

Full Length Research paper

The acceptability of camel milk and milk products from north eastern province in some urban areas of Kenya

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A total of 138 households were interviewed on various aspects of camel milk and camel milk products using a single-visit multiple-subject diagnostic survey in Garisa, Wajir and Eastleigh the main urban centres with high camel milk consumption. 75% of the respondents generally take camel milk or milk products every day. Raw and sour milk are the most popular products. The most important purchasing criterion for raw camel milk was taste (19 and 18%) while packaging was more important for pasteurized milk (18, 18 and 16%) for Wajir, Garisa and Eastleigh respectively. For Yoghurt, the most important purchasing criteria were taste (18%) and aroma (19%). The taste of sour milk is the most important attribute in both Garisa (30%) and Eastleigh (24%). To enhance marketing of camel milk, the appropriate attributes demanded by customers needs to be seriously addressed. Promotion of camel milk and products to non conventional consumers should be done in order to increase their consumption.

Key words: Acceptability, raw camel milk, yoghurt, sour.

INTRODUCTION

Camels (*Camelus dromedarius*) are multipurpose animals increasingly kept for milk and meat (Abdurahman, 2005). According to Muli et al. (2008), camel milk production in Kenya in 2007 was estimated to have stood at over 340 million litres. Only about 12% of the milk is marketed, the bulk of which is sold in raw form to rural consumers (10%) and only 2% reaches urban consumers. From the remaining milk (88%) that does not reach the market, 38% is directly used by camel keeping households and their herders as part of their food requirements and the remaining 50% (or 170 million litres) goes to waste representing a great opportunity for commercialization and enhanced incomes for communities in pastoral communities.

The milk is becoming popular due to its claimed therapeutic property (Rao et al., 1970; Yagil, 1982, 1985) which is attributed to the fact that camels browse on various plant species. The active agents with therapeutic properties from these plant species are secreted into the

milk of camels (Muli et al., 2008). Camel milk is also of high nutritional value, with vitamin C, three times more than the cow's milk, iron content ten times and B vitamins present in reasonable amounts (Barbour et al., 1985; Elagamy et al., 1992; Arrowal et al., 2005)

There is an increasing acceptability of camel milk among non-traditional camel keepers as sometimes the milk turns to be the only one available in arid lands during drought periods or as a result of the frequent extended dry periods. The milk in most market segment is generally consumed in raw form; either fresh or naturally fermented (Yagil, 1982; Alhadrami, 2003). The demand for camel milk by most consumers in urban areas is claimed to be driven by perceived superior quality compared to cow milk in both flavor and need for little milk: water ratio when making tea (Muli et al., 2008) as well as the acclaimed medicinal value. Urban dwellers are quite sensitive to what they consume and any food product especially milk is affected by a number of factors. Understanding of the acceptability of camel milk will help to process quality camel milk and camel milk products that will meet the demand of consumers. This will increase the volume of milk sold as well as diversify the

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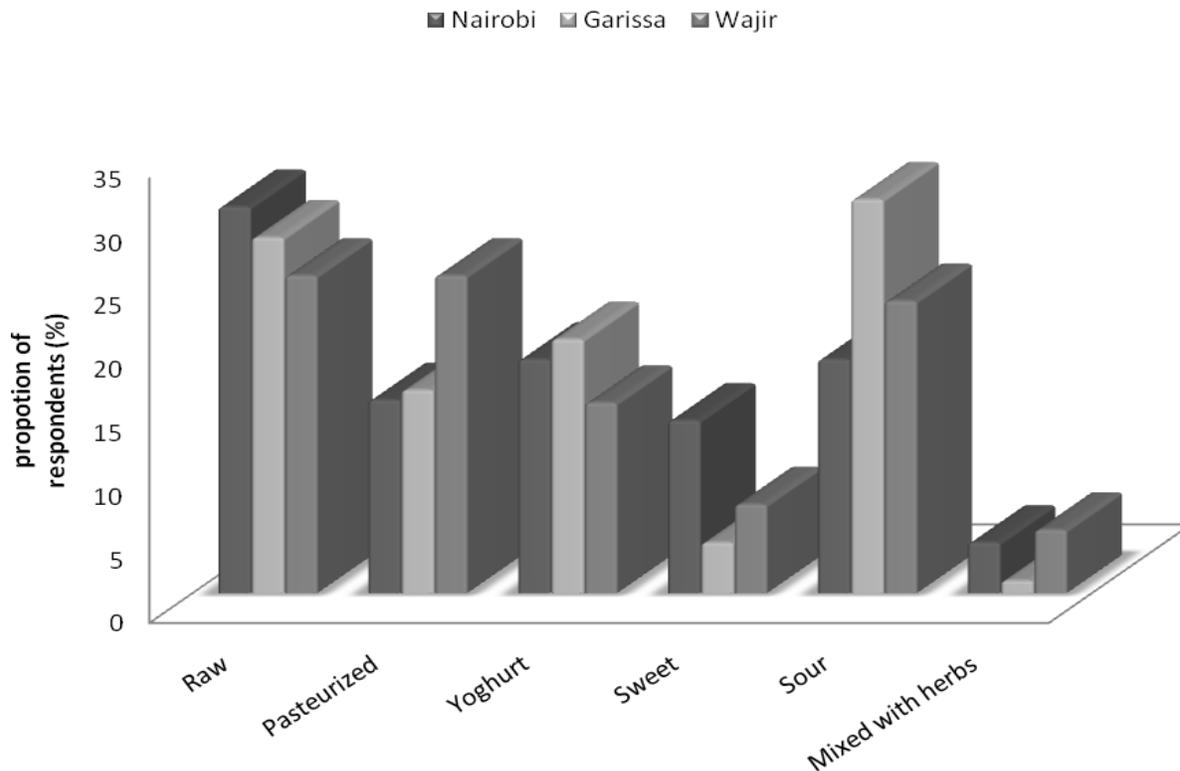


Figure 1. Preference and consumption of camel milk.

milk products currently on sale. In order to increase the incomes of the communities and enhance their livelihoods, it is important to increase the volume of milk sold as well as diversify the milk products currently on sale. The most important initial point is to determine consumer preference for camel milk and milk products in urban areas.

This study was, therefore, aimed at addressing the preference and quality attributes of camel milk and camel milk products in Garisa, Wajir and Eastleigh the main urban centres with high camel milk consumption.

MATERIALS AND METHODS

Description of the study area

This study was conducted in Garissa, Nairobi (Eastleigh) and Wajir towns. Camel keeping is the main livelihood strategy in Garissa and Wajir districts. This is because of the ability to utilize range in marginal areas and survive and produce under harsh environmental conditions. The camels are the main source of food providing meat and milk (Schwartz, 1992; Guliye, 2006). Most of the inhabitants of the study area are Somalis. Camel milk is currently reaching the market through informal channel under which raw milk from both small and large-scale camel herders is handled by informal traders (almost 100% women) to urban consumers, largely comprising the Somali community in Nairobi's burgeoning Eastleigh estate (and business hub) where most of it is bought by households and restaurants, and a smaller but increasing proportion is forwarded to other estates in Nairobi.

Sampling method

Acceptability of camel milk and camel milk products were assessed by using a single-visit multiple-subject diagnostic survey (ILCA, 1990). A total of 138 households (50 each from Garissa and Wajir towns and 38 from Nairobi- Eastleigh) were interviewed. Most people from these urban centres consume and are familiar with camel milk and milk products. They were selected using purposive sampling technique. Households in each town were selected based on accessibility of the home and willingness to take part in the interview. Information about consumption pattern, preference and quality attributes of camel milk and milk products was obtained by means of a semi-structured questionnaire.

Statistical analysis

Descriptive and correlation analysis between acceptability parameters were performed using SPSS software (Version 10, SPSS Inc., Chicago). Chi-square test was used to determine differences in preference between the different milk types reported.

RESULTS AND DISCUSSIONS

Camel milk and milk products preference

The consumption percent rate of raw camel milk is highest in Nairobi (30%), followed by Garissa town (28%) and then Wajir (25%) (Figure 1). Although it has been reported by Yagil (1982) and Alhadrami (2003) that camel

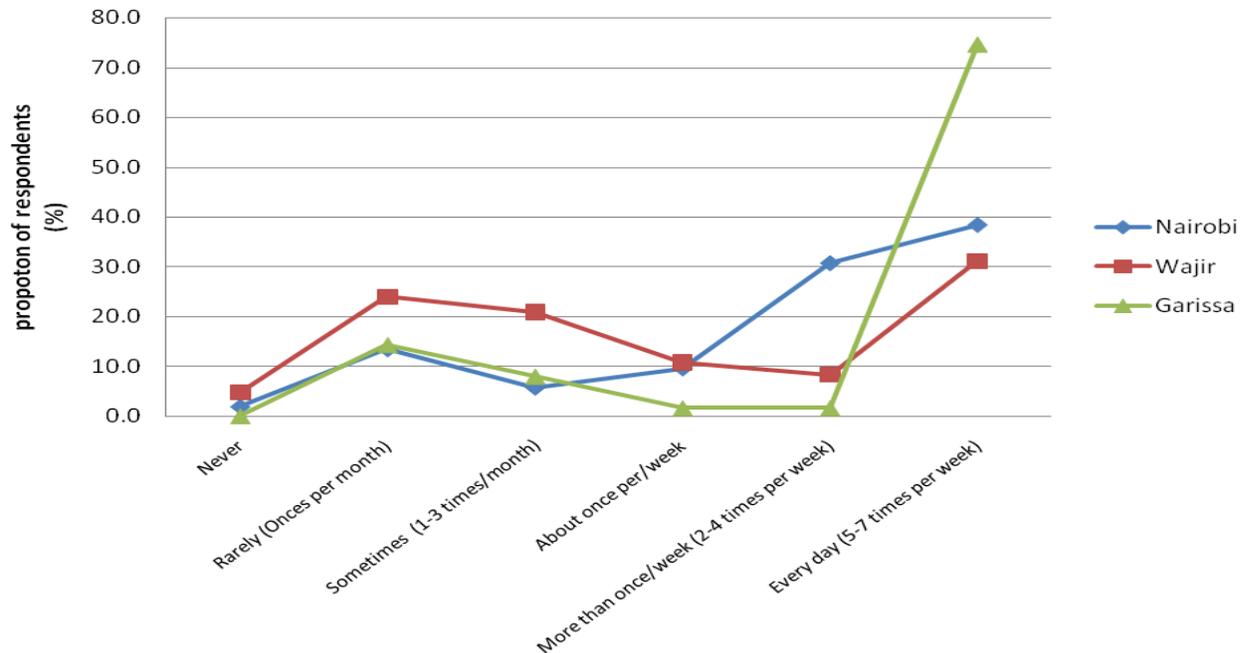


Figure 2. Frequency of camel milk consumption in three urban centres.

milk is consumed fresh in most camel rearing societies, this may not be the case in urban centres. *Muli et al.* (2008) reported that raw milk from camel herders is traded to urban consumers, largely comprising the Somali community in Nairobi's burgeoning Eastleigh estate where most of it is bought by households and restaurants, and a smaller but increasing proportion is forwarded to other estates in Nairobi. Indeed consumption of raw camel milk is higher in Nairobi where most of the residents are Somalis. Garissa and Wajir towns are cosmopolitan and therefore consumption of raw camel milk may be unpopular among the non ethnic Somali tribe leaving in those towns. Consumption of raw camel milk should be of major concern from public health point of view. A report from Morocco indicated that fecal coliforms and *Staphylococcus aureus* were detected in raw camel milk (Benkerroum et al., 2003). In yet another study in Riyadh, Saudi Arabia, *Bacillus*, *Corynebacterium*, *Micrococcus*, *Streptococcus*, *Staphylococcus* and *Pseudomonas* species were isolated from raw camel milk (Zahran and Al-Saleh, 1997). According to the pastoralists view, the claimed therapeutic property of camel milk was attributed to the fact that camels browse on various plant species and active agents with therapeutic properties from these plant species are secreted into the milk of camels. From traditional point of view, anything medicinal is taken fresh or raw without any heat treatment for better effectiveness. This could suggest part of the reason why the raw milk is highly preferred raw. In contrast, raw milk consumption poses the highest risk of exposure of pathogens to humans.

Among the fermented products, sour milk (31%) and

yoghurt (20%) are highly consumed in Garissa town. Sour milk is least consumed in Nairobi (18%). People in Nairobi town seem to associate the sour milk with spoilage. Payment of higher prices for fresh camel milk as compared to souring camel milk in Nairobi is an indication that urban consumers are prepared to pay more for better hygienic quality. Naturally fermented camel milk products namely *susac* and *shubat* are produced in Kenya, Somalia and Sudan (Alhadrami, 2003). Research done in Kenya showed that the quality of *susac*, fermented camel milk, improved using selected mesophilic lactic starter cultures rather than spontaneous fermentation; the resulting fermented milk had a uniform taste and a longer shelf life (Farah et al., 1990; Lore et al., 2005).

Frequency of consumption of camel milk and milk products in three urban centres

75% of the respondents in Garissa town generally take camel milk or its products everyday. Almost everybody consume camel milk or products from this town.

The proportions of people who take camel milk and its products everyday in Wajir town are 31%, rarely 24% and sometimes 21% (Figure 2). Frequency of consumption is widely distributed with high percentage of respondents taking camel milk products every day. Majority of respondents in Eastleigh-Nairobi take camel milk and the milk products everyday (38%) and more than twice a week (31%). Most respondents from all the districts consume camel milk every day.

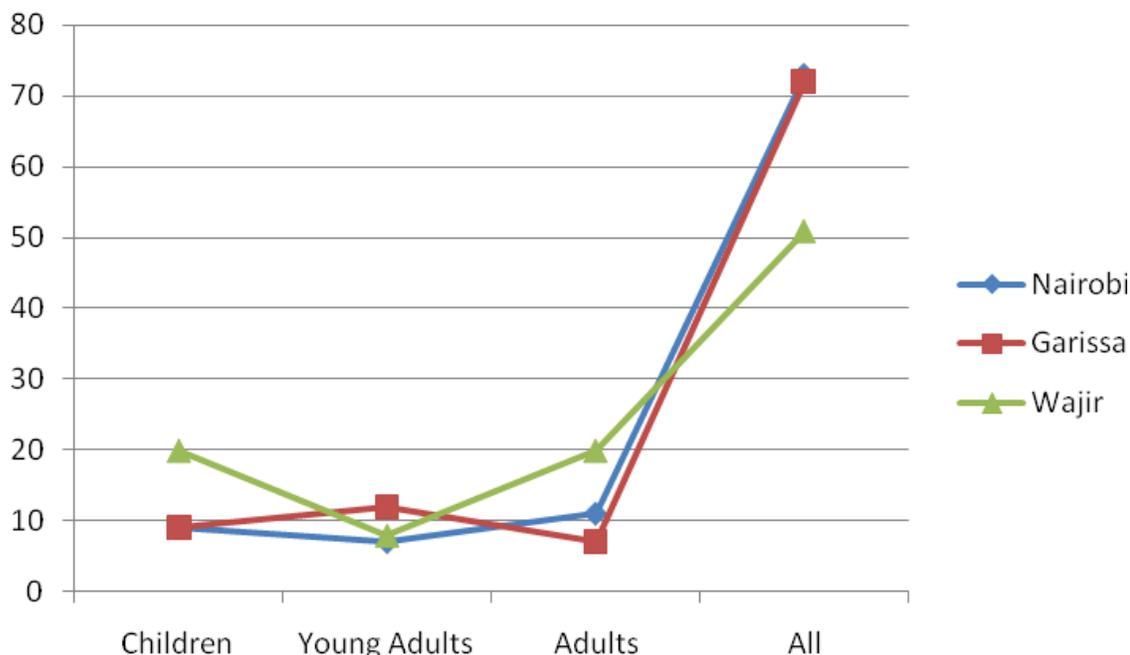


Figure 3. Main household users of camel milk and products

According to Muli et al. (2008), the demand for camel milk is largely driven by perceived superior quality compared to cow milk (in terms of flavor and need for little milk: water ratio when making tea) as well as the acclaimed medicinal value. Pastoralists claim that cows' milk causes obesity but camel milk gives strength, endurance and stamina, an attribute that they need in order to pursue a nomadic life style. Besides, camel milk keeps fresh a longer time and it quenches thirst. One peculiar characteristic of camel milk is its therapeutic value against a number of human diseases (Eyassu, 2007). In his study, pastoralists claimed that camel milk was used to treat a number of illnesses in human beings including jaundice, malaria and constipation.

Main household users of camel milk and milk products

The respondent who indicated that camel milk products are consumed by all members of the family in Garissa town was 72%. 51% respondents in Wajir town indicated that camel milk products are consumed by all family members and 20% by adults. 73% of Nairobi respondents claimed that camel milk and milk products are used by all family members (Figure 3).

There is a significant mix between customers seeking camel milk for its health qualities with those valuing the milk from a food perspective (and substitute to cow milk). Nairobi district has consumers from camel keeping communities, mainly the Somali. The main market is in Eastleigh estate with business hub for medium and low

income people. Muli et al. (2008) study indicated that camel milk from Eastleigh is also forwarded onward to other large urban areas in Kenya, including Nakuru, Mombasa, Kisumu and as far as Kampala in Uganda. Some milk is also sent to Kakuma refugee camp (currently 60 L per week) and some even exported once in a while to Turkey and other parts of the World through customers who buy the milk when traveling to these countries. There are indications that a significant portion of milk from Garissa is sold in Dadaab refugee camp.

Purchasing criteria for camel milk and milk products

Samples of camel milk and milk products were given to consumers to taste and rate them according to their purchasing criteria. Figures 4 to 6 show the quality attributes that affect the purchasing of each product in Garissa, Wajir and Nairobi (Eastleigh) respectively

In Garissa (Figure 4) the most important purchasing criteria for sour milk are taste and colour (30% each). The two are also important for raw camel milk with percent respondents of 19% each. For yoghurt, taste, colour and packaging all have same measure of 18%.

These three are the quality attributes that can influence the purchase of yoghurt from this district. Colour (18%) and packaging (18%) measure highest for pasteurized milk.

In Wajir (Figure 5) the most important quality attributes for raw camel milk are taste (27%) and colour (16%). The other attributes for the raw milk have same measures of

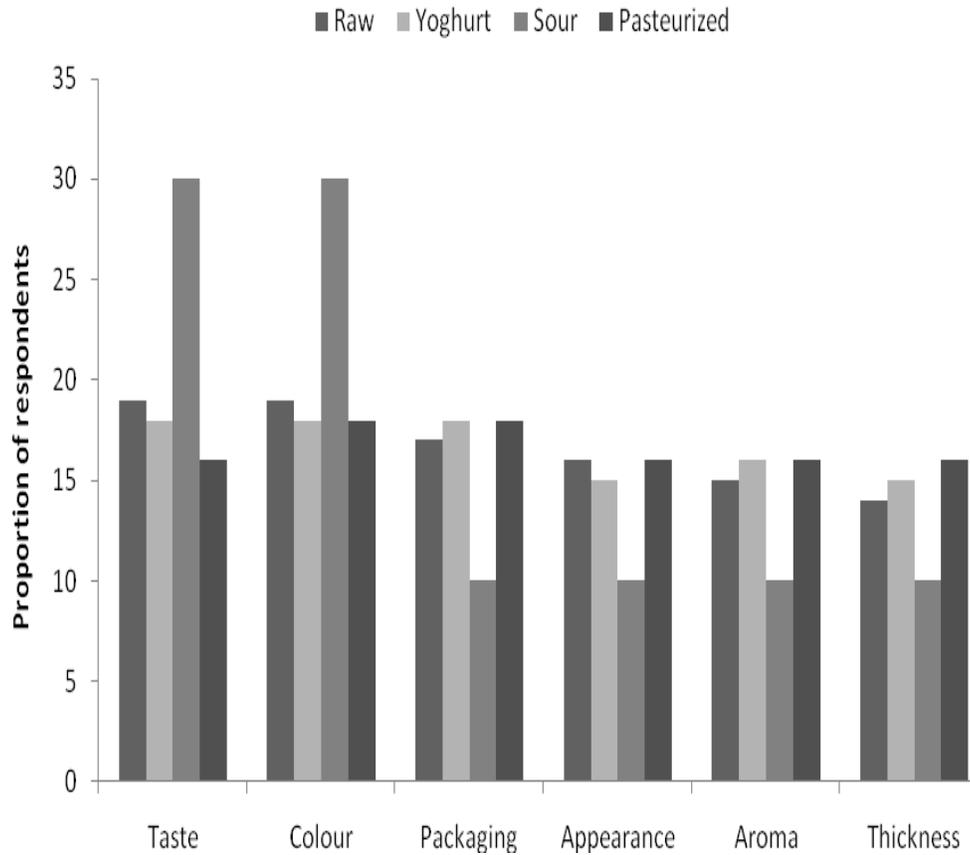


Figure 4. Purchasing criteria for camel milk in Garissa.

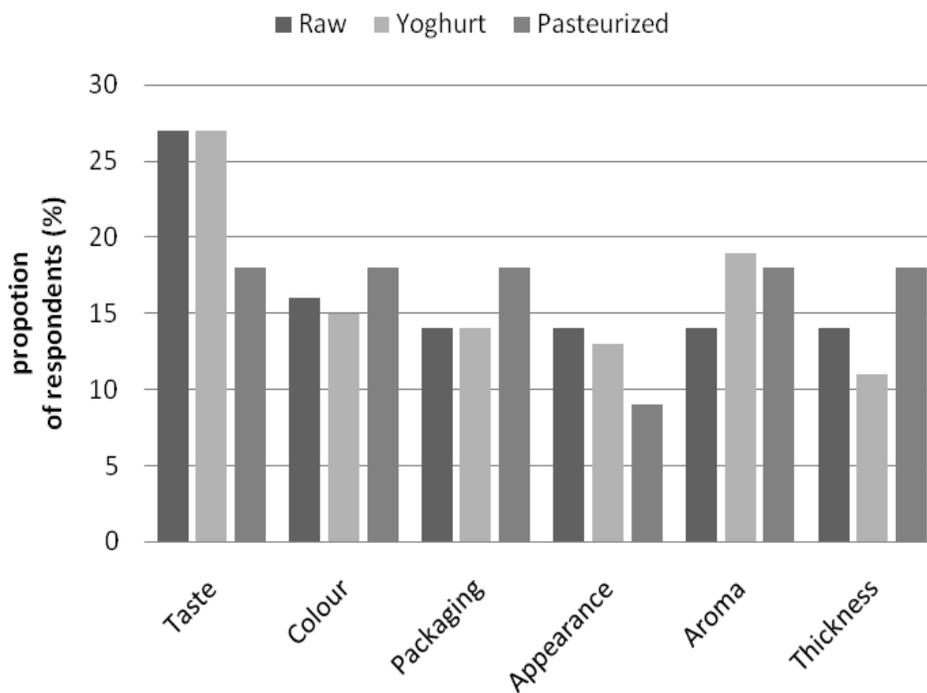


Figure 5. Purchasing criteria for camel milk in Wajir.

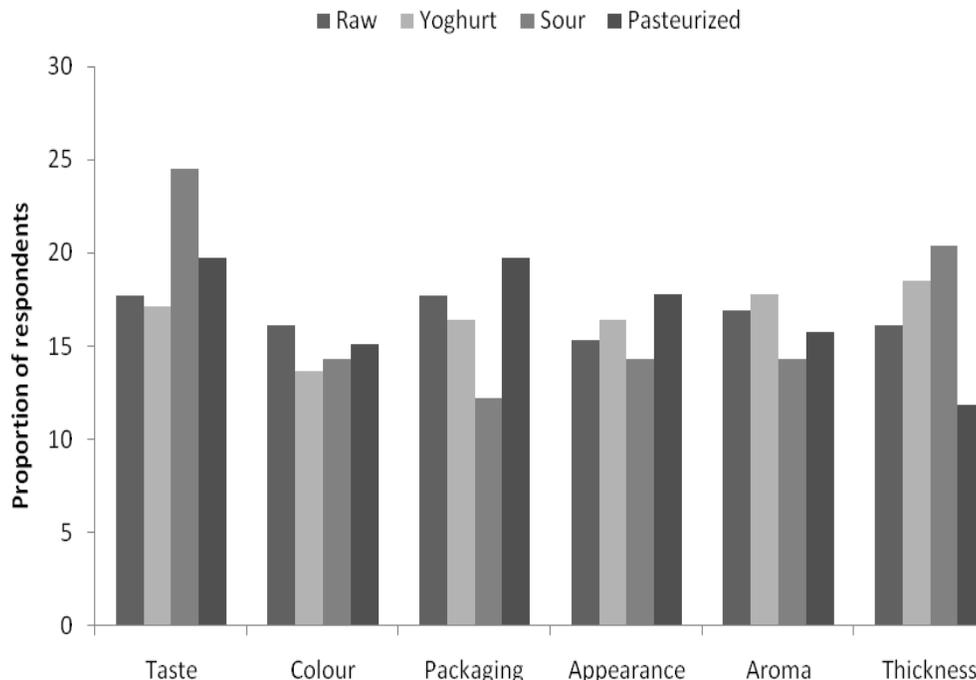


Figure 6. Purchasing criteria for camel milk in Nairobi.

14%. Taste is also an important attribute for yoghurt (27%). This is followed by aroma (19%), colour (15%), packaging (14%), appearance (13%) and thickness (11%) in that order. Pasteurized camel milk got same measure for taste, colour, packaging aroma and thickness of 18% each as quality attributes. The least attribute in the group is appearance (9%), for pasteurized milk.

In Nairobi, (Figure 6) taste and packaging each 18%, are the important purchasing criteria for raw camel milk. These are followed by aroma (17%), colour and thickness each (16%) and appearance (15%) in that order. For yoghurt, aroma and thickness (each 18%) are the highest measures of quality attributes, followed by taste (17%), then packaging and appearance each 16% and colour 14%. The taste of sour camel milk is a very important attribute (24%). Thickness (20%) is ranked second followed by appearance, aroma and colour each 14% and lastly packaging (12%). Taste and packaging (each 20%) are the important quality attributes for pasteurized camel milk. These are followed by appearance (18%), aroma (16%), colour (15%) and thickness (12%).

The most important purchasing criteria for raw camel milk from the three centres is the taste; it should have distinctive taste characteristic to camel milk. In Wajir, taste and aroma are the important quality attributes for yoghurt. Taste, colour and packaging are important for yoghurt in Garissa; while for Nairobi aroma thickness and taste. Pasteurized camel milk quality attributes are almost similar in all the districts; however in Nairobi district taste and packaging are highly valued. The unscrupulous

businessmen should not take this as an advantage to exploit consumers. There is currently no substantial data to compare these results with. Quality and acceptability of a set -type yoghurt made from camel milk was determined by Hashim et al. (2009). Consumer results indicated that the hedonic ratings of the sensory attributes and acceptability of camel milk yoghurt containing 0.75% alginate+ 0.075% calcium were similar to that of cow's milk yoghurt. The camel milk yoghurt containing alginate + calcium and flavored with 4 different fruit concentrates (15%) had similar hedonic ratings and acceptability. This research indicates that although camel milk and milk products are acceptable, each has different quality parameters that attract customers.

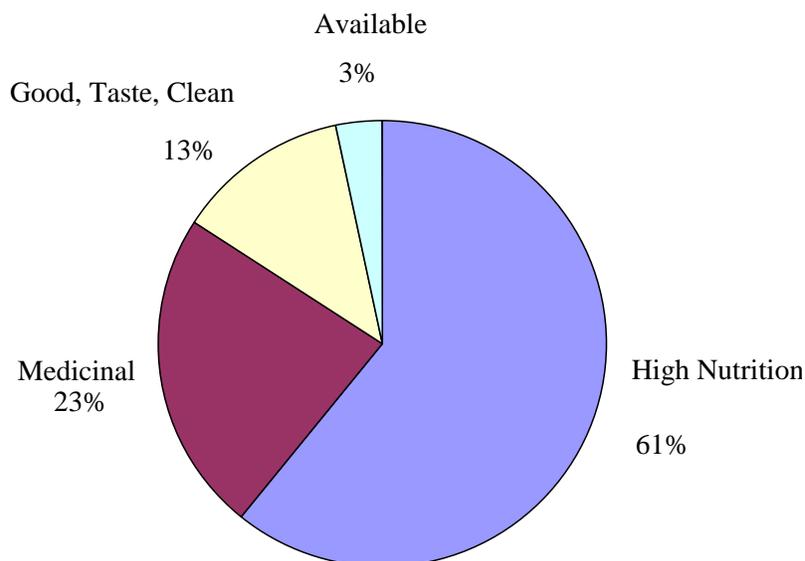
Chi-square technique was used to establish if there was any statistical difference between the purchasing criteria for a given product and between districts. This was done to find out if the most important criteria for a given product in one district were the same in other districts.

The above Chi-square values were calculated from observed and the expected frequencies for each product. These were compared with a Tabled value of 18.307 at 0.05 level of significance and 10 degrees of freedom. All the products had Chi- square values less than 18.307 hence it was concluded that there was no significant difference between the purchasing criteria for the named camel milk products within the three districts (Table 1).

Respondents gave several reasons why they preferred camel milk. The pie chart in Figure 7 summarizes these reasons.

Table 1. Chi-square values for camel milk products.

Camel milk product	Chi- square value
Pasteurized	2.38
Raw	6.21
Sour	5.58
Yoghurt	12.53

**Figure 7.** Main reasons for camel milk preference

Camel milk is highly valued among the pastoralist community, it does not only contain higher amount of nutrients as compared to cow milk, but it also has medicinal properties (Barbour et al., 1985; Elagamy et al., 1992). The survey actually confirmed these two parameters as the main reasons why people consume the milk, with high nutrition having (61%) followed by medicinal having (23%).

Factors affecting consumption of camel milk and its products

The main factors limiting camel milk sub sector are high and fluctuating prices (27%), poor quality products (24%) and product unavailability (24%).

There is a clear indication that there are other factors which influence consumption of camel milk products. The average prices that respondents were willing to pay per litre for raw camel milk in Nairobi are Ksh 80 and Ksh 70 for sour milk per per litre. In Garissa district the average price for all camel milk products is Ksh 120 /L. The amount respondents were willing to pay in Wajir is as follows: Raw camel milk and yoghurt Ksh 54 L for each and Ksh 40 /Lfor pasteurized milk. Looking at these prices, there is a clear indication that raw camel milk is

highly valued among the consumers. All the above prices are low compared to the real market prices of camel milk products in the Kenyan market. From a study by Muli et al. (2008) farmers who take their milk to the camel milk processing plant - the Vital Camel Milk Limited (VCML) based in Nanyuki are paid prices of Ksh 40 /L. Although the study team did not access detailed costing information, estimates by the Managing Director indicated that, at the level of production then, operational costs amounted to about Ksh 30 – 40; packaging Ksh 35, and transportation Ksh 80 /L. The milk is supplied to wholesalers in Nairobi and other parts of the country at Ksh 84 per half litre (that is Ksh 168 /L) with a recommended retail price of Ksh 94 per half litre. From a survey of retail outlets however all retailers with VCML milk were retailing the milk at Ksh 120 per half litre. These prices were quite high compared to Ksh 35 for the same quantity of cow's milk.

The main factors limiting the growth of camel milk sub-sector (Figure 8), are high and fluctuating prices, poor quality products and poor hygiene. Muli et al. (2008) survey revealed that, although there are many factors constraining the development of the camel milk sub sector, the main ones were: Low milk productivity, low quality of milk, poor organization of actors in the chain, poor business orientation of producers, inadequate

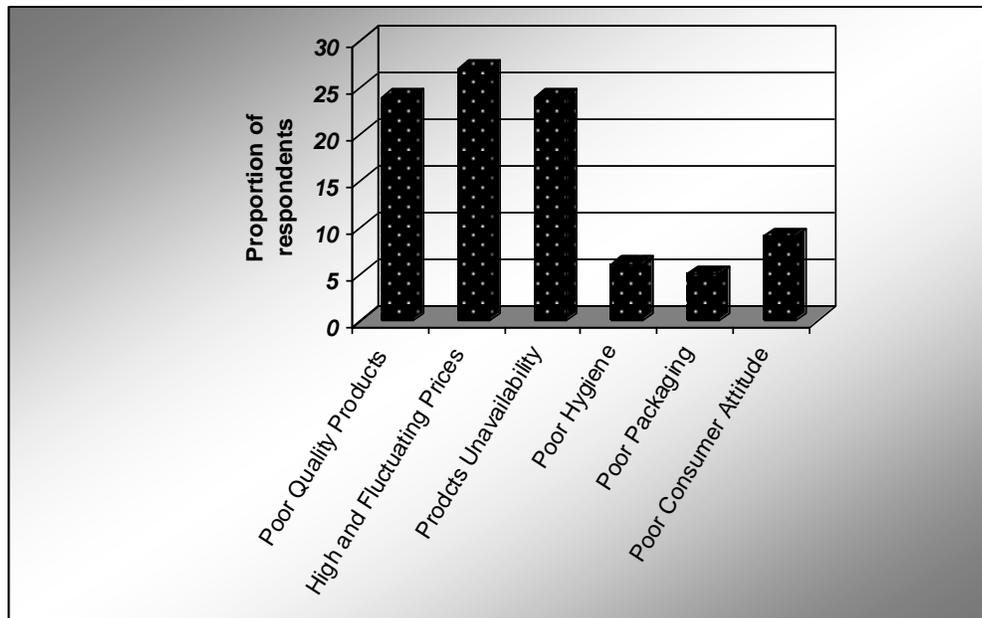


Figure 8. factors affecting consumption of camel milk and its products.

physical and institutional support infrastructure and poor market development. From a combination of these factors, the majority of smallholder milk producers are unknowingly making losses in their activities related to camel milk. Production and profitability among all other factors in the value chain are low. From these factors also, the high growth potential of pasteurized milk channel is struggling to survive and massive losses have so far been incurred which threaten collapse of the entire channel. Their analysis of the constraints facing the camel milk sub-sector showed that most of them were cross-cutting and could not be effectively addressed through piecemeal interventions which do not take a holistic view of the interconnectedness of actors in the value chain. At the foundational value chain segment of production, low milk productivity among farmers is tied to issues of market access, poor organization of the producers as well as traders to collect the milk, and also to poor development of support infrastructure. This in turn has resulted to only small volumes of milk getting through the value chain which is adversely affecting profitability among all other factors in the chain.

Conclusions

Although camel milk and milk products are acceptable, each has specific quality attributes that affect their demand and these should be considered when processing the same. There is an increasing demand for camel milk and milk products from consumers and therefore the prices need to be harmonized. Promotion of camel milk and products to non conventional consumers should be

done to increase their consumption.

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REFERENCES

- Abdurahman OA (2005). Udder health, milk quality and constraints to camel pastoralist in the Horn of Africa. Structures of vulnerability: mobilization and resistance. Interdisciplinary research conference, Stockholm University 12th-14th of January.
- Alhadrami GA (2003). Camel. In: Encyclopedia of Dairy Sciences (Roginski H, Fuquay JW and Fox PF, editors), pp.616-623. Amsterdam: Academic Press.
- Arrowal RP, Beniwal R, Kochar DK, Tuteja FC, Ghorui SK, Sahawi MS, Sharma S (2005). Camel milk as an adjunct to insulin therapy improves long-term glycaemia control and reduction in doses of insulin in patients with type-1 diabetes A 1 year randomized controlled trial. Diabetes Res. Clin. Pract. 68:17.
- Barbour EK, Nabbut MH, Frerius WM, Al-Makhli HM, Al Mukayei AA (1985). Mastitis in *Camelus dromedarius* in Saudi Arabia. Trop. Anim. Health Prod. 17:173-179.
- Benkerroum N, Boughdadi A, Bennani N, Hidane K (2003). Microbiological quality assessment of Moroccan camel's milk and identification of predominating lactic acid bacteria. World J. Microbiol. Biotechnol. 19:645-648.
- Elagamy EI, Ruppanner R, Ismail A, Champagene CP, Assaf R (1992). Antimicrobial and Antiviral Activity of Camel Milk Protective Proteins. J. Dairy Res. 59:169-175.
- Eyassu S (2007). Handling, preservation and utilization of camel milk and camel milk products in Shinile and Jijiga Zones, eastern Ethiopia. Livestock Research for Rural Development 19: 6.

- Farah Z, Streiff T, Bachmann MR (1990). Preparation and consumer acceptability tests of fermented camel milk in Kenya: short communication. *J. Dairy Res.* 57:281-283.
- Hashim IB, Khalil AH, Habib H (2009). Quality and acceptability of a set-type yogurt made from camel milk. *J. Dairy Sci.* 92(3):857-862.
- ILCA (1990). *Livestock Systems Research Manual*. Addis Ababa: International Livestock Center for Africa (ILCA Working Paper 1). <http://www.fao.org/Wairdocs/ILRI/x5469E/x5469E00.htm>.
- Lore TA, Mbugua SK, Wangoh J (2005). Enumeration and identification of microflora in suusac, a Kenyan traditional fermented camel milk product. *Lebensmittel Wissenschaft und Technologie* 38:125-130.
- Muli M, Kimenyi D, Kivolonzi P (2008). The Camel Milk Industry in Kenya. Report of a study commissioned by SNV to explore the potential of camel milk from Isiolo district to access sustainable formal markets.
- Rao MB, Gupta RC, Dastur NN (1970). Camels' milk and milk products. *Indian J. Dairy Sci.* 23:71-78.
- Schwartz HJ (1992). Productive performance and productivity of dromedaries (*Camelus dromedaries*). *Anim. Res. Dev.* 35:86-98
- Yagil R (1982). Camels and camel milk. *FAO Animal Production and Health Paper Number 26*. Food and Agriculture Organization of the United Nations, Rome <http://www.fao.org/docrep/003/X6528E/X6528E00.HTM>.
- Yagil R (1985). *The desert camel: comparative physiological adaptation*. Basel: Karger.
- Zahran A S and Al-Saleh A A (1997). Isolation and identification of protease-producing psychotrophic bacteria from raw camel milk. *Aust. J. Dairy Technol.* 52:5-7.