in Isiolo. There is therefore potential to sell more milk to consumers in Isiolo which is not being tapped. Most of the consumers in Isiolo town area, Nairobi town and Kulamawe get their supplies from the kiosks. For the Nairobi retailers, their selling points are within eastleigh surburb namely 7Th street near Isiolo bus stage. The common point of collection of milk by the consumers therefore is from the kiosks. There are few cases of delivery on foot by the retailers (hawking) in both Isiolo and Nairobi as indicated in the table 12. Thus more hawking is observed in Nairobi.

In Nairobi, out of the milk received some is sold to restaurants within Eastleigh, some to individual consumers who have deep freezers while some is sold to other small retailers and even small individual consumers. Table 13 shows observed prices across the seasons and across various market points in the chain. The retail prices in dry season are higher than the prices in wet season. This is because supply during the dry season is lower than wet season and therefore un able to meet demand. The retail prices increase almost by two times from the production areas to Nairobi.

Table 13: Retail prices of camel milk across various market points in the chain

	Isiolo town (n=18)		Nairobi (n=23)		Kulamawe (n=11)	
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**
Buying price per litre	36.33	4.01	43.57	9.89	21.18	3.920
Retail price in wet season	55.61	13.63	86.09	18.77	31.00	7.63
Retail price dry season	66.33	14.92	104.78	16.20	33.73	7.62

Source: Authors survey, 2009

4.1.4 Characteristics of the traditional camel milk consumers

Table 14 summarizes the qualitative socio economic characteristics of the traditional camel milk consumer households. These are the households who are currently consuming camel milk. The two major ethnic groups in Isiolo and Nairobi that were interviewed and found to consume the camel milk are the Somalis and the Boran. Other ethnic communities are yet to embrace consumption of camel milk on a wider scale. In majority of the households, women were the decision makers in purchasing of milk.

Table 14: Qualitative socio economic characteristics of the traditional camel milk consumers

VARIABLE	ISIOLO (n=47)		NAIROBI (n=78)	
	Freq.	Percent	Freq.	Percent
Gender				
Male	10	21.3	48	61.5
Female	37	78.7	30	38.5
Ethnicity				
Somali	24	51.1	72	92.3
Boran	22	46.8	4	5.1
Gabra	1	2.1	0	0
Kikuyu	0	-	1	1.3
Oromo	0	-	1	1.3
Occupation				
Formal employment	1	2.2	8	10.5
Informal employment	31	67.4	33	44.4
Business	13	28.3	35	46.1
Farmer	1	2.2	0	0
Restaurant	0	0	2	2.6
Decision maker on milk purchasing				
Father	6	12.8	24	33.3
Mother	40	85.1	48	66.7
Either mother or father	1	2.1	0	0

Source: Authors survey, 2009

Table 15 shows quantitative socio economic characteristics of the households of traditional consumers.

Table 15: Quantitative socioeconomic characteristics of traditional camel milk consumers

	ISIOLO (n=47)		NAIROBI (n=78)		
	Mean	**SD**	**Mean**	**SD**	***p***
Household size	6.15	2.28	4.87	2.81	0.01
Age of household head	36.04	10.65	32.08	9.89	0.04
Camel milk consumption/day (L)	1.957	0.87	2.54	1.35	0.01
Price per litre in dry season (Ksh)	39.44	21.54	95.42	20.83	0.00
Price per litre in wet season (Ksh)	33.61	16.77	72.77	18.75	0.00
Frequency of purchase per week	6.89	1.78	6.00	2.18	0.02

Source: Authors survey, 2009.

The mean household sizes in Nairobi are lower than the consumer households of Isiolo. This may be expected given the significant difference in age of the household heads where the household heads of Nairobi are of lower age than the Isiolo household heads. However, the volumes of camel milk consumed in Nairobi households is larger compared with those households of Isiolo. The difference may be explained by the fact that majority of these consumers are business women and men with more disposable income for use in milk purchase. This finding is consistent with the findings of Frank et al. (2007) who observed that income is the key determinant of cow milk consumption levels. The findings however differ with those of Brian and Tsetsgee (2006) who reported that urban Mongolians consume just one quarter as much as their rural counterparts. The frequency of purchase for the Nairobi households is slightly lower. The use of fridges to preserve milk by the Nairobi consumers may explain the lower frequency compared to the rural based consumers of Isiolo.

The mean buying price per unit litre of milk in Nairobi is more than double the prices offered to consumers in Isiolo. Since demand is not often met especially in times of dry season, this may explain the high prices observed in Nairobi in addition to transfer costs.

4.1.5 Characteristics of Potential consumers

Table 16 shows the qualitative socio economic characteristics of the potential consumers.

Table 16: Qualitative socio economic characteristics of potential consumers of camel milk

Variable	Frequency	Percent
Gender of potential consumers (n=108)		
Male	38	35.2
Female	70	64.8
Employment status (n=108)		
Formal	13	12.0
Informal	53	49.1
Self employed	42	38.9
Awareness on processing (n=108)		
Yes	85	78.7
No	23	21.3
Income level of the household (n=108)		
<500	7	6.5
5001-10000	36	33.3
10001-15000	15	13.9
15001-20000	11	10.2
20001-25000	8	7.4
>25000	30	27.8

Source: Authors survey, 2009

Eleven different ethnic groups were interviewed covering three main religious groups which comprise of the Protestants, Catholics and Muslims. Majority of the respondents were of female gender. This was in order given that in many occasions food purchasing decisions are made by the females in the households. All potential consumers indicated having a stream of income earned or received over the month. Most of the respondents were aware of camel milk being processed in some parts of this country and being sold for human consumption. Figure 9 shows the various sources through which the respondents got information. The most common ways or channels from which potential consumers were made aware in order of importance is neighbours who talk about the camel milk, through school, and tours made to production areas. The television and radio as media of awareness creation seemingly were not accessed by many potential consumers to receive information on issues of camel milk.

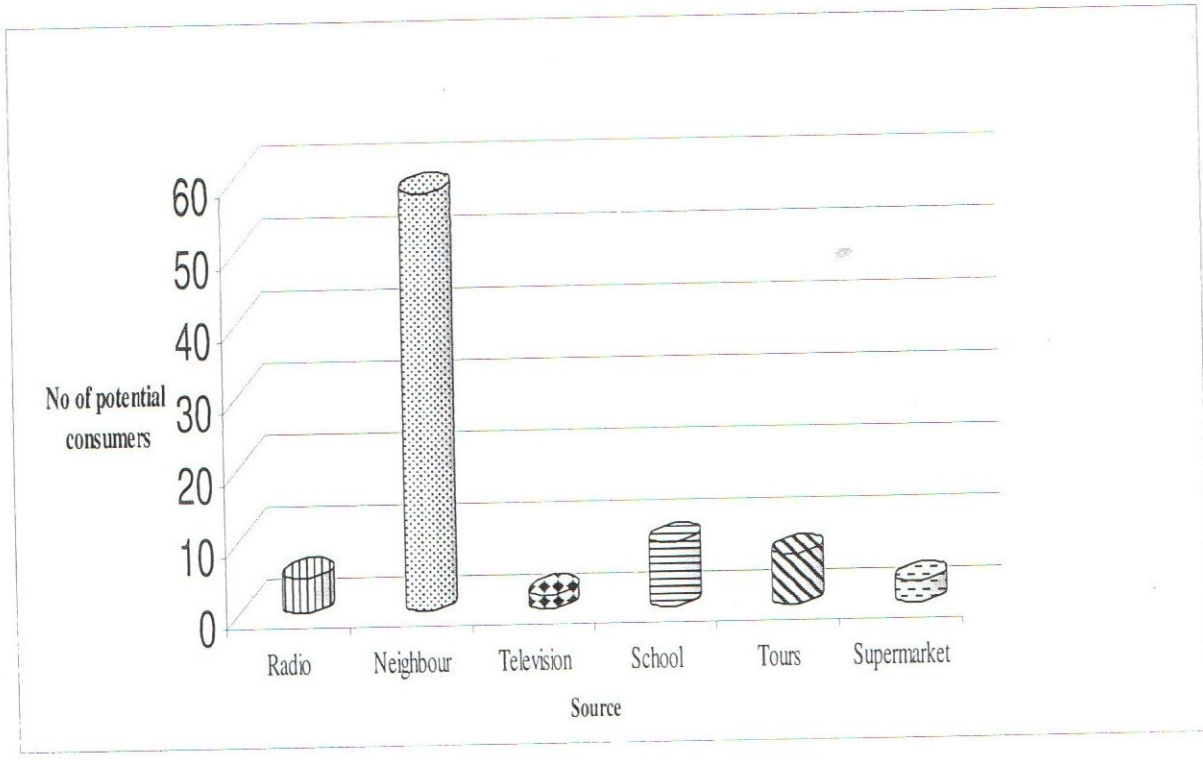


Figure 9: Sources for information on camel milk for potential consumers

Source: Author's survey, 2009

Table 17 below gives the quantitative socio economic characteristics of potential camel milk consumers.

Table 17: Quantitative socio economic characteristics of potential camel milk consumers

Variable (n=108)	Mean	Std. Deviation
Age of respondent(Yrs)	32.12	10.84
Number of children below ten(Yrs)	1.21	1.20
Frequency of purchase of cow milk	6.63	1.23
Quantity of cow milk purchased per week (Litres)	8.79	5.55
Price per unit litre of cow milk (Ksh)	32.68	8.92
Price consumer is willing to pay for camel milk(Ksh)	34.99	12.72
Camel milk to be purchased per week (Litres)	8.85	8.43
Total household expenditure per month (Ksh)	21253.87	18696.63
Total number of household numbers	4.48	1.92
Number of years of schooling	11.90	2.65

Source: Authors survey, 2009

Based on the frequency of purchase, the potential consumers are regular consumers of milk. The price they are willing to pay for camel milk is slightly higher than what they are currently paying for cow milk. The difference of cow milk price from the average price the potential consumers are willing to pay for camel milk is Ksh2.31, meaning that the potential consumers are willing to pay a premium of 7%.This result is consistent to the results obtained by Juma *et al.* (2006) when they found that those willing to pay the price bid for small ruminant meat were ready to pay 7.6% above the current price.

4.1.6 Processing Initiatives

The only off-farm processing initiative is by a camel milk plant that is situated in Nanyuki town. It has a capacity to handle 6000 litres of milk per day. However the plant is currently receiving only 200 litres per day. The milk is processed twice per week. The main suppliers of the raw milk are producers who have been trained on clean milk production and have proved to be reliable in delivering good quality milk. In Kulamawe, producers were trained and engaged in the supply contract. The terms of the contract were that the producers meet the quality standards set which included having the camel in milk in good health and having the

costs of services rendered recovered from the producers' milk earnings. A charcoal cooler with the capacity to hold 600 litres of milk was installed at Kulamawe near the chief's centre. The dairy plant purchases milk at Ksh 40 per litre. This is considered as a premium price by the factory management. The products developed are fresh milk and sour milk, which are packaged in 500ml plastic bottles. The main market for these products is Nairobi where it is sold to supermarkets and armed forces canteen organization (AFCO) at the price of Ksh 102 per bottle of 500 ml for both fresh and sour.

4.1.7. Camel milk value chain mapping

The value chain map in Figure 10 was developed using information provided by the sector players interviewed. This value chain map presents in a simplified graphical form all the major actors in the camel milk value chain. It presents the different actors involved in camel milk from production to distribution of milk to different markets or market segments to which the milk is sold to final consumers.

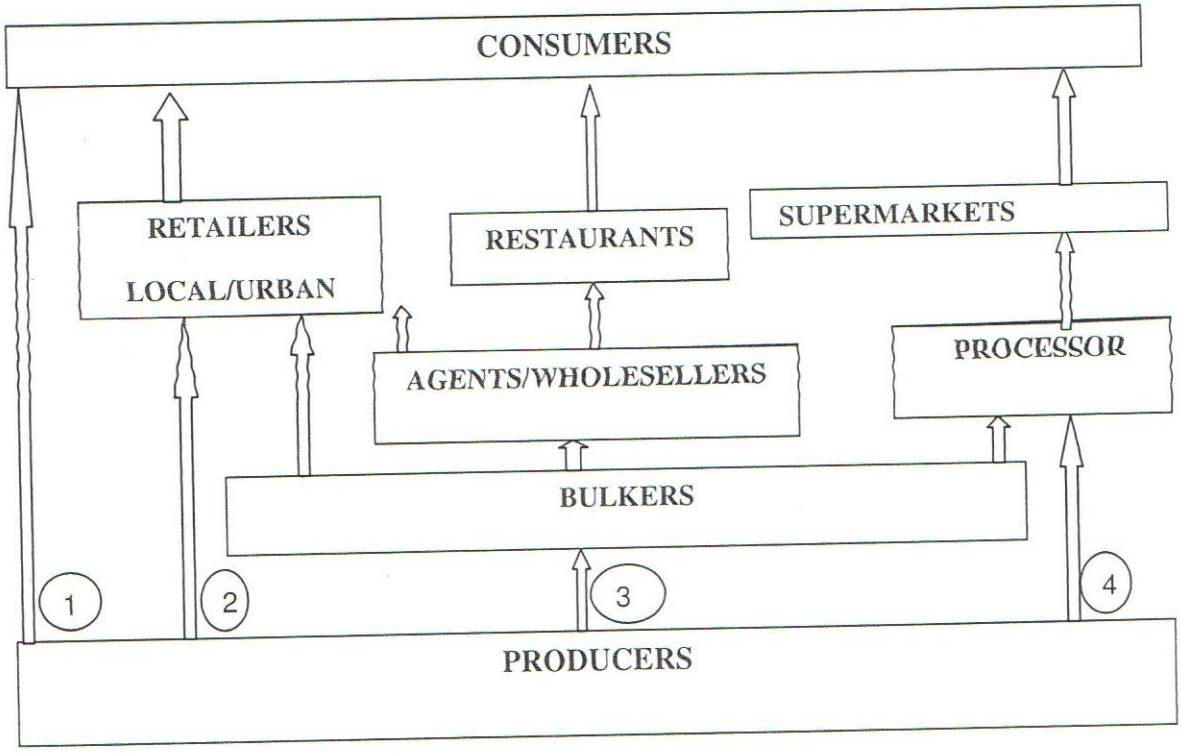


Figure 10: Camel milk value chain map

Source: Author's survey, 2009

As observed in Figure 10, there are four channels through which the milk reaches consumers. Based on the volumes of milk the various chain players handle and their proportionate numbers, the quantities along each channel were computed.

Channel 1: Producers to consumers directly

This channel handles an estimated 2178 Litres per day of milk which constitutes 19% of the total milk marketed.

Channel 2: Producers to consumers through retailers

This is in operation both in the rural areas where production is carried out and also in urban areas. It is the channel that initially handles 1599 litres per day which represent 14% of the amount from the producers. This later adds up to a total of 8276 litres of milk. It delivers the largest amount of milk to the final consumer and therefore of great economic importance. The producers, bulkers and agent/wholesalers contribute into this chain 1599, 308 and 6369 litres respectively.

Channel 3: Producers to consumers through the bulkers, whole sellers or agents and restaurants

An estimated 7000 litres per day pass through this channel from the producers to the bulkers representing 62%. This is mainly in Eastleigh area of Nairobi. From the 7000 litres handled by the bulkers, 6539 is passed to the agent/wholesalers who in turn pass 170 litres to the restaurants then to the final consumers while the rest goes through the retailers.

Channel 4: Producers to consumers through the processors and supermarkets

Based on capacity of the charcoal cooler installed at Kulamawe, this channel has the potential to deliver a total of 600 litres per day representing 5% from producers. The bulkers also contribute into the chain 154 litres as they deliver to the processor directly. This is processed into fresh milk and packaged in 500ml plastic bottles for sale to consumers through the supermarkets in Nairobi. This is the channel that forms the cold milk chain and undertakes value addition of camel milk.

4.1.8 Value Chains Constraints

In the focus group discussion, the constraints affecting value chain participants were obtained. Table18 presents details of the camel milk value chain constraints and suggested solutions. The constraints are categorized into market access, infrastructure, policy, and technology/product development. Kedija *et al.* (2008) reports small milk amounts in areas with small herds as a constraint. This has not come out as a problem in Isiolo because many producers market their milk through women group which generated the necessary volumes that created economies of scale.

Table 18: Value chain constraints

Category of Constraint	Value chain player affected	Specific constraint	Suggested solutions.
Infrastructure	Producers	Insufficient water	Drill more boreholes, excavate dams and water pans
	Bulkers	Milk spoilage that is usually brought back to Isiolo from Nairobi.	Sell as sour milk to recover the costs. Sharing the losses with the producers.
	Retailers	Milk spoilage which occurs when the buses break down and milk delays.	Use of modern transport, cooling and storage facilities
	Processor	Poor road network	Road tarmacking
	Retailers	Spillage during transportation	Using modern metallic containers.
	Processor	Insecurity while on milk collection	Improve security
Management and organization	Producers	Camel diseases due to lack of knowledgeable veterinary officers	Train veterinary officers on camel diseases
	Bulkers	Frequent loss of milk containers.	Clear labeling of the containers.
	Producers	Insufficient pastures in dry seasons	Provide supplementary feeding
	Retailers	Spillage during measurement.	Use funnels during selling time.
	Bulkers	Loss of money to some dishonest bus conductors.	Giving money to the drivers. Use of M-Pesa
	Bulkers	Delayed payments from buyers as this depends on rate of clearance of milk and collection of money from retailers and consumers.	Negotiation to pay early. Using own money to pay the producers.
Input supply	Producers	Inferior milk breeds	Introduce and promote cross breeding of the Somali breeds and Pakistan breeds.
Market access	Retailers	Limited milk market during the wet season.	Sell as fermented milk. Value addition. Explore other markets.

	bulkers	Low payments during the wet season	Limit buying of milk during rain season.
	Retailers	Lack of proper site for selling milk.	Local authority councils to establish milk sheds.
	consumers	Camel milk more expensive than the cow milk.	Adjust prices to attract more customers
	Consumers	Inadequate supply of milk on daily basis especially on dry season.	Delivering more milk to the factory for processing in wet season.
	Bulkers	Less milk during dry season to satisfy customers.	Reaching to new areas to source for milk.
	Bulkers	Inadequate and high transport costs	Pool transport. Label the container to avoid traveling and link the high end receivers using this label.
Market access	Retailers	Inadequate supply of milk on daily basis.	Empowering bulkers to stock sufficient milk and deliver it in time.
	consumers	Untimely arrival of milk.	Improve the transport system to allow milk arrive Nairobi in time.
Technology and product development	consumers	Poor milk hygiene	Sieve milk before it is retailed. Public health department to ensure hygiene standards are met.
	Retailers	Poor hygiene	Clean the jerricans before sending back to the suppliers.
	consumers	Poor packaging materials.	Improved packaging. Consumer to use own container.
Policy	Processor	Hawking of unprocessed milk.	Develop laws that will curb hawking.

Source: Author's survey, 2009

The draft sessional paper of 2006 on dairy industry development also acknowledges that primary milk marketing faces infrastructure bottlenecks caused by poor road networks and lack of appropriate cooling and storage facilities (GOK, 2007).

4.2 Factors influencing the degree of commercialization of camel milk.

Empirical estimates derived from the multivariate linear regression for the factors influencing the degree of commercialization are presented in Table 19. The output for the regression is given in appendix 5.

Table 19: Multivariate linear regression parameter estimates for factors influencing the degree of commercialization

Variable	Coefficient	t	P>t
Distance to milk selling centre	.0007267	0.49	0.625
Gender	.0990803	1.72	0.091**
Age	-.004055	-2.17	0.033*
Experience	.010926	4.45	0.000*
Education level	-.0544273	-2.00	0.049*
Household size	-.0027242	-0.60	0.547
Labour	.0544423	2.17	0.033*
Total livestock units	.0005088	1.43	0.158
Access to veterinary extension services	.058611	1.34	0.185
Productivity	.0239989	1.79	0.078**
Income	.0003634	1.07	0.288
_cons	.462361	4.64	0.000
Model summary: R^2 = 0.6167; F(11,72)= 10.53; Prob>F= 0.000; Root MSE =0.10951			

*** and ** means statistically significant at P< 0.05 and P<0.1 respectively**

TLU = {1.4 *Number of male camels + 1.4 * Number of female camels + 0.7 * Number of young camels both male and females}. Income computed in dollars. 1US $=Ksh 80.

Source: Author's survey, 2009

Based on 5% level of significance, four variables were found to be statistically significant, namely, age(P=0.033), experience(P=0.000), education level (P=0.049) and labour (P=0.033). As expected, age, experience and labour variables are of the hypothesised signs. As age increases, it was observed that the proportion of milk sold decreases.Holding other factors, a producer who is one year older will sell less milk by 0.4% than a younger producer. This is understandable because as age of a producer increases, productivity of the producer declines and hence little total ouput may be produced and consequently little may be set aside for sale. This is contrary to what Rahji (2002) established when he identified the factors influencing the marketable surplus of total farm household production in Oyo state. He found that age of the household head is a significant factor in influencing agricultural commercialization.

Experience was found to be positvely related to the degree of commercialization. Holding other factors, a producer with one year more interms of experience will exhibit a 1% higher volume of milk sold than one with a year less in terms of experience. Long experience means a wealth of necessary skills and strong social networks in the value chains which is important in ensuring succesful transactions and hence increased proportions of milk sold. Although not statistically significant, contrary to expectation distance to the milk selling centre showed a positive sign meaning that the further the producer is from the milk selling centre, the higher the proportion of milk he sells. This is contrary to what Rahji (2002) established that distance to market, were significant factors influencing agricultural commercialization in the state. However this finding can be ascribed to the pooled transport arrangements that have been put in place by the bulkers in Isiolo to address the problem of lack of transport in areas that are far away from the milk selling centres. At these places, the producers' milk is delivered to the bulkers by public transport with the assistence and arrangement of the bulkers themselves hence enabling them have a bigger capacity to market the milk than those using the donkeys.

Education level of producers is negatively related to the degree of commercialization and significant. It is observed that those producers without formal education sell higher proportion of camel milk than those with formal education.The proportion of camel milk sold by those with formal education is 5% less than those who have no formal education. This relationship is contrary because it is known that education increases managerial capacity of small scale farmers and hence the ability to comprehend complicated information related to modern livestock production and determines management skills to be employed. This result could be attributed to

the fact that majority of the producer household members suffered and continue to do so because of conflicts, drought and long distance to school which made them drop off and consequently taking up camel keeping for milk production early as the main source of income. This ultimately enabled them gain sufficient experience and establish important marketing relationships that has enabled them sell milk in higher proportions

Labour size is positively related to the degree of commercialization and significant. Holding other factors, a unit increase in labour force in the production process causes a 5% increase in the amounts of camel milk sold. As noted earlier hired labourers in the production process play the important roles of herding, milking, spraying the camels against pests and watering of camels. This means that where there is good labour supervision, high productivity will be realized and consequently higher proportions of milk will be sold. Total livestock units, access to veterinary extension services, and productivity of the camel showed positive relationship with the degree of commercialization though not significant. Household size had a negative relationship with the degree of commercialization and not significant. This is expected given the high demand for household consumption of milk that is associated with larger household sizes. Income from other sources is positively related to the degree of commercialization though not significant. Thus the higher the income from other sources, the higher the degree of commercialization.

The goodness of fit is measured by R^2 and judging from the results, the explanatory variables explain 62% of the degree of commercialization exhibited by the producers.

4.3 Satisfaction rating and perceptions of traditional camel milk consumers

4.3.1 Consumer satisfaction rating on camel milk marketing attributes

The respondents were asked to state their satisfaction levels on five marketing attributes of camel milk. These were price, taste, packaging, availability and timeliness in delivery. Appendix 3 shows the detailed scores on the responses. Figure 11 and 12 give the summary of the responses for Isiolo and Nairobi respectively.

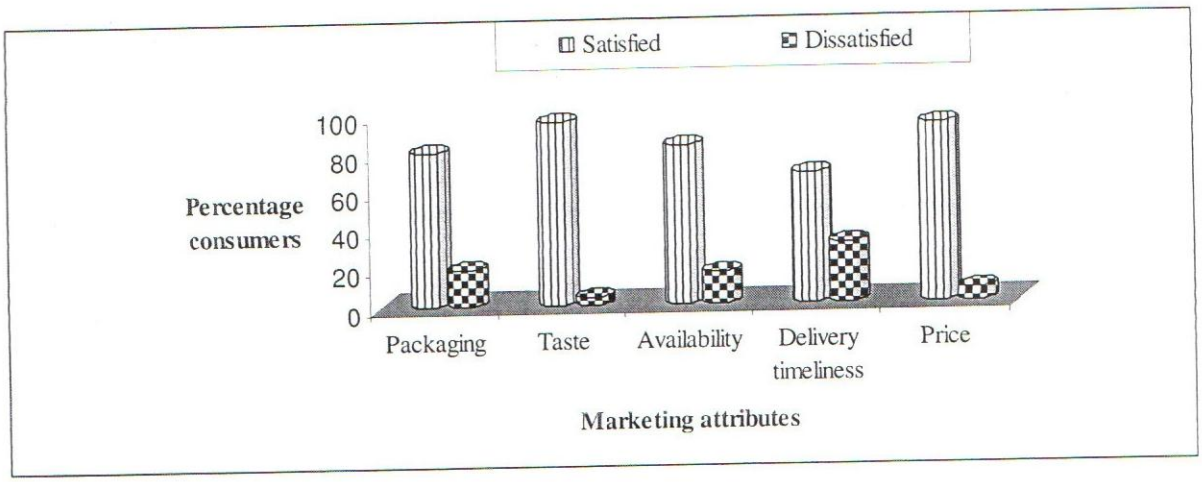


Figure 11: Satisfaction rating on camel milk marketing attributes in Isiolo

Source: Authors survey, 2009

The consumers in Isiolo were found to be relatively comfortable with the taste and price of milk. They are relatively more dissatisfied with the delivery timeliness, packaging and availability. As established during the survey, delays linked to the use of donkeys as a major mode of delivery to the agents in the chain and the poor state of road network could be responsible for this level of dissatisfaction.

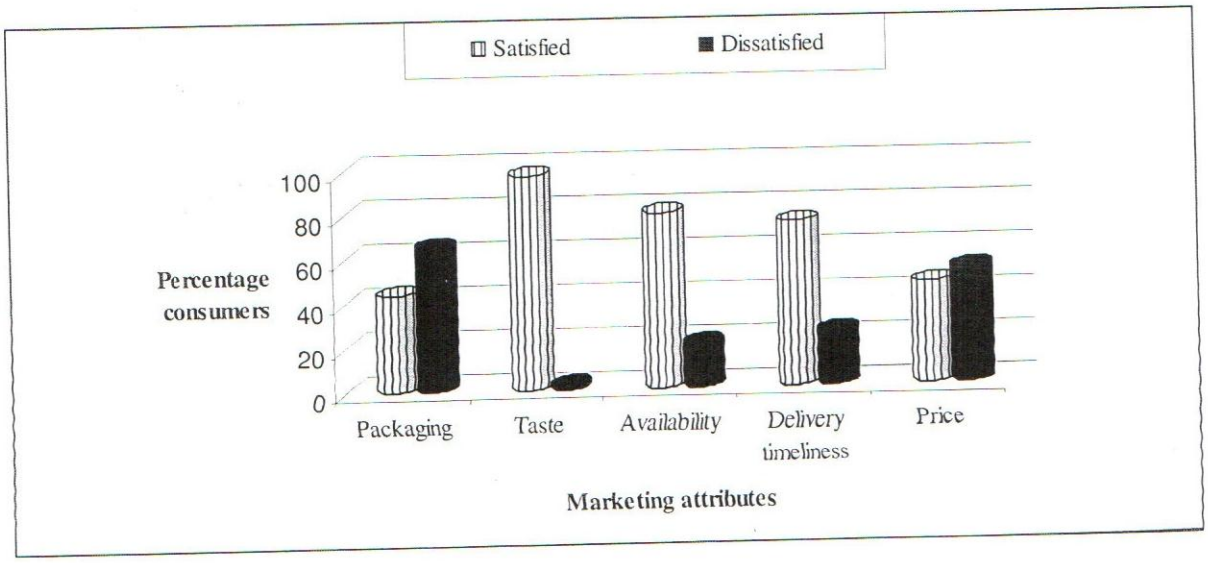


Figure 12: Satisfaction rating on camel milk marketing attributes in Nairobi

Source: Author's survey, 2009

The Nairobi consumers expressed relatively higher levels of dissatisfaction on the prices per unit volume of camel milk and packaging. According to the consumers, the camel milk prices are higher compared to cow milk price. As for packaging, the materials used which are made of polythene are considered unhygienic and not strong enough to carry the milk from the outlets without breaking. The draft sessional paper of 2006 on dairy industry development attributes the emergence of these types of materials to the expensive conventional milk packaging materials that generally have resulted in high and often unaffordable prices of packaged milk (GOK, 2007).

Figure 13 gives the overall situation derived from the responses on the rating of the marketing attributes of the camel milk.

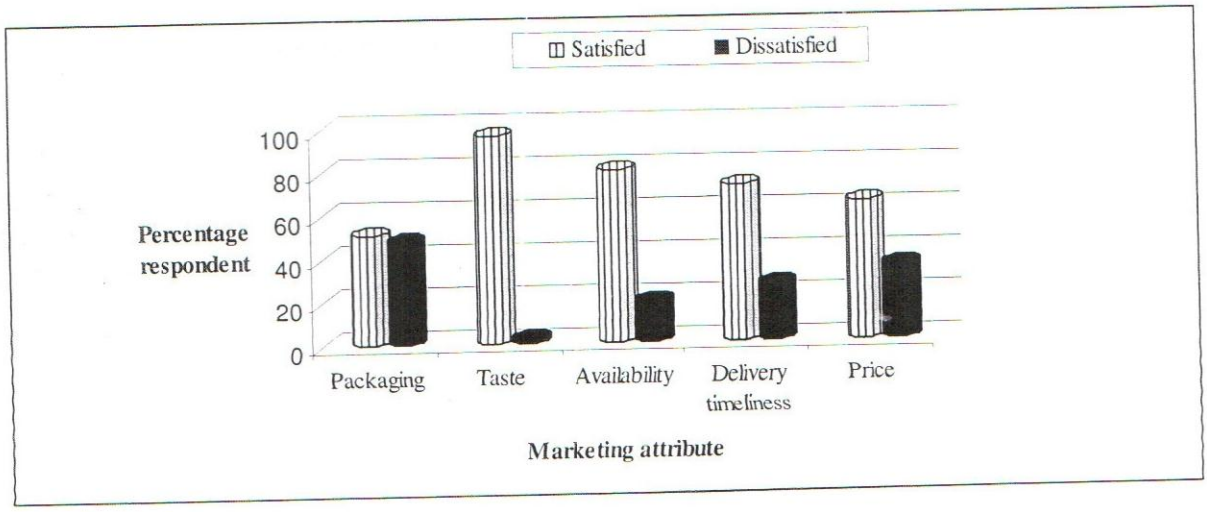
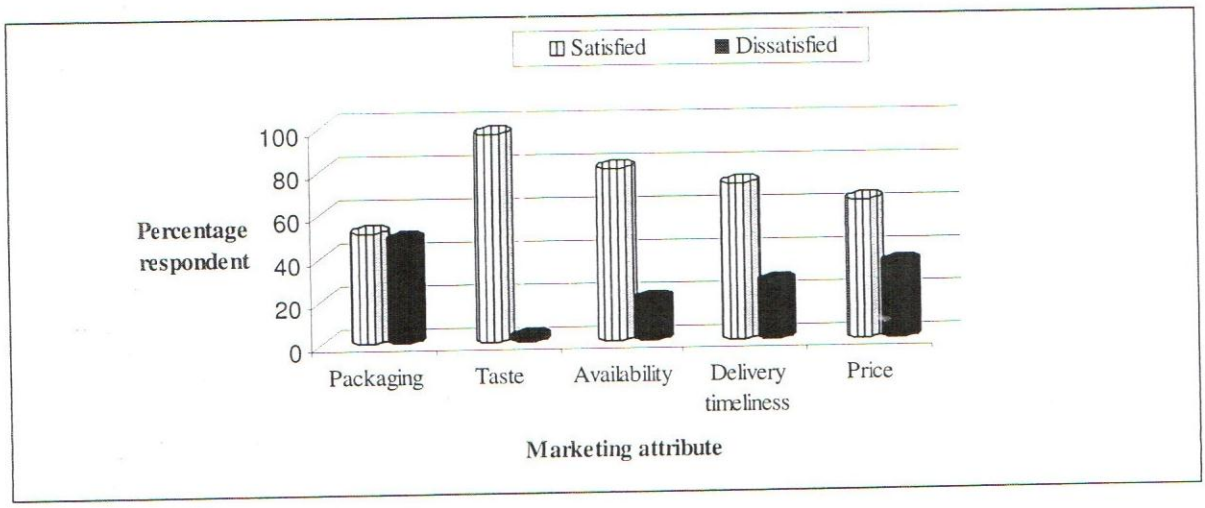


Figure 13: Overall rating on camel milk marketing attributes.

Source: Authors survey, 2009

Generally, consumers are satisfied with the taste and the availability of the milk. The small percentage that expresses dissatisfaction with availability are those who go to work. They do not find milk when they come back from work and need it for tea. This is common during the dry season when supply is low and demand is high. Though consumers in overall terms expressed satisfaction with timeliness of delivery of milk, there was some little dissatisfaction noted with respect to timeliness because milk arrives late beyond the morning period when it is required. In some cases the milk arrives late when it has already gone bad.

The two issues where consumers raised serious dissatisfaction are price offered per unit volume and packaging of the milk. This is because as compared to cow milk, camel milk is more expensive and the materials used for packaging are considered unhygienic. Cuma et al. (2007) found that preference for unpacked fluid cow milk is positively related to household sizes. The reason for this could be that larger households are likely to consume larger volumes and hence to cut down on expenses, unpacked milk would be cheaper. This implies that camel milk packaged in non conventional materials like polythene bags may be targeted for sale to areas with larger household sizes as the may not have serious concerns with the packaging,



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Source: Authors survey, 2009

Generally, consumers are satisfied with the taste and the availability of the milk. The small percentage that expresses dissatisfaction with availability are those who go to work. They do not find milk when they come back from work and need it for tea. This is common during the dry season when supply is low and demand is high. Though consumers in overall terms expressed satisfaction with timeliness of delivery of milk, there was some little dissatisfaction noted with respect to timeliness because milk arrives late beyond the morning period when it is required. In some cases the milk arrives late when it has already gone bad.

The two issues where consumers raised serious dissatisfaction are price offered per unit volume and packaging of the milk. This is because as compared to cow milk, camel milk is more expensive and the materials used for packaging are considered unhygienic. Cuma et al. (2007) found that preference for unpacked fluid cow milk is positively related to household sizes. The reason for this could be that larger households are likely to consume larger volumes and hence to cut down on expenses, unpacked milk would be cheaper. This implies that camel milk packaged in non conventional materials like polythene bags may be targeted for sale to areas with larger household sizes as the may not have serious concerns with the packaging,

4.3.2 Consumer perceptions on camel milk quality attributes

Appendix 4 contains the details of the consumers responses in terms of percentage of consumers across the four levels of responses. Figures 14 and 15 show the summary of the traditional consumers' perceptions on camel milk in Isiolo and Nairobi, respectively.

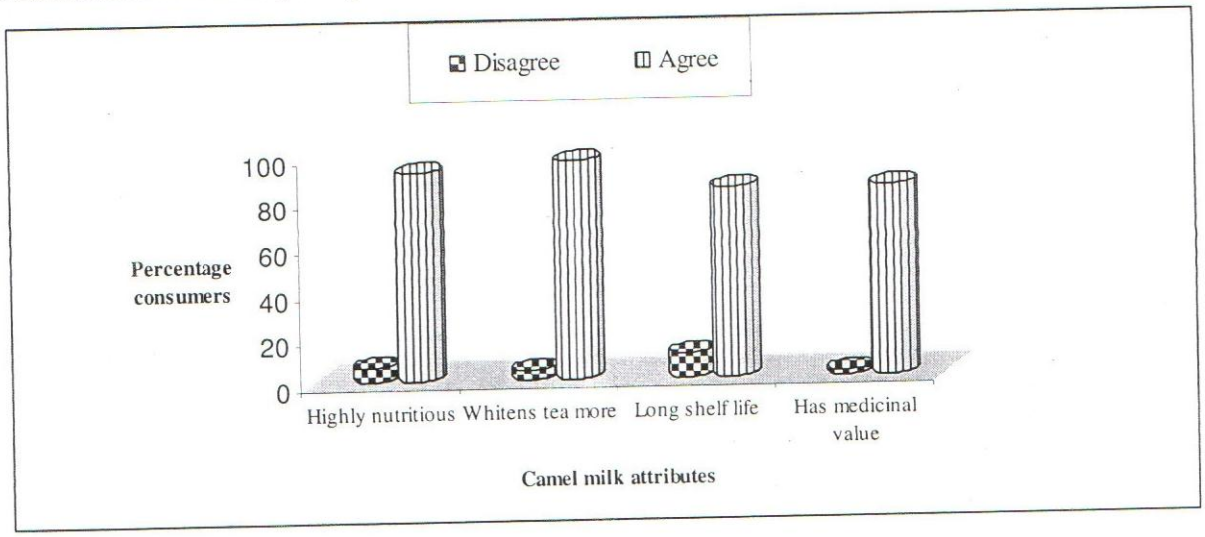

Figure 14: Perception of traditional consumers on camel milk quality attributes in Isiolo.

Source: Authors survey, 2008

Consumers in Isiolo in general, highly agree to all the quality aspects of the camel milk and especially on its therapeutic value. Being within the production region means that they have for along time been exposed to the same milk and have been made to belief all that they have been told about camel milk attributes.

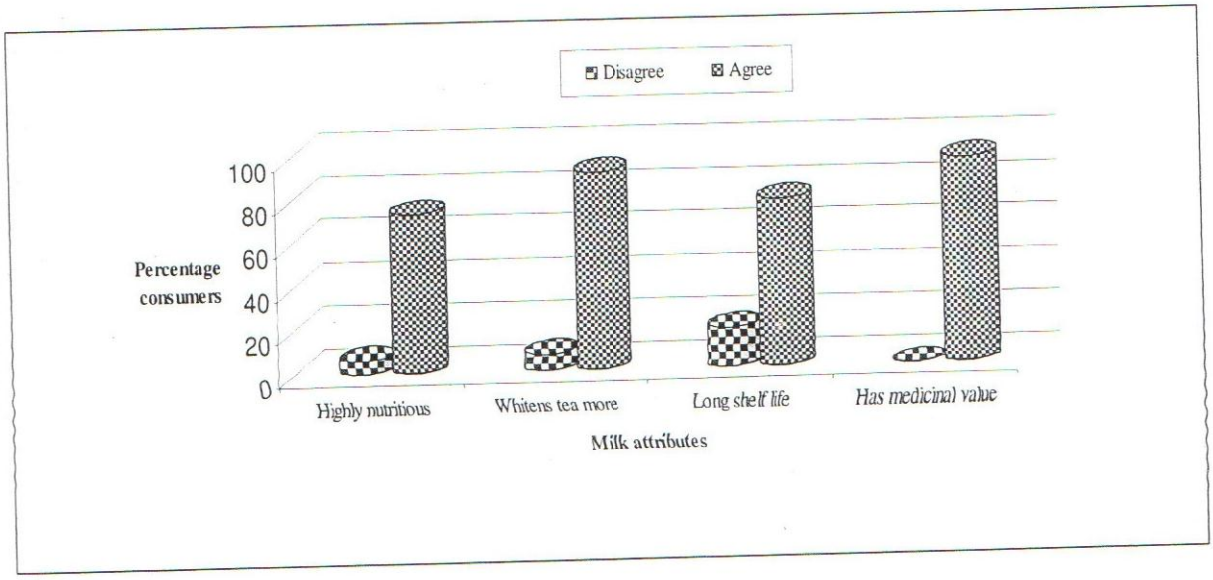

Figure 15: Perception of traditional consumers on camel milk quality attributes in Nairobi.

Source: Author's Survey, 2009

Consumers in Nairobi have higher levels of disagreement on the shelf life of camel milk without refrigeration (Figure 15). This is because the milk arrives in Nairobi long after it has been milked and the transportation delay and therefore predisposing the milk to spoilage. However, they highly agree that it has medicinal properties. Being an urban setting, households would wish to reserve some milk for later day use since fresh deliveries are made only once from the suppliers. For the households without refrigerators the shelf life without refrigeration becomes important consideration.

Figure 16 shows the overall Consumer perception on the camel milk quality attributes.

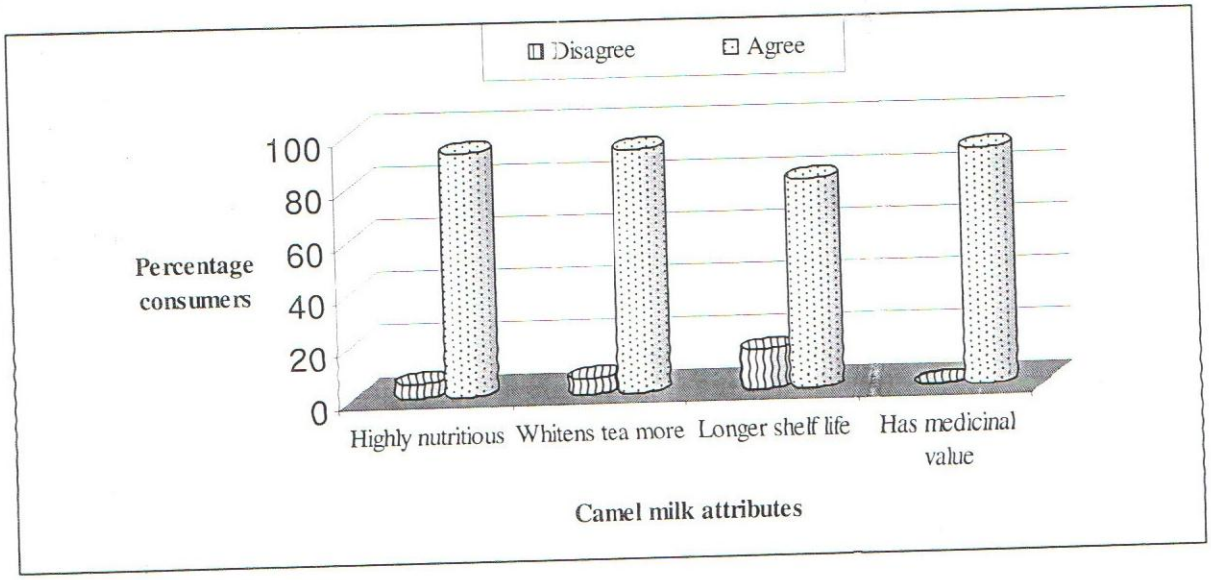

Figure 16: Overall Consumer Perception on camel milk quality attributes

Source: Authors survey, 2009

The consumers generally agree that camel milk is highly nutritious, whitens tea more and that has medicinal qualities. Compared to other quality attributes, there is slightly more disagreement over camel milk staying for long without refrigeration amongst consumers. This is linked to the delayed transportation along the way hence predisposing milk to short life.

Camel milk is believed to be able to manage thirteen different diseases. The four most important ones include, stomach upsets, blood pressure, diabetes and stomach ulcers as shown in Figure 17. These findings are consistent with Rania, (2007) who reported that the medicinal properties of camel milk include curing gastroenteritis and diabetes. They are also similar to the findings of Eyassu, (2007) with respect to treatment of diseases such as malaria and constipation. Clinical medical survey in India by Agrawal *et al*, (2007) established that the prevalence of diabetes amongst consumers of camel milk was 0% while in those not consuming camel milk was 7%. This finding showed that camel milk consumption has significant influence on the prevalence of diabetes.

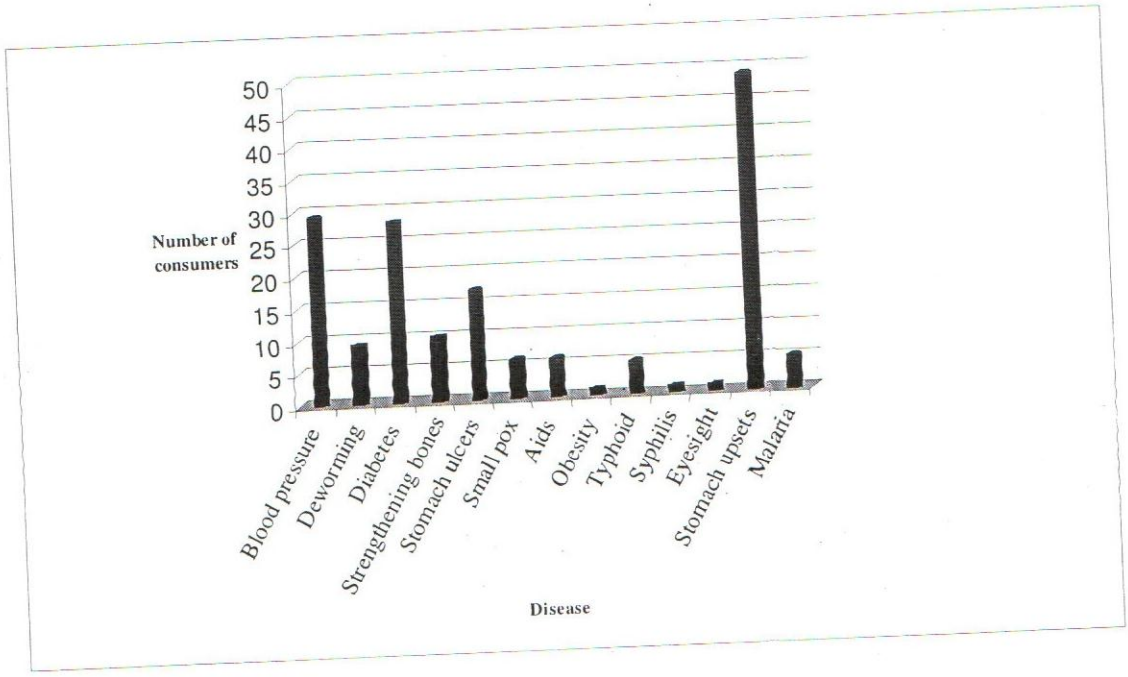

Figure 17: Range of diseases perceived to be managed by Camel milk

Source: Author's survey, 2009

4.4 Factors influencing potential consumers' willingness to pay for camel milk.

4.4.1 Determinants for consumer willingness to pay for camel milk.

Empirical parameter estimates derived from the logistic regression analysis for factors influencing willingness to pay are presented in table 20. The output for the regression is given in appendix 5.

Table 20: Logistic regression parameter estimates for factors influencing willingness to pay

Variable	Odds Ratio	z	P>(z)
Gender	2.61	1.58	0.115
Log Household size	3.47	1.88	0.060**
Log household expenditure	0.66	-0.61	0.540
Log price to be paid for camel milk	0.83	-0.14	0.891
Log quantity of cow milk purchased per week	0.42	-1.84	0.066**
Log number of years of education	6.38	1.6	0.110
Log age of household head	0.25	-1.57	0.116
Total household income	1.36	1.13	0.260
Employment status	1.46	1.25	0.213
Awareness	3.24	2.01	0.045*

Model summary: Number of observations =106 ; LR $chi^2(10)$ = 21.78; Prob > chi2 = 0.016; Log likelihood = -50.31; Pseudo R^2 = 0.18

*** and ** means statistically significant at 0.05 and 0.1 level respectively.**

Source: Author's survey, 2009

Considering 5% level of significance only one variable namely awareness is statistically significant(P=0.045).As expected awareness variable is hypothesed to have positive sign. The odds ratio is 3.2. The odds ratio is the ratio of the odds of an event occurring in one group to the odds of it occurring in another group. An odds ratio greater than 1 indicates that the condition or event is more likely to occur in the first group. And an odds ratio less than 1 indicates that the condition or event is less likely to occur in the first group The above results therefore show that those potential consumers who are aware of camel milk being processed for consumption are more willing to pay for the camel milk than those who are not aware. From the odds ratio, the likelihood to pay for a premium for camel milk for those who are aware is three times more than those who are not aware. This result is in contrast with the results by Keter (2006) who found that awareness on GM maize was not significant and it did not influence the willingness to

pay. This difference could be attributed to the beneficial qualities of the camel milk as compared to the perceived negative effects of GM foods in general that is dominating the global debate.

In India, it is observed that while the camel breeders have always drunk camel milk, the general public is often reluctant to entertain the idea of consuming camel milk. Drynet (N.d) noted that awareness raising and education of consumers about the beneficial effects of camel milk has established demand for fresh camel milk especially by diabetes patients. This approach can be transferred to other camel producing countries including Kenya. Frank et al (2007) also observed that advertisement is more important in consumption of other milk products.

Gender has a positive but not significant effect on willingness to pay in this case.This is different from the results reported by Carlberg *et al.*(2007) on willingness to pay for branded beef in canada using conventional mail out survey method.

Employment status, total household income, level of education and family size have positive relationship but with no significant effect on willingness to pay premium for the camel milk.This is consistent with the findings of Carberg *et al.*(2007).

CHAPTER FIVE

CONCLUSION AND RECOMMENDATIONS

5.1 Conclusions

From the study, the camel milk supply chain comprises of the producers, bulkers, processor, retailers and consumers. At the production stage of the chain, the camel milk subsector engages herders who also do the milking and watering of the camels. This means that the subsector plays a critical role in the arid and semi arid lands by directly creating employment. Milk buying from the producers is mainly the domain of bulkers who are mainly women. They handle upto 7000 litres per day in wet season and 2000 litres per day in dry season. With support along the initiatives of transport and infrastructure, this group has the potential to handle more milk. There are four channels through which milk is distributed and sold to the final consumers in the value chain. The proportions of camel milk sold by producers in dry and wet season are 84.7% and 85.5% respectively. From the statistical analysis, this level of commercialization is driven significantly by the experience of the producers and labour force engaged in the production process. Utilising the experience of the producers who have been in the business for along time and improving the efficiency of the labour force are likely to provide acceptable and sustainable strategies for increased camel milk commercialization. Productivity of camels and access to private veterinary services also have the potential to improve commercialization. Measures that will improve these two areas need to be put in place for increased benefits from the industry.

The constraints faced by the supply chain players have limited the capacity to meet the demands of the consumers. This is confirmed by the findings that the retailers are usually not able to satisfy demand for milk especially in Nairobi during dry season. It is noted that the current consumers are predominantly the Somali and the Borana ethnic groups in both Nairobi and Isiolo and that other ethnic communities are yet to embrace the consumption of camel milk. These two scenarios present new opportunities and a market segment in which camel milk can be promoted and commercialized.

Relatively, there are higher levels of dissatisfaction with the packaging and pricing of camel milk than with the availability of milk and timeliness of delivery. There is therefore need to improve on the type of packaging to that which is considered hygienic and strong enough not to allow spillage and also set prices that are competitive. Four diseases highly believed to be

managed using camel milk according to the consumers are stomach upsets, blood pressure, diabetes and stomach ulcers.

The main factor that plays a big role amongst potential consumers in their willingness to pay for premium for camel milk is awareness. Those who were aware of camel milk being processed for consumption were willing to pay a premium of 7% for the camel milk. What is required therefore is awareness creation.

5.2 Policy recommendations

The Kenya government should enhance budget allocation for infrastructural development to the county and other camel milk producing counties. This is because poor road network within the county, lack of electricity in the interior where it is required for cold storage limits the delivery of milk to the areas where it is required in quantities and quality required. At the retail level, the local authorities in liason with other identified stakeholders should put in place structures similar to the cow milk bars within which the retailers should sell their milk from, under hygienic conditions.

Capacity building on camel disease treatment and management for the government veterinary officers working in these areas should be undertaken. Besides the veterinary officers, the locals who have formal education and are participating in the production of camel milk production need to be trained on various camel management aspects that can enable them become resource persons to their neighbours who are just entering into production. This will enhance productivity.

Establishment of producer cooperative societies at strategic places should be done to make good use of producers who have used their experience to sell milk in high proportions. Packaging standards should be enforced by the government regulatory agency to ensure that the appropriate and hygienic packaging should be used. Pricing of camel milk should take into consideration or have a bearing on the prevailing prices of cow milk with an average price having a premium of not more than 7% over the cow milk price. The use of television as a media to create awareness amongst potential consumers should be enhanced.

5.3 Issues for further research

Research on the factors influencing the quality and distribution of pastures in the pastoral areas of Isiolo is important in order to shade light on the case of Kulamawe area pastures that are said to have superior characteristics in terms of satisfying camels and tolerance to dry conditions.

The range of diseases managed by the camel milk should be investigated clinically to isolate the diseases that can be said to be truly managed by the camel milk. This will provide in informed basis of promoting the milk amongst communities that have not been reached with this milk. The effect of high commercialization of camel milk on the pastoralist households nutritional needs and health status should be investigated.

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APPENDIX

Appendix 1: Checklist for focus group discussion

Objective: To identify constraints, challenges and opportunities in the camel milk production and marketing chain

1. What are the perceived benefits of the camels in the community?
    (a) Identify as many benefits as possible
    (b) Rank the identified benefits in their order of importance (from the most important to the least important)
2. What are the major constraints in raising the camel as a milk animal?
    (a) Identify as many constraints as possible
    (b) Rank the identified constraints in their order of importance (from the most important to the least important)
3. Are camels in this area producing as much milk as they can?
    (a) If no, what are constraints affecting milk production (list as many constraints as possible
    (b) Rank the identified constraints in their order of importance (from the most important to the least important)
    (c) Of the top three constrains, what are the most common coping strategies?
4. What are the major constraints faced in moving milk from the milking areas to the milk collection points?
    (a) Identify as many constraints as possible
    (b) Rank the identified constraints in their order of importance (from the most important to the least important)
    (c) Of the top three constrains, what are the most common coping strategies?
5. At the collection point, why is it necessary to mix milk from different producers?
    (a) Give as many reasons for mixing as possible
    (b) What problems are caused by mixing milk from many producers? (identify as many problems as possible)
    (c) What are mechanisms of coping with these problems?
6. How is milk commonly transported to each of the identified buyer-types?

(a) What are the major constraints in milk transportation

(b) What are the major mechanisms of coping with these problems

7. What are the major constraints encountered during marketing of camel milk?

(a) Identify as many constraints as possible

(b) Rank the identified constraints in their order of importance (from the most important to the least important)

(c) Of the identified constraints, what are the most common coping strategies?

8. Is camel milk processed into other products?

(a) List the various products processed from camel milk

(b) At what level are the various products processed

(c) What are the constraints in camel milk processing

(d) Of the identified constraints, what are the most common coping strategies?

9. Does camel milk have adequate markets?

(a) Identify the most common available markets

(b) Is the demand for the identified markets met?

(c) If not, what are the constraints in not meeting the demand?

(d) If the markets are not adequate, what are strategies for creating or accessing more markets?

10. Do you experience any milk spoilage?

(a) At what stage(s) do you experience milk spoilages?

(b) List reasons for spoilage at each of the identified stages.

(c) How do you usually prevent spoilage at each of the identified stages?

11. Have you received any information on milking, postharvest handling, hygiene and marketing of milk?

(a) What are the sources of information

(b) Is it the right information?

(c) What are the constraints with this system of acquiring information?

12. Are there any other constraints, observations, etc?

Appendix 2: Survey Questionnaire

QUESTIONNAIRE I: CAMEL MILK PRODUCTION

ENUMERATOR (Name) ----------DATE OF INTERVIEW ----------Serial No-----

NAME OF HOUSEHOLD HEAD ----------

RESPONDENT'S NAME (If not household head) ----------

POSITION OF RESPONDENT IN HOUSEHOLD [___]

1=Husband; 2=wife; 3= daughter; 4=son; 5=other relatives (specify); 6=non-relatives (specify)------

DISTRICT---------- DIVISION---------- LOCATION ----------VILLAGE ----------

CLOSEST TOWN ----------

DISTANCE OF THE BOMA/MANYATTA TO: 1. All weather road; 2. Milk selling centre

[___ ___] Km [___ ___] Km

SECTION A. HOUSEHOLD INFORMATION/ LABOUR AVAILABILITY AND USE

A/1. Provide the following detail about the **household head**;

Sex 1 = Male 2= Female	**Age (years)**	**Main activities** 1=pastoralist; 2=agro-pastoralist; 3=crop farmer; 4=civil servant (specify)---------- 5=businessman; 6=retired with pension; 7=retired without pension;8=others (specify)--------	**Years of camel keeping experience**	**Ethnic affiliation** 1.somali 2.maasai 3.Gabbra 4.Rendille 5.Turkana 6.Boran 7.Others(specify)	**Education level** 1=No formal schooling. 2=primary level. 3=Secondary level 4=Tertiary level 5=Others(specify)---	**Religion** 1.Catholic 2. Protestant. 3. Muslim. 4.Traditional 5.Others(specify)
[___]	[__]	[___] [___]	[__ __]	[___]	[___]	[___]

A/2. Give the **number of Household members*** (including HH head) living permanently on the compound:

Age Categories	Males	Female	Total
< 8 years	[__ __]	[__ __]	[__ __]
8 – 14	[__ __]	[__ __]	[__ __]
15 – 21	[__ __]	[__ __]	[__ __]
22 – 65	[__ __]	[__ __]	[__ __]
> 65 years	[__ __]	[__ __]	[__ __]
Total	[__ __]	[__ __]	[__ __]

*A person is in residence if they sleep in the house for at least 3 nights per week

A/3 .Indicate who in the household is **primarily responsible** for carrying out the following **tasks** for the camel enterprise **if practiced.**

Task	**Person responsible** 1=Husband; 2=wife; 3=daughter; 4=son; 5= labourers ; 6 =Others (specify)----------
1. Herding	[__]
2. Feeding(Supplementary)	[__]
3. Milking	[__]
4. Marketing milk	[__]
5. Spraying/Dipping	[__]
6. watering of animals	[__]

A/4. Does the camel owner have **transportation** facilities [__] 1 = YES, [__] 2 = NO

If **YES**, which one (s) 1 = Bicycle; 2 = Handcart; 3 = Animal transport; 4 = Motorcycle; 5 = Pick-up; 6 = Others (specify)_____

A/5. Do you employ labourers? [__] 1 = YES, [__] 2 = NO.

If Yes, indicate their type, sex, their main activities on the camel enterprises and the amount of time spent on camel activities on a typical day.

Labourer	Type 1 = Casual; 2 = Long term	Sex 1 = Male; 2 =Female	main activities 1 =Herding the camels; 2 = milking; 3= Marketing milk; 4 = watering the animals; 5 = Others (specify)	Time spent on Camel activities in hrs per day
1	[___]	[___]	[___] [___] [___] [___]	[___] [___] [___] [___]
2	[___]	[___]	[___] [___] [___] [___]	[___] [___] [___] [___]

SECTION B: LIVESTOCK INVENTORY

B/1. Does the owner of the camel herd stay in the same boma or place where the camel herds are? 1 =Yes,[___]; 2 = No, [___]. If no, why? ----------

B/2. Record the **number of animals** for the different species kept on the boma/manyatta.

Owned by HH	Goats		Camels	Sheep	Donkeys.	Cattle
Adult males	[__ __]	[__ __]	[__ __]	[__ __]	[__ __]	[__ __]
Adult females	[__ __]	[__ __]	[__ __]	[__ __]	[__ __]	[__ __]
(Young)* Immatures	[__ __]	[__ __]	[__ __]	[__ __]	[__ __]	[__ __]
Kept not owned						
Adult males	[__ __]	[__ __]	[__ __]	[__ __]	[__ __]	[__ __]
Adult females	[__ __]	[__ __]	[__ __]	[__ __]	[__ __]	[__ __]
(Young) Immature	[__ __]	[__ __]	[__ __]	[__ __]	[__ __]	[__ __]
Total	[__ __]	[__ __]	[__ __]	[__ __]	[__ __]	[__ __]

* Young means those not reached reproductive age of the species in consideration.

SECTION C: CAMEL MILKPRODUCTION

C/1. In which year did you Start camel keeping? [__ __] and how many did you start with.----------

C/2. What are the dominant breed (s) in the herd ----------and **why** did you select these? ----------

C/3. Where do you source your breeding male? 1. Own bull; 2. Neighbour's male; 3. Others (specify)

C/4. How many camels were in lactation in the last dry season----------, during the last wet season.---------Now--------

C/5. How much milk in litres per day does your camel produce on average during, 1. Wet season----------2. Dry season----------Now-------

C/6. Do you plan to increase the amount of milk you produce? [ ] 1= Yes; [ ] 2= No

If yes, how do you plan to do it? ----------

If No, why? ----------

C/7. How do you feed your calves? ----------

C/8.For how long does the calf continue suckling before it is weaned? Give a period in months [___]

C/9. How many times in a day do you milk? [___] (Indicate a number).Which times of the day----------

C/10.What is the total production of your herd **now** in litres----------

C/11. What is the **average** amount of milk in litres is consumed **by the Household** out of total production **per day**? In dry season --------- Wet season----------Now----------

C/12. Do you sell camel milk?; 1= Yes [___] ; 2= No [___]. If yes What is the **average** amount in litres is sold out of total production by the Household **per day**? In dry season ---------- Wet season----------

If no, why don't you sell any?----------

C/13. In which months of the year do you get more milk? (circle the months)

JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC ALL YEAR

D/14. In which months of the year do you normally experience (a) wet season ----------

(b) Dry seasons?----------

C/15. Who are the buyers of your milk? [___][___]

1= Individual consumers; 2=milk-traders; 3=dairy processor; 4=Farmer group/club/association; 5=Retail shop; 7= Hotel/restaurant/office; 8= other specify_____

C/16. How much milk do you sell to the different types of buyers in C/15 above? Specify average amount to each in the **wet season.**

Buyer Type	Average Quantity Per DAY (Litres)	Price/ litre (kshs)
	[___]	[__ __.]

C/17 .How much milk do you sell to different types of buyers in C/15 above? Specify average amount to each in the **dry season.**

Buyer Type	Average Quantity Per DAY (Litres)	Price/ litre (kshs)
	[___]	[__ __.]

C/ 18. What constraints do you encounter in selling your milk? ----------

SECTION D: CAMEL MANAGEMENT

D/1. Do you **enclose** your animals at night? [____] 1 = Yes; 2 = No. If yes ,why ----------

D/2. What type of feeding and feeds do you use for your camels? ----------

D/3. Is feed sufficient for the camel throughout the year? [____]1 = Yes; 2 = No .If no, which months of the year do you experience shortage?----------If No, how do you cope with this problem-

D/4. How frequently do you water your camels ?----------

D/5. What is the source of this water ?: [___]

1= Bore hole; 2 =Rivers;3.Dams;4 = Other (specify) _____

D/6. Do you give mineral supplements? [____] 1 = Yes; 2 = No .If yes ,how often ?----------

1= Ad lib in mineral box; 2=At weekly interval; 3=At monthly intervals; 4.Rarely; 5. Other(specify) --------

D/7. How many times in the last 1 year have you attended a training on camel management ? ----------

D/8. What would you say are the constraints affecting camel milk production? ----------

SECTION E: INSTITUTIONAL SERVICES

E/1. Have you ever obtained financial credit for your camel keeping activity from any source? [___] 1 = YES; 2 = NO.

If **Yes** for which Purposes and how many years ago? Specify as in the table below.

Credit Purpose	Year taken	Source of credit

If No, why ----------

E/2. Indicate the use and availability of the following services in your area with respect to the camel.

	Availability(Tick if available)	Number of visits to them in last 12 months
Government (i)Veternary services	[___]	[___]
(ii)Livestock extension services	[___]	[___]
Private (i)Veternary services	[___	[___]
(ii)Livestock extension services	][___]	[___]
NGO's (specify) (i)Veternary services	[___]	[___]
(ii)Livestock extension services	[___]	[___]

SECTION F - HOUSEHOLD CASH INCOME ESTIMATES AND CONSTRAINTS

F/1. For the **different sources of income** to the household, **estimate amount** per month:

SOURCE	AVERAGE INCOME PER MONTH Kshs.
Income from all camel sales activities	[_ _ _ _ _ _]
Income from wages/salaries/non-farm activities	[_ _ _ _ _ _]
Income from remittances from absent family members and other external income	[_ _ _ _ _ _]
Income from rent (plots, house, etc…)	[_ _ _ _ _ _]
Income from camel milk.	[_ _ _ _ _ _]
Income from other activities(Specify)	[_ _ _ _ _ _]
Income from sale of other livestock animals	[_ _ _ _ _ _]

F/3 .For how long have you undertaken camel milk as an income source? ----------

F/4.Suggest **other** ways of improving camel production.

i)----------

ii) ----------

iii) ----------

iv) ----------

v) ----------

QUESTIONNAIRE II: CAMEL MILK MARKETING CHAIN ANALYSIS

ENUMERATOR (Name) ----------DATE OF INTERVIEW ----------Serial No-------- NAME OF HOUSEHOLD HEAD. _____

RESPONDENT'S NAME---------- (If not household head) _____

POSITION OF RESPONDENT IN HOUSEHOLD [___]

1=Husband; 2=wife; 3=Daughter; 4=son;5=others(Specify) ----------

DISTRICT---------- DIVISION---------- LOCATION ----------VILLAGE ----------

Respondent,s Mobile phone number----------

ROLE OF RESPONDENT [___]

1=Bulker/Wholesaler 2. Processor; 3= Retailer; 4 = Consumer ;5=Others (specify).--------

(Depending on the role move to the relevant section A,B,C, and D below.)

A) BULKERS

1).From who do you receive the milk you are handling? [___]

1= Producers ;2= Another bulker;3= Others(Specify)----------.If from 2 and 3 above, where do they get their supply from?----------

2). At what price do you buy a unit litre of camel milk? Ksh----------

3) How much milk do you handle per day (litres) ----------?

4) What other activities do you do upon receiving the milk? [___]

1=Retail; 2=Wholesale; 3= Process ;4=Transport to other markets; 5=Others (specify)----------

---

5) (a) To whom do you sell your milk to?[___]

1= Individual consumers; 2=Hotels; 3= Processers; 4= Retailers locally; 5=Retailers in other towns.

b). Specify amount and price for each above:

Customer	Av. Amount of milk sold to the customer.	Av.Price/litre Ksh
Individual consumers		
Hotels		
Processors		
Retailers locally		
Retailers in other towns		
Total		

c) What are the payment arrangements between?

(i)You and Your suppliers----------

(ii)You and your buyers----------

6).What constraints do you encounter in the marketing process?----------
---
---

7). How do you cope with each of the above constraints?----------
---
---

8). Name other bulkers that you know in this place? ----------
---

9) (a) By what means is milk delivered to you? [___]

1=Donkey ;2=Lorry ;3=Pick up;4=Public transport;5=Others (Specify)----------

b) How do you convey milk to other markets?----------
---

c) How much does transportation cost per unit volume of milk? Ksh ----------

B) RETAILERS

1).Who are your suppliers? ----------At what price do you buy a litre at?----

2).To whom do you sell the milk to? [___].

1= Individual consumers; 2.= Hotels ;3= Processors; 4= Retailers locally; 5= Retailers in other towns

3). At what price per litre do you sell to your customers above during wet season and dry season (Fill in the table below)

Customer	**Av.Price/litre Ksh in wet season**	**Av.Price/litre Ksh in dry season**
Individual consumers		
Hotels		
Processors		
Retailers locally		
Retailers in other towns		
Total		

4). Is the demand for camel milk met? [___].1= Yes; 2= No

If No, in which period is it common ----------.

5). Do you experience decreased demand? [___].1. Yes 2. No.

If yes, in which period is it common?----------

6). By what means do you deliver the milk to them? [___].

1=They pick from your kiosk; 2= Bicycle;3=Send someone on foot,.4.= Use public transport ;5.= Others (specify)------

7).What constraints do you encounter? ----------

---

8). What opportunities can be exploited to elimir.ate or mitigate the above problems.----------

---

9).Do you offer any services to your suppliers?----------

---

10). a. Name other retailers locally?----------

b. In what way do you work together?----------

C). PROCESSORS

1).What products do you make?----------

2). How is the demand for these products----------

3). Who are the customers of your products?----------

4)..How do you deliver these products to them?

5).When did you begin? ----------

6).Who are your suppliers of raw milk? ----------

7). At what prices do you buy a unit litre of camel milk that you use? Ksh----------

8). How much litres of raw milk do you receive and use per day for production? ------

9).What is the maximum amount of milk the plant or factory can handle per day? ------

10). Name other processors of raw camel milk that you know in this region----------

---

11).How do you support other players in the chain? ----------

---

12). What constraints do you encounter? ----------

---

13). How do you cope with the above problems.----------

D) TRADITIONAL CONSUMERS

1) .Household size (Indicate No). [___]

2). Household ethnic group ----------

3) Respondent's age (Or ask year of birth) ---------

4) Level of schooling [___]

1=No formal schooling; 2= primary level; 3 = secondary level; 4= Tertiary level

5). Main occupation now _____

6). Respondent's religion. [___]

1=Catholic; 2=Protestant; 3= Muslim; 4=.Atheist; 5=.Hindu ; 6= Others (specify)_____

7). Is milk in general important in your daily life [___] 1= Yes, 2= No

8). In what form do you usually take it [___].

1= Tea; 2.; = Fermented (Mala); 3= Purely Fresh

9). How many times in a week do you buy fresh camel milk for your family use? (Indicate No). [___]

10). How do you usually obtain your milk supply?(Name the outlet) ----------

11). If there are **any** milk purchases, what is the average amount of camel milk that is consumed by the Household in a day in litres?----------

12). At what price do you buy a unit litre of camel milk? (a) In dry season ---------(b) In wet season-------

13). Who makes decisions on food (milk) purchasing in your household? ----------

(For 14-17, Indicate your agreement or disagreement to the following statements with) :

(A) Strongly disagree, (B) Disagree, (C) Don't know (D) Agree, (E) Strongly agree.

14). Camel milk is highly nutritious ----------

15). Camel milk is whitens tea more or is strong when used for making tea----------

16). Camel milk stays for long without going bad without refrigeration----------

17). a).Camel milk has medicinal value----------

b).Which diseases according to you does it cure or manage?----------

18). How do you rate your satisfaction with the aspects of camel milk indicated below using the following measures:

(A) very satisfied , (B) Fairly satisfied ,(C) Satisfied , (D) Slightly dissatisfied ,(E) very dissatisfied.

i) Packaging:

(A) very satisfied , (B) satisfied ,(C) Moderately satisfied , (D) Slightly dissatisfied ,(E) very dissatisfied.

ii) Taste :

(A) very satisfied , (B) satisfied ,(C) Moderately satisfied , (D) Slightly dissatisfied ,(E) very dissatisfied.

iii) Availability:

(A) very satisfied , (B) Satisfied ,(C) Moderately Satisfied , (D) Slightly dissatisfied ,(E) very dissatisfied.

iv) Timeliness in delivery :

(A) very satisfied , (B) Satisfied ,(C) Moderately Satisfied , (D) Slightly dissatisfied ,(E) very dissatisfied.

v) Price

(A) very satisfied , (B)satisfied ,(C) Moderately satisfied (D)Dissatisfied ,(E) very dissatisfied.

19). Suggest ways of improving camel milk marketing for your consumption.

i)----------

ii) ----------

iii) ----------

QUESTIONNAIRE III: CAMEL MILK POTENTIAL CONSUMERS

ENUMERATOR (Name) ---------- DATE OF INTERVIEW ----------

TOWN----------ESTATE----------

NAME OF HOUSE HOLD HEAD----------

RESPONDENT'S NAME (If not household name) ----------

PART 1: RESPONDENT'S DETAILS

POSITION IN HOUSEHOLD. [___]

1=wife of household head; 2= daughter; 3=son; 4=other relatives (specify); 5=non-relatives (specify)

1 .Household size (Indicate No). [___]

2. Household ethnic group ----------

3 Respondent's age ---------

4 .Level of schooling of schooling [___]

1=primary level 2 = O-level 3= A-level 4= Diploma level 5= University 6=Others(specify)----------

5. Main occupation now _____

6. Respondent's religion. [___]

1.Catholic 2.Protestant. 3. Muslim. 4.Traditional 5.Others (specify)_____

7. Do you have children below ten years in your household? [___] 1= Yes, 2= No

8. Is milk important in your daily life [___] 1= Yes, 2= No

9. In what form do you usually take it[___].1= Tea . 2.=Mala .3=Fresh

10. How many times in a week do you buy fresh cow milk for your family use? (Indicate No). [___]

11. How do you usually obtain your milk supply? ----------

12. If there are any milk purchases, what is the average amount of fresh milk that is consumed by the Household?

	Per day or week 1=day 2=week	**Unit** 1=Litre 2=Cups(350mm) 3-Bottles(750mm)	**Quantity**	**Number of months during the year**
Fresh milk	[___]	[___]	[___]	[___]

13. At what price do you buy the above stated unit of cow milk? [____]

14. Who makes decisions on food purchasing in your household----------

PART II: CAMEL MILK AWARENESS AND WILLINGNESS TO PAY

15. Have you ever heard that camel milk is being processed and packaged for sale to buyers in some towns in this country? [____] 1=Yes ,2= no.

16. If yes from which source? [____]

1.Radio 2. Neighbour 3. Newspaper 4. Television 5. Others (specify) ----------

17. **(Explanation of attributes camel milk)** . Camel milk is said to be sweet, strong, and rich in nutrients like iron, carotene, vitamin E, lasts longer without getting spoilt and having medicinal value. It is slightly salty depending on the fodder the camel eats. Would you be willing to buy camel milk if it will be offered to you at the same price as the cow milk? [____] 1= Yes, 2,=No.

(For 18 and 19 below, obtain the correct percentage and ask in terms of Kenya Sh.)

18. If yes, are you willing to buy camel milk if it were offered at a price of

Ksh--------(5%)----------(10%)----------(15%)----------(20%)----------(25%)--------(30%)----------
(35%)----------(40%)----------(45%)----------(50%)

Premium (Tick the maximum price)

19. If No, would you be willing to buy camel milk if it were offered at a price of

Ksh--------(5%),----------(10%),---------(15%),----------(20%),----------(25%),--------(30%),-----
----(35%),----------(40%),----------(45%),----------(50%) Discount (Tick the minimum price).

20. At the price you have mentioned, what amount of camel milk would you be buying at the same frequency as that you mentioned for the cow milk? ----------

21. In which of the following groups do you estimate your **total household income**(Farm, employment, business income, pensions and remittances from elsewhere from all working members.

HOUSEHOLD INCOME CATEGORIES

1=<5000 Ksh / month

2=5000-10000

3=10001-15000

4=15001-20000

5=20001-25000

6=>25000

22. Expenditures per month.

Item	Expenditure (Ksh)
Food	
Clothing	
Medicine	
Fare	
House rent	
Electricity bill	
Water bill	
School fee	
Other	
Saving	
Total	

23. Any general comments about camel milk .----------

(Give appropriate thanks to the respondent for his/her time and cooperation)

END

Appendix 3: Frequencies and scores of consumers satisfaction rating on camel milk marketing attributes

	Very dissatisfied	Slightly dissatisfied	Satisfied	Very satisfied
OVERALL				
Packaging	33 (26.6%)	27 (21.8%)	47 (37.9%)	17 (13.7%)
Taste	0	4.0 (3.2%)	93.0 (75.0%)	27.0 (21.8%)
Availability	0	24.0 (19.7%)	93.0 (76.2%)	5.0 (4.1%)
Delivery	3.0 (2.5%)	30.0 (24.6%)	86.0 (70.5%)	3.0 (2.5%)
Price	3.0 (2.5%)	40.0 (32.8%)	73.0 (59.8%)	6.0 (4.9%)
ISIOLO				
Packaging	1(2.1)	8(17.0%)	25(53.2%)	13(27.7%)
Taste	0	2(4.3%)	33 (70.2%)	12 (25.5%)
Availability	0	8 (17.0%)	36 (76.6%)	3 (6.4%)
Delivery	2 (6.4%)	12 (25.5%)	32 (68.1%)	1 (2.1%)
Price	0	3 (6.4%)	39 (83.0%)	5 (10.6%)
NAIROBI				
Packaging	32 (41.6%)	19 (24.4%)	22 (28.6%)	4 (5.2%)
Taste	0	2 (2.6%)	60 (77.9%)	15 (19.5%)
Availability	0	16 (20.5%)	57 (73.1%)	2 (2.6%)
Delivery	1 (1.3%)	18 (24.0)	54 (69.2%)	2 (2.6%)
Price	3 (4.0)	37 (49.3%)	34(45.3%)	1 (1.3%)

Overall summary

	Average score (± SD)		
	OVERALL	**ISIOLO**	**NAIROBI**
Packaging	3.1840 ± 1.02309	3.0638 ±0.73438	1.9872 ± 0.96016
Taste	2.8480 ± 0.46462	3.2128 ±0.50803	3.1667 ± 0.43891
Availability	2.7360 ± 0.45889	2.8936 ±0.47704	2.8205 ± 0.44848
Delivery	2.6800 ± 0.54097	2.6809 ±0.59368	2.7692 ± 0.50768
Price	2.3920 ± 0.60375	3.0426 ±0.41480	2.4615 ± 0.59636
Overall average score	**2.7680 ± 0.36756**	**2.9787 ±0.31273**	**2.6410 ± 0.34014**

Appendix 4: Frequencies and scores of consumers' perception on Quality attributes of Camel Milk.

Statement	Strongly disagree	Disagree	Don't know	Agree	Strongly Agree
Overall					
Highly nutritious	5 (4.0%)	2 (1.6%)	2 (1.6%)	47 (37.6%)	69 (55.2%)
Whitens tea more	4 (3.2%)	4 (3.2%)	1 (0.8%)	60 (48.0%)	56 (44.8%)
stays for long without refrigeration	5 (4.0%)	14 (11.3%)	6 (4.8%)	65(52.4%)	34 (27.4%)
Has medicinal value	1 (0.8%)	0	11 (8.8%)	44 (35.2%)	69 (55.2%)
Isiolo					
Highly nutritious	1 (2.1%)	2 (4.3%)	1 (2.1%)	31 (66.0%)	12 (25.5%)
Whitens tea more	1 (2.1%)	1 (2.1%)	0	19 (40.4%)	26 (55.3%)
Stays for long without refrigeration	2 (4.3%)	3(6.4%)	3 (6.4%)	22 (46.8%)	17(36.2%)
Has medicinal value	1 (2.1%)	0	7 (14.9%)	20 (42.6%)	19 (40.4%)
Nairobi					
Highly nutritious	4 (5.1%)	1 (1.3%)	16 (20.5%)	0	57 (73.1%)
Whitens tea more	3 (3.8%)	3 (3.8%)	1 (1.3%)	41 (52.6%)	30 (38.5%)
Stays for long without refrigeration	3 (3.9%)	11 (14.3%)	3 (3.9%)	43 (55.1%)	17 (21.8%)
Has medicinal value	0	0	4 (5.1%)	24 (30.8%)	50 (64.1%)

Overall Summary

	Average score (± SD)		
	OVERALL	**ISIOLO**	**NAIROBI**
Highly nutritious	4.38 ± 0.92	4.09 ± 0.80	4.56 ± 0.95
Whitens tea more	4.28 ± 0.89	4.45 ± 0.80	4.18 ± 0.94
Stays for long without refrigeration	3.87 ± 1.06	4.04 ± 1.04	3.77 ± 1.07
Has medicinal value	4.44 ± 0.72	4.19 ± 0.85	4.59 ± 0.59
Overall average score	4.24 ± 0.62	4.19 ± 0.65	4.28 ± 0.60

Appendix 5: Regression outputs

OLS regression output for factors influencing the degree of commercialization of camel milk

Source	SS	df	MS
Model	1.38907134	11	.126279212
Residual	.863423876	72	.011991998
Total	2.25249521	83	.027138497

Number of obs = 84
F(11, 72) = 10.53
Prob > F = 0.0000
R-squared = 0.6167
Adj R-squared = 0.5581
Root MSE = .10951

AVPRPSAL	Coef.	Std. Err.	t	P>t	[95% Conf.	Interval]
DIST_MILK	.0007267	.0014792	0.49	0.625	-.0022221	.0036755
GENDER	.0990803	.0577583	1.72	0.091	-.0160589	.2142195
AGE	-.004055	.0018645	-2.17	0.033	-.0077718	-.0003381
XPERIENCE	.010926	.0024538	4.45	0.000	.0060345	.0158175
EDUCLEV	-.0544273	.0272369	-2.00	0.049	-.1087231	-.0001315
HHSZE	-.0027242	.0045063	-0.60	0.547	-.0117074	.006259
LABRSIZE	.0544423	.0251153	2.17	0.033	.0043759	.1045086
TLU	.0005088	.0003565	1.43	0.158	-.0002018	.0012194
ACPVET	.058611	.0438422	1.34	0.185	-.0287869	.1460089
PRODTVTY	.0239989	.0134439	1.79	0.078	-.0028011	.0507989
INC_DOL	.0003634	.0003395	1.07	0.288	-.0003133	.0010402
_cons	.462361	.0997286	4.64	0.000	.2635557	.6611663

Logistic regression output for factors that influence consumer willingness to pay for camel milk.

Logistic regression

Log likelihood = -50.308554

Number of obs	=	106				
LR chi2(10)	=	21.78				
Prob > chi2	=	0.0163				
Pseudo R2	=	0.1780				

willingtopay	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
gender	2.614519	1.594493	1.58	0.115	.7911835	8.639856
lnhsize	3.469955	2.291791	1.88	0.060	.9508968	12.66235
lnexp	.6592493	.447988	-0.61	0.540	.1740291	2.497338
lnprice	.8279757	1.141398	-0.14	0.891	.0555395	12.34335
lnqpur	.4160318	.1983139	-1.84	0.066	.1634467	1.058954
lneduc	6.376495	7.381802	1.60	0.110	.6594495	61.65701
lnage	.2529079	.2212751	-1.57	0.116	.0455225	1.405072
thhi	1.357336	.3681021	1.13	0.260	.7977121	2.309556
emplstat	1.462607	.4463523	1.25	0.213	.8041954	2.660075
awareness	3.238752	1.896531	2.01	0.045	1.027864	10.20516