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FACTORS THAT NEGATIVELY INFLUENCE CONSUMPTION OF TRADITIONALLY FERMENTED MILK (*MURSIK*) AMONG PRESCHOOL CHILDREN (1-5 YEARS OLD) IN KAPSERET LOCATION -UASIN GISHU COUNTY, KENYA

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ABSTRACT

Traditionally fermented milks are widely consumed in various countries of sub-Saharan Africa and a number of health benefits to human beings are attributed to them. However, available studies show that children less than 5 years old consume milk mainly as fresh milk or when added to tea or porridge. Therefore, information on consumption of traditionally fermented milk by children is scanty, yet factors hindering its consumption have rarely been studied. The objective of this study was, therefore, to establish factors, which negatively influence consumption of *Mursik*, a traditionally fermented milk product from the Kenyan Rift Valley, Uasin Gishu County. This will have a positive impact on its consumption and hence increased nutritional status and health among children**.** The study sought to determine average weekly household *mursik* production, quantity and the extent of consumption by children less than five years and their association with socio-demographic and economic characteristics of households. A cross-sectional descriptive study involving 383 Kalenjin households was conducted within Kapseret location in August 2013. Structured questionnaires and a focused group discussion (FGD) question guide were the main instruments of data collection. The baseline survey showed that only 32% of households fed their children *mursik* and they fed a mean quantity of 250 ml per week or 12 kg annually. Education level of respondents (χ^2 = 0.116, P= 0.025), household *mursik* production levels (χ^2 = 0.1311, P=0.001) and respondents' nutrition knowledge of *mursik* (χ^2 =0.154, P=0.005) negatively influenced *mursik* consumption among pre-school children. Results further indicated that although a majority (86.4%) of respondents had average nutrition knowledge of *mursik*, the application of these nutrition concepts was lacking. This might be due to socio-economic factors, cultural beliefs, attitudes and/or negative perceptions among respondents of *mursik* consumption by young children. There seems to be urgent need for a well-designed nutrition intervention program, sensitizing mothers and the population in general on the importance of traditionally fermented milk (*mursik*) for children and as a transition food that is locally available, affordable and culturally acceptable.

Key words: *Mursik*, Lactic acid bacteria (LAB), probiotic, Preschoolers, Focus group discussion (FGD), Households (HHs)

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INTRODUCTION

Traditional fermented milk products are widely consumed in the entire world. In Kenya, fermented milk consumption and production are considered one of the oldest cultural and traditional practices among many Kenyans. They are widely prepared and consumed mainly by the pastoralists as an accompanying drink at lunch, and other meals. The methods of fermentation used, however vary from community to community in Kenya, resulting in fermented milks that differ in terms of flavor and texture [1, 2]. Among the traditionally fermented milk products in Kenya is *Mursik*, a product with characteristics similar to those of yogurt, Leben (Tunisia), dahi (Arabia), kefir and koumiss of Central Asia [3]. These products are considered safe for consumption because of the low pH and the production of antimicrobial substances by fermenting organisms [4]. They have delicious taste and are important supplements to the local diet, provide vital elements for growth, good health and an appreciable flavor [5]. Although *Mursik* is sour with a sharp almost bitter taste, it is popular among the Kalenjin community. It is prepared from fresh cow's milk, blended with burnt and ground charcoal powder (*wosek*) from a special dry herb (*Iteet*), and left to ferment in a gourd *(sotet*). This product has been in existence for the last 300 years as a traditional method of preserving excess milk [5, 6]. It is very popular with adults especially men, and commonly consumed after meals or with other food preparation such as *ugali* [6]. The Food and Agriculture Organization (FAO) recommends an annual milk consumption of 62.5 kg per capita, but the estimated average milk consumption in African pastoralist communities is about 19-30 kg per capita.

This low level of consumption was attributed to the poor milk production by producing animals, which constitute the African Zebu and Zihiwals breeds [6]. On the other hand, many African people do not appreciate fresh pasteurized milk. This could be because about 80% of Africans are lactose intolerant, a condition characterized by inability to digest lactose because of deficiency of lactase enzyme, and is experienced through cramps, bloating, gas production and diarrhea soon after consuming lactose-containing foods [7]. Fermentation improves milk digestibility, and that is why elderly African people ferment their milk before consumption [8]. Consumption of fermented milks has been established to have enormous health benefits to human beings and great potential in improving the nutritional status of young children [9]. During fermentation of milk, lactic acid and other organic acids are produced and because of their low pH, they have positive effect of increasing the absorption of iron when consumed with other foods. Therefore, the role of fermented milk in complementary feeding and in particular for the prevention of iron deficiency anemia in infants as an innovative theme has recently received attention [10]. A lack of knowledge about feeding practices and limited access to appropriate supplementary foods can result in poor diet and nutrition among infants and young children [11]. Therefore, in complementation of a weaning diet, nutrient and energy dense foods are needed. Animal food sources are energy dense and excellent sources of protein, minerals such as iron, zinc, calcium and vitamins, such as vitamin A and riboflavin [10].

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Benefits of Fermented Milks

Studies have established that fermented milk such as *mursik* and *Kule naoto* culture consist of different bacterial and yeast species referred to as "probiotic" and according to WHO are "live microorganisms which, when administered in adequate amounts, confer a health benefit on the host" [12,13].

Lactic acid bacteria (LAB) species that include *Lactococcus lactis* sub sp lactis, *Leuconostoc mesenteroides* sub sp dextranicum, *L. curvantus*, *Leuc Paramesenteroides*, *L. reuteri*, *L. rhamnosus* and *L. platarum* are the dominant bacterial species. They contribute to the unique flavors and textures present in fermented milk and are believed to possess various nutritional and therapeutic properties [13]. However, the mechanisms of health-improving properties of these probiotics are still not completely understood. On prevention and decreasing incidence and duration of diarrhoea, it is commonly suggested to relate to production of antimicrobial substances against pathogenic bacteria species such as *Staphylococcus aureus* and *Salmonella typhimurium* [14].

The other health benefits from consumption of probiotic milk include modulation of immune response activities in the body, reduction in serum cholesterol levels, prevention of tumors and cancer development, alleviation of lactose intolerance symptoms, reduction in blood pressure, prevention of bacterial viginosis and urinary tract infections, and maintenance of mucosal integrity and improvement in periodontal health [14, 15, 16]. There is also good evidence from a meta-analysis of intervention studies that probiotics can prevent necrotizing enterocolitis, prevent infant sepsis and decrease mortality in pre-term neonates with low birth weights especially in Africa, where there is high infant mortality [17]. Fermented milk supplemented with probiotics has been established to improve intestinal health, humoral and cell-mediated immunity and salivary and fecal antibodies [18]. Some evidence suggests that this can lead to reduced incidence or duration of respiratory infections presumably because the priming at the intestinal mucosal level affects the lung's immune response [19]. Recent large cohort studies in the Netherlands and Sweden established that regular consumption of fermented dairy products was significantly associated with decreasing disease prevalence of bladder cancer and cardiovascular disease [20].

In another large study on Danish participants, it was reported that calcium intake specifically associated with fermented milk was inversely and significantly correlated with periodontitis in children, while calcium from other dairy foods was not [21]. The proteolysis that occurs in fermenting milk results in a higher content of peptides and free amino acids, especially cystine, histidine, and asparagine, which play various roles in health, and produce a more digestible food than milk *per se* [22]. The breakdown of lactose by the bacteria containing β-galactosidase in the fermentation process allows many lactose-intolerant individuals to consume the milk product [23]. Lactic acid bacteria have the ability to re-synthesize vitamins such as folate that were destroyed by milk pasteurization

that occurs prior to fermentation [24]. There is also some evidence that fermented milks alleviate constipation, improve liver, body mass and blood pressure indices and skin health [25].

Benefits of Fermented milk in Vulnerable Populations

Children and adults infected with HIV are associated with depletion of CD4+ and dendritic cells leading to compromised epithelial repair mechanisms and enhanced epithelial permeability. Probiotic fermented milk can help reduce the loss of CD4+ cells, maintain epithelial layer integrity leading to reduced bacterial translocation that can cause serious infectious complications to the immune-suppressed host [26]. An important safety and effectiveness of probiotics study on infants randomly assigned to receive probiotics or placebo for a total of five months, starting two months prior to vaccination, showed no adverse interference with the immune response to mumps, measles, rubella and varicella vaccine [27].

In a case-control study involving 237 infants whose mothers were given probiotics prenatally and who themselves received probiotics at 6 months of age, showed improved health status at the age 2 years and the risk of eczema, food allergy, asthma, and rhinitis was lower [28].

In a study undertaken in Iran, daily consumption of probiotic-fermented milk for 9 weeks maintained serum insulin levels, potentially reducing the risk of children developing insulin resistance [29]. Therefore, consumption of probiotic can help to reduce the load of pathogens that otherwise could cause infections; thus, use of drugs and especially antibiotics in children is likely to be reduced [17].

Advantages of *mursik* over commercially fermented milks

Mursik offers several advantages over commercial counterparts. Probiotic lactic acid bacteria found in *Mursik* and others such as *Kule naoto* from the Maasai have less resistance to antibiotics than probiotic found in commercial yoghurts [15]. This is because of minimal usage of antibiotics on animal treatment by the Kalenjin and Maasai communities. This unique characteristic indicates lower chances of transferable resistant bacteria genes from the traditional Maasai and Kalenjin fermented milks to humans. Traditionally, fermented milk is free from preservatives, sugar and colorings except the black specs of charcoal from the wood used to treat the fermenting gourd, and lastly, it is less expensive [8].

Controversies surrounding consumption of *mursik*

A review by Mikko *et al*. [30] of alcohol and acetaldehyde in African fermented milk (*mursik*), suggested a correlation between high incidence of esophageal cancers in western Kenya and the frequency of *mursik* consumption. A study by Adegboye *et al*. [21] also suggested association between high calcium intake (2000 mg per day or six or more glasses of milk/day) and prostate cancer in frequent fresh or fermented milk consumers.

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The authors of the review demonstrated that spontaneous fermentation of *mursik* results in the production of chemicals that are carcinogenic and repeated exposure of these compounds to the body could initiate the process of carcinogenesis.

Therefore, more research is required to determine the safety of *mursik* and more appropriate production methods, which minimize the levels of any unhealthy products, bearing in mind that *mursik*, enjoys high esteem in these particular communities.

Overall, to alleviate the problem of protein energy malnutrition (PEM), micronutrient deficiencies and improve the general health of infants and young children, the focus should be on the use of locally modified complementary foods, which are affordable, culturally and socially acceptable such as *mursik.* Nevertheless, there are barriers to the consumption of these fermented milk products among the pastoral communities who still widely prepare the products. Therefore, the objective of this study was to establish factors that may be hindering consumption of *mursik* among children. This will have a positive impact on *mursik* consumption and hence nutritional status and health among children.

MATERIALS AND METHODS

A cross-sectional descriptive study was conducted in August 2013 in Kapseret division, Uasin Gishu County, Kenya. Socio-economic and demographic information was collected by trained research assistants using pre-tested questionnaire; a qualitative component was employed to obtain information from caregivers on possible factors hindering consumption of *mursik* among children using focus group discussions (FGDs) and Key informant interviews from the study area.

The quantitative study population consisted of only Kalenjin households with preschool children (1-5 years old) within Kapseret location. This is because *mursik* is mainly prepared and consumed among the Kalenjin communities.

Minimum sample size of 383 households with 1-5 years old preschoolers was determined using the Fisher's formula.

Two-focused group discussions (FGD) with 7-10 members and two key informants were selected for interviews on the location based on the length of stay, experience and knowledge in *mursik* preparation. The participants consisted of Kalenjin women with children between 1-5 years old and community members who hold public responsibilities (farmers, village leaders and church leaders). These sessions were undertaken as the qualitative phase of the investigation to determine the general information on cultural beliefs, attitudes and perceptions, experiences and practices of caregivers or community members towards *mursik* consumption by preschool children and the context in which it is consumed. Focus group discussions (FGDs) clarified and revealed more information, which were not clear or collected in the questionnaire. For the purposes of this study, key

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themes and concepts from the summarized FGD and key informants' notes were used to draw conclusions.

A two-stage sampling method was used to select the villages and households in which questionnaires were administered, and the clusters were villages within the sub-locations, namely: Chepkatet and Lemook. According to the 2009 census report, these sub-locations had 1,873 and 2,068 households, respectively (total 3,941 households). To ensure that each stratum (sub-location) was represented in the sample, stratified random sampling was used. Under stratified sampling, respondents were selected from each sub group (sub-location) to constitute the proportion of each stratum in the sample. This meant that the sizes of the sample from different strata were kept proportional to their sizes.

The allocated sample size in each stratum was then selected using simple random sampling to avoid bias. In both stages, the starting point in each village was the village centre, where a pencil/pen was spun and the direction of its tip became the starting direction.

All households belonging to the Kalenjin communities in the selected villages with children age 1-5 years old only were included until the required sample size was reached. Households from immediate neighboring villages were randomly selected and included in cases where the required number was not reached.

The respondent's nutrition knowledge levels on *mursik* were measured against the scores obtained from the nutrition knowledge questionnaires and rated on percentiles (Low knowledge < 40 percentile, Average knowledge, 40-69 percentile, High knowledge > 70 percentiles).

ANALYSES

Data were entered in MS Access, and analyzed using Statistical Package for Social Sciences (SPSS, 2007) version 16.0 for windows.

Descriptive analysis was done to provide general information on the characteristics of the study population and chi-square (χ^2) tests were done to determine associations between variables. Analyzed data are presented using percentages and bar charts.

RESULTS

Weekly household *mursik* production in Lemook and Chepkatet sub-locations

Table 1 shows the average weekly household *mursik* production in the two sub-locations. *Mursik* production was determined on a weekly basis because the process took a minimum of four days in most study households. The greatest share (63.5%) of households in the location prepared an average of 1 litre of *mursik* per week, 23.6% produced 2-3 litres while

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a few (9%) never prepared any *mursik* from their daily milk production. Household *mursik* production across sub- location did not differ significantly (P= 0.315).

Consumption frequency of *Mursik* by Children < 5 years old in Lemook and Chepkatet sub-locations

Table 2 shows the quantity and frequency of household *mursik* consumption. Of the 383 households assessed, 32.2% fed preschool children with *mursik.* The frequency of consumption for those who fed was daily (9.6%); once a week (64.4%); and once a month (26%). Approximately 76.0% of households fed their children with between one and two cups of *mursik*, 17.3% with more than two cups, while 6.7% fed their pre-school children with less than one cup (250 ml) of *mursik* per week. Households who prepare *mursik* were 35 times more likely to feed their children with it than those who did not (OR= 35.320, 95% CI: 4.837 to 257.894).

Relationship between *mursik* consumption by children < 5 years old and socio-demographic and economic characteristics of households

Table 3 shows the association between *mursik* consumption by <5 yr old children and socio-demographic and economic characteristics of households. There was significant association between *mursik* consumption and education levels of respondents (χ^2 = 0.116, P= 0.025), Household *mursik* production levels (χ^2 = 0.311, P= 0.002), nutrition knowledge on mursik (χ^2= 0.154, p= 0.005) and household livelihood ((χ^2 = 0.143, P= 0.001). Mursik consumption between household sizes did not differ significantly (χ^2 = -0.096, P= 0.058).

Community attitudes and perceptions towards *mursik* consumption by < 5 years old children

An interesting theme that emerged from FGDs was that adults preferentially consume *mursik* within households because of a strong belief that "*it increases their blood levels and makes them strong'.* Members pointed out that in general, fresh milk production is low in the area due to poor adoption of modern dairy farming methods, and this directly affected household *mursik* production. In cases of higher production, most milk goes for sale and preparation of tea, leaving less for *mursik* production. Mothers in the discussions explained that households with enough milk could also prepare *mursik* for sale as a way of increasing household revenue, thus further reducing the available *mursik* for household use.

There were several reasons why some members did not feed their children with *mursik*. A few members said *`we do not feed mursik to children less than five years because mursik contains bacteria which cause diseases'.* Others said *`fresh milk have more nutrients than mursik, hence fresh milk makes children healthier'.* Another interesting theme that came out was the fact that adults, especially household heads should consume *mursik* after lunchtime meal and under a tree in order to make them relax and doze off after a hard

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day's work and *`if children consume mursik, they will doze and lose the opportunity to play and look after the cows'*. Some members indicated that *mursik* is too heavy for children to swallow and *`too strong'* for their soft stomach'. Focus group discussion (FGD) members who fed their children with *mursik* said there is no significant nutritional difference between *mursik* and fresh milk and it was more likely that if children were exposed to *mursik* at an early age they will come to like it at a later stage, and vice versa. A key informant indicated that *mursik* preparation methods differ from time to time and household to household resulting in differing tastes. These inconsistencies in taste according to the informant discourage consumption among the children. However, almost all members in the discussions agreed that *mursik* has a positive effect on some diseases especially diarrhoea, as it has been used since time immemorial to suppress severity of induced diarrhoea that occurs when some herbal medicine are used to *"clean''* the stomach.

Figure 1 shows some of the reasons why respondents did not feed children *mursik.* The most common reason (43%) was a strong cultural belief that *mursik* is exclusively for adults.

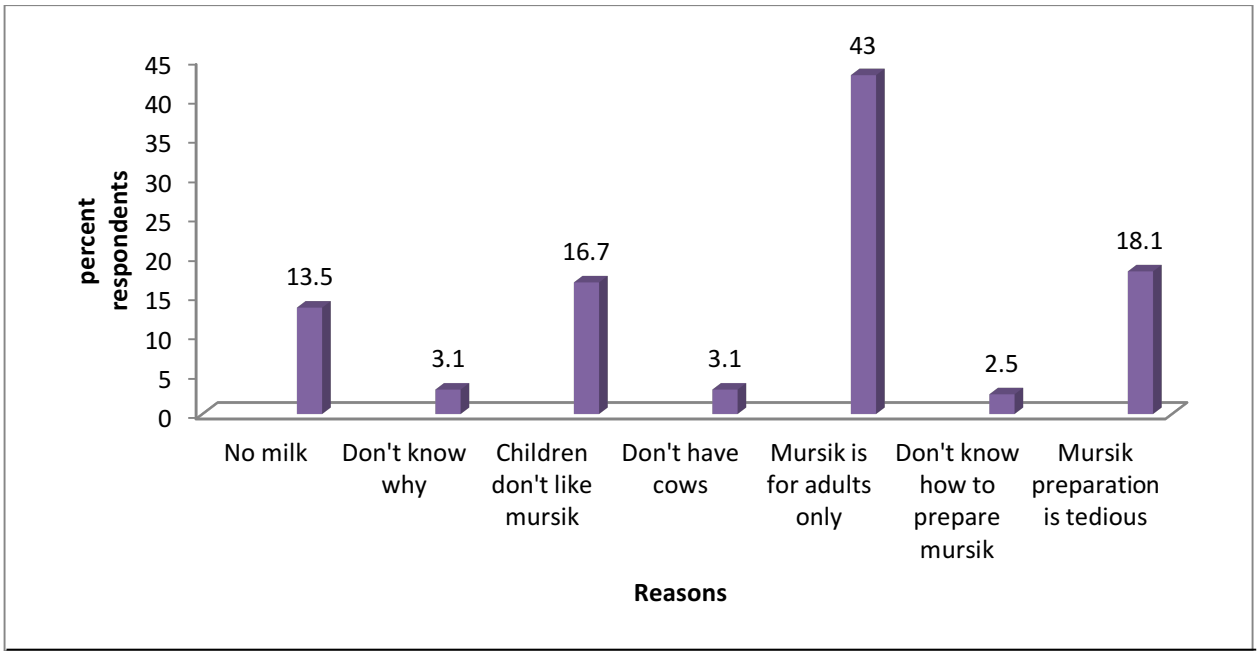

Figure 1: Reasons for not feeding children with *mursik*

Respondents' nutrition knowledge of *mursik*

Most respondents (86.4%) had average nutrition knowledge level of mursik.

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DISCUSSION

Households (HHs) who owned dairy cows and produced milk were more likely to prepare and feed children with *mursik*. The low milk production witnessed in the area was attributed to poor adoption of modern dairy farming and this could be a good predictor of low HHs *mursik* production and consumption by children < 5yrs. The practice of preferential consumption of *mursik* by adults within HHs could further reduce the portions allocated to children. Large proportions of HHs sourced their milk supply from vendors, amounts that are often insufficient for *mursik* preparation and thus they may prefer consuming all their milk in form of fresh milk, in tea and in porridges. HHs with supplies of fresh milk preferred to sell all their milk leaving none for *mursik* preparation. Similarly, some HHs, which prepares enough *mursik*, sells some as a way of increasing revenue, leaving less for consumption especially by children.

Although *mursik* production technology is generally similar among the Kalenjin, different households have different fermentation practices resulting in taste differences. These variations arise from initial methods of gourd preparation, hygiene and cleaning practices, *mursik* incubation conditions and the type of plant species used for milk treatment. This results in variations in the LAB profile, which consequently determines the type of LAB that are established on the inner surface of gourds and the final LAB culture in *mursik*.

The fact that gourds are expensive and scarce, coupled with dwindling trees for milk treatment and few women who have experience in *mursik* preparation, many young mothers get discouraged from preparing *mursik* and consequently feeding their children with it. Further, there is no formal training for *mursik* preparation, especially for young mothers and this could threaten future development and use of the product.

The lengthy process involved in *mursik* production (at least two days of preparation) discourages frequent preparation and consumption within HHs according to FGDs results. Results showed that HHs who prepared less than 5 litres of *mursik* did so purely for domestic use and more frequently fed their children with it than HHs who prepared more and eventually sold it.

Overall, HHs who fed their children with *mursik* stood at 32%, representing only 123 HHs as compared to 68% adults who consumed it, clearly showing a consumption disparity between adults and children.

The primary level of education of respondents had a negative influence on their nutrition knowledge because when one is educated, he/she is exposed to diversified sources of information, which enhances nutrition knowledge leading to consumption of diversified diets to obtain specific nutrients. However, even with average nutrition knowledge on *mursik,* there seemed to be a lack in implementation of the nutrition concepts among the

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respondents. This could be due to strong cultural beliefs and negative perceptions among respondents on the use of *mursik* by children.

CONCLUSION

As evidenced by themes identified in FGDs, this population recognizes that milk is an important part of a nutritious diet and is helpful to child nutrition and growth. There appeared to be a preferential allocation of fresh milk to preschool children, indicating that milk may be providing a significant portion of essential energy and nutrients in the children's diets. However, overall, a low proportion of preschool children in these communities consume *mursik* and the reasons provided were socio-economic and cultural in nature such as negative perceptions, which discouraged consumption of *mursik* among preschoolers.

Low level of education influenced nutrition knowledge on traditional foods in a negative way, and further there seems to be lack in implementation of nutrition concepts among the respondents due to strong cultural beliefs.

Milk production among households in Kapseret location was generally low and did not sufficiently provide for the needs of the respective families.

RECOMMENDATIONS

Relevant offices in the Ministry of Agriculture at the county level should establish avenues of ensuring high milk production among the predominantly farming community in Kapseret location. This may involve the introduction of better animal breeds. Sensitization seminars should be conducted to ensure that community members are fully aware of health benefits of *mursik* particularly to pre-school children. Strategies and/or education that address the mother's perception, negative attitudes and beliefs on *mursik* consumption by children should be put in place to dispel the same. The study recommends that the relevant Ministry at the county level should provide the population in the study area with certified gourd seeds, to ensure continuous supply of gourds for *mursik* preparations and to sensitize the population on the importance of planting and protecting trees used in milk treatment, as this will also help in conservation of biodiversity.

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Table 1: Average weekly households' *mursik* production

	Sub-Locations	
Ave. weekly Mursik production	Chepkatet (%) n= 187	Lemook (%) n= 196
1 litre	64.5	62.5
2-3 litres	25.9	21.3
Over 3 litres	3.6	4.2
None (No production)	6.0	12.0

Table 2: Quantity and frequency of *Mursik* Consumption by children < 5 years old

Characteristic		**Percentage**
Mursik consumption N=383		
	Yes	32.2
	No	67.8
Frequency of mursik consumption N=383		
	Daily	9.6
	Once a week	64.4
	Once a month	26.0
Quantity of mursik consumed (Cups)/week N=383)		
	<1	6.7
	Between 1-2	76.0
	>2	17.3

1 cup is equivalent to 250 millimetres

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Table 3: Association between *mursik* consumption among children < 5 years of age and socio-demographic and economic characteristics of households who fed children mursik N=123

Characteristic	Mursik consumption		Statistical test
	n	(%)	p<0.05
Household size			
<5	73	50.3	χ^2 = -0.096, P = 0.053
>5	50	49.7	
Education level of respondents			
Below primary	69	42.9	χ^2 = 0.116, P = 0.035
Above primary	54	57.1	
HHs mursik production level			
<5 litres	97	69.5	t = 54.80, P = 0.001
>5 litres	26	30.5	(95%CI 1.1304-1.2146)
Household livelihood			
Dairy farming	102	83.0	χ^2 = 0.143, P = 0.001
Employment	21	17.0	
Nutrition knowledge			
<50%	58	47.2	t = 59.70, P = 0.005
>50%	65	52.8	(95%CI 1.4739-1.5765)

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