FACTORS INFLUENCING CONSUMPTION OF TRADITIONALLY FERMENTED MILK (*MURSIK*) AND DIARRHOEA EPISODES AMONG PRESCHOOL CHILDREN (1-5 YEARS OLD) IN KAPSERET LOCATION -UASIN GISHU COUNTY, KENYA

ERICK KIRUI

A56/79571/2012

BSc. Food Science and Technology, - University of Nairobi

A dissertation submitted in partial fulfillment for the requirement of the Degree of Master of Science in Applied Human Nutrition in the Department of Food Science, Nutrition and Technology,-University of Nairobi

AUGUST 2014

DECLARATION

I hereby declare that this dissertation is my original work and has not been presented by any other individual for examination in any other university.

.

Signature_____ Date _____

Eric Kirui

This dissertation has been submitted with our approval as university supervisors:

Signature_____ Date _____

Dr. John Wangoh (Bsc, Msc, PhD)

Department of Food Science, Nutrition and Technology, University of Nairobi

Signature_____ Date _____

Dr. Gerald Muchemi (BVM, Msc, PhD)

Department of Public Health, Pharmacology and Toxicology, University of Nairobi

Signature_____ Date _____

Dr. George Ooko Abongô (Bsc, Msc, PhD)

Department of Food Science, Nutrition and Technology, University of Nairobi

DECLARATION FORM FOR STUDENTS

Declaration of Originality Form

This form must be completed and signed for all works submitted to the University for examination.

Name of Student _____

Registration Number _____

College _____

Faculty/School/Institute_____

Department _____

Course Name _____

Title of the work

DECLARATION

1. I understand what Plagiarism is and I am aware of the Universityôs policy in this regard

2. I declare that this _____ (Thesis, project, essay, assignment, paper, report, etc) is my original work and has not been submitted elsewhere for examination, award of a degree or publication. Where other peopleôs work, or my own work has been used, this has properly been acknowledged and referenced in accordance with the University of Nairobiôs requirements.

3. I have not sought or used the services of any professional agencies to produce this work

4. I have not allowed, and shall not allow anyone to copy my work with the intention of passing it off as his/her own work

5. I understand that any false claim in respect of this work shall result in disciplinary action, in accordance with University Plagiarism Policy.

Signature _____ **Date** _____

DEDICATION

To my wife Ruth, who has been so supportive and bearing. She has been a pillar of strength, always encouraging me to move on. To our children, Sandra, Kethy and Jewel who bore with me throughout the months I was absent. God bless you.

ACKNOWLEDGEMENT

I sincerely thank the Almighty God for taking me this far. Above all, I would like to express my appreciation to my supervisors Dr Wangoh John, Dr Muchemi Gerald and Dr Abong George for their consistent guidance and support throughout this study. Special thanks to all the teaching staff of ANP unit, and not forgetting my colleagues for their generosity in sharing ideas and experiences.

Last, I cannot fail to thank my research assistants Mr.Tum, Mark and Mrs.Biwot who worked tirelessly to ensure that I had good data in time. May God bless you all.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ABBREVIATIONS AND ACRONYMS

CI	Confidence interval
FAO	Food and agricultural organization
FGD	Focus Group Discussion
HS	Households
KNBS	Kenya National Bureau of Statistics
KDHS	Kenya Demographic and Health survey
KII	Key Informant Interview
LAB	Lactic acid bacteria
SPSS	Statistical Package for Social Science
SD	Standard Deviation
PEM	Protein energy malnutrition
PTS	Phosphotranferase
PEP	Phosphoenolpyruvate
OR	Odds ratio
UNICEF	United Nations Children Fund
WHO	World Health Organization
G^2	Chi- square
r	Correlation coefficient

OPERATIONAL DEFINITIONS

Amabere amaruranu: Fermented milk in Gusii tribal language

Antimicrobial: Any substance that destroys or suppresses proliferation of microorganisms

Bacteriocins: Proteins produced by certain strains of bacteria for destroying closely related bacteria

Bioavailability: Proportion of nutrient ingested which becomes available for utilization by the body

Complementary feeding: feeding infants and young children with food or drinks in addition to breast milk

Children: Individuals whose ages are below 18 years

Exopolysaccharides: Complex sugars secreted by microorganisms to cover their cell walls when surrounding conditions are harsh

Household: A person or a group of people living in the same compound, answerable to the same household head and sharing a common source of food and income during the study period

Household head: The person who is the main decision-maker on household income and expenditure

Malnutrition: A state of nutrition where height-for-age, weight-for-age indices fall outside certain pre-determined cut-off points (UNICEF, 1996)

Mursik: Fermented milk in Kalenjin tribal language

Nutrition knowledge: The understanding of different types of food, how they nourish the body and influence health

Nutrient density: This is the content of nutrient in a given amount of food relative to the energy it provides. A nutrient dense food provides a large amount of nutrients for a relatively small amount of calories

Mala: Fermented milk in Kiswahili language

Probiotic: Live microbial food supplements that are beneficial to health

Spontaneous fermentation: A process in a food material that is allowed to ferment using naturally inherent fermentative organisms

Preschool age: Time when a child learn about food, which will latter establish their food knowledge and patterns of food acceptance and preference. Children between ages 1 and 5 years are considered pre-school children in this dissertation

Perception: Refers in this study as feelings towards a subject and any preconceived ideas.

Uji: A cooked thin porridge made from maize meal or other cereal flour

Ugali: A cooked stiff porridge usually made from maize meal

Chekap mwaka: Fermented milk (mursik) that has been ripened for duration of one year

Wosek: Burnt and ground charcoal powder from a special try herb for milk treatment

Iteet: Special dry herb meant for milk treatment

Sotet: Traditional container/gourd in Kalenjin tribal language for milk storage and fermentation

***Sosiot*:** Curved Wood stick obtained from palm tree used for washing inside part of gourd

ABSTRACT

Consumption of fermented milk is attributed to a number of health benefits to human beings. However, these enormous health benefits of *mursik* are rarely known to benefit preschool children. This can only however be achieved if in-depth information on factors influencing *mursik* consumption is determined. The objective of this study therefore was to establish factors influencing consumption of traditionally fermented milk *(mursik*) and diarrhoae episodes among pre-school children. The study sought to determine; average daily householdsô milk and average weekly householdsô *mursik* production and the extent of consumption; determine respondentsô nutritional knowledge levels, attitudes and perception on *mursik* consumption among pre-school children; and, establish the relationship between *mursik* consumption and occurrence of diarrhoea among pre-school children in Kapseret location in Uasin Gishu County. A cross-sectional study involving 383 Kalenjin households was conducted within Kapseret location. Fishersô formula (Fisher et al, 1991) was used to compute the householdsô samples. Semi structured questionnaires and interview guides for focus group discussions (FGDs) were the main instruments of data collection for this study. Bivariate correlation and Logistic regression analysis were performed to establish associations between variables .Data was entered in MS Access, and analyzed using Statistical Package for Social Sciences (SPSS, 2007) version 16.0 for windows and tested for significance at $P < 0.05$.The Analyzed data was represented using cumulative frequency tables, percentages and pie charts.

The study established that the mean household size was 5 members, while the mean age of respondents was 37 years. Most households produced an average of two litres of fresh milk each per day and an average of one litre of *mursik* weekly. The annual *Mursik* consumption among preschool children was below the WHO recommendation of fresh milk consumption of 19-62kg

per capita. Most households fed their pre-school children on 250 millilitres of *mursik* once a week. *Mursik* consumption was significantly (P< 0.05) correlated with education level of respondents (r= 0.118, P= 0.021), Household milk production (r=0.0309, P=0.000), respondentsô nutrition knowledge on mursik (r=0.151, P=0.003) but negatively correlated with household size(r= -0.093, P=0.051). Logistic regression showed significant association between *mursik* consumption and respondentsônutrition knowledge, education level and households livelihoods.

Mursik consumption was significantly related with low frequency of fever (P= 0.012, OR= 0.044, 95% CI: 0.016 to 0.122) and diarrhoae (P= 0.000, OR= 0.068, 95%CI; 0.032, 0.145) among children

Results indicate that majority (86.4%) of respondents had adequate nutrition knowledge, but the application of these nutrition concepts was lacking among the respondents. Socio-economic factors, cultural beliefs, attitudes and negative perceptions among respondents on mursik consumption were also identified as some of the main factors that greatly influence *mursik* consumption among pre-school age children.

There seems to be a need for a well designed nutrition intervention programs in the county focusing on sensitizing mothers on the importance of traditionally fermented milk to children and as a transition food because it is culturally acceptable and affordable.

CHAPTER ONE: INTRODUCTION

1.0 Background information

Traditional fermented milk products are widely consumed in the entire world. In Kenya, its 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 (Savadogo et al., 2004 and Adebesin et al., 2001). 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 (Belkaaloul et al., 2010). These products are considered safe because of the low pH and the production of antimicrobial substances by fermenting organisms (Saavedra, J., 2000). They have delicious taste and are important supplements to the local diet, provide vital elements for growth, good health and an appreciable flavor (Samet-Bali et al., 2012). *Mursik* is sour milk with a sharp almost bitter taste, popular among the Kalenjin community. It is prepared from cowôs milk, blended with burnt and ground charcoal (*wosek*) powder from a special dry herb (*Iteet*), and left to ferment spontaneously in a gourd *(sotet*). This product has been in existence for the last 300 years as a traditional method of preserving excess milk (Livestock Kenya, 2012). It is very popular with adults especially men, and commonly consumed after meals or with other food preparation such as *ugali* (Huss-Ashmore, 1996). FAO, (1990) recommends an annual milk consumption of 62.5kg per capita, but the estimated average milk consumption in African pastoralist communities is about 19-30kg per capita, which is way below the recommended levels.

Low levels of consumption could be due to poor milk production by producing animals, which constitute the African Zebu and Zihiwals breeds (Livestock Kenya, 2012). 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 (Lore, 2003). According to the National Institute of Diabetes, Digestive and Kidney Disease (NIDDK, 2003), people with lactose intolerance experience cramps, bloating, gas production and diarrhea soon after consuming foods containing lactose. Fermentation improves milk digestibility, and that is why elderly African people ferment their milk before consumption (Mureithi et al., 2000). Consumption of fermented milks have been established to have enormous health benefits to human beings and great potential in improving the nutritional status of young children (Miller et al., 2007). 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 especially 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 been focused (Branca. F and Rossi. L., 2000). 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 (Wyatt, 2002).Therefore, in complementation of children; they need foods that are nutrient and energy dense. Animal source foods are energy dense and excellent source of protein, minerals such as iron, zinc, calcium and Vitamins, such as vitamin A and riboflavin (Branca and Rossi, 2002).

To alleviate the problem of protein energy malnutrition (PEM) and micronutrient deficiencies in infants and young children, the focus should be on the use of locally modified complimentary

foods, which are affordable, culturally and socially acceptable such as traditionally fermented milk (*mursik).* Nevertheless, there are barriers to the consumption of these fermented milk products among the pastoral communities who still widely prepare the products.

1.1 Problem statement

Milk is a key contributor to improving nutrition and food security particularly in the rural farming communities in Kenya. Miyamoto et al., (1986), during their study on starter characteristics of *mursik* in Nandi, noted that it is very popular with adults especially men, breastfeeding mothers and initiates. Huss-Ashmore (1996) documented that young children depending on the taste preference may start taking fermented milk after the first year, but diets that were described for children under five years old showed that milk was consumed mainly as fresh milk, mixed with uji (porridge), and added to *ugali* or tea. Therefore, information on consumption of *mursik* among preschool children is scanty, yet few studies have been done to establish the extent and frequency of its consumption among preschool children. Furthermore, Mokua (2004) in his study established that traditionally fermented milk (*Amabere amaruranu* from Gusii) has antimicrobial activity against Escherichia coli, which causes diarrhoea in human, however no efforts have been made to establish the relationship between *mursik* consumption and morbidity factors, especially diarrhoae among young children, given that it is also a traditionally fermented milk. This study therefore investigated factors that greatly influence *mursik* consumption among preschool children and its association with diarrhoae among children.

1.2 Study Justification

Studies that have been done in UasinGishu reveal that milk forms a very important diet in the rural Nandi, in which 74% of the sampled households were shown to consume milk, either in

fermented form or fresh and 84% consume milk daily in tea (Huss-Ashmore, 1996). *Mursik* has been established to impart health benefits (probiotic) to human beings (Miller et al., 2007), enhances iron absorption when eaten with other foods resulting in reduced cases of iron deficiencies, boost immunity and reduce duration episodes of diarrhea especially in young children (Pedone et al., 2000). However, these enormous health benefits of *mursik* are rarely known to benefit all the different age groups of members of the families, especially preschool children. Therefore, consumption levels and in-depth information on factors influencing *mursik* consumption in general will give a better understanding regarding popular perceptions of the use of *Mursik* by different age groups of people within the Nandi community especially preschool children.

1.3 Aim of the study

The aim of the study is to establish the potential use of traditionally fermented milk (*mursik*) for prevention of diarrhoae especially among preschool children.

1.4 Objectives

1.4.1 Main objective

The main objective of the study was to determine the extent of *mursik* consumption among pre-school children (1-5yrs) in Kapseret location in Uasin Gishu County and factors influencing consumption and health outcomes (diarrhoae).

1.4.2 Specific objectives

1. To describe the socio- demographic and economic characteristics of the families of the study children in order to relate with consumption levels and determinant factors of mursik consumption

2. To determine householdôs milk and *mursik* production and *mursik* consumption among preschool children

3. To determine respondentsô socio- demographic and economic characteristics influencing *mursik* consumption among preschool children

4. To establish the health outcomes of *mursik* consumption among pre-school children

1.5. Research Questions

The following questions guided this study:

1. What is the average householdsômilk and *mursik* production among the study respondents?
2. To what extent is *mursik* consumed among pre-school children in the study households?
3. What are the socio- demographic and economic factors influencing consumption of *mursik* among pre-school children?
4. What is the relationship between *mursik* consumption and health outcome (diarrhoea) among pre-school children?

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 1ntroduction

Milk is an excellent source of major nutrients essential for human development and these include; protein, Carbohydrate, Fat, Minerals and Vitamins especially A, D, E and K (Savadogo et al, 2004). Milk protein is rich in essential amino acids, making milk and its products very important constituents of human diet (Lore, T., 2003).The carbohydrate in milk is Lactose, which is difficult to digest in lactose intolerant individuals. The clinical signs of lactose intolerance include bloating and gas production because of bacterial breakdown of lactose in the gastrointestinal tract (Pedone, 1999) .This condition has been shown to be suppressed by consumption of fermented milk (Branca and Rossi, 2002). During fermentation, Lactic acid bacteria and other microorganisms in the milk convert lactose into lactic acid thus lowering the pH below the isoelectric point of casein protein in milk (Mokua, 2004). This causes formation of a coagulum/curd of gel-like consistency. The conversion of lactose into lactic acid therefore result in texture change and production of sour flavor that makes fermented milk a desirable product to consume ((Nakazawa and Hosono, 1992).

2.2 Milk composition

The major constituents of milk are water, fat, protein, carbohydrate (in form of lactose) and mineral matter as ash. Milk composition varies depending on the type of feeds given to the animals, type of animals and breed, and stage of lactation (Marth and Steel, 1998). Table 1 below shows the average composition of milk from different domesticated animals.

Table 1: Mean composition of milk from domesticated ruminants.

Composition	Percent by weight in milk of;		
	Cow	Goat	Sheep
Fat	3.5	4.5	7.4
Protein	2.9	2.9	5.5
Carbohydrate	4.9	4.1	4.8
Calcium	0.12	0.13	0.2
Phosphorus	0.10	0.11	0.16

Source: Bondi, (1993) as quoted by Marth and Steel, (1998)

Milk constitutes 80-87% of water. Milk fat is present in milk in form of small globules dispersed in milk plasma. Fat molecules comprises of triglycerides consisting of triglycerol esterified with fatty acid chains with 4-20 carbon atoms. Milk protein comprises of casein, which constitutes 82-86% of total milk protein and globulins (Marth and Steel, 1998). Lactose is the major Carbohydrate in milk, a disaccharide made of D-glucose and D-galactose linked by an Ŭ-1,4 glycosidic bond as illustrated in the structural formula shown in figure 1 below.

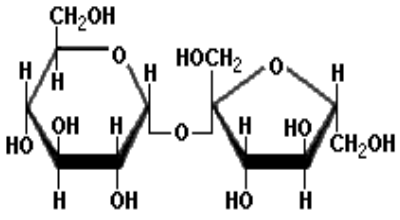

Figure 1: Structural formula of Lactose

2.3 Fermented milk

Fermentation refers to enzymatically controlled anaerobic breakdown of carbohydrate to organic acids or carbon dioxide and alcohol (Chuayama, Jr et al, 2003). Traditionally fermented milk refers to that milk product which is indigenous to the region of production and developed by people living in that region using locally available materials, (Nakazawa and Hosono, 1992). Fermented milk is believed to make people grow stronger and is preferred for their excellent flavor, delicious taste and health giving properties. Throughout the world, milk fermentation has been used to extend shelf life, improve digestibility and enrich it with essential vitamins and proteins (Savadogo et al, 2004; Adebesin et al, 2001).

2.4 Lactose fermentation

Lactose fermentation depends on the mode of transportation into the cell cytoplasm of a microorganism. Lactose may enter the cell as free disaccharide molecule, whereas in others it enters as sugar phosphate depending on the presence of the enzyme lactose permease or phosphotranferase system (PTS).

In those bacteria where lactose enters cell cytoplasm as free sugar, the enzyme ɓ- galactosidase hydrolyses the sugar into glucose and galactose, which are further metabolized through different pathways to yield lactates and other compounds. However, in cases where lactose enters the cell cytoplasm as sugar phosphate, the enzyme phospho-ɓ- galactose hydrolyze it to galactose-6-phosphate and glucose. These are then metabolized through galatose-6-phosphate and Embden-meyerhof pathways to yield lactates. Yeast on the other hand reduces the pyruvate to alcohol (ethanol) and CO_2. (Marth and Steel, 1998; Salminen and Von Wright, 1998).

2.5 Advantages of traditionally fermented milk over commercially fermented milk

Traditionally fermented milk offers several advantages over commercial counterparts, despite the simple and easy fermentation process. Probiotic lactic acid bacteria found in *Kule naoto* and *Mursik,* as was established by Mathara, J. (1999) have minimal resistance to antibiotics than probiotic found in commercial yoghurts .This is because of minimal usage of antibiotics on animal treatment by the Maasai and Kalenjin communities. This unique characteristic indicates lower chances of transferable resistant bacterial 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 cheap and easy to prepare (Mureithi, 2000)

2.6 Global production and consumption of traditionally fermented milks

In the description of fermented milks throughout the world ,consideration is only based on milks from mammals ,which may be a cow, goat, donkey, mare, camel, buffalo and some other species, and not the drinks made from plants such as` soy milk, coconut milkô (Nakazawa and Hosono, 1992). FAO, (2011) estimated worldwide milk production of about 730 million tones of milk and there are more than 6 billion consumers of milk products. According to Marth and Steele, (1998), there are about 3 billion domesticated ruminants in the world, of which dairy cattle are major producers of milk for human consumption as shown in table 2 below

Table 2: Worldwide population of domesticated ruminant and milk production

Species	Population (10^6 head)	Milk production (10^6 Metric Tons)
Dairy cattle	225	445
Sheep	1138	78
Goats	574	96
Buffalo	147	0

Source: FAO, (1993) as quoted by Marth and Steele (1998),

In the traditional areas of the world, where given types of fermented milk are produced, the milk used reflects the type of dairy production of the area (O`Connor and Tripath, 1995) as shown in table 3 below.

Table 3: Worldwide examples of milk preparations and regions of origin;

Fermented milk product	Region of origin
Yogurt	Turkey
Laben	Middle East
Leben	Tunisia
Kefir	Balkans
Koumiss	Mongolia
Irgo, Ititu	Ethiopia
Mala	Kenya
Mursik	Kenya
Kule naoto	Kenya
Acidophilus milk	Europe

Source: O`Connor and Tripathi (1995)

2.7 Production and consumption of fermented milks in Kenya

Kenyaôs dairy production is concentrated on the highlands, with 53% in the former Rift valley regions (Techno Serve Kenya, 2008). According to FAO, (2010), milk (whole and fresh) was the top food and agricultural commodity in Kenya in 2005. Dairying is important in the economies of the rural poor. It is estimated that the number of smallholder dairy farms is about 35% of total rural households. (Techno Serve, 2008). However, during peak seasons in the pastoral areas of Kenya, excess milk is modified through fermentation before consumption as a way of preserving it and for desirable flavor development**.** In these pastoral areas, milk is locally and easily accessible commodity and value addition through indigenous technology has proved highly successful. Adoption of *mursik* technology by non- pastoralist communities has introduced an element of commercialization as a viable source of income for livestock keepers. Furthermore, due to ever-growing population, increased nutrition knowledge and awareness on health benefits of traditionally fermented milk, the consumption of the product has gained popularity among non-Kenyans and those Kenyans living in urban areas (Mathara et al, 1999).

The pastoralists who produce and consume traditionally milk in Kenya include the Maasai community from Narok County and the Kalenjin community from Uasin Gishu, Nandi, Elgeyo and Marakwet Counties. The other districts / Counties where traditional fermented milks are produced and consumed include Turkana, Kitui, Machakos, Marsabit and Garissa among others. Production and consumption of traditionally fermented milk in these regions is a cultural habit that has been practiced for long, and with a general belief that traditionally fermented milks have enormous health benefits to human beings (Mureithi et al, 2000).

The Methods used to preserve milk by the Maasai, Kalenjin, Boranas, Turkanas, Pokot, and Somalis are such that milk can be kept as long as three months (Huss-Ashmore , 1996)), and

preservation of their milk is through fermentation and treatment using charcoal from various types of burnt trees.

The purposes of treating milk with charcoal are; to erase the smell of fresh milk which is undesirable to elderly African people, the smoke from the embers has a preservative effect, which prevents undesired bacterial multiplication that causes spoilage while allowing natural souring , the charcoal smoke imparts a special flavor to the milk and a bluish color which is of high aesthetic value to the consumer and finally the thin layer of *wosek* (fine charcoal) inside the gourd reduces its porosity rendering it airtight (Mureithi et al., 2000).

Table 4 below shows some of the traditionally fermented milk, area of origin, people, and the types of trees used for milk treatment in Kenya.

Table 4: Some Kenyan fermented milks

Fermented milk product	Origin & people	Trees used for preservation
1. *Iria ri matii*	Meru	*Olea europea L .ssp africana*
2. *Mursik*	Kalenjin people	*Euclea divinorum, Acacia malifera, Senna didymobotriya*
3. *Amabere amaruranu*	Gusii	*Acacia busia*
4 *Osaroi, Kule naoto*	Maasai people	*Olive tree (mutamayio)*
5. *Chekha mwaka*	Pokot	*Acacia didymobotriya, Olea europea ssp africana*

Source: Mureithi et al. (2000)

One characteristic common with trees for milk treatment is the high tannin content. Low tannin trees such as *Acacia didymobotriya,* is the preferred species by most communities (Ngule, et al, 2013). However, due to the dwindling supplies of the favored tree species used for milk treatment, the few women fork that have the skills to make the milk and the scarcity of gourds

for milk fermentation, the future use and development of traditionally fermented milk in the traditional areas is drastically declining (Mureithi et al, 2000). Therefore, there is need to preserve gourds since they are cheap and accessible to the local people and the valuable tree species for milk treatment as this is part of indigenous knowledge that also help in conservation of biodiversity. It would be desirable also to identify and characterize some of the common plants used, and the smoke derived thereof as a first step towards understanding the possible effects on the nutritive value of milk and bacterial flora, and whether the improvement in shelf life of traditional fermented milk is due to selective bacteriostasis or bactericidal effects of smoke application.

2.8 Health benefits of traditionally fermented milk

According to Branca and Rossi (2002), fermented milks are not nutritionally any different from unfermented milk. However, a number of health benefits are attributed to consumption of fermented milks, which include; enhancing bioavailability of Iron and calcium as well as being an excellent source of protein and phosphorus. It controls undesirable pathogens in the gastrointestinal tract, improved immune response, enhanced lactose digestion, detoxification action, control of serum cholesterol and lower blood pressure in hypertensive individuals (Lore, 2003, Chuayama, Jr et al, 2003 and Sappo et al, 2003, Nakazawa and Hosono, 1992).

Fermented milks contain live microorganisms referred to as probiotic, which when consumed provide protection against gastrointestinal pathogens and toxins. These organisms exerts their effects by adhering to intestinal lining and inhibit pathogens growth, production of exopolysaccharides which protects intestinal lining, production of antimicrobial chemicals known as bacteriocins and lowers intestinal PH by lactic acid production (Tamime, 2002).

Microorganisms such as Bifidiobacteria and lactobacilli are normally components of intestinal flora throughout the life cycle and their presence and the resultant decrease in fecal PH are associated with lower rates of morbidity and mortality in breastfed infants (Bezkorovainy, 2001). There is increasing evidence that certain strains of lactobacilli have beneficial effects against the occurrence and duration of acute diarrhea and stimulate the immune system in young children (saavedra, 2000).These microorganisms include lactic acid bacteria (LAB) mainly from the *lactobacillus (lb*) group, such as *lb acidophilus*, *lb casei*; yeast and moulds (Tamime, 2002). Studies done by Giovannini et al, 2007 on effects of long-term consumption of fermented milk on preschool age children showed lower number of fever and diarrhea episodes, and improved health status of children with allergic rhinitis. No effect was found in asthmatic children.

The table 5 below show aforementioned probiotic microorganisms.

Table 5: Probiotic microorganisms used in making fermented milks

Genera	**Microbial species**
Lactobacillus	*Lb (acidophilus, casei, rhamnosus, heventicus, Delbrueckii sub sp bulgaricus, paracasei)*
Pediococcus	*P .acidilactici*
Bifidiobacteria	*B. bifidum, breves, longum, lactis*
Other microorganisms in fermented milk	
Yeast	(*Torulopsis, holmii; saccharamyces fragilis, cerevisiae, Lactis; Candida pseudotropicalis* etc)
Molds	(*Geotricum candicum*)
Acetic acid bacteria	(*Acetobacter acetii, ransens)*

Source: Tamime (2002)

One very important characteristic requirement that distinguishes probiotic microorganism in the usual starter cultures is that they should have ability to withstand gastric acid and bile salts; and multiply and survive in large intestines in order to produce their probiotic effects in humans (Tamime, 2002).

In Kapseret, consumption of traditionally fermented milk (*mursik)* enjoys several health claims among the Kalenjin people. It is widely believed that it can treat certain diseases like tuberculosis, allergies, and cancers, among others. *Mursik* consumption has been associated with longevity of life for those who use it regularly (Sanders, M, E., 2000).

2.9 Gaps in knowledge

There is increasing evidence of diarrhoea, and hence malnutrition among preschool children, especially in the rural areas, despite the availability of foods of animal origin. Traditionally fermented milks are such animal products that have recently prompted increased focus because they are nutrient dense, locally available at low cost and culturally accepted, with the potential of preventing gastrointestinal infections and iron deficiency anemia (Branca, R and Rossi, l.,2000). However, information on extent of consumption of fermented milk like *mursik* among preschool children is scanty and not much has been done to find out whether caregivers have adequate nutrition knowledge on *Mursik* and its health benefits and whether consumption could have positive effects on nutritional status and morbidity. This study was design to address this gap by providing information on factors influencing consumption of traditionally fermented milk (*mursik),* and to establish the context in which it is consumed among preschool children.

CHAPTER THREE

3.0 RESEARCH METHODOLOGY

3.1. Research Design

This study assumed a cross-sectional design, using semi-structured questionnaires. Qualitative component was also employed to obtain in-depth information from FGDs and Key informants from the study area.

3.2 Study Location

The study was carried out in Kapseret Location-Uasin Gishu County in the former Rift valley province. It borders Nandi County to the west, Wareng to the North (Eldoret north) and Kesses to the East. It is a temperate and cool climate plateau region with temperatures ranging from a minimum 8.4 ^{0}c to max 27 ^{0}c .It has two rainy seasons with average rainfall from 900mm to 1,200mm per annum.The Location has a total population of 21,800, and the predominant inhabitants in this area is the Nandi ethnic group of Kalenjin community. The division has witnessed rapid increase in population during the last ten years due to immigration of people to the newly settled, former East African Tanning and Extract company farm, which was subdivided and sold to individuals. The major features are the large parcels of land with highly densely populated wattle trees. There are no major rivers in the location (Appendix 6).

3.2.1 Agricultural production

The main agricultural activities are livestock and crop production. The main livestock kept here are the European breeds such as Arshires, Friesians, Nandi mixed breeds like Zebus, and the Zihiwals. Poultry, sheep and goats production are in small scale. The major crops grown are maize and wheat.

3.2.2 Target Population

The 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. Kapseret location registered total population of 21,800 and 3,941households according to National population census (KDHS, 2009).

3.3 Sampling

3.3.1 Sample size determination

Minimum sample size for households with 1-5 years old preschoolers was determined using the Fishers formula (Fisher et al, 1991**).**

$S=z^2\ p\ q\ /d^2$

Where:

S= the desired sample size

Where z =1.96 (The standard normal deviate at 95% confidence interval)

P= Proportion of children who consume mursik set at 50 % (Since there were no records on *mursik* consumption)

q= 1-p the proportion of children who do not consume mursik

d= 0.05 (Degrees of precision desired)

$S= 1.96^2 \times 0.5 \times 0.5/0.05^2$

$= 384$

In addition, 5% attrition = 403 households, but 400 households were taken as sample.

3.3.2. Focused group discussion

Two-focused group discussions (FGD) with 7-10 members were selected each in the whole Location. The participants consisted of women Kalenjin with children between one and five 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 and practices. FGDs clarified and revealed more information, which were not clear or collected in the questionnaire. They were used to explore attitudes, perception and experiences of caregivers/ community members towards consumption of *mursik* by preschool children and the context in which it is consumed. For the purposes of this study, focus was on the identification of key themes and concepts from the summarized FGD notes making it easy to retrieve in order to draw conclusions (Ritchie and Lewis, 2003). A focus group discussion guide (Appendix 3) was provided to guide the process.

3.3.3. Key informants

Two key informants were selected for interviews in the division basing on the length of stay, experience in preparation of *mursik* and knowledge on the possible factors that might be influencing its consumption and health outcomes that are associated with the product.

3.3.4 Sampling procedure

Kapseret location was purposively selected as it has the highest number indigenous dairy farmers who still produce and consume *mursik*. The study employed both quantitative and qualitative methods of data collection.

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.

Kapseret location has two sub-locations, namely; Chepkatet and Lemook. According to the 2009 census report, these sub-locations had 1,873 and 2,068 households respectively. This translated to 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 stratum were kept proportional to the sizes of the strata (Kothari, 2004). The allocated sample size in each stratum was then selected using simple random sampling to avoid bias as illustrated in Table 6 below

Table 6: Determination of Sample in each study stratum

Sub-location	**Target Population**	**Calculation**	**Sample Size**
Chepkatet	1,873	$\frac{1,873}{3,941} \times 400$	190
Lemook	2,068	$\frac{2,068}{3,941} \times 400$	210
Total	**3,941**		**400**

In both stages, the starting point in each village was village centre, where a pencil/pen was spin and the direction of its tip is the starting direction**.**

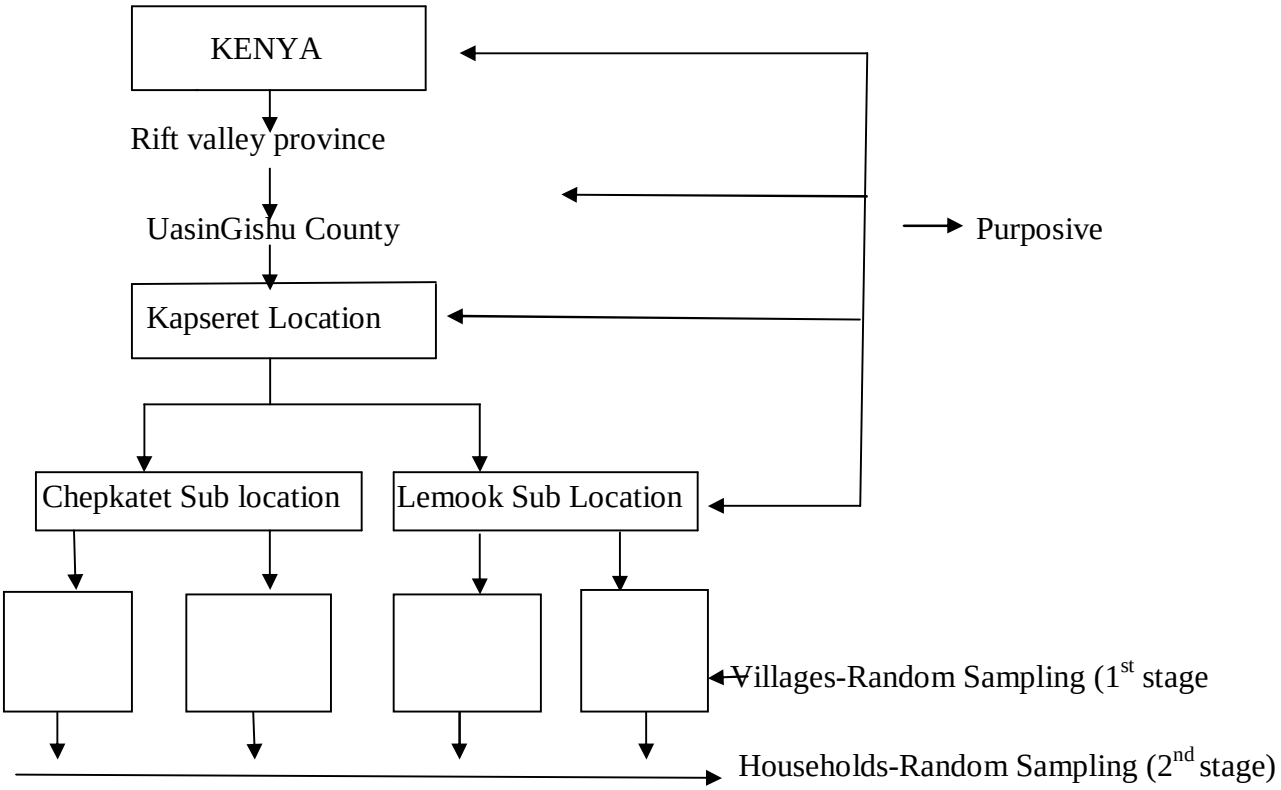

Figure 2: Sampling procedure flow diagram

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 included in cases where the required number was not reached**.**

3.4 Quantification of respondents' nutrition knowledge on mursik

Nutrition knowledge levels of respondents were measured against the scores obtained on the nutrition knowledge questionnaires, where the respondents were graded according to their responses. All questions had four correct responses and marks were awarded to respondents

depending on the responses they gave. Respondents were to give four correct responses to get full mark/ score (4 marks) per question, three responses to get three marks and so on.

Total scores were obtained for each respondent and the nutrition knowledge was rated on percentiles, where the respondents were graded using three cut off points (Courtney, 1999) as follows;

Low nutritional knowledge < 40 ï Lower percentile,

Average nutritional knowledge 40-69-median,

And high nutritional knowledge > 70 - Upper percentile

A marking guide was provided to ensure accurate grading of the respondents

3.5 Inclusion criteria

1. Only households in the selected villages with children age between 1-5 years old were included until the required sample size was reached

2. Caregivers who were available and willing to participate in the study during data collection

3.5.1 Exclusion criteria

Mothers/caregivers with children over 5years old and those who declined request to participate were excluded

3.6 Research instruments

Structured questionnaires were used to obtain information on the socio-demographic characteristics of households. Semi-structured food questionnaires were used determine householdsô milk and mursik consumption by preschool children. Nutrition knowledge questionnaires were used to assess caregiversô knowledge levels on mursik. FGDs and key

informants interview guides were used to get in-depth information on determinant factors and health outcomes of mursik consumption by preschool children.

3.7. Data Collection Procedure

Introductory letter from the University of Nairobi was issued to assist in getting permission from the National Council for Science and Technology (NCST) to conduct the research.

3.8. Training of research assistants

Four research assistants with secondary school education were recruited and trained. Discussions on proper use of all research instruments and demonstrations were done during the session, with the following key points emphasized;

1. That all households should meet inclusion criteria

2. Respondents to accept to be interviewed

3. The importance of clarity when asking questions

4. Accuracy when filling in questionnaires, attentiveness and notes taking during FGD sessions and Key informants interviews

5. Finally the importance of liaising with other research assistants and supervisor for clarifications

3.8.1. Pre-testing of data collection instruments

A pilot study was conducted before the main study. For this purpose, eight (8) households with similar characteristics to those under study and in a different area not included for the study were selected and used , with one research assistant administering questionnaires in two households. To determine content validity of the instrument items, the researcherôs supervisors assisted in

ensuring that the instruments were in relation to the set objectives and content area under study. Their suggestions and comments were used as a basis to modify the research items and make them adaptable to the study. Basing on the feedback from the enumerators, the wording of the instruments were modified, some were excluded while others added as deemed fit.

3.9. Data analysis

Data was entered in MS Access, and analyzed using Statistical Package for Social Sciences (SPSS, 2007) version 16.0.for windows and tested for significance at $P < 0.05$.

Descriptive analysis was done to provide general information on the characteristics of the study population. The chi-square (χ^2) tests were done to determine associations between variables. Logistic regression was performed to determine the statistical relationship between mursik consumption and the independent variables such as household milk and *mursik* production and respondentsô nutrition knowledge levels on mursik. Odds ratios (OR) were used to estimate the relative risk of diarrhoae occurrence and *mursik* consumption among preschool children. Analyzed data was represented using cumulative frequency tables, percentages, pie charts and graphs.

CHAPTER FOUR: RESULTS

4.1. General Information

In the study, 400 questionnaires were administered to respondents in Kapseret Location, where 383 questionnaires were successfully filled, returned and taken as a sample. This gave a response of 95.0%, which is a favorable response rate according to Mugenda and Mugenda (2003) in which they assert that a 50% response rate is adequate.

4.2. Socio-demographic and economic characteristics of the study population

4.2.1 Socio-demographic characteristics of the study population

Table 7 below shows selected socio-demographic characteristic of the study respondents. The mean household size was 5 people (± 2) with the smallest household having 2 members, while the largest had 11. Most (80.9%) of the respondents in both the sub-locations were married, with (86.9%) being female while (13.1%) were male. Majority were between the ages of 26-45 years, (68.1%), a few were in the age 15-25 years (13.9%) while the rest 18.0% were over 46 years. The mean age was 37 years (±1.3).

Most respondents (39.2%) had attained primary level of education, 25.5% had secondary level of education and the rest had preschool (14.8%), post- secondary (5.5%) and adult (2.6%) level of education respectively. Those who had no formal education were 12.3%).

Table 7: Socio-demographic characteristics of the respondents

Characteristics (N=383)		Frequency	Percent (%)
Household size	Mean (5 ± 2)		
	Ò5 members	249	75.2
	> 5 members	134	24.8
Respondents' marital status			
Married		309	80.9
Separated		2	0.5
Widowed		26	6.8
Single		2	11.0
Divorced		1	0.3
Not married		2	0.5
Respondents age (years)			
Below 25		53	13.9
26-45		260	68.1
Above 46		70	18.0
Gender			
Male		50	13.1
Female		332	86.9
Education levels			
Completed primary school		150.1	39.2
Completed secondary school		97.7	25.5
Above secondary school		21.1	5.5
None		47.1	12.3
Preschool		56.7	14.8
Others (Adult education)		10.0	2.6

4.2.2. Socio- economic characteristics of the respondents

Table 8 shows the socio-economic status of the study population. The main occupation of respondents was farming (59.2%) with sale of milk (70.9%) and salaried employment (13.4%) being the main source of income for most households in the study area. Majority (91.1%) own livestock with (90.3%) producing their own milk, though sale of livestock is the least common source of income (2.1%). 98.7% of respondents own land with 24.1%, 31.5% and 44.4% owning less than 1 acre, between 1 to 4 acres and over 5 acres respectively.

Table 8: Socio- economic characteristics of the study households

Characteristics (N=383)		**Percent (%)**
Do you own livestock?	Yes	91.1
	No	8.9
***Do you produce your own milk*?**	Yes	0.3
	No	9.7
Do you own land?	Yes	98.7
	No	1.3
Land size		
< I acre		23.1
Between 1-4 acres		31.5
> 5 acres		44.1
Household main source of income	Salaried employment	13.4
	Casual labour	3.9
	Sale of Milk,	70.9
	Sale of Crop	9.4
	Sale of livestock	2.1
	Trade	15.1
Occupation	Farming	59.2
	Employment	16.2
	Business	18.6
	Casual labour	3.9

4.2.3 Household milk production and consumption

Table 9 below shows the average daily householdsô milk production in the study area. A higher proportion of households (91.1%) had a dairy cow and therefore had their own milk. In Chepkatet sub-location, there were (33.1%) households who produced a capacity of 1 litre of milk per day. There were (58.4%) households who produced 2 litres of milk, (4.8%) who produced less than five but more than three litres of milk and (3.7%) who produced over 5 litres of milk daily. Clearly, a majority of the households (152; 91.6%) produced less than three litres of milk per day. In Lemook sub-location, there were (25.5%) of households who produced 1 litre of milk daily, (5.9%) produced less than five litres but more than three litres of milk and (3.8%) produced over 5 litres of milk, while a majority (119; 64.7%) of the households produced 2 litres of milk daily. As in Chepkatet sub-location, a greater percentage (90.2%; 166) of the households produced less than three 3 litres of milk per day. However, 7.8% of households did not produce any milk. Average household milk production across the sub location did not differ significantly (p= 0.081).There was significant association between household milk production and animal ownership (χ^2=2.8, df=1, p=0.000) and marital status (χ^2, P= 0.025).

Table 9: Average daily households' milk production (N=383)

Milk production	Sub locations		Statistical test (P=< 0.05)
	Chepkatet (%)	Lemook (%)	
≤ 1 litre/ day	33.1	25.5	
1≤2 litres	58.4	64.7	
3 ≤ 5 litres	4.8	5.9	(P > 0.05)
≥ 5 litres	3.7	3.8	
No production	3.4	4.3	

From the findings, itôs apparent that each household in Kapseret location produces an average of 2 litres of milk per day.

Householdsô records on actual quantity of milk used in tea, *uji, and ugali* and *mursik* preparation were scanty due to low levels milk production. Therefore it was not feasible to compare them. Instead, descriptive statistics were generated for households with milk production levels of less than three and over five litres per day and household use as shown on table10 below. Overall, households (n=318) with less than 3 litres of milk used 24.5% of their milk production for the preparation of *uji,* tea etc, 56.6% for *mursik* preparation and 18.7% went for sale. Households (n=32) with Ó5 litres daily milk production sold 62.5%, 21.9% of milk consumed in tea, uji or in *ugali* and 15.6% went for *mursik* preparation respectively. In households with no milk production (n=33), 93.7% of milk mainly bought was used for preparation of tea, uji and 6.3% for mursik preparation.

Table 10: Comparison of daily household milk production and use (N=383)

Household milk production (litres)		**Percent (%) household milk use in;**		
	n	Sales	Tea, ugali etc	Mursik preparation
No milk production (buying)	33	0.0	93.7	6. 3
< 2	102	14.7	25.4	59.8
2-3	216	20.8	24.1	55.1
3-5	19	63.2	21.1	15.8
> 5	13	61.5	23.1	15.4

4.2.4. Household's Mursik Production

Table11 below shows the average weekly householdsô mursik production in Chepkatet and Lemook sublocations. *Mursik* production was determined on weekly basis because the process takes a minimum of four days in most study households.

The greatest share (81%) of households prepared *mursik* while a few (19%) never prepared any mursik from their daily milk production**.** A majority (64.5%) of households in Chepkatet sub-location produced 1 litre of *mursik* per week while (25.9%) produced between 2 and 3 litres, (3.6%) produced more than 3 litres weekly. In Lemook (62.5%) and (21.3%) produced an average of 1 litre and 2-3 litres of mursik per week respectively. However (6.0%) and (12%) of households, did not produce any *mursik* from their respective daily milk productions in Chepkatet and Lemook respectively. Therefore it is apparent that majority of households (64.5%) produced an average of 1 litre of mursik per week. Household mursik production across sub location did not differ significantly (P= 0.315).

Table 11: **Average weekly households' mursik production (N=383)**

	Sub locations	
Ave. weekly Mursik production	Chepkatet (%)	Lemook (%**)**
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

4.2.5. The association between selected socio-demographic and economic characteristics of households and *mursik* production

Table 12 below shows association of selected socio-demographic and economic characteristics and households *mursik* production. Data showed significant association between household *mursik* production and household size (p=0.011), householdsô livelihood (p=0.000), age of respondents (P= 0.035) and education level (p=0.013). Households with own milk production were more likely to prepare mursik than those who bought (OR= 19.479, 95% CI: 8.804-43.094).

Table 12: Association between socio-demographic and economic characteristics of respondents and *mursik* production (N=383)

Characteristic	*Mursik* production (%)	Statistical test (P < 0.05)
Household size		
Ò5 members (n=197)	51.4	χ^2=21.389, df= 9, P=0.011
Ó5 members (n= 186)	48.6	
Education level		
Primary (n=53)	13.8	
Secondary (n=144)	37.6	χ^2= 10.799, df= 3, P= 0.013
Above secondary (n= 186)	48.6	
Households' livelihood		
Livestock production (n= 180)	50.0	
Crop production (n= 144)	37.6	
Employment (n= 40)	10.4	χ^2 =27.966, df=4, P= 0.000
Business (n= 14)	3.7	
Casual labour (n= 5)	1.3	
Age group		
Below 30 years (n= 78)	20.4	χ^2 =5.586, df= 2, P=0.035
Ó30 years (n= 305)	79.6	

4.2.5. Mursik Consumption by Pre-School Children

Overall, 32.2% of households fed their children with mursik, while 67.8% did not as shown on table 13 below. The frequency of consumption was once a week (64.4%); once a month accounted for 26%, while a limited number of households (9.6%) fed their pre-school children on mursik daily. 75.0% of households fed their children with between 1 and 2 cups of mursik, 17.3% with more than 2 cups, while 6.7% fed their pre-school children with less than 1 cup (250 ml) of *mursik* per week. Frequency of mursik consumption across sub locations did not differ significantly (P= 0.130). There was significant association between household mursik production and consumption among preschool children (p=0.000)

Analysis indicated that 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).

Table 13: Quantity and frequency of Mursik Consumption (N= 383)

Characteristic		(%)	Statistical test
Do you feed children with mursik?	Yes	32.2	χ^2, P< 0.05
	No	67.8	
Frequency of mursik consumption			
Daily		9.6	
Once a week		64.4	χ^2, P< 0.05
Once a month		26	
Quantity of mursik consumed (Cups)/week			
< 1		6.7	
Between 1-2		75.0	χ^2, P< 0.05
> 2		17.3	

1 cup is equivalent to 250 millimetres

4.2.6. Relationship between mursik consumption and socio- demographic and economic characteristics of households

Table 14 below shows the correlation between mursik consumption and socio-demographic and economic characteristics of households. There was significant positive correlation between *mursik* consumption and education level of respondents (r = 0.118, P= 0.021), Householdsô *mursik* production levels (r = 0.309, P= 0.000), nutrition knowledge on mursik (r = 0.151, p= 0.003) and householdsô livelihood (r = 0.142, P= 0.005). Householdsô size (r = -0.093, P= 0.051) had negative insignificant correlation with *mursik* consumption.

Table 14: Association between *mursik* consumption and socio- demographic and economic characteristics of households

Characteristic	Mursik consumption (%) Yes	No	Statistical test P < 0.05
Household size			
Ò5	45.7	19.6	r = -0.093, P=0.051
≥ 5	12.8	21.9	
Education levels			
Below primary	19.0	29.8	r = 0.118, P =0.021
Above primary	37.1	14.1	
HHs mursik production level			
Ò1 litre	0.6	31.9	r = 0.309, P =0.000
Ó1 litre	49.7	17.8	
Household livelihood			
Farming	44.5	29.3	
Employment	11.7	3.9	r = 0.142, P = 0.005
Business	5.7	1.0	
Casual labor	0.5	3.4	
Nutrition knowledge			
Low	1.3	0.4	
Average	6.0	6.2	r = 0.151, P= 0.003
High	60	26.1	

4.2.7 Community attitudes and perceptions towards mursik consumption by preschool children

An interesting theme that emerged from FGDs was that adults are given first priority when it comes to mursik consumption within household. Members pointed out that in general, fresh milk

production is low in the area, and this directly affects household *mursik* production. They said that in cases of higher production, most milk goes for sale and preparation of tea, leaving less for *mursik* production. Mothers in the discussion explained that households with enough milk could prepare *mursik* for sale as a way of increasing household revenue.

Most members of FGDs also pointed out that adults preferentially consume mursik because ñit in*creases their blood levels and makes them strong* ``.There were several reasons as to why some members donôt feed their children with mursik. A few members said `` *we don't feed mursik to children less than five years because mursik contains bacteria which causes diseases''.* Others said *`fresh milk has a lot of nutrients than mursik, hence fresh milk makes children healthier''.* An interesting theme that came out was the fact that adults, especially household heads should consume *mursik* after lunch time meal and under a tree in order to make them relax and dose after a hard daysô work. One member said`` *if children consume mursik, they will dose and deny them the opportunity to play and look after the cows''.* Some members indicated that *mursik* is too heavy for children to swallow and` too strongô for their soft stomachô.

The FGD members who fed their children with mursik said there is no significant nutritional difference between *mursik* and fresh milk. They said children who were exposed to *mursik* at an early age will come to like it at a later stage, and those who were never will dislike it. A key informant indicated that *mursik* preparation methods differ from time to time and household to household resulting in differing taste of *mursik*. 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 diarrhoea, as it has been used since time in memorial to suppress allergies and severerity of diarrhoea, and especially the induced diarrhoea that occurs during the process of cleaning the stomach. It appeared that most members were not

sure of other diseases that can be suppressed by consumption of *mursik,* except one who said that its frequent use lowers heart diseases.

4.2.8 Reasons for not feeding children with mursik

Figure 6 shows some of the reasons why respondents did not fed their children with *mursik.* Majority (43%) had a strong cultural belief that *mursik* is exclusively for adults only, while the rest gave various reasons as shown below.

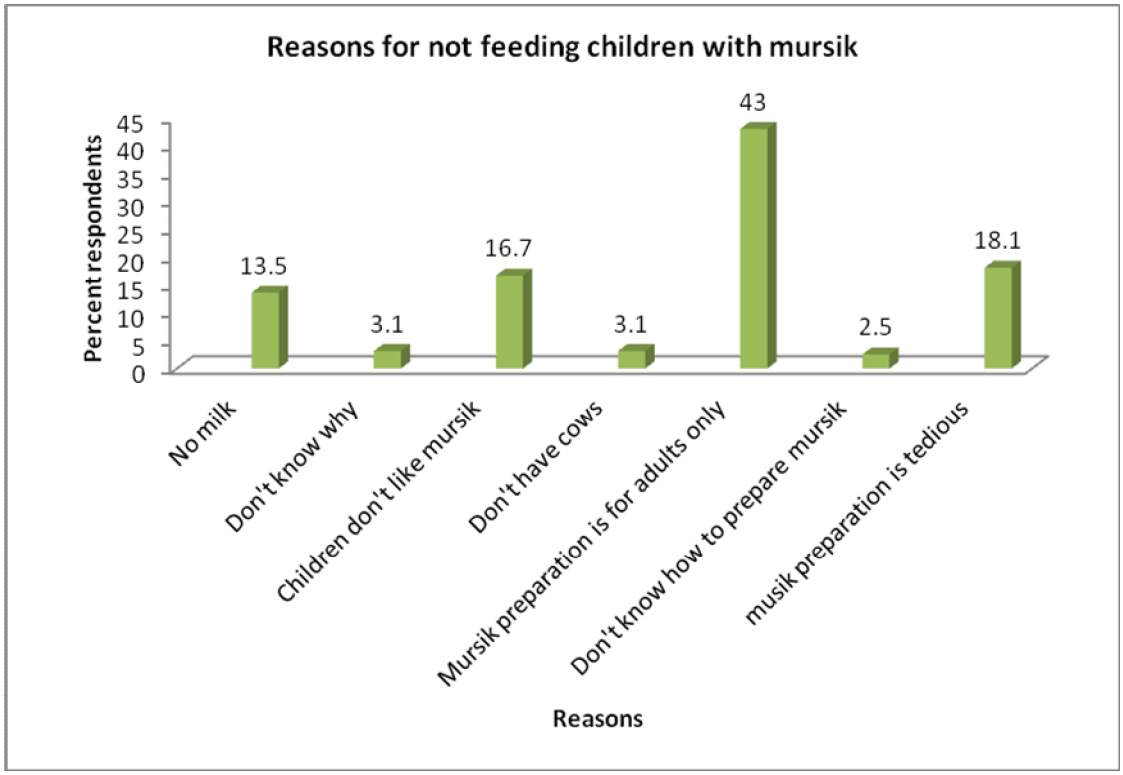

Figure 3: Reasons for not feeding children with mursik

4.2.9. Respondents' nutrition knowledge on mursik

Figure 7 show percent distribution of respondents by nutrition knowledge. The mean nutrition knowledge score of respondents was 16 ± 3.4 and the median was 16.The Minimum percent score was 28 while the maximum was 75%. From the findings, nutrition knowledge levels of

respondents on mursik was average with 86.4% being ranked in the average level (40-69 percentiles) and only 1.3% in the highest nutrition knowledge level (> 70 Percentile), while 12.3% had low nutritional knowledge (< 40 percentile).

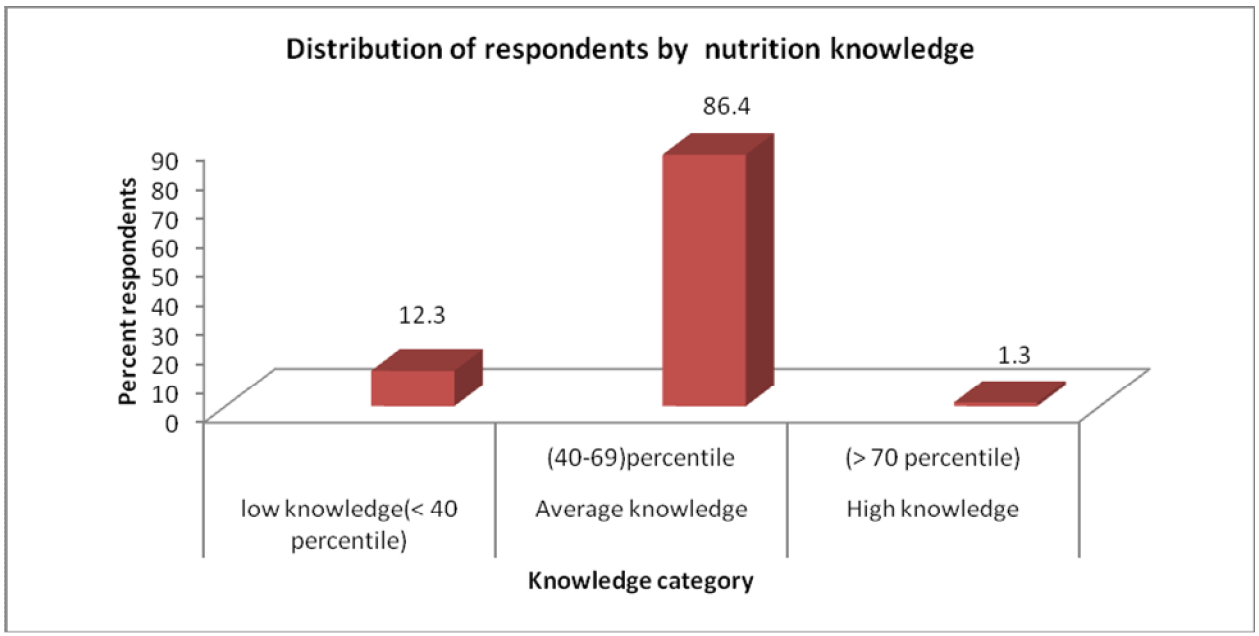

Figure 4: **Distribution of respondents by nutrition knowledge**

4.2.10 Association of nutrition knowledge and mursik consumption

Table 15 below shows the association of *mursik* consumption and respondents nutrition knowledge. It is clear that households with high nutrition knowledge on mursik were more likely to feed their preschool children with mursik (p= 0.011) than those with low nutrition knowledge.

Table 15: Association of nutrition knowledge and *mursik* consumption

Knowledge category	***Mursik* consumption**		Statistical test
	Children fed (%)	Children never fed (%)	(P< 0.05)
Low knowledge (< 40 percentile)	11.9	62.4	
Average knowledge (40-69 percentile)	38.3	20.3	G^2=8.949, 2df, P=0.011
High knowledge (> 70 percentile)	49.8	17.3	

Independent t-test showed no significant difference in the knowledge score between the respondents who fed their children with *mursik* (n=124) and those who did not (n=259), P=0.647, t=-1.157, df =380, 189.993

4.2.11. Morbidity Experience of the study children

Figure 8 below show the morbidity experience of the study children. A majority 37.1 % of children were reported to have suffered from fever, 6 % from diarrhea, coughs 25.1% and colds/ flu 31.9% in the past one month. Of these only 53.2% reported to have received health treatment.

The findings on fever (37.1%) are slightly higher than those reported at the national levels of 20.4% (KNBS, 2009) but in consistent with those of diarrhea of 6.1%. Illnesses across the sub locations did not differ significantly (χ^2, p=0.189).

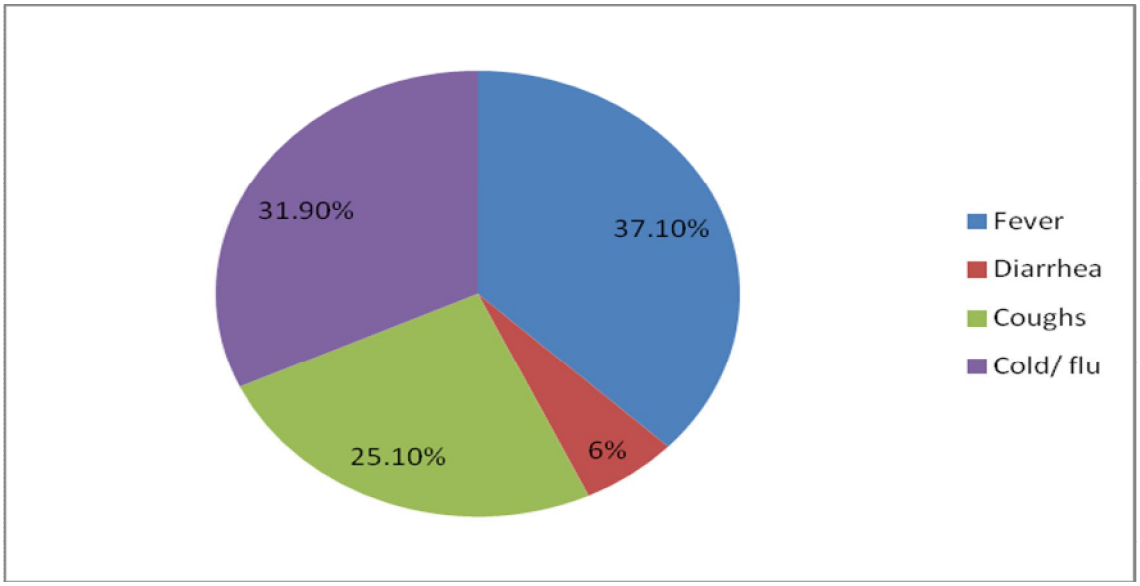

Figure 5: Morbidity experience among children

4.2.12 Health outcomes of mursik consumption among the study children

Table 16 below shows association between morbidity experience and *mursik* consumption among the study children. Fever, vomiting, persistent stomach pains and diarrhoea were found to be significantly associated with *mursik* consumption. The number of households (n=259) who never fed their children with mursik witnessed significantly (p= 0.012) higher episodes (56.4%) of illness within a period of one month while those who fed witnessed 43.6% cases. The odds of illness for mursik consumers relative to non-consumers was (OR= 0.044, 95% CI; 0.016-0.122). Specifically, respondents who fed children with mursik (n=124) witnessed significantly (p=0.000) low cases (37.5%) of diarrhea in children during the past one month (OR= 0.068, 95%CI; 0.032 - 0.145).

Table 16: Relationship between selected morbidity factors and mursik consumption

***Mursik* consumption (P=0.05)**	**% disease occurrence**				**Stat. test**
	Diarrhoea	**Fever**	**Vomiting**	**Stomach pains**	
Yes (N= 124)	43.6	37.4	48.8	12.4	χ^2, P< 0.012
No (N=259)	56.4	72.6	51.2	87.4	

The study also established what the respondentsô believed were the health implications of *mursik* consumption among pre-school children as shown in figure 9. There were 20 (5.2%) of the respondents who indicated that *mursik* consumption stops diarrhoea in children, and 30 (7.8%) who believed that *mursik* consumption boosts children immunity. Those respondents who believed that *mursik* consumption, builds stronger teeth and bones and cleans up body systems

(detoxification) of children were 97 (25.3%) and 43 (11.2%) respectively. The remaining proportion of respondents (50.4%; 190) did not understand the health-related outcomes of *mursik* consumption.

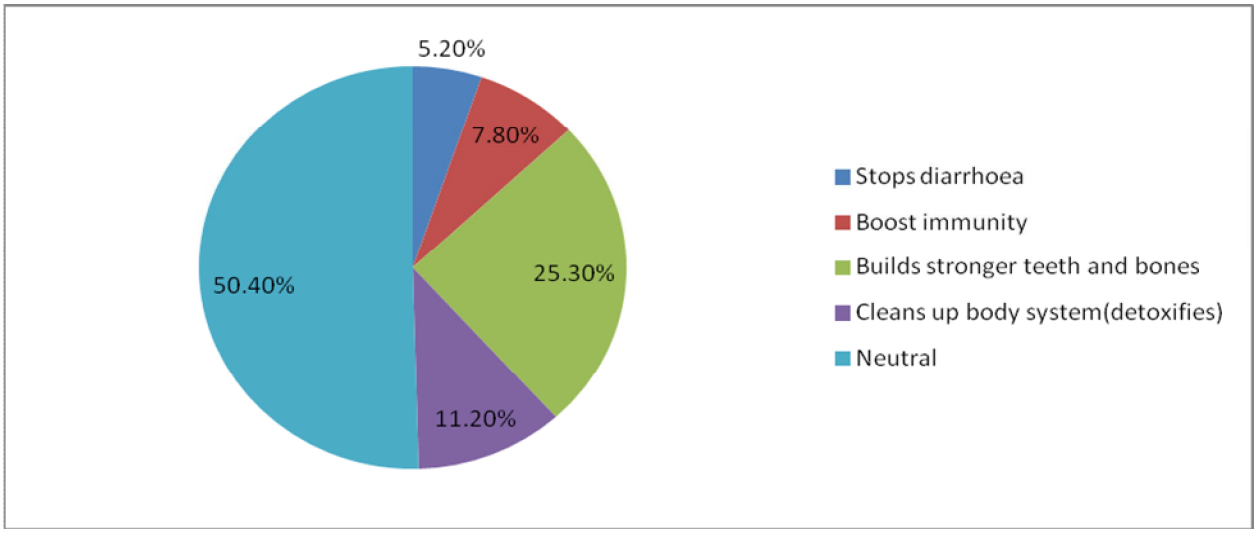

Figure 6: Distribution of respondents based on health outcomes of *mursik* consumption

4.2.13. Factors independently associated with mursik consumption among study children

Table 17 shows the factors, which were significantly independently associated with mursik consumption among preschool children. Logistic regression test was done to assess the independent association between *mursik* consumption by the study children and household size, education level, household livelihoods and nutrition knowledge on mursik. These are the variables shown to be significant in previous analysis and of significance to research questions, hence were assessed for inclusion in the multivariate models. Only respondentsô nutrition knowledge on *mursik*, education level and household livelihoods were found to be statistically and significantly, ($P < 0.05$) associated with *Mursik* consumption. One unit increase in

respondentsô nutrition knowledge on *mursik* (OR=2.686, 95.0% CI: 1.353, 5.332) Increases the odds of *mursik* consumption among preschool children by three times.

Table 17: Factors independently associated with mursik consumption among study children

Characteristics	B	S.E.	Wald	Sig.	95.0 % C.I for Exp (B)		
					Exp (B)	Lower	Upper
Knowledge on mursik	0.988	0.350	7.981	0.005	2.686	1.353	5.332
Household livelihood	0.223	0.112	4.143	0.042	1.257	1.009	1.567
Education level	0.279	0.186	2.267	0.006	1.322	0.919	1.902

The logit model of determinant factors of *mursik* consumption among preschool was as follows:

Mursik consumption = 22.216 + 0.988 (Nutrition knowledge) + 0.223(Households livelihoods)

+ 0.279 (Education level)

CHAPTER FIVE: DICUSSSION

5.1 Demographic and socio- economic characteristics

The higher numbers of females than males could be attributed to the fact that in most rural set-ups, most women are homemakers who attend to the family farms. Men on the other hand fend for their families in either formal employment or casual labor. This explains why there were fewer male respondents than females in this study**.**

Most respondents were between the ages of 26-45 years. This is probably because the proportions of respondents who still have preschool age children in Uasin Gishu are below 45 years (KDHS, 2009).

Majority of respondents had primary level of education, followed by secondary, post secondary and a few with no formal education. This is comparable to the nation results reported in KDHS 2009 as far as education in the study area is concern. The mean household size of 5 people found in the study area is not significantly different ($p > 0.05$) from the national figure of 4.7 and 4.2 reported by KDHS 2008-09 and KNBS, 2010 respectively.

5.2 Average daily Household's Milk and weekly mursik Production

Most households (96.3%) in Kapseret location produced an average of 2 litres of milk per day. This level of production is consistent with the smallholder production of 2 to 5 litres of milk per day, according to Techno serve Kenya, (2008). Techno serve (2008) recommends households milk production of 15 litres per day to bring a family over poverty line. The low production was attributed to the fact that a majority of the respondents (73.1%) indicated that they practised subsistence farming as their main form of livelihood. They also indicated that low milk production could be due to low milk yielding animals (Nandi zebus), inappropriate animal

feeding methods and scarcity of forage (grass) as large proportion of land was under maize cultivation. It is evident in the area that population have not embraced the modern methods of dairy farming, this might have significantly contributed to low milk yields (Techno serve, 2008).

The average household *mursik* production of 1 litre per week has a direct relation to household milk production of 2 litres. That is to say, when milk production is low, it directly translates to low production of *mursik*. A majority of the households that did not produce any *mursik* consumed almost all their daily milk production and sold the surplus while others held to some negative beliefs and perceptions over *mursik* consumption. Others did not have their own supply of milk and therefore bought their milk supplies from vendors which were often insufficient for *mursik* production. The fact that there was scarcity of gourds, appropriate trees for milk treatment and no formal training on how to prepare *mursik,* as was indicated by *FGDs* could discourage the young mothers from preparing it. These findings are in consistent with studies done by Mureithi et al, 2000 on management of trees used in *mursik* production in Trans-Nzoia district, Kenya. Mureithi *et al,* 2000 found out that the twinkling supply of gourds seeds, the scarcity of the preferred tree species for milk preservation and the few women who have knowledge on *mursik* preparation could threaten future development and use of the product.

5.3 Extent of Mursik Consumption by Pre-School Children

A greater proportion of households fed *mursik* to their pre-school children once a week .This was attributed to the fact that a majority of the households only registered a capacity of 2 litres of milk production per day, which may not have been sufficient for *mursik* production. Also the lengthy process involved in *mursik* production (at least two days of preparation and four days of fermentation) discourage frequent consumption (FGDs). FGDs indicated that households who produce less than 2 litres of *mursik* fed their pre-school children more frequently on it, than those

who produce more. This is because households who produce less than 2 litres of *mursik* did so purely for domestic use, whereas those households who produce more than 3litres have introduced an element of commercialization, leaving less for domestic use.

Majority 75.0 % of households fed their pre-school children on 1(250ml) cup of *mursik* per week, which translates to 12 kg per *capita*. This level of *mursik* consumption is lower than the estimated annual *per capita* consumption ranges of 19-62kg of milk in rural areas to 125kg in urban ones (WHO, 1999). This was attributable to the low household *mursik* production of 1 litre per week in average.

5.4 Nutrition knowledge of respondents

Majority of respondents (86.4%) had average nutrition knowledge (40-69 percentiles). According to information received from key informants; there is no special training on nutrition to the mothers, especially education on the importance of *mursik* as a transition food for children. There is a strong association between nutrition knowledge and education level of respondents (P = 0.009), nutrition knowledge and *mursik* consumption (P= 0.001). This is because mostly when one is educated he/she is exposed to diversified sources of information on nutrition knowledge which enhances the consumption of a diversified diet so as to obtain the specific nutrients. However, t-test results showed that there was no significant difference between mean nutrition knowledge scores of respondents who fed and those who never fed children with *mursik*. This means that despite respondentsô adequate nutrition knowledge, other factors like scarcity of milk, lack of knowledge on *mursik* preparation and the negative perception on its consumption among children could have influence on *mursik* consumption in some households.

5.5 Health outcomes of mursik consumption

Health outcomes of *mursik* consumption among preschool children have not been widely established by many studies. However, in this study it is realized that respondents who fed children with mursik witnessed lower cases (32.4%) of illnesses in children in a period of a month during the study as compared to 259 (67.6%) cases witnessed in children who never fed on *mursik*. The odds ratio (OR) of diarrhea for mursik consumers relative to non-consumers was (P= 0.000, OR= 0.068, 95%CI; 0.032 - 0.145), meaning *mursik* consumption lowered the number of diarrhea episodes by 0.1 times or 10%. The other explanation could be that children who consume *mursik* have better immune response than those who do not, meaning *mursik* boost immunity. This is in consistent with studies done by Lore, et al, 2003 who found out that traditional fermented milk controls undesirable pathogens in the gastrointestinal tract, improved immune response, has detoxification action, controls serum cholesterol and lower blood pressure in hypertensive individuals. The findings of this study are also in tandem with studies done by Mokua (2004), who found out that traditionally fermented milk (*Amabere amaruranu* from Gusii) which is comparable with *mursik* has antimicrobial activity against Escherichia Coli, which causes diarrhoea in human. Studies conducted in Italy (Marcello Giovannini, *et al.,* 2007) on effects of long-term consumption of fermented milk in children, showed that the number of fever or diarrhea episodes were lower in the intervention group as compared to the controls, and children with allergic rhinitis showed improved health status. No effect was found in asthmatic children.

5.6 Factors independently associated with consumption of mursik by the study children

Regression analysis identified the effect of each contributory variable while holding other factors constant. The results showed that mursik consumption was significantly influenced by respondentsô nutrition knowledge, education level and household livelihoods. Adequate nutrition knowledge is important as it exposes one to diversified sources of information on types and sources of health foods, leading to enhanced consumption so as to obtain the specific nutrients. Low nutrition knowledge on the other hand however, played positively on the negative attitudes and perception on *mursik* consumption among preschool in the present study. This can be explained by the fact that majority had attained only primary level of education, which might not be sufficient in understanding the composition and nutrients in food they consume.

Household livelihoods played a key role in determining the types and frequency of foods consumed in the households. Households whose main source of livelihood is dairy/ livestock keeping, are more likely to be sufficient in milk supply for domestic use including *mursik* production and consumption than those who are engaged in other activities away from dairy farming.

CHAPTER SIX: CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

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 milk to preschool-age children, indicating that milk may be providing a significant portion of essential energy and nutrients in the childrenôs diets. However, in overall a low proportion of preschool children were fed with *mursik.* The reasons provided were of cultural in nature and the negative perceptions which discourage consumption. The reasons included perception that *mursik* was too strong (to mean low pH) for the soft stomachs of young children. Other respondents cited the tedious process of preparing *mursik* which served as a demotivating factor towards its preparation. Other factors included the low household *mursik* production, as a result of insufficient fresh milk production.

Majority of respondents had low level of education (primary level of education) which influenced nutritional knowledge in a negative way. There was a positive relationship between nutrition knowledge and *mursik* consumption.

Results from this study indicated that *mursi*k consumption significantly decreased the odds of illnesses in general, and especially the number of diarrheal episodes among preschool children. This could mean mursik consumption has a positive effect on body immune system and morbidity.

6.2 Recommendations

Milk production among households in Kapseret location was generally low and did not sufficiently provide for the needs of the respective families. Relevant offices in the Ministry of Agriculture department 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 breeds.

Relevant offices in the Ministry of Health and Agriculture department at the county level should conduct sensitization seminars to ensure that community members are fully aware of knowledge on nutritional value of *mursik* particularly to pre-school children. Strategies and/or education that address the motherôs perception, negative attitudes and beliefs that *mursik* is not suitable for children should be put in place to dispel the same. The study recommends that the Ministry of Agriculture at the County level to 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.

REFERENCES

Adebesin, A. A., Amusa. N. A and Fagade, S.O. (2001). Microbial quality of locally fermented milk (Nono) and fermented milk-cereal mixture (Furada Nono) drink in Bauchi city, Nigeria. *Journal of Food Technology in Africa, 6, pg 87-89.*Retrieved September 9, 2013 from http:// www.bioline.org

Allen, S .J., Martinez, E .G., Gregorio, G .V., Dans, L .F. (2010). Probiotic for treating acute infectious diarrhoea. *European journal of clinical Nutrition*, 42**,** pg 420-525

Bezkorovainy, A. (2001). Probiotics: determinants of survival and growth in the gut. *Journal of Clinical Nutrition.*73, 399S ï 405S

Branca, F. and Rossi, L. (2002). The role of fermented milk in complimentary feeding of young children: lessons from transition countries*. European journal of clinical Nutrition*, 56**,**516-520

Chuayama, E, L., Ponce, C, V, Rivera, R, B and Cabrera, E. (2003). Antimicrobial activity of probiotics from milk products. *Philippine journal of microbiology and infectious Disease,* 32, pg 67. Retrieved on October 10, 2013 fromhtt://www.psm.d. Org. ph/ index.php/ journals/ vol.32, 2

Courtney, T. (1999). Hand book of statistics. Usefulness of percentiles in statistics. Macmillan publishers. New Jersey: pg 10-12

Fisher, A., Laing, T., Stoecher, J and Townsed,J, J. J. (1991).Handbook for family planning operations, research designs and sample size determination. The population Council: New York: USA pg. 43-45

Huss-Ashmore, R. (1996). Livestock, nutrition, and intra-household resource control in Uasin Gishu district, Kenya. *Human Ecology*, 24**(**2), 191-213.

KDHS, (2009). Kenya Demographic and Health Survey, **CBS, (2008**). Central Bureau of Statistics, Government of Kenya, Nairobi pg 129-140

Kothari, C.R. (2004). Research Methodology, Methods and Techniques, 2nd Ed, New Delhi: New Age International publisher, 2004, Pg. 1-2.

Lore, T. (2003). Fermented milk, good for health. Consumption of lactic acid checks growth of bacteria. Daily Nation. Retrieved October 15, 2013 fromhttp://www.Nationaudio.com/news/Daily Nation supplements

Marcello, G., Carlo A., Enrica, R., Filippo, S., Antonia R., Gian, V, Z and Giovanni, R and the Felicita study group (2007). A randomized prospective double blind controlled trial on effects of long-term consumption of fermented milk containing *lactobacillus casei* in pre-school children with allergic asthma and/or rhinitis. Department of Pediatrics [G.V.Z.], L Sacco Hospital, University of Milan, Via GB Grassi 74, I-20157 Milan, Italy.pg 18-26

Marth, E.H.and Steele. (1998). Applied dairy microbiology. New York: Marcel Dekker, inc.pg 19

Mathara, J, M. (1999). Studies on lactic acid producing micro flora in mursik and kule naoto, traditional fermented milks from Nandi and Maasai communities in Kenya. *Journal of Food Technology in Africa, pg 15.* Retrieved on 30 November 2013

Michaelsen, K, F., Weaver, L., Branca, F., Robertson, A. **(2000).** Feeding and Nutrition of Infants and Young Children in the WHO European Region with Emphasis on Former Soviet Countries. *Copenhagen, Denmark: WHO/UNICEF. WHO Regional Publications European Series, No. 87.67-75* Retrieved 5 November 2013

Miyamoto, T. (1986). Identification of properties of lactic acid bacteria isolated from traditional fermented milk beverages in E.Africa. *Journal of Food Technology in Africa,* ***6,*** *93-95.*Retrieved September 20, 2013 from http:// www.bioline.org

Mokua, A.R. (2004). Effect of Kenyan fermented milk on Escherichia coli.pg 15-19. Retrieved on 25-10-2013.www2. uw stout.edu/contents/lib/thesis/2004/2004 mokuar.pdf

Mugenda and Mugenda. (2003). Research methods: Quantitative and Qualitative approaches.pg 127-145

Mureithi, W., Christoffel, D. Edward W. Wesakania, Kuria, K. and Catherine G. (2000). Management of trees used in *mursik* (fermented milk) production in Trans-Nzoia District, Kenya. *Journal of Ethnobiology*. **20** (1): pg 75ï 91.

Miller, M., Wilks, M., Costeloe, K. (2007). Probiotics for infants? Arch Dis Child Fetal Neonatal Ed. (88):F354-F358

Nakazawa, Y. and Hosono, A., (1992). Functions of fermented milks; Challenges for health sciences. Pg256-265

Ngule, C.M., Anthoney, S and Obey, J., K, (2013). Phytochemical and bioactivity evaluation of Senna didymobotriya Fresen Irwin used by the Nandi community in Kenya" *International Journal of Bioassays* **2** (7): pg 1037ï 1043. Retrieved 30 November 2013

Pedone, C., Bernabeu, A., Postaire, E., Bouley, C., Reinert, P., (1999). The effect of Supplementation with milk fermented by Lactobacillus casei (strain DN-114 001) on acute

diarrhoea in children attending day care centers. *International Journal of Clinical Practice* 53:pg 179ï 184

Ritchie, J., & Lewis, J. (Eds.). (2003). Qualitative Research Practice - A Guide for Social Science Students and Researchers, London: SAGE Publications.pg 65-73

Saavedra, J. M., Abi-Hanna, A., Moore, N., and Yolken, R. H. (2004). Long-term consumption of infant formulas containing probiotic bacteria: tolerance and safety. *American Journal of Clinical Nutrition,* 79 (2), 261-261

Salminen, S. And Von Wright, A. (1998). Lactic acid bacteria: microbiology and functional aspects. 2nd Ed. New York: Marcel Dekker, Inc.pg 237-246

Samet, B., Moni, E. and Dhouib, A. (2012). Characterization of typical Tunisian fermented milk, Leben. *African Journal of Microbiology Research* Vol. 6(9), pp. 2169-2175.

Sanders, M, E. (2000). Considerations for use of probiotic bacteria to modulate human health. *The Journal of Nutrition* 130 (2S Supplementary): 384Sï 390S. Retrieved 14-05- 2013

Savadogo, A. and Traore, A. S. (2004). Antimicrobial activities of lactic acid bacteria strains isolated from Burkina Faso fermented milk. *Journal of Environmental and Public Health*

Volume 2009 (2009), Article ID 678495, pg 113-22. Downloaded from http://dx.doi.org/10.1155/2009/678495 on Nov 01, 2013

Tamime, A.Y. (2002). Fermented milks; a historical food with modern applications; A review*, European journal of clinical Nutrition,* 56, S2 S15

Techno Serve Kenya, (2008). The dairy value chain in Kenya- Nairobi.pg 17-25

Wyatt, A. (2011). Thesis: Exploring the relationship between Infant and Young Child Feeding practises and level of dairy production among smallholder dairy farmers in Rift Valley, Kenya.pg 27-29.downloaded on June 4, 2013.

APPENDIX 1*:* CONSENT TO CONDUCT INTERVIEW

FACTORS INFLUENCING CONSUMPTION OF TRADITIONALLY FERMENTED MILK (MURSIK) AND HEALTH OUTCOMES AMONG PRESCHOOL CHILDREN (1-5YRS) IN KAPSERET LOCATION-UASINGISHU COUNTY

Hello, My name is_____. I am a student at the University of Nairobi doing Master of Science in Applied Human Nutrition. In order to get information about consumption patterns of mursik, aim conducting a survey in this area and your household has been selected by chance from all households in this area.

The information you provide will be useful in establishing factors affecting the consumption of mursik in your community in general. A copy of this report will be submitted to your community Nutrition leaders who may use it for Nutrition education projects in this area.

All information you give will be confidential. The information will be used to prepare general report but will not include any specific name. There will be no way to identify that you are the one who gave the information. We encourage you to participate in this study and your cooperation will be highly appreciated.

If it is okay with you, may i proceed to ask you some questions related to mursik consumption among preschool children in your household?

Respondent agreed to be interviewed _____ 1= Yes 2 = No

Signature of interviewer _____ Date_____

APPENDIX 2: QUESTIONNARE: GENERAL INFORMATION OF KAPSERET LOCATION – JULY/SEP-2, 2013

FACTORS INFLUENCING CONSUMPTION OF TRADITIONALLY FERMENTED MILK (MURSIK) AND HEALTH OUTCOMES AMONG PRESCHOOL CHILDREN (1-5YRS) IN KAPSERET LOCATION-UASINGISHU COUNTY

Questionnaire no: _____ Household number _____

1. Date: ___/____/____ (Day/Month/Year)
2. Team Number: _____
3. County: _____
4. Constituency/District: _____
5. Location: _____
6. Sub-location: _____
7. Village: _____
8. No. of years in homestead_____

SECTION 1: HOUSEHOLD DEMOGRAPHIC PROFILE

No.	Name(First name only)	Age	Sex	Marital Status	Rshp to HH Head	Education Level	Occupation	Contribution. to HH Income
1.								
2.								
3.								
4.								
5.								
6.								
7.								
8.								
9.								
10.								

CODES

Educational Level

0= none
1= preschool
2= Primary
3= Secondary
4= Beyond Secondary
5= Adult literacy

Relationship to hh head
1=household head 2= wife
3=Daughter/son 4=others

Marital status
1= married 5= separated
2= Single 6= Not applicable
3= Divorced
4= Widowed

Occupation
1= Employed
2=Business
3=Farming 4=casual labor

Sex
1=male
2=Female

SECTION 2: FOOD SECURITY AND LIVELIHOODS

2.1Do you have your own farm? 1=Yes 2=No

2.2 If yes, what is the size in acres? 1=< 1 acre 2= between (1-4) acres 3= > 5 acres

2.3 What is **your main source** of livelihood activity?

1=Farming 2= Livestock keeping 3=Employment 4=Casual labor 5=Business 6=others (specify)

2.4 What is/are **your main** source of **income?**

1= Sale of livestock products (milk) **2= Sale** of livestock 3= Sale of crops 4=Employment

5=Casual labor 6= other (specify)

SECTION 3: FOOD CONSUMPTION QUESTIONNARE –Fresh Milk production and consumption (Use HH measures e.g. cups, spoons)

(This section is to be answered by the caregiver/ HH head)

3.1 Age of the primary caregiver/HH head_____ Yrs

3.2 Relationship to the HH_____ 1= mother 2=maid 3=relative 4=Father

3.3 Level of education_____ 1=none 2=primary 3=secondary 4=Tertiary

3.4 How old is this homestead? 1=Less than 5 yrs old 2=More than 5 yrs old

3.5 Do you keep lives stock? (If no, skip to 3.7) 1= Yes 2= No

3.6 Do you produce your own milk for HH consumption? 1=Yes 2=No

3.7. (If not, then) Where do you get milk for HH consumption 1=Buy 2= from neighbors, relatives etc

3.8 If own milk production, then what is your;- (Skip to 3.8.3, if milk is bought)

3.8.1. Total HH milk production/day

1= < 5 lt 2= > 5 lts_____ 3= other_____

3.8.2 Total milk sales/day

1=< 5 lts _____(cups 2= >5 lts _____

3.8.4. Total average HH milk consumption in tea, uji, ugali etc/day

1=<2lts_____ 2= >3 lts_____

3.8.5. Total milk (fresh) consumption/child < 5 yrs old/day

1 = < 1cup (0.35lts) _____ 2 = 3cups (1 lt _____ 3 = > 3 cups (> 1 lit) _____

3.8.6.Total milk (fresh) consumption/child (5-12 yrs) old/d

1=< 1 lt _____ 2=>2 lts _____

3.8.7.Total fresh milk consumption/Adult>12yrs/day

1=< 1ltr _____ 2=> 1ltr_____

SECTION 4.0: HOUSEHOLD MURSIK PRODUCTIONS AND CONSUMPTION

4.1 Do you prepare mursik in your household? (If no, skip to 4.13)

1=Yes 2=No

4.2 How long does it take to prepare mursik (i.e. before fermentation)?

1= 1day 2=2-3 days 3= 4 -7 days 4= others

4.3 If yes, what is the total household mursik production (when prepared)?
1=< 5 litres 2=> 5 litres

4.4 Do you feed children < 5 yrs with mursik?
1=Yes 2=No

4.5 If **yes**, how often do they consume it?
1=Daily 2= Once a week 3= Once a month

4.6 If yes, what is the total mursik consumption/child< 2 yrs/day?
1=< 1cup 2=between 1-2cups 3=over 2 cups

4.7 If yes, what is the total mursik consumption/child 3-5 yrs old/day
1=< 1cup 2=between1-2 cups 3=over2 cups

4.8 If your child consumes mursik, does he/she consume with other foods?
1=Yes 2=No

4.9 Give an approximate amount of mursik consumed by an adult (>5yrs)/day
1=2cups 2=> 2cups 3= others

4.10 Are there any other persons preferentially fed with mursik? 1= Yes 2= No

4.11 If yes, then who are they? 1=Pregnant mothers 2= Head of HH 3= Elderly person

4= Sick person 5= others (specify)

4.12 What are the reasons for preferential consumption of mursik in 4.11? (Respondent to state all)_____

4.13 If **No** in 4.4(Do not feed children with mursik), then what are the reasons?

1= No milk 2= donôt know why 3= children donôt like it 4=donôt have cows

5= Mursik is for adults only 6= donôt know how to prepare mursik

7= mursik preparation is tedious

Section 5: knowledge – (Indicate level of education of respondent) _____

(Read the question and choices provided to the respondent and mark according to the response given. Award marks as follows;
(marking scheme)

One correct or no response - Low nutritional knowledge

Two correct response - Average nutritional knowledge

>Three correct response - High nutritional knowledge

5.1. What is **the physical** difference between fresh milk and mursik?

1= fresh milk lighter 2= fresh milk is white 3=Mursik is thick 4=mursik has blackish/grayish specs

5.2. What could be the reason/s for fermenting milk?

1= to preserve milk 2=improve its flavor 3= Erase smell of fresh milk 4=to enrich with vitamins/nutrients

5.3. Which one among fresh milk, mursik and mala keeps for longer period

1=UHT milk, 2=mursik 3=mala 4= All

5.4. In your opinion, is there **any nutritional** difference between fresh milk and mursik?(Respondent to state any two) _____

5.5. Among the listed components (nutrients), which ones are contain in mursik

1=Fat 2= Protein 3= sugars 4= vitamins

5.6. In your opinion, which one between fresh milk, mursik and mala makes your child healthier?

1=mursik 2= fresh milk 3= mala 4= all

5.7. In your opinion, what could be the reasons for consuming mursik?

1=Satisfying 2=Tastier 3=makes child/ person strong 4=It has medicinal properties

5.8. What can you say about the black charcoal in mursik?

1= It Impart flavor 2=preserve mursik 3= Give a better color of mursik 4=Remove bad smell of gourd

5.9. What are some of the health problems/diseases that can be suppressed by consuming mursik.

1=Diarrhea 2= stomach ulcers 3= cancer 4= heart diseases

5.10. Do you know of any health problem caused by excessive consumption of mursik? (Respondent to state)_____

General comments

1. In your opinion, do think mursik is a healthy food for children less than 5 yrs old?_____

2. Do you have any additional comment that you would like to make about this study? __

SECTION 6: MORBIDITY AND HEALTH OUTCOMES

8.1 Has your child suffered from any illness in the past one month?

1= Yes 2=No

8.2 If yes, then which disease/symptoms was he/she suffering from?

1=Fever 2=Diarrhea 3=Vomiting 4=Persistent stomach pains 5=others (specify)

8.3 What action did you take?

1=Took child to hospital 2= Used herbal medicines 3=Bought drugs from shop

4=Gave **mursik** to drink 5= none

8.4 Which are the most common diseases affecting children in this community?

1=Fever 2=Diarrhea 3= Colds/flu 4=coughs 5= persistent abdominal pain

8.5 Have you noticed any relationship between diarrhea in children or adults and consumption of mursik? 1=Yes 2= No

8.6 How common would you say this is in; A. Adults; 1=Very common 2= Not common

B. Children 1= Very common 2= Not common

APPENDIX 3: FGD DISCUSION /QUESTION GUIDE

FACTORS INFLUENCING CONSUMPTION OF TRADITIONALLY FERMENTED MILK (MURSIK) AND HEALTH OUTCOMES AMONG PRESCHOOL CHILDREN (1-5YRS) IN KAPSERET LOCATION-UASINGISHU COUNTY

1. Date of interview_____2. Duration : 1 hr 30 minutes

3. Village_____ Location_____

4. Name of moderator/Facilitator_____

6. Names of notes takers_____, _____, _____

7. Team members (Number):-_____,

8. Introduction

The facilitator and notes takers introduce themselves to the participants who in turn will do the same before the start of discussion .Facilitator clarifies to the FGD members that what they are discussing is purely for study purposes and would like every member to contribute towards the topic. Notes taking will be done by two enumerators, who will later compare notes and put them together. The facilitator will guide the discussion so that every member of FGD can have a chance to express what she knows about the topic, and it is important to clarify that there is no wrong or right answer but members are only required to give representative views related to the topic.

Milk-discussion (Fresh)

At the moment, how many of us own milking cows?

If not, then where do you get milk for HH use? (Probe- if from purchases, then how much/day)

If own production, then how much/ day?

Of the total milk produced/ day, how much is kept for HH consumption?

Of the total milk for HH consumption, how much is kept for other uses? (Probe further e.g. **(**Drinking, Making tea, uji, mursik preparation etc and approx. amounts in cups)

Of the total milk produced, how much do you sell/day in the morning & evening?

In cases of excess household milk production, what do you do? (Probe whether this translates to increased consumption, mursik preparation, or sales)

In your opinion what are the causes of household milk shortage? (Probe whether it is due to; lack of milking animals, no land, no feeds, etc)

Mursik-discussion

Ask the members if they know what mursik is, and if they prepare in their HHS (Probe-Let members explain in own words)

Let them explain the difference between fresh milk and mursik in their own words

Do you know how to prepare mursik? (Let the respondents state a step-by-step methods of mursik preparation till good quality *mursik* is produced, all tools used & why, importance of charcoal in preparation, trees for milk treatment and why these types of trees, how do select the trees and who intensifies them?

How long does it take to prepare mursik? (Preparation of tools to initial stage of fermentation)

Who are the frequent consumers of mursik? (Probe-Let members group this consumers according to age, sex, special cases etc and why. Do they consume with other foods or not?

Between children < 5 years, pregnant mothers and elderly men, who consume mursik more?

What could be the reasons for differences seen above? (Probe why do others consume less or not at all)

Do all children consume mursik? If not, then what could be the reasons (Probe further if it be due to taste, smell, color, and caregiversô nutritional knowledge of Mursik, perceptions or attitudes?)

If children consume mursik, do they consume with other foods? (Probe which foods).

What are some the health benefits of mursik? (Let members explain in their own words).

Let the members discuss in detail any known disease/symptoms that may be controlled by consumption of mursik or any adverse effects of excessive consumption of the product. (Probe the association between mursik and occurrence of diarrhea, cancer, Ulcers, heart disease, GI infections etc)

What are the differences between children, adults who take mursik & those who donâ? (Let members describe their physical appearance)

Do you have any other comment which may beneficial to this study?_____

After the discussions, the participants will be thanked for their participation and contribution to the discussion and promised that the findings will be availed to their local administration when complete.

APPENDIX 4: KEY INFORMANT DISCUSSION GUIDE

FACTORS INFLUENCING CONSUMPTION OF TRADITIONALLY FERMENTED MILK (MURSIK) AND HEALTH OUTCOMES AMONG PRESCHOOL CHILDREN (1-5YRS) IN KAPSERET LOCATION-UASINGISHU COUNTY

Duration: 1½ hrs

Date of interview_____, Informant No_____

Location_____, Village_____

Number of years in the home state_____

Education background (If any)_____

Introduction:

Facilitator introduces his/her team to the key informant and clarify that the discussion is purely for research purposes for a Nairobi university student.

Discussions

The facilitator will explain the purpose of the discussion to the informant before engaging in the discussion .The informant will be asked to give an in-depth information on the history of consumption of both fresh milk and mursik, preparation methods of mursik including all the tools used and why they are used, categories of people who consume it and reasons why others donâ(Probe if children < 5yrs are fed with mursik), its health benefits and attributes and finally if there is any association between consumption of mursik and gastrointestinal disease prevention e.g. diarrhea, stomach pains and others like cancer, heart disease etc, the effects of excessive consumption of milk and milk products if any.

During the discussion, enumerators will take notes, which will be compared and combined together to pack-up the research. At the end of the discussion, the facilitator will thank the informant for her contribution towards the topic.

APPENDIX 5: TRAINING PROGRAM FOR RESEARCH ASSISTANTS

Aim

The aim of the training is to equip the research assistants with knowledge and skills on how to collect data using interview methods and data entry into the database.

Objectives

By the end the training, the research assistants should be able to;

Interpret the contents of the questionnaire

Describe how sampling will be done

Know the process of conducting interview

Know the ethics and code of conduct when conducting interviews

Day/Time	Topics	Teaching methods	Teaching aids	Facilitator
Day one 8.30-10.30 A.M	Introduction, aims of the study, objectives, Activity matrix for data collection, code of ethics& conduct-sampling frame& sampling-Doôs & donôts when conducting interview	Discussion &Lecture	Flip charts	Principal investigator/Researcher
10.0-11.0 A.M	**Tea break**			
11-12.30	-Go through tools, -FGD guide, Key informant guide, -Translation into Kalenjin/Kiswahili	Discussion	Flip charts, makers, Questionnaires Pencils, erasers,	Principal investigator
1.0-2.0	Lunch break			
2.0-3.30	Completion of translation	Discussion	Flip charts,questionnaire pencils, clip boards	Principal investigator
Day-two 10.0-12.30	Pretesting of questionnaire	Field exercise at Mulango village	questionnaires, pencils,erasers, clip board	Principal investigator
Lunch 1.0-3.30	Meet to discuss field questionnaires Discuss how to improve		Questionnaires,Flip charts, Makers	Principal investigator

APPENDIX 6: MAP SHOWING THE LOCATION OF UASIN GISHU COUNTY (GREEN)