NUTRITIONAL STATUS OF CHILDREN UNDER FIVE YEARS, AND ASOCIATED FACTORS, IN MBEERE SOUTH SUB COUNTY, KENYA

BY

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A56/68840/2011

Dissertation submitted in partial fulfillment of the requirements for the Degree of Master of Science in Applied Human Nutrition in Department of Food Science, Nutrition and Technology, Faculty of Agriculture, University of Nairobi

November, 2014

DECLARATION

I hereby declare that this Dissertation is my original work and has not been presented for a Degree in any other University.

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DEDICATION

To my husband, my children; Madina and Isacko. Your love, sacrifices and faith gave me strength to continue making my dream a reality and to my grandmother Sampile whose words of wisdom has been my guiding principles in life.

ACKNOWLEDGEMENTS

First and foremost I am very grateful to God for his love and care that I can count on, all my life.

I am particularly indebted to my supervisors Dr. Mwangi Alice Mboganie and Dr. Gerald Muchemi who despite their busy schedules, always found time to guide and encourage me during entire period of this study. Thank you so much.

I am greatly thankful to the director Kenya Agricultural Research Institute (KARI) for the scholarship to pursue M.Sc. degree at the University of Nairobi. Special thanks also go to Agri-food system project leader Dr. Immaculate who also doubled up as my supervisor. Thank you for your guidance and tireless effort to see this work a success.

My gratitude also goes to Agrifood system project team members Kithinji Mutea, Esther Kihoro and Esther chelimo, Mr. Kerore (Extension Officer, Ministry of Agriculture), Stella (Ministry of Health) and entire survey teams for the wonderful work during data collection exercise. I am indebted to community members of Mutuobare Ward of Mbeere South Sub-county particularly the women and children who accepted to be participants of this study.

Special thanks to my husband Guyo for his support and encouragement throughout the period I was away for studies. Thank for your guidance and moral support without which I would not have pursued this course all the way to completion. I am also indebted to my children Madina and Isacko who had to put up with my busy schedule at the University. Thank you for your sacrifice, love and patience all this time. Last but not the least, thanks to my parents who always gave me words of encouragement and most important of all, their blessings.

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ACRONYMS AND ABBREVIATIONS

AE	Adult Equivalent
ASAL	Arid and Semi-Arid Lands
BCG	Bacillus Calmette-Guerin
BMI	Body Mass Index
CI	Confidence Interval
DPT	Diphtheria, Pertussis, Tetanus
ENA	Emergency Nutrition Assessment
FAO	Food and Agriculture Organization
FSAU	Food Security Analysis Unit for Somalia
GAM	Global Acute Malnutrition
HH	Household
IYCF	Infant and Young Child Feeding
KDHS	Kenya Demographic and Health Survey
KFFSG	Kenya Food Security Steering Group
KNBS	Kenya National Bureau of Statistics
MICS	Multiple Indicator Cluster Survey
MMS	Ministry of Medical Services
MPHS	Ministry of Public Health and Sanitation
MUAC	Mid-Upper Arm Circumference
NCHS	National Centre for Health Statistics

OPV	Oral Polio Vaccine
SAM	Severe Acute Malnutrition
SMART	Standardization Monitoring and Assessment of Relief and Transitions
SPSS	Statistical Packages for Social sciences
UNICEF	United Nation Children's Fund
WHO	World Health Organization

OPERATIONAL DEFINATION

Dietary Diversity	The number of different food groups consumed over a given period of time (FSAU, 2005).
Household	People living together and eating from the same pot at the time of the study (FSAU, 2005)
Household Caloric Acquisition	Number of calories, or nutrients, available for consumption by household members over a defined period of time
Livelihood	Comprises the capability, assets (including both materials and social resources) and activities required for a means of living (Chambers and Conway 1992)
Stunted	Height –for- age below -2 Z-score or below 80% of the median height for age for reference population (WHO, 2006)
Underweight	Weight- for- age below -2 Z-score or below 80% of median weight for age for reference population (WHO, 2006)
Wasted	Weight-for-height below -2 Z- score or below 80% of median weight for height for reference population (WHO, 2006)

ABSTRACT

The nutritional status of children under five years is an indicator of nutritional situation in society. Research estimates that risks related to stunting, severe wasting and intrauterine growth retardation are linked to 2.2 million deaths and 21% of disability-adjusted life years worldwide for children under 5 years. In 2012, 2.2 million people in Kenya were classified in either the crisis or stressed phase of food insecurity and Mbeere south Sub County was classified in stressed phase. Malnutrition in Eastern Kenya where Mbeere Sub County is located had high (42%) stunting, (7.3%) wasting and 20% underweight. Considering that Mbeere South Sub-county is generally low potential dry zone, this situation could have impacted negatively on nutrition status of vulnerable groups especially children under five years. However, limited data exists to support this. Therefore, this study sought to determine nutritional status of children under five years and associated factors in Mbeere South Sub-county for informed appropriate action to mitigate the high levels of malnutrition in the region.

The nutritional status of one child from each of 144 households were sampled in Kiambeere Ward in Mbeere Sub County was assessed using anthropometric measurements (height/length, weight, MUAC). Data were collected on household demographic and socio-economic characteristics, food production, utilization and food consumption, water and sanitation situation and child characteristics including infant and young child feeding practices (IYCF), immunization and morbidity status using pretested structured questionnaires.

Study children were classified according to levels of their nutritional status based on WHO (2006) reference standards. Energy and protein intake was compared with requirements on the basis of the household composition in terms of adult equivalent (AE). Descriptive statistics were used for analysis of socio-economic, demographic characteristics, IYCF, immunization and morbidity data. The chi-square was used to determine differences in proportions and Pearson correlation were done to determine association between independent variables and nutritional status of children.

The mean household size was 4.73 ±0.743 and 10% of the households were female headed. The ratio of male to female in the study population was approximately 1: 1.1. The dependency ratio of the population was 1.02. About 90 % of the households in the study population relied on unsafe water supply from unprotected water sources. Only 6.2% and 18.4 % of the households met their energy and protein requirement from the food consumed by the household. Up to 39% of the children were stunted, 7.1% were wasted and 18.1 0% were underweight. These levels were above the national average and high enough to classify the community as chronically foods insecure, according to the FAO/FNSAU integrated food security phase classification of 2006. The prevalence of stunting and wasting was significantly higher in boys than in girls (χ^2 =6.765, p =.034) and (χ^2= 13.053, p = .036) respectively.

Over 80% of the children below 24 months were reported to have breastfed exclusively for the first 6 months of life. Majority (90.8%) of the children were fully immunized for age and 95.8% received the BCG vaccine. The dropout rate was 3.7% OPV, 1.5% DPT-HepB-Hib and 7.5% Pneumococcal vaccine.

There was significant negative correlation between children's age and nutritional status based on wasting and underweight (r=-.243, p=0.046 and r=-.296,p=0.007 respectively). Household size was positively and significantly correlated to stunting and wasting (r=.410, p=0.047 and r=.402, p=0.041 respectively). A child who was sick two weeks prior to the survey was more likely to be wasted than a healthy child (Odds Ratio; 1.56, CI: 0.6-5.76).

In conclusion, malnutrition among children under five years in Mbeere South Sub County is indicative of chronic food insecurity situation. Large household size and morbidity experience are important associated factors. Therefore, multisectoral approaches that address different household dynamics including food security, health and nutrition issues at community level should be employed to alleviate malnutrition.

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background Information

Nutritional status of children is an indicator of the level of development and future potential of the community. A well-nourished population has a capacity to be productive and to improve its standard of living through hard work. Furthermore, in children malnutrition adversely affects their cognitive and learning performance. Adults, who as children suffered malnutrition, suffer functional impairments including reduced intellectual performance and working capacity (Ola et al., 2011). Inadequate nutrition is one of a wide range of interlinked factors that form poverty syndrome – low income, large family size, poor education and limited access to food, water, sanitation and maternal and child health services (UNICEF, 2012). To address malnutrition, the type of malnutrition and nutrition related risk factors need to be identified and evidence based intervention and policies implemented.

Research estimates that the risks related to stunting, severe wasting and intrauterine growth retardation caused 2.2 million deaths and 21% of disability-adjusted life years worldwide for children under 5 years and in Kenya, infant and under-five mortality rates are 77 and 115 per 1000 live births respectively (MMS /MPHS, 2009). The national figure for acute malnutrition of children under five years old is estimated at 6%, however there are huge variations in different regions of the country. In the Arid and Semi-Arid Areas (ASAL) where food insecurity and

natural disasters have often afflicted the population, rates of acute malnutrition are between 15 and 20% of children under five years and sometimes substantially higher (MMS /MPHS, 2009). Prevalence of stunting in Eastern Region where Mbeere South Sub County is located is estimated at 41.9% (KNBS and ICF Macro, 2010).

With the above background information, it is logical to expect high prevalence of malnutrition among vulnerable groups, especially children in Arid and semi-arid region of Mbeere South Sub-county. However the information on nutrition status of children under five years is scanty. This study was therefore designed to study nutritional status of children under five years and associated factors.

1.2 Statement of the Problem

According to food insecurity classification (KFSSG 2012), about 2.2 million people in Kenya were classified in either the Crisis or Stressed Phases of food insecurity. Mbeere South Sub County was classified in the Stressed Phase. The greatest impact of food insecurity is normally observed in children who are the most nutritionally vulnerable group of the population. Malnutrition observed in children under five years in Eastern region where Mbeere South Sub-county is located is high, estimated at 41.9% stunting, 7.3% wasting and 19.8 % underweight (KNBS and ICF Macro 2010). According to WHO classification (FSAU, 2005), these level are unacceptably high. Considering that Mbeere South Sub County is generally low potential dry zone, this situation could have impacted negatively on nutrition status of vulnerable groups especially children under five years. However limited data exists to support this. Therefore, this study sought to determine nutritional status of children under five years and associated factors in

Mbeere South Sub County for informed appropriate action to mitigate the high levels of malnutrition in the region.

1.3 Study Justification

Several studies have shown that several factors are associated with nutritional status of children under five years. However, among the studies that have been conducted so far, the factors associated with malnutrition differ within countries or even regions around the world. Mbeere South Sub County has its own special characteristics in terms of socio-economic, water and sanitation, food security and feeding practices but data on how these factors impact on nutrition status of children is scanty.

1.4 Study Aim

The aim of the study was to contribute towards improvement of nutrition status of children in Mbeere South Sub-county.

1.5 Study Purpose

The purpose of the study was to generate information on risk factors associated with nutrition status of children under five years, for the purpose of providing baseline data for an intervention program planned for Mbeere South Sub County.

1.6 Study Objective

The main objective of the study was to determine nutritional status of children under five years and associated factors in Mbeere South Sub County.

Specific objectives of the studies included:-

1. To determine demographic, socio-economic characteristics, food production and utilization of households in Mbeere South Sub County
2. To determine the nutritional status of children under five years in the study area
3. To determine infant and young child feeding (IYCF) practices for children (0-24 months old) in Mbeere South Sub County.
4. To determine immunization (12-35 months) and morbidity status of children under five years in Mbeere South Sub County.

1.7 Hypotheses

1. There is no significant association between demographic, socio-economic factors, household food production and utilization and nutritional status of children under five years in Mbeere South Sub County.
2. There is no significant association between Infant and Young Child Feeding (IYCF) practices and nutritional status of children aged 0-24 months in Mbeere South Sub County.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Overview of Malnutrition

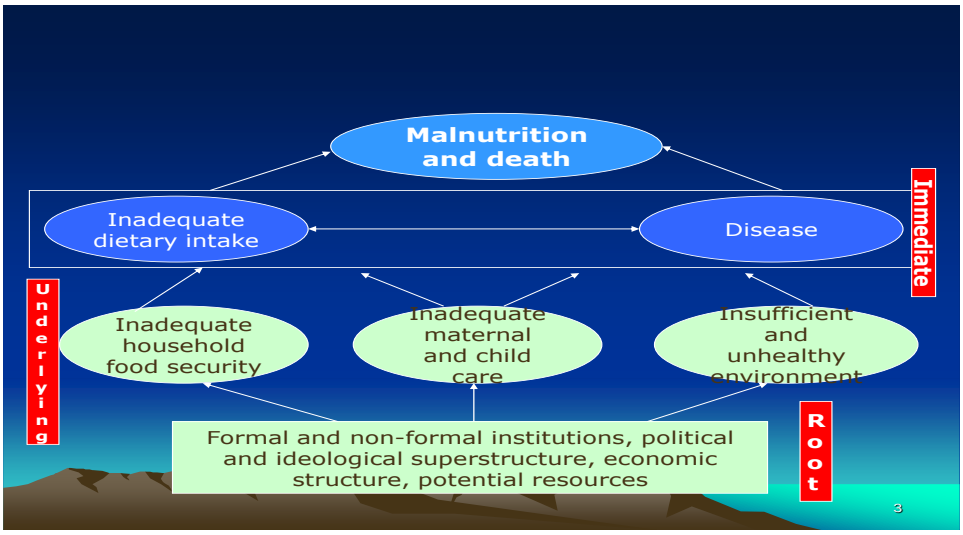
Malnutrition is defined as "a state in which the physical function of an individual is impaired to the point where he/she can no longer maintain adequate bodily performance processes such as growth, pregnancy, lactation, physical work, resting and recovering from disease (MMS/MPHS, 2009).

Malnutrition commonly affects all groups in a community, but infants and young children are the most vulnerable because of their high nutritional requirements for growth and development (Blössner et al., 2005). Globally, an estimated 165 million children under-five years of age, or 26%, were stunted, 16%, were underweight, 8% were wasted and 7% were overweight. High prevalence levels of stunting among children under-five years of age in Africa (36%) and Asia (27%) remain a public health problem, one which often goes unrecognized. More than 90% of the world's stunted children live in Africa and Asia (UNICEF et.al, 2012).

In Kenya, 35 percent of children under five are stunted, while the proportion severely stunted is 14 percent, 16 % are underweight (low weight-for-age) and 4 % are severely underweight (KNBS and ICF Macro 2010). Malnutrition observed in children under five years in Eastern region where Mbeere South Sub County is located is high, estimated at 41.9% stunting, 7.3% wasting and 19.8 % underweight (KNBS and ICF Macro 2010).

2.1.1 Causes of malnutrition

There has been agreement among researchers on factors contributing to malnutrition. The primary determinants as conceptualized by several authors relate to unsatisfactory food intake, severe and repeated infections, or a combination of the two (UNICEF, 1998 and Rowland et al., 1988). The interactions of these conditions with the nutritional status and overall health of the child and by extension of the populations in which the child is raised have been shown in the UNICEF Conceptual framework (figure 1) of child survival (UNICEF, 1998).



Sources: UNICEF, 1998

Figure 1: Conceptual Framework Showing Causes of Malnutrition

2.1.1.1 Immediate causes of malnutrition

Inadequate food intake and disease are immediate causes of malnutrition and create a vicious cycle in which diseases and malnutrition exacerbate each other. Malnutrition lowers the body's ability to resist infection resulting to longer, more severe and more frequent episodes of illness.

Thus inadequate food intake and diseases must be both addressed to support recovery from malnutrition (UNICEF, 1998).

2.1.1.2 Underlying causes of malnutrition

The underlying causes are those that give way to immediate causes. The three major underlying causes of malnutrition include inadequate household food security, limited access to adequate health services and/or inadequate environmental health conditions and inadequate care in the households and at community level especially with regards to women and children (UNICEF, 1998).

2.1.1.3 Basic causes of malnutrition

The basic causes of malnutrition in a community originate at the regional and national level where strategies and policies that affect the allocation of resources (human and, economic, political and cultural) influence what happens at community level. Geographical isolation and lack of access to market due to poor infrastructure can have a huge negative impact on food security (MMS/MPHS, 2009), access to healthcare services as well as healthy environment. The above model characterizes the correlates of malnutrition as factors that impair access to food, maternal and child care, and health care. It is these very factors that impact the growth of children. Consequently, the assessment of children's growth is a suitable indicator for investigating the wellbeing of children, and for examining households' access to food, health and care (UNICEF, 1998).

2.2 Nutritional Status of Children Under Five Years

Nutritional status of children is an indicator of the level of development and future potential of the community. The nutritional status of infants and children under five years of age is of particular concern since the early years of life are crucial for optimal growth and development (Preschulek et al., 1999). Nutritional deficiencies affect long term physical growth and development and may lead to high level of illness and disability in adult life. Moreover high prevalence of malnutrition jeopardizes future economic growth by reducing the intellectual and physical potential of entire population (Kabubo-Mariara, 2006).

Children under five years constitute a significant proportion in Kenya. A survey by the Central Bureau of Statistic (KNBS and ICF Macro 2010) showed that children under five comprise 15.7 % of national population. Information on nutritional status of this group may therefore be a good indicator of nutritional situation in a wider society.

Eastern region has highest prevalence of stunting (42 %) while Nairobi region has the lowest at 26 %. Sixteen (16 %) of children under five are underweight (low weight-for-age) and 4 % are severely underweight. Prevalence of stunting and underweight was observed to be high in rural areas as compared to urban areas (KNBS and ICF Macro 2010).

Prevalence of malnutrition varies across the world. A study done in Nigeria among the children aged 0-5 yrs found out that 35.7% stunted, 14.9% underweight and 5.5% wasted (Lawal and Samuel, 2010). Elsewhere in Ethiopia prevalence of stunting was (54.2%), underweight (40.2%) and wasting (10.6 %) (Aweke et al., 2012). A comparative study on nutritional status of preschool children in Butembo (DRC) and Gitega (Burundi) found that only 21.14% and 36.43% of the preschool children from Butembo (DRC) and Gitega (Burundi), respectively fell within

the normal range in regards to stunting (≥-2 z-score) (Ekesa et al., 2011). Although the prevalence of malnutrition differs among different regions around the world, it is evident that malnutrition exists and there is need to address it effectively.

2.3 Methods of Assessing Nutritional Status

Nutritional assessment is the first step in the treatment of malnutrition. The goals of nutritional assessment are identification of individuals who have, or are at risk of developing malnutrition, to quantify the degree of malnutrition and to monitor the adequacy of nutrition therapy. The methods of assessment are based on series of anthropometric, dietary, laboratory and clinical observations used either alone or more effectively, in combination. Correct interpretations of the results often require consideration of other factors such as socio-economic status, cultural practices, and health and vital statistics (Gibson, 2005). In this study dietary method and anthropometric measurements were used because they yield satisfactory results within the limit of resources available.

2.3.1 Anthropometric method

Anthropometry involves measurement of variation of physical dimension and gross composition of human body at different age level and degree of nutrition. Anthropometry is particularly useful when there is chronic imbalance between intake of protein and energy (Gibson, 2005). Anthropometric indices are derived from combination of raw measurement. These include height, weight, and age of the individuals whose nutritional status is being determined. The measurements are then used to calculate the anthropometric indicators of nutritional status such as height-for-age, weight-for-age and weight for height. The indicators are then used to classify

and interpret nutritional status of individuals as shown in table 1. Anthropometric methods of assessments are preferred in most study for its advantages. The equipment used is portable and inexpensive. Measurements can be performed relatively quickly and with ease hence do not require highly skilled staff to perform them. This method however has some limitation as well. Although sometimes the method can detect moderate and severe form of malnutrition, it cannot be used to identify specific nutrient deficiency states (Gibson, 2005).The main imprecision errors in anthropometric are random imperfection in measuring instruments or in the measuring and recording techniques (Arroyo et al., 2010). To control and minimize errors during the assessment, examiners need to be carefully trained on techniques of calibrating the equipment and taking accurate measurements.

Table 1: Cut Off Points for Malnutrition

Indicators	**Moderate(GAM)**	**Severe(SAM)**
Wasting	WHZ; <-2 to ≥-3Z scores	WHZ; below -3Z
Underweight	WAZ; <-2 to ≥-3Z scores	WAZ; below -3Z
Stunting	HAZ; <-2 to ≥-3Z scores	HAZ; below -3Z

Source: WHO, 2006

2.3.2 Biochemical or Laboratory methods

The assessment of nutritional status by laboratory tests potentially offers a reproducible quantitative means of measuring specific nutrients that can be of great use to clinicians, nutritionists, and researches. It can provide objective confirmation of nutritional deficiencies.

Laboratory tests can also be used to monitor nutritional therapy with greater precision compared to separate use of dietary, anthropometric, or clinical assessment techniques. They may be used to determine quantitative alterations in biochemical levels of nutrients, their metabolites, or dependent enzyme activities that are often not detected by anthropometric methods. Although they nicely quantitate levels of a certain nutrient in a specific body fluid at a particular time, these measurements may not correlate with values at other times, in other body pools, or with deficiencies of other nutrients. Furthermore, many drugs, diseases, and end environmental conditions not related to nutrition can affect measured levels of nutrients (Falcão, 2000).

2.3.3 Clinical methods

The method it utilize a number of physical signs (specific and non-specific), that are known to be associated with malnutrition, deficiencies of vitamins and micronutrient. This method involves getting good nutritional history and general clinical examination with special attention to organs like hair, nail, and angle of the mouth, eyes, skin, tongue, muscles, bones and thyroid glands. Detection of relevant sign helps in establishing a nutritional diagnosis. The method is fast and easy to perform, inexpensive and non- invasive. However it has a limitation in ascertaining early diagnosis (Gibson, 2005).

2.3.4 Dietary assessment method

Diet is one of the prime determinants of health and nutritional status. An inadequate diet, poor in both quality and quantity has been one of the reasons for high levels of malnutrition in children. Dietary surveys are therefore one of the essential components of nutritional assessment. (Kulsum et al., 2008). The appropriate tool for dietary assessment will depend on the purpose for which it

is needed. The purpose may be to measure nutrients, foods or eating habits. Different methods have been developed for the purpose of assessing dietary intake. These range from detailed individual weighed records collected over a period of 7 days or more to food frequency questionnaires, household survey methods and simple food lists. Each has merits, associated errors and practical difficulties to be considered when choosing one method above another (Wendy et al, 2003). Dietary assessment can be done at household level or individual level depending on the objective of the survey.

Household methods

The methods of assessment at the household level are: household recall, food accounts and inventories. Data generated by these methods are useful for comparing food availability among different communities, geographic areas and socioeconomic groups. However, these data do not provide information on the distribution of foods among individual members of the household.

Food account method

Household members keep a detailed record of the quantities of food entering the household, including home produced food, purchases gifts, and from other sources. The method is widely used in household budget surveys. Main disadvantage of this method is that data are limited to food brought into the home and fail to account for food consumed outside home.

Household record

In the household record method, the foods presented for consumption to household members are weighed or estimated in household measures. This method may be well suited to populations in which a substantial proportion of the diet is home produced rather than purchased (Gibson, 2005).

Individual methods

Dietary diversity

Dietary diversity is defined as the number of individual food items or food groups consumed over a given period of time (Ruel, 2003). The type and number of food groups used for assessment and subsequent analysis may vary depending on the level of measurement and intended purpose. At the household level, dietary diversity is usually considered as a measure of access to food, while at individual level it reflects dietary quality, mainly micronutrient adequacy of the diet. The reference period can vary, but is most often the previous day or week (FAO, 2011, WFP, 2009). For this study individual dietary diversity score of the children was determined based on simple counts of number of food groups consumed in the past 24 hour (8 food groups by FAO for individual dietary diversity). DDS is easy to calculate (Ruel, 2003), moreover majority of respondent's do not find the questions associated with assessing DDS intrusive (Swindale and Bilinsky, 2006). However the method also has a limitation since Measures of dietary diversity typically do not include quantities consumed. There can also be significant fluctuations over time in consumption of food groups. This poses challenges in extrapolating survey data to arrive at broad conclusions about the food security status (IPC Global Partners, 2008).

Challenges in assessing dietary intake

The recall ability and psychological characteristics of individuals can influence dietary reporting. For example, an individual may be aware that their diet is unbalanced and so may be reluctant to provide honest answers to questions, or their recollection of intake may simply be flawed.

Participants may report behavior that they perceive as socially desirable rather than accurate (NOO, 2010).

2.4 Household Food Security

Food security has been defined as a situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and preferences for an active and healthy life. Thus, food insecurity is a situation that exists when people lack access to sufficient amounts of safe and nutritious food for normal growth and development to leave an active and healthy life. Food insecurity may be caused by the unavailability of food, insufficient purchasing power, inappropriate distribution or inadequate use of food at the household level (FSAU, 2005).

2.4.1 Measurement of indicators of food security

Household food security can be accessed by use of process indicator; those that describe food supply and food access and outcome indicators that describe food consumption. Process indicators are imprecise and due to confounding factors, time consuming and expensive (Hoddinott et al., 2002). Food consumption entails individual intakes, household caloric acquisition, dietary diversity, and indices of household coping strategies (Deaton and Gross., 1998).

Food availability

Food availability is a factor of production capacity, amount of imports and amount that is normally used at a given period in time and of the availability of storage. Food availability is also influenced by the availability of seeds, pest infestation/attack, weather conditions, availability of

pasture, and land acreage under cultivation, labour availability and insecurity issues. The amount of food used by households, traded or stored, all influence food availability (FSAU, 2005). In this study, household crop production was assessed to determine household food availability.

Food access

Many factors affect people's access to food. These include Cultural factors, reduced purchasing power, Logistical/geographic obstacles to markets and Insecurity. Household food access is also determined by seasonal patterns. For instance, the main food crop produced may not be sufficient to meet the household needs at all times (FSAU, 2005). In this study, household food access was assessed by determining household caloric acquisition from household's farm produce. At individual level dietary diversity of the study children was assessed.

Food utilization

Adequate Utilization refers to the ability of the human body to ingest and metabolize food. Nutritious and safe diets, an adequate biological and social environment, a proper health care to avoid diseases ensure adequate utilization of food. In most cases, utilization is only discussed

from a biological perspective (Rainer et al., 2000)

2.5 Factors Associated with Malnutrition

According to a study in DRC a low maternal educational level (less than 7 years), the absence of a drinking tap water available in the house or yard, male gender, and age of children were all significantly associated with increased risk of stunted growth while decreased appetite, diarrhea and age of children were significant predictors of emaciation (Mukatay et al., 2010).

According to a study in Pakistan, household income and Childcare practices had an important and significant impact on child nutritional status. Childcare practices were negatively and significantly related to child nutritional status (Uzma and Muhammad, 2006).

A study on household food insecurity and nutritional status of under five years in Western Highlands of Guatemala showed that food insecurity at the household level was significantly associated with HAZ, such that children in moderately food insecure households had 0.08 lower HAZ and children in severely food insecure households had 0.09 lower HAZ than children from food secure households (Chaparro, 2012). Similar study in Nigeria found out that Food-insecure households were five times more likely than secure households to have wasted children (crude OR = 5.707, 95 percent CI = 1.31-24.85) (Ajao et al., 2010)

In Kenya an inverse relationship is observed between the household wealth index and the stunting levels for children, that is, children in the lowest household wealth quintile record the highest stunting levels (44 percent). The proportion of stunted children declines with increase in the wealth quintile (KNBS and ICF Macro 2010). This could be attributed to ability of the household to purchase adequate food and obtain better health care services. According to the same report, mother's education can exert a positive influence on children's health and survival. Under five mortality is noticeably lower for children whose mothers either completed primary school (68 deaths per 1,000 live births) or attended secondary school (59 deaths per 1,000 live births) than among those whose mothers have no education (86 deaths per 1,000 live births). However, under-five mortality is highest among children whose mothers have incomplete primary education. Similar patterns are observed for infant mortality levels.

A study done in Kwale County found that children in female-headed households were more likely to be underweight than their counterparts in male-headed households, which could be attributed to extreme poverty in female-headed households. The same study also established children from large households to be more likely to be wasted (Amegah and Adeladza, 2009).

2.6 Knowledge Gap

There has been agreement among researchers on several factors associated with malnutrition. However, among the studies that have been conducted so far, the risk factors differ with countries or even regions around the world. Mbeere South Sub County has its own special characteristics in terms of socio-economic, food security and child feeding practices but data on how these factors impact on nutrition status of children is scanty. Therefore this study was set to fill this gap by determining nutritional status of children less than five years as well as identifying associated risk factors specific to the study area.

CHAPTER THREE

3.0 METHODOLOGY

3.1 Study Setting

The study was conducted in Mbeere South Sub County in Eastern Region of Kenya. The Sub Count lies between latitudes 0° 20′ and 0° 50′ south and longitudes 37° 16′ and 37° 56′ and covers a total area of 2,092.5 km^2 with a population of 219,220 persons (KNBS and ICF Macro 2010).

The site was selected because this study was part of on-going project in Mbeere South Sub County. The Kenya Agricultural Research Institute (KARI) project entitled "Making Agri-food systems work for the rural poor in Eastern and Southern Africa" funded by the International Development Research Centre (IDRC) has been under implementation in Mbeere South Sub County for the last three years. Objective of the project was to stimulate the adaptation of pro-poor Agri-food systems innovations as a contribution to improving food security and sustainable natural resource management. In addition, the project sought to understand household nutrition, current socio-economic status of the community as well as issues around food production.

The sub county is generally considered a low potential dry zone. It is covered by three agro-ecological zones; the marginal cotton zone (LM4); the lower midland livestock-millet zone (LM5); and the lowland livestock millet zone (L5).

The area has a bimodal pattern of rainfall which is often not reliable and ranges between 550mm -1,100 mm per year with most parts of the District receiving 640 mm of rainfall per year. Therefore, the area is generally a low potential dry zone with Majority of the people practicing Agro – Pastoralist (80%) who produce crops such as:- maize, sorghum, millet, beans, cow peas, green grams, pigeon peas, cotton and tobacco.

The Sub County is adequately covered by two mobile networks, Safaricom and Airtel. The rural road network is murram roads with one main all weather roads feeding to Nairobi-Embu highway (Appendix 1).

3.2 Study Design

The study was cross-sectional both descriptive and analytical in nature, designed to assess the nutrition status of children under five years and its association with demographic and socio-economic characteristics, household food security, water availability, hygiene and sanitation, Infant and young child feeding practices (IYCF) as well as immunization and morbidity status of children under five years old.

3.3 Study Population

The sampling unit for this study was the household with children below five years and the respondent were the principle care giver of the index child.

3.4 Sampling

3.4.1 Sample size determination

Sample size was calculated using Fisher's et al. (1991) formula and was based on the prevalence of underweight for Embu County, which was at 10% according to multiple indicator cluster survey carried out in the year 2008 (KNBS,2009a).

$n=Z^2p\ (1-p)/d^2$ (Fisher et al, 1991)

Where;

n= minimum sample size (for population >10,000)

Z= level of significance, 1.96 at 95% Confidence level

P=Estimated underweight prevalence, HAZ-<-2 is 10%

d=Degree of precision required (usually as a proportion, 0.05 for 5%)

Therefore,

$n=Z^2p\ (1-p)/d^2$

$n=1.96^2\times0.1\times0.9/0.05^2=138$

4% attrition=138+ (5%×138) = 145

3.4.2 Sampling procedures

Multistage sampling procedure was used as diagrammatically presented in Figure 2. The first and second stage was purposive sampling of Embu county and Mbeere South Sub County. The third

stage was purposive selection of Kiambeere Ward. The fourth stage was purposive selection of Mutuobare and Kiambere location

Proportion to population size sampling was used to select 145 households in Mutuobare and Kiambeere location. Thirty eight (38) households were selected from 450 households that constitute the Mutuobare location and one hundred and seven (107) households were selected from 1506 households that constitute Kiambeere location. Household with children under five years were selected by random walk sampling method. A child under five years was purposively selected for the study from each of the selected household. Household with more than one child under five years, only one child was selected for the assessment randomly by toss of a coin. It was assumed that children in the same household were subjected to the same condition hence any selected child could represent the household.

Sampling procedure

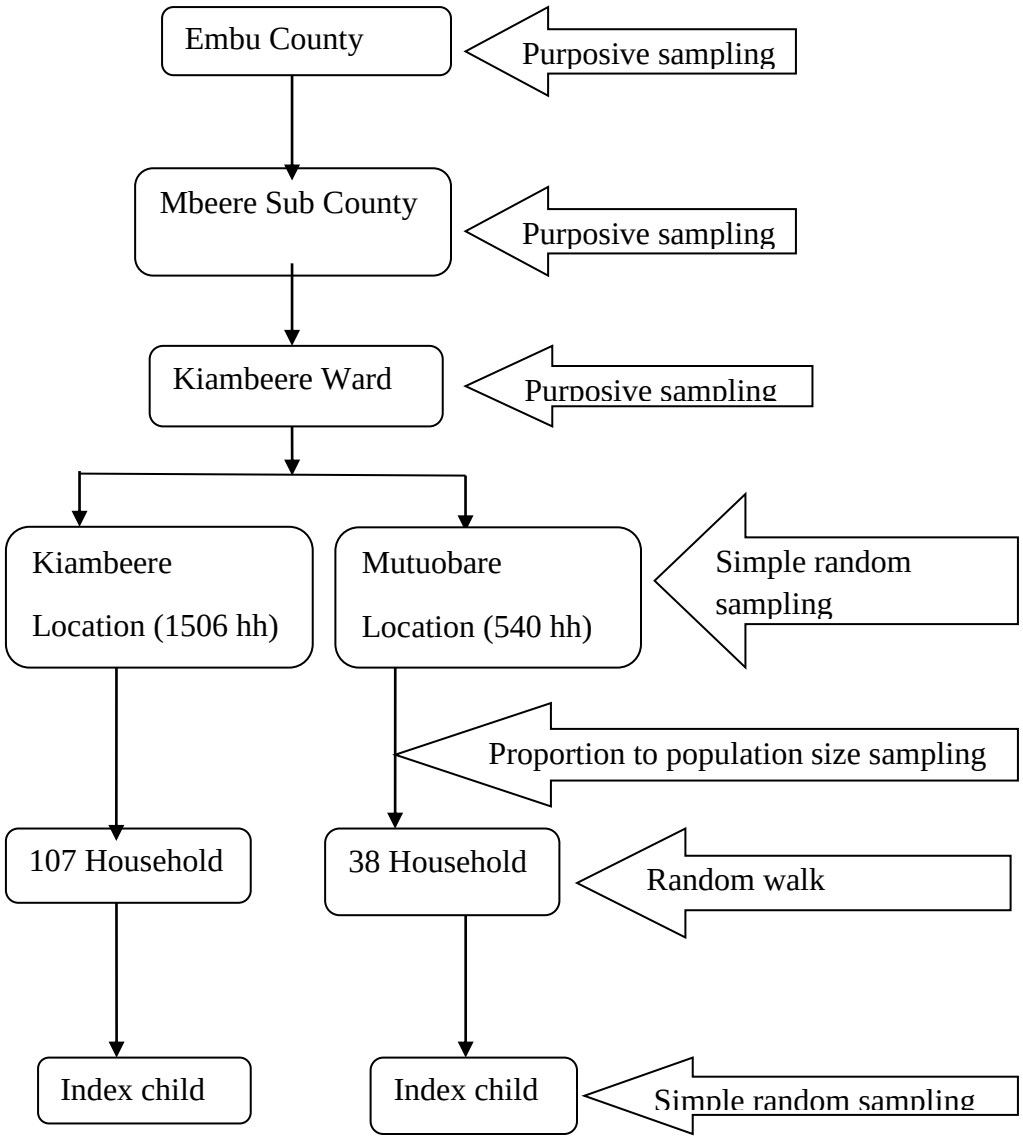


Figure 2: Schematic Diagram Showing Sampling Procedure

Inclusion and exclusion criteria

Households with a child under five years and were permanent residents of the study area were included in the study. Household without a child under five years and those with children below five years but not permanent resident of the study areas were excluded from the study.

3.5 Study Tools

3.5.1Questionnaire

A structured questionnaire (Appendix2) was used to obtain demographic and socio-economic characteristics of the study household. The questionnaire also incorporated food production and utilization, and Dietary diversity questions, anthropometry and child immunization question, as well as infant and young child feeding practices questions

3.5.2 Equipment

Anthropometric measurements were taken for children under five years. The following equipment were used: salter scale, with accuracy of 0.1 Kg for weight, height/length board with accuracy of 0.1 cm to measure height and length and MUAC tapes with accuracy of 0.1cm.

Training of field assistants: flip charts, felt pens, masking tapes, document wallet, pens and note books.

3.6 Recruitment and Training of Field Assistants

Vacancies for research assistants were advertised through posters. The minimum requirement was completion of Kenya Certificate of Secondary Education with minimum grade of C+, experience in data collection was added advantages. A total of eight undergraduate students from various public universities were selected, one extension officer from ministry of Agriculture, a

nutrition officer from ministry of health and a research officer from KARI were engaged for the study. For the research assistants, beside the academic qualification, other qualities assessed included understanding of local language, which was Kimbeere and ability to fluently translate English sentences to the local language and Kiswahili, general knowledge and effective communication skills.

The recruited research assistants were trained for two days. The training covered; background and objective of the study, selection of households and respondents, administering the questionnaires and interviewing techniques and taking of anthropometric measurements of the children.

Learning methods like role play were used to explain the purpose and objective of the study. Anthropometric techniques like taking weight, length/height and MUAC were demonstrated during the training to the research assistants. Training also included demonstration of survey ethics and taking care of survey tools and equipment

During the training each research assistant was given an opportunity to take anthropometric measurement and administer questionnaire under close supervision of principal investigator. (Appendix 3)

3.7 Pre-testing of Study Tools

20 households that were not part of study sample were used for pretesting of the study tools and equipment. During the pretest, the time required to administer the questionnaires and respondents understanding of the questions were noted. Modifications were made to the questionnaire later using the pretest results.

3.8 Methods of Data Collection.

Different methods were used to collect different sets of data

3.8.1 Demographic and socio-economic data

A pretested questionnaire was used to collect data on household profile i.e. household size, sex, age, education level, marital status and occupation of the household members. The respondents were also interviewed to give details on their socio- economics characteristics of the household like land ownership, livestock owned, main food production, household income and water and sanitation situation.

3.8.1.1 Food production and consumption

To obtain data on food production the respondents were interviewed to determine and record proportion of crops produced in the last season. He/she was asked to give details on the type of food crops grown by the household during the season preceding the survey, the amount of food produced, the proportion sold and as well as the amount of stock that remained for family consumption until the next harvest.

Dietary diversity

Individual (index child) dietary diversity was investigated through 24 hour recall dietary intake interview with the mother/ care taker. For this study 8 food groups recommended by FAO (2011) for individual dietary diversity (IDD) was used. The food groups included; cereals, legumes/nuts/seeds, milk and milk product, fruits, dark green leafy vegetables, eggs, white tuber/roots and meat.

3.8.1.2 Water availability, hygiene and sanitation status of the households

Through interview with respondents, vital information on the sources of water, distance to the water sources, daily average amount of water for domestic use were established. Moreover the information on whether the household treat their drinking water and the type of treatment employed was noted. Information on the presence of toilet facilities, hand washing facilities and mode of refuse disposal by the households were collected both through interviews with the respondents as well as through observations where possible.

3.8.2 Nutrition status of the index child

Anthropometric measurements were taken for children aged (6-59) months to determine their nutritional status as follows:

Date of birth: The date of birth for each child was inquired from the care taker/ mother and cross checked from immunization cards and recorded in months.

Length/ height: Length for children (6-24) months was measured lying flat and centrally on measuring boards placed on a hard flat surface on the ground. The length was read to the nearest 0.1 cm (head and feet against the base of the board and foot piece respectively).

Height of children aged above 24 months was measured standing straight on measuring board placed on hard flat surface against a wall with line of sight perpendicular to the horizontal surface. The child's height was measured by gradual lowering of head piece on top of the head and taking the reading of the height between head peace and base of the board to the nearest 0.1 cm

Weight: the child was put in the weighing pants and was gently lowered on the standardized Salter scale with the strap of the pant in front (Appendix 4). The scale was hanged from a secure position, the child's weight read to the nearest 0.1 Kg after the scale needle stabilizes.

3.8.3 Infant and young child feeding practices

The mother/caretaker of the index child (0-24 months) was interviewed to get information on initiation of breastfeeding, frequency of breast feeding and complementary feeding practices.

3.8.4 Immunization and morbidity status of index child

The data on morbidity, immunization and deworming practices of the index child were collected through interview with the mother or the principal care taker with reference to health cards where possible.

3.9 Ethical Considerations

Verbal consent from all caregivers/mothers of the sampled children was sought before administration of the questionnaire (appendix 5). All the information collected during the survey were treated as confidential and used for the purpose of the survey only.

3.9 Data Quality Control

During survey

The questionnaire was validated through pre-testing. The research assistants were closely supervised by the principal investigator during the pre-testing and throughout the survey period.

Each questionnaire was checked to confirm that it has been answered to completion before leaving the households.

The weighing scale was tarred before each child was weighed and the child was weigh with minimum clothing on. The height/length of each child was measured accurately by standing or resting the height/length board on a flat ground. Measurements were taken twice and average of the two was adopted as true measures of the parameter. The measurements were repeated where large variations were observed between the two readings.

During data processing

After data entry into the computer, frequencies were run for each variable to check for outliers that may have occurred due to errors during data entry and also check for consistency of responses between questions.

3.11 Data entry, Cleaning and Analysis

The data was entered and analysis using SPSS version 20, Emergency Nutrition Assessment for Standardized Monitoring and Assessment of Relief and Transition (ENA for SMART) and Nutrisurvey, 2007 software. Data cleaning was done by running and tabulating all variable frequencies in SPSS.

Frequencies and cross tabulation were used to give frequencies, means, standard deviation in descriptive analysis on demographic and socio-economic characteristics of households. Proportion of male and female headed household, Age and sex distribution, education level and occupation of the study population, household size, source of income and expenditure were established. These demographic and socio-economic characteristics were correlated with

nutritional status to establish if there was a relationship. Data from water, hygiene and sanitation, morbidity were cross tabulated to find their association with nutritional status.

Household food production and utilization was conducted. Proportion of the total household produce that was assigned to various household uses like amount of produce put up for sale, donation to neighbors/relatives, home consumption and storage was established. Household caloric acquisition from the amount of food produce consumed by the household was determined. Using Nutrisurvey 2007 software, Proportion of food consumed by the household was converted to amount of energy (kcal) and protein (g). Energy and protein requirement for the household members were determined using a reference person as 1 consumer unit (CU). A reference person, 65-kilogram man, aged above 14 years undertaking "moderate activity" yields a caloric requirement of approximately 2,900 kilocalories per day (Gibson., 2005, sehmi, 1993, Kanyuira, 2010). Individual requirements for the rest of the members of the household are made on the basis of their age and sex to yield "adult equivalents (AE)."(Appendix 6). Household energy and protein adequacy from the food consumed was determined. Duration of consumption of the remaining food stock was also projected using the AE requirement of the household. These were analyzed to determine if there was association between energy and protein adequacy of the household and nutritional status.

Emergency Nutrition Assessment for Standardized Monitoring and Assessment of Relief and Transition (ENA for SMART) was used to convert raw anthropometric data (weight, height and Age of the children) into anthropometric Z-score that was used to classify children into levels of nutritional status (stunting, wasting and underweight). The classification of the nutritional status

was done according to the WHO cut-off points recommended by the World Health Organization. The z-score data was then transferred to SPSS version 20 to be analyzed with other variable.

Infant and young child feeding practices was established by running the frequencies of various infant feeding practices and complementary feeding. These include frequency of timely initiation of breastfeeding, exclusive breastfeeding and timely introduction of complementary feeding. These variables are cross tabulated to find association with nutritional status.

The immunization analysis was limited to children between 12 months and 24 months of age at the time of survey. The age limitation was based on assumption that children less than 12 months may not be fully immunized and according to WHO recommendation, child immunization coverage should be assessed for children who are older than 12 months (Bronte and Dejong, 2005). Analyses employed in this work includes cross tabulation, correlation and regression, t-test. A p-value of less than 0.05 was accepted as significant.

CHAPTER FOUR

4.0 RESULTS

4.1Characteristic of Study Population

Table 2 describes the demographic characteristics of the study population. The survey was conducted among 145 households but one was dropped due to extreme outlier on some variables. The mean household size was 4.73 ±0.743. Age distributions of the household members were highly varied. The proportion of children aged between 6-17 years was comparatively higher (27.8%). The children under five years (target population) comprised of 26.9% of the total population**.** The ratio of male to female in the study population was approximately 1: 1.1. The dependency ratio of the population was 1.02.

The majority of the study population had attended primary school or was in primary school (71%). About 23.5% had attended secondary school while only 2.0% had attained above this level. The main occupation of population over 18 years was farming (64.1%). Only a very small proportion (4.9%) of the study population had salaried employment. Population in different occupation were significantly different (χ^2, $p<0.000$). Most occupations were dominated by male except farming. More women were unemployed than their male counterparts.

Table 2: Some Selected Socio-demographic Characteristics of Study Population

Characteristics	**Statistics**	
	N	%
Total population	681	100
Sex distribution		
Male	320	47
Female	361	43
Sex ratio		
Male to female 1:1.1		
Education level of > 18 years	**N=308**	
	N	%
University	1	0.2
College	6	1.8
Secondary	72	23.5
Primary	218	71.0
Illiterate	11	3.5
Occupation of >18 years	**N=308**	
	N	%
Salaried employment	15	4.9
Farmer	198	64.1
Self-employment	36	11.7
Student	17	5.5
Unemployed	11	3.6

4.2 Characteristics of Study Households

4.2.1 Characteristics of household heads

Table 3 shows selected characteristic of household heads. Majority (57.6%) of the households heads were farmers. One out of every 10 households was headed by female. Majority (89.5%) of the household heads were married. Only a very small proportion (10.4%) of households' heads had salaried employment. About 15.6 % were self-employed or engaged in small business and 13.9% were casual laborers. The others were either student (0.7%) or had no employment (1.8%).

Table 3: Selected Characteristics of Households Heads

Household heads characteristic	**% (N=144)**
Sex	
Male	90.8
Female	9.2
Marital status	
Married	89.5
Separated	2.8
Widowed	0.7
Single	6.3
Divorced	0.7
Occupation	
Salaried employment	10.6
Farmer	57.7
Self employed	15.5
Casual labor	14.1
Student	0.7
Unemployed	1.4
Education level	
Standard 1-4	5
Standard 5-8	56.8
Form 1-4	33.8
>Form 4	4.3

Although the study showed that all the household heads had some formal education, the highest education level attained by majority of the household heads was 5-8 years of primary education. Only 4.3% had attained college level of education.

4.2.2 Household food situation

4.2.2.1 Food Production and utilization

Land size and type of tenure

The average land size per household was 3.4 acres (SD=2.4) with minimum size being 0.31 acres and largest size being 15.0 acres. The mean size of land used for farming purposes was 2.4 acres (SD=1.5). Table 4 show type of land tenure. All the households had access to land for agricultural and other uses. The main type of land tenure was ownership without title deeds (60%). Only 17.9% of the study households had title deed for their land. The rest of the households under study either accessed land by renting it (6.3%) or used land owned by parents/other relatives (15.8%). Majority of the households had access to at least one piece of land. About 23.4% and 2.6% had access to 2 and 3 pieces of land, respectively. Only 0.4% of the study households had access to four to more pieces of land.

Table 4: Type of Land Tenure

Land ownership	***% of household***
Ownership without title deed	60
Ownership with title deed	17.9
Rent	6.3
Owned by parent or relatives	15.8

Eighty (85 %) of the households kept some form of livestock and over 70 % reared indigenous chicken. However, majority of the household (80.5%) ranked farm produce as main source of food while 19.5 % ranked purchase as their main source of food. Over 80 % of the study households produced maize and cowpeas. About 70 % of the households produced green gram while sorghum and beans were produce by less than 50 % of households (Table 5).

Table 5: Main Sources of Food and Type of Crops Grown and Livestock Kept by Study Households

Characteristics	**% of households (N=144)**
Sources of food	
Own farm production	80.5
Purchase	19.5
Types of crops grown	
Maize	81.9
Cow peas	81.2
Green gram	71.0
Sorghum	46.5
Beans	33.3
Types of livestock Kept	
Chicken	74
Goats	61
Cattle	33
Sheep	7

The average production level of green grams, maize and cowpeas was 3.5, 3.3 and 3.1 bags of 90 kg per household (Table 6). However almost half the green gram produced was sold compared to maize and beans which are mainly for home consumption.

Table 6: Mean Amount of Food Production and Utilization

Utilization	Green grams (90Kg bag)	Cowpeas (90Kg)	Sorghum (90Kg)	Beans (90Kg)	Maize (90Kg)
Produced	3.5	3.1	2.9	2.4	3.3
Sold	1.7	0.7	1.1	0.6	0.7
Given out	0.3	0.2	0.3	0.1	0.1
Consumed	0.7	1.3	1.0	0.9	1.3
In store	0.8	0.9	0.5	0.8	1.2

4.2.2.2 Household food consumption

Table 7 shows household mean energy and protein intake as estimated from food consumed from harvest to the time the survey was conducted. Energy and protein intake by the households was compared with household requirements on the basis of the household composition in terms of adult equivalent (AE) (Appendix 6).

Table 7: Mean (SD) Values of Household Energy and Protein Consumption

Nutrient	**Energy (Kcal)**	**Protein (g)**
[1]HH CU requirement	2.8(0.81)	2.7(0.96)
[2]HH requirement/day	8120(2356)	140.6(50.1)
[3]HH intake/day	6830.6(2246.4)	127(40.8)
[4]Intake /AE	2439.5	47.0
[5]HH CU consumed	2.4(0.81)	2.5(0.79)
[6]AE Deficit	-0.4	-0.2
% HH meeting AE	6.2	18.4

*[1]AE means Adult Equivalent. AE used for energy and protein were **2900kcal/day** (for moderately active male adult) and **52g (0.8g/kg/day)** respectively for a male adult of 65 Kg. 2900 Kcal/day or 52g/day=I CU (consumer unit). Mean household (HH) Energy and protein consumption per day for the last 3 months*

[2]the mean energy and protein required by the household per day for the last 3 months (household consumption unit multiplied by adult equivalent (AE)).

[3]the mean energy and protein consumed by the household per day for the last 3 months.

[4]the mean Energy and protein intake per household consumption unit per day (Household intake/day divided by household consumption unit/day)

[5]mean energy and protein consumer unit sustained by food consumed by the households per day for the last 3 months
[6]Energy and protein deficit by the households per day for the last 3 months(difference between HH CU requirement/day and HH CU consumed)

The mean Adult Equivalent (AE) for energy and protein consumed was significantly lower than the required AE ($t_{(143)} = -4.438$., $p<.05$) and $t_{(143)} = -3.118$, $P<.05$ respectively). Only 6.2% and 18.4 % of the households met their energy and protein requirement from the food consumed by the households. Table 8 shows the duration the remaining food stock would last assuming the stock would exclusively be used for home consumption, the household composition would remain the same and the food consumed would meet household daily energy and protein need. The energy and protein giving foods that were available in the store could only last for 1 or 2 months respectively from the time of the survey. The stock was not enough to last to subsequent harvest that was 6 months away.

Table 8: The Mean (SD) Nutrient Values in Store and Duration of Adequacy

Energy(kcal) available	**Energy required /day**	**Adequacy duration (months)**	**Protein g/AE**	**Protein(g) Required/day**	**Adequacy duration (months)**
243,600 (117,865)	2.8×2900	1	8480 (4,367)	2.7×52	2

4.2.2.3 Household Energy Adequacy and Nutritional Status of Children

The households were categorized based on their nutrient adequacy and the corresponding children's mean z-score was tabulated as shown in the Table 9. Although in all the three indicators of nutritional status the mean z-score are worse in households with inadequate energy intake, the difference was not statistically significant($p>0.05$). There was no significant

correlation between nutrient adequacy of the households and the child nutritional status (Table 21)

Table 9: Mean Z-score by Household Energy Intake Status

Household Energy intake status	**WAZ (Mean)(SD)**	**HAZ**	**WHZ**
HH with Adequate Energy intake/AE	-0.83(0.93)	-1.63(0.80)	0.07(0.98)
HH with inadequate Energy intake / AE	-1.01(1.1)	-1.65(1.0)	-0.13(1.4)

Figure in parenthesis are standard deviation

WAZ- weight-for-age z-score, HAZ-height-for-age z-score, WHZ-weight-for-height z-score

4.2.3. Household income and expenditure

Main source of income for most of the household was sale of crops (43.1%), followed by sale of livestock (27 %). The mean monthly household income in the study population was Ksh. 5214. 30 (SD= 4879.40). The minimum monthly income among the study population was Ksh. 200 while the highest income was Ksh. 20,000. Majority (58.5%) of the households earn less than Ksh. 2000 per month. Table 10 shows percentage of income spent on various household needs. Highest (68.5%) proportion of household income was spent on purchase of food among other competing needs including education (30.8%) and other non-food items (24.3%).

Table 10: Percentage of Income Spent on Various Households Need

Item	N = 144	Mean % of income
Food	142	68.5
Education	101	30.8
Non-food item	126	24.3
Rent	15	14.0
Transport	88	13.4
Farm input	78	21.4
Healthcare	108	16.2

4.2.4 Water availability, hygiene and sanitation status

Majority (63.0 %) of the households obtain water from protected boreholes during dry season as shown in the Figure 2. However during wet season the main water source was rain water, used by 60.9% of the households. Only 18.8% of the households use protected boreholes during rainy season and 0.7 % household used tap water during both season. Seventy one (71%) of the households did not treat their water. Seventy eight (78%) of those who treated their water used chemical method while the remaining 22.5% boiled their water before use.

The average amount of water for domestic use per household per day was 61.3 litres. Given the household size of five, this is about 12 litres per person per day. The average number of minutes taken to go to water sources and back including waiting time was 116 minutes (1 hour and 56 minutes).

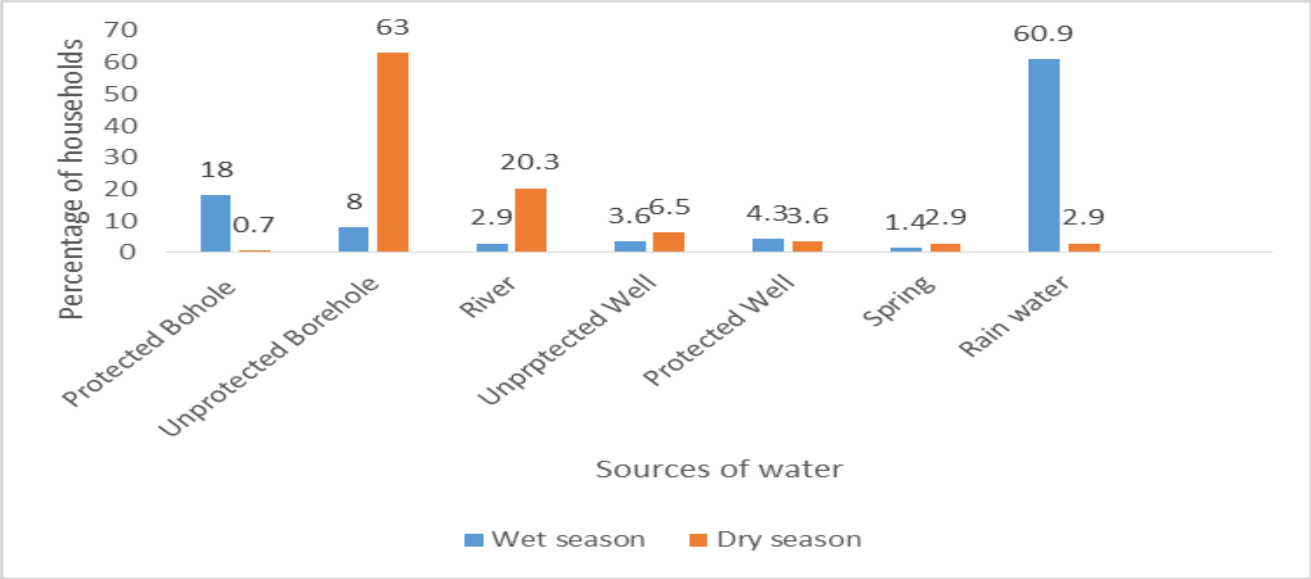


Figure 3: Distribution of Households by Sources of Drinking Water

Sanitation situation of households is shown in Table 11. Majority of the households (96.4%) of the households used traditional pit latrine and only 0.1% used flash toilet. Ten (10%) of the households did not practice hand washing. Of the remaining 89.8%, only 23.4% used water and soap while majority (52.6%) did not use any soap.

The findings revealed that 78.1% of the household burnt their refuse in pits and 6.6% buried in pits. However about 15.3% throw them in backyard. Ninety seven point one (97.1%) of the households in the study population access public hospital for treatment while only 2.9% access private hospitals. The average time in minutes taken to reach health facilities was 80 minutes.

Table 11: Sanitation Situation of Households

	Frequency	Percentage
Hand washing practices		
Yes with soap	32	23.4
No	14	10.2
Yes but no soap	72	52.6
Yes but no water	5	3.6
Yes but no water and soap	14	10.2
Mode of refuse disposal		
Burry	9	6.5
Throw in back yard	21	5.2
Burn in pit	108	78.3

4.3Nutritional Status of Children

Table 12 shows the age and sex distribution of the study children. The ratio of boys to girls was 1.4. The mean age of the sampled children was 28.4 months (SD = 17.7) with the youngest child being less than one months old and the eldest 59 months old.

Table 12: Distribution of Study Children by Age and Sex

Age in Months		**Sex of the child**		
	Male (%)	Female (%)	N	Total (%)
<6	59	41	17	12
6-11	46	54	13	9
12-23	44	56	32	22
24-35	26	74	31	21
36-47	37	63	27	19
48-59	4	46	24	17
Total	**42**	**58**	**144**	**100**

4.3.1 Underweight

Table 13 describes the prevalence of underweight as measured by weight-for-age z-scores. Underweight is defined as <-2 z scores weight-for-age, severe underweight is defined as <-3z scores weight-for-age). There was no evidence of prevalence of underweight observed among 17 children below the age of 0-6 months. However, for children aged (6-59 months), the prevalence of underweight was 18.1% of whom 12.6% were moderately underweight while 5.5% were severely underweight. There were more underweight boys than girls but a chi-square test on the difference in the prevalence of underweight between the difference gender found no significant difference ($p>0.05$). The mean WAZ was -0.99±1.10

Table 13: Prevalence of Underweight Based on Weight-for-age Z-scores by Sex

	All (n = 127) %	Boys (n = 51) %	Girls (n = 76) %
Underweight	18.1 (11.4-24.8 C.I)	21.6 (10.3-32.9 C.I)	15.8 (7.6-24.0 C.I.)
Moderate underweight	12.6 (6.8-18.4 C.I.)	15.7 (5.7-25.7 C.I.)	10.5 (3.6-17.4 C.I.)
Severe underweight	5.5 (1.5- 9.5 C.I.)	5.9 (-0.6-12.3 C.I.)	5.3 (0.2-10.3 C.I.)

C.I=confident interval

4.3.2 Chronic malnutrition (Stunting)

Table 14 describes the prevalence of stunting as measured by height-for-age z-scores. The prevalence of stunting among the children was 39%. About 28% of these were moderately malnourished while the rest (11%) were severely stunted. The prevalence of stunting was significantly higher in boys 45.1% than girls 35.5% (χ =4.720, df =1, p =.030). The means HAZ was -1.69±1.05.

Table 14: Prevalence of Stunting Based on Height-for-age Z-scores by Sex

	All (n = 127) %	**Boys (**n = 51) %	**Girls (**n = 76) %
stunting	39.4(30.9-47.9 C.I)	45.1 (31.4-58.8 C.I)	35.5 (24.8-46.3 C.I)
Moderate stunting	28.3(20.5-36.2 C.I)	25.5 (13.5-37.5 C.I)	30.3 (19.9-40.6 C.I)
Severe stunting	11.0 (5.6-16.5 C.I.)	19.6 (8.7-30.5 C.I.)	5.3 (0.2-10.3 C.I.)

C.I=confident interval

4.3.3 Acute malnutrition

Table 15 shows the prevalence of acute malnutrition by gender of the children. The prevalence of acute malnutrition was assessed using weight-for-height z-scores and presence of oedema. Global acute malnutrition (GAM) is defined as <-2 z scores weight-for-height and/or oedema, severe acute malnutrition is defined as <-3z scores weight-for-height and/or oedema)

The prevalence of GAM was 7.1%. About 5.5% of the children were moderately malnourished while 1.6% severely malnourished. The prevalence of wasting was higher in boys 9.8% than in girls 5.3% but the difference was not significant (p >0.5). The mean GAM was -0.10±1.33.

Table 15: Prevalence of Acute Malnutrition by Gender

	All (n = 127) %	**Boys (**n = 51) %	**Girls (**n = 76) %
Global malnutrition	7.1 (2.6-11.5 C.I.)	9.8(1.6-18.0 C.I.)	5.3 (0.2-10.3 C.I.)
Moderate wasting	5.5 (1.5- 9.5 C.I.)	7.8 (0.5-15.2 C.I.)	3.9 (-0.4- 8.3 C.I.)
Severe malnutrition	1.6 (-0.6- 3.7 C.I.)	2.0 (-1.8- 5.8 C.I.)	1.3 (-1.2- 3.9 C.I.)

When malnutrition levels were cross-tabulated with age cohorts, there were significant differences in prevalence of malnutrition between age groups as shown in the Table 16. Stunting was lowest in the first year of life and highest in second and third year of life while underweight and wasting was highest in the second year of life. Prevalence of underweight increased with age from the fourth year of life. No incidence of wasting was observed in the first year of life.

Although the differences in prevalence of malnutrition were higher in boys than girls in all the indicators of malnutrition in this study, the difference was significant in HAZ (P< 0.05).

Table 16: Prevalence of Global and Severe Malnutrition by Age

Age (Months)	N	WAZ		HAZ		WHZ	
		<-3 z-score %	<-2 z-score %	<-3 z-score %	<-2zscore %	<-3 z-score %	<-2z-score %
6-11	13	0	7.69	7.69	15.4	0	0
12-23	32	6.25	25	25	43.8	0	18.8
24-35	31	9.7	9.7	9.7	45.2	3.2	6.5
36-47	27	0	11.1	0	37.0	0	0
48-59	24	4.2	25	8.3	37.5	4.1	4.1
Total	127	9.4	18.1	11.0	38.9	1.5	7.1
1P-value		**.048***		**.032***		**.047***	
2P-value		**.577**		**.030***		**.858**	

WAZ- weight-for-age z-score, HAZ-height-for-age z-score, WHZ-weight-for-height z-score
1p-value is pearson chi square significant level between age groups
2p-value is pearson chi square significant level between girls and boys
** Indicate that the difference between malnutrition levels between age group and different sexes are significant at 0.05 levels of significance*

4.3.4 Mid-upper arm circumference (MUAC)

Table 17 shows the distribution of study children by MUAC. Majority of the children (61.6%) of the children had a normal MUAC measurement (>13.5). the mean MUAC was 13.8±1.4 cm. Over 18 % of the children were at risk of being malnourished.

Table 17: Distribution of Study Children According to MUAC

MUAC (cm)	Diagnosis	Prevalence
<11.5	Severely malnourished	7.2
11.5-12.4	Moderately malnourished	12.8
12.5-13.4	At risk of malnutrition	18.4
>13.5	Satisfactory nutrition	61.6

4.4 Infant and Young Child Feeding Practices

Sixty three children aged (0-23 months) were assessed for feeding practices. Of these, 27% were below 6 months of age. The mean age of the children was 11.24 months.

4.4.1 Breastfeeding and Complementary Feeding Practices (0-23 months)

Table 18 shows the feeding practices among the study children. At the time of the survey, 96.8% of children aged (0-23 months) were breastfeeding. About 67.6% of the mothers of the infants less than 2 years of age began breastfeeding in the first hour of life. Over 80% of the children were breastfed exclusively for the first 6 months after birth. A hundred (100%) of the mothers of infants continued to breastfeed their children at one year. Majority (84.4%) of the mothers reported that they breastfeed their children on demand while only 15.6% reported that they breastfeed on choice.

Eighty one point six (81.6%) of mothers of infants 6-9 months of age introduced complementary foods while 18.4% of the mothers introduced their children to complementary feeding before the age of 6 months. The mean age at which children were introduced to foods/fluids other than breast milk was 5.6 months (SD= 1.8).

Table 18: Feeding Practices among Children 0-23 Months Old

Feeding indicator	%
Child breastfeeding(62)	
Yes	96.8
No	3.2
Child given colostrum	
Yes	96.8
No	3.2
Time when the child was first breastfeed(n=62)	
Immediately	67.6
Within first day	27.1
Within 3 days	3.8
More than 3 days	1.7
Frequency of breastfeeding (n=60)	
On demand	86.7
Mother's choice	13.3
Introduction to complementary food (n=49)	
0-5 months	18.4
6-9 months	81.6
>9	0

4.4.2 Child food consumption patterns

About 68.4% of the study children were fed on solid/semi-solid diet in the previous 24hours preceding the interview while the rest (31.6%) did not. Only 64.5% of the breastfeeding children were fed on other solids /semi solid foods in the previous 24hours. A significantly higher proportion of non-breastfed children were fed on solids/semi-solid foods in the preceding 24 hours compared to the breastfed children (χ =63.059, df =1, p= 0.000). 31.8% of the children were feed 3 times. About 27.3% of the children were fed twice while 9.1% fed once. About nineteen point seven (19.7%) and 9.1% of the children were fed 4 and 5 times respectively. Table 19 describes the distribution of the study children by the number of times they were feed

in the last 24 hours preceding the survey day. There was no significant difference in the number of times a child was fed between the breastfeeding and non-breastfeeding children (χ =4.649, df = 5, p = 0.460).

Table 19: Distribution of Study Children by Number of Times Given Solid/semisolid Food in the Last 24 hours

Breastfeeding Status	**Number of times the child was given solid/semisolid food in the last 24 hour**						
	0	**1**	**2**	**3**	**4**	**5**	**Total**
	%	**%**	**%**	**%**	**%**	**%**	**%**
Yes	3.6	6.1	18.2	15.2	7.6	7.6	**58.3**
No	0.0	2.3	9.1	16.7	12.1	1.5	**41.7**

4.4.3 Dietary diversity of the children

Figure 4 shows the distribution of children by number of food group consumed within the last 24 hours. The mean dietary diversity was 4.2 food groups (SD =1.7). The minimum number of foods was 2 food groups while the maximum was 8 food groups. Most (24.2%) of the children consumed 3 food groups while only 4.7% ate foods from the 8 groups. Cereals (97%) were the highest consumed food group followed by legumes, nuts and seeds (76.8%) then milk and milk products (60.5%). The meat group was the least consumed food group (19.2%).

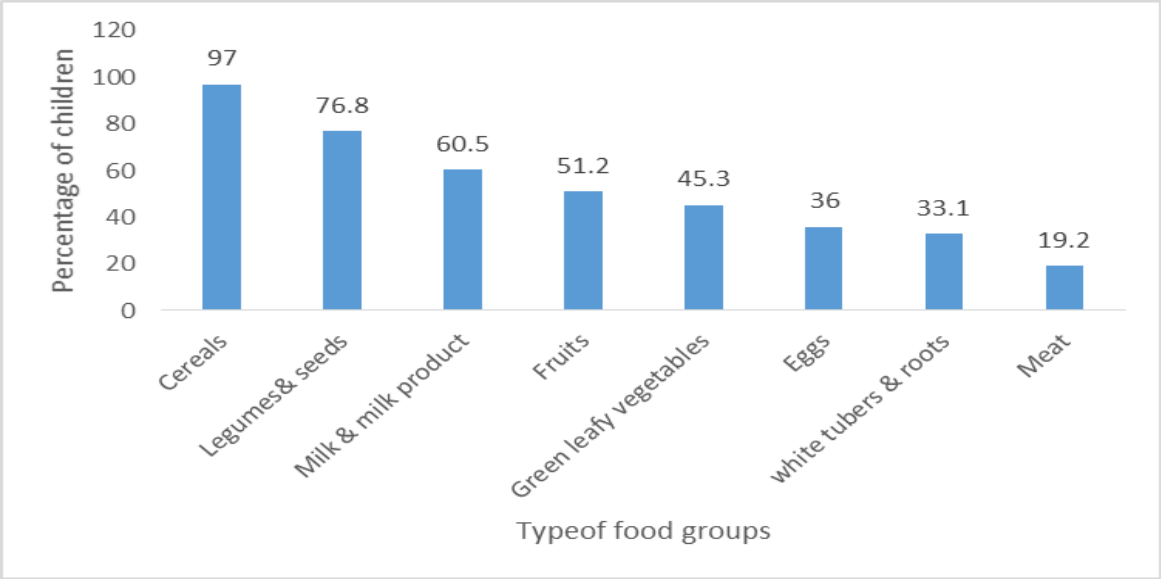


Figure 4: Distribution of Children by Food Group Consumed

Figure 5 shows the distribution of the study children by the dietary diversity scores. Forty one point nine (41.9%) of the children had low dietary diversity (< 4 food groups). About 35.7% of the children had medium dietary diversity (4-5 food groups) while only 22.5% had high dietary diversity score (6- 8 food groups). The most frequently consumed food groups were cereals, legumes and seeds, milk and milk product and fruits/green leafy vegetables. Meat was the least consumed food group. However there was no significant (P>0.05) difference between number of food groups consumed and nutritional status of children. (Table 21).

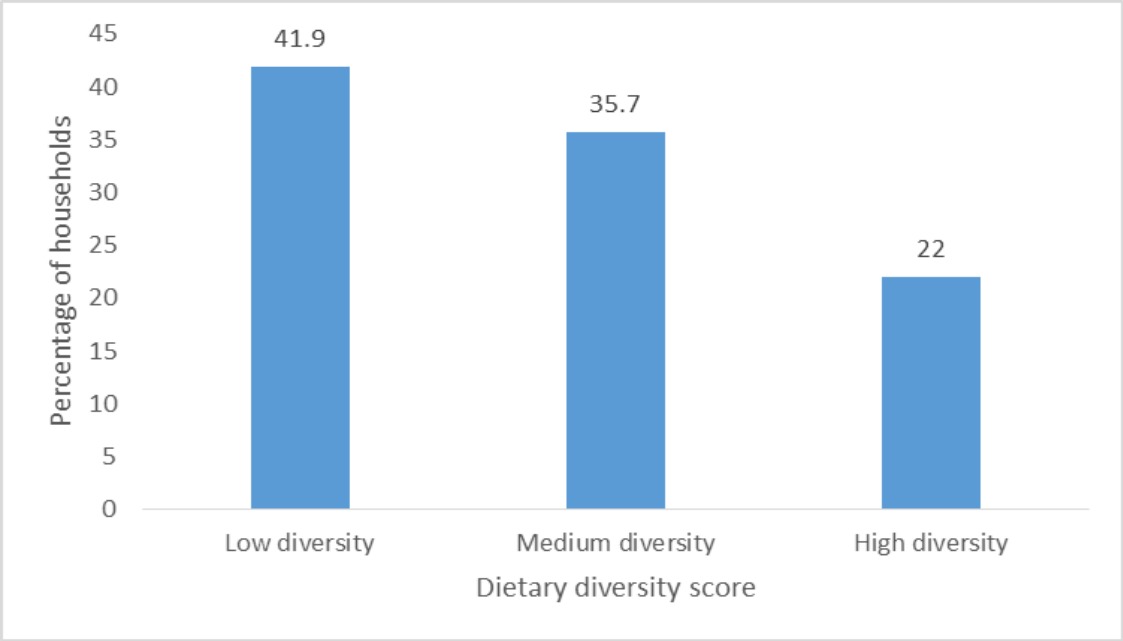


Figure 5: Distribution of Study Children by their Dietary Diversity Scores.

In all the indicators there was no significant association between nutritional status and infant and young child feeding practices ($p>0.05$). (Table 21).

4.5 Child Health Status

4.5.1 Immunization status of the children

The figure 5 shows the vaccination status of the children. The study revealed that 90.8% of the children were fully immunized while the rest (9.2%) had not received all the recommended vaccines. All the children had received the OPV1 and DPT1 vaccines. Ninety five point eight (95.8%) received the BCG vaccine. Pneumococcal vaccine 3 was received by the least number of children (54.1%). The dropout rate for OPV (3.7%), DPT-HepB-Hib (1.5%) and Pneumococcal vaccine (7.5%) respectively.

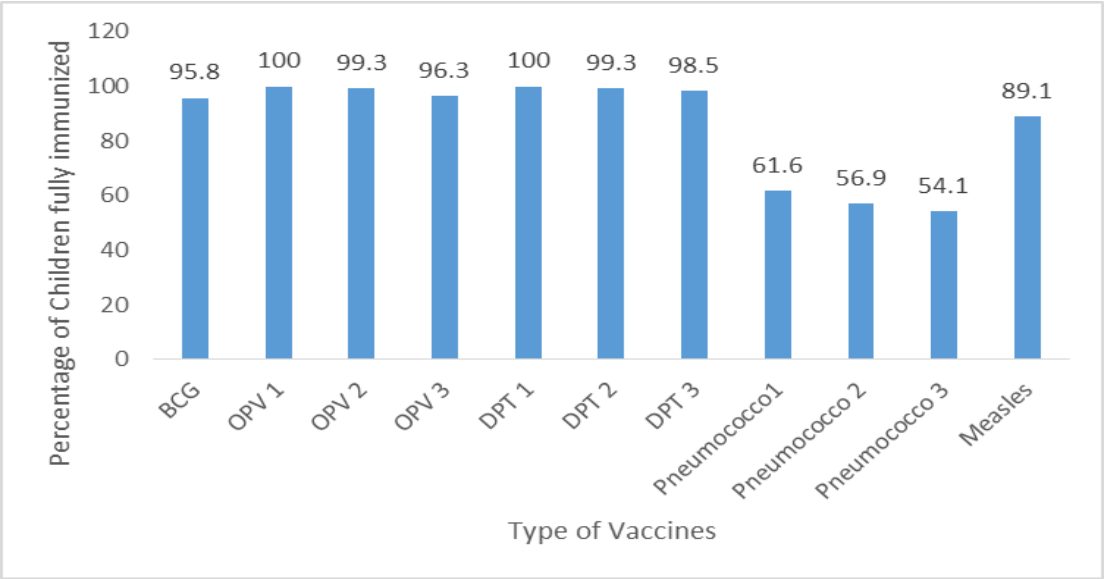


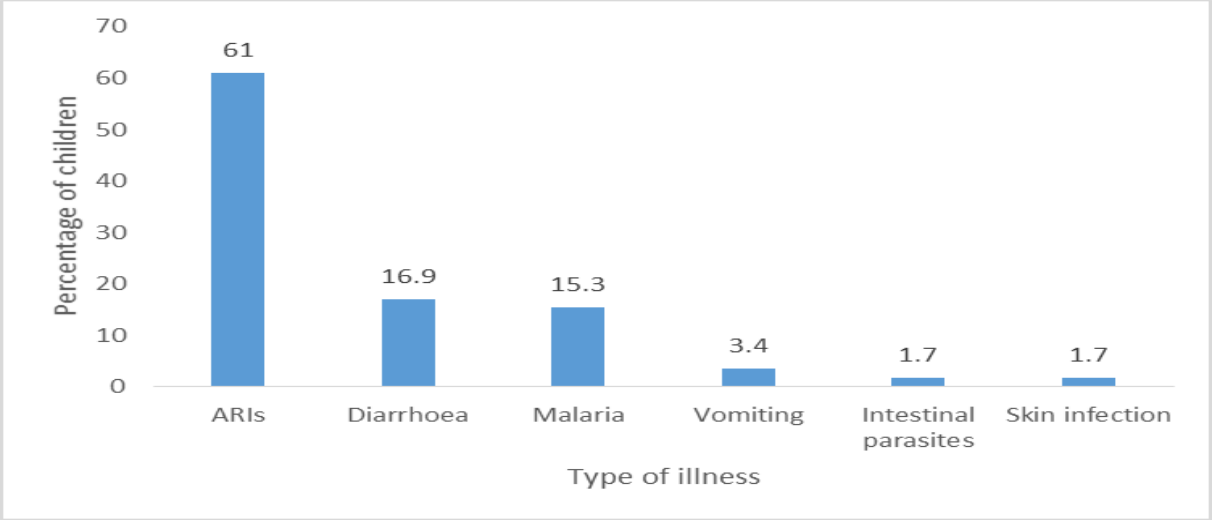
Figure 6: Immunization Coverage of Children 12-24 Months Old

According to immunization cards records, about 72.8% of the children had received vitamin A supplementation in the last 6 months preceding the survey time. Only 42.7% of the children had received deworming drugs in the last 3 months preceding the survey.

4.5.2 Morbidity experience among children

Figure 7 shows the prevalence levels of the different illnesses among the study children. About 41% of the respondents reported that their children had experienced one or more form of illness in 14 day period preceding the survey time. Acute respiratory illnesses (cough, fever and difficulty breathing) was reported by most of the respondents (61.0%) followed by diarrhea (16.9%), malaria (15.3%), vomiting (3.4%); and intestinal parasites and skin infections with 1.7% prevalence each. There was significant positive association between morbidity status and prevalence of wasting and stunting. However the association was only significant in wasting (X^2=5.402, df=1, p=0.020). Although there was no direct significant association between

morbidity and nutritional status, there was significant difference in prevalence of morbidity among those who practice hand washing with soap and those without, (X^2=9.746, df=4, p=0.045).



ARI-Acute Respiratory Infection

Figure 7: Prevalence of Illness among Children Under Five Years

4.5.3 Health seeking behavior

Most (91.4) of the children who had reported signs of illness reported that they sought assistance from different sources. The rest (8.6%) did not seek any assistance. Majority of the respondents said they sought help from a public health facility (77.6%) (Table 20).

Table 20: Distribution of responded by health seeking behavior

Assistance	Percent
Public health facility	77.6
No assistant sought	8.6
Shopkeeper	5.8
Community health worker	3.4
Private clinic/Pharmacy	3.4
Traditional healer	1.7

4.6 Factors Associated with Nutritional Status of Children

4.6.1 Socio-demographic factors and nutritional status of the children

Bi-variate analysis was performed on various selected variables with nutritional indices of the children to determine possible associations (Table 21). A significant positive and linear relationship was found to exist between underweight, stunting and wasting among the children under five years after an inter-variable Pearson correlation analysis. Negative and significant correlation was observed between children's age and nutritional status based on wasting and underweight (r= -0.243 and r=-0.296 respectively). Household size was positively and significantly correlated to stunting and wasting (r=0.410, r=0.402 respectively). Household size was also positively and significantly correlated with total land size owned and size of land farmed on by the household ($p<0.05$). However, there was no significant relationship ($p>0.05$) between amount of food produced (kg), protein and energy consumed by the household and size of land farmed on by the household.

There was no significant relationship between the three indicators of nutritional status (HAZ, WAZ and WHZ) and gender, marital status and education level of the household head. Similarly, there were no direct significant associations between household income and nutritional indicators (HAZ, WAZ and WHZ). However, there was a significant association ($p<0.05$) between number of food groups consumed and household income. Household income was also significantly and positive related to proportion of income spent on purchase of food (r=0.492, p=0.000). These are indications that any extra shilling earned is spent on buying food for the household.

Table 21: Pearson correlation coefficients of selected variables and nutrition status

Variables	**WAZ**		**HAZ**		**WHZ**	
	R	**p**	**R**	**p**	**r**	**p**
Age in months	-.296**	.007	.544	.395	-.243*	.046
Sex of the child	.083	.356	.143*	.030	.004	.966
household heads education level	-.045	.242	.036	.109	-.052	.542
Education level of the mother	.088	.325	.126	.159	.018	.845
Household size	.611	.460	.410*	.047	.402*	.041
Number of good groups consumed	.501	.341	.231	.237	.054	.112
marital status of household head	-.92	.046	.015	.365	-.014	.101
Gender of the household head	-.91	.056	.013	.399	-.013	.112
Household Kcal adequacy	.030	.737	.010	.910	.049	.582
Morbidity status	.159	.073	.036	.684	.173*	.040
Water treatment	.044	.625	-.193	.321	.182	.421
Exclusively breastfed	-.06	.726	-.100	.330	.236	.132
Introduction to complementary feeding	-.042	.540	-.057	.652	.441	.069

** Correlation significant at 0.01 levels (2 tailed). *Correlation significant at 0.05 levels (2 tailed)

WAZ- weight-for-age z-score, HAZ-height-for-age z-score, WHZ-weight-for-height z-score

4.6.2 Morbidity, water, sanitation and nutritional status

A child who was sick two weeks prior to the survey was more likely to be wasted than a healthy child (Odds Ratio; 1.56, CI: 0.6-5.76). There was no direct relationship between water treatment, use of source of drinking water and nutritional status ($p>0.05$). However there was OR of 1.11 of a child getting sick from household with no proper hand washing practices.

CHAPTER FIVE

5.0DISCUSSION

5.1 Demographic and Socio-economic Characteristics of Study Households

The size of the household (4.7) in Mbeere South Sub County is close to national average for rural area of 4.6 (KNBS and ICF Macro, 2010). The sex ratio (male: female, 1:1.1) of the study population is similar to national trend where women are more than men. Almost half of the population is below 15 years and the average age of the study population is 20 years. The fact that 55.2 % of the population was below 18 years means that dependent population outweighs the productive population. This youthful age structure is typical of populations with high fertility and high mortality rates (Masci, 2006). High number of dependent population places heavy burden on the independent population in provision of basic needs such as nutrition, education and special health care.

5.1.1 Household food situation

Majority of the households depend on sale of crops as their main source of income from which they earn below one dollar a day. This implies that they do not have the power to access adequate food even when food is available in the market.

Ideally farming households are expected to be food secure. However, from the dietary adequacy assessment, only 6.2% and 18.4% of household meet their energy and protein requirement respectively from their own production. The study also shows that on average almost 70 % of

household income is spent on food purchase among other competing needs. The household income is inadequate; therefore poor households are spending 2/3 of their income on basic need like food indicating that they are food insecure. At this point we can also speculate that most households complement their diet largely by purchased food.

5.1.2 Water availability, hygiene and sanitation status

Water supply, sanitation and hygiene have direct impact on diseases especially diarrhea and therefore are important for preventing malnutrition. When people are exposed to high levels of infection due to unsafe and insufficient water supply and inadequate sanitation, their nutrition status is compromised (WHO, 2001).

The finding of this study shows that about 90 % of the households in the study population rely on unsafe water supply from unprotected water sources. The fact that water treatment is also not a common practice; the household members could be at high risk of water borne diseases. with the daily average amount of water for domestic use being 61.3 litres per household and considering the house hold sizes this study population, majority (62.5%) of the household access less domestic water than the recommended amount of 15 litres per person per day as stipulated in SPHERE standards (SPHERE, 2011). The time used to fetch water is rather long and involving. Moreover mothers spend most of their time away fetching water for household use rather than staying home taking care of their children. This situation not only jeopardizes the hygiene standard and increasing the risk to infectious diseases among the children but also child care practice. Poor water and sanitation situation has also been reported by other studies in Ethiopia (Aweke et al., 2012, Andrew et al., 2008)

5.2 Nutritional Status of Children

Analysis of nutrition status in this study is according to the new WHO, 2006 standard. Nutritional status of children under five years of age is an outcome of immediate, underlying and basic causes of malnutrition (UNICEF, 1998).

The finding of this study shows that generally, prevalence of stunting and underweight is higher but prevalence of wasting is similar to national average reported by KDHS (KNBS and ICF Macro, 2010). Prevalence of stunting and underweight is lower but wasting is similar to average for Eastern province. There is no evidence of overweight in the area.

The prevalence of underweight (18.1%) and stunting (39%) is higher than that reported by Kenya demographic health survey (KDHS) for national average of 16% and 35% respectively. These high levels of malnutrition qualify the area to be classified as chronic food insecure area according to the FAO /FNSAU integrated food security phase classification of 2006.

According to WHO classification for assessing severity of malnutrition in the population, prevalence of stunting (39%) is high. Besides, this translates to 39% stunted children who are unlikely to grow to their full potential both physically and mentally due to under-nutrition. The process of becoming stunted, due to restricted nutrient supply and/or frequent infection, is likely a common cause of both short stature and structural and functional damage to the brain, resulting in delay in the development of cognitive functions as well as permanent cognitive impairments (Kar *et al*. 2008, Kathryn and Khadija, 2011).

The observation that the prevalence of stunting in the first year of life is low is similar to that from the finding of a survey conducted earlier in 2008 in Mbeere Sub County (KNBS, 2009b) and Makueni District (Macharia et al., 2005); whereby the prevalence of stunting was highest among children 12-35 months. This could be attributed to poor weaning and complementary feeding practices resulting into inadequate energy and protein intake. The poor feeding practices may be due to either lack of knowledge by the mother or lack of adequate food.

The finding that prevalence of stunting and wasting is higher in male than female concurs with that of national prevalence indicated in Kenya Demographic Health survey (KNBS and ICF Macro, 2010). Other studies are required to explain the relationship between sex and nutritional status which is an important phenomenon as far as understanding malnutrition is concerned.

5.3 Infant and Young Child Feeding Practices

UNICEF and WHO (2012) recommends that children be exclusively breastfed for the first six months of life and children be given solid or semi-solid complementary food in addition to continued breastfeeding from 6 months to 24 months or more when the child is fully weaned. Furthermore early initiation of breastfeeding, exclusive breastfeeding for six months, and timely introduction of age-appropriate complementary feeding are the key interventions to achieve the Millennium Development Goal 1 and 4, which address child malnutrition component of the targets and mortality respectively (Bhutt et al., 2008).

In this study 80 % of the children are reported to have been exclusively breastfed. This proportion is higher compared to national rate of 32 % reported in KDHS (KNBS and ICF

Macro, 2010). Although 67.6% of children are introduced to breast within 1 hour of life and majorities (86.7%) of them are breastfed on demand, over 18% are introduced to complementary feeding earlier than recommended period of 6 months. Despite the self-reported rate of exclusive breastfeeding in the area, the level of malnutrition in the area is highest among the older children 6-59 months old.

In the developing world, lack of dietary diversity is a critical issue where diets consist mainly of starchy staples, with less access to nutrient-rich sources of food such as animal proteins, fruits and vegetables (World Bank, 2007). This is particularly true as evidenced by this study where majority of the children (41.9%) consume low dietary diversified (<4 food groups) diet comprising mainly of cereals and legumes and low consumption of animal protein. While the intake of energy is important in diet, other nutrients such as vitamins, proteins and minerals are also necessary for healthy living. Nutritional wellbeing is determined by the proportion of essential nutrient in the diet. Micronutrient deficiencies are common even in areas where macronutrient intake is adequate and stable. Hence food diversity in the diet is an important factor in nutrition security (FSNAU, 2003).

Variety of food in the diet also influences food utilization in the body. Due to inter-nutrient interaction, absorption of some food may be enhanced by others for instances fruits and vegetables enhance absorption of some micronutrients in cereals and legumes. The monotony of the diet which is evident in this study may limit the kind of nutrient interactions required for food utilization by the body resulting to inadequate nutrient balance, hence negatively affects nutritional status. Dietary diversity is known to vary across seasons depending on seasonal

availability of food depending as described by FAO (2008). This study was conducted between July and August, two months after the harvest. However apart from the major household staple foods stocks, the households rely on market supplies for fruits and vegetables. Access to this type of food therefore entirely depends on households' purchasing power at the time.

5.4 Child Immunization and Morbidity Status

The millennium Development Goal (MDG) No. 4 aims at reducing child mortality by two third between 1990 and 2015. Immunization plays a key role towards achieving this goal. Immunization coverage for all antigens except the pneumococcal vaccine was higher compared to national coverage according to Kenya demographic health survey (KNBS and ICF Macro, 2010). In Kenya, official launching of the pneumococcal vaccine was in 2011 making it comparatively new. Therefore, there was no baseline data to compare the coverage of pneumococcal vaccine in the study population. About 4% of the children did not receive BCG vaccine probably due to home delivery.

The high prevalence acute respiratory infection (ARI) (61%) among the study children could be due to the smoke from the firewood commonly used for cooking compounded with the high level of malnutrition and poor dietary diversity. ARI is one of the leading causes of childhood morbidity and mortality throughout the world (KNBS 2010). The risk factors for acquiring respiratory infections are poverty, restricted family income, low parental education level, lack of breastfeeding and, most importantly, malnutrition (Cashat-Cruz et al., 2005)

Diarrheas prevalence of 17% is higher compared to 14 % prevalence in previous survey conducted in the same area (KNBS and ICF Macro, 2010) and 7% in survey conducted in Ijara District, Eastern province (John and Charles, 2011). This could be due to high prevalence of usage of unsafe water and generally poor hand washing practices observed in this study. Only 42.7 % of the children were dewormed 3 months prior to the survey. Children who are not dewormed regularly are prone to worm infestation. Based on poor water and sanitation situation of the households as discussed earlier in this chapter and poor deworming rate (42.7%), worm infestation is a likely phenomenon among the children; however, it was beyond the scope of this study to establish these factors through laboratory diagnosis.

5.5 Factors Associated with Nutritional Status

The negative and significant relationship observed between children's age and nutritional status based on stunting and underweight could be explained by the fact that as the child grows older he/she becomes more dependent and access different food than the younger infant who depends on what is provided by the caregiver/mother (Meme, 1996). However, in this study the prevalence of wasting and underweight seem to increase after the 48 months of age. This is probably due to increased physiological activities of the child at this age which may necessitate more nutrient intake to support growth and development. Children at this age are outside homes either in school or playing, failing to feed regularly to replenish their energy.

Lack of relationships between the nutritional status and gender of the household head as well as their education level could be attributed to the fact that the overwhelming majority of the

household heads were of the same gender (male) and also similar education level to impact difference in nutritional status.

The negative significant relationships among household size and stunting and wasting could be explained by the fact that the family meal is distributed among large numbers of household members resulting to inadequate diet for an extended period eventually causing chronic malnutrition (Macharia et al., 2005).

Contrary to other studies (Onyango et al., 1998; Ruel, 2002), this study did not find significant association between nutritional status and dietary diversity. Thus, malnutrition in this area might be caused by other factors other than just having a diversified diet. Additional studies are required to explain cooking method and caloric adequacy of the complementary foods consumed by children in the study area. The high consumption of food items from mainly cereals observed in this study only confirms that the diets of the children were predominantly based on starchy staples. Besides lacking adequate nutrient, it is also possible that the quantity of carbohydrates obtained from these cereals group was still not adequate to meet the macronutrient needs of the children. From personal observations, the diet of children below two years mainly comprised of starchy staple (mashed banana and potatoes). While the intake of energy is important in diet, other nutrient such as vitamins, proteins and minerals are also necessary for healthy living. Moving from a monotonous diet to one containing a more diverse range of foods has been shown to increase intake of energy as well as micronutrients in developing countries (Gina et al, 2007). Although legumes, nuts and seeds were the second most popular food groups after cereals, the benefit from consumption of these food groups was not evident in determining nutritional status

in this study probably because other factors like quality of the diet, quantity of food consumed and utilizations by the body are also determinant factors.

There was no direct significant relationship between nutritional status in terms of W/A, W/H and H/A and energy adequacy. Household adequacy did not translate to individual energy adequacy and hence better nutrition probably because food often may not be distributed equally within the family. Furthermore, energy contribution from food purchased by the household was not determined and it may be a major contributor if high proportion of income spent on food observed is anything to go by.

CHAPTER SIX

6.0 CONCLUSSION AND RECOMMENDATION

6.1 Conclusion

The study established that malnutrition is high among children under five years, with risk being highest among those who were between the ages of 12-36 months of life. These high levels qualify the area to be classified as chronic food insecure area. The high self-reported level of exclusive breast feeding does not translate into improved nutritional status in older children.

There is high morbidity experience, generally due to poor sanitation and high incidence of use of unsafe water in the area. Food production among the study household is inadequate, due to farming on small pieces of land (2 acres) and low rainfall, limit their capacity to produce enough food. Diet diversity is poor comprising mainly starchy food followed by legumes. Households depend on market supply for their vegetable and fruits and therefore ability to acquire them entirely depends on purchasing power. Therefore, malnutrition among children under five years in Mbeere South Sub-county is indicative of chronic food insecurity situation. Large households size and morbidity experience are important associated factors.

6.2 Recommendation

Since most households complement their diet largely by purchased food, the types and the amount of food purchased for consumption and their contribution to the family dietary requirement need to be established. There is also need to explore the seasonality changes in energy and protein availability from farm produce and food purchase to get real food security situation in the area.

The problem of food insecurity could be tackled through multisectoral approaches that address different household dynamics including food security, health, nutrition and water/sanitation. Agricultural projects should therefore integrate health and nutrition components during planning to develop focused interventions aimed at improving nutrition, health and food security of the households. It is therefore recommended that the planned project/programme for Mbeere South Sub County should make provision for such integration and collaboration with the relevant sectors including health and water. Provision of nutritional education to the community members is also essential to address malnutrition.

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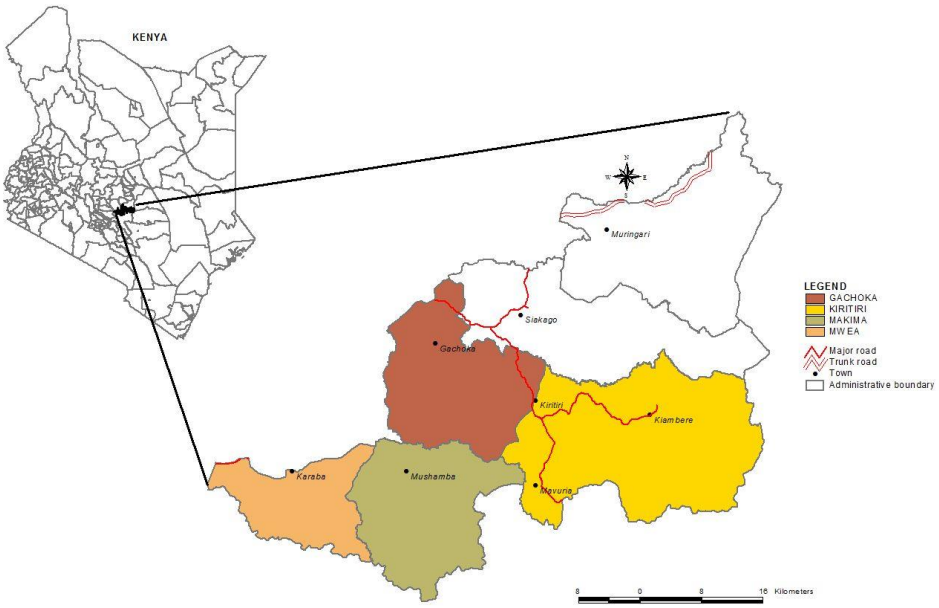
APPENDICES

Appendix 1: Map of Mbeere sub-county - Showing the study area



Location of Mbeere South Sub-county

Appendix 2: Questionnaire

IDENTIFICATION
Household No. HHID: _____Questionnaire Serial Number_____.
Date :(dd mm yy): _____
Supervisor: _____
Enumerator's name: _____
District: _____
Division: _____
Location: _____
Sub-Location: _____
Village: _____
Name of farmers' group: _____

DEMOGRAPHIC AND SOCIO-ECONOMIC CHARACTERISTICS
Name of Respondent: _____
Marital status of respondent: _____
Codes: 1=Married; 2=Separated; 3=Widowed; 4=Single; 5=Divorced
Year of birth of respondent: _____
Relationship of the respondent to the household head: _____
Codes: 1=House hold head; 2=Spouse; 3=Son; 4=Daughter; 5=Grandson; 6=Granddaughter; 7=Parent; 9= Employee

1. Household profile

S/No	Name	Sex M=1 F=2	Year of birth	Level of Education	Main Occupation
Parents					
1: Household head					
2: Spouse					
Children					
3					

Codes:

Main occupation	Education levels	
1=salaried employee	0= Pre school	12=Form 4
2=farmer	1=std 1	13= Form 5
3=self employment	2=std 2	14= Form 6
4=casual labourer	3=std 3	15= College Yr 1
5=student	4=Std 4	16= College Yr 2
6 = unemployed	5=Std 5	17= College Yr 3
7 =others (specify)	6=std 6	18= College Yr 4
	7=Std 7	19= Univ yr 1
	8=Std 8	20= Univ yr 2
	9=Form 1	21= Univ yr 3
	10= Form 2	22= Univ yr 4
	11= Form 3	23= Univ yr 5 and above

2. What is your average household income per month? _____

3. Did you receive remittances or pensions in the last 12 months? 1. Yes [ ] 2.No [ ]
4. If yes, how much do you receive per month? _____

5. What are your other important sources of income?

Source of income	1=Yes; 2=No	How much per month
Sale of crops		
Sale of livestock		
Sale of livestock products		
Petty trading		
Donations/Borrowing		
Charcoal burning		
Sand harvesting		
Others, specify		

6. How much do you spend on the following household items per month?

Expenditure	Amount
Food	
Education	
Non-food items e.g. clothing	
Rent	
Transport costs	
Cost of health care	
Farm inputs	
Labour	
Others, specify	

7. What types of materials make the walls, roof and floor of the main house? (Make observation as much as possible)

Walls	Roof	Floor
Codes: 1=Mud; 2=Wood; 3= Iron sheets; 4=Bricks 5=Stone; 6=Others (specify)_____	Codes: 1= Grass thatch; 2= Iron sheets; 3= Tiles; 4= Others (specify)_____	Codes: 1=Mud; 2=Wood; 3=Concrete; 4=Other (specify)_____

PRODUCTION INFORMATION
1. How many pieces of land holding do you use? _____
2. How many acres in total land holding do your household own? _____
3. How much land do you farm on? _____

4. Please indicate the type of tenure for each piece of land used.

Land Pieces	Type of tenure	Codes
Piece 1		1=Owned with title deed; 2=Owned without title deed; 3=Rented; 4=Owned by parent/ relative; 5=Government/Communal/Co-operative
Piece 2		
Piece 3		
Piece 4		
Piece 5		

3. If you planted any of the following crops in the last season kindly fill in the table below

Crop/Varieties	Area planted (Acres)	Watering system 1.Rain fed 2. Irrigated	Land preparation type 1.Manual 2.Oxen 3.Tractor	Seed Type 1.Purchased new hybrid 2.Retained hybrid 3.OPV (Local variety) 5.Improved local variety 6. Improved vines	Harvest Quantity		Sales Quantity		Price of sales		Amount given away		Amount Consumed		Amount of loss during storage		Total (Kgs)
					Qty	Unit	Qty	Unit	Qty	Unit	Qty	Unit	Qty	Unit	Qty	Unit	
Green grams																	
1=N26 (Nylon)																	
2=Local																	
Cowpeas																	
1=K80																	
2=M66																	
3=KVU																	
4=Local																	
Sorghum																	
1=Gadam																	
2=Serena																	
3=Local variety																	
Dolichos (*Njahi/ Njavi*)																	
1=DL001																	
2=Local variety																	
Sweet potatoes																	
1=Kemb 10																	
2=Bungoma																	
					Quantities: 1=kg; 2=Gorogoro 3=Sack; 4=Debe												

4. Did you own livestock?
5. If Yes, please complete the following table on the households livestock activities over the past 12 months.

		Number owned	Owned by : 1=HH Head 2=spouse, 3=joint, 4=Others	Current Value Per Unit (Ksh)	Number Consumed (Last one year)	Number Sold (Last one year)	Average Unit Price When Sold (Ksh)
Type of livestock		NumOwn	Ownby	CurVal	Consume	Sold	Avgpric
Grade cow	1						
Grade bull	2						
Grade calves	3						
Cross cow	4						
Cross bull	5						
Cross calves	6						
Local cow	7						
Local bull/oxen	8						
Local calves	9						
Sheep	10						
Goat	11						
Goat(dairy)	12						
Chicken-indigenous	14						
Chicken-improved	15						
Ducks/Geese	16						
Turkeys	17						
Pigs	18						
Rabbits	19						
Doves/Quail	20						
Donkey	21						
Other livestock	22						

WATER AND SANITATION

1. What is your main source of drinking water during the wet season? _____
   1 =Tap
   2 =Borehole (protected)
   3=Borehole (not protected)
   4=River
   5= Well (not protected)
   6= Well (protected)
   7 = spring
   8 =rain water
   9= Others (specify) _____

2. What is your main source of drinking water during the dry season? _____
   1 =Tap
   2 =Borehole (protected)
   3=Borehole (not protected)
   4=River
   5= Well (not protected)
   6= Well (protected)
   7 = spring
   8 =rain water
   9= Others (specify) _____

3 Do you treat your drinking water? _____ 1=Yes 2=No

4 If Yes, how do you treat your water? _____
   1=Boiling
   2=Use traditional herbs
   3=Use of chemicals (water guard)
   4=Filters/sieves
   5=Others (specify).....

5 Presently, how much water do you use for domestic purposes in litres per day? _____

6 How long does it take you to get to the water source and back including waiting time? _____minutes

7 Which means of transport do you use to get there? _____
   1 =Walking
   2 =Bicycle ride
   3 = Matatu ride
   4 = Motorcycle
   5 = Cart
   6 = Others (specify) _____

8 What kind of toilet facility does your household have? _____
   1= Flush toilet
   2=Traditional pit latrine
   3= Ventilated improved latrine
   4= None/Bush/Field
   5= Digging a hole
   6=other (specify).....

9 Is there a hand washing facilities with soap near the toilet? _____
   1=yes with soap 2=No 3=yes but no soap 4=yes but no water 5=yes but no water and soap

10 How do you dispose off your refuse? _____1=Bury 2=Throw in backyard 3= Burn in pit
   4=others(specify) _____

11 What health care facilities/services do you have access to? _____
   1=Public hospitals/health centre 2= Private hospitals/health centre 3=None 4= Others (specify)

12 How far is the health facility, where you get your services? ---------- minutes

13 Which means of transport do you use to get there? _____
1=walking 2=Bicycle 3= Matatu ride 4=Motorcycle 5=cart 6= others(specify)

INFANT AND YOUNG CHILD FEEDING PRACTICE

1. Name of the child _____

2. Name of mother_____

3. Name of the father _____

4.Date of birth of the child_____

5. Did you give colostrum to (NAME)? _____1=Yes; 2=No
6. When after birth did you first put [NAME] to the breast _____

   1=Immediate (within 1 hr)

   2= Within first day

   3- Within first 3 days

   4=More than 3 days

   5= Don't know

   6= Other –specify_____
7. Is [NAME] still being breastfed? _____1=Yes; 2=No
8. If No, at what age did the child stopped breastfeeding? _____
9. If YES, how often do you breast feed [NAME]? _____1= On demand; 2= Own (mothers) choice; 3= Others (specify)_____
10. Did you give the following to [NAME] in the last 24 hours (Multiple choices allowed)

    1= Breast milk

    2= Water

    3= Milks (cow/goat/camel/pkt of milk)

    4= Porridge

    5= Vegetables/fruits

    6= Other solid/ semi- solid foods

    7= Other (specify) _____
11. If [NAME] received solid/semi- solid foods in the last 24 hours. How many times? _____
12. At what age was the child first given water/ food other than breast milk? _____

DIETARY DIVERSITY

1. Was yesterday a feast day or celebration day where you ate something unusual? 1=Yes; 2=No
2. If no, did the child consume any of the following food groups from yesterday to day at the time of the survey?

Food group	Examples	1-Yes; 2=No
Cereals	Bread, millet, sorghum, maize, rice, wheat *e.g. ugali, porridge or pastes or other locally available grains?*	
White tubers and roots	White potatoes, white yams, cassava, or foods made from roots?	
Dark green leafy vegetables	Dark green/leafy vegetables, including wild ones + locally available vitamin-A rich leaves such as cassava leaves etc?	
Fruits	Ripe mangoes, papayas, water melon, oranges, bananas, lemon, wild fruits?	
Meat	Beef, pork, lamb, goat, poultry, rabbit, wild game, chicken, duck, or other birds?	
Eggs	Eggs	
Fish/sea food	Fresh or dried fish or shellfish?	
Legumes, nuts and seeds	Beans, cowpeas, green grams, peas, lentils, nuts, seeds or foods made from these?	
Milk and milk products	Milk, cheese, yogurt or other milk products?	
Sugar and honey		
Oils and fats	Oil, margarine, fats or butter added to food or used for cooking?	
Miscellaneous	Spices, chocolate, sweets, beverage etc?	

IMMUNIZATION AND MORBIDITY OF CHILDREN

1. (Ask the mother and confirm the following information on immunization status of the child from immunization card)

If there is no card please comment and use recall:

S/ No	Sex 1= M 2= F	BCG scar present? 1=Yes 2=No	Pentavalent (OPV)			DPT Vaccines			Pneumococco Vaccines			Measles 1=Yes 2=No 3=Don't know	Vitamin A supplementation
			OPV 1 1=Yes 2=No 3=Don't know	OPV 2 1=Yes 2=No 3=Don't know	OPV 3 1=Yes 2=No 3=Don't know	DPT 1 1=Yes 2=No 3=Don't know	DPT 2 1=Yes 2=No 3=Don't know	DPT 3 1=Yes 2=No 3=Don't know	1 1=Yes 2=No 3=Don't know	2 1=Yes 2=No 3=Don't know	3 1=Yes 2=No 3=Don't know		

2. Has the child been de-wormed in the last 3 months? 1=Yes; 2=No; 3= Don't know
3 Has the child been sick in the last 2 weeks? 1=Yes 2=No
4 If YES, what was the child suffering from? (More than one responses possible) _____
   1= Diarrhea
   2=Vomiting
   3=Fever with chills like malaria
   4=Fever, cough, difficulty in breathing
   5=Intestinal Parasite
   6= Measles
   7= Eye infections
   8=Skin infections
   9= Accident
   10=Malnutrition

11=Stomachache
12=Toothache
13=other (specify)

5 When the child was sick where did you seek assistance? (More than one response possible)
1=Traditional healer
2=Community health worker
3=Private clinic/ pharmacy
4=Shop/keeper
5=Public health facility
6=Mobile clinic
7=Relative or friend
8=No assistance sought

ANTHROPOMETRY

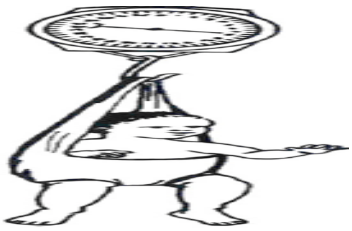
1. Child measurements

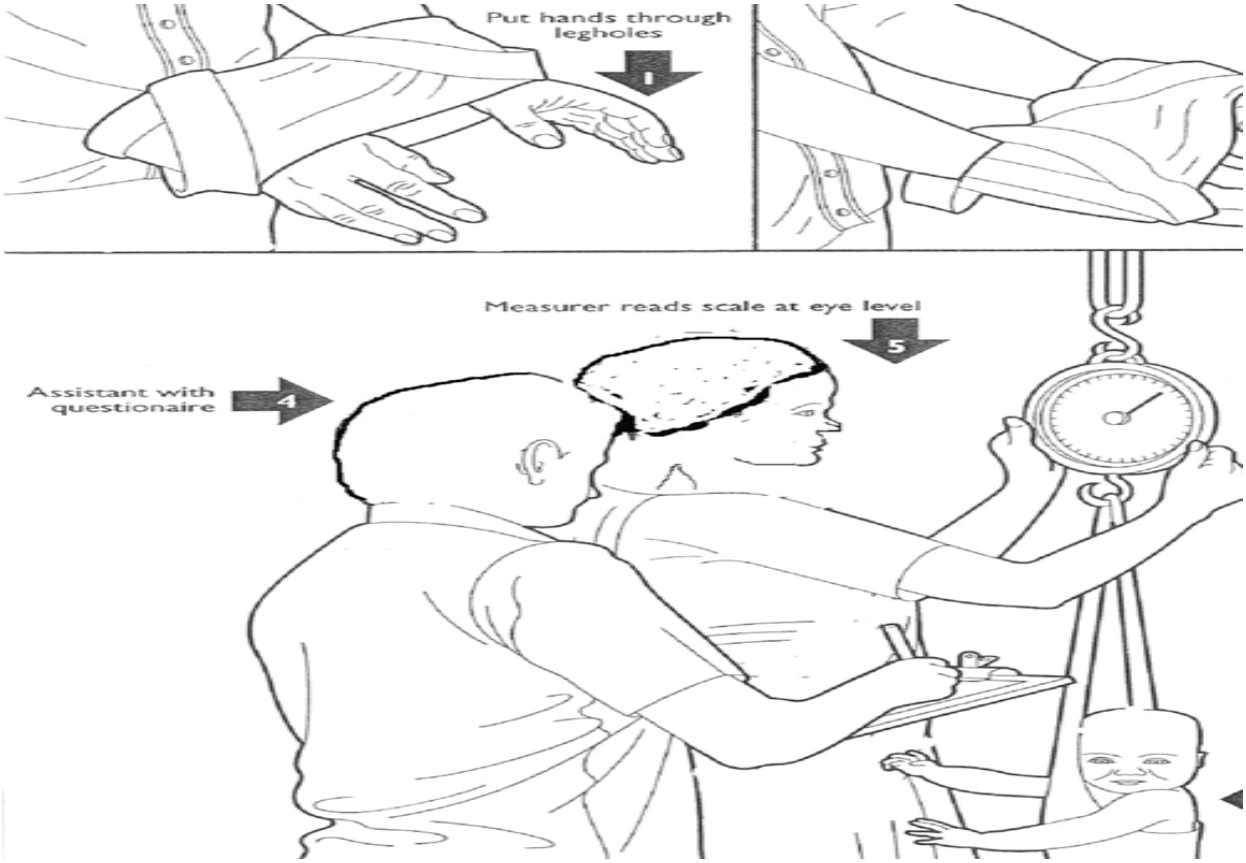
S/N	Child's Birth order	Child's name	Child sex 1=M 2=F	Date of birth(Verify from clinic card)	Age (mths)	Weight(Kg) (*to nearest 0.1 kg*)			Height(cm) (*to the nearest 0.1 cm*)			Oedema 1=yes 2=No	MUAC (cm)		
						1st	2nd	Aver.	1st	2nd	Aver.		1st	2nd	Aver.

Appendix 3: Field assistant training program

Day 1				
Time	Objective	Subject	Learning method	Learning aids
8.00-8.30	Climate setting and introduction	Participants and facilitators introduce themselves		
8.30-9.00	Purpose and objective of the study	Problem statement Purpose of the study Specific objective	Lecture, discussion, questions and answers	Flip charts, handout
9.00-10.00	Expected output of the study	Anthropometric and non anthropometric data	Lecture discussion, demonstration, questions and answers	Flip charts, handout
	10.00-1.30 B R E A K			
10.30-11.00	Study ethics	Seeking consent from the respondent	Lecture questions and answers	Flip charts, handout
11.00-12.00	Interpreting and administering questionnaires	Demonstrate how to ask questions, observation	Lecture, question and answers	Flip charts, handout
12.00-1.00	Measuring and recording weight, height /length and MUAC	Standardizing tools positioning the child on the height/length board, scale reading measurement	Lecture and demostration	Flip charts, handout
1.00-2.00	L U N C H			
2.00-3.00	Interpretation and familiarization with questionnaire	Study the questions Interpreting the questions	discussions	
3.00-4.00	Role play	Purpose of role play Perform role play	Lecture, demonstration role play	
Day 2				
8.00-9.00	Recap	Demonstration of anthropometric measurement And administering questionnaires	Demonstration, role play.	
9.30-10.00	Using checklist	Taking inventory of equipment	Demonstrations	
10.30-4.00	Pretesting tools and questionnaires	Asking questions, recording, identity and modification required.	Practical work of asking question and recording	Sample of questionnaire

Appendix 4: Anthropometric measurement





Source: Gibson, 2005

Appendix 5: Consent form

KENYA AGRICULTURAL RESEARCH INSTITUTE (KARI) AGRI-FOOD SYSTEMS PROJECT

NUTRITIONAL STATUS OF CHILDREN AGED (0-59 MONTHS) AND ASSOCIATED FACTORS: A CASE STUDY OF MBEERE SOUTH DISTRICT, KENYA

My name is _____and I am part of a team from the Kenya Agricultural Research Institute (KARI), who, together with the Ministry of Agriculture are evaluating the activities carried out in your area by the Agri-food systems project. You have been selected through a random process to represent other farmers in this area. Your contribution is completely voluntary and confidential.

The information you provide will be useful in finding the food and nutrition status of children in this community. A copy of this report will be submitted to your community leaders who may use it for planning of development project in this area.

The information you give will help us better understand your current socio-economic status as well as issues around production of crops and household nutrition. It will help us understand the opportunities and challenges that you face in being successful. Answering these questions will take about 45 minutes. There is no other cost or risk involved in the study.

All information shared here will only be used for the study, and will not be shared in a way that you can be identified by KARI or any government office. While we are speaking, I will write your responses so that I can remember everything that you say correctly. In the final study, all the responses from all the groups we have talked to will be put together. No specific answer will be linked to your group specifically or to you personally. Your participation is completely voluntary, and there is no penalty for not taking part. You can also stop participation at any point during the survey or refuse to answer a question.

Do you have any questions?

If you think of any questions during the interview, please feel free to ask me

Do you agree to participate?

IF RESPONDENT ORALLY AGREES, ENUMERATOR SIGN BELOW

DATE_____

_____ ___

I have informed the respondent about:

- Who I am
- Where I'm from
- The purpose of the study
- Secrecy
- Writing responses
- Benefits of the study
- Time Cost
- Questions

Appendix 6: Energy scale and protein scale

Energy Consumer Units/Adult equivalents were calculated according to Gibson, 2005

Energy scale

Caloric Adult Equivalents

Males >14 yrs=1.0 CU (2900 kcal)

Females ≥ 11 yrs and boys 11-14 yrs = 0.9 CU

Children 7-10 yrs = 0.75 CU

Children 4-6 yrs = 0.4 CU

Children <4 yrs = 0.15 CU

Source: Gibson, 2005

Nominated adult male equivalent value 2900 kcal/day for moderately active person (Sehmi, 1993, Kanyuira, 2010) was used to calculate AE available for the household.

Protein scale

The total protein consumed in the household was divided by 52 g (protein required for adult male per day: 0.8g/kg/day for adult male of 65 kg) to get Adult Equivalent available for the household.

To get the AE for the household, the following scale according to (Sehmi, 1993, Kanyuira, 2010) was used.

Adult Equivalents

Adult male	> 18 yrs	=0.9
	16-.18 yrs	=1.08
Boys	14-<16 yrs	=1.0
	12-<14 yrs	=0.83
	10-<12 yrs	=0.65
Children	7-<10 yrs	=0.52
Boys	5-<7 yrs	=0.40

Female adult	> 18 yrs	= 0.79
	16->18 yrs	= 1.81
Girls	14-<16 yrs	= 0.88
	12-<14 yrs	= 0.85
	10-<12 yrs	= 0.69
	7-<10 yrs	= 0.52
Children	5-<7 yrs	= 0.40
(Boys and Girls)	3-<5 yrs	= 0.34