CONTRIBUTION OF SWEETPOTATOES TO NUTRIENT ADEQUACY IN DIETS OF CHILDREN 6-59 MONTHS IN TRANS-MARA EAST SUB-COUNTY, NAROK COUNTY, KENYA

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A56/89083/2016

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A DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE IN APPLIED HUMAN NUTRITION OF THE UNIVERSITY OF NAIROBI

DEPARTMENT OF FOOD SCIENCE, NUTRITION AND TECHNOLOGY

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I **MERCY CHEPKOECH** declare that this dissertation is my original work and has not been submitted to any other institution for any other award.

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DEDICATION

I dedicate this work to my parents, David and Stella Chepkwony for their limitless love and care, my siblings for their support: *you are all the force behind me!*

ACKNOWLEDGEMENT

I thank God for the gift of life and opportunity to study, to this far glory to His name. I would like to express my gratitude to the University of Nairobi for the scholarship opportunity offered to me to pursue Master of Science in Applied Human Nutrition. A special note of appreciation is extended to my supervisors, Dr. George Abong' and Dr. Sophia Ngala for their guidance and supervision throughout the study period. Their criticism, suggestions and contributions were highly treasured.

Special appreciation goes to the entire Department of Food Science Nutrition and Technology of the University of Nairobi and its staff who encouraged, guided and constantly gave me the morale to go on despite the difficulties encountered.

I am greatly indebted to my friends Joshua Ombaka and Victor Koech for the support and assistance in diverse ways throughout the study period, may God bless you abundantly. I would also like to express my gratitude to the field assistants who willingly offered to assist during data collection, without which this work won't have been possible, thank you so much.

To my friends, classmates and family, thank you for the moral support, prayers and love.

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LIST OF ACRONYMS AND ABBREVIATIONS

ANOVA- Analysis of variance

ASAL- Arid and Semi-Arid Lands

C.I- Confidence interval

df- Degrees of freedom

EBF-Exclusive Breastfeeding

ENA- Emergency Nutrition Assessments

FGD- Focus Group Discussion

IYCF- Infant and Young Child Feeding

KDHS-Kenya Demographic Health Survey

KES-Kenya Shillings

OFSP- Orange-Fleshed Sweetpotatoes

RDA-Recommended daily allowance

sd- Standard deviation

SP-Sweetpotatoes

SPSS- Statistical Package for Social Sciences

SMART- Standardized, Monitoring and Assessments for Relief and Transitions

UNICEF- United Nations Children's Fund

WHO- World Health Organization

OPERATIONAL DEFINATIONS

Dietary diversity (DD)

Dietary diversity is defined as the count of food items (food variety score, FVS) or food groups (dietary diversity score, DDS) consumed by individual or community level within a specified time period. DD as such refers to nutrient adequacy and not to excessive intake of dietary components.

Household

This refers to those people who live in the same house and share meals.

Nutrient adequacy

Nutrient adequacy refers to the achievement of recommended intakes of energy and other nutrients. To estimate the nutrition adequacy of the diet, Nutrient Adequacy Ratio (NAR) is calculated for energy and nutrients of interest. The NAR for a given nutrient is the ratio of the subjects' daily intake to the current recommended allowance for the subjects' sex and age category

Utilization of sweetpotato

This refers to the use of sweetpotatoes in child feeding, how it is incorporated in child's food and the preparation methods.

ABSTRACT

Sweetpotato versatility, drought tolerance, resistance to diseases and its great contribution to food security makes it an important staple food in the developing countries. Poor soil productivity, insufficient soil moisture, diseases, pests and erratic rainfall among other factors accelerates food insecurity in ASAL areas. There is, however, limited information on sweetpotato utilization and contribution to nutrient adequacy in the diets of children in developing countries. This study aimed at determining the contribution of sweetpotatoes to nutrient adequacy in the diets of children aged 6-59 months in Trans-Mara East Sub- County.

A cross-sectional study was carried out in January and February 2018 to determine the consumption of sweetpotatoes and their contribution to nutrient adequacy in the diets of 211 children aged between 6-59 months. The study consisted of qualitative and quantitative data collection methods. The data obtained was analysed using SPSS version 20, Nutrisurvey 2007 and ENA for SMART 2011 software.

Majority of the respondents (92.9%) were female while the rest were male (7.1%). There was a significant association (χ^2=71, df=30, $p<0.05$) between household head's main occupation and the education level. Slightly over a quarter of the children (30.3%) had low dietary diversity score which is less than four food groups. The most consumed food group was cereal based products (80.1%) while the least was fish (4.3 %). The diets of the children under study did not meet the RDAs for carbohydrates, vitamin A, calcium and iron. White-fleshed sweetpotato was the most consumed variety. Most households (88.6%) boiled the sweetpotato while 11.4% fried. Lack of sweetpotato consumption led to significant ($p<0.05$) reduction in the iron intake with R^2 of 0.26 and beta of -5.4. The consumption of sweetpotatoes did not result in any significant difference ($p>0.05$) in the intake of calcium, vitamin A, zinc, carbohydrates, fibre and protein.

The overall prevalence of wasting, underweight and stunting was 3.8%, 9.6% and 28.9%, respectively.

Sweetpotatoes are produced by majority of the households in Trans-Mara East. They are introduced to diets of children mainly in form of boiled roots. Despite the fact that various sweetpotato varieties are grown in the area, their utilization and contribution to nutrient adequacy in diets of children is low. Because of the great potential of sweetpotatoes growth in this region, there is need for increased promotion efforts to increase the frequency of sweetpotato utilization with emphasis on highly nutritious orange fleshed varieties. This can be done by educating caregivers on the nutritional importance of consumption of sweetpotato and formulation of delicious recipes.

CHAPTER ONE: INTRODUCTION

1.1 Background Information

Sweetpotato (*Ipomoea batata*) (L) belongs to family Convolvulacea (morning glory) (CIP, 2017a). Due to its versatility, drought tolerance and its great contribution to food security it is considered important staple food in the developing countries of the world (El Sheikha and Ray, 2017). There are many varieties with different skin and flesh which can be white, yellow-orange or deep purple (Sindi *et al.*, 2013). Globally, China is the top producer with 71.3 million tonnes which is about 69% of world total production. It is followed by United nations of America that produces 1.34 million tonnes, Brazil with 0.53 million tonnes while in Africa, Nigeria leads in production with 3.77 million tonnes followed by Uganda with 1.86 million tonnes (FAOSTAT, 2017). Sweetpotato is ranked as the sixth most important food crop globally after rice, wheat, potatoes, maize and cassava while in the developing nations it is ranked as fifth most important food crop (CIP, 2013). Sweetpotato production in Kenya is mainly done in central, coastal and western regions of the country which accounts for 75% of total production annually. Out of this production, about 80% is produced in the Lake Victoria basin (Tumwegamire *et al.*, 2014a).

Trans-Mara East Sub-County is a semi-arid region in Narok County and the residents have always depended on seasonal rains for maize production until recently when maize production was rendered almost impossible by Maize Lethal Necrosis Diseases (FAO, 2012). Further studies have shown that soil productivity, insufficient soil moisture and erratic rainfall, have accelerated poverty and food insecurity in many of the households in Trans Mara East Sub-county (Saidi, Kuria and Mutai, 2014). Because of this, most vulnerable groups including children below five years are at risk of malnutrition. Focus has now shifted to sweetpotato production both in large and small scale since they tolerate all climatic conditions and sweetpotatoes are not so much

affected by diseases and pests. Many efforts that seek to promote sweetpotato farming and utilization are already in place; a good example is the case of International Potato Center (CIP) multi stakeholder partnership program, Sweetpotato for Profit and Health (SPHI) that targets reaching 10 million households in sub-Saharan African within ten years to promote increased uptake so as to reduce malnutrition among children under age of five years (UNICEF, 2017a).

Globally, out of 667 million children under age of five years, 159 million are stunted; 50 million are wasted and 41 million are overweight (IPRI, 2016). In Africa and Asia, nearly half of all deaths in children under the age of five years are attributable to undernutrition. This is because undernutrition puts children at greater risk of dying from common infections, increases the frequency and severity of such infections, and contributes to delayed recovery (UNICEF, 2016). Poor nutrition in the first 1,000 days of a child's life can lead to irreversible consequences such as stunting, impaired cognitive ability, reduced school and work performance (UNICEF, 2013). Adequate nutrition is therefore important and nutrition-sensitive agriculture is a sustainable way of ensuring this. This approach emphasizes consumption of nutritionally rich foods, dietary diversity, and food fortification as key in eradication of malnutrition (FAO, 2014). Sweet potato-based complementary food formulations, prepared from cream- or orange-fleshed sweet potato, contain β-carotene, the precursor of vitamin A and energy and therefore a great potential to solve both food insecurity and nutrition insecurity (Amagloh *et al.*, 2012).

1.2 Statement of the Problem

Despite the countless efforts by governments and non-governmental organizations globally to improve nutrition status of the populace, 795 million of people globally are still undernourished and 33.2% are in sub-Saharan Africa (FAO, 2015). In Kenya, the rates of malnutrition in children less than five years remain high, wasting at 4% and 11% underweight while stunting rate stands at 26% (KDHS, 2014). This situation is not different in Narok; stunting rate is at 32.9%, wasting at 3% and underweight at 11.6%. This could be because of various reasons such as low food production that leads to food insecurity and ever increasing population attributable to high teenage pregnancies and low education levels attainment particularly among the girls. There are high chances of increased malnutrition in Narok region particularly Trans-Mara East Sub-County because of the rising population, diminishing resources and Maize Lethal Necrosis Disease. There has been promotion and consumption of sweetpotatoes in the region as an alternative to maize. There is, however, limited information on their utilization and contribution to nutrient adequacy especially in children aged below five years. The objective of this study was to assess the consumption of sweetpotatoes and their contribution to nutrient adequacy in children aged 6-59 months in Trans-Mara East Sub-County.

1.3 Justification

Since there is a lot of promotion of sweetpotato farming, there is need to promote their maximum utilization to enhance food security of the consumers and hence lead to positive impact in nutrition status. To do this, there is need for evidenced-based information that will not only guide the basis of consumer awareness creation but also in identification of gaps that need to be addressed to achieve maximum benefits. The results of the study will also be used as a guide in

the development of strategy to educate the mothers to incorporate sweetpotatoes in the foods for their children. This information is also necessary in nutrition education focused at increasing effective demand by changing the perceptions and poor utilization of sweetpotatoes. The results will guide the Government in developing policies regarding use of sweetpotatoes to alleviate nutrient deficiency. The study will benefit the County government of Narok, Trans-Mara East Sub-County and the government of Kenya because the information obtained will be used to inform policy making regarding better utilization of sweetpotatoes to improve the nutrition status of children which in turn benefit the children and households as well.

1.4 Aim

To contribute towards food and nutrition security in Kenya through improved utilization of sweetpotatoes.

1.5 Purpose

The purpose of the current study is to make available information on the current practices of sweetpotato consumption and enhance utilization of the same in the diets of infant and young children among rural households in Trans-Mara East Sub- County, Narok County, Kenya

1.6 General Objective

To determine the contribution of sweetpotatoes to nutrient adequacy of children aged 6-59 months in Trans-Mara East Sub- County

1.6.1 Specific objectives

1. To determine the demographic and socio-economic characteristics of households with children aged 6-59 months in Trans-Mara East Sub-County
2. To determine feeding practices and dietary intakes of children aged 6-59 months in Trans-Mara East Sub-County
3. To establish the methods of incorporation of sweetpotatoes into the diets of children 6-59 months old in Trans-Mara East Sub-County
4. To assess the nutritional status of children aged 6-59 months in Trans-Mara East Sub-County

1.7 Hypothesis

1. There is no significant association between the demographic and socio-economic characteristics of households with children aged 6-59 months in Trans-Mara Sub-County and the Kenya national averages

2. There is no significant difference between dietary intakes of children aged 6-59 months in Trans-Mara East Sub-County consuming sweetpotatoes and those who do not consume

3. There is no significant difference in methods used to incorporate sweetpotatoes and other foods in the diets of children 6-59 months in Trans-Mara East Sub-County

4. There is no significant difference between nutrition status of children aged 6-59 months consuming sweetpotatoes and those not consuming in Trans-Mara East Sub-County

CHAPTER TWO

LITERATURE REVIEW

2.1 Historical Perspective of Sweetpotatoes

Sweetpotatoes are said to have been discovered by explorers who were looking for treasures such as gold, silver, spices and jewels in North and South America (Caroline Roullier, Laure Benoit, Doyle B and McKey, 2013). They have been consumed since prehistoric times as evidenced by sweetpotato relics dating back 10,000 years that have been discovered in Peruvian caves (HKI, 2012). Christopher Columbus brought sweetpotatoes to Europe after his long journey to other worlds in 1492 and the 16th century, the Spanish introduced them to the Philippines and Portuguese to Africa, India, Indonesia and southern Asia (Oxfeld, 2017). Sweetpotatoes were introduced to East Africa by British farmers in early 1880s since then; it has grown in importance both as food and cash crop (Glato *et al.*, 2017).

2.2 Sweetpotato Production

Sweetpotato is ranked as the sixth most important food crop globally and ranked fifth in the developing countries with about 105 million tons produced yearly out of which 95% of the total production is produced in developing countries (CIP, 2017a). Globally, China is the top producer (71.3 million tonnes) which is about 68.6% of world total production, United nations of America produces 1.34 million tonnes, Brazil 0.53 million tonnes while in Africa, Nigeria leads in production with 3.77 million tonnes followed by Uganda (1.86 million tonnes) (FAOSTAT, 2017). Production in Eastern and Central Africa has been increasing from 1960s and current predictions shows that sweetpotato production in Africa will be more than double by 2020 (Chauvin, Mulangu and Porto, 2012). Approximately 7 million tonnes of sweetpotato is

produced in Sub-Saharan Africa annually which contributes about 5% of global production (CIP, 2017b). Sweetpotato is one of the most important food crop in Kenya alongside maize and Irish potato (Momanyi, Amata and Atuncha, 2016).

2.2.1 Common varieties of sweetpotatoes grown in Kenya

There are many varieties of sweetpotatoes cultivated by Kenyan farmers with varied skin and flesh colors; ranging from orange, deep purple and white to yellow (Jepkemboi *et al.*, 2017). Farmers and consumers select varieties basing on a number of criteria which may include; potential yield, disease and pest resistance, maturity period, growth type taste and nutritive value (Low *et al.*, 2017). The orange fleshed sweet potato varieties are gaining popularity due to their higher contents of beta-carotene which is a precursor of vitamin A and therefore can prevent vitamin A deficiency (Momanyi, Amata and Atuncha, 2016). Other than landraces that are specific to communities, the commonly grown varieties of sweet potatoes in Kenya include; SPK01 (Kakamega13), SPK0049 (Kakamega4), Kemb23,Kemb10 (Simama),KSP11, Mafuta, Mugando, Muibai, Ex-diani, Bungoma and CIP42009 (NAFIS, 2018). Orange-fleshed varieties that have been released and promoted in Kenya include Carrot C, Kenspot 3, Kenspot 4, Kenspot 5,W-151 and Naspot 10 (Tumwegamire *et al.*, 2014b). Sweetpotato varieties cultivated in Narok County are mainly landraces that are white, cream or yellow-fleshed and are identified using different names in the various locations within the County.

2.2.2 Ecological requirement for sweetpotato production

Sweetpotatoes tolerate a wide range of growing conditions such as droughts, poor soil and minimum care (NAFIS, 2018). They are grown at an altitude of 0 –2100m and up to 3000m height above sea level but does better in lower and mild elevation zone (Anyanga, 2015). They grow best at 24 ^{0}C, when temperatures fall below 12 ^{0}C or exceeds 35 ^{0}C growth is slowed down

while rainfall of 750-1000mm favors the growth of the sweetpotato though it is able to withstand droughts but with reduced yields (NAFIS, 2018). Sweetpotatoes can be cultivated in several types of soils but tend to do well in loose soils which allow expansion of tubers (Rosally *et al.*, 2015). They grow best in fertile sandy loams and do poorly in clay, water logged too shallow or stony soils and poorly aerated soils may retard tuber formation and therefore reduce the yield (Tedesco and Stathers, 2015).

2.3 Nutrient Content of Sweetpotatoes

Sweetpotato contains nutrients such as carbohydrates, fibers, carotenes, thiamine, riboflavin, niacin, potassium, zinc, calcium, iron, vitamins A , vitamin C, and high-quality protein as shown in **Table 1** (USDA, 2014). Sweetpotato is particularly rich in carbohydrate, the prime form of it is starch and they are important sources of dietary fibre (Abong *et al.*, 2016). Besides the carbohydrate, sweetpotato have vitamins and minerals that can contribute considerable recommended dietary allowance (El Sheikha and Ray, 2017). Oranged-Fleshed Sweetpotatoes have relatively higher beta-carotene content which is the precursor of vitamin A, and therefore consumption of OFSP when they are in season helps to establish stores of vitamin A that can then be used when the supply is minimal (Tedesco and Stathers, 2015).

Table 1: Nutritive value of raw sweetpotato

Nutrients	Average value per 100g of sweetpotato
Water (g)	77.3
Energy (kj)	359
Protein (g)	1.6
Total lipid (g)	0.1
Carbohydrate (g)	20.1
Fibre (g)	3
Calcium 9 (mg)	30
Iron (mg)	0.6
Magnesium (mg)	25
Phosphorus (mg)	47
Potassium (mg)	337
Sodium (mg)	55
Zinc (mg)	0.3
Vitamin C (mg)	2.4
Niacin (mg)	0.6
Vitamin B6 (mg)	0.2
Vitamin A (IU)	14187

Source: (USDA, 2014)

2.4 Sweetpotato Utilization

There are various methods of sweetpotato utilization from when they are fresh to added value products (Sheikha and Ray, 2017). Sweetpotato utilization maybe seasonal in that rainfall distribution affects their production such that areas with rainfall throughout the year consume predominantly fresh roots and leaves while dry areas dried products of sweetpotatoes are more common (Low *et al.*, 2017). With the increasing need to scale-up nutrition with sweetpotatoes, researches have introduced other processed products such as composite flour, bread, biscuits, porridge, weaning foods, juices, doughnuts, pancakes and animal feed (Okello, Sindi and Low, 2014) . Processed products have longer shelf-life, reduced bulkiness, easy accessibility by urban population or non-growers and thus improved economic value of the crop (Sohail *et al.*, 2013). Inedible parts like stems and leaves are used to feed livestock and in Kenya, recent research has established a trend where small farmers use sweetpotatoes as livestock feeds (Tedesco and

Stathers, 2015). Other value-addition methods used by consumers include processing into alcohols, medicinal syrup, culture media, buns, doughnut, strips, bread, queen cake, croquette, and beverages (CIP, 2014).

2.5 Sweetpotato Processing

To improve the utilization, sweetpotato is processed both locally by use of traditional methods and commercially (Fetuga *et al.*, 2014; Tedesco and Stathers, 2015). Some local processing methods include; boiled sweet potato roots which are peeled (or left unpeeled) and washed, then boiled in water, mixture of sweetpotatoes and beans which are boiled separately and then mixed when ready, mashed sweetpotatoes and beans where raw sweetpotatoes roots are added to boiled beans cooked and mashed when ready, dried chips of sweetpotatoes, which are boiled, salt added, and either eaten in that form or mashed (Momanyi, Amata and Atuncha, 2016). Coming up with new technologies both at local and industrial levels will process value-added SP that will promote the production, consumption and economic value (Sohail *et al.*, 2013). Commercial processing of sweet potato into other more commercial products such as sweetpotato chips, juice, cakes, flour and biscuit has been promoted through farmer groups, NGO's and CBO's so as extend the availability, diversify the uses and to add value to the crop (Abong *et al.*, 2016; Ray, 2017). In Kenya the farmers prefer cooking local food '*Mshienye'* by mashing beans together with orange-fleshed sweetpotatoes and demand for this dish is increasing because of the appealing orange colour of the product (Tedesco and Stathers, 2015).

2.5.1 Effects of processing on nutrient content of sweetpotatoes

Processing may reduce the nutritional value of sweetpotatoes as a result of losses and changes in major nutrients including carbohydrates, proteins, minerals and vitamins (Ikanone and Oyekan,

2014). Nutrients may be lost either by degradation which can occur by destruction and chemical changes such as oxidation or by leaching into cooking medium (Statherset *al.*, 2013). Vitamins are susceptible to both degradation and leaching while minerals are affected only by leaching, free amino-acids could also be leached or may react with sugars to form complexes while starches may be hydrolyzed to sugar (Allen *et al.*, 2012). Boiling of sweetpotatoes retains more carbohydrate than frying while frying retains more vitamin C and minerals than boiling (Ikanone and Oyekan, 2014). True retention of beta-carotene varies from 70-92%, depending on cooking time and whether the pot was covered with a lid; covering increases true retention of beta-carotene (Kim *et al.*, 2014). Processing of sweetpotatoes may also lead to improvement of organoleptic qualities, destruction of toxins and anti-nutritional factors, increase in digestibility and nutrients bioavailability (Ikanone and Oyekan, 2014). For example, phenolic contents of the processed sweetpotatoes are higher than that of raw sweetpotatoes and studies indicate that all home processing methods result in a significant increase in phenolic content of the flesh tissues in the following order: deep-frying > baking > boiling > microwaving (Bellail *et al.*, 2012). Addition of proportion of sweetpotato flour in processing other foods, example in wheat flour, increase nutritive values in terms of fibre and carotenoids and lowers the gluten level (Saeed *et al.*, 2012).

2.6 Storage of Sweetpotato for Improved Utilization

Sweetpotato roots are perishable and without proper storage quality declines as they lose water and weight during storage and risk of attack by pests and diseases increases as well (Statherset *al.*, 2013). There are quite a number of methods used to store sweetpotatoes; one of them is piecemeal harvesting where it involves harvesting from farm little by little and only during

consumption while before consumption it is just left stored in the ground (Tedesco and Stathers, 2015). Piecemeal harvesting is important since it allows for continuous spread in consumption over a season, reduces weevil attacks and it reduces the peak labour needs during harvesting (Obadoh, 2015). Drying and storing in gunny bags/sacs is another most important storage technique used by farmers to extend the period when it may be consumed and allow for transportation to market places (Abong *et al.*, 2016).

2.7 Nutrition of children under-five

The nutritional status of children under the age of five years is an important measure and indicator of children's health (KDHS, 2014). Malnutrition in children is particularly damaging since the effects are irreversible, resulting in permanent impairment of cognitive function and impacting on the quality of life, productivity of an individual and national economy (UNICEF, 2016). Many efforts are in place to ensure improved nutrition status for children under five and the global nutrition report shows that most countries are on course for meeting the set targets in regard to malnutrition for example, stunting rates are declining in all regions except Africa and Oceania (IFPRI, 2016). In Kenya, the rates of malnutrition in children less than five years remain high with wasting level at 4%, underweight level at 11% and stunting level at 26% (KDHS, 2014). There are multiple causes of malnutrition and they can be summarized to immediate causes which include inadequate dietary intake and diseases, underlying causes contributes to immediate causes and basic causes as shown in **Figure 1** (UNICEF, 2016).

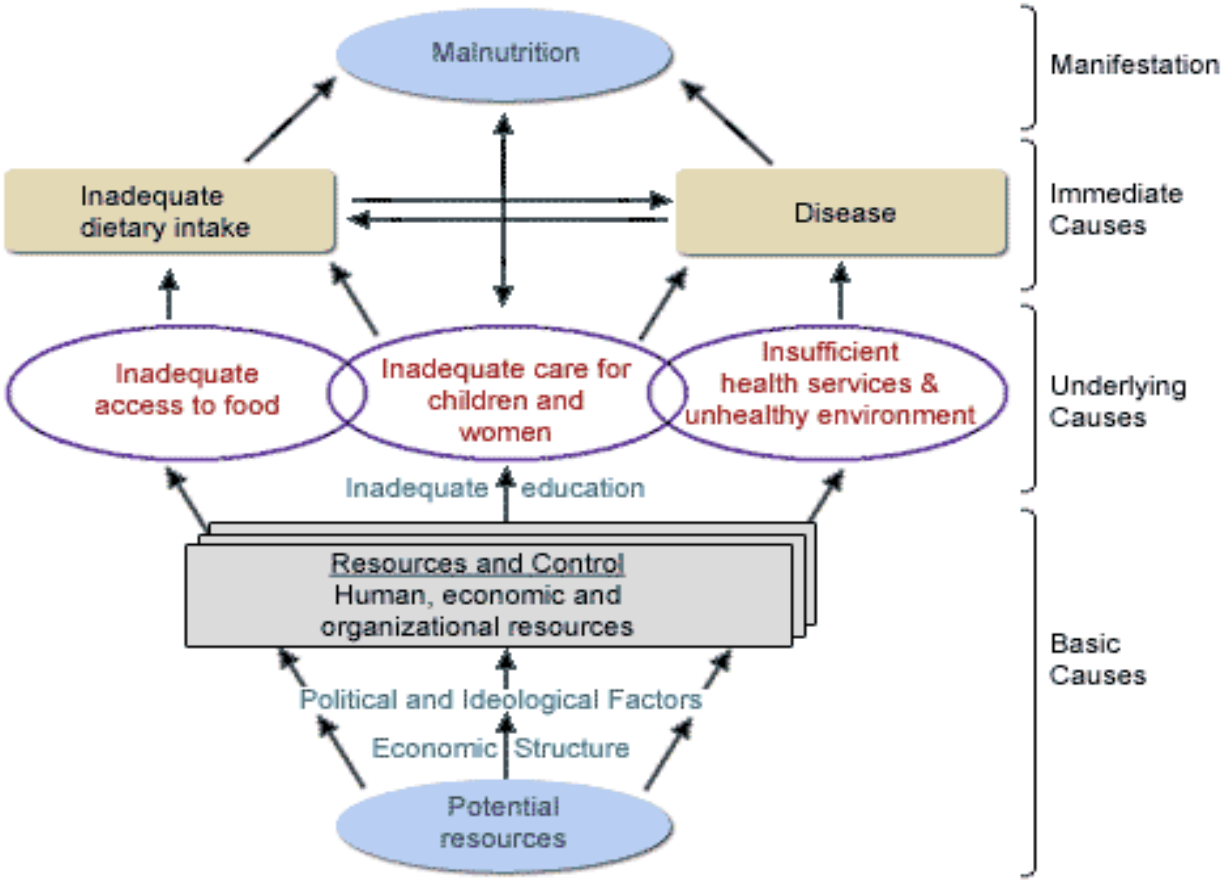

Figure 1: UNICEF Conceptual Framework of Malnutrition. Adopted from UNICEF, 1999

2.7.1 Infant and young child feeding

Adequate nutrition during infancy and early childhood is essential for growth, development and good health of each child (Kumar *et al.*, 2017). Exclusive breastfeeding, timely introduction of complementary food, feeding frequency and dietary diversity are among the core infant and young children feeding practices that if undertaken appropriately, results to a well-nourished child (Merita *et al.*, 2017). Studies show that sweetpotatoes could be incorporated in child's diet both locally and even for commercial purposes affordably; for instance when used to formulate complementary food it supports growth to the same extent as nutritionally adequate industrial-manufactured infant cereal (Amagloh, 2015). Sweetpotatoes are readily available and their promotion through education enables integration into young child diet enabling the child to

benefit from the essential nutrients (Low *et al.*, 2017). Sweet potato-based complementary food formulations, prepared from cream or orange-fleshed sweetpotato, contain significantly more β-carotene, the precursor of vitamin A, than cereal-based products, acceptable sensory attributes and desirable physical properties, such as viscosity, for complementary feeding (Amagloh *et al.*, 2012).

2.8 Nutrient Adequacy of Children's Diet

Nutrient adequacy is the comparison between the nutrient requirement and the intake of a certain individual or population (Castro-Quezada, Román-Viñas and Serra-Majem, 2014). In population groups, the prevalence of nutrient inadequacy can be determined by the probability approach or using the Estimated Average Requirement (EAR) cut-point method (Arsenault *et al.*, 2014; Haldimann *et al.*, 2015). Dietary patterns can also be used as they have moderate to good validity to assess adequate intakes of some nutrients (Arsenault *et al.*, 2013). Deficiencies of nutrients are prevalent among young children residing in developing countries and are linked to a wide range of adverse health outcomes, such as birth defects, poor growth, impaired cognition and increased morbidity and mortality (Girard *et al.*, 2012; Nyaradi *et al.*, 2013). Overall nutritional quality and thus adequacy of a diet is improved with diverse diet (Rathnayake, Madushani and Silva, 2012). Dietary diversity is influential in meeting nutrient requirements in children due to their ability to achieve adequacy with smaller quantities of foods (Phillips *et al.*, 2015). High malnutrition level in Narok County have been attributed to less diverse diets, which is evidenced by high consumption levels of carbohydrate based staples and the low consumption of vitamin and mineral rich fruits and vegetables (Malaso, Ochola and Ogada, 2018). Increasing dietary diversity with nutrient-rich foods such as vitamin A-rich fruits and vegetables, eggs, dairy, and meats enhances nutrient adequacy in diets of children (Girard *et al.*, 2012).

2.9 Dietary Assessment

2.9.1 24Hour dietary recall

This is a subjective dietary assessment tool that uses open-ended questionnaires administered by a well-trained interviewer to obtain actual intakes of food from an individual over the previous twenty four hours (Shim, Oh and Kim, 2014). One of its greatest strengths is that it provides detailed food intake data with relatively minimal respondent burden with a high degree of accuracy (Albar *et al.*, 2016). Some of the limitations of using this method are the possibility of biasness by the subject when reporting the intakes or difficulties in recalling. It also requires a long period of time to administer and unless multiple recalls are taken then it doesn't provide information on the usual intakes of food (Eisinger-Watzl *et al.*, 2015). Dietary 24-hour hour recall is used as reference assessment method because it has ability to gather relatively accurate data compared to the other methods (Thompson *et al.*, 2015). Dietary 24-hour recall has been reported to be used to collect dietary intake data in a wide range of studies and settings, like in Canada web-based self-administered dietary 24-hour recall is used to collect dietary intakes of children and adults (Kirkpatrick *et al.*, 2017).

2.9.2 Food frequency questionnaire

Food frequency questionnaire is a subjective dietary assessment method that uses self or interviewer administered questionnaire to obtain information on usual dietary intakes over a long period of time (Fraser *et al.*, 2016). FFQ is specific to study groups and research aims which therefore limits its use and the fact that closed ended questionnaire is used reduces the accuracy (Shim, Oh and Kim, 2014). FFQ has successfully been used in the past the results established that it overestimates as well as underestimates the absolute intake of various nutrients and foods but the ability of the FFQ to rank subjects according to their dietary intake is acceptable

(Streppel *et al.*, 2013)**.** Data from FFQ can be validated using other dietary assessment methods like 24-hour dietary recall although similar both FFQ and 24-hour dietary recall experience similar potential errors as they are both based on recall (Freedman *et al.*, 2014).

2.10 Gaps in Knowledge

Studies show that there is limited documentation of consumer's dietary habits and consumption patterns of sweetpotatoes in Kenya (Wabwile, Ingasia and Langat, 2016). This kind of information is essential in informing various policies and food security strategies that would improve nutrition status using sweetpotatoes. Consumption of sweetpotatoes has increased tremendously in the recent past, as rural area produces the sweetpotatoes. Very few studies have looked at the impact it has on the diversity of the diets. There is also a global need of sufficient and evidence-based information which is crucial in maximizing investments targeted at improving food security and in turn nutrition status of the populations(IFPRI, 2016).

CHAPTER THREE: STUDY DESIGN AND METHODOLOGY

3.1 Study Site

3.1.1 Geographical location

The study was conducted in Trans-Mara East Sub-County of Narok County in Kenya. Narok County is located in the South Rift Valley bordering the Republic of Tanzania to the South, Kisii, Migori, Nyamira and Bomet counties to the West, Nakuru County to the North and Kajiado County to the East as shown in **Figure 2.**

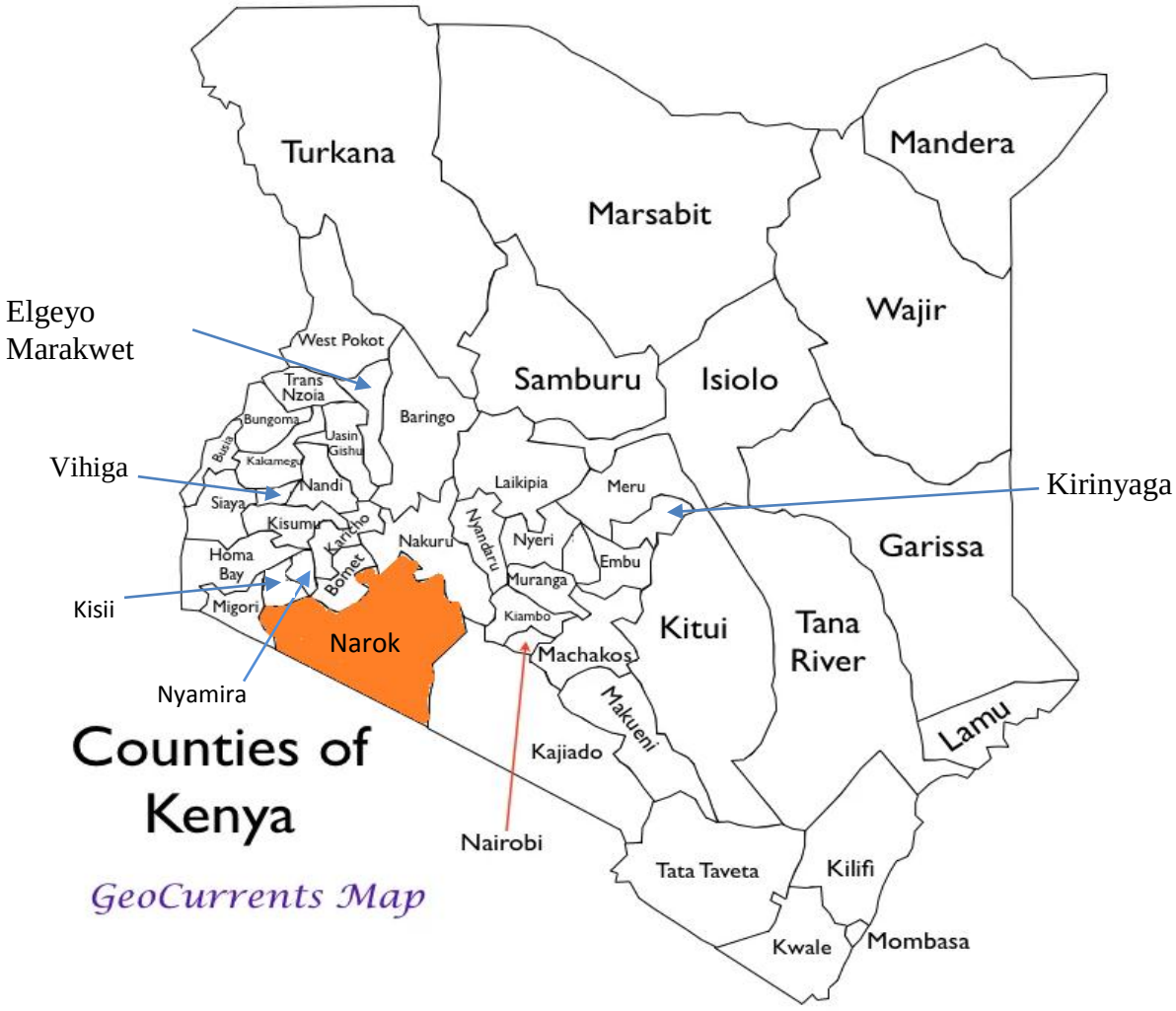

Figure 2: Map showing the location of Narok County. Source:(KNBS, 2013)

3.1.2 Demographic characteristics

Trans-Mara East Sub County has a population size of 94,115. The average household size is 5 which is higher than the national household size of 4.4. It has a child-rich population, where 0-14 year olds constitute 51% of the total population. This is due to high fertility rates among women as shown by the highest percentage household size of 4-6 members at 43% (KNBS, 2015).

3.1.3 Economic activities

The main economic activity in Trans-Mara East Sub-County is agriculture. Food crops grown include maize, finger millet, beans, sweetpotatoes, Irish potatoes, onions and avocadoes. Currently there are no cash crops but tea is being adopted as a cash crop especially in Oloolmasani.

3.1.4. Climatic conditions

Narok County experiences a bimodal type of rainfall with the average annual rainfall ranging from 500mm to 1800mm per annum. Most of the rainfall is experienced in the months of April-May and July-August. Temperature range is between 12°C and 28°C (NCG, 2018).

3.1.5 Administration

Trans-Mara East Sub-county is represented by one member in the National assembly and it constitutes four county assembly wards which are each represented by one member in the County assembly. The county assembly wards includes; Oloolmasani, Kapsasian, Ilkerin and Mogondo as shown in **Figure 3**. Within the various wards are villages that are lead by Chiefs and Assistant chiefs.

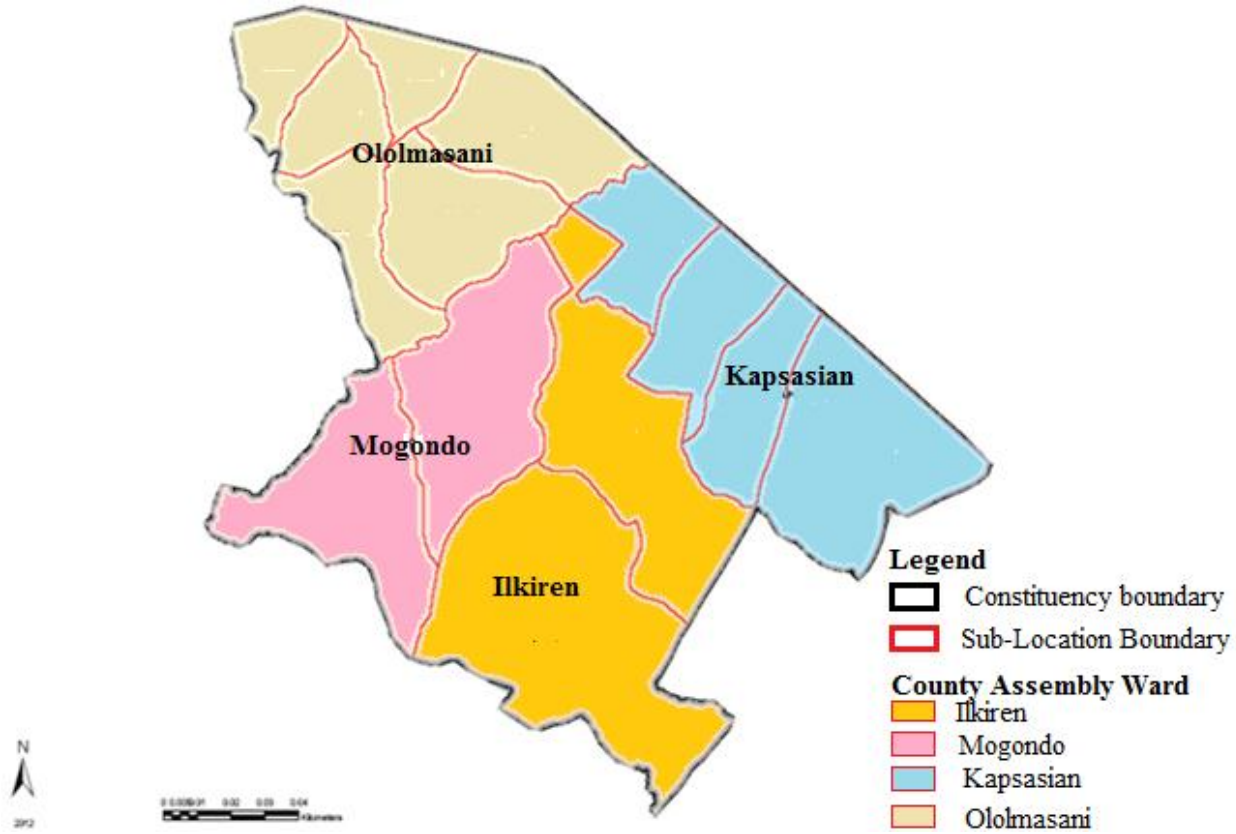

Figure 3: Map of Trans-Mara East Sub-County Source:(KNBS, 2013)

3.2 Research Methodology

3.2.1 Study design

A cross-sectional survey was employed in this study to collect data on demographic and socio-economic status of the population, feeding practices, dietary intakes, current utilization of sweetpotatoes in Trans-Mara East Sub-County of Narok County, their contribution towards nutrient adequacy and nutrition status of children under five years.

3.2.2 Study population

The study population comprised all children in Trans-Mara East Sub-County of Narok County, and the sampling frame was children under the age of five years.

3.2.2.1 Inclusion criteria

Households with children aged 6-59 months

3.2.2.2 Exclusion criteria

Children aged 6-59 months with terminal illnesses

3.2.3 Sample size determination

To get appropriate sample size, probability proportionate to size sampling methodology was used as specified by Fisher (1998).

$$n = \left(\frac{z^2 pq}{d^2}\right)$$

n= sample size if the target population is greater than 10,000

z= the standard normal deviate at the required confidence level

p=the proportion of the under five children

q= (1-p)

d= desired level of precision

Given that 18% of the population in Narok County is children below five years of age (INSSR, 2018) the sample size was determined as follows:

$$n = \frac{(1.96)^{2*}0.18*0.82}{(0.05)^2} = 227$$

An additional of 5% was made to take care of attrition and refusals. The sample size used was therefore, 237. A total of 211 households were successfully interviewed which was less than estimated sample size because of inaccessibility of some selected households. More than half the households (50.2%) were from Oloolmasani while the rest (49.8%) were from Mogondo Ward.

For 24-hour dietary recalls, a sub sample of 30 children was selected by simple random sampling. This was achieved by using the sampling interval computed using the following formula:

$N/n = k^{th}$ value.

Where: N= total number of the households

n=sample size for the 24 hour dietary recall.

Every 8^{th} eligible household was therefore interviewed for the dietary recall until the required sample size was achieved.

3.2.4 Sampling procedure

Trans-Mara East Sub-County of Narok County was purposely selected because it's a major sweetpotato producer within Narok County. Using excel, Oloolmasani and Mogondo wards were randomly selected. For each ward, two villages were randomly selected using random number generator. For Mogondo ward, Mogondo village and Angaset village were picked and studied while for Oloolmasani; Tagitech and Kisiara villages were picked. Equal number of households was studied in the four villages. A list of all households of each village was obtained from the village elder with assistance of community health volunteer and the households were randomly selected using random number generator application. Where a household had been selected and it was not eligible for the study, one next household would be skipped. The direction of movement was established randomly by tossing a pen.

3.2.5 Specific method considerations

3.2.5.1 Establishment of socio-demographic and socio-economic characteristics of households

A detailed semi-structured questionnaire was used to obtain data on demographic and social-economic characteristics of the study households (Appendix 2). Variables that were included in the questionnaire were; age of the indexed child and that of the household head, sex, marital status of the household head, religion, education levels, occupation of the household head, sources of income and the amount spent of food.

3.2.5.2 Feeding practices and dietary diversity of children

A semi-structured questionnaire (Appendix 2) was administered by trained interviewers to the caregivers to collect information on various feeding practices like complementary feeding, food frequency and dietary diversity. A 24 hour recall questionnaire was used to capture information on actual food intakes. The respondents were asked all foods and beverages the indexed child had consumed for the last 24 hours. Household measures were used to determine the actual intakes. Food frequency questionnaire was used to assess the usual food intakes. A list of foods was provided alongside their frequency of consumption. Focus group discussions were also used to collect information on selected feeding practices, consumption of sweetpotatoes and preparation methods and how they are incorporated in children's diet. One focused group discussion with ten members was selected in each of the four villages and the participants included caregivers of children below five years but above the age of 6 months. A focus group discussion guide (Appendix 3) was provided to guide the process.

3.2.5.2 Establishment of methods of incorporation of sweetpotatoes into the diets of children

A semi-structured questionnaire (Appendix 2) was used to capture how sweetpotatoes are utilized in children's diets. A focus group discussion was also used to collect information on consumption of sweetpotatoes and preparation methods and how they are incorporated in children's food.

3.2.5.4 Nutritional status of children

Weights and heights were measured twice for each indexed child and the average was computed.

3.2.5.4.1 Height

The height/length was measured using the height board of the United Nations Children Funds (UNICEF). To assess the height or recumbent length, the caregiver assisted the child in removing excessive clothing and shoes. Then the two assistants guided the child on standing up straight on the height board with feet together, knees straight and heels, buttocks and shoulder blade in contact with the vertical surface of height board. Height measurement was done to nearest centimeters. Length to the nearest centimeters was measured for children below two years.

3.2.5.4.2 Weight

Weight of the children was measured using an electronic scale. The children were weighed with minimum clothing; they were assisted by the enumerators on how to stand on the scale, upright and facing forward with minimum movements, for the ones who were below two years the scale was zeroed with the mother, who then held the child for weighing.

3.3 Research Instruments

A detailed questionnaire was used to collect data and semi-structured interview schedule to the caregivers to collect data. The questionnaire was pre-tested in Kapkoros village; this helped in familiarizing the researchers with the data collection tool (KOBO-COLLECT) and questions as well as assessing the time allocated for each question.

3.4 Recruitment and Training of Field Assistants

The recruitment of the interviewers was advertised verbally through the area Chiefs and Sub-chiefs. The recruitment criteria consisted of good conduct and reliability, ability to read and write, good communication skills, education background of health sciences and community health workers had an added advantage. The training of interviewers was done for two days and the areas covered were; research ethics**,** conducting interviews**,** administering questionnaire**,** administering food frequency, administering 24-hour dietary recall and taking anthropometry measurements.

3.5 Ethical Consideration

An introductory letter was also obtained from the Department of Food Science, Nutrition and Technology of the University of Nairobi. Informed consent was sought from the Trans-Mara East Sub-County administrator and the chiefs from Oloolmasani and Mogondo locations. Consent was also sought from each respondent after clearly explaining the study and its objectives. The respondents were assured of anonymity in any information they availed. Those who declined to participate were assured of no penalty for their action and their decision was respected.

3.6 Data Quality Assurance and Control

Questionnaires were easy-to-understand and clear questions were designed. The enumerators were properly trained to ensure correct interpretation of the questions and on appropriate techniques of anthropometric measurements as well as proper filling-in of the questionnaires. A pre-test of questionnaires was carried out to verify the relevance of the questions in achieving the objectives as well as making the enumerators more conversant with the data collection exercise. An average of nine questionnaires were done and submitted daily by each team after which the researcher checked for any issue that might have arisen. For anthropometric data, plausibility checks on the quality of measurements were ran using ENA for SMART software.

3.7 Data Management and Analysis

Open ended questionnaires were coded before analysis while close ended questions were pre-coded during questionnaire design. Data was imported to SPSS from KOBO-COLLECT server and analysis was done using SPSS version 20 and significance tested at $p<0.05$. Data for the 24 hour dietary recall was analysed using the Nutrisurvey 2007 software while anthropometric data was analysed using ENA for SMART 2011 software. Data from FGDs were reviewed and for each question a summary of key findings were obtained and analysed. Descriptive statistics such as percentages, means and frequencies were used to describe the population characteristics such as the demography, income, occupation and the education of the caregivers. Statistical analyses like T-tests were used to compare means of independent variables while Regression was used to predict probability of nutrient adequacy. Chi-square tests were used to determine associations between variables and to predict the probability of certain variables affecting the nutrition status of study children.

CHAPTER FOUR

RESULTS

4.1 Demographic and Socio-economic Characteristics of the Households

Majority of the respondents (92.9%) were female while the rest were male (**Figure 4)**. The ages of the household heads ranged from 20 to 62 years. There was no significant difference ($p>0.05$) between the mean age for the female (36.6±9.7 years) and male headed households (36.3±7.9 years). There was no significant difference in household size (5±2) among the four villages ($p>0.05$).

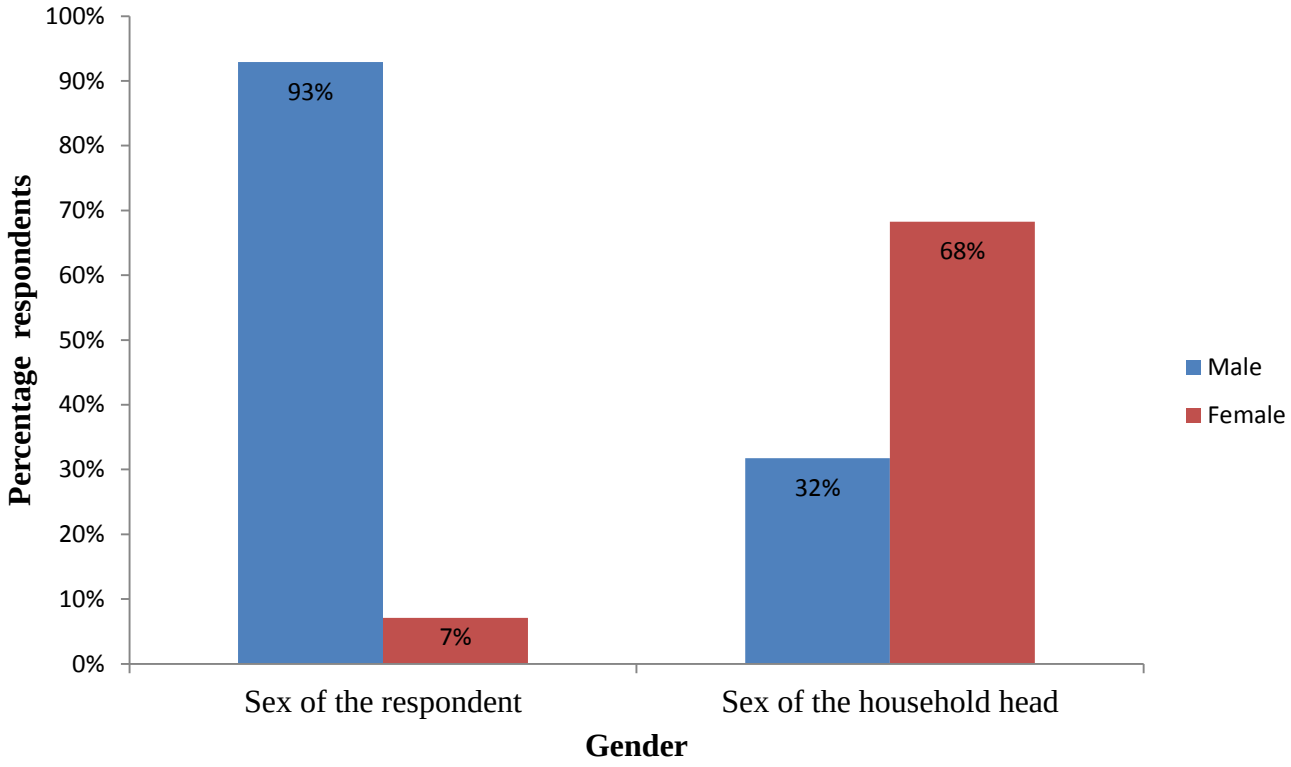

Figure 4: Distribution of household heads by gender

4.1.1 Age and sex of study children

The mean age of the study children was 27.9±14.3 months with minimum age being 6 months and maximum 59 months. The proportion of male and females was 46.4% and 53.6% respectively giving male to female ratio of 0.87: 1 (**Table 2).**

Table 2: Demographic characteristics of the study children

Characteristics	**Percentage** (n=211)
Age in months	
6-17	24.6
18-29	29.4
30-41	27.0
42-53	15.6
54-59	3.3
Total	**100**
Gender	
Male	46.4
Female	53.6
Total	**100**

4.1.2 Distribution of household heads by marital status and level of education

Majority of household heads were married (98.6%), while 1.4% was either widowed or single. Education level of the study population was low with 70.4% being primary drop-outs while only a quarter had attained secondary education and post-secondary education. There was significant association (χ^2=32.2, df=18, p<0.05) between highest level of education attained by the household heads and the village. There was no significant association (χ^2=8.6, df=12, p>0.05) between the marital status of the household head and the highest education level attained (**Table 3)**.

Table 3: Distribution of household heads by marital status and level of education

Socio-demographic characteristics	Percentage (n=211)
Marital status	
Married	98.6
Widowed	0.9
Single	0.5
Education level	
Primary drop-out	64.4
Completed primary	10.4
Secondary drop out	5.2
Completed secondary	8.1
Tertiary education	11.9

Highest level of education of household heads across the villages					
	Primary drop-out	Completed primary	Secondary dropout	Completed secondary	Tertiary
Kisiara	63	14.8	3.7	9.3	9.3
Tagitech	80.7	1.9	3.8	1.9	11.5
Mogondo	61.4	7	8.8	12.3	10.5
Angaset	52.1	18.8	4.2	8.3	16.7
Highest level of education of household heads based on marital status					
Married	64.9	10.1	4.8	8.2	12
Widowed	50	50	0	0	0
Single	0	0	100	0	0

4.1.3 Distribution of household heads by main occupation

Majority of the household heads (68.7%) depended on farming as their main occupation while the rest (31.3%) were either in employment or not active in income generation. There was a significant association between household head's main occupation and the education level(χ^2=71, df=30, $p<0.05$). There was a significant difference between the mean income of household earned in the previous month and household heads main occupation ($p<0.05$) (**Figure 5)**.

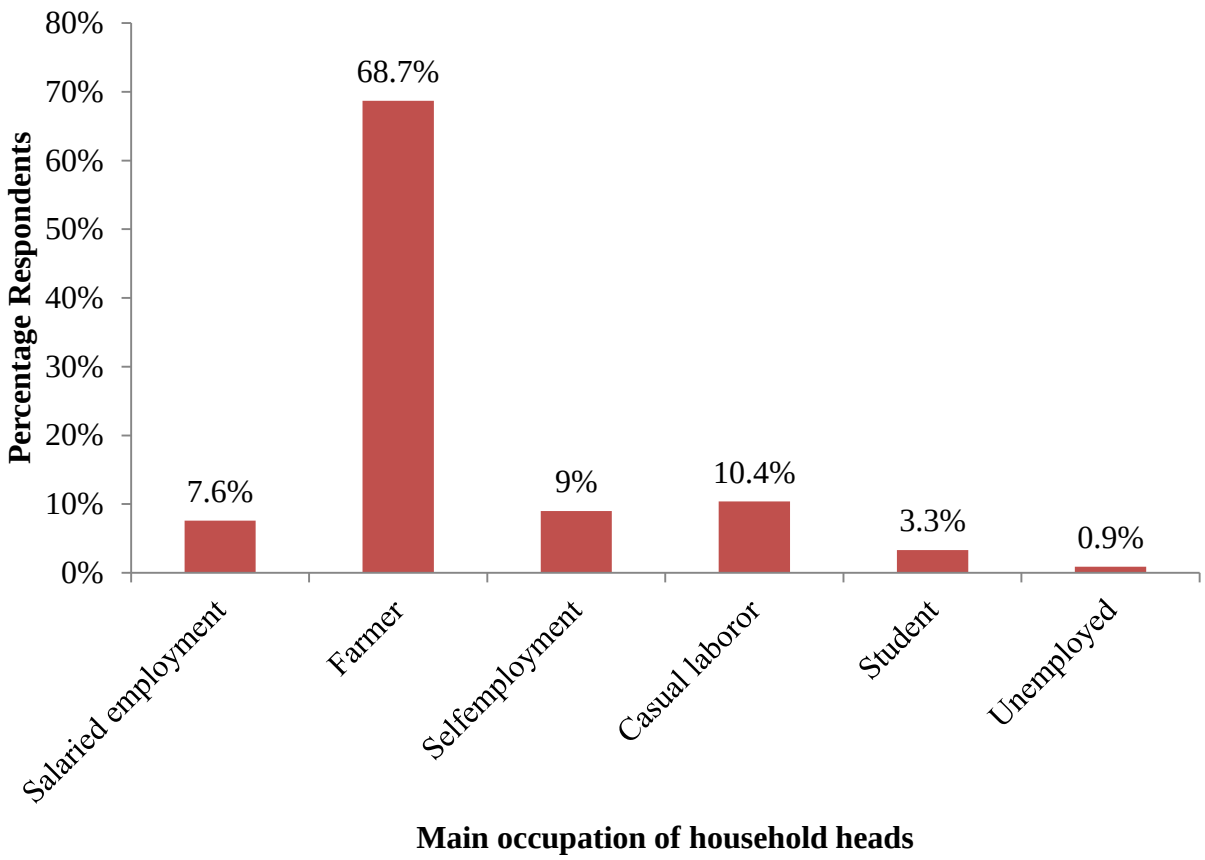

Figure 5: Distribution of household heads by main occupation.

4.1.4 Distribution of households by income

Farming (77.6%) was the most common source of income among the study households .Other households engaged in business and casual labour (19.4%) while 9.6% depended on formal employment. The main source of income of the households were significantly different (χ^2=35, df=3, p<0.05) among the villages.

The mean income for the households in the previous month was 12,891 ± 10,996.9 shillings. The income ranged from 2,000 to 60,000 shillings. The minimum amount of income spent on food was 500 shillings and a maximum 20,000 shillings. The mean income spent on food was 4,282.2 ± 2731.3 (**Table 4).** A positive correlation existed between the amount of money spent

on food and the total household income in the previous month ($r=0.6$, $p<0.01$). There was a significant association between mean income of the household heads and the highest education level attained ($p<0.05$) **(Table 4)**.

Table 4: Distribution of households by source of income

Household economic characteristics	Percentage (n=211)
Household main source of income	
Farming	77.3
Formal employment	9.5
Casual labour	7.6
Business	5.6
Household income in the previous month KES	
<10,000	51.7
10,001-20,000	37
20,001-30,000	5.2
30,001-40,000	3.3
40,001-50,000	1.9
50,001-60,000	0.9
Amount of income spent on food KES	
<1000	
1001-5000	86.7
50001-10,000	13.3
10,001-15,000	2.4
15,001-20,000	0.6

4.2 Feeding Practices and Dietary Intakes of Children Aged 6-59 Months

4.2.1 Complementary feeding

Approximately three quarters (72.5%) of children were reported to take family foods while the rest were reported to take special foods as shown in **Table 5.** Majority of the respondents reported to practice responsive feeding with nearly three quarters (73%) feeding their children four times or more a day. One in every four children (25.1%) were fed thrice a day while the rest (1.9%) fed twice or once in a day. Most of the respondents (86.7%) reported that the children are fed by their mothers as they are the key caregivers while less than one in ten reported that the child is fed by siblings or relatives within the household. Others reported that their children had grown and could feed themselves.

Eight in a hundred respondents (7.6%) reported that food left by the child would be eaten by the same child the following day or at a later time. Approximately half of the respondents (46%) reported to throw away any leftover food while 34.1% and 12.3% were eaten by caregivers and other children, respectively**.**

Table 5: Distribution of respondents by complimentary feeding practices

Feeding practices	Percentage (n=211)
Type of food fed to the indexed child	
Family food	72.5
Special food	27.5
Frequency of feeding	
Four times of more a day	73
Thrice a day	25.1
Twice or less a day	1.9
What is done with child's left-over food	
Eaten by the child the next day	7.6
Throw away	46
Eaten by the care giver	34.1
Eaten by other children	12.3

4.2.2 Food groups consumed by the study children

Cereal based products were the most commonly consumed food groups (80.1%) followed by milk and milk products (74.1%). Cereals and green leafy vegetables were consumed by 69.2% and 61.6% respectively. The least consumed food group was fish (4.3%), fresh poultry meat (10%) and organ meat (17.5%). There was a significant association between cereal consumption and villages studied (χ^2=12.2, df=3, p<0.05) (**Table 6)**.

Table 6: Distribution of study children by food groups consumed

Food groups	Kisiara (%) n=54	Tagitech (%) n=51	Mogondo (%) n=57	Angaset (%) n=48	Totals (%) n=211	p-value(χ^2)
Cereals	17.5	13.3	22.7	15.6	69.2	.007*
Cereal products	19	19.9	22.3	19	80.1	.636
White tubers and roots	8.5	5.2	9	5.7	28.4	393
Dark green leafy vegetables	14.2	12.8	18	16.6	61.6	.106
Other vegetables	10.4	11.8	9.5	5.7	37.4	.149
Vitamin A rich fruits	10	8.5	10.4	6.2	35.1	.561
Other fruits	11.4	10	11.4	5.2	37.9	.106
Organ meat	5.2	6.6	3.3	2.45	17.5	.157
Fresh poultry meats	4.3	1.4	2.4	1.9	10	.266
Eggs	9.5	6.2	10	6.2	31.8	.395
Fish	0.9	0.9	1.4	0.9	4.3	1
Pulses/Legume, nuts	7.6	8.5	9	6.2	31.3	.72
Milk and milk products	18	16.6	21.3	19	74.9	.206

***Statistically significant at P< 0.05**

4.2.3 Dietary diversity

The mean dietary diversity score was4.4 ± 1.6 food groups. Range of food groups consumed by the children was between 2 and 7 **(Table 7)**. Majority of children (69.7%) had high dietary diversity score of more than four food groups while 30.3% had a low dietary diversity score of less than four food groups. There was a significant difference in the mean dietary diversity scores of female and male children ($p<0.05$). There was no significant difference ($p>0.05$) in the mean dietary diversity scores of children based on the education levels of the household heads.

Table 7: Distribution of children by dietary diversity scores (DDS)

DDS	Percentage (n=211)
2	11.4
3	19
4	21.3
5	18.5
6	22.3
7	7.6

There was no significant difference in the mean dietary diversity scores for the various age groups ($p>.05$).There was, however, significant association ($p<0.05$) between village and dietary diversity of indexed children **(Table 8).**

Table 8: Distribution of the children by age, mean dietary diversity score (DDS) and villages

Age in months	Percentage n=211	Mean DDS	Standard deviation
6-24	47.1	5.1	2
25-36	29.0	4.6	1.8
37-48	15.2	5.1	2.0
49-59	8.6	4.4	1.9

Villages	Low dietary diversity (%)	High dietary diversity (%)
Kisiara	20.4	79.6
Tagitech	30.80	69.2
Mogondo	28.1	71.9
Angaset	43.8	56.3

4.2.4 Nutrient intake of study children

Means for specific nutrients were run and percentage of the recommended daily allowances computed. The study children's diet did not meet the RDAs for Carbohydrates, Vitamin A, Calcium and Iron (**Table 9)**.

Table 9: Mean nutrient intake per day for children aged 12-36 months

Nutrient	Mean nutrient intakes	RDA	% of RDA*
Carbohydrates(g)	94.5±48.5	130	72.7
Fibre(g)	22.4±15	19	118
Protein(g)	13.1±6.4	13	100
Vitamin A (ug RAE)	254 ±2I9	300	85.5
Zinc (mg)	3.8±1.5	3	100
Calcium (mg)	621.1±102.1	700	88.7
Iron (mg)	6.4±5.1	7	91.4

***Food and Nutrition Board, Institute of Medicine, National Academies, 2005, RDAs for children 1-3 years**

4.3 Incorporation of Sweetpotatoes into the Diets of Children

4.3.1 Sweetpotato production

Majority of the respondents (91.9%) reported that they grow sweetpotatoes compared to 8.1% who did not grow. There was a significant association between the village and sweetpotato production (χ^2=10.9, df=3, p<0.05) (**Table 10)**. Slightly less than half of the respondents (47.9%) grew white-fleshed sweetpotatoes, less than a quarter (17.1%) grew yellow-fleshed sweetpotatoes and 13.7% grew orange-fleshed sweetpotatoes. There was a significant difference in the varieties grown in the four villages (χ^2=52.7, df=12, p<0.05).

Table 10: Distribution of the Households and villages by sweetpotato production

Sweetpotato production and varieties grown	Percentage n=211
Sweetpotato production	
Yes	91.9
No	8.1
Sweetpotato varieties grown	`
Orange-fleshed	13.7
Yellow-fleshed	17.1
White-fleshed	47.9
All-varieties	13.3

Sweetpotato production in the study villages		
Villages	**Yes (%)**	**No (%)**
Kisiara	90.7	9.3
Tagitech	82.7	17.3
Mogondo	94.7	5.3
Angaset	100	0

4.3.2 Sweetpotatoes in the diet of study children

Majority of the respondents (70.6%) had their children on a diet inclusive of sweetpotatoes while the remaining (29.4%) respondents' children were not on such diet as shown in **Table 11.** The trend of the diet of these children across the villages wasn't significantly different (χ^2 =8.9, df=3, p>0.05). Tender age was reported as the key reason (85.5%) why the children didn't consume sweetpotatoes while others (14.5%) cited health and safety reasons as summarized. Of the children that consumed sweetpotatoes, more than half (68.5%) began eating sweetpotatoes at the age of 12-24 months, slightly less than a quarter (23.5%) began at 24-36 months and the rest (8.1%) started aged above 36months.

Availability of sweetpotatoes was the major reason (52.6%) for its consumption at such early ages. Two out of one hundred respondents (1.9%) reported that the children began eating sweetpotatoes when they had begun complimentary feeding while 0.9% began when they had

stopped breastfeeding. Other reasons were that sweetpotatoes were not available earlier on while other children began eating diets inclusive of sweetpotatoes after they had complete teething.

Table 11: Distribution of children by sweetpotato consumption

Sweetpotato consumption	Percentage
Is the indexed child consuming sweetpotatoes?	
Yes	70.6
No	29.4
Reasons why indexed child did not consume sweetpotatoes	
child still young	85.5
Child experience diarrhea or constipation	12.9
Child could get choked	1.6
Age at which indexed child began eating sweetpotatoes	
6-12 months	2.7
12-24 months	68.5
24-36 months	23.5
36-48 months	5.4

4.3.3 Sweetpotato preparation and frequency of consumption

The most common mode of sweetpotato preparation reported was boiling (88.6%) while a few others (11.4%) peeled and fried. From focused group discussions, the caregivers reported that the boiled sweetpotato tubers would be eaten with tea, milk and porridge. In a case where the sweetpotatoes are fried, they would be mixed with other foods like githeri, rice, Irish potatoes or pumpkins.

About a half (45.5%) of the respondents reported that their children had been fed with white-fleshed sweetpotatoes in the preceding seven days while the rest (54.5%) had not. Less than a half (35 %) of the respondents reported that they had fed their children with yellow fleshed sweet potato in the preceding seven days while majority (65%) had not. About a quarter of the respondents (24.2%) reported that their children had eaten orange-fleshed sweetpotatoes in the

preceding seven days while 74.9% had not eaten. Distribution of consumption of sweetpotatoes is a shown in **Table 12**.

Table 12: Distribution of children by varieties of sweetpotatoes consumed (n=211)

	Yellow-fleshed sweetpotatoes		**White-fleshed sweetpotatoes**		**Orange-fleshed Sweetpotatoes**	
	Yes (%)	No (%)	Yes (%)	No (%)	Yes (%)	No (%)
Kisiara	9	16.60	14.2	11.4	7.20	18.20
Tagitech	6.20	18.50	12.8	11.8	4.80	19.60
Mogondo	8.10	19	10.4	16.6	8.10	19.10
Angaset	11.40	11.40	8.1	14.7	4.30	18.70
Total		**100**		**100**		**100**
P-Values (χ^2)		0.104		0.417		0.55

4.3.4Association between sweetpotato consumption, demographics and socio-economic characteristics

Children from female headed households were four times less likely to consume diets with sweetpotatoes compared to the male headed households (Binary logistic, OR=0.4, 0.2-0.7, 95% CI). There was no significant relationship between household's main source of income (χ^2=9.3, df =6, p>0.05) education level of the household head (χ^2=8.6, df=12, p>0.05) and consumption of sweetpotatoes. The distribution of consumption is shown in **Table 13.**

Table 13: Sweetpotato consumption, demographics and socio-economic characteristics (n=211)

Socio-economic characteristics	Sweetpotato consumption Yes (%)	No (%)	Total (%)	P-value ($\chi^{2)}$
Gender				
Female	55.2	44.8	100	0.01*
Male	77.8	22.2	100	
Household's main source of income				
Farming	66.9	33.1	100	
Formal employment	85	15	100	0.17
Casual labour	81.2	18.8	100	
Business	81.8	18.2	100	
Highest education level of household head				
Primary drop-out	73.7	26.3	100	
Completed primary	59.1	40.9	100	
Secondary dropout	81.8	18.2	100	0.157
Tertiary level	62	38.0	100	

***Statistically significant difference: P< 0.05**

4.3.5 Consumption of sweetpotatoes, dietary diversity and nutrient intakes of children aged 12-36 months

From students t-test, there was no significant difference (Independent sample t-test=2.2, df =208, p>0.05) between dietary diversity scores for the children reported to consume diets inclusive of sweetpotatoes and those who were reported not to consume diets inclusive of sweetpotatoes. Other than iron intake, the other nutrient intakes were not significantly different between children reported to consume sweetpotatoes and those that do not consume sweetpotatoes (**Table 14)**. Lack of sweetpotato consumption led to significant (p<0.05) reduction in the iron intake with R^2 of 0.26 and beta of -5.4. The consumption did not result in any significant difference (p>0.05) in the intake of calcium, vitamin A, carbohydrates, fibre, protein and zinc.

Table 14: Mean nutrient intake per day for children aged 12-36 months based on sweetpotato consumption

Consume sweetpotatoes	Carbohydrates (g)	Fibre(g)	Protein(g)	Vitamin A(µg RAE)	Zinc(mg)	Calcium(mg)	Iron(mg)
Yes	116.7±21.4[a]	20.6±6.7[a]	11.6±3.0[a]	283±237.9[a]	3.7±1.2[a]	619.7±109.9[a]	8.3±5.3[a]
No	83.4±76.2[a]	26±24.8[a]	16.1±9.8[a]	198.7±172.4[a]	4.2±2.1[a]	623.8±89.7[a]	2.8±1.6[b]

Values with different letters in the same column are statistically different at $p<0.05$.

4.4 Nutritional Status of Children

4.4.1 Wasting (weight-for-height z-scores)

The overall prevalence of global malnutrition was at 3.8 %. More female children were severely wasted (4.5%) compared to male children (2.1%).Wasting prevalence ratio for females to males was 0.9: 1 **(Table 16).** By ages of the children, there was no significant difference in wasting rates among the various age groups ($p>0.05$). There was no significant association between wasting levels and villages ($\chi^2=6.4$, df=6, $p>0.05$) **(Table 15).**

4.4.2 Underweight (weight-for-age z-scores)

The overall prevalence of underweight was 9.6 % (6.9-13.3, 95% C.I.), moderate underweight was at 9.1 % (7.4-11.2, 95% C.I) and severe underweight was 0.5 % (0.0-11.4, 95% C.I.). More male children were underweight (11.8%) compared to female children (6%) **(Table 16).** Severe underweight was present among children aged 6-17 months (1.9%) and none in the other age groups. There was no significant difference in the prevalence of underweight among the age groups studied ($p>0.05$). There was no significant association ($p>0.05$) between underweight level and the villages **(Table 15)**.

4.4.3 Stunting (height-for-age z-scores)

Overall prevalence of stunting was high at 28.9 % (23.6-34.9, 95% C.I.) and prevalence of severe stunting was 11.7% (8.8-15.4, 95% C.I). There was no significant association ($\chi^2=2.2$, df=2, $p>0.05$) between gender of the children and stunting levels **(Table 16)**. There was no significant difference in stunting levels among the age groups ($p>0.05$). There was no significant difference ($p>0.05$) in stunting levels across the villages **(Table 15).**

Table 15: Nutrition status of children aged 6-59 months across the villages

Nutrition status		Kisiara	Tagitech	Mogondo	Angaset	p value (χ^2)
Wasting	Normal	92.6	88.5	93	87.2	
	Wasted	7.4	9.6	1.8	8.5	0.4
	Severely wasted	0	1.9	5.3	4.3	
Underweight	Normal	88.9	92.3	91.2	83.3	
	Underweight	9.3	7.7	7	16.7	
	Severely underweight	1.9	0	1.8	0	0.6
Stunting	Normal	72.2	80.8	73.7	62.5	
	Stunted	18.5	11.5	15.8	27.1	0.6
	Severely stunted	9.3	7.7	10.5	10.4	

Table 16: Nutrition status of children aged 6-59 months based on gender

Nutrition status	Female (%) n=112	Male (%) n=99
	Wasting	
Normal	89.6	90.9
wasted	6	7
Severely wasted	4.5	2.1
	Underweight	
Normal	94	86.8
Underweight	6	11.8
Severely underweight	0	1.4
	Stunting	
Normal	79.1	69.4
Stunted	11.9	20.8
Severely stunted	9	9.7

4.4.4 Association between nutrition status of children aged 0-59 months and demographics and socio-economic characteristics

There was no significant association between both underweight status (χ^2=3.5, df=2, P>0.05), stunting status (χ^2=2.7, df=2, P>0.05) and the gender of household head. There was no significant association (χ^2=0.9, df=2, P>0.05) between the gender of household head and wasting status of the children.

There was no significant association (χ^2= 6.1, df=6, p>0.05) between household's main source of income and wasting status of children. There was a high incidence of moderate and severe stunting in children in households whose main source of income was formal employment and none in the household whose main source of income was casual labour. The association between household main source of income and prevalence of stunting was significant (χ^2=21.7, df=6, p<0.05) **(Table 17)**. There was no significant association between household's main source of income and the prevalence of underweight among the children (χ^2=2.2, df=6, p>0.05) (**Table 17)**.

Table 17: Association between household main source of income and nutrition status of children below five years

Nutrition status n=211	Farming (%)	Formal employment (%)	Casual labour (%)	Business (%)	P-value (χ^2)
Underweight					
Normal	87.7	95.2	93	90	0.898
Moderately underweight	11	4.8	6.3	10	
Severely Underweight	1.2	0	0	0	
Stunting					
Normal	72.4	47.6	100	90	0.02*
Moderately stunted	17.8	38.1	0	0	
Severely stunted	9.8	14.3	0	10	
Wasting					
Normal	90.7	95.2	81	90	0.402
Moderately wasted	5.6	4.8	19	6.7	
Severely wasted	3.7	0	0	0	

Gender of the household head and nutrition status				
Stunting	**Normal**	**Moderate**	**Severe**	
Female (%)	79.1	11.9	9	0.25
Male (%)	69.4	20.8	9.7	
Wasting				
Female (%)	89.6	6	4.5	0.63
Male (%)	90.9	7	2.1	
Underweight				
Female (%)	94	6	0	0.173
Male (%)	86.8	11.8	1.4	

***Significant at 0.05**

4.4.5 Association between nutrition status and sweetpotato consumption

There was however no significant association (χ^2=4, df=2, P>0.05) between sweetpotato consumption and wasting status. There was no significant association underweight (χ^2=0.6, df=2, P>0.05) between sweetpotato consumption and underweight status. There was no significant association (χ^2=2, df=2, P>0.05) between sweetpotato consumption and stunting status (**Table 18)**.

Table 18: Sweetpotato consumption and nutrition status

	Sweetpotato consumption		
Nutrition status	Yes	No	P-value (χ^2)
Wasting rates			
Normal	91.2	88.7	0.134
Wasted	7.4	4.8	
Severely wasted	1.4	6.5	
Stunting rates			
Normal	69.8	79	0.373
Stunted	20.1	12.9	
Severely stunted	10.1	8.1	
Underweight rates			
Normal	89.9	87.1	0. 753
Underweight	9.4	11.3	
Severely underweight	0.7	3.3	

CHAPTER FIVE

DISCUSSION

5.1 Demographic and Socio-economic Characteristics of the Households

The respondents were mainly women which imply that majority of the caregivers for children below five years are women. This agrees well with a study done in Baru Village, Sarolangun, Jambi–India that established that the main role of mothers in a family is to act as a nanny (Merita *et al.*, 2017). Women play an important role in child care in Kenya as reported in a study done in western Kenya (Melorose, Perroy and Careas, 2015). The main reason for this is the fact that a woman is considered a central figure and is essential to implement life, particularly among infants and young children (Ickes *et al.*, 2017; Kumar *et al.*, 2017).

Majority of the households were headed by males, a finding similar to the country's finding (KDHS, 2014). This is attributable to cultural practices and low education levels attained by the women. Majority of the household heads were married which could be attributed to cultural belief within the community that even those widowed are considered married and death of a spouse is not something that is easily spoken about. The sex composition ratio of 0.87 males to female is slightly lower than the country's findings of male to female ration of 1 (KDHS, 2014).

The mean household size in the study area was 5, which did not differ significantly between the four villages. This is higher than the Kenyan national average household size of 4.6 (KNBS, 2013). Large household size have important implications on the household priorities and evidence shows that large households are likely to be food insecure compared to smaller households (Olayemi, 2012).

It is clear from the results that most of the study population had low levels of secondary and tertiary education and this could have contributed to the few households head (7.6%) having a

salaried employment and majority engaging in farming activities. The low education level attainment results from economic and socio-cultural factors, which may include lack of tuition fees, ignorance about schooling and inability to achieve passing grades in primary school. Pregnancies and early marriages also contribute to the high primary school dropouts particularly among the women (Ivar *et al.*, 2017). Other studies confirm that the better educated a household head is, the lower the risk of poverty which translates to higher chances of food and nutrition security (Bilenkisi, Gungor and Tapsin, 2015).

The results of this study showed a significant positive correlation between the amount spent on food and the total household income in the previous month. The findings are similar to one study done in Scotland (Ada *et al.*, 2015). The positive correlation may reflect improvement of quality of diets according to Engel law that states that there is a higher propensity of households experiencing increasing income to spend a bigger proportion of the food budget on a diversified diet thus improving the nutritional status of the household members (Babalola and Isitor, 2014).

5.2 Feeding Practices and Dietary Intakes of Children Under-five Years

From the findings, very early introduction of complimentary feeding was common, majority at 1-2 months. These findings are similar to a study carried out in western Kenya that established that mean age for introduction of complementary feeds was 2.7 months (Mbagaya, 2009). This could be because of insufficient knowledge on exclusive breastfeeding for the first six months, attributed to low education levels of the caregivers and the fact that they are living in low income households. This has a negative implication on the nutrition status and consequently health status of the child. This is because there is high likelihood of contamination of food for the infant's premature and delicate digestive system to handle (Saha and Bhattacharjya, 2018; Tamirat Tafesse, 2018).

Dietary diversity is a qualitative measure of food consumption that reflects household's dietary diversity and a proxy to individual nutrient adequacy (FAO, 2013). The individual dietary diversity scores were computed based on the 7 food groups(WHO, 2010). Children consumed between 2 and 7 food groups. Majority of children had high dietary diversity score of more than four food groups while 30.3% had low dietary diversity score of less than four food groups. This study was conducted in January and February just after maize harvest season. The commonly consumed food groups were cereals based products which could be attributed to bumper harvest the previous season, followed by milk and milk products. The least consumed foods were fish and fish products, this could be attributed to the fact that eating of fish is not in the culture and there is no permanent source of fish in the area.

Carbohydrates, vitamin A, calcium and iron are among the nutrients whose RDAs were not met. For the means of carbohydrates, vitamin A and iron which were slightly less than the RDAs could be attributed to underreporting of the intakes. This possibility of underreporting has been of concern in other studies like in a study done in Pila, Poland (Merkiel and Chalcarz, 2016). Despite the popular intake of milk in the study population which is the main source of calcium, the RDAs are not met. This could be because of under-estimation of the amounts of milk given to the child coupled with low consumption of other calcium rich food. Achieving adequate calcium levels in childhood is important for the development of peak bone mass crucial in minimizing incidence of fractures and osteoporosis later in life (Zeyninejad *et al.*, 2015).

5. 3 Incorporation of Sweetpotatoes into the Diets of Children Under-five Years

Approximately 92% of the households studied grow sweetpotatoes. This shows that sweetpotato is a highly accepted crop in Trans-Mara East. Sweetpotato has a great potential of increasing household food security and alleviating poverty (Niringiye *et al.*, 2014).

Majority of the respondents reported that the indexed child consumed sweetpotatoes which implies that sweetpotatoes play an important role in child feeding and can contribute to improvement of nutrition status of children (Motsa et al, 2015). Sweetpotato contributes a significant amount of nutrients such as fibre, proteins and vitamin A in children's diets (Tedesco and Stathers, 2015). The commonly cited reason for those children who didn't consume sweetpotatoes was that they were still young and could probably get choked, diarrhoea or constipate. As such, majority of the children began to eat sweetpotatoes between 12-24 months yet most began complimentary feeding as early as at 2 months. The frequency of consumption of sweetpotato-based products shows that boiled sweetpotato roots is the most commonly consumed sweetpotato product in the Trans-Mara East while a few would fry and mix with beans, githeri, pumpkins, Irish potatoes and rice. The sweetpotatoes would then be eaten either with tea, milk or porridge. The most popular varieties of sweetpotato tubers consumed across the villages were the white-fleshed sweetpotatoes followed by the yellow-fleshed and lastly orange-fleshed sweetpotato varieties. This partly explains the reason why vitamin A intake was below the recommended daily allowance. Lack of information about the importance of the biofortified orange-fleshed sweetpotatoes could be attributed to limited adoption and consumption. Biofortification is a fast emerging strategy to fight micronutrient deficiency and oranged fleshed sweetpotato has been biofortified (Brauw and Meenakshi, 2015).

5. 4 Nutritional Status of Children 0-59 Months

Wasting represents the failure to receive adequate nutrition in the period immediately before the survey. The results showed that wasting was at 3.8% and there was no case of severe wasting. Children whose weight-for-height is below minus two standard deviations (-2 SD) from the median of the reference population are considered wasted. Wasting below 5% is considered low and therefore wasting rate was within this range (WHO, 2018a). This is mainly because there was plenty of food in the area during the time of the survey. Underweight reflects the effects of both acute and chronic malnutrition. From the results 9.1% of the children were underweight and only 0.5% were severely underweight. Children whose weight-for-age is below minus two standard deviations (-2 SD) from the median of the reference population are considered underweight. These results are consistent with the study done in Narok County where 11.6% of children were reported to be underweight and 0.6% severely underweight (KDHS, 2014). Stunting is the outcome of failure to receive adequate nutrition over an extended period and is also affected by recurrent or chronic illness (UNICEF, 2017b). According to the results, 28.9% of the children were stunted while 11.7% were severely stunted. These results are slightly different from the study for Narok County where the degree of stunting was reported as 32.9% while 8.7% were severely stunted (KDHS, 2014). According to WHO global database stunting level of 20-29% is considered medium (WHO, 2018b).The rate of stunting in Trans-Mara East, which is at 28.9%, is within this range and could be attributed to food insecurity and inappropriate infant and young child feeding practices.

CHAPTER SIX

CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

The population in Trans-Mara East comprises large households which can have a negative implication on food and nutrition security. The main source of income is farming and a few in employment and businesses.

Dietary diversification in the region is generally low, with over a quarter of the children consuming less than four food groups per day.

Sweetpotato is produced by almost all the households in Trans-Mara East. They are introduced to diets of children under-five mainly in form of boiled roots. Despite the fact that there are various varieties grown in the area, their utilization and especially of the more nutritious orange fleshed is low.

The levels of malnutrition among the children in Trans-Mara East are generally high, especially stunting and underweight levels.

6.2 Recommendations

In spite of the extensive availability of sweetpotatoes within the Narok County, the utilization and use is greatly limited. There is need for promotion of utilization of sweetpotatoes in nutrition programmes to increase the frequency of utilization of sweetpotato with emphasis on highly nutritious orange fleshed varieties. This can be done by educating caregivers on the nutritional importance of consumption of sweetpotato particularly by children to improve the daily nutrient intakes and promotion of alternative methods of preparing sweetpotato-based products including the leaves.

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APPENDIX 1: CONSENT FORM

CONTRIBUTION OF SWEETPOTATOES TO NUTRIENT ADEQUACY IN DIETS OF CHILDREN 6-59 MONTHS IN TRANS-MARA EAST SUB-COUNTY, NAROK COUNTY

Introduction

You are being invited to take part in this research study. The study seeks to contribute towards food and nutrition security in Kenya through improved utilization of sweetpotatoes. The purpose of the current study is to make available information on utilization and contribution of sweetpotatoes to nutrient adequacy in children below five years of age in Trans-Mara East Sub-county. In this study, you will be expected to provide truthful information regarding your household to the enumerator assigned to you. Once you consent to participate, you will be asked questions that will be captured in tablets/ mobile phones after which the enumerator leaves your homestead. The data collected shall only be seen by members affiliated with the study and will not be linked to any identifying information such as name or other personal details that you will supply. The data collected shall be averaged over many participants and therefore your individual data shall be identifiable. The study poses no risks to you or your family. You may decide to stop participating in the study at any time however we encourage you to remain in the study. You have the right to demand that any data provided until that point be withdrawn/destroyed. If you have any questions with regards to this information sheet, you should ask the enumerator before the study.

Researcher: Chepkwony Mercy Chepkoech Contacts: 0701788323

CONTRIBUTION OF SWEETPOTATOES TO NUTRIENT ADEQUACY IN DIETS OF CHILDREN 6-59 MONTHS IN TRANS-MARA EAST SUB-COUNTY, NAROK COUNTY

Kindly tick where appropriate

I confirm that I have read (or been read to) and understood the information sheet for the above study. I have the opportunity to consider the information, ask questions and have had the questions answered satisfactorily. ☐

I understand that my participation is voluntary and that I am free to withdraw at anytime without giving any reason, without my legal rights being affected. ☐

I understand that relevant sections of information and data collected during the study may be looked at by other members of this research team. I give permission for these individuals to have access to these records. ☐

I agree to take part in this study without any demands and of my own free will. ☐

Name of the respondent……

Date……

Signature …….

APPENDIX 2: QUESTIONNAIRE

CONTRIBUTION OF SWEETPOTATOES TO NUTRIENT ADEQUACY IN DIETS OF CHILDREN 6-59 MONTHS IN TRANS-MARA EAST SUB-COUNTY, NAROK COUNTY

Sub-County……..……Ward……Village……...

Village……..questionnaire number……..

Name of interviewer…… …….Date of interview..…./…/2017

Respondent's name…….

Gender ( ) 1= Male, 2= Female

SECTION A: Demographic and Socio-economic characteristics

Household profile

S/No	Name	Relationship to HH head -codes-	Age (years)	Marital status -codes-	Religion -codes-	Level of education	Main occupation -codes-
1							
2							
3							
4							
5							
6							

RHHH	Marital status	Religion	Education	Occupation
1= HHH 2=Spouse 3=son 4=Daughter 5= Grandson 6=Grand daughter 7=Relative 8=Parent 9=Employee	1= married 2=Separated 3=Widowed 4=Single 5=Divorced 6=not applicable <15 years	1= Christian 2=Muslim 3=Traditionist 4=Others (specify)	1= In Primary 2=Primary drop-out 3=Completed primary 4=Secondary drop-out 5=In secondary 6=Completed secondary 7=Tertiary level 8=University 9=Adult education	1= salaried employee 2=farmer 3=Self employment 4=Casual laborer 5=Student 6=Unemployed 7=Others (specify)

11. Socio-economic characteristics

What is the household's main source of income (Livelihood)?

1=Formal employment 2= farming 3= Casual labour 4= Fishing 5= business

What was the total household income last month? And how much was spent on food?

Does your household own any of the following Assets?

	Item	Please Tick
a	Grass Thatch	
b	Iron Roof	
c	Other roof (specify)	
d	Mud Wall	
e	Brick/stone wall	
f	Other wall (specify)	
g	Number of Rooms in the dwelling place	
h	Cultivated Land (acres) last season	
i	Cows (Number)	
j	Goats (number)	
k	Sheep (number)	
l	Donkeys (number)	
m	Poultry (number)	
n	Others (specify)	

SECTION B: FEEDING PRACTICES OF CHILDREN BELOW 24 MONTHS
BREASTFEEDING HISTORY
Where was the child born?
1= Hospital
2= At home
3= Others Specify_____
How soon after delivery was breastfeeding initiated?
O= First 30 minutes 3= Other (Specify

1= First 1 hour 2= After 24 hours
b) Are you still breastfeeding this child?
0= Yes (If yes jump to question 19)
1= No (If no go to next 5)
When did you stop breastfeeding?
0= Below 6 months
1= 6-12 months
2= 12-18 months
3= 18-24 months

Why did you stop breastfeeding?

0= Baby is not getting enough
1= Cultural beliefs
2= the baby has grown up

SECTION C: COMPLEMENTARY FEEDING

Did you give the child any food or drink besides breast milk in the first 6 months

0= Yes (If yes go to next) 1= No (if no skip to Q11)

What foods or drinks did you give your child?

0= Water 2= Porridge 4= Solid Food
1=Herbs 3= Milk

When was the first time you gave your child any other food or drink apart from breast milk? (Pre-lacteal feed including herbs).

0= 0-2 days
1= 1st month 3= At 6 months
2= 2-6 months 4= After 6 months

What do you do with left over child's food

0= Eat the next day 1=Throw away
2= Eaten by the mother/caretaker

Who feeds your child?

0= Mother1= Siblings 2= Father 3= Caregiver (house help, grandmother, aunty etc)

How frequently is your child fed?

……
……

Does your child take family foods or special food?

……
……..

If child takes family foods, when did the child start?

……
……

Has_____ (name) received any vitamin A capsules in the last 6 months?

1= yes
2= no

SECTION I: SWEET POTATO UTILIZATION IN CHILD FEEDING

Do you grow sweetpotatoes?

1= Yes
2= No

If you do, which varieties?1= White-fleshed 2=Orange-fleshed 3= yellow fleshed 4= All of them
Does the child (name) consume sweet potatoes)
1=Yes
2= No

If no why?
……
……
……
……
a) If child (name) consumes sweet potatoes, at what age did he/she begin?
1=6-12months 2= 12-24 months 3=24-36 months 4= 36-48 months 5 48-59 months
b) Why?

……
……
How do you prepare sweet potatoes for child (name)?
……
……
……

SECTION E: 24 HOUR DIVERSITY OF FOOD FOR THE INDEX CHILD

Food Group: Examples	RECORD: 0= no, 1= yes, 88= don't know
Cereals: Millet/Sorghum/Maize porridge,	
Cereal products: Spaghetti, pasta, anjera, rice, bread, mahmri, mandazi, ugali (sima) or other foods made from grain like: Sorghum, Millet, Wheat	
Vitamin A rich vegetables and tubers: Pumpkins, carrots, orange or yellow fleshy sweet potatoes	
White tubers and roots: Sweet Potato (white), white Yams, Cassava, Irish Potato or any other foods made from roots	
Dark green leafy vegetables including wild green vegetables like: cassava leaves, amaranthus, mchicha, pumpkin leaves, spinach, kales, sweet potato leaves	
Other vegetables: Cabbage, Tomatoes, Onions, Green Pepper, Mushroom	
Vitamin A rich fruits :Ripe mangoes, papayas + other locally available vitamin A rich fruits	
Other fruits: Bananas, Oranges, Lemons, Tangerines, Pineapples, coconut	
Organ meat (iron rich: Liver, Kidney, heart, gizzard or other organ meats	

Fresh meats poultry, offal (e.g chicken/poultry, camel/goat meat, beef)	
Eggs: Chicken, Ducks, Guinea fowls, Turkey, Pigeon, or other eggs from any kind of birds	
Fish: Fresh or dried fish or shell fish (Tilapi, octopus, crab)	
Pulses/Legume, nuts (e.g beans, lentils, green grams, cowpeas)	
Milk and milk products (e.g. goat/camel/fermented milk, milk powder)	
Oils/fats*(e.g. cooking fat or oil, butter, ghee, margarine)	
Sweets, Sugar, honey, sweetened soda or sugary foods such as chocolates, sweets or candles.	
Condiments and Spices: Chillies, Pepper, Ginger, Spices, Herbs, Salt	
Beverages: Kahawa, black tea	

SECTION G: FOOD FREQUENCY QUESTIONNAIRE

Please indicate; how many times in the last 7 days did_____(ref child) eat each of the food in the list

	Name of food	No. of days the food was consumed	Source of food 1- produced 2- purchased 3- other(specify
1	Whole milk		
2	Fish		
3	Egg		
4	Chicken		
5	Beef		
6	liver		
7	Carrots		
8	White-fleshed sweetpotatoes		
9	Orange fleshed sweet potato		
10	Yellow fleshed sweet potato		
11	Passion fruits		
12	Avocado		
13	Green leafy vegetables		
14	Pumpkins		

SECTION H: 24 HOUR DIETARY RECALL

Starting with the first thing eaten yesterday after getting up, kindly narrate the foods and beverages child X consumed.

TIME/ MEAL	Name of food	Ingredients used	Amount of ingredients used	Total amount of dish	Total amount served to the children	Amount the child ate	Amount the child left

Code	Meal	Description of indicative local measure	Source
1	Lunch	Handful	Own production
2	Breakfast	Cupful	Bought
3	Dinner	Spoonful	Donation
4		Plateful	Others(specify)
5		Counts(eggs/ slices)	
6		½ cup	
7		½ plate	
8		Others(Specify)	

APPENDIX 3: FOCUS GROUP DISCUSSION GUIDE

Topic: Sweetpotato production, methods of incorporation to children's diets infant and child feeding practices.

Duration: 45 minutes.

Introduction:

Introduce self*, note taker and the general purpose of the discussion.

Main Discussion

1. What are the sources of livelihood for people in this community?
2. Which foods are mainly produced by people in this area? (By rank)

a) Do people in this area produce sweet potatoes?

b) If yes, which varieties are there?

3. What is the sweet potato used for in this community?

b) Do children consume sweet potatoes?

c) What amount of sweet potato is an average child (below 5 years) able to consume in one sitting?

4. Is there a change in feeding practices during sickness?

5. What is the common sweet potato preparation methods used in this community?

6. How do you prepare your children's sweet potatoes?

7. When do you introduce feeds to your children?