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Camel Milk Value Chain in Kenya: A Review

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Abstract

The dromedary camel is considered an integral species of the arid and semi-arid lands (ASAL) in Kenya. It's adaptation to the climatic and geographical conditions of the ASAL had enabled the camel to be regarded as the most important animal source of food as well as source of transport, draught and cultural significance. Camel milk is to a great extent utilized in the ASAL at subsistence level, but also makes way to the peri-urban centres and ultimately to the capital city, where there is high demand for the product.

The main purpose of this review is to consolidate research done on camel milk value chain in Kenya, to establish the contribution of camel milk to the pastoral and national economy, to determine opportunities for investment by the county governments and private sectors as well as to recommend milk value chain upgrading strategies in a bid to increase livelihoods of pastoral communities and other actors involved in the camel milk value chain.

Keywords: camel milk, value chain, marketing, upgrading strategies

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1. Introduction

The camel is one of the oldest animal domesticates occurring in two phenotypic forms as one humped (Dromedary) or two humped (Bacterian). The dromedaries (*Camelus dromedarius*) often occur in Africa and the Middle East while the Bacterian (*Camelus Bactrianus*) are found more often in Central Asia (Knoll and Burger, 2012). Being a multipurpose animal, it is globally kept for milk, meat, wool, transport, racing, tourism, agricultural work, and beauty contests (Faye, 2015). Of the projected world population, 31.1 million are believed to be one-humped dromedary camels (*Camelus dromedarius*) and 3.7 million two-humped (*Camelus bactrianus*). Approximately 20.1 million dromedaries, representing two thirds of the world's camel population, are in in North East Africa, i.e. Somalia, Sudan, Ethiopia and Kenya.

Camels also play an important role in the pastoral society as they offer transport to people and cargo, plough farms, de-silt dams, and are an important requirement in ceremonies such as marriage, burials, and religious events and in conflict resolution. A few camels are found scattered across the country mainly for touristic amusement through trekking safaris and camel racing (CAMASEPRO, 2012).

1.1 Camel population in Kenya and the world

According to Food and Agriculture Organization (FAO), 2019, the global estimate of camels in 2017 was 34.8 million, of which 30.1 million are found in Africa and 4.7 million in Asia. Kenya has the fourth largest camel herd in the world (Table 1) estimated at 3,338,757 after Chad, Somalia and Sudan.

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Table 1. Estimated camel populations of Africa and the world in 2017

Country	Camel population	Country	Camel Population
Africa			
Chad	7,285,309	Nigeria	282,000
Somalia	7,222,181	Tunisia	237,005
Sudan	4,849,003	Egypt	149,224
Kenya	3,338,757	Western Sahara	111,329
Niger	1,788,149	Djibouti	70,965
Mauritania	1,479,648	Libya	64,469
Ethiopia	1,210,663	Morocco	59,000
Mali	1,192,900	Burkina Faso	19,475
Algeria	381,882	Senegal	4,765
Eritrea	379,189	Namibia	90
Other Areas			
Mongolia	434,096	Iraq	78,196
India	325,155	Syria	66,390
China,	323,000	Qatar	40,843
Oman	262,870	Uzbekistan	17,685
Kazakhstan	193,124	Jordan	14,322
Afghanistan	172,000	Kuwait	9,389
Iran	141,052	Europe	7,163

Source: FAO, 2019

1.2 Camels in the ASAL of Kenya

The dromedary camel in a Kenyan context is considered an integral species of the arid and semi-arid lands (ASAL), an eco-system characterized by low and sparse rainfall ranging between 150 mm and 550 mm annually, high temperatures throughout the year and with high rates of evapo-transpiration (GoK, 2017).

The ASAL occupies approximately 89% of the country's landmass, hosting about 36% of the human population, 70% of livestock and 90% of wildlife (GoK, 2017). An estimated 70% of cattle, 87% of sheep, 91% of goats and 100% of camels of the national livestock population are found in ASALs (Behnke and Muthami, 2011). Pastoralism, agro-pastoralism and dry-land agriculture are the key livelihood strategies adapted to climate conditions in ASALs.

Most of the camels in Kenya are found in the north and north eastern counties of Turkana, Baringo, Marsabit, Wajir, Mandera, Isiolo, Garissa and Tana River where they are mostly kept by pastoral communities namely Somali, Gabbra, Rendille and Turkana (Musinga *et al*, 2008). In Kenya, camel population density increases with aridity as portrayed in Figure 1.

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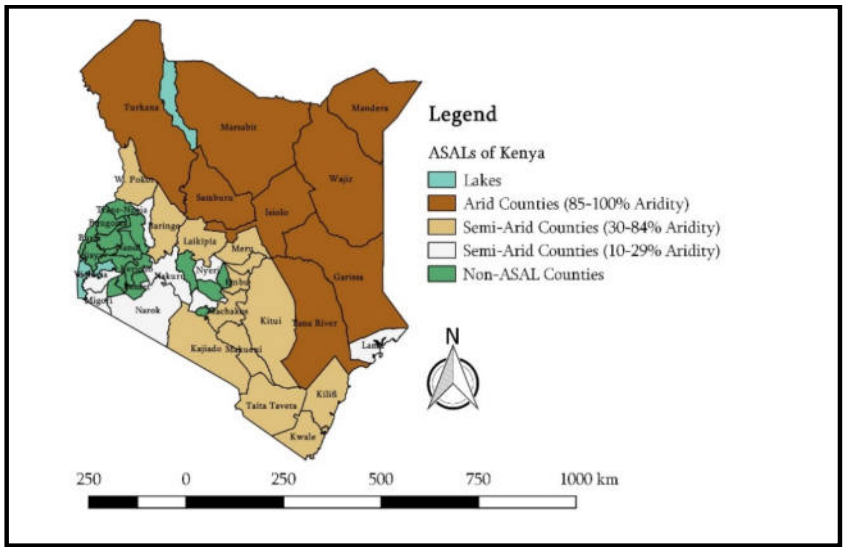

Figure 1: Map of Arid and Semi-Arid Lands of Kenya
Source: Statistics derived from Ministry of Devolution and ASAL areas, 2017

As illustrated in Figure 2. the counties leading with the highest camel populations are Mandera with 1,016,970 (Mandera CG, 2018), Turkana with 832,462 (Turkana CG, 2013), Wajir with 533,651 (Wajir CG, 2015), Garissa with 486,000 (Garissa CG, 2018) and Marsabit with 217,360 (Marsabit CG, 2018). All these counties are predominantly arid ecological zones. They are distantly followed by Samburu with 60,000 (Samburu CG, 2013), Isiolo with 40,460 (Musinga *et al*, 2008), West Pokot with 35,271 (West Pokot CG, 2018), Baringo with 10,189 (Baringo CG, 2013) and Laikipia with 9800 camels (Laikipia CG, 2018). These counties fall between arid and semi-arid zones with 30-84% aridity.

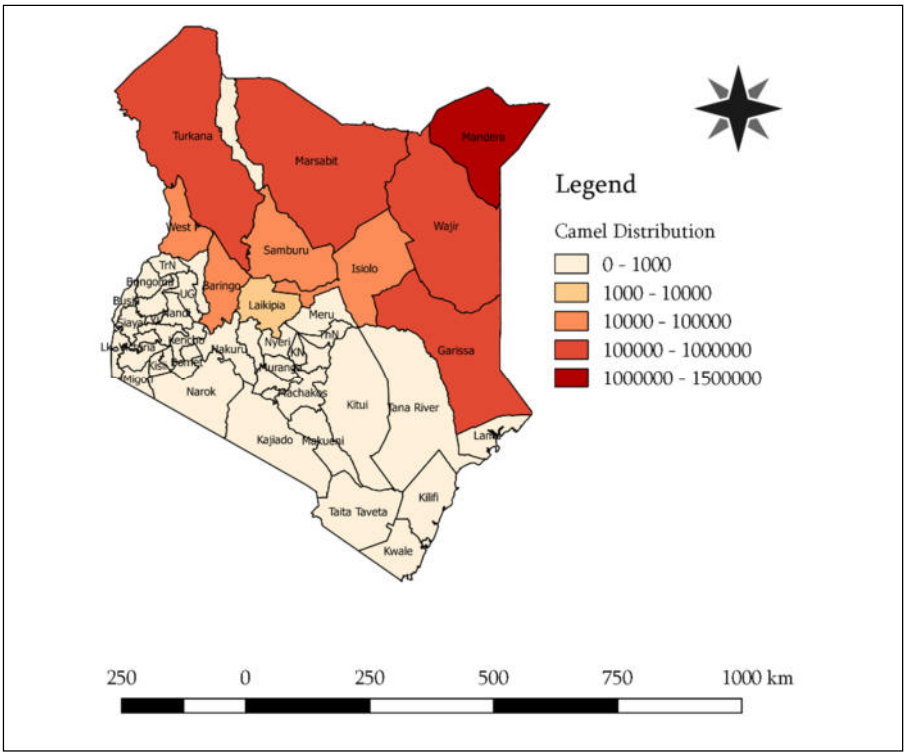

Figure 2: Map of Camel Population Distribution in Kenya
Source: Compiled from various County Government integrated development plans

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Camels are able to survive in such environments due to an array of excellent anatomical and physiological adaptations that allow them to withstand long periods of time without water without any adverse effects (Khan *et al,* 2003). These communities keep camels for food security by the provision of milk and meat, as well as hides.

1.2 Camels in the peri-urban areas

Camel rearing within peri-urban areas for the purpose of supplying milk and meat to the increasing human population in the towns is emerging as a new production system (Agriconsortium, 2003). Due to rural-urban migration and a great demand for camel milk in urban areas, camel milk production has greatly increased in peri-urban centres such as Kajiado (Muloi, 2018), Mt. Marsabit (Tura and Walaga, 2015) and Isiolo's central division (Noor, 2013). Adoption of camels by non-camel keeping communities is a trend observed across the peri-urban centers of the North. Furthermore, camels have shifted further south gaining importance in have been successfully introduced in Kajiado, Samburu, Meru, Laikipia, West Pokot, Kilifi, Kitui, Mwingi, and Narok; areas where until recently cattle were the only large domestic herbivore species kept . The shift has been seen as an adaptability response to climate change, as a means to build climate resilience since camels can survive severe droughts and continue to offer food security and economy in dry periods better than other classes of livestock (Hülsebusch and Kaufmann, 2002). Herren, 1990 reported during prolonged droughts, milk production in cattle and goats' ceased at higher proportions of 52% and 75%, respectively than camels 22%. Furthermore, while the national livestock population has been on a decline in the past two decades for reasons attributed to climate change as evidenced by more frequent droughts (UNDP, 2005), decline in long-season rainfall and the significant warming in temperature (USAID, 2010), the camel population has somewhat stabilized in the past decade (Figure 3). This has been attributed to the camels better adaptation to the changing climate (Hülsebusch and Kaufmann 2002).

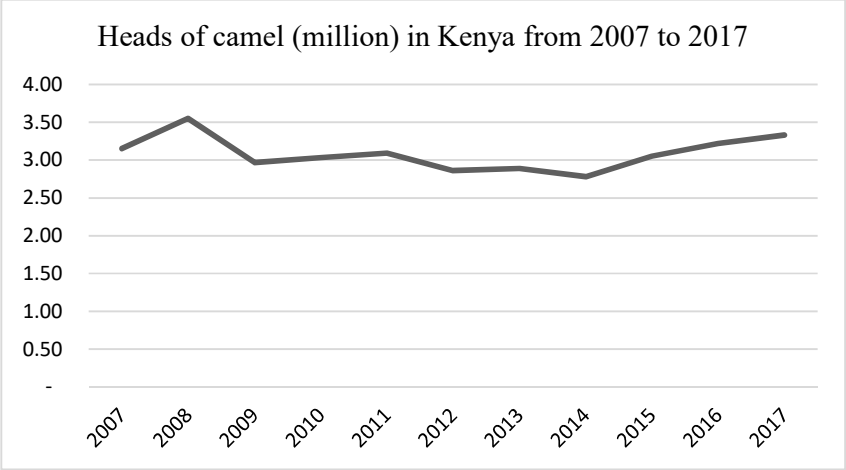

Figure 3: Camel population trends in Kenya between 1997 and 2007
Source: FAO, 2019

2.0 Camel milk Production in Kenya

Milk in Kenya is predominantly produced from cattle, camel and goats which support approximately 1.8 million rural households and additional 700,000 jobs along the dairy value chain (GoK, 2019). Due to climatic variability in the ASAL, a majority of northern pastoralists pursue camel husbandry with constant movement in search of better pasture and water (Farah *et al*, 2004). Camel milk production therefore varies greatly from place to place depending on feed quality and quantity, water availability, breed, milking frequency, disease status, physiological state of the camel (Simpkin et al., 1996). For example, GoK (2019) reported that the Somali and Pakistani camel breeds are higher milk producers than Rendille/Gabra and Turkana breeds and are more popular for dairy production in the country. Simpkin (1998) reported that during a lactation of 10 to 12 months, the Somali adult female camels produces a daily average yield of 5 to 8 kg; the Rendille/Gabra breed 3 to 4 kg and the Turkana camel breed is 2 kg to 3 kg per day.

According to FAO, 2019, Kenya was the second highest camel milk producer in 2017, production reaching 876,224 tonnes after Somalia with 953,673 tonnes (Table 2). It represented 18.40 % of total milk produced in Kenya in 2017, valued at KES 87.6 billion, behind cow milk which was leading at 74.83% but ahead of goat and sheep milk at 5.40% and 1.41% respectively (Figure 4).

Table 2: Global leaders of fresh camel milk producers in 2017

Country	Camel milk (tonnes)	Country	Camel milk (tonnes)
Somalia	953,673	China, mainland	14,559
Kenya	876,224	Algeria	14,004
Mali	300,000	Yemen	13,431
Ethiopia	171,706	Eritrea	12,169
Saudi Arabia	134,266	Morocco	8,750
Niger	107,745	Qatar	8,590
Chad	64,634	India	8,107
Sudan	60,897	Afghanistan	6,824
UAE	54,024	Djibouti	6,043
Mauritania	25,000	Mongolia	5,900

Source: FAO, 2019

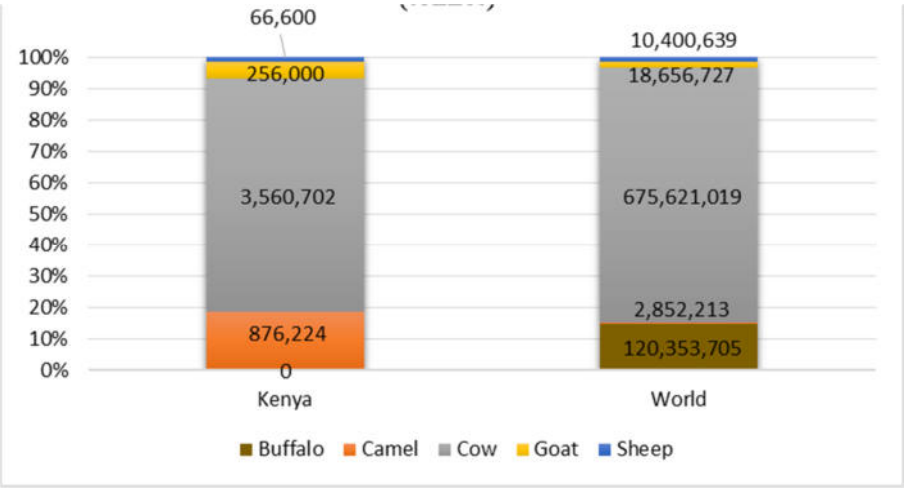

Figure 4. Global and Kenyan milk production across species in 2017
Source: FAOSTAT, 2019

Camel milk production in Kenya has been on a steady incline for the past 2 decades (Figure 5) and this has been attributed to the developing of camel milk market integration, specifically with the urbanization of populations formerly living in pastoral areas (Muloi *et al,* 2018).

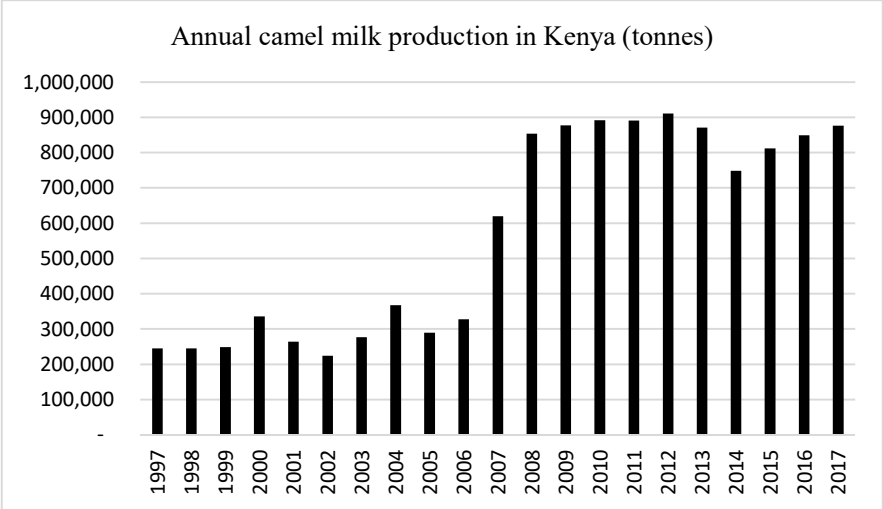

Figure 5. Production trends of camel milk in Kenya
Source: FAO, 2019

The informal camel milk trade to supply urban consumers has become an important source of income for camel keepers (CAMASEPRO, 2008). Of equal importance has been the aggressive marketing of the nutritional properties of camel milk by camel milk processors and some county governments in the ASALs (Turkana CG, 2018).

2.1 Potential of camel milk and its benefits to the ASAL

Camel milk is to a great extent utilized in the north and north eastern counties at subsistence level. In dry seasons and times of drought when occasioned with scarcity of milk from cattle, sheep and goats, the camel contributes to the nutrient uptake of the pastoralists by up to 50% (Farah & Fischer, 2004).
The gross production value of camel milk in Kenya stands at US$ 450.1 (Figure 6.) which is 2.5 times higher than that of sugar cane, 4.7 times higher than green coffee, 7.9 times higher than indigenous chicken and 115 times greater than lint cotton.

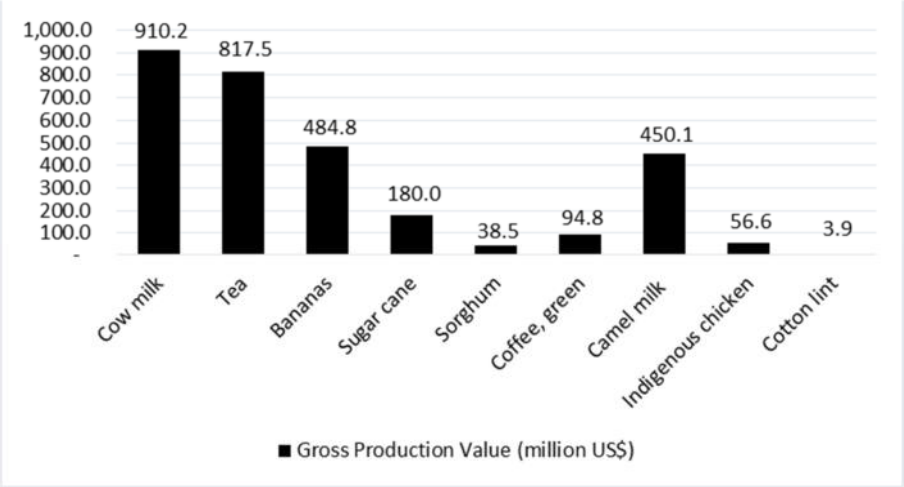

Figure 6: Gross production value of camel milk and other commodities in Kenya in 2017
Source: FAO, 2019

However, the contribution of camels to the socioeconomic welfare of the pastoralists in Kenya has been unnoticed by a combination of dynamics that tend to underestimate their true value (Farah *et al*, 2004). Firstly, camel population estimates are usually inaccurate due to lack of regular census. The 2019 national household census will attempt to reveal the camel distribution and population across the country. Secondly, camel products and in particular milk which rarely enters the formal economy tends to be grossly underestimated. Thirdly, little consideration has been given to camel improvements for many years when planning national development. For example, out of the 29 counties confirmed as ASAL, only 7 arid counties had made mid-term plans for improving the productivity and products of the camel (Table 3).

Table 3: Provisions for the camel in the Arid Counties integrated development plans (CIDP) 2018-2022.

	County	Camel numbers	CIDP objectives specifically targeting the camel	Source
1	Turkana	832,462	Promote camel rearing Revamp marketing of camel products	Turkana CG, 2018
2	Marsabit	217,360	Support Moyale Camel Dairy Cooperative	Marsabit CG, 2018
3	Wajir	533,651	Camel breeds to be introduced in all sub counties	Wajir CG, 2015
4	Mandera	1,016,970	-	Mandera CG, 2014
5	Samburu	Undeclared	Establish land in the lower midlands for camel rearing	Samburu CG, 2018
6	Isiolo	Undeclared	Improve camel breeds Support four camel milk marketing cooperatives Demarcate land for pasture, fodder and disease free zones	Isiolo CG, 2018
7	Garissa	486,000	Increase yearly camel milk production by 0.5 ltr/she-camel Fully operationalize Garissa, Korakora and Daadab camel dairies	Garissa CG, 2018
8	Tana River	undeclared	Purchased & distributed 120 camels to most vulnerable to enhance drought preparedness	Tana River CG, 2018

Source: Various county integrated development plans

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2.2 Nutritional potential of camel milk

In a meta-analysis study (1905–2006) done by Zibaee *et al*, 2015, camel milk was examined and compared with other milk in six manuscripts (Kanuspayeva *et al*, 2009, Khaskheli *et al*, 2005, Omar and Hamad, 2010, Abdoun *et al*, 2007, Shamsia 2009 and Yagil 1982). Camel milk components were reported to average as follows: protein 3.1%; fat 3.5%; lactose 4.4%; ash 0.79%, and water content averaging at 88.1% which is similar to that of human milk. Camel milk is also reported to have therapeutic qualities, citing that it can be used in treatment of Rota viral diarrhea (Mona, 2010, Yagil, 2013), cow milk allergy (Ehlayel, 2011) autism (Shabo and Yagil, 2005, Al Ayadhi, 2013) as well as metabolic and autoimmune diseases, hepatitis, tuberculosis, diabetes, liver cirrhosis and rickets (Zibaee *et al*, 2015).

3.0 Camel milk marketing and National value chains analysis

The camel dairy value chain map is summarized in Figure 7. Camel milk marketing system in Kenya is largely informal, featuring traders acting as conduits between producers, bulking agents, processors and consumers (Muloi *et al*, 2018). The available formal marketing is through dairy cooperatives and commercial processors such as the Vital Camel Milk limited (Vital brand) and Ngamia Milk suppliers (White gold brand) both found in Nanyuki, Laikipia County that pasteurizes packages and maintains cold storage and distribution of camel milk up to distant retail outlets.

There are five main routes to the market as established by Muloi *et a*l, 2018 and Sikuku, 2016):

i. Consumption within a herder's household as well as calf milk (unestablished volumes with seasonal variation)
ii. Consumption in rural households and restaurants (consumed fresh, fermented or used for making tea),
iii. Consumption in urban markets including Nairobi's Eastleigh suburb, Nakuru, Mombasa, Kisumu,
iv. Consumption at high-end health markets.
v. Exports.

Camel milk marketing studies carried out in Isiolo (Nyamori and Kagunyu, 2005; Noor *et al* 2013; Elhadi and Wasonga, 2015; Muloi *et al*, 2018), Garissa (Bruntse, 2004), Kajiado (Muloi *et al*, 2018) indicate that the main urban market for camel milk is Eastleigh in Nairobi, a suburb largely inhabited by the Somali community.

3.1. County status of camel milk value chains

3.1.1. Isiolo

Muloi *et al*, 2018 established that about 5% of pastoralists owned herds above 50 camels, 80% owned 50-100 camels and 15% owned herds below 50 camels. Mwaura *et al*, 2015 identified that the milk traders in this chain were predominantly women organized in marketing cooperatives such as Anolei Camel Milk Marketing Cooperative Society, Tawakal Self-Help Women's Group and Defee Self-Help Women's Group. These traders purchase milk from the pastoralists, in 20 litre plastic containers and deliver to bulking Centre that assess the quality of milk, provide cooling facilities, market information, training credit facilities and bargaining power over the sale price of camel milk to the terminal market in Nairobi. Tawakal Cooperative Society for instance has successfully added value to camel milk and is processing yoghurt and 'susa', a traditional fermented sour milk.

Upon arrival in Nairobi's Eastleigh market, 85% of the milk delivered is traders sold directly to end users (household level), to milk bars, to small and medium restaurants and to three and four star hotels, while 10% exported to Kampala Uganda; 3% is sent to Kakuma in Northern Kenya, and 2% is consumed in numerous local towns such as Nakuru, Eldoret, Kisumu and Mombasa (Muloi *et al*, 2018)

AU-IBAR, 2017 estimated that the Isiolo – Nairobi camel milk trade created a monthly gross turnover of up to KES. 10.58 million, and about 94% of this was due to the demand for camel milk in the Nairobi terminal market. This demand for hygienically produced camel milk in urban areas outstrips supply and is likely to continue to grow. Provision of veterinary services in the rangelands is limited but the pastoralists mostly depend on non-governmental organizations and community animal health workers for provision of health services. However, pastoral communities have also developed immense indigenous knowledge in managing camel diseases, albeit with varying degrees of success.

3.1.2. Kajiado

Muloi *et al.,* 2018 reported that about 20% of pastoralists owned herds above 50 camels, 65% owned 50-100 camels and 15% owned herds below 50 camels. Milk traders reported transporting milk using off-road vehicles and motorbikes to collection centres in Bisil and Kajiado towns. The milk is then transported in bulk to Eastleigh market where milk traders distribute 80% of the milk to end user customers; 10% to small and medium restaurants; 7% to large hotels and 3% to milk bars. In this value chain, no milk is exported to other countries or transported to areas outside Nairobi.

3.1.3. Garissa

In Garissa, report by Bruntse (2004) indicates that there is substantial amount of milk from the upland (about 1200 l/day - camels, cattle and goats) that is marketed right in Garissa town mainly by organized and registered women groups. The chains are reported to be similar to those observed in Isiolo where the market chain involves the

producer sellers, middlemen and consumers (Musinga, et al, 2008). Other stakeholders in the milk marketing chain at Garissa are the transporters, local authorities (obtain cess) and the public health department. Bruntse (2004) report further indicates that at least 1000 liters of camel milk are transported from Bangalle in Tana River for sale at Eastleigh, Nairobi on buses and matatus.

3.1.4. Mandera

In Mandera, the chain is more organized with majority of the sellers being intermediaries between the producers and consumers. The intermediaries, who are predominantly women affiliated to individual women groups under the umbrella of Mandera Milk Sellers Women Group, buy milk from the pastoralists and deliver to towns by vehicles. The milk marketing chain in Mandera could be summarized as follows: producer sellers – primary milk collector (mainly female) – milk transporter (male) – secondary milk collector and seller (mainly women groups in the town) – consumers in the town. On the average, each producer markets 30 liters of camel milk daily (Wayua *et al*. 2004). According to Mandera County Government (2018), camel milk production in 2015 was 530,729 litres and was valued at KES. 53,072,900

3.1.5. Marsabit

In Marsabit town, most of the milk is sold in the open-air market (Mulinge *et al*. 2001). Hawkers or producers themselves deliver the fresh smoked or non-smoked milk to the market. There appeared to be few middlemen in Marsabit market trading in the dairy products. Women walk on foot from as far as from Karare (20 km) carrying small amounts of milk to the open-air market every morning. In Moyale, most of the milk handled in the open-air market is sour, fresh milk being delivered directly to consumers by producer sellers (Mulinge *et al*. 2001).

According to Tura & Walaga 2015, the peri-urban area of Mt. Marsabit has over 900 camels kept between households and primary schools. The Somali breed camel consists of 93% of camels kept on the mountain followed by crosses of Rendille/Gabbra x Somali 6% and Rendille breed 1%. Adopters and indigenous keepers form 91% and 1% of camel keepers respectively. The main challenges facing camel production here were identified as; slippery ground during the rainy season, limited water sources, high tick load, high infestation of biting flies, limited land size and crop- camel conflict. Due to smaller land size on Mount Marsabit keeping large herds can be destructive to the environment. It is recommended milking herds of 15-20 camels be integrated with other livestock species in private land/ranch of about 250 acres. Similarly, capacity building of the camel adopters on camel production and husbandry.

3.1.6. Nanyuki Camel dairy processor (Laikipia County)

Muloi *et al*., 2018 reported that in the Nanyuki camel milk chains, ranching is the main form of camel keeping, where camels are grazed in open grasslands and in the evening kept into enclosed structures. This system is characterised by a higher quality of veterinary care and management practices. 50% of farms supplying milk in this chain are reported to produce 50L of milk per day. The processing company reported to work directly with farmers, without relying on middlemen. Whole pasteurized milk was reported as the main processed product at 60% of the total processed milk, while 25% was low fat boiled milk, and 7% yoghurt. Fermented milk and other milk products made up the remaining 5%. The company estimated that approximately 85% of the processed camel milk products were sold to large and medium sized supermarket outlets in Nairobi. On the other hand, 10% of the processed products were sold to other towns in Kenya, and 5% exported to regional and international markets.

3.1.7. Elgeyo Marakwet

Lapkeiyet self help group in Kerio Valley, a predominantly cattle-keeping region was first introduced to camels (a bull and 4 females) in 2005 amidst much reservation from the community, citing breach of culture and possible spurring of inseurity from camel bandits (The Standard, 2018). In 2018 the camels were more than 100. The group supplies more than 100 litres of milk to Eldoret town at Sh100 to Sh120 per litre which is double what a litre of cow milk retails for (The Standard, 2018). The purchase of a milk coolant plant to preserve the camel milk in wet seasons has reduced milk losses.

3.2 Seasonality of the milk and prices

In Isiolo district, the study by Nyamori and Kagunyu (2005) revealed that more than 90% of traders dealt in camel milk during the dry season unlike in the wet season when both cattle and camel milk were available. At Laisamis in Marsabit district, both households and traders sold goat and sheep milk during the dry season since cattle and also camels were in the satellite camps and hence limited milk supply within the settlements. The price of a liter of camel milk mostly ranges from Ksh. 20 to 80 depending on the season, location and the stage in the marketing chain. The village level prices of camel milk in Mandera for example are Ksh.5 per 400 ml cup, whereas in the town the price is Ksh. 15 (Wayua *et al*. 2004). Unconfirmed reports indicate that the camel milk being marketed at Eastleigh, Nairobi by Vital Camel Milk Dairy as health food is fetching over Ksh. 300/liter. In both Isiolo and Marsabit districts, the price of milk increased by an average of 25% in the dry season due to low milk supply and relatively higher demand (Nyamori and Kagunyu 2005).

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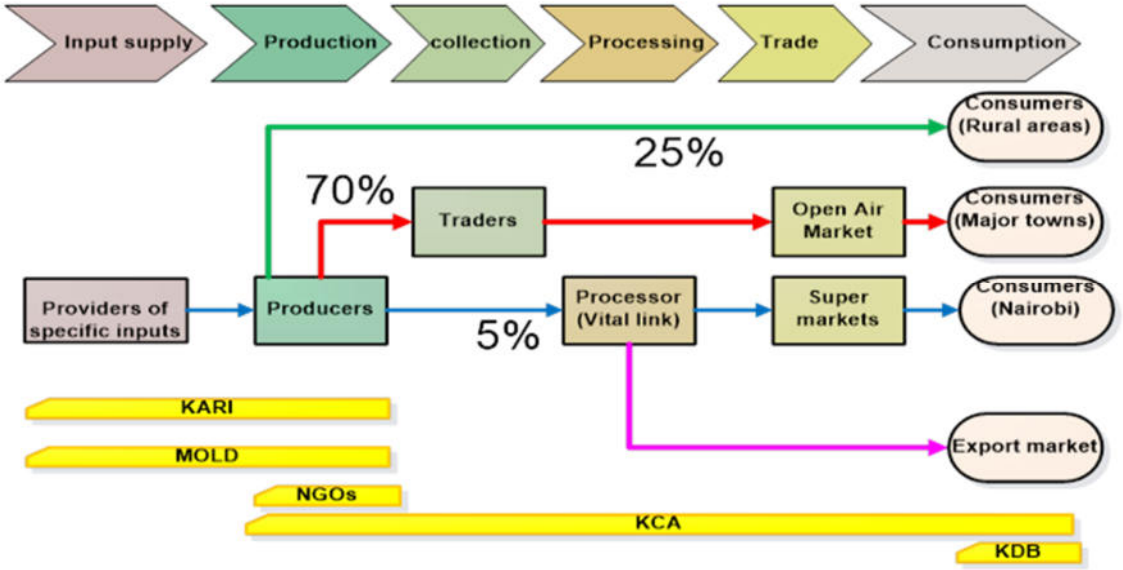

Figure 7: The Camel dairy value chain map
Source: Tura et al, 2011

3.3 Challenges

The review identified six key constraints in camel milk value chain that were in agreement with the findings of national milk value chain analysis conducted in 2011 as:

i. Inadequate market infrastructure

ii. Limited processing facilities and poor milk handling along the value chain

The environment in which camels are reared is characterized with dust/mud and high water scarcity. Often pastoralists use camel urine to 'clean' their hands and the milking containers when milking. Use of smoke to disinfect milking containers is a common practice among camel keeping communities which hinders milk marketing because this practice renders the milk smelly which is not acceptable to a cross section of consumers. Similarly, the lack of cooling facilities is a major impediment.

Camel milk is commonly stored in traditional containers that are difficult to clean. Plastic containers are the most popular container material used to transport camel milk are equally difficult to clean and are easily get contaminated, leading to spoilage of camel milk. Donkeys and old vehicles are the most common means of transporting camel milk from production areas to the destination urban centres.

iii. Lack of organized market channels

Difficulties in aggregating the milk volumes required for the market and long distances to the markets and poor infrastructure are major challenges in marketing camel milk.

iv. Limited access to credit

v. Limited technological innovations and value addition

vi. Poor linages along the value chain.

3.4 Opportunities

Camel milk is one of the main product of camel with a high interest for local population in ASALs for the main reason that it is self-consumed within the producing rural community and thus, contributes to the food security in the ASALs. On the other hand, the presence of a growing demand for camel milk from the urbanized population in those areas and thus a growing market opportunity. However, as the camel milk is still not widely integrated into a number of county government development plans, the product risks being ignored. Opportunities lie in the camel being resistant to severe droughts and provision of milk throughout the year unlike cattle. Access to good transport infrastructure and proximity to major markets which offer higher price is a key opportunity. Enhancing linkages between producers, transporters and traders will strengthen quality assurance from farm level through use of cold chain. Improvement of camel milk market facilities, value addition and improved packaging to appeal to non- camel keeper's consumers is another opportunity. The deliberate provision of adequate capacity building on camel milk hygiene and handling practices across the rural communities as well as the diversification of the camel milk value chain portfolio are potential opportunities. Cooperative development and oriented policies are required to enable easy trade in this sub sector and others to address the identified barriers.

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4.0 National upgrading strategy

The national value chain analysis is purposed to determine facilitation of the chain development process, strengthen private business linkages, foster public private partnership, finance services in value chains, introduce social, ecological and product quality standards, improve the business environment of value chains, monitor and manage impact as well as determine the camel milk chain upgrading strategy

The upgrading strategy developed by stakeholders/actors in the camel milk value chain organized by KARI Garissa in 2011 (Tura *et al*, 2011) recommended Market penetration of camel milk in the local and export markets. This can be achieved through enhancing quality in the camel milk marketing to urban consumers and export and this will look into the following: camel milk borne diseases, capacity building for actors on milk handling hygiene, enhanced milk production (feeds, supplementation, disease control, camel breed selection), camel milk end market analysis and camel milk policy framework.

5.0 Stakeholders in the camel milk value chain

Stakeholders in the camel milk value chain (Table 4) include camel producers in the northern and southern rangelands, camel traders associations, camel milk processors (women led self-help groups and industry), camel butchers association, national and county government officers in the livestock, veterinary and public health departments, Kenya Agricultural and Livestock Research Organization (KALRO), Kenya Livestock Marketing Council and the Kenya Camel Association as well as numerous non-governmental organizations.

Through the collaborative partnerships of various stakeholders, commercialization of the camel milk value chain has been enhanced. For instance, the coming together of women traders in self-help groups has facilitated the organized financing of the camel milk enterprises, providing enough capital to purchase milk from producers and transport the same to final market destinations (BDA, 2018). The provision of aluminum and mazzi cans and cold storage to various women-led self-help groups in the Northern ASALs has safeguarded the quality and shelf life of camel milk, enabling it to reach the final markets in good stable condition (USAID, 2019). The provision of organized camel milk transport networks for traders has equally boosted the commercialization of the product, enabling the reliable delivery of camel milk to final markets (Muloi et al, 2018).

Table 4. Activities of the main stakeholders in the camel milk value chain

Stakeholder	Location	Key Activity	Period	Impact
Government of Kenya (NMG,2013)	ASALs	Distribute 75 camels to self-help groups and schools and extension services	2013-2014	Boost camel population Enhance food security Mitigate effects of climate change
Kenya Agricultural & Livestock Research Organization (KALRO) (KALRO, 2017)	National	Generate and promote technologies, strategies and innovations for demand driven camel product value chain	1999-2003 2009-2014 2018-2022	Characterized camel breeds. Improved camel productivity and welfare Enhanced livelihoods of camel keepers. Products value addition
Kenya Livestock Marketing Council (KLMC) In collaboration with other stakeholders (KLMC, 2000)	National	Provide reliable market information to producers and traders generates market information system linking producers and traders to the markets (prices and volume) capacity building on value addition of milk, hides and skins actively participate in the co-management of markets	2000 to date	Enhanced market access for livestock producers and traders Provision of reliable and timely market information Improved livelihoods of livestock keepers in the drylands
Kenya Camel Association (KCA, 2018)	National	Capacity building of camel production and product value addition through field days	annually	Improved camel management and productivity
Kenya Bureau of Standards (KEBS) (KEBS, 2006)	National	Provision of specification for raw whole, pasteurized and fermented camel milk	2006-2017	Enforcement of product conformity Enhanced consumer confidence

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				Enhanced trade
ILRI (ILRI, 2018)	ASALs in Northern Kenya and Southern Ethiopia	Research across the camel meat and milk value chains	ongoing	Reduced poverty, enhanced food and nutrition security, improved natural resources and ecosystem services.
Kenya Investment Authority (KIA, 2004)	National	To strengthen awareness of investment potential in the camel milk value chain	2004 to date	Increased opportunities for direct investment in processing facilities including cold chain solutions and processing facilities for dairy
Women Enterprise Fund /SNV (BDA, 2018)	12 Counties	Capacity building in entrepreneurial skills in camel milk value chain	2016-2020	Increase decision-making power of 20,000 women
USAID multi-sectorial collaborations fostering public-private partnerships (USAID, 2019)	Garissa under REGAL-IR program Isiolo, Turkana, Nakuru, Nyeri, Nyahururu, Nandi, Kericho, Laikipia, and Embu under Kenya Feed the Future Innovation engine (KFIE) program Marsabit, Wajir Garissa, Isiolo, Turkana under Accelerated value chain development- livestock component (AVCD-LC) (ILRI)	Financial facilitation to purchase aluminum cans, cooling fridges, and capacity building in milk production, hygiene, value addition and business skills Innovative livestock identification and traceability mechanisms Foster market linkages between livestock producers and traders Enhance livestock traceability	2015-2016 2012-2017 2018	Enhanced resilience of the community through increased incomes and decision-making power in households and communities Strengthening of the drylands economy Improved breeding and animal/herd performance recording Improved accessibility to insurance and credit Improved access to regional and global market opportunities. Improved market information dissemination and business linkages aimed at increasing livestock trade and resilience of communities living in the ASAL regions.
DFID/Mercy Corps (BRACE, 2018)	Hadado, Wajir BRACED program	Purchase of refrigerators and a van		Improve livelihoods of 50 female traders

6.0 Opportunities for business to youth and women

The ASALs of Kenya have been reported to suffer high levels of youth unemployment which renders them vulnerable to radicalization, involvement in cattle rustling and other social perils. Furthermore, women and other vulnerable groups are marginalized during decision making processes in ASALs (GoK, 2017).

The accelerated involvement of Kenyan youth and women in agribusiness and agricultural product value chains will certainly contribute to increased youth employment, food security (Osti *et al*, 2015) and by extension contribute to meeting the Sustainable Development Goals (SDGs), including ending extreme poverty, zero hunger and gender equality.

Considering the ASALs cover 89% of the country's landmass, the national and county governments should consider investing in youth through a commitment to providing financial support, including increased spending on youths' initiatives along agricultural product value chains. The Youth enterprise development fund (YEDF) gazetted in 2006 has since created employment and credit opportunities for the youth. It has been described by Kimando and others (2012) that for the YEDF to succeed, the youth enterprise owners need to be equipped with both short and long term skills in entrepreneurship, business planning and financial management and be well conversant with their business interest for their business ventures to be sustainable. It has also been suggested that provided with skills such as credit management, entrepreneurship and business management, as well as livestock production and camel milk sanitation skills offered at vocational and technical training institutions will greatly prepare the youth and women to start and management business in the camel milk value chain as well as other chains. Furthermore, linking the women and youth to Sharia-compliant financial institutions will enhance access to financial services and enable members to open bank accounts.

Entrepreneurial opportunities for the youth and women in the camel milk value chains include, breeding of dairy

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camel breeds, fodder production, establishing camel milk bulking points and cooling centres, processing of camel milk and value addition to develop an assortment of innovative products, provision of cold-chain transportation as well as export of camel milk

7.0 Recommendation and way forward

7.1 Potential for commercialization of camel milk in Kenya

Musinga *et al,* 2008 revealed that the emergence of commercial camel milk industry in Kenya has been attributed to the influx of camel keeping communities, mainly the Somalis. UNHCR, 2014 documented that after political crisis in Somalia during 1991-1992 and 2007-2009 Kenya has received Somali refugees to the tune of 400,000. As traditional consumers of camel milk living in urban Kenya away from their camel herds, it is argued that it is this influx of camel milk consumers that has created a significant rise in the demand for camel milk in Nairobi which triggered commercialization of the industry. It could therefore be argued that the commercial camel milk industry in Kenya is relatively young at around 28 years old.

The major factor affecting camel milk yield is its genetic potential (Musinga *et al,* 2008). In comparison to successful camel dairy research in Israel, UAE, Saudi Arabia that produce 30-40 litres of milk daily, Kenyan dromedaries highest milk producing breed like Somali breed has average daily yield of 6 litres. Kenyan camel breeds have not been selected for milk production and have a great potential to be exploited genetically in a bid to establish commercial camel production hubs across the ASALs. Genetic breeding should therefore be a key research priority in Kenya.

7.2 Way forward

With the camel milk value chains already identified and mapped, the commercialization of production hubs across the ASALs, bulking points, cold storage hubs and camel milk transport services should be supported and capacity built to provide such services.

The review found milk contamination to be a common and a major factor hindering milk marketing from pastoral areas. Sub-clinical mastitis is a big challenge in camel milk production. Milk quality and infection testing is not a common practice among the camel keepers. This is despite the fact that the California Mastitis Test (CMT) is an easy test to administer and the technology has been taught to the camel keepers.

This review recommends that the County governments in the ASALs should foster public–private partnerships with the rural dairy self-help groups and cooperatives to facilitate vertical and horizontal linkages across the camel milk chain; to develop entrepreneurial skills through trainings; to create linkages between producers, traders, veterinary service and consumers, promote camel milk value addition and facilitate financial access by linking the self-help groups and cooperatives to identified financial institutions.

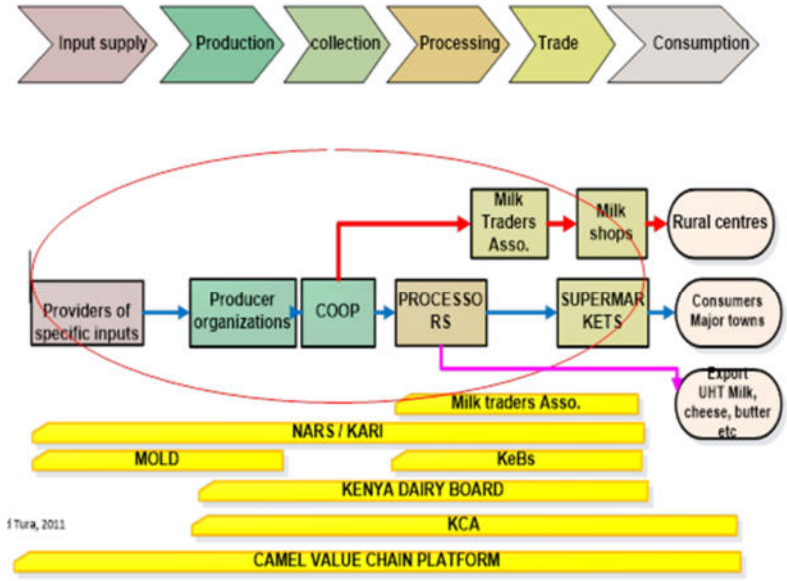

Figure 8: Futuristic camel dairy value chain map
Source: Tura et al, 2011

Markets and trade in ASALs need to be supported to reduce losses of livestock and livestock products as a result of climatic factors, by the provision and accessibility to water points and establishment and provision of fodder.

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The availability of permanent rivers like Tana, Ewaso Nyiro and Daua rivers provide good opportunity for provision of water and fodder for camels and other livestock. However, the growth of invasive riverine species like *Propopsis juliflora* has a negative impact on camel milk production. It makes it difficult for camels to have access to drinking water. To enhance sustainable high milk yielding breeds of camels, there is need to have long term breeding programmes while the camel keepers are trained on good breeding practices. There is need to register Kenya camel breeds with Kenya studbooks and formation of Kenyan camel breeders' association (KCBA).

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