HOUSEHOLD'S KNOWLEDGE, ATTITUDE AND FOOD HANDLING PRACTICES, CONSUMPTION OF TRADITIONAL FERMENTED MILK AND RISK FACTORS FOR ADULT OVERWEIGHT AND OBESITY IN ISIOLO CENTRAL SUB COUNTY

Muriungi Martin Koome

A56/75408/2014

A DISSERTATION SUBMITTED IN PARTIAL FULFILMENT FOR THE AWARD OF MASTER OF SCIENCE DEGREE IN APPLIED HUMAN NUTRITION, DEPARTMENT OF FOOD SCIENCE, NUTRITION AND TECHNOLOGY UNIVERSITY OF NAIROBI

17th November, 2016

PLAGIARISM DECLARATION FORM

Name of Student: Muriungi Martin Koome
Registration Number: A56/75408/2014
College: College of Agriculture and Veterinary Sciences
Faculty: Agriculture
Department: Food Science, Nutrition and Technology
Course Name: Master of Science in Applied Human Nutrition
Title of the work: **Household's knowledge, attitude and food handling practices, consumption of traditional fermented milk and risk factors for adult overweight and obesity in Isiolo Central sub County.**

DECLARATION

1. I understand what Plagiarism is and I am aware of the University's policy in this regard
2. I declare that this dissertation is my original work and has not been submitted elsewhere for examination, award of a degree or publication. Where other people's work, or my own work has been used, this has properly been acknowledged and referenced in accordance with the University of Nairobi's 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: _____.

DECLARATION

This dissertation is my original work and has not been presented for a degree in any other university

Signed…… Date……...

Muriungi Martin Koome

This dissertation has been submitted for examination with our approval as University of Nairobi supervisors

Signed …… Date……

Prof. Wambui Kogi-Makau

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

Signed……. Date……

Mr. Peter.O. Lamuka

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

DEDICATION

To

My fiancée; Purity Makena,

Lovely Parents; Mr and Mrs Muriungi,

Sisters and Brother

Celia Joan Makena, Rosemary Mwendwa and Moses Mutethia.

ACKNOWLEDGEMENTS

I thank God for this opportunity to express knowledge in form of a dissertation.

Special thanks to the Principal investigator Prof Wambui Kogi- Makau and Mr Peter Lamuka for their timely response, positive criticism and motivation.

I acknowledge the ER-Africa safe dairy project on health hazards caused by bacteria in African traditional fermented dairy products, a collaboration research project between the University of Nairobi, Department of Food Science, Nutrition and Technology and the Institute of Food, Nutrition and Health, Laboratory of Food Biotechnology, ETH Zurich. The study was part of capacity development and technological transfer between the two institutions.

To my lovely Parents for their emotional and financial support. I would not have succeeded without their assistance.

I am highly indebted to Isiolo county director of public health, County director of nutrition, and the county nutrition support officer-UNICEF, for their individual inputs during the data collection period.

Appreciation to research assistants Batula Halkano, Hawo Buba, Dennis Kinyua, James Loopa, Nasibo Hawo, Abdullahi Musa and the twenty-five Community health workers for their support in the data collection process.

Special Regards to the University of Nairobi, Department of Food Science Nutrition and Technology, lecturers and staff, Dr. Sophie Ngala, Mr. Dasel Mulwa, Bernard Khaliwa, Joan Waluvengo, and my fellow classmates for their support in preparation of this dissertation.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABSTRACT

Several communities' process traditional fermented milk but there is insufficient information on the knowledge, attitude and practice (KAP) related to food handling among households that produce and those that do not produce traditional fermented milk. Studies on milk consumption have linked fermented milk consumption to reducing the risk of obesity and overweight among several populations. The general objective of the study was to assess the knowledge, attitude and food handling practices among households that produce and those that do not produce traditional fermented milk and to establish the risk factors for adult overweight and obesity in Isiolo central sub county. A cross-sectional survey was carried out among households in an emerging peri-urban town in the Northern part of Kenya in January 2016. A two stage multi-cluster sampling was used to select 5 Sub-locations and 25 villages from the sampling frame. A pretested semi structured interview questionnaire was used to collect data from 423 households. Data was analysed for descriptive and inferential statistics. The prevalence of households involved in the cultural production of traditional fermented milk was 13.8%. The combined average mean knowledge, attitude and practice scores on food handling for household's that produced and those that did not produce traditional fermented milk was 56.9±17.6%, 69.8±20.2% and 57.7±16.9% respectively. However, the study found households that did not produce traditional fermented milk scored highly on the knowledge and practices items related to food handling compared to households that produced traditional fermented milk. Further analysis on the socio-demographic characteristics associated with knowledge, attitude and practices on food handling showed significant association between age, gender, residency and the educational status of study adults.

About 49.6% of adults consumed traditional fermented milk, findings on the nutritional status showed that less than half (48.6%) of adults had normal BMI scores. The prevalence of adult underweight, overweight and obesity was 21%, 18.7% and 11% respectively. In subsequent binary logistic regression analysis, female gender and households from a higher wealth index were significantly at risk of adult overweight and obesity. Rural residency, lower educational status, fewer household members and adults who did not consume pork, sausages, fish, lentils, peas, chapatti and vegetables emerged as protective factors against overweight and obesity in the study population.

The study findings indicate that age, gender, residency and educational status are significantly associated with knowledge, attitude and food handling practices. The study findings also establish sociodemographic and dietary patterns as protective factors for adult overweight and

obesity. Households need to adhere to basic hygiene principles to prevent food contamination during the preparation and cooking process while adults are encouraged to change their lifestyles by limiting the consumption of diets high in sugar, fat, salt and decrease sedentary lifestyles.

ACRONYMS AND ABBREVIATIONS

ACF	Action against hunger
ANOVA	Analysis of Variance
BMI	Body Mass Index
CDC	Centre for Disease Control
CHV	Community Health Volunteer
CI	Confidence intervals
CO_2	Carbon-iv-oxide
CVDs	Cardio Vascular diseases
FAO	Food and Agriculture Organization of the United Nations
FGD	Focus group discussion
IFRI	International Food Policy Research Institute
IHME	Institute for Health Metrics and Evaluation
IMC	International medical corps
IQR	Inter quantile range
KAP	Knowledge Attitude and Practice
KDHS	Kenya Demographic and Health Survey
KNBS	Kenya National Bureau of Statistics
LMC's	Low and middle income countries
MOH	Ministry of Health
NCD's	Non-Communicable Diseases
REA	Rural electrification Authority
SBSEC	*Streptococcus Bovis/streptococcus Equinus Complex*
SD	Standard Deviation
SPSS	Statistical package for social sciences
TFM	Traditional Fermented Milk
WASH	Water hygiene and sanitation
WHO	World Health Organization
UNICEF	United Nations Children Fund

OPERATIONAL DEFINITION

Bio-Availability: The degree/amount of nutrients from a meal that can be absorbed during digestion and absorption in the Gastro-intestinal tract.

Knowledge: An individual' understanding of any topic, including ability to remember terminologies.

Perception: Are cognitive beliefs/perceptions or attitudes that influence the behaviour or actions of an individual.

Practice: Identifiable actions of an individual in response to a stimulus.

Risk factor: Any element/characteristic or exposure of an individual such as knowledge or attitude which increases the probability for developing a health outcome such as a disease.

Spontaneous/Natural fermentation: Fermentation caused by growth of micro-organisms (bacteria or yeast) on a food substance without the addition and /or control of micro-organism.

Traditional Fermented milk: Fermented animal milk prepared by local communities through cultural processes.

Food Borne Pathogen: Any Micro-organism that may be present in either raw or cooked food and has the ability/mechanism to cause human disease or illness once ingested.

Food borne diseases: Illnesses due to ingestion of micro-organisms present in food.

Safe Food Handling: Any measures or conditions during food preparation, processing and storage aimed at ensuring food is free from disease causing micro-organisms.

Body Mass Index: An indicator of adult nutritional status measurement obtained by dividing weight in kilograms (Kg) and height in metres squared (M^2).

Underweight: A category of undernutrition classified as a body mass index of less than 18.5

Obesity: A category of over nutrition classified as a Body Mass Index of greater than 30

Overweight: A category of over nutrition classified as Body Mass Index of 25-30.

CHAPTER ONE

1.1. Introduction

Human beings have prepared fermented foods such as beer, leavened bread, cheese and sour milk since pre-historic times (William Shurtleff, 2015).Fermentation is the utilization of bacteria, yeasts and other micro-organism to breakdown complex food substances such as carbohydrates to simple organic acids (lactic acid) and gas (Co_2) under the absence or presence of oxygen. The action of micro-organism on foods yields important aspects such as enhancing the nutritional value, digestibility and keeping qualities of foods (Manas et al., 2015).

Studies of milk and dairy products on adult overweight and obesity have shown that fermented dairy products play a significant role in body weight redution by depleting adipose tissues due to the action of calcium, vitamin D, casein, whey proteins and trans-palmitoleic acids (Catherine et al., 2013; Francesco et al., 2014). However, most traditional fermented milk products are produced through spontaneous fermentation giving rise to variations in quality and stability (Abeer et al., 2009). The microbial safety of traditional fermented milk has been evaluated with several studies isolating food borne pathogens such as *Coli formers, Escherichia Coli* and *Staphylococcus aureus* which are indicator micro-organisms for poor hygiene and sanitation (Swai and Schoonman,2011). Recent studies on fermented dairy products in East and West Africa have isolated the SBSEC (Streptococcus Bovis/Streptococcus Equinox Complex) family of bacteria's that have been linked to colon cancer in humans (Jans et al., 2013; Juan et al., 2008).

Overweight and obesity may pose serious health risks to adults, since there has been a direct link to non-communicable diseases such as cancers, diabetes, cardio vascular diseases, osteoarthritis, gall bladder and hypertension (WHO, 2014). Global trends show an increase in cases of overweight and obesity over time. Global reports for the year 2014 showed that around 1.9 Billion or 11.1% of adults were either overweight or obese compared to 8.9% for the year 2010 (IFPRI, 2015). Kenyan statistics do not differ much either, country reports for the year 2013 showed that 30% and 34.1% of male and female adults were overweight (IHME, 2014).

The increasing trend of adult obesity and overweight has had adverse health impact and seen a recent upsurge of NCDs globally (WHO, 2014). Non-Communicable diseases are on the rise with a paradigm shift from the developed countries to the low and middle income countries (Manuel et al., 2015). NCDs accounts for more than 63% of global mortality (WHO, 2014).

Diabetes, cancer, cardiovascular diseases (CVD's) and chronic respiratory diseases are some of the major contributors of NCD's globally and within the country (MOH, 2015). The four major behavioural risk factors accountable for the high rise in NCDs are alcohol and tobacco use, sedentary lifestyles and unhealthy diets (WHO, 2014). Unhealthy diets are diets high in calories, salt, refined sugars and fats. Excessive intake of diets high in fats and sugars may lead to the deposition of fat in the adipose tissues and might cause overweight or obesity conditions (WHO, 2014). Therefore, the critical role of milk and dairy products on adult nutrition status is important with reference to hygiene and sanitation of traditional fermented milk during the preparation process.

1.2 Problem Statement

Several pastoral communities in Isiolo produce traditional fermented milk. However, numerous studies have found significant levels of food borne pathogens that cause food borne disease in traditional fermented milk processed in the region. Poor household's knowledge, attitude and practices on appropriate food handling could be a risk factor for food borne diseases in traditional fermented milk. Consumption of fermented milk has been linked to lowered risk of adult overweight and obesity due to the depletion of excess adipose tissue. The excess adipose tissues are as a result of the consumption of unhealthy diets that are characterized by diets high in calories, salt, refined sugars and saturated fatty acids.The current study therefore seeks to determine the knowledge, attitude and food handling practices among households that produce and those that do not produce traditional fermented milk and to establish the risk factors for adult overweight and obesity in the study population.

1.3 Rationale

Statistics indicate that over 75% of the Kenyan population consume fermented milk (Njarui et al., 2011). Majority of the Kenyan population live in rural areas characterized by inadequate hygiene and sanitary conditions, low income levels, high illiteracy levels and adherence to unsafe food preparation methods (World Bank, 2009; Trade Economics, 2015), such prevailing conditions could jeopardize the safety of traditional fermented milk produced in the region. Diarrhoea from food borne pathogens accounts for over 4% of global deaths annually, and claims more than 2.2 million people globally and about 1.5 million children under the age of five years from developing nations (Christa, et al., 2011; WHO, 2015). Therefore, there is need to assess the knowledge, attitude and food handling practice at the household level with a specific focus on households involved in the cultural production of traditional fermented milk.

1.4 Aim

The aim of the study was to contribute towards improving the safety of traditionally fermented milk and knowledge generation on optimum nutrition practices.

1.5 Purpose

The purpose of the study was to provide information on household's knowledge, attitude and practices on food handling and to establish the risk factors for adult overweight/obesity. The findings can be used to provide information to households on proper food handling to prevent food borne diseases and create awareness on optimum nutrition practices to prevent overweight and obesity among adults in Isiolo central sub county residents

1.6 General objective

To assess the knowledge, attitude and food handling practices, and establish the risk factors for adult overweight and obesity in Isiolo central sub county.

1.7 Specific objectives

1. To determine the socio-demographic characteristics of households that produce traditional fermented milk in Isiolo Central sub county.
2. To assess the cultural practices in the preparation and storage of traditional fermented milk in Isiolo central Sub county.
3. To assess knowledge, attitude and food handling practices among households that produce and those that do not produce traditional fermented in Isiolo central sub county
4. To establish association between socio-demographic characteristics and knowledge, attitudes and food handling practices among households that produce and those that do not produce traditional fermented milk
5. To determine the socio-demographic and economic characteristics of Isiolo central sub county residents.
6. To assess morbidity patterns and physical activity status of adults in the study population
7. To determine dietary patterns and consumption of traditionally fermented milk by adults in the study population
8. To assess the nutritional status of adults in the study population using Body Mass Index (BMI) and Waist-Hip Ratio.

9. To establish the risk factors for adult over weight and obesity

1.8 Research questions

1. What are the socio-demographic characteristics of households that produce traditional fermented milk?
2. What are the cultural practices in the preparation and storage of traditional fermented milk?
3. What is the knowledge, attitude and food handling practices among households that produce and those that do not produce traditional fermented?
4. Is there an association between socio-demographic characteristics with knowledge, attitudes and food handling practices among households that produce and those that do not produce traditional fermented milk?
5. What is the socio-demographic and economic characteristics of Isiolo central sub county residents?
6. What are the morbidity patterns and physical activity status of adults in the study population?
7. Which are the dietary patterns of residents in Isiolo central sub county?
8. What is the nutritional status of adults in the study population using Body Mass Index (BMI) and Waist-Hip Ratio?
9. What are the risk factors for adult overweight and obesity in the study population?

1.9 Hypothesis

H_o: There is no significant association on the knowledge, attitudes and food handling practices among households that produce and those that do not produce traditional fermented milk.

H_o: Consumption of traditional fermented milk, socio-economic and demographic characteristics, morbidity patterns, physical activity status and dietary patterns are not significant risk factors for adult for adult overweight and obesity in Isiolo central sub county.

2 CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction to safe food Handling

Milk fermentation is the utilization of bacteria, yeasts and other micro-organism to breakdown complex substances such as carbohydrates to simple organics acids (alcohols) and gas (carbon IV oxide) under the absence or presence of oxygen. Milk fermentation in pastoral regions is not a new invention as the practice has been handed down to subsequent generations over time (Mathara et al., 2004).

2.2 Food handling practices

Studies indicate that unhygienic preparation of food is the main cause of food borne disease within households (Motarjemi and Nout, 1996). The WHO developed the five keys to safe food as a guideline for food handlers to ensure food prepared is safe for consumption (WHO, 2010). The key messages sensitize food handlers on keeping the food environment clean, separating raw and cooked foods, keeping foods at the right temperatures and using safe water/raw materials for cooking.

A study in a residential community in Singapore found that washing hands with or without soap was a protective factor against diarrhoeal episodes (Pang et al., 2015) while another study on food borne illness from four districts in India reported that lack of sufficient information on handwashing was a precursor to food borne illness (Gnanasumathi and Ramesh, 2014).

A study on food safety at home in Italy consequently found that cooked food could be contaminated during the preparation process through cross contamination by juices from raw or fresh foods (Elisa et al., 2012) while a similar study on food safety in Turkish residential colleges reported the use of separate kitchen utensils or equipment's for raw and fresh foods during preparation and storage prevented cross contamination (Siow and Norrakiah, 2011).

Improper practices such as leaving foods at room temperatures for more than two hours could result in accumulation of food borne pathogens enough to cause illnesses as reported by (Hillers et al., 2003) while improper storage of cooked food was also reported to cause food borne diseases (Subbulakshm et al., 2012).

The use of safe water and raw materials during food preparation averts contamination of food by pathogenic micro-organisms and toxic chemicals (WHO, 2010). Cultural practices such as the use of raw milk to produce fermented milk products such as cheese or sour milk from raw

milk have been linked to transmission of major food borne pathogens (Abeer et al., 2013; Abebe et al., 2013 and Omore et al., 2005) while luck of clean water for washing utensils and kitchen equipment's was found to cause low microbial standards for fermented products in Southern Ethiopia (Abebe et al., 2013).

Several authors have highlighted the risks associated with utilization of plastics materials to store fermented dairy products with health risks such as the rapid build-up of food borne pathogens and difficulties during the cleaning process (Swai and Schoonman, 2011; Omore et al., 2005). Therefore, foods prepared by households should follow basic hygiene principles to prevent food borne disease due to unsafe food handling procedures.

2.3 Socio-demographic characteristics and KAP assessments on food safety

Studies on socio-demographic factors associated with knowledge, attitude and food handling practices have been conducted extensively (Patil et al., 2005). The most significant socio-demographic characteristics discussed include; age, gender, educational status and residency.

A study by (Mohd et al., 2015) showed that the level of knowledge and practices on food safety increased with increase in age, indicating that young food handlers were more at risk of causing food borne disease compared to older respondents. Nearly similar findings were reported by (Rahman et al., 2012; Amy et al., 2011 and Fein et al., 2011). Probable reasons as suggested by (Siow and Norrakiah, 2011) was that older food handlers had greater experience on handling food properly, however a study in Ghana on food handling showed that age did not influence the knowledge and practice by food handlers (George et al., 2011).

A meta-analysis on consumer awareness on food safety in middle east countries showed that gender influenced the knowledge, attitudes and food safety practices (Patil et al., 2005), the study found that majority of males did not observe hygiene as compared to females. A similar study on food safety showed that females exhibited appropriate food handling practices compared to males (Fein et al., 2011), however (Gul, 2012) found insignificant differences between gender and knowledge/practices on food handling.

Higher educational status has been frequently associated with increased awareness on knowledge and practices on food handling (Seaman, 2011; Gnanasumathi et al., 2014 and Sudershan et al., 2008); nevertheless, (George et al., 2011 and Subbulakshm et al., 2012) found insignificant differences between education level and appropriate knowledge on food handling practices. Reasons for educated individuals not adhering to proper food handling practices and reporting low level of attitudes on food safety have been discussed in a study on the

consumption of raw oysters which found that participants who were well educated and from a higher wealth category consumed raw oysters since they were expensive and considered a delicacy and reserved for consumers from a higher wealth category (Klontz et al., 1991).

Very few studies implicate the association between residency and knowledge/ practices on safe food handling although a study by (Subbulakshm et al., 2012) showed rural households with respondents who could read and write obtained higher mean knowledge scores on food safety compare to those could not read or write. However, the use of KAP assessments to obtain information regarding food safety has some strengths and weakness.

2.4 Review of KAP methodology

KAP assessments have been used to assess and understand various health aspects in Africa since the 1960s (Schopper et al., 1993). Currently, KAP methodologies are used to plan and manage programs or assess the impact of interventions in different rural communities (Annika, 2009). A KAP survey is not a stand-alone methodology but should be viewed as a pathway or guideline for clarifying human behaviour (Rahman et al., 2012), it is recommended that KAP surveys should be used in combination with other data collection methods such as focus group discussions (FGD) and key informant interviews (Annika, 2009). A major drawback of KAP assessments is the social desirability bias and recall biasness (Amy et al, 2014 and Tolulope et al., 2015) but studies have shown that properly trained research assistants can avoid social desirability bias during the data collection (Tolulope et al., 2015).

2.5 Risk factors for adult overweight and obesity

2.5.1 Determinants of adult nutritional status

Several socio-demographic characteristics play important role as determinants to adult nutrition. Studies have indicated that BMI is significantly associated with age (Wanjiku et al., 2010). A study on the risk factors associated with cardiovascular diseases in a transition population in an urban town in Kenya found that the prevalence of obesity fell sharply with age (Wanjiku et al ., 2010) while another study on the double burden of malnutrition among the urban poor in Nairobi, the capital city found the proportion of obese and overweight adults increased steadily with age and was highest within the age group of sixty years and above.

Studies have also highlighted the association between gender and adult nutritional status among the Kenyan population (Jayne et al., 2011), females were found to be more overweight and obese as compared to men. National records show that the proportion of underweight males

is higher than women, nevertheless, there are more women who are overweight and obese compared to men in the country (MOH, 2015).

Residency has also been considered a contributing factor to the recent upsurge of childhood and adult obesity and overweight (FAO, 2004). The likelihood of obesity and overweight in urban populations is greater compared to the rural population. This has been linked to dietary lifestyles characterized by consumption of diets rich in fats and sugar and diets low in dietary fibre (Manuel et al., 2015), other contrubuting factors such as increased sedentary lifestyles have been linked to urbanization (Milton and Macniven, 2014); nevertheles, technological equipments and advancement such as television,computers and home wifi networks have encouraged sedentary lifestyles in urban populations leaving little or no avenues for physical activities (Milton and Macniven, 2014).

Majority of rural population have greater access to diets rich in fruits and traditional leafy vegetables, indigenous cereals and pulses (Matthew et al., 2016), consequently,there are better avenues for physical activity in rural areas such as farm work,livestock grazing amongst other activitities that ensure the rural population have adequate opportunities for physical activities (Hallal , et al., 2012).

Educational status is also major determinant to adult nutritional status. A study on the double burden of malnutrition in the country reported that the proportion of underweight and obese adults increased with increasing educational status, nearly similar trends were reported in several sub-Saharan countries (Ziraba et al., 2009;Murage et al., 2015).

Therefore, determinants of adults nutritional status is a complex mixture of factors which determine the nutritional status.

2.6 Milk, dairy products and adult overweight /obesity

The role of dairy products in human nutrition has been conducted widely with several studies highlighting significance beneficial factors derived from the consumption of both fermented and unfermented milk (Dugan and Fernandez, 2014). Observational studies on milk consumption and metabolic syndrome such as obesity in young adults showed that consumption of less than 35 servings of dairy products per week lowered the risk of metabolic conditions by 72% (Pereira et al., 2002) while another study on the Americn population found that consumption of greater than 2 servings of dairy products per day lowered the risk of developing metabollic syndromes such as diabetes by 11% compared to those with low dairy intake. Systematic studies on fermented milk consumption and metabolic syndromes such

as obesity have recently shown that about 3-4 servings of dairy products either fermented or unfermented decreases the risk of developing metabollic conditions by 29% as compared to 2 servings per day (Tremblay and Gilbert , 2009).

However, most observational studies suggest that consumption of dairy products may have a protective factor against metabollic syndrome (Dugan and Fernandez, 2014), but there are inconsistencies; some studies have recently failed to establish significance association between milk and metabollic conditions such as obesity (Beydoun et al., 2008), but a positive association between cheese intake and metabollic syndrome emerged as protective factors in the study (Beydoun et al., 2008). In another study on middle aged koreans,the daily dietary intake of dairy products was found to be a protective factor against metabollic syndrome due to the association of dairy consumption and decreased central obesity (Beydoun et al., 2008).

2.7 Adult nutritional assessment methods

2.7.1 Body mass index

Body mass index (BMI) is a measurement obtained by dividing weight in kilograms (Kg) and height in metres squared (M^2). BMI is an indicator of adult health status assumed to be a direct reflection of dietary adequacy other than other factors such as infections, cultures, habits or appetite (WHO, 2015). BMI is mostly used to monitor adult health and nutritional status in socio-economic deficit regions since a low BMI can be a basis for targeting nutrition or health specific interventions or evaluation of interventions (WHO, 2000). A major critique of BMI is its insensitivity to different body composition due to ethinic differences hence some populations migh be considered overweight yet they are healthy or vice versa (WHO, 2000).

2.7.2 Waist-hip ratio

Waist hip ratio is a measurement obtained by dividing the waist circumference by the hip circumference (WHO, 1995). A waist hip ratio of 0.9 in men and 0.8 in women is considered safe but as the ratio increases it further doubles the risks associated with obesity related conditions. Waist Hip ratio is used to identify individuals at risk of obesity related conditions due to excess fat accumulation in the abdominal region also known as central or abdominal obesity. Central obesity is associated with increased cardiovascular diseases, type 2 diabetes and premature deaths in both men and women (WHO, 2008). The WHO recommends that the utilization of waist hip ratio for anthropometry should not be to predict mortality but rather to prevent and predict disease burden and assess interventions addressing the disease burden (WHO, 2008).

2.8 Gaps in knowledge

Several studies in the country are focused on food safety along the market value chain of agricultural products but there exists insufficient information on Knowledge, attitude and food handling practices among pastoral households yet sufficient evidence exists which implicate foods prepared by households to be a major source of food borne illnesses due to improper safe food handling practices; consequently, majority of the studies in the country are focused on nutritional status of children but there is insufficient information on the risk factors for adult overweight and obesity in an emerging peri-urban town in Kenya.

3 CHAPTER THREE

HOUSEHOLD'S KNOWLEDGE, ATTITUDE AND FOOD HANDLING PRACTICES AMONG HOUSEHOLDS THAT PRODUCE AND THOSE THAT DO NOT PRODUCE TRADITIONAL FERMENTED MILK IN ISIOLO CENTRAL SUB COUNTY.

3.1 Abstract

Several communities' process traditional fermented milk but there is insufficient information on knowledge, attitude and food handling practices at the household level. The general objective of the study was to assess the knowledge, attitudes and food handling practices among households that produce and those that do not produce traditional fermented milk. A cross-sectional survey was carried out among households in an emerging peri-urban town in the Northern part of Kenya in January 2016. A two stage multi-cluster sampling was used to select 5 Sub-locations and 25 villages from the sampling frame. A pretested semi structured interview questionnaire was used to collect information from 423 households. Data was analysed for descriptive statistics while chi-square tests and Anova were used to establish associations between knowledge, attitude and practices scores on food handling and socio-demographic characteristics. The combined mean knowledge, attitude and practice scores on safe food handling for household's that produced and those that did not produce traditional fermented milk was 56.9$\pm$17.6%, 69.8$\pm$20.2% and 57.7$\pm$16.9% respectively. Further analysis on the socio-demographic characteristics and KAP scores showed significant association between gender, residency, and educational status. The study findings indicate that age, gender, residency and educational status are significantly associated with knowledge, attitude and food handling practices. There is need to inform households that produce and those that do not produce traditional fermented milk on basic hygiene principles.

3.2 Introduction

Safe food handling is any measure or condition during food preparation, processing and storage aimed at ensuring food is free from food borne pathogens (FBP). Recent statistics indicate that nearly 1 in every 10 persons falls ill due to consumption of foods contaminated with FBP while 420 million people die annually due to more than 200 illnesses associated with unsafe foods (WHO,2016). Children below the age of five years are the most affected since they contribute to over 40% of global mortality (WHO,2016). The most common disease associated with unsafe food consumption is diarrhoea which claims about 92,000 children and 220,000 adult lives annually (WHO, 2016). Many countries continue to bore the brunt of food borne diseases with increased budgetary expenditures on health (Subbulakshm et al., 2012) yet most food borne diseases are caused due lack of adherence to basic food hygiene principles (Mendagudali et al., 2016 and Tolulope et al., 2015).

3.3 Problem statement

There exists insufficient information on Knowledge, attitude and food handling practices among pastoral households that produce traditional fermented milk in Isiolo county. The microbial safety of traditional fermented milk has been evaluated with several studies isolating food borne pathogens that are indicators of food contamination, the study seeks to assess the knowledge, attitude and food handling practices among households that produce and those that do not produce traditional fermented milk.

3.4 General objective

The aim of the study was to contribute towards improving the safety of traditional fermented milk and knowledge generation on food safety in Isiolo Central Sub-county. The general objective was to determine the knowledge, attitude and food handling practices among households that produce and those that do not produce traditional fermented in Isiolo Central Sub County. The following activities were conducted under the general objective: -

I. Assessment of socio-demographic characteristics of households that produced traditional fermented milk.
II. Assessment of cultural practices in the preparation and storage of traditional fermented milk in Isiolo Central Sub County.
III. Establishment of the association between socio-demographic characteristics with knowledge, attitude and practices among households that produced and those that did not produce traditional fermented milk.

3.5 Study Setting and methodology

3.5.1 Study setting

Isiolo County was purposively selected as an ideal study setting due to reasons such as previous research undertakings on traditional fermented milk and a large livestock and milk production. Isiolo became a County in 2010 under the new Kenyan constitution having been one of the thirteen districts in Eastern Province. The new Constitution divided Isiolo County into three sub counties, Isiolo Central Sub County, Garbatulla Sub County and Merti Sub County. It borders Marsabit to the north, Garissa and Wajir to the south east and east respectively, Tana River, and Meru County to the south and Laikipia and Samburu County to the west.

The county covers an approximate area of 25,605 Km^2. Most of the county is a flat, low lying plain that receives an average rainfall of 580mm with annual temperatures of 27^0C (IMC, 2012).The major livelihood strategies in the county are livestock-based, subsistence farming, and petty trade. Livestock and agriculture-based activities contribute to over 70% of the household income in the county and more than 75% of informal employment (IMC, 2012). The main livelihood strategy is pastoralism – keeping cattle, goats, camel and donkeys. Other significant livelihood strategies are; agro-pastoral, waged labour, and firewood/charcoal. There are also semi-urban or urban settlers, whom have dropped out of the pastoralist lifestyle (IMC, 2012).

The milk industry in Isiolo County is majorly driven by camel milk production (SNV, 2010). It is estimated that Isiolo County has over 49,691camels. The camel population has increased drastically during the last two decades due to influx from other counties. It has a daily milk production of about 40,000 litres. About 45% of milking is done by herdsmen and 23.7% by male household heads (SNV, 2010).

Isiolo County has a well-coordinated camel milk dairy hub that supplies camel milk to the capital city and terminal markets. Out of the 40,000 litres, only about 5,000 litres raw milk (12.5%) is supplied to the main market in Nairobi, Eastleigh area, the rest is marketed and consumed in Isiolo town and its environs (Mwangi et all., 2013).

3.5.2 Study population

The study population comprised of adults eighteen years and older residing in Isiolo central sub county at the time of the study.

3.5.3 Study design

A descriptive cross sectional study design was used to establish knowledge, attitude and food handling practices among households that produced and those that did not produce traditional fermented milk.

3.6 Sampling

3.6.1 Sample size determination

According to the principal researcher's knowledge, there was insufficient information in the prevalence of households that produced traditional fermented milk in Isiolo central sub county, but information on traditional fermented milk consumption by households in Isiolo central sub county was available from a previous study and was used to estimate households to be sampled in the study.

A modified Sample size formula illustrated in equation 1 below was used to estimate the proportion of households that produced traditional fermented milk adopted from the Epi-tools epidemiological calculator (Sergeant, 2015) .

The following variables where keyed in the epi-tools epidemiological calculator to obtain the study sample size; the proportion of households that consumed traditional fermented milk in the region (Kaindi et al., 2012), a desired confidence interval of 0.95 and a desired precision of 0.05+, the variables yielded a sample size of 384 households and after allowing an attrition rate of 10% gave a total sample size of 423 households for sampling in Isiolo Central Sub County.

Equation 1

$$n = (Z^2 \times P\ (1 - P))/e^2$$

Z=Value from standard normal deviate corresponding to desired confidence level (Z=1.96 for 95% level of Confidence)
P=Expected true proportion of households consuming Traditional Fermented Milk in Isiolo County P= 46%)
e= Desired Precision (0.05-Half Desired Confidence width)
n = Sample Size =384
Attrition Rate: 10% x 384/100 Total sample size: 38 +384 = 423 households

3.6.2 Sampling criteria

Study participants were selected within households based on their age (18 years and older) and inclusion/exclusion criterion described below.

Inclusion criterion

1. Households with participants 18 years and older
2. Visitors who had stayed for more than two months in the household
3. Willingness to participate in the study and offer personal and cultural information.

Exclusion Criterion

1. Unwilling to participate in the study
2. Visitors who had not stayed in the house for more than 6 months in the household
3. Neighbours/passers by

3.6.3 Sampling procedure

3.6.3.1 Selection procedure

Purposive sampling was used to select Isiolo County, Isiolo central sub county and five Sub locations. A two stage multi-Cluster sampling was thereafter used to sample households and villages distributed across five sub location in the study site. Twenty-five clusters or villages with 17 households were chosen since it would yield the required sample size of 423 households although it surpassed the sample size by 2 households, but this was acceptable (Robert, 1997).

The first stage involved selection of villages from the seven sub locations. The list of villages and households from the seven sub locations were obtained from the county public health office. Proportional to size sampling was used to sample 25 villages from the sampling frame.

The second stage was to select households from villages through the segmentation method (Robert, 1997). The procedure involved enumerators subdividing villages into sections/segments based on imaginary lines, and covering the sections/quarters by visiting all the households in the sections before moving to another segment on the same village, whilst keeping the boundaries based on the imaginary lines.

Once a household had been selected for the study, the village guide/community health volunteer with assistance from the principal researcher would proceed and introduce the aim and purpose of the study to household members, however households with more than two eligible members, were given equal chances to participate through simple random sampling

exercise where an enumerator subdivided identical pieces of papers based on the number of eligible participants and labelled the pieces of papers "NO" representing those not to participate in the study and "YES" to represent the member to participate in the study. The enumerator would proceed to fold and shuffle the bit of paper and all eligible household members were allowed to pick a folded paper, unfold and display to the enumerator the choice picked, whoever picked the piece of paper labelled "YES" was enrolled in the study and the enumerator would proceed to obtain consent and then administer the questionnaire. Figure 3.6-1 illustrates the sampling scheme.

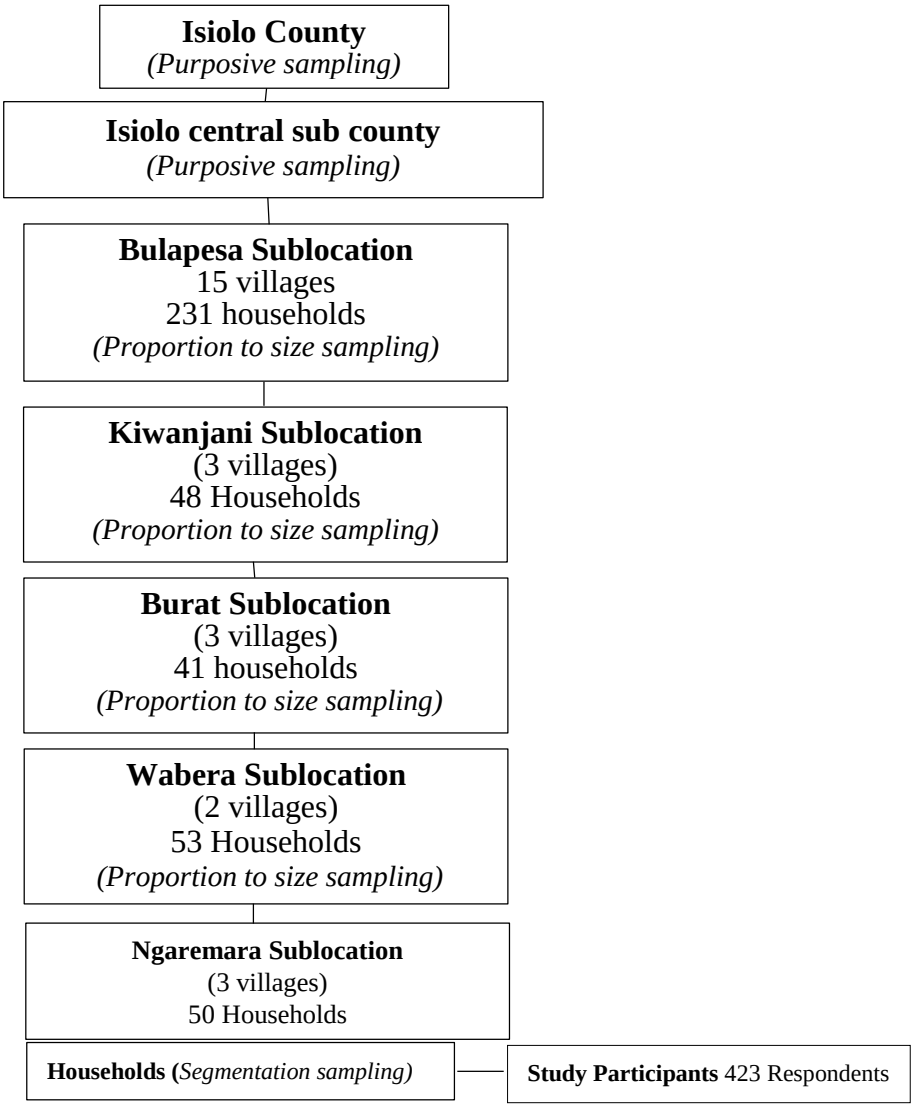


Figure 3.6-1 Sampling Scheme

3.7 Research instruments

3.7.1 Semi structured questionnaire

A pretested semi-structured questionnaire (see appendix 2) adopted from a clinical study running parallel to the study was used to collect quantitative data while two focus group discussions (see appendix 3) comprising of adults, were carried out on selected study sites to collect information on traditional milk fermentation.

3.8 Recruitment and training of research assistants

3.8.1 Recruitment

The research study required six enumerators and twenty-five community health volunteers (CHVs). Recruitment of research assistants was conducted in Isiolo town prior to the study. Advertisements (see appendix 4) seeking to recruit enumerators was displayed on public notice boards, public administration offices and health centres. Recruitment was based on applicants with a degree in nutrition, nursing or any other health sciences; previous experience in research related work with proof of recommendation letter and a good knowledge of local dialect. Out of 56 applicants, only 12 candidates qualified for the positions and the top six among the twelve were chosen to fill the position advertised. Community health volunteers served as village guides and where chosen from the villages sampled with the help of county director of public health.

3.8.2 Training

Training of research assistant was conducted by the principal researcher at Isiolo central sub county health committee conference room. The main objective of training was to ensure data collected was of high quality. The training workshop covered various aspects of the study such as background information on milk fermentation, study objectives, sampling methodology, research tools, data collection procedures, interview techniques and ethical considerations. A combination of different learning methods was used during the training workshop to enhance active participation through questions, brainstorming sessions, discussions, demonstrations, role playing and lectures when introducing new concepts by the principal investigators. (See appendix 5 and 6 for the training protocols).

3.8.3 Pre Testing of study Tools

A pilot study for pretesting the research tools was conducted among ten households in the study location but the data collected was not included in the analysis but used to refine the research tools. The pilot study exposed research assistants to practical skills on household sampling and study participant's selection. Enumerators also refined their interviewing skills during the

pretesting with supervision from the principal investigator. An evaluation of the pilot study was convened at the training venue to identify constraints encountered the activity.

3.9 Data collection procedures

3.9.1 Demographic and socio-cultural data

A semi structured interview questionnaire was used to collect information on age, gender, residency, and educational level of traditionally fermented milk producers. Information on the proportion of residents producing traditionally fermented milk was also captured in the questionnaire.

3.9.2 Cultural practices in production of traditionally fermented Milk

Information was collected on the type of raw milk used and whether raw milk was boiled before fermentation, initiation of the fermentation process, fermentation period and temperature, storage materials and temperatures of the final product. Information gathered from focus group discussions also supplemented information obtained from the study participants on cultural practices in the production of traditionally fermented milk.

3.9.3 Knowledge, attitude and practices on food handling

Assessment of knowledge, attitude and food handling practices was based on the FAOs guidelines on nutrition related KAP assessments (FAO, 2014) and the WHO five keys to safe food handling (WHO, 2010). A three point Likert's scale with a positive, negative and neutral response was used to measure the knowledge, attitude and food handling practices. An aggregate score for knowledge, attitude and practice was computed to determine the overall score on safe food handling.

3.9.3.1 Knowledge assessment

Ten knowledge items on safe food handling were classified into four categories; (1) activities that prevented contact with disease causing microorganisms, (2) Key moments to wash hands, (3) eating of leftover foods not kept in cool environment and separation of raw and cooked food (4). Each correct response was valued as a score of "1" while any incorrect response or don't know response was valued as a score "0". The denominator for the knowledge assessment test was the number of questions which were ten (10) in number. Aggregate scores for each study participant was converted to percentage by the formula below and used to indicate the level of knowledge among the study participants.

Equation 2

Percentage of Knowledge scores for study participant = $\frac{\text{Number of correct Answers}}{\text{Total Number of Questions on Knowledge -10}} \times 100$

.

3.9.3.2 Attitude assessment

For attitude assessment on food handling, five attitudinal items were classified into five categories; (1) consumption of contaminated food, (2) Diarrhoea and fermented milk, (3) hygienic handling of Fermented milk and handwashing (4). Each favourable attitude was valued as "1" while unfavourable attitudes were assigned a value of "0". The denominator for attitude assessment was the number of questions which were five (5) in number. The expected total score for all favourable items was five. Aggregate scores for each study participant was converted to percentage by the formula below and the percentages used as indicators for attitude scores in the study. A score of less than 50% was considered as an indicator of negative or poor attitude scores.

Equation 3

Percentage of Favourable attitude = $\frac{\text{Number of correct attitudes expressed}}{\text{Total Number of Questions on attitudes (5 Questions)}} \times 100$

3.9.3.3 Practice assessment

Assessment of practices on safe food handling was determined by seven practice items on (1) cleaning of utensils (2) water treatment methods (3) separation of raw and cooked foods (4) storage of perishable foods (5) personal health and hygiene (6) food handling when sick and food handling etiquette (7). Responses that were evidence based recommendations where scored as "1" while other responses scored as "0". The denominator for practice assessment test was the number of questions which were seven (7) in number. The expected total score for all evidence based recommendations was seven. Aggregate scores for each study participant was converted to percentage by the formula below and used as indicators for practice scores in the study. A score of less than 50% was considered a low score on practice assessment.

Equation 4

Percentage of practice scores = $\frac{\text{Number of correct response on practices}}{\text{Total Number of questions on practices (7 questions)}} \times 100$

3.9.3.4 Overall KAP scores

Aggregate KAP scores on safe food handling were computed by combining total knowledge, attitude and practice score and reported as a percentage as illustrated in equation 5 and used to determine the level of knowledge, attitude and practice on safe food handling.

Equation 5

$$\text{Percentage of Aggregate score} = \frac{\text{Knowledge score + Attitude score+ Practice score}}{\text{Total Number of questions on knowledge, attitude and practices (22)}} \times 100$$

3.10 Ethical considerations

A research Permit (see appendix 10) was obtained from the Kenyatta National Hospital/ University of Nairobi Ethics and Research Committee (KNH/UON-ERC). Authorization to conduct the study was obtained through a stakeholder's meeting with the health and nutrition county government personnel seven months prior to the study. The principal researcher with the research assistants were to respect the rights of the respondents and not to disclose personal information. A client informed consent form (see appendix 1) was made available for the clients to sign on his/her free will that she/he agreed to provide personal information. Findings on the study were to be shared through peer reviewed journals, policy bulletins and community feedback workshops. A copy of the dissertation would be sent to the department of Public Health and Nutrition, Isiolo County and thereafter a dissemination workshop on key research findings to the health and nutrition officials at Isiolo County and Referral Hospital.

3.11 Data quality control

Several measures were put in place by the principal investigator to ensure data collected in the study was consistence, dependable, accurate, reproducible and repeatable. The measures were applied in two stages; pre-survey and during data collection and processing.

3.11.1 Pre-survey measures

The recruitment process for the post of the research assistant's ensured that only skilled applicants were selected to conduct the study ensuring, data collected was consistence and dependable.

A two-day training workshop exposed research assistants to the study background, this ensured that the research instruments used and data collected was relevant during the entire study. During the training workshop, research assistants were trained on interview protocols to ensure information obtained from the study participants was valid and recorded accurately in the questionnaires.

A pilot study was conducted on the last day of the training to expose the research assistants to practical skills on interviewing skills, household sampling methodology and questionnaire filling ensured data collected was precise, valid and repeatable. Questionnaires were standardized based on experiences from the pre-test, making them short, and easy to comprehend for both the research assistant and study participants.

3.11.2 During data collection

The use of community health workers as village guides to introduce research assistants to households for sampling, ensured provision of accurate and reliable information from participants.

The segmentation of villages for household sampling methodology ensured all houses in the sampling frame had equally chances of being sampled thereby avoiding such biasness that could lead to sampling errors.

Random spot checks to supervise whether research assistants adhered to proper data collection protocols were conducted by the principal researcher. Procedures during data management such as data tracing where a questionnaire was given an identification number that incorporated the date of data collection, enumerator name, respondent number, ensured traceability during data cleaning procedures for missing values.

Data security management through daily collection of questionnaires and packing them in well labelled envelopes and later securing them in metallic boxes prevented the loss of questionnaires and also prevented unauthorized persons from gaining access to confidential information in the questionnaires.

3.12 Data management and analysis

The principal researcher reviewed raw data in the questionnaires by checking questionnaires were filled correctly before entering data in (SPSS) Version 20 (IBM Corporation, New Orchard, Armonk, New York, USA). Descriptive statistics such as frequency distributions and ranges were used to check for out of range or invalid values that emanated from either data entry or data collection procedures. Outliers such as missing data or invalid values were traced through the questionnaire identification number and the true value obtained from the questionnaires and filled in appropriately. Errors that emanated from data collection procedures such as out of range values were managed through exclusion from data analysis. Only two variables were identified with extreme values and exempted from analysis; respondents age and household size. Descriptive analysis such as means, mode, median, proportions,

frequencies and measures of dispersion such as standard deviations, range and interquartile range were used to analyse variables such as age, gender, education level and residency. Aggregate KAP scores on safe food handling were converted to percentages and used as indicators for knowledge, attitude and practice on safe food handling. Inferential statistics such as chi square test were used to test for significance differences between categorical data such as gender, educational status and residency while Independent t test and analysis of variance were used to establish association between the continuous dependent variable knowledge, attitude and food handling practices and the independent variables age, gender, residency and educational. A p-value of less than 0.05 and 95% level of confidence was used in the study. Qualitative data from focus group discussion was grouped according to themes and used in the discussion to describe the study findings.

3.13 Results

A total of 423 respondents consented to participate in the study. All 423 questionnaires were included in the data entry but only 408 questionnaires were analysed due to flagging procedures during the data cleaning process thereby achieving a response rate of 96.4%.

3.14 Socio-demographic characteristics

Out of 423 participants interviewed in the study, 55 (13.5%) of households prepared traditional fermented milk. Of the respondents who produced traditional fermented milk, more than half (67.3 %) were females and 32.7 % males. The mean age of respondents was 39.2 $\pm$ 16 years. Majority (66.9%) of traditional fermented milk producers were below the age of 40 years. Respondents more than 82 years old were exempted from analysis by stem, leaf plots and box plots on SPSS during flagging procedures, the mean age after exclusion of outliers was 37.0 $\pm$ 13.3 with the youngest respondent aged 18 years and the oldest 82 years. The median age was 35.0 [Interquartile Range (IQR): 26-46. To determine age differences between genders, an independent T test was used to test for differences, results showed that the mean age of female respondents was higher 37.0$\pm$ 14.0 years compared to males 36.8 $\pm$ 12.1 years but it was insignificant (Independent t test = -0.64, df 53; $p > 0.05$). Majority (69.1 %) of traditionally fermented milk producers resided in rural regions. Findings on the education status showed that almost half (49.1 %) of traditional fermented milk producers had never attained any formal education but there were more females (40%) than males (27.3 %) who had never gone to school. The mean household size for traditional fermented milk producers was 6.4 $\pm$ 2.5. Only one household had more than 11 members and was exempted from analysis, the mean household size after the exclusion of the household was 6.2$\pm$ 2.3 persons with a minimum of 2 members and a maximum of 11 members. The median household size was 6.0 (IQR: 4-8). Table 3.14-1 demonstrates the socio demographic characteristics of households that produce traditional fermented milk.

Table 3.14-1 Socio demographic characteristics of households that produce traditional fermented milk

Social Demographic Characteristics (N = 55)	Percent
Gender	
Male	32.7
Female	67.3
Residency	
Peri-Urban	30.9
Rural	69.1
Educational status	
Primary	64.3
Secondary	28.6
Post-secondary	7.1
Did not attend school	
Household size	
1-3 members	14.5
4-6 members	41.8
Above 6	43.6
Age categories	
Below 40 years	67.3
Above 40 years	32.7
Production of Traditional fermented milk (N =408)	
Households that produce	13.5
Households that do not produce	86.5

Further analysis on socio-demographic characteristics showed that education status of traditional fermented milk producers was associated with gender (Chi-square test = 10.54, df 2; p-value <0.05) with more males than females attaining post-secondary education. Educational status was significantly associated with residency. Urban residents attained higher education levels than rural residents (Chi square test = 16.02, df 3; p-value>0.001). Household size was significantly associated with the educational level of traditionally fermented milk producers, as the level of education increased the number of persons living in a household decreased (Chi square test = 16.44, df 4; p-value <0.05).

3.15 Cultural practices in the preparation and storage of traditional fermented milk

3.15.1 Type of animal milk

Majority (60%) of the respondents used cow milk in the production of traditional fermented milk while less than a quarter (21.8%) used camel milk and 14.5% goat milk. Only a few (1.8%) used a mixture of cow and goat. Figure 3.15-1 shows the type of animal milk used in the preparation of traditional fermented milk.

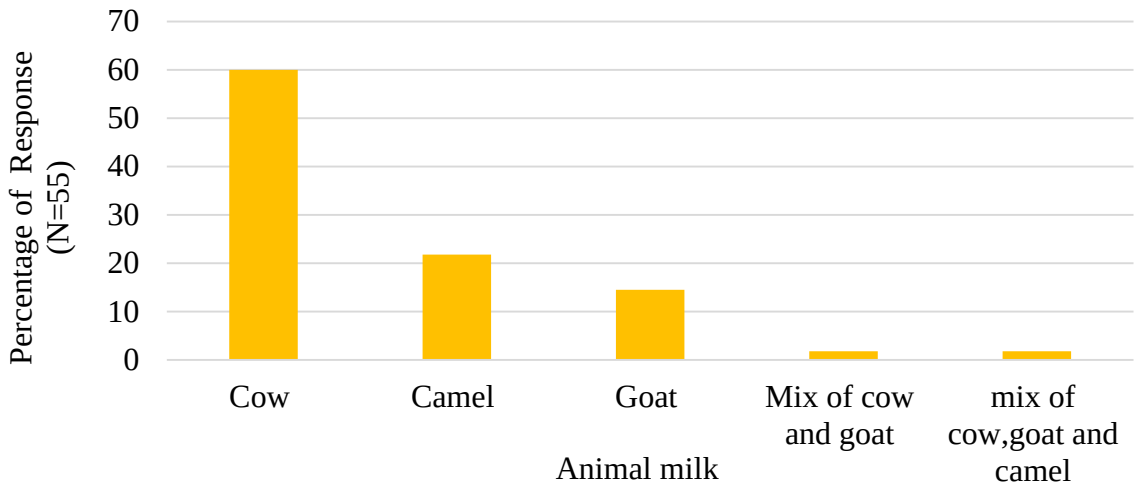


Figure 3.15-1 Type of animal milk used in preparation of traditional fermented milk

3.15.2 Boiling of milk before fermentation

Almost all (95%) of traditional fermented milk producers did not boil milk prior to fermentation. Figure 3.15-2 demonstrates the proportion of traditionally fermented milk producers who did not boil milk before fermentation.

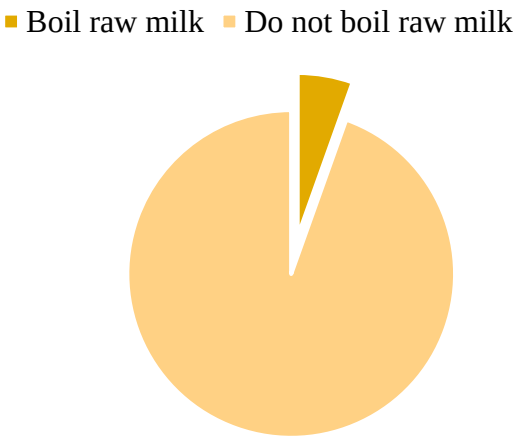


Figure 3.15-2 Proportion of households that do not boil raw milk before fermentation

3.15.3 Initiation of fermentation process

The most common method of initiating fermentation was continuously adding fresh milk to fermented milk (47.3%) while almost a third (30.9%) of households produced traditional fermented milk spontaneously without adding any cultures. Only a few (1.8%) of producers used commercial starter cultures. Figure 3.15-3 illustrates the various methods used to initiate fermentation in the preparation of traditional fermented milk.

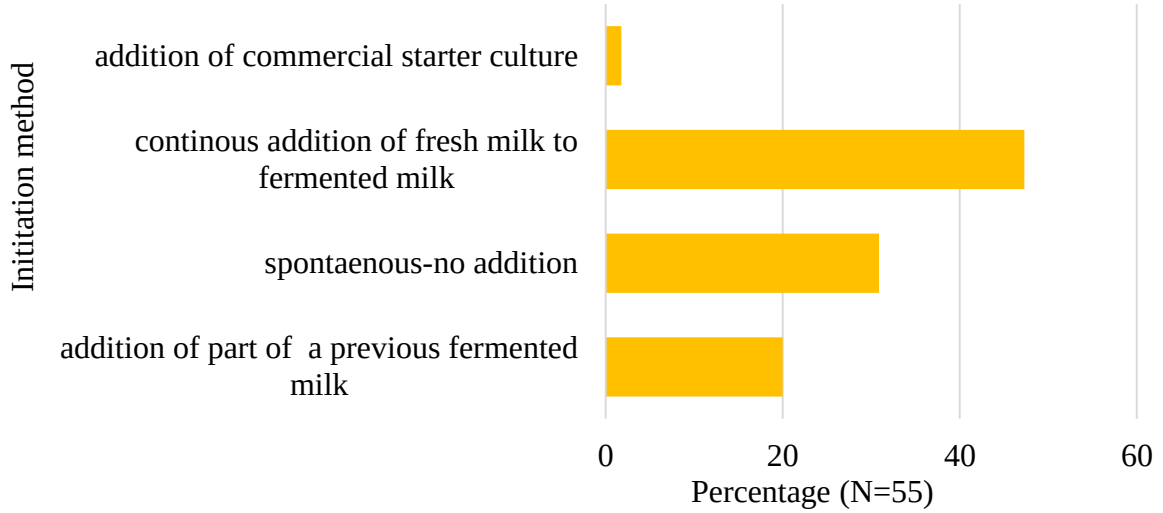


Figure 3.15-3 Methods of milk fermentation

3.15.4 Duration of fermentation

Table 3.15-1 shows the fermentation period in the cultural production of traditionally fermented milk. The most common fermentation period in the study was between 1-2 days and more than 2 days with (30.9% and 30.9%) respectively while a few (5.1%) of household's fermented milk within less than six hours. About 41.8% of producer's fermented milk at ambient room temperatures of (26 to 36^{0}C) while 38.2% fermented milk at the coldest part of the house (below 25^{0}C) wile 20.0 % kept in warm temperatures (higher than 25^{0}C). A majority (61.8%) of the respondents stored the final product at ambient room temperatures (between 25^{0}C-35^{0}C) while 23.6% stored in warm temperatures (above 35^{0}C) and a few (14.5%) stored in refrigerators (below 10^{0}C).

Table 3.15-1 Fermentation period in the production of traditionally fermented milk

	N=59
Fermentation Period	**Percent (%)**
Less than 6 hours	5.1
Almost half a day (6-12 hours)	9.1
More than half a day(12-18 hours)	7.3
About 1 day	16.4
One to two days	30.9
More than 2 days	30.9

3.15.5 Container materials used to store traditional fermented milk

Figure 3.15-4 illustrates various storage container materials reported in the study. Majority (71 %) of respondent's stored traditional fermented milk in containers made of plastic material while 27 % stored fermented milk in materials made from plant materials while 2% used metallic storage containers.

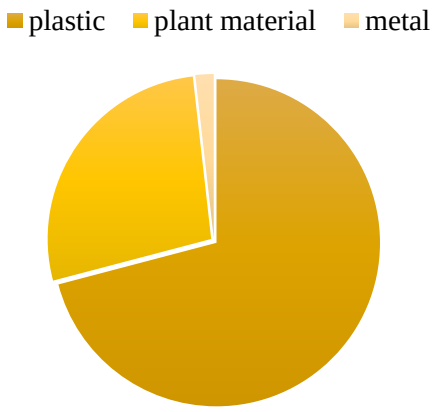


Figure 3.15-4 Container materials used to store traditional fermented milk

3.16 Knowledge, attitude and food handling practice assessment

3.16.1 Knowledge assessment

The combined mean knowledge scores for households that produced and those that did not produce traditional fermented milk was 56.9±17.6%. The median score was 60.0% (IQR: 40-70), with a high score 100% and a low score of 10%. The combined mean knowledge score was higher than the average of 50% but there was a significant difference ($P< 0.05$) between knowledge scores for households that produced and those that did not produce traditional fermented milk (Independent t test, $t = -3.588$, 406 df, $p = 0.000$); non producers obtained a mean knowledge score of 58.1±17.2 % as compared to 49.0±18.3 % for households that produced traditional fermented milk. Figure 3.16-1 shows the mean plot for attitudes on food handling.

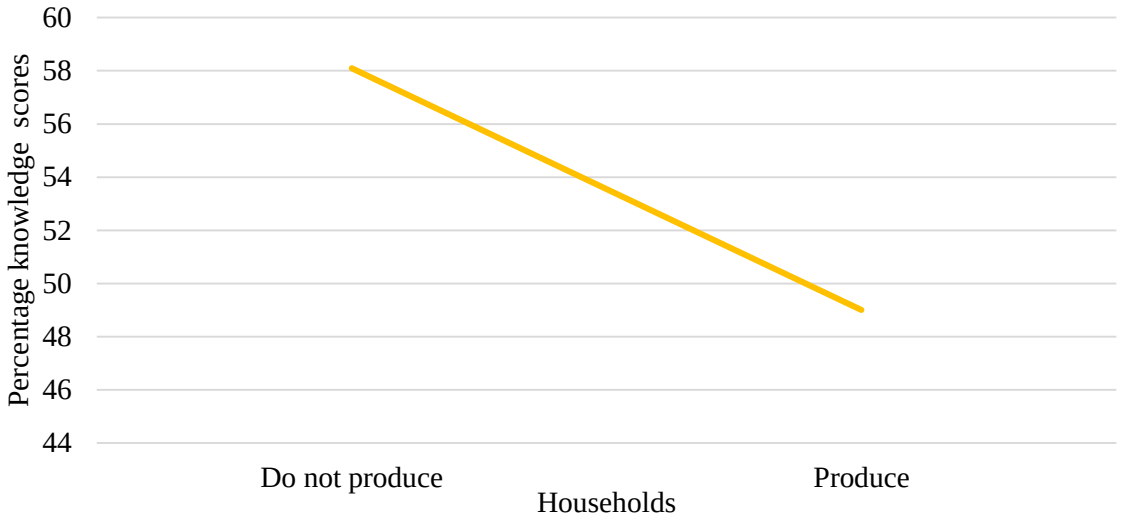


Figure 3.16-1 Means plot for Knowledge scores

Table 3.16-1 indicates the correct answers from the knowledge assessment on food handling

Table 3.16-1 Correct answers from the knowledge assessment on food handling

Knowledge questions	Responses		
	Non Producers (N=353)	Producers (N=55)	Significance
	%	%	P-value
I) Which activities help prevent contact with disease causing microorganisms?			
1. Handwashing after using the toilet	97.7	96.4	0.631
2. Proper waste disposal from home environment	96.9	96.4	0.690
II) What are the Key moment when you should wash hands?			
3. After using the toilet	96.0	94.5	0.489
4. After washing baby's bottom	52.1	38.2	0.060
5 Before food preparation	56.1	32.7	0.001*
6 Before feeding a child	39.7	40.0	1.000
7 After handling raw food	26.3	10.9	0.011*
8 After handling garbage	29.7	20.0	0.151
III) Why should someone avoid eating left overs not kept in a cool place?			
9 Eating of leftover foods not kept in a cool place may cause food borne diseases	58.9	34.5	0.001*
IV) Why should raw and cooked foods be separated?			
10 Separation of raw and cooked food prevents contamination	27.8	27.3	1.000
Cumulative Knowledge score, mean (SD)	**58.1 (17.2)**	**49.0 (18.3)**	**0.002***

***Statistically significant difference, p<0.05**

About 56.1% of households that did not produce traditional fermented milk had better knowledge on washing of hands before food preparation as a critical moment to prevent food contamination compared to 32.7% of households that produced traditional fermented milk. About (23.8%) of the households that did not produce traditional fermented milk were aware of washing hands after handling raw food compared to (10.9%) of households that produced traditional fermented milk. Households that did not produce traditional fermented milk were more aware of not consuming left over foods compared to households that produced traditional fermented milk.

Majority of households that produced and those that did not produce traditional fermented milk demonstrated good knowledge on food handling practices among several items; both groups (97.7% - non producers, 96.4 % - producers) were well aware of washing hands after using the toilet was an activity that prevented contact with disease causing microorganisms. Both groups (96.9% - non producers, 96.4% - producers) were also well informed on proper disposal of faecal waste from home environment was an activity which prevented contact with disease causing micro-organism. Both groups (96.0% - non producers, 94.5% - producers) had adequate knowledge on washing of hands after using the toilet as a key moment that prevented food contamination by disease causing micro-organisms.

Nevertheless, the level of knowledge on other issues was surprisingly low; less than half of both groups (39.7% - non producers, 40.0% - producers) were not aware that washing hands before feeding a child was a key moment to prevent contamination. A few respondents (29.7% - non producers, 20.0% - producers) knew washing of hands after handling garbage also prevented food contamination with disease causing microorganisms while approximately a quarter of both groups (27.8% – non producers, 27.3% - producers) were not aware that separating raw and cooked food aided in keeping cooked food safe for consumption.

3.16.2 Attitude assessment

The combined mean attitude score for households that produced and those that did not produce traditional fermented milk was 69.8$\pm$ 20.2%. The highest mean attitude score was 100% while the lowest was 14 %. The median score was 80 % (IQR: 60-80). Both households obtained scores higher than 50%. There was no significant difference on the attitude scores among households that produced and those that did not produce traditional fermented milk (Independent t test, t = -0.428, 406 degree of freedom; p = 0.669). Households that produced traditionally fermented milk had a mean attitude score of 68.9 $\pm$ 18.7% while households that

did not produce traditional fermented milk obtained a score of 69.9 ± 20.2%. Figure 3.16-2 shows the mean plot for attitudes on food handling.

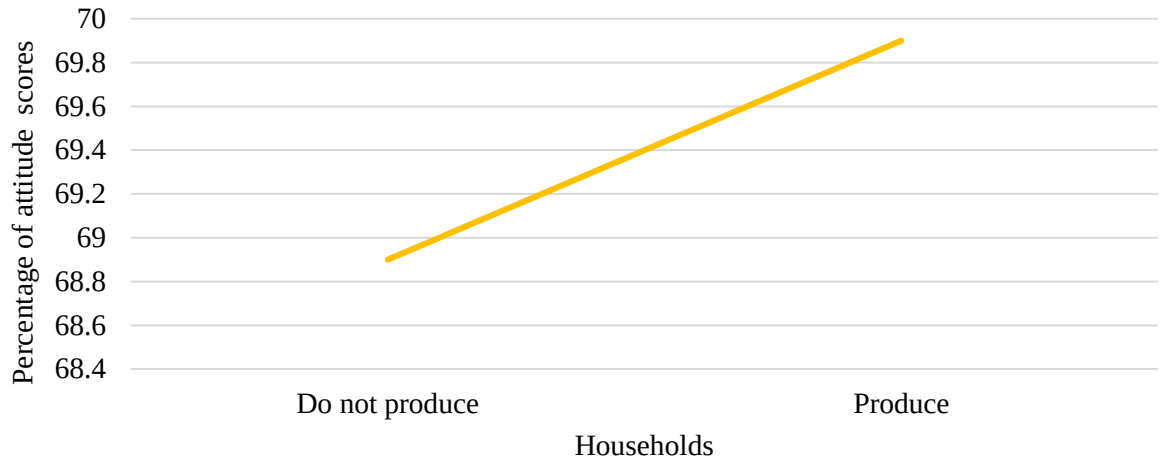


Figure 3.16-2 Means plot for attitude scores on food handling

Table 3.16-2 shows the correct attitude response on food handling.

Table 3.16-2 Correct attitudes responses

Attitudinal Statements	**Correct Responses**		
	Non-Producers (N= 353)	**Producers (N=55)**	**Significance Test**
	%	%	p-value
1. Consumption of contaminated food causes food Borne diseases.	88.7	76.4	0.017*
2. Traditionally fermented milk can cause Diarrhea.	52.4	40.0	0.110
3. Limited Knowledge on hygienic handling of Traditional Fermented milk is a hindrance to food safety.	40.8	50.9	0.187
4. Failure to wash hands can lead to food borne diseases.	75.4	81.8	0.394
5. It is appropriate to wash hands before preparing food.	92.6	94.5	0.782
Cumulative Attitude Score Mean Score (SD)	69.9 ± 20.2	68.7 ± 18.7	0.669

*Statistically significant difference, p<0.05

About 88.7% of households that did not produce traditional fermented milk were more concerned compared to 76.4% of households that produced traditional fermented milk on consuming contaminated food. Both households (92.6%-non producers, 94.5%-producers) agreed that it was appropriate to wash hands before food preparation. Both groups (75.4%-non producers, 81.8%-producers) also expressed positive concerns on why failing to wash hands

could lead to food borne diseases. Low attitudes were expressed on the items concerning food borne diseases due to limited knowledge on hygienic handling, households that produced traditional fermented milk obtained higher scores (50.9%) compared to 40.8% for households that did not produce traditional fermented milks. About 40.8% of non-producers agreed limited knowledge on hygienic handling of traditionally fermented milk could be a hindrance to the safety of the final product whereas more than half (52.4%) of non- Producers were more concerned about traditionally fermented milk causing diarrhoea as compared to 40.0% of households that produced traditional fermented milk.

3.16.3 Practice assessment

The combined mean practice scores on food handling among households that produced and those that do not produce traditional fermented milk was 59.4±14.9%. The highest practice score recorded was 100% and the lowest was 14%. The median score was 57.1% (IQR: 57.1-71.4). The combined mean practice score was slightly higher than the average of 50%, but there was a significant difference ($P < 0.05$) on the mean practice scores for households that produced and those that did not produce traditionally fermented milk (Independent t test, $t = -1.920$, 405 degrees of freedom, $p = 0.056$), non-producers obtained a high mean practice score of 59.9 ± 14.3% compared to producers of traditionally fermented milk who scored 55.8 ± 17%. Figure 3.16-3 shows the mean practice scores on food handling.

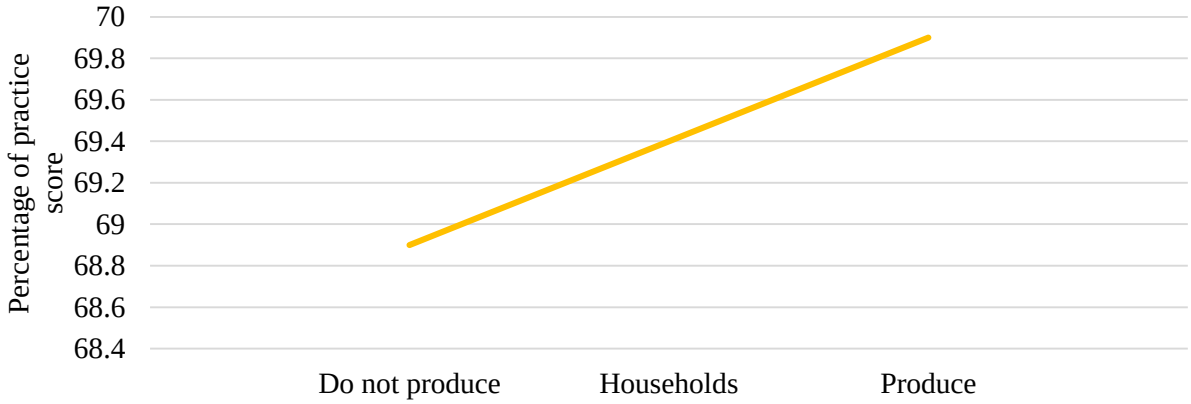


Figure 3.16-3 Means plot for Practice scores on food handling

Table 3.16-3 indicates that almost all (90.9%) of households that did not produce traditional fermented milk maintained personal health and hygiene during food preparation as compared to (74.6%) of households that produced traditional fermented milk.

Table 3.16-3 Correct responses on food handling practices

	Appropriate Practices by Respondents	Correct Responses		
		Non-Producers (N= 355)	Producers (N=55)	Significance Test
		%	%	p-value
1.	Cleaning of utensils with hot water and detergent	88.6	87.3	0.820
2.	Safe water treatment method	53.8	52.2	0.665
3.	Separation of raw foods such as meat with cooked or ready to eat foods to prevent cross contamination	74.2	72.9	0.870
4.	Proper storage of perishable foods	85.2	74.0	0.117
5.	Maintenance of personal health and hygiene during food preparation	90.9	74.6	0.004*
6.	Refrain from handling food handling during sickness episodes	15.9	16.9	1.000
7.	Proper food handling etiquette	11.3	13.6	1.000
Cumulative Attitude Score Mean Score (SD)		59.9 $\pm$ 14.3	55.8 $\pm$ 17.6	0.056*

*Statistically significant difference, $p<0.05$

Both groups (88.6%- non producers and 87.3%-producers) reported to clean utensils appropriately with hot water and detergent. More than half (53.8% and 52.2%) of producers and non-producers of traditionally fermented milk reported to use safe methods to treat water such as boiling and chlorination. Both households that produced and those that did not produce traditional fermented milk separated raw food with cooked or ready to eat foods.

3.16.4 Aggregate KAP Scores.

Aggregate KAP scores on safe food handling were computed by combining the total knowledge, attitude and practice scores and reported as a percentage. The mean KAP score for households that produced and those that did not produce traditional fermented milk was 60.5$\pm$ 11.9%. The highest KAP score recorded was 90.9% and the lowest KAP score was 22.7%. The median score was 63.6% (IQR: 54.5-68.1). There was a statistically significance difference in the mean KAP score among households that produced and those that did not produce traditional fermented milk (Independent T test, t = -3.295, 406 Degrees of freedom, p = 0.001). Households that produced traditional fermented milk had a mean KAP score of 55.7$\pm$ 12.5 while households that did not produce traditional fermented milk scored 61.3$\pm$11.7. Figure 3.16-4 shows the combined KAP score on food handling.

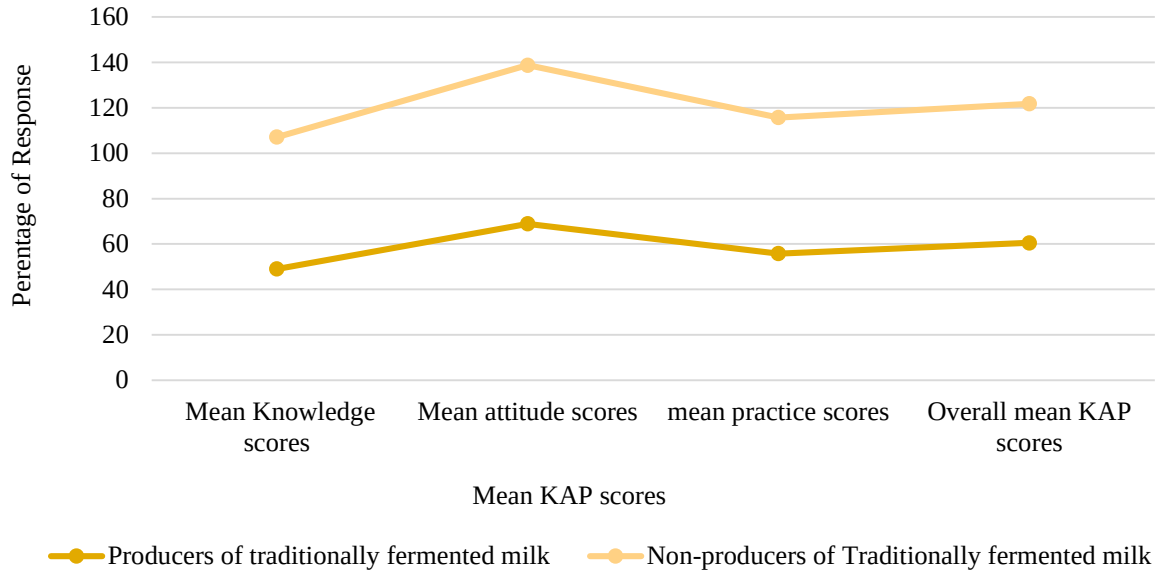


Figure 3.16-4 Combined Mean KAP scores

3.17 Socio-demographic characteristics and KAP on food safety

Results for the association between knowledge, attitude and practice on food handling and selected sociodemographic characteristics, are presented in Table 3.17-1.

Table 3.17-1 Mean KAP scores by socio-demographic characteristics

Sociodemographic Characteristics	Mean knowledge percent score	Mean attitude percent score	Mean practice percent score	Mean Overall percent KAP score
		(N=408)		
Age				
Below<40	56.5 ± 18.1	71.9±18.9	59.0 ± 14.3	60.1 ± 12.1
Above>40	57.6 ± 16.7	66.0±21.3	59.6 ± 16.5	60.8 ± 11.8
Significance	0.916	**0.004***	0.708	0.613
Gender				
Male	57.0 ± 17.7	69.0 ± 19.1	58.3 ± 14.5	60.1± 12.0
Female	56.8 ± 17.6	70.1 ± 20.4	59.7 ± 15.4	60.7 ± 11.9
Significance	0.532	0.619	0.385	0.640
Residency				
Peri-Urban	58.7 ± 18.0	71.0 ± 19.2	61.5 ±14.2	62.4 ± 11.5
Rural	54.3 ± 16.6	68.0 ± 21.0	56.0 ±15.9	57.9 ± 12.1
Significance	**0.013***	0.135	**0.000***	**0.000***
Educational Status				
No education	53.0 ±17.3	65.9±20.0	56.0± 17.1	56.9±12.1
Primary	58.7 ± 15.7	70.7 ± 19.2	60.5± 13.9	62.0 ± 10.6
Secondary	59.8 ± 18.5	74.0 ± 19.7	62.3 ± 12.7	63.8 ± 12.1
Post-secondary	58.4 ± 22.0	72.5 ± 21.9	60.7 ± 14.9	62.3 ± 13.3
Significance	**0.010***	**0.020***	**0.011***	**0.000***

*Statistically significant difference, p <0.05

3.17.1 Mean KAP scores and age

Both age groups (below 40 years and above 40 years) scored more than half on knowledge, attitude, practice and overall KAP on food safety. However, older adults (above 40 years) obtained high knowledge, practice and overall KAP scores compared to younger adults. The mean attitude scores on food handling was significantly associated with the age categories (Independent t test; t = -2.858, 406 degree of freedom, p = 0.004). Adults below the age of 40 years obtained high attitudinal scores on food handling as compared to respondents above 40 years.

3.17.2 Mean KAP scores and gender

There was no significance difference between genders and KAP scores (Independent t test; t = -0.497, 406 degree of freedom, p = 0.619). Majority of the genders scored more than half on all the four aspects assessed. However, female adults obtained high scores on the attitude, practice and overall KAP scores as compared to male respondents.

3.17.3 Mean KAP scores and residency

Residency was significantly associated ($p < 0.05$) with the mean Knowledge and Practice scores on food handling. Urban residents scored highly on knowledge and practice items related to food handling compared to rural residents.

3.17.4 Mean KAP scores and educational status

Educational status was significantly associated ($p > 0.05$) with KAP scores, respondents who had attained secondary and post-secondary education had relatively high knowledge, attitudinal and practice compared to respondents who had attained only primary education or with no education at all.

3.18 Discussion

3.19 Socio-demographic characteristics of traditional fermented milk producers

The study found that only a few proportion of households were involved in the production of traditionally fermented milk that was limited to rural households; the results observed could be probably due to the cultural tradition of milk fermentation by pastoralist communities in the country (Mathara et al., 2004).

The role of gender in the production of traditional fermented cannot be assumed either; findings from the study showed that females were majorly involved in the household production of traditional fermented milk compared to males, similar findings were reported in Southern Ethiopia (Abebe et all., 2013), reasons for the observation could most likely be that men are involved in the herding and milking process while the household processing is left to women (Abebe, et all., 2013) .

A majority of traditional fermented milk producers were below the age of forty years; this could perhaps be due to the fact described earlier where a majority of producers were women, and as they aged, the cultural tradition of milk fermentation was transferred to the younger members of the family.

Almost half of traditional fermented milk producers did not attain any form of education, consequently there were more women than men who were illiterate; the high illiteracy levels observed in the study could be partly due to ignorance, poverty and early marriages as reported in the region (ACF, 2016). Studies have shown that educational status is correlated to knowledge on food handing (Siow and Norrakiah, 2011; Elisa et al., 2012), since women are majorly involved in the production of traditional fermented milk as presented in this study, the possibility of low knowledge on food handling cannot be ruled out.

3.20 Cultural practices in the preparation and storage of traditionally fermented milk.

Majority of producers in the current study utilized cow milk in the production of traditional fermented milk; similar reports were reported by Abebe (2013), however findings in the current study disagree with Yazan and Oliver (2015), who reported that camel milk was the most utilized in the production of traditional fermented milk, the disparities could be due differences emanating from the sampling methodology,

It is well known that boiling of raw milk eliminates milk borne pathogens (Gadaga et al., 2004; Omore et al., 2005). The current study found that households involved in the production of traditional fermented milk did not boil raw milk before fermentation, the observations were

also reported by several authors (Mwangi, et al., 2013; Wayua et al., 2012; Njarui et al., 2011). Reasons emanating from the FGD sessions was that boiled milk lost nutrients during the boiling process and flavour was altered after boiling. Studies have shown that boiling milk destroys water soluble vitamins and anti-oxidants but is the safest and most economical method of ensuring milk is safe from food borne diseases (Abeer et al., 2009 and Gadaga et al., 2004).

Less than half of traditional fermented milk producers initiated fermentation by continually adding fresh milk to fermented milk, similar findings were reported by (Gadaga et al., 2004 and Abeer et al., 2009). Findings from the study also showed that less than a quarter of households that produced traditional fermented milk initiated fermentation through natural/spontaneous fermentation. This is a common traditional method in the study region (Jans et al., 2013) but such methods are discouraged since they have been shown to affect the quality and stability of traditional fermented milk (Abeer et al., 2009). As reported by Gadaga (2004), naturally fermented milk encourages the growth of pathogens, the presence of pathogens affects the growth and action of lactic acid bacteria which leads to low production of lactic acid and this in turn affects the pH of the final products. As reported by (Abeer et al., 2009), a low pH of less than four inhibits the growth of pathogenic microorganisms in fermented milk, therefore findings in this study show that fermented milk initiated by methods which have no control of micro-organisms involved in the fermentation are most likely to expose consumers of traditionally fermented milk to food borne pathogens which could lead to food borne diseases,

Temperatures and time during incubation and storage of fermented dairy products have been shown to affect pathogens survival (Gadaga et al., 2004). In the current study, most of the producers reported to ferment their products one to two days at ambient temperatures of about 26^0C-36^0C which is similar to findings by Abebe, (2013). Findings on the final storage temperatures and time also showed that majority of producer's stored fermented products at ambient temperatures of 26^0C-36^0C which is similar to Abebe, (2013) .The ideal fermentation period is usually more than 62 hours (Swai and Schoonman, 2011) to achieve complete action of LAB; the current study is in agreement with Swai and Schoonman (2011), however a few producers fermented milk for less than 6 hours which predisposed consumers to potential food borne pathogens in partially fermented milk.

Fermented milk should be stored under cool temperatures of less than 10^0 C but majority of producers stored the final products under ambient temperatures of 26^0C-36^0C as reported from

the FDGs; therefore, this study shows that incubation period and storage temperatures of the final products may promote the growth and multiplication of food borne pathogens in traditionally fermented milk

Milk Storage containers usually determine the ease of cleaning. Metallic materials are preferred to other materials such as plastic or wooden materials (Swai and Schoonman, 2011). The current study showed that majority of traditionally fermented milk producers used plastic materials which is in agreement with (Swai and Schoonman, 2011 and Abebe et al. 2013). The government of Kenya through the ministry of health banned the use of plastic materials for storage of milk sighting rapid micro-organisms growth, ease of cleaning and was a potential source of contaminants (Omore et al., 2005).

3.21 Knowledge, attitude and food handling practice

3.21.1 Knowledge on food handling

The study found households that were not involved in the production of traditional fermented milk were not aware of refraining from consuming left over foods not stored appropriately, nevertheless, the same households were also not aware that washing hands before food preparation and after handling raw food such as meat was a preventive measure against food contamination. Nearly similar results were reported by Pang, (2015) and Elisa, (2012) on food handling among consumers. The results observed in the current study could perhaps be due to lack of sufficient information on critical moments to wash hands by food handlers, nevertheless, households that were involved in the production of traditional fermented milk also demonstrated poor knowledge concerning consumption of left over foods not stored in appropriately, since the study has established that majority of producers reside in rural areas, storage facilities such as refrigerators, freezers or cold boxes cannot be utilized due to luck of electricity therefore there is need to educate producers of traditional fermented milk on conventional methods to store fermented milk products.

Majority of households were aware that washing hands after using the toilet was a prevention activity to mitigate against the spread of food borne pathogens, similar findings on hand washing from the region were reported by ACF (2016), the results observed in this study could possibly be linked to the fact that washing hands after using the toilet is a habit practiced out of simple common sense thus the high knowledge scores on this knowledge item. However, majority of households were not aware of washing hands before feeding a child or after handling garbage, similar results were obtained in a study on food and hand hygiene in

Singapore (Pang et al., 2015), reasons for the results observed in this study could perhaps be due to ignorance on the emphasis of the critical times to wash hands.

Separation of raw foods such as meat, milk or fresh vegetables and cooked or ready to eat foods prevents the spread of pathogens which may lead to food borne diseases (WHO, 2010). Findings in current study are in agreement with similar findings by (Pang et al., 2015; Elisa et al., 2012; Siow and Norrakiah 2011) which showed that majority of food handlers and consumers had insufficient knowledge on the separation of raw and cooked food, the most probable reason could be due to lack of information on cross contamination during the food handling process.

3.21.2 Attitudes on food safety

The combined mean attitude score among households that produced and those that did not produce traditional fermented milk was 69.8± 20.2. There was no significance difference among households on the attitudinal items on food handling. Findings from the study showed that majority of households that produced traditional fermented milk expressed positive attitudes on the limited knowledge of food handling during the processing of fermented milk to be a hindrance to the safety of the final product, this finding is in agreement with (Abebe et al., 2013). The results observed could most linked to the fact that producers might be well averse with simple yet important information on proper food handling procedures such as washing hands or proper washing of utensils during the processing of traditional fermented milk.

3.21.3 Food safety practices

It is important to treat water since water quality and hygiene can be a source of food contamination (Abebe, et al., 2013). Findings in the current study showed that majority of households treated water for drinking by either boiling or using chemicals, nearly similar results were obtained by ACF (2016) from the region.

Fresh and raw foods such as vegetables, fruits, meat and milk should be separated from cooked or ready to eat food to prevent the spread of pathogenic micro-organisms from raw to cooked foods (WHO, 2010), the current study showed that majority of households separated raw and cooked foods by thorough washing of hands after handling raw food and the using separate utensils such as chopping boards and knives during food preparation, our findings disagree with another study on consumer awareness on food safety issues in Turkey by Gul, (2012) which reported that consumers did not separate raw and cooked food; the probable reasons

for the results observed in the current study could most likely be linked to cultural traditions that encourage separation of raw and cooked foods.

Refraining from handling food during episodes of illness or when showing symptoms of illness has been shown to prevent food contamination during food preparation (Imani, 2010). Findings in this study reveal that majority of producers and non-producers of traditionally fermented milk did not abstain from handling food during sick episodes, the most probable reason could be due to lack of information on personal health and hygiene during food handling. Poor etiquette during food preparation such as smoking or chewing tobacco, nose picking, coughing and sneezing, spitting over food or tasting food with fingers has been shown to introduce food borne pathogens (WHO, 2010). Findings in this study are consistent with findings in a similar study in Ethiopia by Abebe (2013) where practises such as dipping fingers in milk to facilitate milking by lubricating the udder was shown to be a potential source of raw milk contamination. The most probable reason for the result observed in this study and other studies could be linked to utter ignorance of hygiene principles by food handlers at the household level. There is need to reinforce efforts to sensitize the community on proper hygiene principles during food preparation such as proper etiquette that discourage smoking or chewing tobacco, nose picking, coughing and sneezing, spitting over food or tasting food with fingers.

3.22 Socio-demographic characteristics and KAP on Food safety

The study showed that older participants obtained high scores on knowledge, practice and overall KAP scores on food handling compared to younger participants, however the difference was insignificant, the results differ with those reported by Gul, (2012) where younger participants had low knowledge scores on knowledge related to food safety as compared to older participants. Experience comes with age (Gul, 2012) therefore older adults maybe more experienced in identification of potential hazards during food handling and will therefore ensure food is prepared in safe and hygienic ways to prevent food borne diseases.

In the current study women scored highly on attitudes related to food handling while men scored highly on knowledge and food handling practices. Several reasons exist, previous results showed that men attained high educational levels than women, this could probably lead to the high knowledge scores obtained by men. Several studies, indicate that knowledge on food safety is correlated to practices on food handling (Siow and Norrakiah, 2011; Esron et al., 2005) therefore the more knowledgeable men were on food safety, the more likely they would practice food handling.

Findings in this study showed that educational status was significantly associated with knowledge, attitudes and practices on food handling; nearly similar results were reported by (Siow and Norrakiah, 2011; Esron et al., 2005 and Oliver et al., 2005), participants with little or no education attained low knowledge, attitude and practice scores on food handling compared to participants with secondary and post-secondary education. The implications from this study could indicate that producers of traditional fermented milk with little or no education maybe most likely processing products which are contaminated by food borne pathogens due to poor knowledge on food handling.

The current study also found that residency was significantly associated with knowledge, attitudes and practices on food handling, the findings are in agreement with Oliver, (2005) where majority of rural residents scored lowly on knowledge related to food handling. Reasons for the low scores by rural residents could perhaps be due to lack of sufficient information on proper food handling, low literacy levels by the rural population or lack of amenities such as piped water to ensure proper hygiene and sanitation is upheld.

3.23 Conclusion

The study shows that only a few households are involved in the cultural production of traditional fermented milk. The study has also shown that fermented milk production is more common in rural compared to urban regions with majority of females being involved in the household process. The study has also shown that cultural practices such as using unboiled/pasteurized milk in the fermentation process, abuse of temperature and time during fermentation and storage of fermented milk products and storage of milk in plastics containers is prevalent in the region and could be a potential source of food contamination. The study has also found that households that do not produce traditional fermented milk obtained higher scores on knowledge, attitude and food handling practices compared to households that produced traditional fermented milk. Several socio demographic factors are associated with knowledge, attitude and practices on food handling; younger adults obtained high attitudinal scores related to food handling compared to older adults. The study has also shown that male adults score better on knowledge items related to food handling while female adults score highly on attitudinal items assessing food handling. Urban residents also score better on knowledge and attitude items related to food handling compared to rural residents. The study has also shown that adults with secondary and post-secondary education have adequate knowledge on food handling as compared to those with primary education. There is need for

households to adhere to basic hygiene principles to ensure is safe from contamination during preparation and storage.

3.24 Recommendations

1. Households should be enlightened on basic hygiene principles such as critical moments to wash hands, conventional methods to store left over foods, separation of raw and cooked foods and proper personal health and hygiene during food handling.
2. Households that produce traditional fermented milk should ensure that they use boiled milk in the fermentation process and utilize appropriate methods for initiating fermentation such as the use of commercial starter cultures. Consequently, households should strive to prevent temperate time and time abuse and avoid using plastic and wooden materials to store fermented milk.
3. All intervention strategies aimed at sensitizing households on proper food handling measures should consider age, gender, residency and educational status of adults. All efforts should be tailored towards minimising the risk of contamination by food borne pathogens during cultural production of traditionally fermented milk.
4. Efforts to popularize production and consumption of traditional fermented milk in both urban and rural regions should be well supported by relevant stakeholders since this traditional practice can help the fight against food insecurity and also be a source of income to the younger population.
5. A communication strategy on proper food handling practice to households and communities in urban and rural regions can be developed through collaborated efforts by relevant stakeholders to provide information on food safety.
6. There is need for further research studies on the effect of traditional fermented milk on the nutritional status of adults in semi-arid regions.

4 CHAPTER FOUR

CONSUMPTION OF TRADITIONAL FERMENTED MILK AND RISK FACTORS FOR ADULT OVERWEIGHT AND OBESITY IN ISIOLO CENTRAL SUB COUNTY.

4.1 Abstract

Over nutrition defined as a Body Mass index of greater than 25.0 is a risk factor for diabetes, cardio vascular diseases, cancer and hypertension. The general objective of the study was to assess the risk factors for adult overweight/obesity in the study population. The specific objectives were to determine the socio-demographic and household characteristics of the study population, asses the physical status and morbidity patterns, assess the dietary patterns and consumption of traditional fermented milk, determine the nutritional status and thereafter establish risk factors for adult overweight/obesity. A cross-sectional survey was carried out among households in an emerging peri-urban town in the Northern part of Kenya in January 2016. A two stage multi-cluster sampling was used to select 5 Sub-locations and 25 villages from the sampling frame. A pretested semi structured interview questionnaire was used to collect data from 423 households. Data was analysed for descriptive and inferential statistics. The prevalence of traditional fermented milk consumption was 49.6%. Findings on the nutritional status found less than half (48.6%) of adults had normal BMI score. The prevalence of adult underweight, overweight and obesity was 21%, 18.7% and 11% respectively. Demographic characteristics such gender, residency, educational status of household head, household size, ownership of television, gas cooker, mobile phone and dietary patterns which included consumption of pork, sausages, fish, lentils, peas, chapatti and vegetables were significantly associated with adult overweight and obesity ($P<0.05$). In subsequent binary logistic regression analysis, household ownership of a gas cooker, television and mobile phone ownership was significantly associated with adult overweight and obesity while rural residency, educational level of study participant and household head, fewer household members and non-consumption of pork, sausages, fish, lentils, peas, chapatti and vegetables emerged as protective factors against overweight and obesity. There is need for an intervention program on the risk factors for adult overweight and obesity.

4.2 Introduction

Non-Communicable diseases have in the recent years doubled especially in the low and middle income countries (WHO, 2016). The low and middle income countries face a double burden of disease and disability since communicable diseases contribute a major proportion of morbidity and mortality outcomes (WHO, 2014). The prevalence of obesity and overweight in adults has increased gradually in the Sub Saharan region (Manuel et all., 2015). Adult overweight and obesity are the major risk factors for non-communicable diseases such as hypertension, CVD's, type 2 diabetes, colonic cancer, post-menopausal breast cancer and osteoarthritis (WHO,2016). Country reports indicate that NCD's are rapidly increasing in the country (MOH, 2015), similar trends have been reported in the Southern Sahara (SSA) countries and LMC's globally (Vorster et al., 2011; Barry et al., 2012; Manuel et al., 2015).

4.3 Problem statement

Consumption of fermented milk has been linked to lowered risk of adult overweight and obesity due to the depletion of excess adipose tissue. The excess adipose tissues are as a result consuming diets rich in calories, salt, refined sugars and saturated fatty acids. Obesity and overweight are two major risk factors for cancer, diabetes, cardiovascular heart diseases and chronic respiratory diseases. Non-communicable diseases account for more than 63% of mortality cases globally (MOH, 2015). The study therefore seeks to establish the risk factors for adult overweight and obesity in Isiolo central sub county.

4.4 General Objective

The aim of the study was to contribute knowledge on optimum nutrition practices. The purpose of the study was to provide information on the nutritional status of adults in Isiolo central Sub-County, findings would be used to enlighten the general population on optimum nutrition practices to prevent overweight and obesity. The general objective was to assess the consumption of traditional fermented milk and establish the risk factors associated with adult overweight/obesity in Isiolo Central Sub County.

The following were the specific activities carried out under the general objective: -

I. To assess the socio-demographic and socio-economic characteristics of the study population
II. To assess the physical activity and morbidity status of adults in the study population
III. To evaluate the dietary patterns and consumption of traditionally fermented milk by adults in the study population
IV. To assess the nutritional status of adults in the study population using Body Mass Index (BMI) and Waist-Hip Ratio
V. To establish the risk factors for adult overweight and obesity.

4.5 Study setting and methodology

4.5.1 Study setting

The study setting and methodology is as discussed in chapter 3.

4.6 Sampling

4.6.1 Sample size determination

The proportion of households that consume traditionally fermented milk in the study site was used to determine the sample size for the study. The prevalence of households that consume traditional fermented milk in the study region was 46% (Kaindi et al., 2012), the prevalence was used to estimate a single proportion in a modified Sample size formula adopted from the Epi-tools epidemiological calculator (Sergeant, 2015). The parameters entered in the epidemiological calculator are described below. The calculator yielded a sample size of 384 households and after allowing an attrition rate of 10% gave a total sample size of 423 households for sampling in Isiolo Central Sub County.

Equation 1

$$n = (Z^2 \times P\ (1 - P))/e^2$$

Z=**Value from standard normal deviate corresponding to desired confidence level (Z=1.96 for 95% level of Confidence)**
P=**Expected true proportion of households consuming traditionally fermented milk in Isiolo County (P=46%)**
e= **Desired Precision (0.05-Half desired Confidence width)**
Sample Size =**384**
Attrition Rate =**10% of 384 =423**

4.6.2 Sampling criteria

Study participants were selected within households based on their age (18 years and older) and inclusion/exclusion criterion described below.

4.6.2.1 Inclusion criterion

1. Household with participants 18 years and older
2. Visitors who had stayed for more than 6 months in the household
3. Willingness to participate in the study and provide personal and cultural information.

4.6.2.2 Exclusion Criterion

1. Unwilling to consent participation in the study
2. Visitors who had not stayed in the house for more than 6 months
3. Neighbours/passers by
4. Pregnant women

4.7 Sampling procedure

4.7.1 Selection procedure

Sampling units used in the study were sub-counties, sub-locations, villages and households as the smallest sampling units. Purposive sampling was used to select Isiolo county and Isiolo central sub county. A two stage multi-cluster sampling was used to sample villages and households in the study since the principal researcher had estimated 25 clusters with 17 households would yield the required sample size of 423 households although it surpassed the sample size by two households, but this was acceptable (Robert , 1997).

The first stage involved selection of 25 villages from a sampling frame of 116 villages through proportional to size sampling. The second stage was to select households from villages through the segmentation method (Robert, 1997). The procedure was as follows, enumerators subdivided villages into sections/segments based on imaginary lines, and then covered the sections/quarters by visiting all the households in the section/segment before moving to another segment on the same village, whilst keeping the boundaries based on the imaginary lines. Figure 4.7-1 illustrates the sampling procedure in the study.

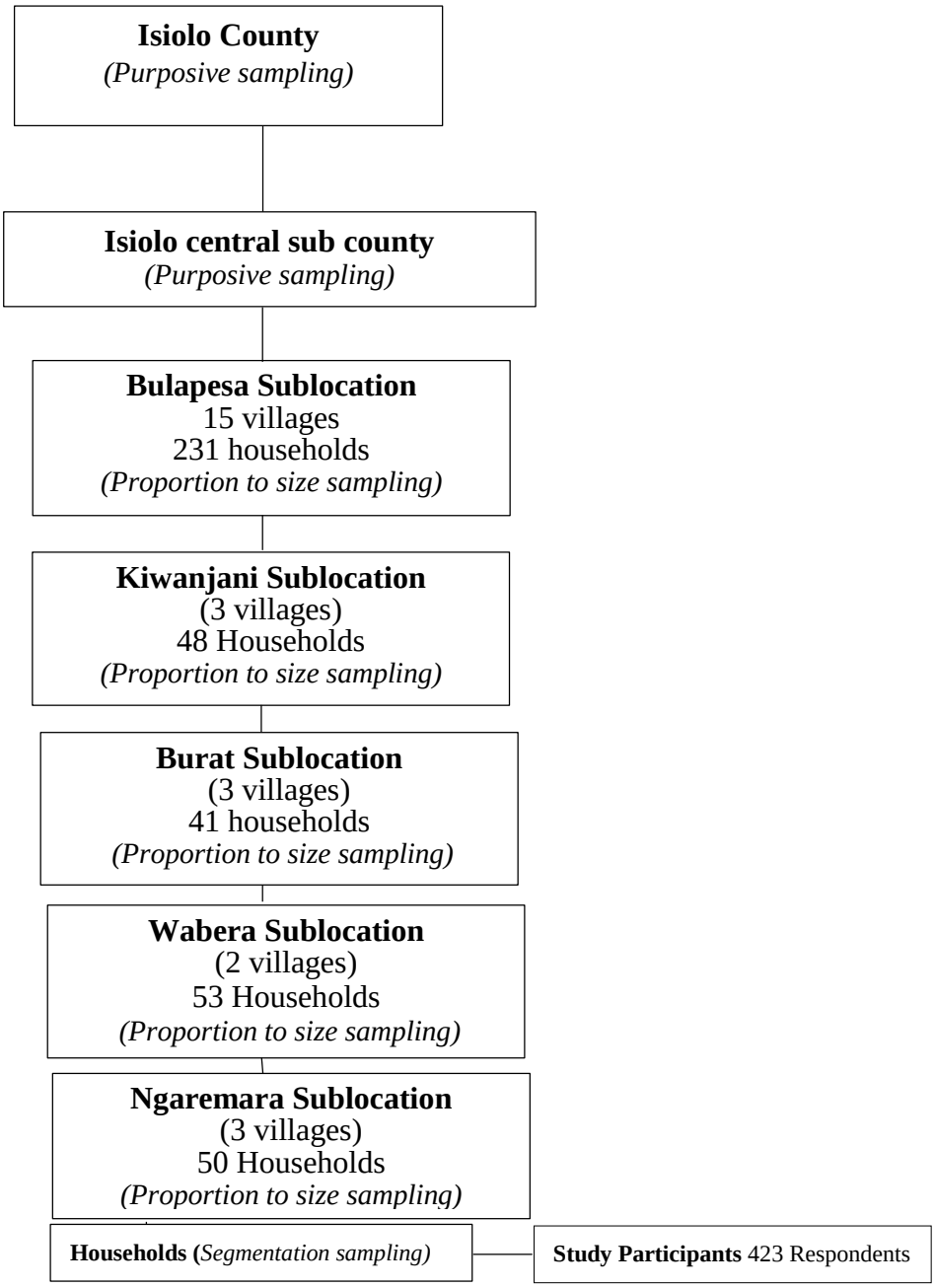


Figure 4.7-1 Sampling Scheme

4.8 Research instruments

4.8.1 Semi structured interview questionnaire

A pretested semi-structured questionnaire (see appendix 2), adapted from a clinical study running parallel to the study was used to collect information on sociodemographic and household characteristics, socio-economic characteristics, morbidity and physical activity, food consumption patterns, consumption of traditional fermented milk and nutritional status of adults in the study population.

Two focus group discussions (appendix 3) were carried out on selected study sites to collect information on the consumption of traditional fermented milk.

4.8.2 Anthropometric equipment's

To measure weight, a UNICEF portable Seca digital weighing scale number 1041015 able to read weight of up to 150kg, with a reading accuracy of 100g was used to measure the weight of study participants while height was measured by a modified stadiometer capable of measuring an accuracy of 0.1 centimetre. A stretch resistant measuring tape able to measure at least 150cm with a constant 100g of tension was used to measure waist and hip circumference.

4.8.3 Stationery and non-stationery materials.

Various equipment's and stationery materials such as notebooks, clipboards, flipcharts, felt pens, pens, erasers, pencil sharpeners, staplers, name tags, photocopy papers, printers and laptops were used in the preparation, data collection and data analysis.

4.9 Recruitment and training of research assistants

4.9.1 Recruitment

Recruitment of research assistants was carried in Isiolo town prior to the study. Advertisements (appendix 4) seeking to recruit enumerators were placed in strategic locations in Isiolo town. Recruitment was based on applicants with a degree in nutrition, nursing or any other health sciences, previous experience in research related work with proof of a recommendation letter and good knowledge of local dialect. Community health volunteers from the ministry of health were selected from villages in the sampling frame and were to assist the research teams to navigate through villages and households.

4.9.2 Training

The research assistants were trained for two days at the sub county public health conference room by the principal researcher. The enumerators were exposed to several study components such as background information, study objectives, sampling methodology, research tools, data collection and anthropometric procedures. The sessions also covered ethical values such as respecting the wishes of study participants, confidentiality of personal information and professional conduct. A combination of learning methods such as lectures, energizers, brainstorming sessions, questions, role playing and discussions enhanced active participation by research assistants during the training period (see appendix 5 and 6 for training protocols).

4.9.3 Pre Testing of study Tools

A pilot study for pretesting the research tools was conducted among 10 households in the study site but information collected was not included in the analysis. The research assistants refined their interviewing skills and anthropometric techniques. An evaluation of the pilot study was convened at the training venue to identify constraints encountered during the pre-test and some of the major constraints experienced during the pilot study were discussed and amended thereafter.

4.10 Methods of data collection

4.10.1 Sociodemographic and household characteristics

Demographic information such as age, gender, residency and the educational status was collected. Information on household characteristics such as household size, roofing materials, energy sources for cooking, food storage appliances, sources of drinking water, communication equipment's and transport means were also obtained through the semi-structured interview questionnaire.

4.10.2 Household socio-economic status

To compute household socio-economic status, household ownership of assets such as television, refrigerators, mobile phones, auto mobiles and bicycles, housing characteristics such as roofing materials, toilet facilities and access to basic services such as water and electricity were multiplied by assigned asset weights as used in the Kenya demographic and health survey carried out in 2014 (DHS, 2016) and summed up. Once the wealth index was computed, wealth percentiles were used to create cut off points for classifying households as "poor", "middle" and "high" wealth class, the wealth quantiles were later cross tabulated with variables of intrest in the study.

4.10.3 Morbidity patterns and physical activity status

Information on medical conditions diagnosed within the last one year was collected through interviews while physical activity status was defined as activities that increased the heart rate above the resting rate regardless of the intention such; as pleasure, work, or transportation

4.10.4 Dietary patterns and consumption of traditional fermented milk

Information on food consumption patterns was collected through a semi quantitative food frequency questionnaire adapted from Harvard University (Harvard University, 2007) and Food consumption scores adopted from the World Food Programme (WFP) as a measure of food consumption (WFP/FAO, 2008).

4.10.5 Semi quantitative food frequency questionnaire

The semi-quantitative food frequency questionnaire was used to collect consumption frequency of foods from eight groups namely protein, carbohydrate, fruits, beverages, vegetables and dairy products. For each food category, a commonly used unit or photograph of the food was availed for participants to specify. Five frequency categories; never, few (1-2 days) per month, few (1-2) days per week, several days (3-6) days per week and daily were established for most common consumed foods in the market at the time of the study. Participants were asked how often, on average over the one month they consumed that amount of each food. The portion sizes were defined in household units (e.g.: 1 teaspoon of sugar, 1 egg), or defined as small, average or large or as metric units.

4.10.6 Consumption of traditional fermented milk

Study participants were expected to provide information on the sources, frequency and amounts of traditional fermented milk they consumed. The average consumption was estimated by a 250mls cup.

4.10.7 Food consumption scores

Information was collected on common food items consumed in the study site and grouped into nine standard food groups. The consumption frequency of the eight food groups within 7 days was multiplied to assigned weights of each food group and values summed to obtain the food consumption scores of each participant. (See appendix H for calculation of food consumption scores).

4.10.8 Nutritional status of study participants

4.10.8.1 Measuring weight

Respondents stood in the middle of the UNICEF supplied Seca electronic portable weighing scale, barefooted with minimal clothing. The research assistant read and recorded the weight of the participant to the nearest 100g in the anthropometry section of the questionnaire for the first measurement and repeated the measurement procedure again for the second reading. Thereafter, the average of the two measurements were computed using electronic calculators and recorded in the questionnaire as the final measurement for weight (CDC, 2007).

4.10.8.2 Measuring Height

Respondents removed their shoes and stood on the flat baseboard surface of the modified stadiometer by the vertical scale with the feet parallel and with heels, buttocks, shoulders and back of head touching the vertical scale mounted on a flat wall. The head was comfortably held

erect, with the lower border of the orbit of the eye identical to horizontal plane as the external canal of the ear. The arms hang loosely at the sides. The sliding head board was gently lowered crushing the hair and making contact with the top of the head. The research assistant recorded the first measurement with an accuracy of 0.1 centimetre and repeated the procedure. The average of the two measurements were computed using electronic calculators and recorded in the questionnaire as the final measurement for height (CDC, 2007) (See appendix 7 for measuring height procedures).

4.10.8.3 Measuring waist circumference

Respondents stood with their feet close together and arms at the side to ensure that body weight was evenly distributed and were measured with minimal clothing. The research assistant stood at the side of respondent and located the midpoint between lower margin of the least palpable rib and top of the iliac crest or the smallest area of the waist which is above the belly button. The research assistant marked the mid-point, extended the measuring tape around the marked point at the waist ensuring that the tape sat parallel to the floor and lied snugly taking caution that the tape did not constrict the respondent. The research assistant recorded the first measurement with an accuracy of 0.1 centimetre and repeated the procedure to obtain the average of the two measurements (WHO, 2008).See appendix 7 for the waist-hip measurement procedures).

4.10.8.4 Measuring hip circumference

Respondents stood with feet close together and arms at the side to ensure that body weight was evenly distributed and were measured with minimal clothing. The research assistant stood at the side of respondent and located the area around the widest portion of the buttocks and extend the tape around the hips. The tape sat parallel to the floor and lied snugly ensuring that it did not constrict the respondent, measurements were taken and recorded to the nearest 0.1 cm and the procedure repeated for the second measurement. The average of the two measurements were computed and recorded (WHO, 2008). See appendix 7 for hip measurement procedures.

During the training, a measurement standardization procedure was conducted by allowing all the six research assistants make 10 measurements of height and weight waist/hip measurement for waist-hip ratio in duplicate amongst themselves. The results for the first reading were noted in an appropriate record form and put aside until the second series of measurements were taken, in the same order as before. The principal researcher also took the measurements in a similar

fashion. All readings were tabulated. Precision and accuracy was then determined as detailed by (WHO, 1995).

4.10.9 Classification of nutritional status

4.10.9.1 Body Mass Index

Body Mass Index values were converted to nutritional status indicators according to the WHO reference standards (WHO, 2015). The cut off points used in the study for conversion of BMI values to nutritional status is shown in Table 4.10-1.

Table 4.10-1 Classification of Nutritional status according to BMI

Classification	**BMI(Kg/M$^{2)}$**
	Cut off Points
Underweight	<18.50
Normal weight	18:50-24.99
Overweight	25.00-29.99
Obese	≥ 30.00

4.10.9.2 Waist Hip Ratio

Waist-hip values were converted to nutritional status indicators according to WHO reference standards (WHO, 2008). The cut off points used in the study for conversion of waist-hip ratio value to Nutritional status are shown in Table 4.10-2.

Table 4.10-2 : WHO cut off points for Waist-hip ratio

Indicator	Cut off points		Risk of Medical Complications
	Males	Females	
Waist-Hip Ratio	**≥ 0.90cm**	**>0.85cm**	**Substantially increased**

4.11 Ethical consideration

A research Permit (see Appendix 10) was obtained from the Kenyatta National Hospital/ University of Nairobi Ethics and Research Committee (KNH/UON-ERC). Authorization to conduct the study was obtained through a stakeholder's workshop from the County Government of Isiolo seven months prior to the study. A client informed consent form (see appendix 1) was made available for the clients to sign on his/her free will that she/he agreed to provide personal information. The principal researcher and research assistants were to respect the rights of the respondents and not disclose personal information obtained from the households surveyed.

Findings from the study would be shared through peer reviewed journals, policy bulletins and community feedback workshops. A copy of the dissertation would be sent to the department of Public Health and Nutrition, Isiolo County and thereafter a dissemination workshop on key research findings to the health and nutrition officials at Isiolo County and Referral Hospital through a board meeting.

4.12 Data quality control

Several measures were put in place by the principal investigator to ensure data collected in the study was consistence, dependable, accurate, reproducible and repeatable.

4.12.1 Pre-survey measures

Multiple data collection tools to assess adult nutritional status and dietary assessment methods ensured data collected was accurate and consistence. The recruitment process for the post of the research assistant's ensured only skilled applicants were selected to conduct the study ensuring data collected was consistence and dependable data was collected for analysis. The two-day training workshop exposed research assistants to interview protocols, practical skills on interviewing skills, household sampling methodology, questionnaire filling and taking anthropometry measurements ensuring data collected was precise, valid and repeatable.

4.12.1.1 During data collection and processing

The segmentation of villages for household sampling methodology ensured that all houses had equal chances of being selected thereby eliminating sampling errors. Anthropometric measurements were conducted twice to reduce errors and the averages computed by the research assistants to ensure measurements were accurate and precise. The accuracy of the measurements where confirmed by the principal researcher through spot checks. Data security management was enhanced by collecting the questionnaire daily and securing them in well labelled envelopes and later in metabolic boxes to prevent questionnaires from getting lost and to prevent unauthorized access to the. Questionnaires were assigned serial numbers to ensure anonymity of the information collected. Raw data was reviewed by the principal researcher to ensure all questionnaires were filled correctly before data entry procedures. Descriptive statistics such as frequencies and cross tabulations were run to check for outliers and invalid values flagged off where appropriate.

4.13 Data analysis

Data was entered in statistical package for social science SPSS Version 20 (IBM Corporation, New Orchard, Armonk, New York, USA). Descriptive statistics such as means and standard deviations were used to describe continuous data such as age and household size while median, mode, frequencies, percentages and proportions were used to describe categorical data such as gender, residency, education level, and household. Comparison of means, proportions and percentiles was established by Chi-square tests, fisher's exact test (for cells with less than 5 values) and student t-test where appropriate. A binary logistic regression model adjusted for con-founding factors such as age and gender was used to determine the association between consumption of traditional fermented milk and associated factors on the nutritional status. The dependent variable, for the study was nutritional status; either normal or over nourished individuals while the independent variables included consumption of traditional fermented milk, food groups, food consumption scores, physical activity status, household wealth index, sociodemographic and household characteristics. The results were presented with the odd risk and the p-value. An odds ratio of greater than 1 was considered a risk factor for adult over nutrition while odds ratio of less than 1 was considered as a protective factor for obesity/adult overweight.

4.14 RESULTS

4.15 Socio-demographic and household characteristics

4.15.1 Socio-demographic characteristics

Out of the 407 participant's interviewed, 67.6% were females and 32.4% males. The mean age was 39.3±16, years but respondents with more than 82 years of age were exempted from analysis by stem and leaf plots during the flagging procedures, the mean age after exclusion of outliers was 38.4±14.9, the youngest respondent was 18 years and oldest 82 years. The median age was 35 years (IQR: 27-50) but majority (52.8%) of participants were young adults between 18 to 34 years. There was a statistically significance difference ($p<0.05$) between the mean age of males and females in the study (Independent t test = 3.08, df 405; $p > 0.002$), male participants had a mean age of 41.6±16.3 which was slightly higher than 36.8±14.0 years for female participants. Findings on residency showed that more than half (59.0%) of respondents resided in peri-urban areas while 41.0% resided in rural areas. More than a third (36.0 %) of respondents had never attained any level of education while a little more than 7% went past secondary school education. There was a statistically significance difference ($p<0.05$) between gender and educational level attainment (fishers exact test = 16.9, df 3; $p < 0.001$); about 75.3 % of female respondents had never attained any level of education compared to 24.7% of male respondents however, at least 15.2% of male respondents attained post-secondary education compared to 4.4% of female's respondents. Residency was significantly associated ($p<0.05$) with the education status of respondents (fishers exact test = 16.6, df 3; $p < 0.00$). Almost half (45.5%) of rural residents had never attained any level of education compared to 29.2 % in peri-urban regions. Majority (69.3%) of the households interviewed had males as the household head while a little more than 30.7% of households had females as the household head. More than half (51.4%) of households had between 4 to 6 members, the mean household size was 5.4±2.3 with a minimum of 1 member and a maximum of 11 members. Table 4.15-1 shows the socio-demographic characteristics of respondents in the study.

Table 4.15-1 Socio demographic characteristics of study participants

Social Demographic Characteristics (N=407)	Percent (%)
Age categories	
Young adults (18-34 years)	52.8
Middle aged adults (35-54 years)	32.2
Old adults (above 55 years)	15.0
Gender	
Male	32.4
Female	67.6
Residency	
Peri-Urban	59.0
Rural	41.0
Educational level	
Primary	36.0
Secondary	19.7
Post-secondary	7.9
Did not attend school	35.9
Household Head Gender	
Male	69.3
female	30.7
Household Head Educational level	
Primary	31.0
secondary	20.4
Post-secondary	11.5
Did not attend school	37.1
Household size	
1-3 members	20.9
4-6 members	51.4
Above 7	27.8

4.15.2 Household characteristics

The most common source of energy for cooking was the open fire place by 50.9% of adults while the least was propane stove by 3.7% of the households. At least 27% of households were connected to the main power grid while 2.9% relied on solar or generators for lighting their houses. The most common food storage appliance was the refrigerator with a little more than 7% of households while 6.6% of households had freezers and 2.0% cooling boxes. Majority (87.7 %) of households had access to improved water sources for drinking while 12.7% used non-improved sources. More than half (69.8%) of households had access to a toilet facility within the compound. The mobile phone was the most common means of communication by 83.8% of respondents while more than half (59.7%) reported to own a radio and 45.0 % of households reported to own a television, only 8.1% of households owned a computer or laptop. About 16.5% of households interviewed owned a motor bike while 13.3% owned a bicycle

and a little more than 10% owned an auto mobile. Table 4.15-2 shows the households characteristics in the study.

Table 4.15-2 Household characteristics

Characteristic (N=407)	Percentage
Energy source for cooking/	
1. Open fire place/use of wood	50.1
2. Charcoal stove	30.2
3. Petroleum stove	16.5
4. Gas	18.9
5. Propane stove	3.7
Source of Lighting	
6. Power generator/solar	2.9
7. Connected to power grid	27.0
Food storage appliances	
8. Cooling box	2.0
9. Refrigerator	7.9
10. Freezer	6.6
Sources of drinking water	
Improved source	**87.7**
11. Tap water	79.6
12. Rain water	1.2
13. Protected well	6.9
Non-Improved sources	**12.3**
14. Borehole	6.6
15. Pond/lake	0.5
16. River/stream	5.2
Communication Equipment's	
17. Radio	59.7
18. TV	45.0
19. Mobile phones	83.8
20. Computer/laptop	8.1
Transport means	
21. Bicycle	13.3
22. Motor bike	16.5
23. Auto-mobile	10.6

4.16 Household wealth index

About 37.8% of households were classified in the lower wealth category while a similar proportion (37.6%) of households were classified in the middle wealth category and the rest of the households (24.6%) were classified in the high wealth category. The mean household wealth index was 0.14± 0.1 with maximum wealth index of 0.18 and a minimum wealth index of -0.08.

4.17 Morbidity patterns and physical activity status

4.17.1 Morbidity patterns

As provided in Table 4.17-1, the most frequently condition diagnosed was stomach ulcers with a little more than 9%, depression (6.1%) and hypertension (6.1%). About 2.0% of respondents were diagnosed with diabetes and 2.8% with heart problems. Cancer was not reported by any of the study participants. Table 4.17-1 shows the morbidity patterns as reported by the study participants.

Table 4.17-1 Morbidity patterns as reported by study participants

Medical Conditions in the past one year	Percent (N=407)
1. Heart problems	2.7
2. Heart Infections	1.7
3. Stomach ulcers	9.8
4. Diabetes	2.0
5. Depression	6.1
6. Liver problems	1.7
7. Meningitis	0.2
8. Pneumonia	5.9
9. Cancers	-
10. Unexpected weight loss	2.2
11. Brucellosis	3.7
12. Hypertension	6.1

4.17.2 Physical activity status

Majority (69.0%) of study participants were involved in physical activities while 31.0% were not, nevertheless 70.9% of female's adults were more physical active compared to 65.2% of male's adults but the difference was statistically insignificant (Chi-square test = 1.383, df 1; p<0.253). However, the proportion of physically inactive female adults was greater compared to male adults. Physical activity declined with increasing age while rural residents were more physically active (74.3%) compared to 65.4% of urban residents.

4.18 Food consumption patterns

4.18.1 Dietary patterns

Food groups were classified in different classes as shown in Table 4.18-1. More than half (57.0%) had never consumed processed sour milk while a little more than 14% consumed processed yogurt 1-2 days a week, however cheese consumption was low and was reported by 2.2% of adults within a month. The most frequently consumed beverage was water by 91.4% of respondents while the least consumed was coffee with milk by 85% of respondents.

Consumption of animal proteins was generally very low in the study since majority of the study participants never consumed fish (81.1%), poultry (61.2%) and pork (90.2%); consequently, consumption of processed animal products such as sausages and processed meat was less common; however, 28.1 % of respondents consumed eggs 1-2 days a month while almost half consumed animal protein (beef, lamb, mutton) 1-2 days a month.

Consumption of pulses was common in the study since more than half of the respondents consumed beans lentils, peas and green grams, however the most common pulse consumed daily was beans by 16.2% of respondents while the least was green grams and lentils by 1.5%.

Cereal and cereal products contributed the major bulk of the food consumed within a month by almost half of study participants. Anjera, a pancake prepared by pastoralists was the most frequently consumed cereal product daily by 36.4% of study participants while ugali was the most consumed several times a week by 31.9% of respondents.

Consumption of fruits and vegetables was relatively low in the study less than a third (24.3%) of the study participants consumed fruits daily while 31.9% consumed vegetables daily, nevertheless 14.7 % and 29 % consumed fruits and vegetables 3-5 days a week respectively. The frequency of consumption for the different food groups are as shown in Table 4.18-1.

Table 4.18-1 Consumption frequency of foods within one month

Food Items	Consumption frequency within one month (N = 407)				
	Never	Few(1-2) days Per week	Few (1-2 days) Per month	Several days(3-6) per week	daily
	%	%	%	%	%
Processed Milk and milk Products					
1. Sour milk (Mala)	57.0	17.2	11.5	10.8	3.7
2. Yoghurt	65.4	14.5	13.0	7.1	-
3. Ice cream	87.2	3.9	6.6	1.7	0.5
4. Pure Butter	94.3	1.5	2.2	1.2	0.7
5. cheese	96.3	1.0	2.2	0.2	0.2
Beverages					
6. Tea with milk	20.1	2.0	2.2	1.2	74.4
7. Tea without milk	57.7	6.1	20.4	3.7	12.0
8. Coffee with milk	85.0	2.2	7.4	3.9	1.5
9. Coffee without milk	65.6	5.4	14.7	8.8	5.4
10. Water from household	4.9	0.7	1.2	1.7	91.4
Animal and Animal Products					
11. Eggs	43.8	9.9	28.1	13.8	4.4
12. Pork/Beef/sausages	91.2	2.7	4.9	1.0	0.2
13. Poultry	61.2	25.6	10.3	2.7	0.2
14. Pork	90.2	6.1	2.2	1.5	-
15. Processed meats	87.5	3.9	6.4	1.5	0.7
16. Meats	12.3	7.9	43.0	23.8	13.0
17. Roasted meats	68.8	11.5	9.1	9.1	1.5
18. Fish	81.1	5.9	9.6	2.7	0.7
Pulses					
19. Beans	10.1	3.4	45.2	25.1	16.2
20. lentils	75.2	4.9	11.5	5.4	2.9
21. Green grams	38.8	10.3	40.8	8.6	1.5
22. Peas	52.6	6.9	32.9	6.1	1.5
Cereal and Cereal Products					
23. Ugali	5.7	3.2	43.2	31.9	16.0
24. Pilau /rice	20.4	4.7	40.8	24.4	10.1
25. Spaghetti	27.5	6.6	47.9	16.0	2.0
26. Anjera	31.9	3.9	19.4	8.4	36.4
27. Chapatti	21.4	15.0	44.0	17.2	2.5
Fruits and vegetables					
28. Vegetables	5.2	1.2	32.7	29.0	31.9
29. Fruits	19.2	6.1	35.6	14.7	24.3

4.18.2 Consumption of traditional fermented milk

About 49.6% of adults consumed traditional fermented milk. The most frequently consumed traditional fermented milk was fermented sour cow milk by 25% of adults while the least consumed fermented sour sheep milk by less than 11%. Figure 4.18.1 shows the consumption frequency of traditional fermented milk from different animal milks.

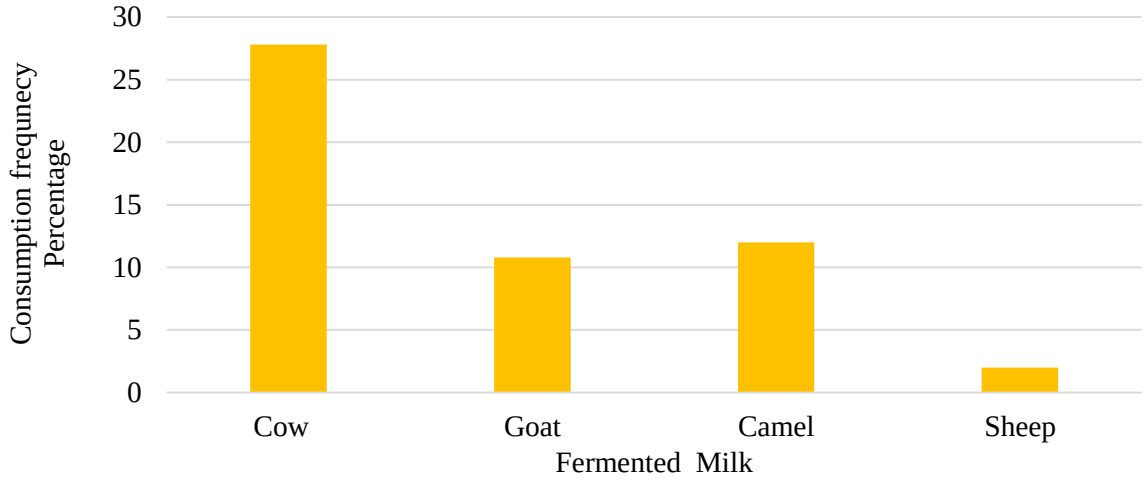


Figure 4.18-1 Daily Consumption frequency of traditional fermented milk

Informally traded sour cow milk was the most consumed daily by 11.2% of respondents compared to 4.0 % from homemade sources. The average mean intake of homemade sour cow milk was 1.9±1.1 with a minimum of 1 cup and a maximum of 6 cups while the mean monthly intake from informally traded sources was 1.7±0.9 with a minimum of 1 cup and maximum of 6 cups. Traditional fermented sheep milk was the least consumed amongst the four animal milk with by more than 95% of respondents reported not have consumed informally traded sour camel milk; nevertheless, about 22.7% of respondents consumed homemade sour sheep milk with an average monthly intake of 1.7±0.5 and a maximum of 2 cups and a minimum of 1 cup. Table 14.8-2 shows consumption frequency of traditional fermented milk and the source of the milk.

Table 4.18-2 Consumption frequency of traditional fermented milk within one month

Fermented animal milk	Consumption frequency within one month (N=407)				
	Never	Few (1-2 days) per month	Few (1-2 days) per week	Several (3-4 days) per week	Daily
	%	%	%	%	%
1. Informally traded sour cow milk	71.9	4.0	6.4	6.4	**11.2**
2. Homemade sour cow milk	73.9	7.6	5.6	4.0	**8.8**
3. Informally traded sour goat milk	82.8	4.3	**6.5**	4.3	2.2
4. Homemade sour goat milk	59.1	9.7	**15.1**	8.6	7.5
5. Informally traded sour camel milk	67.6	**14.3**	9.5	2.9	2.7
6. Homemade sour camel milk	72.6	**10.4**	7.5	2.8	6.6
7. Informally traded sour sheep milk	**95.5**	-	-	-	4.5
8. Homemade sour sheep milk	68.2	**22.7**	4.5	4.5	-

*Numbers in **bold** indicate the highest consumption frequency

4.18.3 Food consumption scores

The mean food consumption score in the study was 60.5± 25.3 with a minimum FCS score of 14 and a maximum of 112. Majority (85.5%) of the study participants had acceptable food consumption thresholds while 12% had borderline food consumption scores, however 2.5% of respondents had poor food consumption scores. Further analysis from the food consumption scores found that pulses were the most common food group consumed within 7 days while the least consumed food group were vegetables. Consumption of milk was relatively high since it was consumed for more than 4 days while fruits and oil were consumed for more than 3 days a week. Consumption of meat/fish and sugar was relatively low in the study since majority of adults reported not to have consumed within 2 days a week. Figure 4.18-2 shows food consumption patterns within seven days prior to the study.

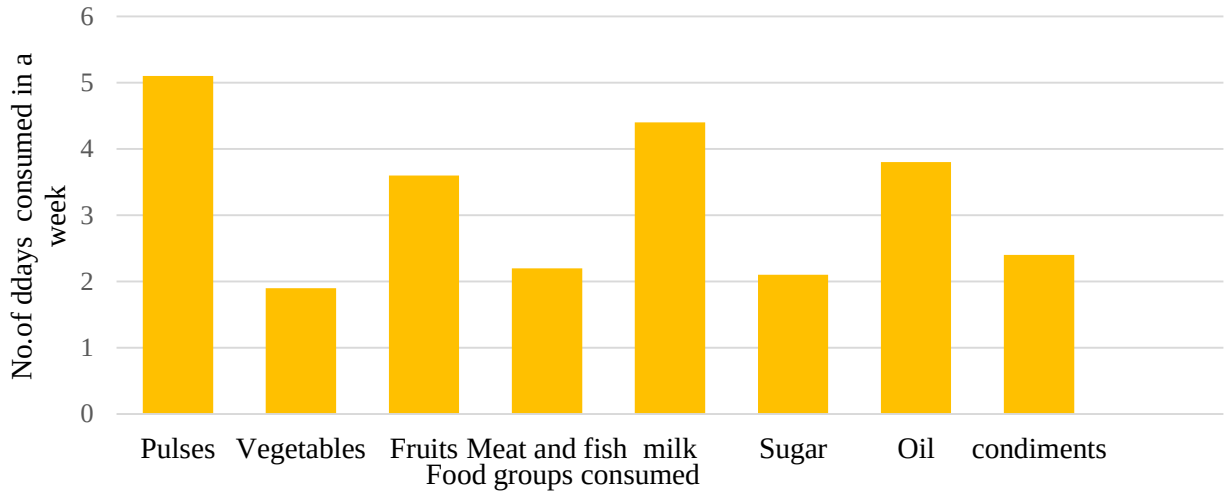


Figure 4.18-2 Consumption of food groups within seven days

4.19 Adult nutritional status

4.19.1 Body mass Index (BMI)

The mean BMI score was 23±5.5 with a minimum score of 11 and a maximum score of 46. Majority (48.6%) of the adults had normal BMI, nonetheless 21.6% of adults were underweight. About 18.7 % of adults were overweight while a little more than 11% classified as obese, further analysis showed statistically significant differences among genders (p<0.05), (Independent t test = -2.833, df 405; p <0.005), majority of females had a higher mean BMI score of 23.5±5.8 compared to 21.9±4.7 for male adults. There were more female respondents who were overweight (19.6%) and obese (14.5%) in the study compared to male respondents; nevertheless, the proportion of male respondents who were underweight was higher (26.5%) than females (19.3%) but majority (53%) of male respondents had normal BMI scores as compared to 46.5% of female respondents as shown in Table 4.19-1 illustrates the nutritional status of adults in the study by body mass index.

Table 4.19-1 Nutritional status of respondents

	Body Mass Index Kg/M^2 (N = 407)			
Gender	**Underweight <18.50Kg/M^2**	**Normal 18:50-24.99 Kg/M^2**	**Overweight ≥ 25.00-29.99 Kg/M^2**	**Obese 30.00 Kg/M^2**
	%	**%**	**%**	**%**
Male	26.5	53.0	16.7	3.8
Female	19.3	46.5	19.6	14.5
Total	21.6	48.6	18.7	11.1

4.19.2 Nutritional status by waist-hip ratio

The mean waist-hip ratio for male adults was 0.8±0.09 with a minimum waist-hip ratio of 0.6 and a maximum of 1.2. Females adults had a mean waist hip ratio of 0.8±0.1 with a minimum waist-hip ratio of 0.6 and a maximum of 1.5. Majority (72 %) of males had normal waist-hip ratio compared to 68.4% of female respondents. Almost a third (31.6%) of female respondents were classified with abdominal obesity compared to 28% of male adults. Figure 4.19-2 shows the nutritional status of respondents by Waist-hip ratio.

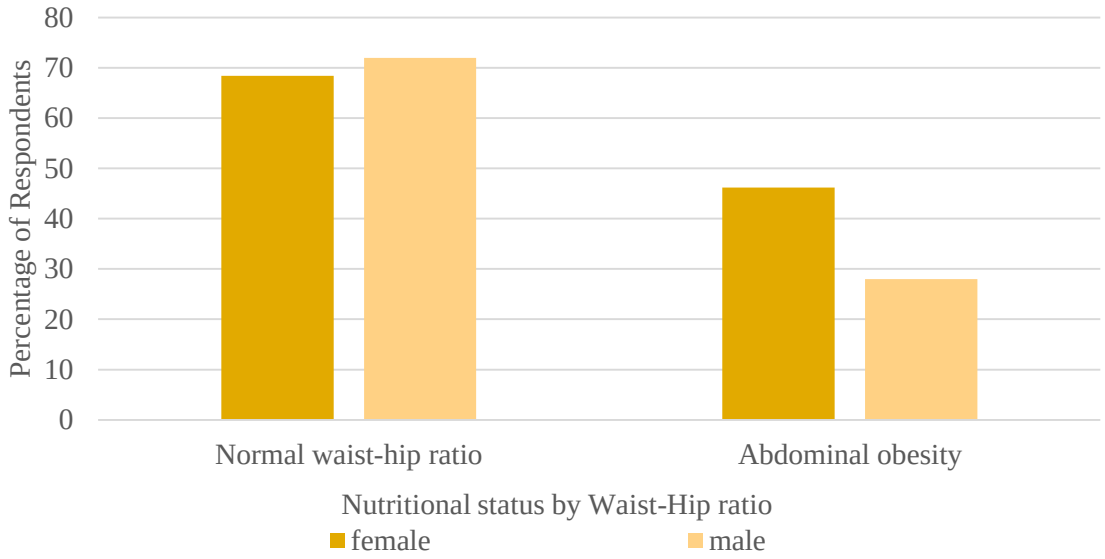


Figure 4.19-1 Nutritional status of respondents by waist-hip ratio

4.19.3 Body Mass index and waist-hip ratio as nutritional assessment methods

To determine significance differences between body mass index and waist-hip ratio as nutritional assessment methods, nutritional status was re-classified into two major classes; normal weight and over-nutrition, findings showed significant differences (p<0.05) between the two methods for assessing adult nutritional status (Chi-square test = 16.8, df 3; p<0.000). Body mass index slightly classified 3.1% individuals as over nourished compared to waist-hip ratio subsequently, waist-hip ratio classified 65.2% of respondents with normal nutrition as compared to 62.1% by Body mass index. Figure 4.19-2 illustrates the nutritional status as classified by Body Mass index and Waist-Hip ratio.

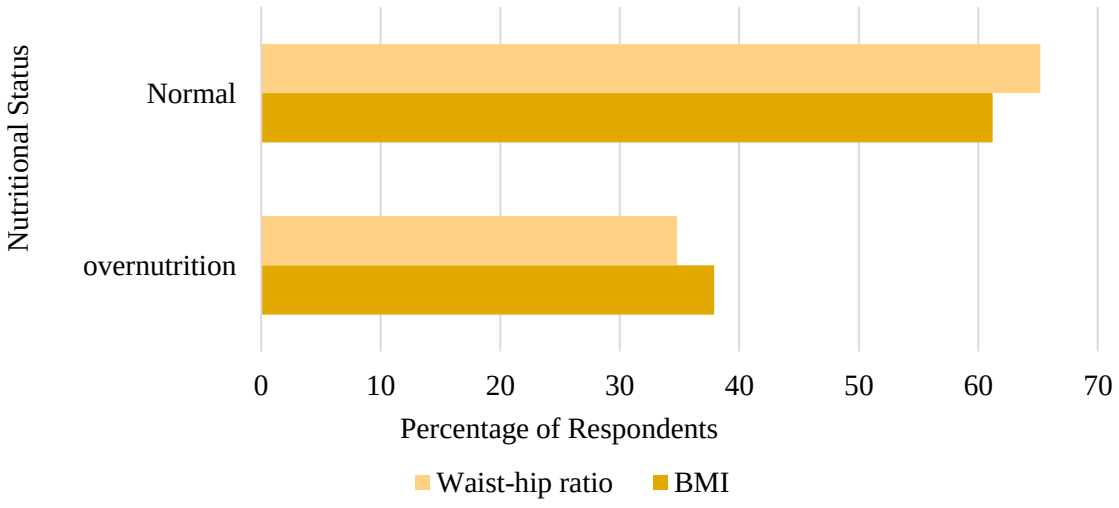


Figure 4.19-2 Nutritional assessment by body mass index and waist-hip ratio

4.20 Risk factors associated with adult overweight and obesity

To establish the risk factors associated with adult overweight and obesity, bivariate correlation analysis was performed between adult nutritional status and socio-demographic attributes, household characteristics, morbidity outcomes, physical activity status, dietary patterns and consumption of traditional fermented. Results are presented in appendix 9.

Household ownership of a gas cooker was highly significant with odds ratio (OR) being 1.9 [95% Confidence Interval (CI): 1.1-3.1; p<0.013], while television set (OR: 1.7; p<0.014), female gender (OR: 1.2; p<0.015), presence of a toilet facility (OR: 1.8; p< 0.034) and mobile phone ownership (OR: 2.1; p<0.043) were significant risk factors for overweight and obesity. Household heads who had attained education (OR: 0.6; 95% CI: 0.2-0.6; p<0.001), non-consumption of pork (OR: 0.3; p<0.003), non-consumption of peas (OR: 0.5; p<0.004), non-consumption of chapatti (OR; 0.5; p<0.004), non-consumption of fish (OR: 0.4; p<0.004), non-consumption of lentils (OR: 0.4; p<0.06), non- consumption of sausages (OR: 0.3;p<0.008) households with 1-3 family members (OR 0.3; p<0.009),rural residency (OR: 0.5 ; p< 0.011*)* and respondents who had attained education (OR:0.6; *p<0.059)* emerged as protective effects for overweight and obesity .

However there was no significant association between consumption of traditional fermented sour milk regardless of the animal, household size, household wealth index, household's drinking water sources, ownership of bicycle, auto-mobile ownership, food consumption scores, physical activity, consumption of yoghurt, processed yoghurt, tea with milk, meat, beans, anjera, vegetables, fruits with adult overweight and obesity.

4.20.1 Demographic factors associated with adult overweight and obesity

Further analysis on the socio-demographic factors showed that female gender, adults residing in urban areas, higher educational status, and large household's size were significant risk factors for adult overweight and obesity. Findings are presented in table 4.20-1.

Table 4.20-1 Demographic factors associated with adult overweight and obesity.

Associated demographic factors	Adults (N = 319)		
	Overweight/Obese	Normal Weight	P Value
	%	%	
Gender			**0.017**
Male	27.8	72.2	
Female	42.3	57.7	
Residency			**0.012**
Rural	28.7	71.3	
Peri-Urban	43.1	56.9	
Educational Status of respondent			**0.059**
Yes	41.7	58.3	
No	31.0	69.0	
Educational status of household head			
Attended	44.9	55.1	**0.000**
Did not attend	25	75	
Household size			
1-3	22.4	77.6	**0.013**
4-6	41.7	58.3	
>7	42.7	57.3	

Numbers in **bold** indicate Statistical significance at $p < 0.05$

4.20.2 Household wealth index and socio-demographic characteristics.

The presence of several confounding factors associated with adult overweight and obesity within the socio-demographic characteristics required further cross tabulation with the household wealth index to ascertain the significance of each risk factor. Majority of adults who belonged to the lower wealth quantile had little or no education and were less overweight or obese. However, adults who had attained some level of education belonged to the middle and higher wealth index quantiles and made up a greater proportion of adults with overweight and obesity, a similar observation was also noted with household heads with little or no education. Majority of adults who belonged to lower wealth quintile were from large households and were more overweight and obese. Nevertheless, adults from households with fewer members belonged to the higher wealth quantile and comprised of a small proportion of overweight and obese adults in the study. Results are presented in Table 4.20-2.

Table 4.20-2 Demographic factors associated with wealth index categories

Demographic factors	Wealth index categories (N = 407)			
	lower	middle	Higher	P Value
	%	%	%	
Educational status of respondent				**0.000**
Yes	25.7	40.2	**34.1**	
No	59.6	32.9	**7.5**	
Educational status of Household head				**0.000**
Yes	23.8	42.6	**33.6**	
No	61.6	29.1	**9.3**	
Household size				**0.002**
1-3	30.6	32.9	**36.5**	
4-6	34.0	41.1	**24.9**	
>7	50.4	34.5	**15.0**	

Numbers in **bold** indicate Statistical significance at $p < 0.05$

4.20.3 Household ownership characteristics associated with adult overweight and obesity

Findings from the logistic regression showed that adults who owned either a television, gas cooker, mobile phone or the presence of a toilet facility within the compound were overweight and obese as compared to adults who did not possess any of the assets above, results are presented in Table 4.20-3.

Table 4.20-3 Household assets ownership and adult overweight/obesity

Associated household ownership characteristics	Adults (N = 319)		
	Overweight/Obese	Normal Weight	P Value
Television Ownership	%	%	**0.015**
Yes	44.7	55.3	
No	31.2	68.8	
Presence of Toilet Facility			**0.035**
Yes	41.4	58.6	
No	28.0	72.0	
Ownership of Gas Cooker			**0.018**
Yes	50.7	49.3	
No	34.3	65.7	
Mobile phone Ownership			**0.059**
Yes	40.1	59.9	
No	23.8	76.2	

Numbers in **bold** indicate Statistical significance at $p < 0.05$

To ascertain the significance of each household asset as a risk factor for adult overweight and obesity, the household wealth index was cross tabulated with the household ownership characteristics. Findings from the analysis showed that adults from households that owned either a television, gas cooker, mobile phone or had a toilet facility within the compound were from a higher wealth quantile and were more likely to be overweight and obese as compared to adults from lower wealth quantiles. The findings on household ownership characteristics and wealth quantiles are presented in Table 4.20-4.

Table 4.20-4 Household ownership of assets and wealth index quantiles

Household ownership of assets	**Wealth index quantiles (N = 407)**			
	lower	**middle**	**Higher**	**P Value**
	%	**%**	**%**	
Television ownership				**0.000**
Yes	5.5	42.1	52.5	
No	64.3	33.9	1.8	
Presence of toilet facility				**0.000**
Yes	24.3	42.6	33.1	
No	69.1	26.0	4.9	
Gas cooker ownership				**0.000**
Yes	0.0	7.8	92.2	
No	46.7	44.5	8.8	
Mobile phone ownership				**0.000**
Yes	28.4	43.1	28.4	
No	86.4	9.1	4.5	

Numbers in **bold** indicate Statistical significance at $p < 0.05$

4.20.4 Dietary patterns associated with adult overweight and obesity

Analysis of dietary patterns associated with overweight and obesity in the study showed that a greater proportion of adults with obesity and overweight were consumers of pork, sausages, fish, peas, lentils, vegetables and chapatti. Table 4.20-5 demonstrates the dietary patterns associated with adult overweight and obesity.

Table 4.20-5 Dietary patterns associated with adult overweight and obesity

Dietary Patterns	Adult nutritional Status (N = 319)		
	Overweight/Obese	Normal Weight	P Value
	%	%	
Pork			**0.004**
Consumed	60.5	39.5	
Did not consume	34.9	65.1	
Sausages			**0.014**
Consumed	58.8	41.2	
Did not consume	35.4	64.4	
Fish			**0.005**
Consumed	54.1	45.9	
Did not consume	34.1	65.9	
Lentils			**0.007**
Consumed	50.0	50.0	
Did not consume	33.2	66.8	
Peas			**0.004**
Consumed	45.9	54.1	
Did not consume	30.0	70.0	
Chapatti			**0.000**
Consumed	42.3	57.7	
Did not consume	18.6	81.4	
Vegetables			**0.034**
Consumed	**39.1**	**60.9**	
Did not consume	**8.3**	**91.7**	

Numbers in **bold** indicate Statistical significance at $p < 0.05$

The variable residency was used to establish significant association with dietary patterns. Findings from the analysis showed that majority of adults who reported to consume pork, sausages, yoghurt and lentils resided in peri-urban regions. Table 4.20-6 provides the results from the analysis.

Table 4.20-6 Dietary patterns associated with residency

Dietary patterns	Residency (N = 407)		
	Rural	**Peri-Urban**	**P Value**
	%	**%**	
Pork			**0.017**
Consumed	22.5	77.5	
Did not consume	43.1	56.9	
Sausages			**0.000**
Consumed	13.9	86.1	
Did not consume	43.7	56.3	
Yoghurt			**0.000**
Consumed	28.4	71.6	
Did not consume	47.7	52.3	
Lentils			**0.004**
Consumed	28.7	71.3	
Did not consume	45.1	54.9	

Numbers in **bold** indicate Statistical significance at $p < 0.05$

Wealth index quantiles were analysed for significance associations with dietary patterns, findings showed that households with acceptable food consumption scores had higher wealth quantiles. Consequently, adults who consumed pork, sausages and yoghurt were from a higher wealth quantile while those who consumed fish, lentils, peas, and chapattis and vegetables were from the middle wealth quantile while adults who did not consume most of the foods included in the analysis belonged to the lower wealth quantile. Table 4.20-7 shows the dietary patterns associated with wealth index categories.

Table 4.20-7 Dietary patterns associated with wealth index categories

Dietary Patterns	Wealth index categories (N = 407)			
	low	middle	High	P Value
	%	%	%	
Food consumption scores				**0.019**
Acceptable	36.2	36.8	27.0	
Poor	47.5	42.4	10.2	
Pork				**0.002**
Consumed	15.0	42.5	42.5	
Did not consume	40.3	37.1	22.6	
Sausages				**0.000**
Consumed	**16.7**	**25.0**	**58.3**	
Did not consume	**39.9**	**38.8**	**21.3**	
Yoghurt				**0.000**
Consumed	17.0	36.9	46.1	
Did not consume	48.9	38.0	13.2	
Fish				**0.042**
Consumed	26.0	41.6	32.5	
Did not consume	40.6	36.7	22.7	
Lentils				**0.000**
Consumed	20.8	46.5	32.7	
Did not consume	43.5	34.6	21.9	
Peas				**0.037**
Consumed	31.6	39.9	28.5	
Did not consume	43.5	35.5	21.0	
Chapatti				**0.001**
Consumed	33.4	39.1	27.5	
Did not consume	54.0	32.2	13.8	
Vegetables				**0.001**
Consumed	35.8	39.1	25.1	
Did not consume	76.2	9.5	14.3	

Numbers in **bold** indicate Statistical significance at $p < 0.05$

4.21 Discussions

4.22 Socio-demographic and household characteristics

4.22.1 Socio-demographic characteristics

There were more females (67.6%) than males (32.4%) who participated in the study similar results were reported by several authors (Ziraba et al., 2009; Wanjiku et al., 2010). The lower response rate by men could indicate frequent and longer absence from households (KNBS, 2014).

The mean age of study participants was 38.4±14.9 years. More than half (59%) of respondents were young adults between the ages of 18-34 years, nearly similar findings are reflected at the national level where majority of the population is comprised of young adults (KNBS, 2014).

The study showed that majority (59%) of study participants resided in areas classified as peri-urban while 41% resided in rural areas, the study differs with the national statistics which indicate that more than half (66%) of the Kenyan population reside in rural areas. The differences could be due the population dynamics of the study area since majority of the study population areas which are densely populated and are classified as peri-urban during the study design.

Findings in the current study showed that slightly more than a third (36.0%) of adults had never attended school, this is higher than the national figure of 27 % (KNBS, 2014). The study also found that there were more females than males who had never attended school, consequently more male adults attained secondary and post-secondary education than female adults, the findings are consistence to studies conducted in other parts of the country (Wanjiku et al., 2010). The reasons for the low educational status in the study region has been linked to ignorance, poverty and early marriages (ACF, 2016).

The current study revealed that urban residents were more educated than rural residents, similar findings are reflected at the national level (KNBS,2014). The presence of private and public schools in urban areas coupled with a change in attitude towards both girl and boy child education could be probably linked to the high educational level in the urban regions compared to rural regions in the study site and the country as well.

Majority (69.3%) of households were headed by a male adult while 30.7% were headed by a female adult, the current study findings are consistence with the national figure. The study also showed that more than a third (37.1%) household heads have never attended school. Several

studies on household food security conducted in the country, regionally and in low and middle income economies relate a great proportion of household food insecurity to the educational status of household head (Omenoni et al., 2007; Bashir et al., 2012 and Mutisya et al., 2016).

The mean household size was 5.4, the current study findings differ with the national figure of 3.9 people. The differences observed in the current study could be due to the inclusion of households with more than 6 household members during the data cleaning process thereby increasing the household size.

4.22.2 Household characteristics

The current study showed that majority (80.3%) of households use solid fuels such as wood and charcoal as a source of energy for cooking, the figure is higher than the national average of 75% (KNBS, 2014) this could probably be due to the availability firewood and charcoal from dried shrubs in region (IMC, 2012; ACF, 2016). The use of gas for cooking probably due to its convenience and economic reasons was 18.9% in the study, this was higher than the national average of 12% (KNBS, 2014), the trend is increasing nationally up from 6.2% in the KDHS 2008/2009 report, this can be mainly be attributed to rapid urbanization of towns previously regarded as rural towns and market forces that lower the prices of cooking gas (Mwende, 2016).

Majority (87.8%) of households obtained drinking water from improved sources such as tap/piped water or protected wells while 12.7% used non-improved sources such as open wells, dams, rivers or lakes/ponds. National statistics indicate that 71% of households obtain water from improved sources while 27% use non-improved sources. The study region has seen an increased involvement by the county government and non-governmental organizations working to increase water, sanitation and hygiene (WASH) components in households, schools and communities (ACF, 2016).

More than two thirds of households interviewed had access to a toilet facility within the compound, similar results were reported nationally (KNBS, 2014), the higher figures obtained in the current study could be linked to increased WASH activities by non-governmental organizations and the county government.

More than half (59.7%) of households owned a radio, 45% owned a television set while 83.3% of respondents owned a mobile phone, the figures were slightly higher than the national figure and the trend has been increasing over the last five years (KNBS, 2014).

4.22.3 Household wealth Index

Majority of households in the study region clustered around the lower and middle wealth quantiles with a few households in the higher wealth index located in the peri-urban regions, nearly similar trends were reported nationally with majority of households in the higher wealth quantiles located in Nairobi, the capital city (KNBS, 2014).

4.23 Non-Communicable diseases and physical activity

4.23.1 Non communicable diseases

The prevalence of diabetes, hypertension, and cardiovascular heart diseases was 2.0%, 6.1% and 2.8% respectively. Findings from the FDGs confirmed that cases of cancer, diabetes and hypertension had increased in the study region. Country reports for the year 2014 reported that the prevalence of diabetes and hypertension to be less than 1% and 9% respectively (KNBS, 2014) but the national survey did not collect information on cardiovascular diseases (CVD's) but a STEP survey for non-communicable disease risk factors in Kenya carried out in the year 2015 reported 7.6% of Kenyans were at risk of cardiovascular diseases risks (MOH, 2015). Similar studies conducted in the western part of the country reported the prevalence of hypertension and diabetes was less than 6% (Gerald et al., 2013). The increasing trend of diabetes, hypertension and CVD's has not only been observed in Kenya but also in the Southern Sahara countries (Vorster et al., 2011; Barry et al., 2012 and Manuel et al., 2015). Studies have linked the increasing trend of NCDs to increased exposure to the four major risk factors namely, unhealthy diets, physical inactivity, alcohol and tobacco use (Ferdinand and Armani, 2007; Vorster et al., 2011; Murage et al., 2015; Manuel et al., 2015). Findings from the FDG's also confirmed that sedentary lifestyle coupled with little physical activity and diets high in sugar and fats was a probable cause of the recent cases of diabetes and hypertension in the region.

4.23.2 Physical activity status

The current study found majority (69%) of adults were physically active. The figure is lower compared to a similar study conducted in the western part of the country that reported 93% of adults were physically active throughout the week (Gerald et al., 2013) this could probably be linked to the energy intensive farming conducted in the western part of the country. The current study showed that females were more physically active compared males, similar findings are reflected at the national and the global level (Hallal et al., 2012; MOH, 2015). The observations can be attributed to gender roles in different cultures. Urban residents were less physically active compared to rural residents, the findings are also replicated at the nation level (MOH,

2015) reasons for the trend observed has been discussed can most likely be attributed to urbanization with unsupportive environments such as poor urban planning, insecurity, lack of adequate information, motorized transport systems and socio-cultural factors (MOH,2015).

4.24 Dietary patterns

4.24.1 Food consumption scores

The current study found 85% of households had acceptable food consumption scores while 12% and 2.5% of households had borderline and poor FCS respectively. Nearly similar findings were reported in the study region (ACF, 2016). The high acceptable FCS were attributed to sufficient rains at the beginning of the year which provided pasture for animals and resulted in an increase in milk and agricultural production (ACF, 2016).

4.24.2 Food consumption patterns

Consumption of animal and animal products such as eggs, beef, mutton, lamb, fish and poultry was generally low, the findings are consistence with similar reports from the study region (ACF, 2016). Probable reasons for the low consumption of animal and animal products could be attributed to the lack of purchasing power by households or unavailability of meat products (ACF, 2016). Nevertheless, religious/cultural barriers that inhibit the consumption of certain animal or animal product such as pork with Muslims could also have attributed to the low consumption of animal and animal products.

Consistence with reports from the region (MOH, 2015), consumption of low nutrient dense foods such as rice, spaghetti, chapatti, ugali, boiled maize and anjera contributed to the major bulk of the food consumed within a month by almost half of the adults, this could be due easy affordability and availability of cereal and cereal products in the region. Consumption of Anjera/ pancake during breakfast was very common probably due to cultural influence of the Cushitic community familiar with preparing anjera (Osere, 2005).

The WHO recommends at least 5 servings of fruits and vegetables daily, findings from the current study showed that less than a third (24.3%) of adults consumed fruits daily while 31.9% consumed vegetables daily , the results are much lower than the national average (MOH, 2015). The most likely reason for the relatively low consumption of fruits and vegetables in the current study could be lack of knowledge and awareness on the health and nutritional benefits of fruits and vegetables in the diet or lack of purchasing power by households in the study region.

4.24.3 Consumption of milk and milk products

Milk consumption in Kenya is among the highest in the world (Muriuki, 2011). Milk was among the highest consumed foods within one week in the study region, nearly similar findings were reported in the region (ACF, 2016). This could be attributed to sufficient rainfall which provided fodder and water availability thereby increasing milk production.

The current study found consumption of cheese was relatively low, nearly similar findings were reported in a study on the consumption of dairy products in rural and urban households in Machakos County, a semi-arid region on the Eastern part of the country (Njarui et al., 2011). The most probable reasons for low consumption of processed dairy products in the current study region and the country could be the availability and high prices of processed dairy products. Consumption of homemade sour goat milk was the most common in the study compared to milk informally traded sour goat milk. Possible reasons for the observation could be that only a few households prepare fermented sour goat milk for commercialization purposes while the rest is consumed by household's members. Consumption of fermented sheep milk was not common in the study region; reasons could be attributed to culturally acceptability of sheep milk. A study on the acceptability of goat and sheep milk in Malawi showed that negative attitudes on the consumption of non-traditional/culturally appropriate milk was the major factor affecting acceptability of goat and sheep milk in the country (Banda, 2007).

4.25 Nutritional status of adults

The mean BMI score was 23.5 but female adults had a higher mean BMI compared to male adults. The current study findings are consistence with the national BMI score of 23.3 (MOH, 2015). Majority (48.6%) of adults had normal BMI scores, the findings disagree with a similar study report in a Kenyan rural adult population which reported 76% of adults had normal BMI scores (Jayne et all., 2011), reasons for the disparities could be attributed to the five years' differences between the two studies taking into consideration that cases of over nutrition had increased gradually in the country (MOH, 2015).

About 21.6% of adults were underweight, this was slightly lower compared to a similar study conducted in the country (Chege, 2016). Similar trends are reflected in low and middle income countries such as India where the prevalence of underweight adults is 22.7% (Matthew et al., 2016). Studies have highlighted the link between adult underweight with increased risk of medical conditions such as osteoporosis, anaemia and decreased fertility (Pengpid and Peltzer, 2015). The current study consequently found that the proportion of males adults who were

underweight was higher compared to females, this is consistent with studies conducted in other parts of the country (Murage et al., 2015; Chege, 2016).

The prevalence of adult overweight and obesity was 18.7% and 11% respectively, the proportion of overweight adults was slightly lower than the national and global prevalence of 19% and 39% respectively (MOH, 2015; WHO, 2016). However, the study findings on adult obesity was higher than national average of 8.9 % but lower than the global prevalence of 13% (MOH, 2015; WHO, 2016). Overweight and obesity have been linked to several non-communicable diseases such as hypertension, CVD's, type 2 diabetes, colonic cancer, post-menopausal breast cancer and osteoarthritis (WHO, 2016).

There were more females than males who were overweight and obese in the study, this is consistence with similar studies in the country (Wanjiku et al., 2010; Jayne et al., 2016) and the continent as well (Odenigbo et al., 2011 and Chinedu, 2014). Reasons for the high cases of overweight and obesity in the current study and other African countries among females have been linked to societal customs and gender roles (Odenigbo et al., 2011). Studies on the continent have highlighted how African societies perceive an obese or overweight woman as a symbol of higher socio-economic status (Siervo et al., 2006), therefore the larger the body size, the healthier and wealthier the family is perceived by the community. Lack of knowledge on the risks associated with obesity could also be contribute to the high cases of female obesity in the study and other African societies as well (Siervo et al., 2006).

The study indicated that 37% of adults were classified with abdominal obesity based on waist-hip ratio measurement, the figure is slightly higher than the national average of 27% (MOH, 2015); nevertheless, there were more females (38.5%) who were classified with abdominal obesity compared to males (17.5%) similar trends are reflected at the national level, studies have shown that abdominal obesity is a risk factor for diabetes, hypertension, and cardio vascular heart diseases (WHO, 2008) and is a better predictor compared to BMI (WHO, 2008).

There were no significant differences in BMI and Waist hip ratio as body assessment methods. However, BMI over classified individuals as over nourished compared to waist hip ratio. A meta-analysis conducted across different countries globally between 1966-2004 to assess BMI and waist- hip ratio as body measurements for predicting type 2 diabetes found the two methods had similar associations in predicting the incidence of type 2 diabetes (Gabriela et al., 2007); however, BMI did not take into consideration ethnic differences among populations globally (Neovius et al., 2005). A combination of Body mass index and Waist hip ratio can therefore

be used to determine adult nutritional status since either methods take into consideration discriminatory capabilities of different populations.

4.26 Risk factors associated with adult overweight and obesity

The current study showed that rural residents were less likely to be over nourished compared to urban residents, similar findings were reported in the country and region as well (Ly et al., 2013: Murage et al., 2015; Mathew et al., 2016). A study comparing the risk factors for adult over nutrition in the continent showed that the odds for being overweight or obese in urban residents was highest among the Kenyan urban population with an odds risk of 1.54 compared to Nigeria and Burkina Faso while Malawi had the lowest odds risk. The likelihood of obesity and overweight progression in urban regions increases rapidly over time especially in low and middle income countries (Ly et al., 2013), consequently, studies in India have also established that obesity and overweight has been observed in rural populations living closer to major urban market centres due to processes linked to urbanization (Matthew et al., 2016).

Urbanization has been highlighted as the main driver for obesity and overweight in developing countries (Manuel et al., 2015). Urbanization had led to a change in dietary and physical activity lifestyles for urban residents which has contributed majorly to the escalating cases of obesity and overweight in both the developed and developing nations (Murage et al., 2015). Compared to the urban population, rural residents are self-reliant in terms of food production since they grow their own foods, consume traditional foods such as green leafy vegetables, cereals and pulses, they also consume of a lot of fruits and vegetables more frequently (FAO, 2004). Urban residents have little or no control on the food production systems and rely majorly on external forces such as processed foods (Manuel et al., 2015). Studies have established that the urban population diets are charactersized by diets high in animal fats, added salt and sugar and low consumption of pulses and dietary fibre (Teo et al., 2009).

The study found certain dietary patterns such as the consumption of pork, sausages, yoghurt, peas, lentils, fish,chappati and vegetables increased the risks for adult overweight and obesity. A cross sectional survey to establish factors associated with adult BMI in rural Southern India found significant association on the consumption of fruits,vegetables, pulses and legumes with adult underweight, overweight and obesity (Matthew et al., 2016). Further analysis showed that majority of adults who frequently consumed the foods above were from the high and middle wealth categories due to their affordability.

Further analysis on the current study established significant association between the wealth quantiles and the risk factors for adult overweight and obesity that included; educational status of respondents and hosehold heads,households size and ownership of various household asstes such as gas cookers,television,mobile phones and toilet faciltiies.

The educational status of adults was significantly associated with the odds for adult overweight or obesity.The study also indicated that majority of adults who had attained education were from the high and middle wealth categories and most were overweight and obese.The findings are consitent with national reports where women with no education and from the lowest wealth quantile were less likely to be overweight or obese compared to women from the highest lowest quartile (KNBS,2014. The most probale reason can be attributed to increased modifiable risk factors for overweight and obesity due to the higher socio-economic quantile enhanced by better education as (Zienczuk and Egeland, 2012).

The educational status of the household head was a protective factor against adult overweight and nutrition. The study showed that adults residing in households whose household head had attained some level of education were at risk of overweight or obesity,the study also revealed that majority of households with a higher wealth index were headed by household heads who had attained education. Studies on the critical role of household heads in determining household food security have been discused extensively (Mutisya et al., 2016) therefore, household heads with higher educatational status are most likely to belong to a higher wealth category and therefore expose the household members to modifiable risk factors for overweight and obesity through consumption of high caloric diets and little physical immobolity (Chen et al., 2013.

The current study also established that adults living in households with small family sizes were less likely to be overweight or obese and majority belonged to a higher wealth category. Large family sizes was associated with a lower wealth index and consequently low socio-ecomomic status therefore accesibility to nutritiously adeuqute diets might have contributed to the obseration in the current and similar studies (Omonona et al., 2007); consequently,adults from households in the lower wealth index quantile may be exposed to high energy expenditure as result of the daily manual jobs they are involved thereby facilitating physical activity (Leilei et al., 2015).

Household ownership of gas cooker increased the odds for being overweight or obese by 1.9 times, further analysis established that adults from households that owned a gas cooker were

of a higher wealth quantile, similar findings were reported in a cross sectional study in India which established that households and families from a higher socio-economic class were mostly likely to differ in their dietary and physical activity lifestyles with those of a lower socio-economic status (Matthew et al., 2016).

The study showed that adults living in households with a television set were more likely to be over nourished compared to those in households without a television. Majority of adults from households that owned a television belonged to the middle and higher wealth index. A study on childhood obesity in low and middle income economies showed that the proportion of households owning a television or computer was inversely proportional to reduction on physical activities thereby contributing to obesity in children with trends increasing globally (Milton and Macniven, 2014). A similar study on emerging obesity in North Indian states showed that ownership of television was significantly associated with BMI and increased progressively with households that owned a television (Agrawal, 2002). The odds of developing type I and type 11 obesity increased significantly with the household possession of a television (Matthew et al., 2016). Reasons have been attributed to a reduction in physical activities since a greater proportion of the day is spent watching television thereby promoting a sedentary lifestyle that inhibits physical activities (Milton and Macniven, 2014; Matthew et al., 2016), consequently ownership of television sets could indicate a higher socio-economic status which has adverse effects on dietary and physical activities as discussed earlier (Matthew, et al., 2016.

The study also showed that individuals who owned a mobile phone were 1.8 times more likely to be over nourished compared to those who did not. Ownership of a mobile phone device was also significantly associated with the wealth category, majority of adults who owned a mobile phone were in the middle and higher wealth quantiles. Similar observations were reported in in Northern Indian states (Agrawal, 2002), the findings were attributed to the effect of rapid urbanization which has profound effect on the dietary and lifestyles of adults.

4.27 Conclusion

Findings from the socio-demographic and household characteristics have shown that majority of the study participants are relatively young and reside in peri-urban areas. The study has also shown that residency is significantly associated with adult educational status and household size. The study has also shown that household ownership of assets such as television, refrigerators, radio, gas cookers is significantly associated with wealth index quantiles and adult overweight and obesity. The morbidity patterns and physical activity findings reveal that that non-communicable diseases such as diabetes, hypertension and cardiovascular disease are prevalent in the study region, consequently majority of the rural population are more physically active compared to urban resident. Findings on dietary assessment reveal that consumption of Traditional fermented milk is prevalent in the study with sour cow milk being the highest consumed in the study region followed by camel and goat milk, however, consumption of animal products, fruits and vegetables is relatively low in the study. Nutritional assessment findings indicate that the prevalence of obesity is higher than the national prevalence but the proportion of overweight adults is lower than the national average. There are more females than males who are overweight and obese in the study region. Further analysis reveal that there is no significance difference between BMI and waist-hip ratio as body assessment methods.

Finally, the study has established dietary and demographic risk factors for adult overweight and obesity in the study region such as, consumption of pork, sausages, fish, beans, lentils, peas, chapatti and vegetables as significant dietary risk factors for adult overweight and obesity while female gender, urban residency, and educational level of an individual and household head, large household size, and household ownership of assets such as a gas cooker, television or mobile phone as demographic risk factors for adult overweight and obesity in the study region.

4.28 Recommendations

1. Almost a third of adults were overweight or obese with females taking a greater proportion than males. There is need for obese and overweight in the study region to manage weight through increasing the consumption of dietary fibre, avoid diets high on fat and sugar and be more physically active.
2. Urban residents were less physically active compared to rural residents. Adults residing in urban regions need to increase their daily physical activity to at least 150 minutes per week to discourage sedentary lifestyles that promote unhealthy weight gain.
3. Non-communicable diseases are on the rise and so adults in the study region should ensure that they consume diet high in dietary fibre, low in fats, sugars and oils and be physically active to mitigate against the Non-communicable diseases.

4. The prevalence of adult overweight and obesity was high among household classified in high wealth index quantile, such households should avoid consumption of diets high in fats and sugars and also increase their daily physical activity.

5. Consumption of fruit and vegetables was low in the study population, therefore households should consume at least 5 portions of fruits and vegetable daily to meet their recommended daily allowances for dietary fibre and micro-nutrients.

6. There was no significance difference in Body mass index and waist hip ratio has body assessment methods therefore either method can be used to determine adult nutritional status.

7. There is need for further studies on obesity and overweight in households from low socio-economic status.

CHAPTER FIVE

General conclusions and recommendations

1. The study has shown that consumption of traditional fermented milk is predominant in the study region but households that produce traditional fermented milk have low knowledge and practices on food handling.
2. Households should ensure they maintain simple hygiene rules such as washing hands with soap to prevent spread of pathogens, separate raw and cooked food during food preparation and store left over foods appropriately to prevent food contamination during the handling process
3. Households that process traditional fermented milk should ensure that they boil milk before fermentation, initiate fermentation through use of starter cultures, avoid temperature time abuse and use metallic containers to store fermented milk to ensure milk is safe for consumption.
4. The study has also showed that adult overweight and obesity is prevalent in the study and several risk factors have been established such as household ownership common assets and female gender.
5. The study has also established several protective factors against adult overweight and obesity such as rural residency, higher educational status, few household members and non-consumption of pork, sausages, lentils, peas, yoghurt, chapatti and vegetables.
6. Overweight and obese adult should manage their weight through appropriate measure such as limiting dietary intake of sugars and fats and should be more physically active
7. Generally, adults in the study population should increase the daily consumption of fruits and vegetables and also incorporate physical activities in their daily routines.
8. There is need for further studies on further studies on food handling in pastoral communities undergoing transition and the socio-economic status and adult obesity and overweight,

REFERENCES

Abebe , B., Zelalem , Y., & Ajebu , N. (2013). Handling, processing and utilization of milk and milk products in Ezha district of the Gurage zone, Southern Ethiopia. *Journal of Agricultural Biotechnology and Sustainable Development, 5*(6), 91-98. doi:10.5897/JABSD2013.0206

Abeer , A. A., Abdel , A., & Dardir , H. A. (2009). Hygienic Quality of Local Traditional Fermented Skimmed Milk. *World Journal of Dairy & Food Sciences, 4*(2), 205-209.

ACF. (2016). *Isiolo County Integrated SMART survey report.* Isiolo: Action Against Hunger,Ministry of Health, Agriculture, Water, Livestock, National Drought Management Authority.

Agrawal, K. P. (2002). Emerging Obesity in Northern Indian States: A Serious threat for Health. *International Institute for Population Sciences Conference* (pp. 1-17). Bangkok: International Institute for Population SciencesI.

Amy, L., Linda, A., & Nadine , R. (2011). *Food Safety Perceptions and Practices of Older Adults.* Department of Nutrition and Food Science,University of Maryland.

Annika, l. (2009). How much can a KAP survey tell us about peoples Knowldege,Attitudes and Practices? *Anthropology matters Journal, 11*(1), 5-13.

ASDSP. (2016, 08 31). *Counties*. Retrieved 08 31, 2016, from Agricultural Sector Development Support Programme: www.asdsp.co.ke/index.php/isiolo-county

Banda, J. (2007). Acceptability of goat's, sheep's and cow's milk in Malawi. *International IJC*, 129-138. doi: 10.1111/j.1470-6431.1992.tb00506.x

Barry , P., Linda , A., & Shu Wen Ng. (2012). Global nutrition transition and the pandemic of obesity in developing countries. *Nutr Rev, 70*(1), 3-21. doi:http://dx.doi.org/10.1111/j.1753-4887.2011.00456.x

Bashir, M., Schilizzi, S., & Pandit, R. (2012). *The determinants of rural household food security: The Case of Landless Households of the Punjab, Pakistan.* Crawley, Australia.: School of Agricultural and Resource EconomicsSchool of Agricultural and Resource Economics, University of Western Australia,. Retrieved from http://www.are.uwa.edu.au

Beyza , H. U. (2015). Nutritional and Health Aspects of Goat Milk Consumption. *Akademik Gıda, 31*(1), 56-60. Retrieved from http://www.academicfoodjournal.com

CDC. (2007). *National health and Nutrition Examination survey:Anthropometry procedures manual.* Atlanta: Centre for Disease Control.

Chege, P. (2016). Multiple cardiovascular disease risk factors in rural Kenya: evidence from a health and demographic surveillance system using the WHO STEP-wise approach to chronic disease risk factor surveillance. *South African Family Practice, 58*(2), 54-61. doi:http://dx.doi.org/10.1080/20786190.2015.1114703

Chen, B.-B., Jin, M.-J., Mao,, Y.-Y., Zhu, Y.-M., Yu, Y.-X., Wu, Y.-Y., . . . Kun , C. (2013). Prevalence of Overweight and Obesity and Their Associations with Socioeconomic Status in a Rural Han Chinese Adult Population. *PLoS ONE*, e79946. doi:doi:10.1371/journal.pone.0079946

Christa , L., Ingrid , K. F., Nancy , B., Mark , y., Neff , W., Olivier , F., . . . Robert , E. (2011). Scaling Up Diarrhea Prevention and Treatment Interventions: A Lives Saved Tool Analysis. *PLoS Med 8, 8*(3), e1000428. doi:10.1371/journal.pmed.1000428

DHS. (2016, 10 1). *Wealth Index construction*. Retrieved from The Demographic and health survey program: http://dhsprogram.com/topics/wealth-index/Wealth-Index-Construction.cfm

Elisa , L., Maria , F., Liana , L., Viviana , V., Angela , M. A., & Elisabetta , D. V. (2012). Food safety at home: knowledge and practices of consumers. *Journal of public Health*, 47-57. doi:DOI 10.1007/s10389-011-0437-z

FAO. (2004). *Globalization of food systems in developing countries: impact on food security and nutrition.* Rome: Food and Agriculture Organization of the United Nations. Retrieved from http://www.fao.org/docrep/007/y5736e/y5736e00.htm

FAO. (2014). *Guidelines for assessing nutrition-related knowledge, attitudes and practices.* (F. Yvette, & G. Peter , Eds.) Rome, Italy: Food and Agriculture Organization of the United Nations. Retrieved from www.fao.org/docrep/019/i3545e/i3545e00.htm

FAO. (2016). *International Year of Pulses 2016*. Retrieved 08 30, 2016, from Food and Agriculture Organization of the United Nations: http://www.fao.org/pulses-2016/communications-toolkit/fact-sheets/en/

Ferdinand, K., & Armani, A. (2007). The management of hypertension in African Americans. *Crit Pathw Cardiol, 6*, 67-71.

Francesco , V., & Andrea , S. (2014). Milk, Dairy Products, and Their Functional Effects in Humans: A Narrative Review of Recent Evidence. *Advances in Nutrition, 5*, 131-143. doi:10.3945/an.113.005025.

Gabriela , V., Sue , D., David , J., & Karri , S. (2007). Comparison of Body Mass Index, Waist Circumference, and Waist/Hip Ratio in Predicting Incident Diabetes: A Meta-Analysis. *Epidemiol Rev, 29*(1), 115-128. doi:10.1093/epirev/mxm008

Gadaga , T., Nyanga , L., & Mutukumira, A. (2004). The occurrence, growth and control of pathogens in african fermented foods. *African Journal of Food Agriculture Nutrition and Development, 4*(1), 20-23. Retrieved from http://bioline.org.br/request?nd04009#gadaga

George , A., & Ekua , A. (2011). Evaluation of Food Hygiene Knowledge Attitudes and Practices of Food Handlers in Food Businesses in Accra, Ghana. *Food and Nutrition Sciences*, 830-836. doi:10.4236/fns.2011.28114

Gerald , B. S., Ann , M., Patrick , C., Chrispinus, S., Daniel , A., Andrew , O., . . . Barasa , K.-O. (2013). Multiple cardiovascular risk factors in Kenya: evidence from a health and demographic surveillance system using the WHO STEPwise approach to chronic disease risk factor surveillance. *Heart Journal, 99*, 1323-1329. doi:10.1136/heartjnl-2013-303913

Gnanasumathi, S., & Ramesh , K. (2014). Food Safety Knowledge and Practices of Consumers in Tamil Nadu. *Reaserch Journal of commerce and behavioral science*.

Gnanasumathi, S., & Ramesh , K. S. (2014). Food Safety Knowledge and Practices of Consumers in Tamil Nadu. *Reaserch Journal of commerce and behavioral science, 3*(8), 19-24. Retrieved from http://www.theinternationaljournal.org

Gul , A. F. (2012). Safe Food Handling: Knowledge, Perceptions, and Self-Reported Practices of Turkish Consumers. *International Journal of Business and Management, 7*(24), 1-11. doi:10.5539/ijbm.v7n24p1

Hallal , P., Andersen , L., Bull , F., Guthold , R., Haskell , W., & Ekelund , U. (2012). Global physical activity levels: surveillance progress, pitfalls, and prospects. *380*, 247–57.

Harvard University. (2007, 10 16). *Harvard T.H. Chan School of Public Health Nutrition Department's File Download Site*. Retrieved from Havard University: https://regepi.bwh.harvard.edu/health/nutrition.html

Hillers , V., Medeiros , L., Kendall , P., Chen , G., & Dimascola S. (2003). Consumer Food-Handling Behaviors Associated with Prevention of 13 Foodborne Illnesses. *Journal of Food Protection, 66*(10), 1893-1899.

IFPRI. (2015). *Global Nutrition Report 2015.* Washington, DC.: International Food Policy Research Institute. doi: http://dx.doi.org/10.2499/9780896298835

IHME. (2014, may 28). *Global prevalence of overweight and obesity in children and adults during 1980–2013*. (Institute for Health Metrics and Evaluation, Producer) Retrieved from Knoema: http://www.healthdata.org/research-article/global-regional-and-national-prevalence-overweight-and-obesity-children-and-adults

Imani, F. A. (2010). Detection of enterotoxigenic Staphylococcus aureus isolates in domestic dairy products. *Iran J Microbiol., 2*(3), 137-142.

IMC, M. (2012). *Intergrated Health And Nutrition SMART Survey Isiolo County.* Nairobi-Kenya: Ministry of Public Helalth and Sanitation/International Medical Corps.

Jans, C., Kaindi, D. W., Bock, D. N., Njage, P. M., Kouamé-Sina , S., Bonfoh , B., . . . Meile , L. (2013). Prevalence and comparison of Streptococcus infantarius subsp. infantarius and Streptococcus gallolyticus subsp. macedonicus in raw and fermented dairy products from East and West Africa. *International Journal of Food Microbiology, 167*(2), 186-195.

Jayne , J., Scrimgeour , A., Polhemus , M., Otieno , L., & Bovill, M. (2011). Dietary a socio-economic correlates of nutritional status in a rural adult kenyan population. *African Journal of Food,Agriculture, Nutrition and Development, 11*(4), 5036-5052.

Jeremia , M. N., & Afam , J. I. (2014). The physicochemical and sensory evaluation of commercial sour milk (amasi) products. *African Journal of Food Science, 7*(4), 56-62. doi:10.5897/AJFS12.089

Juan , C., María , P. A., & Amparo , C. (2008). Association between Streptococcus infantarius (Formerly S. bovis II/1) Bacteremia and Noncolonic Cancer▽. *Journal of clinical microbiology, 46*(4), 1570. doi:10.1128/JCM.00129-08

Kaindi , D., Schelling , E., Wangoh , J., Imungi , J., Farah , Z., & Meile , L. (2012). Risk factors for symptoms of gastrointestinal illness in rural town Isiolo, Kenya. *Zoonoses, 59*(2), 118-125. doi:10.1111/j.1863-2378.2011.01425.x. Epub 2011 Jul 18.

KDHS. (2010). *Kenya Demographic and Health Survey 2008-09.* Calverton, Maryland: Kenya National Bureau of Statistics (KNBS) and ICF Macro.

Klontz , K., Desenclos, J., Wolfe , L., Hoecherl , S., Roberts , C., & Gunn R,A. (1991). The raw oyster consumer—a risk taker? Use of the Behavioral Risk Factor Surveillance System. *Epidemiology, 2*, 437-40.

KNBS. (2014). *Kenya Demographic and Health Survey.* Nairobi,Kenya: Kenya National Bureau of Statistics. Retrieved from www.knbs.or.ke.

Leilei , P., Yue , C., Yijun , K., Shuyi , Y., & Hong, Y. (2015). Association of obesity with socioeconomic status among adults of ages 18 to 80 years in rural Northwest China. *BMC Public Health*, 160. doi: 10.1186/s12889-015-1503-1

Ly, K., Thanh , T., Quang , N., Tung , T., & Annette, L. (2013). Double burden: a cross-sectional survey assessing factors associated with underweight and overweight status in Danang, Vietnam. *BMC Public Health, 13*(35), 1-10. Retrieved from http://www.biomedcentral.com/1471-2458/13/35

Manas , R. S., Marimuthu , A., Ramesh , C. R., & Rizwana, P. R. (2014). Fermented Fruits and Vegetables of Asia: A Potential Source of Probiotics. *Biotechnology Research International*, 250424.

Manas Ranjan Swain, & Marimuthu Anandhara. (2014). Fermented Fruits and Vegetables of Asia: A Potential Source of Probiotics. *Fermented Fruits and Vegetables of Asia: A Potential Source of Probiotics, 2014*, 250424.

Manuel , M., Maria , P., Giovanni , M. V., Fernando , C., & Francesco , R. P. (2015). Cardiovascular Risk Factors in Sub-Saharan Africa: A Review. *Italian Journal of Medicine, 9*(4), 305-313. doi:10.4081/itjm.2015.533

Mathara, j. m., Schillinger, U., Kutima, P. M., Mbugua, ,. S., & Holzapfel, W. H. (2004). Isolation, identification and characterisation of the dominant microorganisms of kule naoto: the Maasai traditional fermented milk in Kenya. *International journal of food microbiology, 94*(3), 269-78.

Matthew , L., Sally , H., Kirit , P., & Cate , D. (2016). Factors associated with BMI, underweight, overweight, and obesity among adults in a population of rural south India: a cross-sectional study. *BMC Obesity, 3*, 2-13. doi:10.1186/s40608-016-0091-7

Mendagudali , R., Akka , K., Swati , I., Shedole , D., & Bendigeri , N. (2016). Knowledge, attitude, and practices of food safety among women of Khaza bazar, the urban field practice area of KBN Institute of Medical Sciences, Kalaburagi, Karnataka. *International Journal of Medical Science and Public Health, 5*(3), 516-520. doi:10.5455/ijmsph.2016.20102015146

Milton, K., & Macniven, R. (2014). Review of the epidemiological evidence for physical activity and health from low- and middle-income countries. *Glob Public Health, 9*, 369-81.

MOH. (2015). Integrated smart survey isiolo county kenya. Nairobi: Action Against Hunger | ACF-USA (ACF), International Medical Corps (IMC) and Ministry of Health.

MOH. (2015). *Kenya national strategy for the prevention and control of non-communicable diseases 2015 - 2020.* Nairobi: Ministry of Health.

MOH. (2015). *KENYA stepwise survey for non communicable diseases risk factors 2015 report.* Ministry of Health, Division of Non Communicable diseases . Nairobi: Ministry of health,Kenya National bureau of statistics,World Health Organization.

Mohd , F. S., Son, R., Mohhiddin , O., Toh, P. S., & Chai, L. C. (2015). Food court hygiene assessment and food safety knowledge, attitudes and practices of food handlers in Putrajaya. *International Food Research Journal, 22*(5), 1843-1854. Retrieved from http://www.ifrj.upm.edu.my

Motarjemi, Y., & Nout, M. (1996). Food fermentation: a safety and nutritional assessment. Joint FAO/WHO Workshop on Assessment of Fermentation as a Household Technology for Improving Food Safety. *Bulletin of the World Health Organization, 74*(6), 553–559.

Murage , E., Muthuri, S., Oti, S., Mutua, M., Steven van de Vijver,, & Kyobutungi, C. (2015). Evidence of a Double Burden of Malnutrition in Urban Poor Settings in Nairobi, Kenya. *PLoS ONE, 10*(6), e0129943. doi: http://dx.doi.org/10.1371/journal.pone.0129943

Muriuki, H. (2011). *Dairy development in Kenya.* Rome: Food and Agricultre organization of the United Nations.

Mutisya, M., Ngware, M., Kabiru, C., & Kandala, N.-b. (2016). The effect of education on household food security in two informal urban settlements in Kenya: a longitudinal analysis. *Food Security, 8*(4), 743–756. doi:10.1007/s12571-016-0589-3

Mwangi, L., Matofari, J., Muliro, P., & Bebe, B. (2013). Handling practices and microbiological quality characteristics of traditional pastoral fermented milk (SUUSA). *African Crop Science Conference Proceedings. 11,* pp. 427-430. Kampala: African Crop Science .

Mwende, J. (2016, 05 10). *Energy.Oil and Gas.* Retrieved 08 26, 2016, from Kenya Bussiness Review: http://www.kenyanbusinessreview.com/745/cooking-gas-prices-kenya-2/

NHLBI. (2016, 09 2016). *Health Information for the Public*. Retrieved 09 09, 2016, from National Heart,lung and Blood Institute: https://www.nhlbi.nih.gov/health/health-topics/topics/atherosclerosis

Njarui, D., Gatheru , M., Wambua , J., Nguluu , S., Mwangi , D., & Keya , G. (2011). Consumption patterns and preference of milk and milk products among rural and urban consumers in semi-arid Kenya. *Ecology of Food Nutrition, 50*(3), 240-262. doi: 10.1080/03670244.2011.568908.

Nurhan, U. (2005). Consumer food safety knowledge and practices in the home in turkey. *Food Control*. doi:10.1016/j.foodcont.2005.08.006

Odenigbo, U., Odenigbo, U., Oguejiofor, O., & Adogu, P. (2011). Relationship of Waist Circumference, Waist Hip Ratio and Body Mass Index as Predictors of Obesity in Adult Nigerians. *Pakistan Journal of Nutrition, 10*(1), 15-18. doi:10.3923/pjn.2011.15.18

Oliver, S., Jayarao, B., & Almeidai, R. (2005). Foodborne Pathogens in Milk and the Dairy Farm Environment: Food Safety and Public Health Implications. Foodborne pathogens and disease, *2*(2), 115-129.

Omonona, B. T., & Agoi, , G. A. (2007). An analysis of food security situation among nigerian urban households: evidence from lagos state, nigeria. *Journal of Central European Agriculture, 8*(3), 397-406.

Omore, A., Lore, T., Staal, S., Kutwa, J., Ouma, R., Arimi, S., & Kang'ethe, E. (2005). *Addressing the public health and quality concerns.* Smallholder Dairy (R& D) Project,

SDP Research . nairobi: Regal Press Kenya Limited. Retrieved from http://hdl.handle.net/10568/2177

Osere, F. (2005). *Food culture in Sub-Saharam Africa.* Westport,connecticut,london: Greenwood press.

Pang, J., Shao, W., & Liyang, H. (2015). Current Knowledge,attitude and behaviour of hand and food hygiene in a developed residential community oF Singapore:a cross sectional survey. *BMC Public Health, 15*, 577. doi:10.1186/s12889-015-1910-3

Patil, S., Cates, S., & Morales, R. (2005). Consumer Food Safety Knowledge, Practices, and Demographic Differences: Findings from a Meta-Analysis. *Journal of Food Protection, 9*(11), 1884-1894. Retrieved from http://www.ingentaconnect.com/content/iafp/jfp

Pengpid , S., & Peltzer , K. (2015). Prevalence of overweight and underweight and its associated factors among male and female university students in Thailand. *PMID, 66*(2), 176-86. doi: 10.1016/j.jchb.2014.11.002

Rahman , M., Arif , M., Bakar , K., & Tambi , Z. (2012). Food safety knowledge, attitude and hygiene practices among the street food vendors in Northern Kuching city, Sarawak. *Borneo Sci*, 95–103.

REA. (2016, 08 25). *Lighting up rural Kenya.* Retrieved 08 26, 2016, from Rural Electrificcation Authority: http://www.rea.co.ke/

Robert , M. (1997). *Sampling Guide.* Washington Dc: Food and Nutrition Technical Assistance Project (FANTA).

Schopper, D., Doussantousse, S., & Orav, J. (1993). Sexual behaviors relevant to HIV transmission in a rural African population: How much can a KAP survey tell us? *Social Science & Medicine, 37*(3), 401-412. doi:http://dx.doi.org/10.1016/0277-9536(93)90270-E Spencer

Seaman, P. (2010). Food hygiene training: Introducing the Food Hygiene Training Model. *Food Control, 21*(4), 381-387.

Sergeant, E. (2015, 11 11). *Epitools epidemiological calculators*. Retrieved from AusVet Animal Health Services and Australian Biosecurity Cooperative Research Centre for Emerging Infectious Disease: http://epitools.ausvet.com.au.

Siervo , M., Grey , P., Nyan , O., & Prentice , A. (2006). Urbanization and obesity in The Gambia: a country in the early stages of the demographic transition. *Eur J Clin Nutr, 60*(4), 455-463. doi:10.1038/sj.ejcn.1602337

Siow, O. N., & Norrakiah, A. S. (2011). Assessment of Knowledge, Attitudes and Practices (KAP) Among Food Handlers at Residential Colleges and Canteen Regarding Food Safety. *Sains Malaysiana*, *40*(4), 403-410.

SNV. (2010, 10 14). *Camel milk production in kenya.* (W. Thomas , Ed.) Retrieved from SNV WORLD:http://www.snvworld.org/download/publications/factsheet_-_isiolo_camel_milk.pdf

Subbulakshm, G., Rameshkumar, S., & Padma , P. P. (2012). Awareness and Attitudes of Food Safety Knowledge and Practices: It's Impact on Practical execution of Food Safety. *Reaserch Journal of Economics and Bussiness Studies, 2*(2), 42-46.

Sudershan , R., Rao , G., Rao , P., Rao , M., & Polasa , K. (2008). Food safety related perceptions and practices of mothers: a case study in Hyderabad, India. *Food Control, 19*(5), 506–13.

Swai, S. E., & Schoonman, L. (2011). Microbial quality and associated health risks of raw milk marketed in the Tanga region of Tanzania. *Asian Pacific Journal of Tropical Biomedicine, 1*(3), 217-222. doi:10.1016/S2221-1691(11)60030-0

Teo, K., Chow, C., & Vaz, M. (2009). The Prospective Urban Rural Epidemiology (PURE) study: examining the impact of societal influences on chronic noncommunicable diseases in low-, middle-, and high-income countries. *Am Heart J, 158*, 1-7.

Tolulope , O., Zuwaira , I., Danjuma , A., Yetunde , O., Chundung , A., & Ayuba, I. (2015). Training: a vital tool for improving the knowledge and practice of food safety and hygiene among food handlers in boarding schools in Plateau state. *J Med Trop, 16*(2), 87-92.

Trade Economics. (2015, 8 23). *Rural population (% of total population) in Kenya*. Retrieved from Trading Economics: http://www.tradingeconomics.com/kenya/rural-population-percent-of-total-population-wb-data.html

Vorster, H., Kruger, K., & Margetts, B. (2011). The nutrition transition in Africa: can it be steered into a more positive direction? *Nutrients, 3*, 429-441.

Wanjiku , M., Allen , F., & Hannah , K. (2010). Urbanization, ethnicity and cardiovascular risk in a population in transition in Nakuru, Kenya: a population-based survey. *BMC Public Health, 10*, 569. doi:10.1186/1471-2458-10-569

Wayua , F., Okoth , M., & Wangoh, J. (2012). Survey of Post-Harvest Handling, Preservation and Processing Practices along the Camel Milk Chain in Isiolo District, Kenya. *African Journal of Food Agriculuture Nutrition and Developoment, 12*(7), 6891-6912.

WFP/FAO. (2008). *Measures of food consumption.* Rome-Italy: WFP/FAO.

WFP/FAO. (2008). *Measures of Food Consumption-Harmonizing Methodologies.* rome-Italy: Interagency Workshop report.

WHO. (1995). *Physical status: The use and Interpretation of Anthropometry.* Geneva: World Health Organization.

WHO. (2000). *Obesity,preventing and managing the Global Epidemics.* Geneva: World Health Organization.Retrievedfrom http://apps.who.int/iris/bitstream/10665/42330/8/WHO_TRS_894_eng.pdf

WHO. (2008). *Waist circumference and waist–hip ratio: report of a WHO expert consultation.* Geneva: World Health Organization.

WHO. (2010). Basic steps to improve safety of street-vended food. *International Food Safety Authorities Network* (pp. 1-5). Geneva: World Health Organization.

WHO. (2010). *Global Recommendations on Physical Activity for Health.* Geneva, Switzerland: World Health Organization. Retrieved from /apps.who.int/iris/bitstream/10665/44399/1/ 9789241599979_eng.pdf.

WHO. (2014). *Global status report on noncommunicable diseases.* Switzerland: World Health Organization. Retrieved from http://www.who.int/ncd

WHO. (2015,). *focus on diarhoea,dehydration and rehydration*. Retrieved 08 21, 2015, from Rehydration Project: http://rehydrate.org/diarrhoea/index.html

WHO. (2015) *Global data base on body mass index*. Retrieved from World Health Organization: http://apps.who.int/bmi/index.jsp?introPage=intro_3.html

WHO. (2016) *Obesity and overweight.* Retrieved 08 31, 2016, from World Health Organization: http://www.who.int/mediacentre/factsheets/fs311/en/

WHO. (2016, 2 3). *Food safety*. Retrieved 7 25, 2016, from World Health Organization: http://www.who.int/topics/food_safety/factsheets/en/

William Shurtleff, A. A. (2015, february 4). *A Brief History of Fermentation, East and West*. Retrieved from http://www.soyinfocenter.com/index.php

Wood, S., & Tsu, V. (2008). *Advocacy, communication and socio mobilization for TB control: a guide to developing knowledge, attitude and practice survey.* Geneva: World Health Organization.

World Bank. (2005, 12 8). *nutrition resources.* (c. stock, Ed.) Retrieved from World Bank: http://siteresources.worldbank.org/nutrition/resources/Tool2.chap2.pdf

World Bank. (2009). *Kenya - Poverty and Inequality Assessment : Executive Summary and Synthesis Report.* Poverty Reduction and Economic Management Unit Africa Region. USA: world bank. Retrieved from http://hdl.handle.net/10986/3081

Yazan , A. E., & Oliver , V. W. (2015). *Economic and nutritional contribution of camel milk in Northern Kenya.* London: International Institute for Environment and Development.

Zenebe, T., Ahmed, N., Kabeta, T., & Kebede, G. (2014). Review on Medicinal and Nutritional Values of Goat Milk. *Academic Journal of Nutrition, 3*(3), 30-39. doi:10.5829/idosi.ajn.2014.3.3.93210.

Zienczuk, N., & Egeland, G. M. (2012). Association between socioeconomic status and overweight and obesity among Inuit adults: International Polar Year Inuit Health Survey, 2007–2008. *Int J Circumpolar Health, 71*. doi: 10.3402/ijch.v71i0.18419

Ziraba , A., Fotso , J., & Ochako , R. (2009). Overweight and obesity in urban Africa: A problem of the rich or the poor? *BMC Public Health, 9*, 465. doi:10.1186/1471-2458-9-465. pmid:20003478

APPENDIX

APPENDIX 1: INFORMED CONSENT FORM

Introduction and consent form for a study on **Household's knowledge, attitude and food handling practices, consumption of traditional fermented milk and risk factors for adult overweight and obesity in Isiolo Central Sub County.**

Introduction.

Hello, my name is _____and I am working in collaboration with Martin Koome Muriungi from the University of Nairobi, Department of food science, nutrition and technology, applied human Nutrition Programme. I am conducting a research survey that seeks to determine **Household's knowledge, attitude and food handling practices, consumption of traditional fermented milk and risk factors for adult overweight and obesity in Isiolo Sub County**.

Purpose.

The information you provide will be only used to asses' household food handling practices and risk factors for adult overweight and obesity.

Confidentiality.

Information given will be kept confidential and used to prepare a dissertation which will not include any specific name. Reference numbers will be used to link you name and your answers without identifying you.

Your participation in this study is voluntarily, and if you have any issue concerning the study that you don't wish to raise with me, you can contact NACOSTI/UON/ERC. However, I hope that you will participate in the survey since your views are very important.

Benefits.

The benefits of this study is the information will be useful in ensuring safety of traditional fermented milks.

By signing or approving this consent indicates that you understand what will be expected of you and you are willing to participate in the survey.

May I begin now?

Signature of respondent. _____

Signature of interviewer_____

Date_____

APPENDIX 2: QUESTIONNAIRE

ID participant: **[_][_][_][_][_]** (=initials of interviewer plus 3 digit number code 100 to XXX)	**Date of interview: [_] [_]/ [_] [_]/2015 (df /mm/ ivy)**	**Time of interview Start : [_][_] h [_][_] min End: [_][_] h [_][_] min**

SECTION 1
RESPONDENT DEMOGRAPHIC INFORMATION

	For coding purposes only
1) Country of birth: _____	1) Text
2) Age in years: _____	2) Age (years) [_][_][_]
3) Sex: □ 1-Male □ 2-Female	3) [_]
4) Sub County Residency _____	4) Text
5) Sublocation Residency _____	5) Text
6) Age of household head in years: _____ **7) Sex of household head** □ 1-Male □ 2-Female	6) Age (years) [_][_][_] 7) [_]
8) Do you live in an urban or rural area? □ 1-Urban □ 8-other:_____ □ 2-Peri urban □ 9 don't know □ 3-Rural	8) [_]
9) Did you go to school? □ 1-yes □ 2-No □ 0 no information **10) if yes in (Q9), please indicate your highest level of education that you completed** □ 3-Kindergaten □ 6-Tertiary □ 4-Primary school □ 7-Université □ 5-High school 8-other : _____ □ 9 don't know	9) [_] 10) [_]
11) Did your household head go to school? □ 1-yes □ 2-No □ 9 don't know **12) if yes in (Q11), please indicate his/her highest level of education that he/she completed** □ 3-Kindergarten □ 6-University □ 4-Primary school□ 8-other:_____ □ 5-High school□ 9 don't know	11) [_] 12) [_]
13) Structure of your nuclear family unit in your household: How many persons live in this household? Write total number of persons: Number of persons age 5-13 years: Number of persons below age 5 years: Number of people above 18 years _____	13) Total: _____ 6-13:_____ <5: _____ >18:_____
14) Do you follow specific dietary habits □ 1-yes □ 2-No □ 0 no information **15) if yes in (Q14), please indicate which dietary habit(s)** □ 3-vegetarian □ 4-vegan (no animal products = no meat, no honey, no eggs, no milk) □ 5-no pork meat □ 7-no cereal-based products □ 6-no dairy products□ 8-other:_____ □ 9 don't know	14) [_] 15) [_]
16) What is the source of your drinking water? □ 1-tap water □ 3-protected well □ 2-bore hole □ 4-rain water □ 5-pond/lake □ 6-river/stream	16) [_]

□ 8-other:_____ □ 9 don't know	
17) What is your house's roofing material? □ 1-concrete □ 4-iron sheet □ 2-roofing tiles □ 3-grass thatched roof □ 5-wood □ 6-combination of soil, plant and cow dung materials (Manyatta) □ 8-other:_____ □ 9 don't know	17) [_]
18) Please tick all items/descriptions which are part of your household	19) [_]
19) Open fireplace □ 1-yes □ 2-No □ 9-don't know	20) [_]
20) Wood stove □ 1-yes □ 2-No □ 9-don't know	21) [_]
21) Petroleum stove □ 1-yes □ 2-No □ 9-don't know	22) [_]
22) Propane stove □ 1-yes □ 2-No □ 9-don't know	23) [_]
23) Solar □ 1-yes □ 2-No □ 9-don't know	24) [_]
24) Electric grid □ 1-yes □ 2-No □ 9-don't know	25) [_]
25) Cooling box □ 1-yes □ 2-No □ 9-don't know	26) [_]
26) Refrigerator □ 1-yes □ 2-No □ 9-don't know	27) [_]
27) Freezer □ 1-yes □ 2-No □ 9-don't know	28) [_]
28) Water closet □ 1-yes □ 2-No □ 9-don't know	29) [_]
29) Pit latrine □ 1-yes □ 2-No □ 9-don't know	30) [_]
30) Radio □ 1-yes □ 2-No □ 9-don't know	31) [_]
31) TV □ 1-yes □ 2-No □ 9-don't know	32) [_]
32) Bicycle □ 1-yes □ 2-No □ 9-don't know	33) [_]
33) motorbike □ 1-yes □ 2-No □ 9-don't know	34) [_]
34) car □ 1-yes □ 2-No □ 9-don't know	35) [_]
35) mobile phone □ 1-yes □ 2-No □ 9-don't know	36) [_]
36) computer □ 1-yes □ 2-No □ 9-don't know	37) [_]
SECTION 2 **Physical Activity Status Assessment**	
Light activities Your heart beats slightly faster than normal You can talk and sing **Examples:** Walking leisurely, stretching, vacuuming, light yard work	
Moderate activities Your heart beats faster than normal You can talk but not sing **Examples:** Fast walking, aerobics class, strength training, swimming gently	
Vigorous activities Your heart rate increases a lot You can't talk or your talking is broken up by large breaths **Examples:** Stair machine, jogging or running, tennis, Racquetball, Pickle ball or Badminton	
37) Physical Activities are activities where you move and increase your heart rate above its resting rate, whether you do them for pleasure, work, or transportation. Do you rarely or never do any physical activity? □ 1-yes □ 2-No □ 0 no information	38) [_]
38) please indicate the type of physical activity that you undertake:	39) [_]
39) Light activities □ 2-No □ 3-few (1-2) days per week, time per day: _____ hours □ 4-several (3-6) days per week, time per day: _____ hours □ 5-daily, time per day: _____ hours □ 9 don't know □ 0 no information	40) [_]
40) Moderate activities □ 2-No □ 3-few (1-2) days per week, time per day: _____ hours □ 4-several (3-6) days per week, time per day: _____ hours □ 5-daily, time per day: _____ hours □ 9 don't know □ 0 no information	41) [_]

41) Vigorous activities

□ 2-No □ 3-few (1-2) days per week, time per day: _____ hours

□ 4-several (3-6) days per week, time per day: _____ hours

□ 5-daily, time per day: _____ hours

□ 9 don't know □ 0 no information

42) [_]

42) Strength e.g. weight lifting

□ 2-No □ 3-few (1-2) days per week, time per day: _____ hours

□ 4-several (3-6) days per week, time per day: _____ hours

□ 5-daily, time per day: _____ hours

□ 9 don't know □ 0 no information

43) [_]

43) Flexibility e.g. stretching, yoga

□ 2-No □ 3-few (1-2) days per week, time per day: _____ hours

□ 4-several (3-6) days per week, time per day: _____ hours

□ 5-daily, time per day: _____ hours

□ 9 don't know □ 0 no information

44) [_]

SECTION 3
Co-morbidities

44) Have you suffered from any of the following symptoms during the last 7 days before this interview?

45) Fever	□ 1-yes	□ 2-No	□ 9-don't know	46) [_]
46) diarrhea	□ 1-yes	□ 2-No	□ 9-don't know	47) [_]
47) abnormal chills	□ 1-yes	□ 2-No	□ 9-don't know	48) [_]
48) fever with chills	□ 1-yes	□ 2-No	□ 9-don't know	49)[_]
49) blood in stool	□ 1-yes	□ 2-No	□ 9-don't know	50) [_]
50) fatigue	□ 1-yes	□ 2-No	□ 9-don't know	51) [_]
51) flu-like illness	□ 1-yes	□ 2-No	□ 9-don't know	52) [_]
52) loss of appetite	□ 1-yes	□ 2-No	□ 9-don't know	53 [_]
53) coughing	□ 1-yes	□ 2-No	□ 9-don't know	54) [_]
54) back pain	□ 1-yes	□ 2-No	□ 9-don't know	55) [_]
55) abdominal pains	□ 1-yes	□ 2-No	□ 9-don't know	56) [_]
56) vomiting	□ 1-yes	□ 2-No	□ 9-don't know	57) [_]
57) constipation	□ 1-yes	□ 2-No	□ 9-don't know	58) [_]
58) painful joints	□ 1-yes	□ 2-No	□ 9-don't know	59 [_]
59) headache	□ 1-yes	□ 2-No	□ 9-don't know	60) [_]
60) abnormal chills	□ 1-yes	□ 2-No	□ 9-don't know	61) [_]
61) abnormal chills	□ 1-yes	□ 2-No	□ 9-don't know	62) [_]
62) inflammation of the joints	□ 1-yes	□ 2-No	□ 9-don't	63) [_]
know boil/furuncle	□ 1-yes	□ 2-No	□ 9-don't	64) [_]
know				

63) Have you been diagnosed with any of the following conditions during the past year

66) [_]

64) heart/cardiac problems □ 1-yes □ 2-No □ 9-don't know

if yes for heart problems, please specify: _____

_____

67) [_]

65) infective endocarditis = infection/inflammation of the inner heart tissue, e.g. valves

68) [_]

	□ 1-yes	□ 2-No	□ 9-don't know	69) [_]
66) lung problems	□ 1-yes	□ 2-No	□ 9-don't know	70) [_]
67) stomach ulcers	□ 1-yes	□ 2-No	□ 9-don't know	71) [_]
68) kidney failure	□ 1-yes	□ 2-No	□ 9-don't know	72) [_]
69) diabetes	□ 1-yes	□ 2-No	□ 9-don't know	73) [_]
70) depression	□ 1-yes	□ 2-No	□ 9-don't know	74) [_]
71) liver problems	□ 1-yes	□ 2-No	□ 9-don't know	75 [_]
72) meningitis	□ 1-yes	□ 2-No	□ 9-don't know	76) [_]
73) pneumonia	□ 1-yes	□ 2-No	□ 9-don't know	
74) cancer	□ 1-yes	□ 2-No	□ 9-don't know	77) [_]

if yes for cancer, please specify type of cancer: _____ _arthritis □ 1-yes □ 2-No □ 9-don't know **75)** weight loss □ 1-yes □ 2-No □ 9-don't know **76)** recurring boils □ 1-yes □ 2-No □ 9-don't know **77)** brucellosis □ 1-yes □ 2-No □ 9-don't know **78)** Blood pressure □ 1-yes □ 2-No □ 9-don't know **79)** other, please specify: _____	78) [_] 79) [_] 80) [_] 81) [_]

SECTION 4
Food Consumption Score (In the last one week)

Instructions: Ask the number of days in a week the respondents consumed foods from any of the food groups

Food Group consumed	**Cereals Tubers**	**Pulses**	**Vegetables**	**fruits**	**Meat fish**	**Milk**	**sugar**	**Oil**	**Condiments**
Number of days the food group was consumed in a week below									

Section 5
Semi-quantitative Food Frequency Questionnaire – (in the past one year)

Instructions: [For each food listed, tick in the box indicating how often on average you have used the amount specified during the past year]. Try to average your seasonal use of foods over the entire year. For example, if a food such as beef is eaten 4 times a week during approximate 3 months that it is in season, then average use would be once per week.	
80) After discovering your current conditions indicated above (Q.65), have your modified your diet in any way? □ 1-yes □ 2-No □ 9 don't know **81) If yes in Q82, what foods are helping you cope with your condition [List]:** - _____ - _____ - □ 9 don't know **82) If yes in Q82, What foods are you avoiding [List]:** - _____ - _____ - _____ - □ 9 don't know	82) take list 83) take list Or code [_] 84) _____ __
Instructions for the following dietary frequency questionnaire For those who say YES, [ASK about the frequency/ quantity of consumption in period before diet was modified to get the usual dietary intake --to fill in the food tables] For those who say NO, [Skip to Next question]	

	Food Groups	Frequency				
		No	3-few (1-2) days a month,	4-few (1-2) days per week	5-several days (3-6) per week,	Daily
83	Raw/unpasteurized cow milk					
84	Pasteurized/boiled cow milk					
85	Informally traded sour cow milk					
86	Homemade sour cow milk (250 ml cup)					
87	Raw/unpasteurized goat milk (250 ml cup)					
88	Pasteurized/boiled goat milk					
89	Informally traded sour goat milk					
90	Homemade sour goat milk (250 ml cup)					
91	Raw/unpasteurized came milk					
92	Pasteurized/boiled camel milk					
93	Informally traded camel milk					
94	Homemade sour camel milk (250 ml cup)					
95	Raw/unpasteurized sheep milk					
96	Pasteurized/boiled sheep milk					
97	Informally traded sheep milk					
98	Homemade sour sheep milk (250 ml cup)					
99	Mala from established processors					
100	Yoghurt					
101	Pure butter					
102	Cheese					
103	Tea with milk					
104	Tea without milk					
105	Coffee with milk					
106	Coffee without milk					
107	Water from main household source					
108	Eggs					
109	Sausages					
110	Poultry					
111	Processed meat					
112	**Meat (Not Roasted)**					
113	Meat Roasted					
114	Fish					
115	Beans (All types)					
116	Lentils					
117	Green grams					
118	Peas					
119	Ugali					
120	Pilau					
121	Spaggetti					
122	Anjera					
123	Green leafy vegetables					
124	vegetables					
125	Fruits					

SECTION 6 **Anthropometric assessments**		
126) Measure height (Meters) Trial 1_____ centimeter Trial 2._____ centimeter	Measure weight (kg) Trial 1= [__/___/___ Kg Trial 2= [___/__/____ Kg	126) Average __/___/___ cm
127) Measure Waist Circumference (cm): Trial 1 = [__] centimeter Trial 2=[___] centimeter	Measure hip Circumference: Trial 1= [__] centimeter Trial 1= [__] centimeter	127) Average ___/___/___ kg
SECTION 8 **Methodology of fermented milk production** **Ask only if fermented/soured milk is produced within the household, If not Produced to question *136***		
128) Which type of raw milk do you use for this product? □ 1-whole milk □ 2-powdered milk □ 3-mix of whole milk and powdered milk □ 8-other: _____ □ 9-don't know		128 [_]
129) Which animal milk is used for making this fermented milk product? □ 1-cow milk□ 4-mix of cow and goat milk□ 9-don't know □ 2-goat milk□ 5-mix of cow and camel milk □ 3-camel milk□ 6-mix of goat and camel milk □ 7-mix of cow, goat and camel milk□ 8-other:		129) [_]
130) Do you boil the milk before starting the fermentation? □ 1-yes □ 2-No □ 9-don't know		130) [_]
131) How do you initiate the fermentation? □ 1-addition of a part of a previous fermented milk □ 2-spontaneous, no addition□ 3-addition of yogurt from commercial sources □ 4-continuous addition of fresh milk to fermented milk□ 5-addition of of mala from commercial source□ 8-other:_____ □ 6-addition of commercial starter culture □ 9-don't know¨		131) [_]
132) For how long do you do the fermentation? □ 1-less than 6 hours □ 3-more than half a day (12-18 hours) □ 2-almost half a day (6-12 hours) □ 4-about 1 day □ 5-One to two days □ 6-more than two days □ 8-other:_____ □ 9-don't know		132) [_]
133) At which temperature do you do the fermentation? □ 1-keep in coldest part of house, below 25°C□ 2-ambient temperature, 25-35°C □ 3-warm, higher than 35°C□ 8-other:_____ □ 9-don't know		133) [_]
134) At which temperature do you store the final product? □ 1-fridge, below 10°C □ 2-ambient temperature, 25-35°C □ 3-warm, higher than 35°C□ 8-other:_____ □ 9-don't know		134) [_]
135) Which type of material is the container for the milk storage made of? □ 1-plant material (wood, calabash) □ 2-plastic □ 9-don't know □ 3-metal □ 8-other:_____		135) [_]

SECTION 9 Knowledge Attitude and Practice Assessment on Safe Food Handling Knowledge Assessment	
136) Food poisoning often result from contact with germs (faeces Indicate if you think the described activity below helps to lower the risk of sickness due to germs. **137) Wash hands after going to the toilet/cleaning baby's bottom** □ 1-yes □ 2-No □ 9-don't know	136) [_] 137 [_]
138) Remove faeces from home & surroundings (latrine, use cat method, clean up animal faeces □ 1-yes □ 2-No□ 9-don't know	138) [_]
139) There are key moments when you need to wash your hands to prevent germs from reaching food. What are these key moments? (Record all that applies) □ 1-after going to the toilet/latrine □ 2-after cleaning baby's bottom/Changing baby's nappy/Dippers □ 3- before preparing /handling food, □ 4- before feeding a child/eating □ 5-after handling raw food, □ 6-after handling garbage □ 9-Don't know	139) [___]
140) Why should someone avoid eating leftovers that were not kept in a cool place? □ 1-Because food is not safe anymore□ 9-don't know □ 2-Foods get spoiled (germs multiply very quickly and can cause illness) □ 3- Higher temperatures make germs grow faster□ 4- Other	140) [_]
141) Why should raw and cooked foods be separated? □ 1- There is no need to separate raw and fresh foods □ 3- Other □ 2- To prevent contamination fresh foods with raw foods□ 4-don't know	141) [_]
Attitude Evaluation ***(Please state either positively or negatively your answers to the following questions).*** **142) How serious do you think you are to get sick from eating contaminated food?** □ 1- Not serious □ 2-you are not sure □ 3-likely	142) [_]
143) How likely do you think you can get diarrhoea from consumption of Traditional fermented milks? □ 1-Not likely □ 2-you are not sure □ 3-likely	143 [_]
144) Do you perceive Limited knowledge on hygienic handling of milk to be a hindrance to the safety of traditional fermented dairy milk consumed by people of all ages? □ 1 -strongly Agree □ 2-you are not sure □ 3-strongly disagree	144) [_]
145) How likely do you think you are to become sick, such as having stomach ache or diarrhea, from not washing your hands? □ 1-Not likely □ 2-you are not sure □ 3-likely	145)[_]
146) How good do you think it is to wash your hands before preparing food? □ 1-Not Good □ 2-you are not sure □ 3-Good	146)[_]
Practice Assessment ***(Please answer the following questions based on day to day activities)***	

147) After you have prepared dinner, kitchen surfaces, pots, pans, plates and utensils are dirty. Can you describe how you clean them usually? □ 1-Scrape excess food into rubbish bin, □ 2-Wash with hot water □ 3-Wash with detergent, □ 9- Don't know/no answer	147) [_]
148) How do you make water safe for drinking? □ 1- boil ,□ 2- add chlorine/bleach □ 3- strain it through a cloth, □ 4- use a water filter □ 5- use solar disinfections, □ 6- let it stand and settle □ 7- Do nothing, □ 9-Don't know **149) How do you prevent raw meat, offal, poultry, milk and milk products touching other foods such as those that are cooked or ready to eat** □ 1- Separating with bare unwashed hands □ 2-through washing of hands during food handling □ 3- use of separate utensils for handling and processing □ 9-Don't Know	148) [_] 149) [_]
150) How do you store perishable fresh foods such as raw meat, poultry and seafood? □ 1- In the refrigerator (below 5 °C)/cool box □ 2- Covered (protected from insects, rodents, pests and dust □ 3-Separated from cooked or ready-to-eat food □ 4- Other □ 9- Don't know/no answer	150) [_]
151) Can you please describe how you maintain personal health and hygiene when handling food i.e. during food preparation and consumption? □ 1- Keeping short fingernails, taking a daily shower, keeping short hair or gathered into a cap or a scarf. □ 2- Refraining from preparing/handling food when showing symptoms of diseases such as skin rash, boils and cuts, running nose, eye and ear infections and diarrhoea. □ 3- Avoids bad habits during preparation/serving food, such as, smoking or chewing tobacco, nose picking, coughing and sneezing, spitting over food, tasting food with your fingers □ 9- Don't know/no answer	151)[_]

APPENDIX 3: FOCUS GROUP DISCUSSION GUIDELINES

ID participant: **[_][_][_][_][_]** (=initials of interviewer plus 3 digit number code 100 to XXX)	**Date of interview:** **[_][_]/[_][_]/2015** **(dd /mm/ yyyy)**	**Time of interview** **Start : [_][_] h [_][_] min** **End: [_][_] h [_][_] min**

Introduction and consent

Hello, my name is **Koome Muriungi Martin** and I am from the University of Nairobi, Department of food science, nutrition and technology, applied human Nutrition Programme. I am conducting a research survey that seeks to find out
I would very much appreciate your participation in this survey.
Your views shall be confidential at all times

Group member's information.

	Name	Gender	Age	Occupation	Signature of Group member/thumb print
1					
2					
3					
4					
5					
6					
7.					
8.					

Name of the moderator _____
Name of the Assistant Moderator survey team_____
Group Leader_____
Questions

Engagement Question

1. What is the Local name of the Traditional fermented milk and from which animal milk is used?
2. How available is the Traditional fermented milk in your community and whom do you prioritize while giving traditional fermented milk in the household?
3.

Exploration Question

4. How does Traditional fermented milk improve the health (medicinal Properties) /nutrition of an individual in your community?
5. What problems (safety Issues-Use of raw milk, hygiene and sanitation) do you encounter in the preparation of traditional fermented milk products
6. What are the taboos on the consumption of traditional fermented milk?
7. Are you concerned about lifestyle disease such as hypertension, diabetes and cancer in your community?

Exit Question
Is there anything else you would like to talk about traditional fermented milk?

APPENDIX 4: ADVERTISEMENT FOR ENUMERATORS

University of Nairobi

COLLEGE OF AGRICULTURE AND VETERINARY SCIENCES
DEPARTMENT OF FOOD SCIENCE, NUTRITION AND TECHNOLOGY
P.O. BOX 29053 -00625, KANGEMI, NAIROBI

ERAfrica-SafeDairy Project

ADVERTISMENT FOR HOUSEHOLD SURVEY ENUMERATORS

We plan to conduct a household survey on households Fermented Dairy Products (FDP) and human health under a Project whose brand name is ***"SafeDairy Project"***.

We are in the process of identifying household survey study enumerators. These will be persons with KCSE certificate (preferred are those with medical, public health, nutrition, food science, veterinary science) training background, with previous experience in conducting surveys data collection; who are interested and available to participate as enumerators in data collection in June/July 2015.

The household survey study enumerators are expected to be persons of high integrity. They must be literate in/and able to communicate effectively/be fluent in one or more of the local languages (Borana, Somali, Turkana, Meru) of Isiolo County and in English and Kiswahili.

If you meet the requirements stated above, please submit an application including the listed, through the **e-mail address given below.**

1. A cover letter indicating your interest to work as an enumerator for the Safe Dairy-Household survey study, your telephone and e-mail contact.
2. A brief three page curriculum vitae (CV); which must indicate (a) your gender (sex) (b) education levels (c) one or more of local language dialects in Isiolo County that you speak (d) the name and contact of one referee who knows you from a professional point of view (e) whether you have previously worked as an enumerator (f) your mobile telephone number and e-mail address (g) place of residence
3. Scanned copy of your KCSE and any training certificates
4. Scanned copy of certificate/recommendation letter, **if any** that shows you have previously worked as an enumerator.
5. Letter of good conduct.

Based on your qualifications we shall shortlist and invite the shortlisted for interview.

Please submit your application by **April 30, 2015** to:
Principal Investigator
SafeDairy Project
E-mail: safedairyproject@Gmail.com

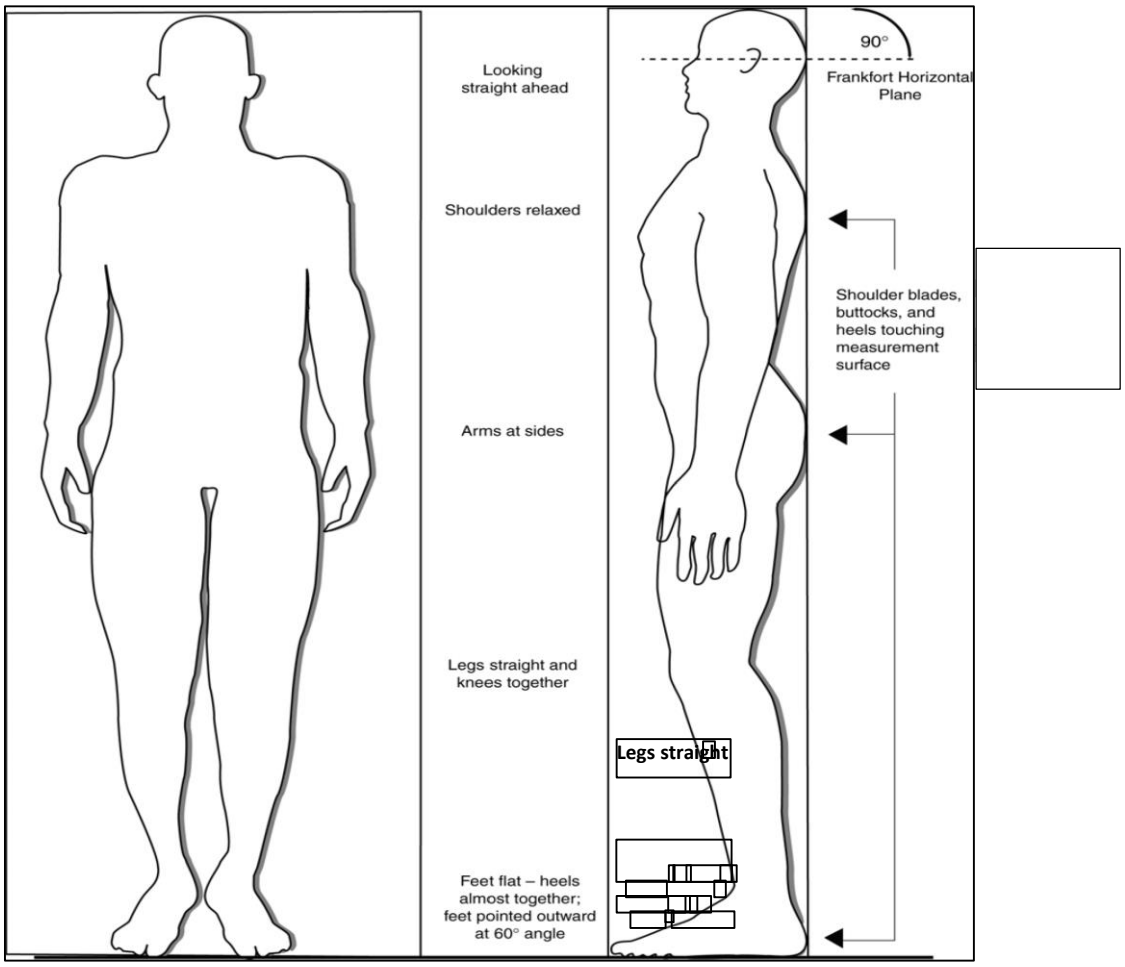
APPENDIX 5: TRAINING PROTOCOL FOR THE FIELD ASSISTANTS

5. The objectives of the training will include the following
    - Elaboration of study objectives, Clarification of roles and responsibilities, Elaboration of sampling methodology, Familiarization of research tools, Data collection procedures, Administration of questionnaires, Practical skills on questionnaire administration, Interview techniques, Education on ethical considerations
6. General Assumptions
    - Trainees will have adequate knowledge of nutrition and health programmes and might have engaged in household surveys.
    - Training will also involve general introduction of the enumerators on hazards specific to milk and milk products, cultural methods of traditional milk fermentation and food consumption assessments.
    - The training will supposedly help in data collection and analysis.
7. Preparation to be done by the principal researcher.
    - He will arrange appropriate venue for the training to take place
    - He will prepare training contents, schedules, notes and other training tools.
    - He will prepare training materials i.e. flipcharts, blackboard/whiteboards/stationery and questionnaire photocopying.
8. Teaching modes
    - Active participation by the research assistants shall be expected through questions, brainstorming sessions, discussions, demonstrations and role playing

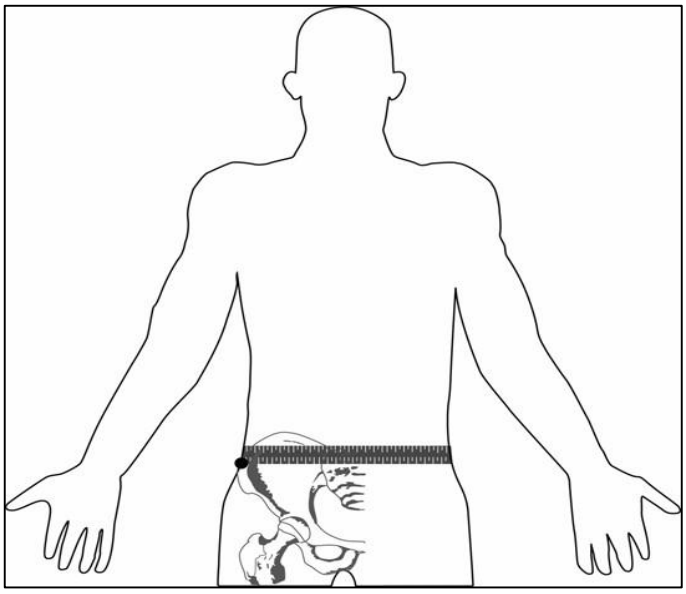
APPENDIX 6: TRAINING SESSION PLAN

Objective	Activity	Time	Duration	Materials
Day 1				
To give a brief overview of the study Topic and objectives	Energizers, brainstorming and Lecture	8:00am 9:00am	1 Hour	Handouts, Flipcharts, Felt pens and whiteboard makers, pens, note books, pencils, Sample Questionnaires.
To Clarify Roles & Responsibilities of field assistants	Lectures and discussions	9:00am 10:00	1 hour	
Tea/Coffee Break		10:00-10:30am	½ hour	
To elaborate the Sampling Methodology	Lecture, discussions & demonstrations	10:30 11:30am	1 hour	
Lunch break		11:30am 12:30pm	½ hour	
To Familiarize with research tools and data collection procedures	Lectures, discussions and demonstrations	12:30pm 2:00pm	1 1/2 hour	
To equip interviewers with interviewer techniques	Brainstorming, Discussions Role-playing	2:00pm 4:00pm	2hours	
	DAY 2			
Objective	**Activity**		**Time**	
Recap from the previous day	Revisit of topics covered	8:00am 8:30am	½ hour	
To Educate on ethical considerations	Discussion and lecture, demonstrations	8:30am 9:30am	1 hour	
Tea break		9:30am 10:00am	½ hour	
To equip enumerators with interviewing skills	Demonstrations and role play/drama	10:00am 11:30am	1 1/2 hour	
Lunch break	11:30am 12:30pm			
To equip enumerators with Practical interviewing skills	Pre-testing of questionnaires	12:30pm 2:30pm	2hours	
To identify constraints during field testing and questionnaire evaluation	Discussions	2:30pm 3:30pm	1 hours	
conclusions	Conclusions and preparation for the actual survey.	½	hour	

APPENDIX 7: MEASURING STANDING HEIGHT AND WAIST-HIP CIRCUMFERENCE



(CDC, 2007)



APPENDIX 8: FOOD CONSUMPTION SCORES COMPUTATION

Example:

The Tablebelow shows the number of days for which different food groups where consumed within one week (7 days) and the computed food consumption score of the Respondent

Food Group consumed	Cereals Tubers	Pulses	Vegetables	fruits	Meat fish	Milk	sugar	Oil	Condiments
No.of Days consumed in a Week.	7	3	7	1	3	4	7	7	1

Food consumption score = **(^{a}staple x staple) + (^{a}pulse x pulse) +(^{a}veg x veg)+ (^{a}fruit x fruit) +(^{a}animal x animal) +(^{a}sugar x sugar) + (^{a}dairy x dairy) + (^{a}oil x oil)**

Where $^{\alpha}1$= weight of food group from table below and $^{x}1$ number of days which the food group was consumed within one week (7 days) from table above.

Therefore: (7x2)+(3x2)+(1x7)+(1x1)+(4x3)+(4x4)+(7x0.5)+(7x0.5)+(1x0.0) = 60 since the score is greater than 35,from the threshold table below the respondents falls in the **acceptable food consumption category.**

Food consumption scores thresholds

No	***Food Groups***	***Justification***	***Assigned weights***	***Threshold profiles***
1.	Cereals &Tubers	*Energy dense ,anti-nutritional factors, low proteins*	*2*	**0-21** Poor Food Consumption
2.	Pulses	*High proteins/energy ,anti-nutritional factors present,*	*3*	
3.	Vegetables	*Low proteins/energy/no fat, micro-nutrients present*	*1*	**21.5-35** Borderline Food Consumption
4.	Fruits	*Low proteins/energy/no fat, micro-nutrients present*	*1*	
5.	Meat & fish	*High protein, energy ,fat, micro-nutrients*	*4*	**>35** Acceptable Food Consumption
6.	Milk	*High protein, energy ,fat, micro-nutrients*	*4*	
7.	Sugar	*Empty calories*	*0.5*	
8.	Oil	*Fat present but consumed significantly*	*0.5*	
9	Condiments	*Empty calories*	*0.0*	

APPENDIX 9: BIVARIATE ANALYSIS AND BINARY LOGISTIC REGRESSION ANALYSIS FOR RISK FACTORS ASSOCIATED WITH ADULT OVERWEIGHT AND OBESITY.

Variable	Risk Factor	Overweight and Obesity (N=319) Yes %	No %	P value	OR	95% CI	P Value
Age Categories	Below 40	36.1	63.9	0.366	0.8	0.5-1.2	0.366
	Above 40	41.2	58.8				
Gender	Female	42.3	57.7	**0.001**	1.2	9.9-10.9	**0.015**
	Male	27.8	72.2				
Residency	Rural	28.7	71.3	**0.011**	0.5	0.3-0.8	**0.011**
	Urban	43.1	56.9				
Educational attainment of Respondent							
	Not attained	69.0	31.0	**0.058**	0.6	0.3-1.0	**0.059**
	attained	58.3	41.7				
Educational attainment of Household Head							
	Not attained	75.0	25.0	**0.000**	0.4	0.2-0.6	**0.001**
	attained	57.6	76.9				
Household size	1-3	22.4	77.6	**0.015**	0.3	0.1-0.7	**0.009**
	4-6	41.7	58.3		0.9	0.5-1.6	0.880
	>7	42.7	57.3				
Household wealth Index							
	Lower	32.9	67.6	0.215	0.5	0.3-1.0	0.081
	Middle	37.6	62.4		0.7	0.4-1.2	0.302
	Higher	44.6	55.4				
Household water sources	Non-Improved	33.3	66.7	0.529	0.7	0.3-1.6	0.528
	Improved	38.6	61.4				
Gas Cooker	Yes	50.7	49.3	**0.0l2**	1.9	1.1-3.1	**0.013**
	No	34.3	65.7				
Presence of a toilet facility	Yes	41.4	58.6	**0.032**	1.8	1.0-3.1	**0.034**
	No	28.0	72.6				
Television Ownership	Yes	44.7	55.3	**0.014**	1.7	1.1-2.8	**0.014**
	No	31.2	68.8				
Bicycle ownership	Yes	46.9	53.1	0.159	1.5	0.8-2.8	0.160
	No	36.3	63.7				
Auto Mobile ownership	Yes	48.8	51.2	0.126	1.6	0.8-3.2	0.128
	No	36.3	63.7				
Mobile phone ownership	Yes	40.1	59.9	**0.043**	2.1	1.0-4.5	**0.047**
	No	23.8	76.2				
Food consumption scores	Poor	46.3	53.7	0.236	1.4	0.7-2.8	0.237
	Good	36.7	63.3				
Physical Activity	Active	39.5	60.5	0.392	1.2	0.7-2.0	0.391
	Not active	34.4	65.6				
Yoghurt	Did not consume	38.6	61.4	0.742	1.0	0.6-1.7	0.741
	Consume	36.8	63.2				
Processed Mala	Did not consume	36.7	63.3	0.621	0.8	0.5-1.4	0.620
	Consumed	39.4	60.6				
Tea with Milk	Did not consume	35.2	64.8	0.649	0.8	0.4-1.5	0.648
	Consumed	38.5	61.5				
Meat	Did not consume	35.9	64.1	0.781	0.9	0.4-1.8	0.780
	Consumed	38.2	61.8				
Pork	Did not consume	34.9	65.1	**0.002**	0.3	0.1-0.7	**0.003**

	Consumed	60.5	39.5				
Sausages	Did not consume	35.4	64.6	**0.008**	0.3	0.1-0.7	**0.010**
	Consumed	58.8	41.2				
Fish	Did not consume	34.1	65.9	**0.004**	0.4	0.2-0.7	**0.004**
	Consumed	54.1	45.9				
Beans	Did not consume	42.9	57.1	0.575	1.2	0.5-2.7	0.574
	Consumed	37.5	62.5				
Lentils	Did not consume	33.2	66.8	**0.005**	0.4	0.3-0.8	**0.006**
	Consumed	50.0	50.0				
Peas	Did not consume	30.0	70.0	**0.003**	0.5	0.3-0.8	**0.004**
	Consumed	45.9	54.1				
Anjera	Did not consume	35.4	64.6	0.526	0.8	0.5-1.3	0.525
	Consumed	39.1	60.9				
Chapatti	Did not consume	30.0	70.0	**0.003**	0.5	0.3-0.8	**0.004**
	Consumed	45.9	54.1				
Vegetables	Did not consume	8.3	91.7	**0.031**	0.1	0.0-1.1	0.063
	Consumed	39.1	60.9				
Fruits	Did not consume	30.6	69.4	0.252	0.6	0.3-1.3	0.253
	Consumed	39.3	60.7				
Homemade sour Goat Milk	Did not consume	40.3	59.7	0.227	2.7	0.7-11	0.143
	Consumed	11.5	88,5				
Homemade sour Cow Milk	Did not consume	37.4	62.6	0.427	0.6	0.2-1.7	0.428
	Consumed	47.1	52.9				
Homemade sour Camel Milk	Did not consume	39.8	60.2	0.116	1.6	0.8-3.2	0.11
	consumed	28.0	72.0				
Homemade sour sheep Milk	Did not consume	25.0	75.0	0.260	-	-	-
	Consumed	-	100				
Informally Traded sour goat milk	Did not consume	38.4	61.6	0.326	2.1	0.4-10.6	0.336
	Consumed	22.2	77.8				
Informally traded sour camel milk	Did not consume	37.5	62.5	0.633	0.8	0.3-1.8	0.632
	Consumed	42.3	57.7				
Informally traded sour cow milk	Did not consume	37.9	62.1	0.967	0.9	0.5-1.7	0.966
	Consumed	38.2	61.8				

APPENDIX 10: ETHICAL RESEARCH PERMIT

UNIVERSITY OF NAIROBI
COLLEGE OF HEALTH SCIENCES
P O BOX 19676 Code 00202
Telegrams: varsity
(254-020) 2726300 Ext 44355

KNH/UON-ERC
Email: uonknh_erc@uonbi.ac.ke
Website: http://www.erc.uonbi.ac.ke
Facebook: https://www.facebook.com/uonknh.erc
Twitter: @UONKNH_ERC https://twitter.com/UONKNH_ERC

KENYATTA NATIONAL HOSPITAL
P O BOX 20723 Code 00202
Tel: 726300-9
Fax: 725272
Telegrams: MEDSUP, Nairobi

Ref: KNH-ERC/A/418

16th October 2015

Prof. Wambui Kogi-Makau
Principal investigator
Safe Dairy Project
Dept. of Food Science Nutrition and Technology
Faculty of Agriculture
University of Nairobi

Dear Prof. Makau

Research Proposal: Health Hazards caused by bacteria in African Traditionally Fermented Dairy products Erafrica: Safe Dairy Project (359/05/2015)

This is to inform you that the KNH/UoN-Ethics & Research Committee (KNH/UoN-ERC) has reviewed and **approved** your above proposal. The approval periods are 16th October 2015 – 15th October 2016.

This approval is subject to compliance with the following requirements:

a) Only approved documents (informed consents, study instruments, advertising materials etc) will be used.
b) All changes (amendments, deviations, violations etc) are submitted for review and approval by KNH/UoN ERC before implementation.
c) Death and life threatening problems and serious adverse events (SAEs) or unexpected adverse events whether related or unrelated to the study must be reported to the KNH/UoN ERC within 72 hours of notification.
d) Any changes, anticipated or otherwise that may increase the risks or affect safety or welfare of study participants and others or affect the integrity of the research must be reported to KNH/UoN ERC within 72 hours.
e) Submission of a request for renewal of approval at least 60 days prior to expiry of the approval period. (*Attach a comprehensive progress report to support the renewal*).
f) Clearance for export of biological specimens must be obtained from KNH/UoN-Ethics & Research Committee for each batch of shipment.
g) Submission of an *executive summary* report within 90 days upon completion of the study. This information will form part of the data base that will be consulted in future when processing related research studies so as to minimize chances of study duplication and/or plagiarism.

For more details consult the KNH/UoN ERC website **http://www.erc.uonbi.ac.ke**

"Protect to Discover"

Yours sincerely,

PROF. M.L. CHINDIA
SECRETARY, KNH/UON-ERC

c.c. The Principal, College of Health Sciences, UoN
The Deputy Director CS, KNH
The Chairperson, KNH/UoN-ERC
Co-investigators: Dasel Wambua Mulwa, Peter Lamuka, Alice Mbonganie Mwangi, Godfrey Nsereko Lule

APPENDIX 11: PLAGIARISM CHECK REPORT.

Turn tin Originality Report

FOOD HANDLING, CONSUMPTION OF TRADITIONAL FERMENTED MILK AND RISK FACTORS FOR ADULT OVERWEIGHT AND OBESITY IN ISIOLO CENTRAL SUB COUNTY

by Martin Koome

From Masters and Phd (ANP)

Processed on 03-Oct-2016 12:27 EAT

ID: 714614748

Word Count: 47380

Similarity Index

13%

Similarity by Source

Internet Sources:

11%

Publications:

7%

Student Papers:

4%