PREVALENCE OF PROTEIN ENERGY MALNUTRITION AND ASSOCIATED FACTORS AMONGST CHILDREN AGED 6-59 MONTHS IN CHAVAKALI, VIHIGA COUNTY, KENYA.

INVESTIGATORS: MSC. APPLIED HUMAN NUTRITION CLASS OF 2013-2014

CORDINATORS: MR. DASEL MULWA

: MISS JANE NJENGA

A SPECIAL PROJECT SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE DEGREE OF MASTERS OF SCIENCE IN APPLIED HUMAN NUTRITION.

DEPARTMENT OF FOOD SCIENCE, NUTRITION AND TECHNOLOGY UNIVERSITY OF NAIROBI.

2014

Table of Contents

ABBREVIATIONS

AIDS – Acquired immune deficiency syndrome

FAO – Food and Agriculture Organization

HIV – Human Immunodeficiency Virus

KDHS –Kenya Demographic Health Survey

MCHH – Maternal and Child Health Hospital

MUAC – Mid Upper Arm Circumference

PEM – Protein Energy Malnutrition

PEU – Protein Energy Under nutrition

WHO – World Health Organization

Operational definition

Energy: calories (or joules) derived from macronutrients: protein, carbohydrate and fat

Micronutrients: vitamin A, B-complex, iron, zinc, calcium, others

Protein: deficit in amino acids needed for cell structure, function

CHAPTER ONE: INTRODUCTION

1.1 Background

The primary causes of morbidity and mortality among children aged less than 5 years are pneumonia, diarrhoea diseases, low birth weight, asphyxia and in some parts of the world, human immunodeficiency virus (HIV) infection and malaria. One out of every two such deaths has malnutrition as the underlying cause (Murray and Lopez, 1997). However, malnutrition is rarely cited as being among the leading causes of death even though it is prevalent in developing countries (WHO, 2000).

Malnutrition is currently the leading cause of global burden of disease (Ezzati *et al.*, 2002) and has been identified as the underlying factor in about 50% of deaths of children under 5 years of age in developing countries (Black *et al.*, 2003). The condition may result from lack of food or from infections that cause loss of appetite while increasing the body's nutrient requirements and losses. Children between 12 and 59 months old are especially at risk since they are the most vulnerable to infections such as gastroenteritis and measles (WHO, 2000). It is estimated that, in developing countries, more than one-quarter of all children younger than 5 years of age are malnourished (UNACC, 2000).

Protein energy malnutrition (PEM) is a potentially fatal body depletion disorder (Dulger *et al.*, 2002). The term protein energy malnutrition applies to a group of related disorders that include marasmus, kwashiorkor and intermediate states of marasmic kwashiorkor. Marasmus involves inadequate intake of protein and calories and is termed “the sickness of the weaning” with no oedema (de Onis *et al.*, 1993). Kwashiorkor including marasmic kwashiorkor is characterized by massive oedema of the hands and feet, profound irritability, anorexia and desquamative rash, hair discolouration and a large fatty liver (Manary and Brewster, 1997). Hypoalbuminaemia and

electrolyte imbalances have been put forward as possible causes of the oedema (Ahmed *et al.*, 2009).

The most prevalent form of PEM is the mild/moderate PEM. Indicators of these form of malnutrition are underweight (the child weighs significantly less than well-nourished children of same age) and wasting (the child weighs significantly less than well-nourished children of the same height), which indicates recent malnutrition.

Stunting is a form of chronic malnutrition where the child is significantly shorter in comparison with children of same age who are well nourished. Acute PEM is a severe form of protein energy malnutrition. There are usually two forms, kwashiorkor and marasmus, which may lead to death if not well, attended to (Svedberg, 1987).

Infants and young children are the most severely affected by PEM because of their high energy and protein needs relative to body weight and their particular vulnerability to infection (Ibeziako L NS, 2012). Several complementary feeding practices can have an adverse effects on child nutrition. One factor is the age at which complementary foods are introduced into the child`s diets. Others include the method of food preparation, the frequency of feeding and the energy density of the complementary foods. In all circumstances, especially during illness, young children need to be fed frequently during the day. Mothers may have difficulty in feeding children often enough if they are working in the field or looking after livestock; thus the limited time available to mothers may be an important constraint on children`s food intake(Neimeret al,2001).

1.2 Problem statement

PEM impairs the linear growth of children, leading to a further reduction in food intake, nutrient absorption, direct or catabolic nutrient losses and increased metabolic requirements. Early

diagnosis of protein energy malnutrition will prevent complications from occurring in children who fall victim to the condition. However, there is very little knowledge on early and precise diagnosis of PEM in Chavakali, thus the outcome of this study provided remedy for early detection and precise diagnosis.

1.3 Justification

The study was to provide information about prevalence and associated risk factors of PEM in Chavakali. It help in identifying factors that are barriers to good nutrition practice, and translate each guideline into specific messages that health care providers, mothers, non-governmental organizations (NGOs) and agencies can come up with the right measures of improving and eradicating PEM. The data was also meant to be used in planning interventions concerning malnutrition, particularly PEM.

1.4 Study Aim

To contribute towards better understanding of the nutrition status of children between 6-59 months old in Chavakali.

1.5 Study purpose

To provide information and knowledge on PEM and enable the community to make better use of their available and affordable food resource in order to reduce the rate of PEM in the region

1.6 overall objective of the study

To determine the prevalence and associated risk factors of protein energy malnutrition among children between 6- 59 months in Chavakali.

1.6.1 Sub-objectives

To determine social–economic and demographic characteristics of the households in chavakali

To assess the nutrition status of children between 6- 59months in Chavakali.
To determine the dietary diversity of children between 6- 59 months in Chavakali
To determine hygiene and sanitation related to children between 6-59months old in the village.

1.7 Hypothesis

Morbidity, hygiene and sanitation are the main risk factor associated with PEM.

1.8 Assumptions and limitations

ASSUMPTIONS

The community was helpful, willing to be surveyed and gave detailed information.

LIMITATION

The study was done during farming season and some mothers could not find time to participate in the study.

1.9 Benefits

The information provided baseline data for any further studies in the study area.

The study-documented information that assists government, local leaders, NGOs to implement and develop interventions to improve nutrition status of the children.

This study helped mothers and caregivers in Chavakali to gain nutritional knowledge and good sanitation and hygienic information to improve nutritional status of their children.

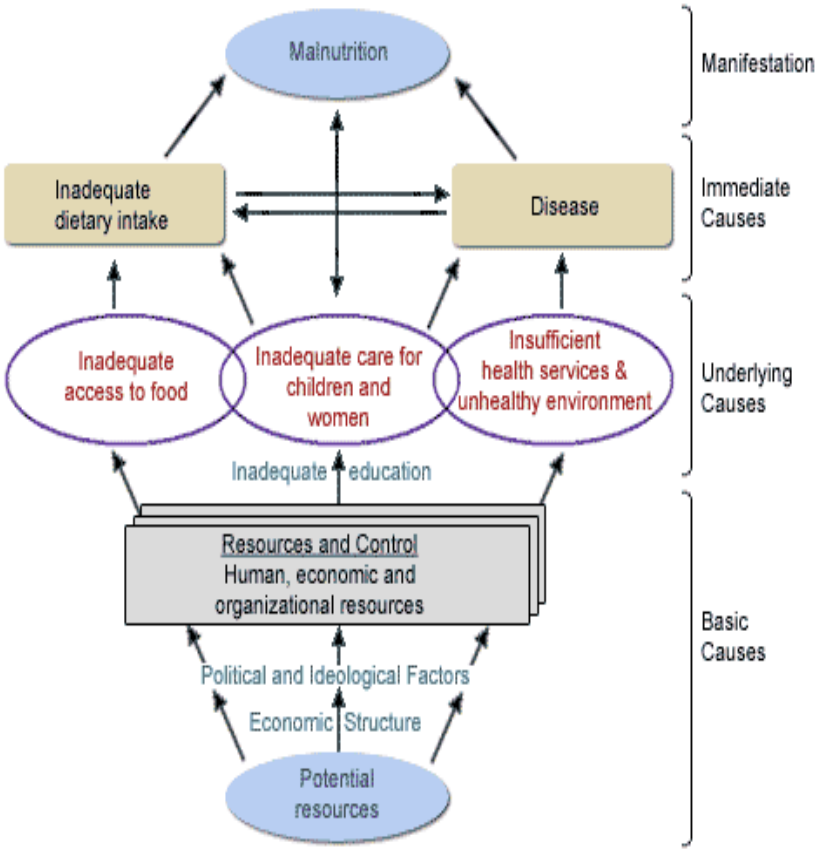
CHAPTER TWO: LITERATURE REVIEW

2.1 MALNUTRITION

Malnutrition is globally the most important risk factor for illnesses and death, affecting especially hundreds of millions of pregnant women and young children. It is currently the leading cause of global burden of disease (Ezzati *et al.*, 2002). However, evidence has shown that child death and malnutrition are not equally distributed throughout the world. The World Health Organization defines malnutrition as "the cellular imbalance between supply of nutrients and energy and the body's demand for them to ensure growth, maintenance, and specific functions (Scrimshaw *et al.*, 1968). Severe malnutrition, typified by wasting, oedema or both, occurs almost exclusively in children (Brabin and Coulter, 2003).

There are two (2) elements of malnutrition: protein–energy malnutrition and micronutrient deficiencies. Apart from marasmus and kwashiorkor (the two forms of protein– energy malnutrition), deficiencies in iron, iodine, vitamin A and zinc are the main manifestations of malnutrition (Muller and Krawinkel, 2005). The degree and distribution of protein–energy malnutrition and micronutrient deficiencies in a given population depends on many factors: the political and economic situation, the level of education and sanitation, the season and climate conditions, food production (Brabin and Coulter, 2003), cultural and religious food customs, breast-feeding habits, prevalence of infectious diseases, the existence and effectiveness of nutrition programs and the availability and quality of health services (F.A.O., 2004).

2.2 causes of malnutrition



Conceptual framework of the causes of malnutrition in the society

Source:UNICEF,1998

According to this framework, developed by UNICEF, malnutrition occurs when dietary intake is inadequate and health is unsatisfactory, being the two immediate causes of malnutrition. In developing countries, infectious diseases, such as diarrhoeal diseases (DD) and acute respiratory diseases (ARI), are responsible for most nutrition-related health problems.

Readily available food, appropriate health systems and a "healthy" environment are ineffective unless these resources are used effectively. As a result, the absence of proper care in households and communities is the third necessary element of the underlying causes of malnutrition.

Finally, this conceptual framework recognizes that human and environmental resources, economic systems and political and ideological factors are basic causes that contribute to malnutrition.

This model relates the causal factors for under-nutrition with different social-organizational levels. The **immediate** causes affect individuals, the **underlying** causes relate to families, and the basic causes are related to the community and the nation. As a result, the more indirect are the causes, the wider the population whose nutritional status is affected.

2.3 Protein Energy Malnutrition

Protein-energy malnutrition (PEM) may be present at any time during the life cycle, but it is more common in the extreme ages that is, during infancy/childhood and in the elderly (Castaneda *et al.*, 1995). The present review will be restricted mostly to the condition present during infancy and childhood. Protein energy malnutrition in children (PEM) is a pathologic depletion of the body's lean tissues caused by starvation, or a combination of starvation and catabolic stress (Castaneda *et al.*, 1995). It is the disease that develops when protein intake or energy intake, or both, chronically fail to meet the body's requirements for these nutrients (Hoffer *et al*., 1999). The underlying mechanisms include decreased food intake because of anorexia, decreased nutrient absorption, increased metabolic requirements and direct nutrient losses(Gonzalez-Barranco and Rios-Torres, 2004).

Patients that lose 10–20 percent of their body weight may have moderate PEM. Losing 20 percent of body weight or more is generally classified as severe PEM (Gonzalez-Barranco and Rios-Torres, 2004; Hamer *et al.*, 2004). Primary PEM results from a diet that lacks sufficient sources of protein and/or energy. Secondary PEM usually occurs as a complication of chronic diseases such as AIDS, cancer, chronic kidney failure, inflammatory bowel disease, and other

illnesses that impair the body's ability to absorb or use nutrients or to compensate for nutrient losses (Hamer *et al.*, 2004). Marasmus and Kwashiorkor are the two (2) forms of the protein–energy malnutrition.

Protein-energy malnutrition (PEM) is a problem in many developing countries, most commonly affecting children between the ages of 6 months and 5 years. The condition may result from lack of food or from infections that cause loss of appetite while increasing the body's nutrient requirements and losses. Children between 12 and 36 months old are especially at risk since they are the most vulnerable to infections such as gastroenteritis and measles (WHO, 2000b).

2.3.1 Kwashiorkor

Kwashiorkor, also called wet protein-energy malnutrition, is a form of PEM characterized primarily by protein deficiency. This condition usually appears at the age of about 12 months when breastfeeding is discontinued, but it can develop at any time during a child's formative years (Manary *et al.*, 1998). Kwashiorkor usually manifests with fluid retention (oedema) usually starting in the legs and feet and spreading, in more advanced cases, to the hands and face. Oedema may be detected by the production of a definite pit as a result of moderate pressure for 3 seconds with the thumb over the lower end of the tibia and the dorsum of foot. Because of oedema, children with kwashiorkor may look “fat” so that their parents regard them as well fed (Manary *et al.*, 1998).

There is hair discoloration or loss of pigmentation; curly hair becomes straight easily pluckable. Coloured, dark skin may become dried and lighter in some places especially in the skin folds; outer layers of skin may peel off and ulceration may occur; the lesions may resemble burns (Cundiff and Harris, 2006). Children with Kwashiorkor are usually apathetic, miserable, and irritable. They show no signs of hunger, and it is difficult to persuade them to eat. There is

hepatomegaly, lethargy, severe immune deficiency and early death occurs (UNACC, 2000). Hypoalbuminaemia and electrolyte imbalance have been put forward as possible causes of the oedema (Waterlow, 1992).

2.3.2 Marasmic kwashiorkor

This is a severe wasting in the presence of oedema. It is a mixed form of PEM, and manifests as oedema occurring in children who may or may not have other signs of Kwashiorkor (Manary and Brewster, 1997; Manary *et al.*, 1998).

2.3.3 Marasmus

Early marasmus occurs usually in the first year of life in children who have been weaned from breast milk or who suffer from weakening conditions like chronic diarrhoea. It is frequently associated with contaminated bottle-feeding in urban areas (Pinstrup-Andersen *et al.*, 1993). Primarily marasmus is caused by energy deficiency from prolonged starvation. It may also result from chronic or recurring infections with marginal food intake (de Onis *et al.*, 1993). Marasmus is characterized by stunted growth and wasting of muscle and tissue. Wasting indicates recent weight loss, whereas stunting usually results from chronic weight loss. The major nutritional indicators studied are: stunting (low height-for-age); underweight (low weight-for-age); and wasting (low weight-for-height). Of the three (3), wasting is the most dangerous and signifies acute malnutrition (Muller and Krawinkel, 2005). The main sign is a severe wasting and the child appears very thin and has no fat. Most of the fat and muscle mass have been expended to provide energy. There is severe wasting of the shoulders, arms, buttocks and thighs, with no visible rib outlines. There is no oedema (swelling that pits on pressure) of the lower extremities (Manary and Brewster, 1997). Clinical aspects typically include a triangular face, extended abdomen

(from muscular hypotonia) and anal or rectal prolapse (from loss of perianal fat) (Manary *et al.*, 1998).

2.4 Clinical features of PEM

Protein–energy malnutrition usually manifests early, in children between 6 months and 2 years of age and is associated with early weaning, delayed introduction of complementary foods, a low-protein diet and severe or frequent infections (Kwena *et al.*, 2003; Muller *et al.*, 2003). PEM is characterized by atrophy and weakness of the skeletal muscles (including the respiratory muscles), reduced heart muscle mass (Powell-Tuck, 1997), impaired wound healing, skin thinning with a predisposition to decubitus ulcers, fatigue, apathy and hypothermia. The extracellular fluid compartment characteristically expands in PEM, occasionally causing oedema (Hoffer, 2001). Synthesis of pigments in the hair and skin fails (e.g., hair colour may change and skin becomes hyperpigmented) because of a lack of substrate (e.g., tyrosin) and coenzymes (Muller and Krawinkel, 2005).

The other essential aspects of severe protein–energy malnutrition are the fatty degeneration of the liver and heart. This degeneration is not just a sign of severe malnutrition; it also causes subclinical or overt cardiac insufficiency, especially when malnutrition is accompanied by oedema. If the myocardial insufficiency is not corrected, iatrogenic fluid and sodium overload quickly escalate it into cardiac failure (Kwena *et al.*, 2003; Muller *et al.*, 2003). Another injurious aspect of PEM is the loss of subcutaneous fat, which markedly reduces the body‟s capacity for temperature regulation and water storage (Alam *et al.*, 2003). As a result, malnourished children become dehydrated, hypothermic and hypoglycemic more quickly and severely than others (Gracey, 1999). Severe protein–energy malnutrition is associated with atrophy of the mucosa of the small bowel, leading to a loss of absorption as well as of digestion

capacity (Alam *et al.*, 2003). Furthermore PEM is associated with chronic hypovolaemia, which leads to secondary hyperaldosteronism, and further complicates fluid and electrolyte balance (Kwena *et al.*, 2003; Muller *et al.*, 2003). PEM affected children do not show signs of hyperkalaemia. This is because the development of muscular dystrophy mobilizes much of the body‟s potassium, which is then lost through urine (Manary and Brewster, 1997).

2.5 Epidemiology of malnutrition

Malnutrition is currently the leading cause of the global burden of disease (Ezzati *et al.*, 2002) and has been identified as the underlying factor in about 50% of deaths of children under 5 years of age in developing countries (Black *et al.*, 2003). In 1998 it was estimated that 9% of children below 5years of age globally suffer from wasting and this affects every fourth child world-wide: 150 million (26.7%) are underweight while 182 million (32.5%) are stunted (WHO, 1998). Geographically, more than 70% of PEM children live in Asia. Most of these children were born by malnourished mothers (UNESCO/WHO, 2002). Nearly a third of these children who died with malnutrition as underlying factors were stunted and a quarter were underweight. This situation is expected to worsen in some parts of the world including sub-Saharan Africa (de Onis *et al.*, 2000; de Onis *et al.*, 2004) . These figures are indications of a serious public health crisis with long term effects on population, health, human capital accumulation and sustainability of developing countries. The commitment of the international community to reducing childhood malnutrition and mortality has been renewed recently through the Millennium Development Goals, but achieving this ambition requires further studies on how the determinants and the level of malnutrition respond to changing economic context, which has been the case in many developing countries experiencing high burden.

2.5.1 Malnutrition in Developed countries

Malnutrition remains one of the most common causes of morbidity and mortality among children throughout the world (WHO, 1999). In developed countries, Protein Energy Undernutrition (PEU) is common among the institutionalized elderly (although often not suspected) and among patients with disorders that decrease appetite or impair nutrient digestion, absorption, or metabolism. Although PEM is not prevalent among the general population of the developed world, it is often seen in elderly people who live in nursing homes and in children whose parents are poor. PEM occurs in one of every two surgical patients and in 48% of all other hospital patients (WHO, 1999).

2.5.2 Malnutrition in Developing countries

Malnutrition is a major public health problem throughout the developing world, particularly in southern Asia and sub-Saharan Africa (Schofield and Ashworth, 1996); (WHO and UNICEF, 2004). Diets in populations in these countries are frequently deficient in macronutrients (protein, carbohydrates and fat, leading to protein–energy malnutrition), micronutrients (electrolytes, minerals and vitamins, leading to specific micronutrient deficiencies) or both (Millward and Jackson, 2004). Apart from deficiencies in single nutrients, such as vitamins, essential fatty acids, amino acids, iron, and trace elements (Woodward, 1998), the high prevalence of bacterial and parasitic diseases in these developing countries contributes greatly to malnutrition there (de Onis *et al.*, 1993; Stoltzfus *et al.*, 2004). The World Health Organization report (WHO, 2000b) indicated that malnutrition was responsible, directly or indirectly, for 54 per cent of the 10.8 million deaths per year in under-five children and contributes to every second death (53%) associated with infectious diseases in developing countries. In the year 2000 it wasestimated that, in developing countries, more than one-quarterof all children younger than 5 years of age were

malnourished (UNACC, 2000). Brabin and Coulter (2003) reported that of all the children under the age of 5 years in developing countries, about 31% were underweight, 38% had stunted growth and 9% showed wasting. According to United Nations Children‟s Fund (UNICEF, 2006b) report, 27% of children < 5 years of age in developing countries suffer from wasting. This is against the background evidence that malnutrition contributes to 54% of all deaths among children < 5 years of age.

2.5.2.1 Malnutrition in Kenya

Although malnutrition continues to be a major public health problem throughout the developing world, in Kenya there has been substantial scope of progress in reducing the average malnutrition level. The prevalence of underweight fell progressively from 30% in 1988 to 21% in 2003. The prevalence of stunting fell from 29% to 26% between 1988 and 1993, and then increased again to 29% during the period 1993-2003. The level of wasting remained unstable during the period 1993-2003 (GDHS, 1998-2003). However, the 2003 Kenya demographic and health survey report indicated that, malnutrition accounted for 40% of under 5 mortality in Kenya (KDHS, 2003). UNICEF (2006a) reported that 22.4% of the under-five children were stunted and 17% were underweight.

2.6 Effect of Malnutrition on Children

Chronic PEM has many short-term and long-term physical and mental effects, including growth retardation, lowered resistance to infection, and increased mortality rates in young children (Pelletier *et al.*, 1995). It was recognized in the 1950s that the severe forms of protein-energy malnutrition, kwashiorkor and marasmus, were associated with marked cognitive effects (Scrimshaw *et al.*, 1968) although the lasting effects on survivors were unknown. Effects of malnutrition in early childhood can be devastating and permanent. Whether or not children are

well-nourished during the prenatal period and the first years of life can have a profound effect on their health status, as well as their ability to learn, communicate, socialize, reasoning and adapt to their environment (Pelletier *et al.*, 1995).

2.7 Diagnosis of PEM

The diagnosis of malnutrition is generally based on objective measurements of nutritional status, including assessments of oral intake, weight loss, anthropometric data, and determination of cell-mediated immunity, biochemical parameters, physical examination and body composition analysis (Hulst *et al.*, 2004).

2.7.1 Anthropometric Measurements

In children, protein–energy malnutrition is defined by measurements that fall below 2 standard deviations under the normal weight for age (underweight), height for age (stunting) and weight for height (wasting) (Pinstrup-Andersen *et al.*, 1993).

Reduced height-for-age reflects the slowing of skeletal growth, and is considered to be a reliable indicator of long-standing malnutrition in childhood. Low weight-for-height, on the other hand, indicates a deficit in tissue and fat mass. This measure is more sensitive to temporary food shortages and episodes of illness. A low weight-for-age is also used in the literature to indicate malnutrition, however this does not discriminate well between temporary and more permanent malnutrition (Zere and McIntyre, 2003).

2.7.1.1 Weight

It is a measure of overall nutritional status with age, sex and height required for optimal interpretation. Weight is determined using digital or beam balance scale. It is recorded to the nearest 0.01Kg in infants and 0.1Kg in older children (Duggan *et al.*, 2004).

2.7.1.2 Mid-upper arm circumference (MUAC)

This is a quick and simple way to determine whether or not a child is malnourished using a simple colored plastic strip. MUAC and triceps skin fold (TSF) are also used as part of the assessment to determine body fat and protein stores in children with chronic disease (Duggan *et al.*, 2004). MUAC is suitable to use on children from the age of 12 months up to the age of 59 months.

2.7.1.3 Height or Length

Measurement of length in particular, but also of height, requires great care to be of value. Both remain the reserve for assessment of linear skeletal growth. Height or length generally correlates better with socioeconomic status than soft tissue measurement such as weight. Although relatively insensitive to short-term nutritional deficits, height or length reflects long-standing nutritional experience. Length is usually indicated for children up to 24 months of age, and height is used thereafter. Readings are recorded to the nearest 0.1 cm (Neumann *et al.*, 1982).

2.8 Biochemical Markers of PEM

Biochemical parameters provide valuable information for the over-all management and act as very sensitive indicators. Different biochemical parameters are altered during protein energy malnutrition (Mishra *et al.*, 2009). In case of severely malnourished wasted children, serum total protein and albumin are normal or reduced and fractions of the glycoproteins responsible for binding drugs are decreased (Muller and Krawinkel, 2005). The serum albumin concentration remains normal in successfully adapted PEM and it falls when adaptation fails. A normal serum albumin concentrationin a PEM patient is a favourable prognostic finding. It is an indication of a successful adaptation and, the absence of metabolic stress (Hoffer, 2001).

Because albumin and pre-albumin are negative acute-phase proteins, their serum levels fall in response to metabolic stresseven in the absence of PEM. The reductions of total serum protein and albumin are more marked in kwashiorkor with oedema than in marasmus. Lowering of these serum total protein and albumin values in PEM could be explained on the basis of generalized protein deficiency leading to impaired synthesis (Mishra *et al.*, 2009). It could also be due to the redistribution of albumin into an expanded extracellular fluid compartment that occurs in acute severe inflammation (Hoffer, 2001). In kwashiorkor the oedema may clear during nutritional rehabilitation without any change in serum albumin concentration (Kazeem *et al.*, 2009). Studies by Rahman *et al.,*(2007) observed that the mean serum total protein and albumin level in normal children 12-59 months of age was significantly higher than that of malnourished children. However, mean of serum globulin level was higher in malnourished children than that of normal children. Raised globulin level is anticipated in malnourished children since malnutrition is commonly associated with infections (Rahman *et al.*, 2007).

2.9 Interventions

Interventions to prevent protein–energy malnutrition range from promoting breast-feeding to food supplementation schemes. Micronutrient deficiencies are best addressed through food-based strategies such as dietary diversification and fortification of salt with iodine has been a global success story. To be effective, all such interventions require accompanying nutrition-education campaigns and health interventions (Muller and Krawinkel, 2005). Malnutrition in the young child may be „prevented" by identifying the individuals at risk and for the period when the risk is greatest, modifying their environment, or even removing them from it in order to ensure that, as individuals, they are spared the sequelae of undernutrition.

2.10 Management and Control

In spite of the various dietary approaches to manage severe malnutrition (Khanum *et al.*, 1994) patients with kwashiorkor (including marasmic kwashiorkor) continue to die much more frequently than those with marasmus alone in developing countries (Ahmed *et al.*, 1999). An additional concern is that many of these children with severe malnutrition are also infected with HIV (Ambrus and Ambrus, 2004). Therefore there is the need for a systematic approach to the severely malnourished patient that goes beyond an appropriate diet. Essential management steps include intake of a reduced volume of protein and sodium during the first phase while emergency measures are taken to reduce the risk of hypoglycemia, hypothermia and dehydration (WHO, 1999). Oral, enteral and parenteral volume loads must be checked carefully to avoid imminent heart failure. Thus, continuous monitoring of central venous blood pressure is very desirable. In the early phase of rehabilitation, a protein intake exceeding 1 g/kg body weight in combination with impaired liver function (with breakdown of the urea cycle) and little urine excretion (a result of dehydration) easily exceeds the malnourished child‟s metabolic capacity to rid himself or herself of excess ammonia (WHO, 2000a).

CHAPTER THREE: METHODOLOGY

3.1The study setting

Chavakali district is in Vihiga County. The project took place in 8 locations of Chavakali. It has an estimated population of 10,350 predominantly low-income classes who can't afford high quality dietary protein of animals and plant origin and have no adequate nutritional education. Most of the inhabitants are Luhya.

3.2 study design

A cross-sectional study design covering households with children aged 6-59 months was carried out in various locations of Chavakali.

3.3 sample size

The sample size was determined by using the Fischer method (Fischer et al., 1991)

$n=z^2pq/d^2$

n=desired sample size

z=standard normal deviate set at 1.96 which corresponds to 95% confidence interval.

P= children below 5 years who are estimated to be wasting in Kenya are 7 %(KDHS, 2008-2009)

q=1-p (denote children not wasting (93%)

d=degree of accuracy desired set at 0.05 or 5% for the study.

n is therefore $=\frac{1.96^2\times0.07\times0.93}{0.05^2}=100$

The desired sample size was 100

3.4 sampling frame

The sample was drawn at a district level. It mainly target the children aged 6-59 months.

3.5 sampling procedure

Step 1.Cluster Selection: The population was divided into clusters of households using geographical boundaries, by using random sampling a sample of total number of clusters was selected.

Step 2.Asample of households from each clusters was randomly selected which was used to get the desired sample size.

3.6 study tools

A semi-Structured and structured questions - contained information such as socio-economic, morbidity, demographic characteristics and childcare information.

Anthropometric assessment tools such as digital weighing scale, Salter scale, height board. These were used to take weight, height respectively in order to determine the nutritional status of the children.

3.7 Data collection procedure

Weight of all children between 6-59 months old was taken.

Length of children 6-23 months was measured using a length board to the nearest o.1 cm while lying down. The height of children 24-59 months was measured using a length board to the nearest 0.1cm ,while standing without shoes on.

Observations for edema: fingers was pressed on the foot skin to observe if depression will form ,also other clinical signs such as emaciated skin ,sunken eyes ,protruding stomach was observed.

Socio-economic status: information was collected from the respondents on the ownership of household assets to enable to analysis of socio-economic status. All the study children were observed for physical cleanliness in terms of their clothes, body, and face and nose.

3.8 Pre-testing of research tools

The tools were tested on the field using at least 10 people from the sample population to determine their effectiveness in data collection. The various adjustment and modification were made to ensure that the tools will be efficient during the actual study and data collection.

3.9 Data quality control

The data on the questionnaire was checked on daily basis to ensure completeness of information, consistency of answers and for proper filling by the investigators. The data was coded appropriately before finalizing.

3.10 Ethical considerations

Permission was sought from the local authorities.

We introduced ourselves to the caretakers of the children and requested them to give us the necessary information. They too accepted our request and cooperated with us.

3.11 Data analysis

Anthropometric Data such as weight, height and age was entered in ENA for SMART and the resultant data such as weight-for-age, height-for-age and weight-for-height exported to SPSS for analysis. Frequency distributions were computed for other variables, cross-tabulations between variables were performed using standard cut offs i.e. less than -3.0 SD (severe), -3 to -2 SD (moderate), -2 to -1 SD (mild), -1 to 1SD (normal) for stunting, underweight and wasting ,respectively. Across-tabulation between anthropometric data, clinical observation with other variables such as morbidity , hygiene and sanitation water treatment, house hold population, household, head, education level of the parent and level of occupation was done by using chi-square to identify their relationship and the risk factors that contribute to protein energy malnutrition in Chavakali.

CHAPTER FOUR: RESULTS

4.1 SOCIO-DEMOGRAPHICS

4.1.1 Gender Distribution

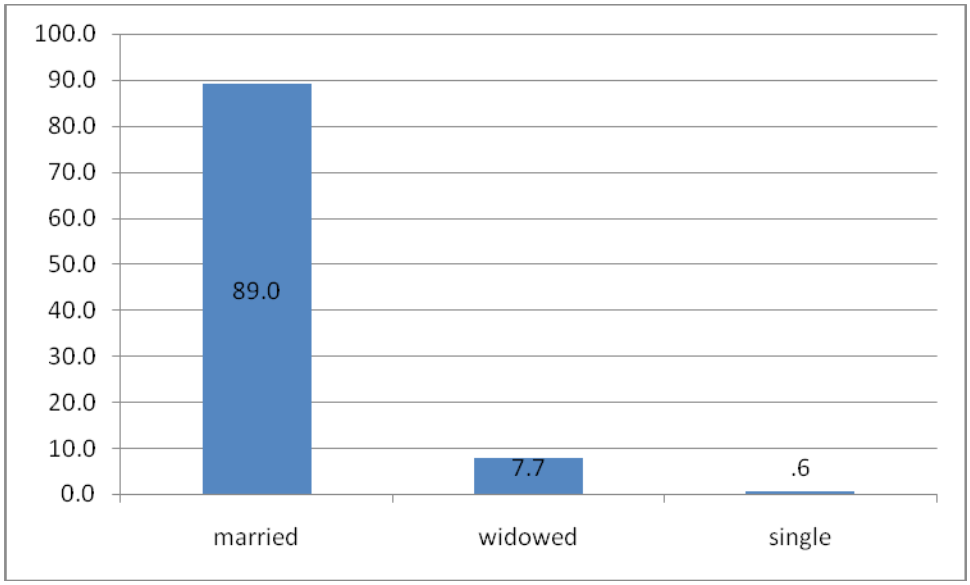
The table below summarizes the distribution of gender within the sampled households

	Frequency	Percent
Male	429	49.3
Female	441	50.7
Total	870	100.0

It was found that the female made up 50.7% of the sampled households while males were 49.3%.

4.1.2 Marital status of HHH

	Frequency	Percent
married	138	89.0
widowed	12	7.7
single	1	.6
Total	155	100.0

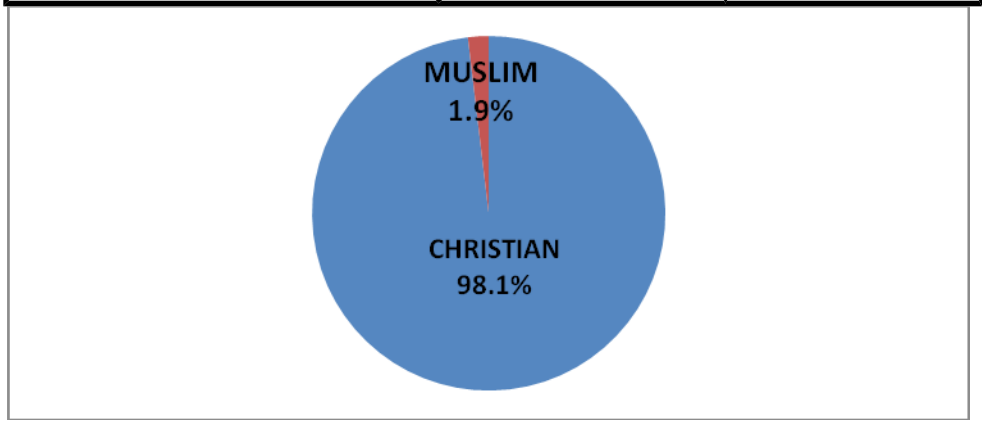


It was found that most (89%) household head were married while 7.7% reported to be widowed while 0.6% were single.

4.1.3 Distribution of Religion Among Households

The table below summarizes the distribution of religion within the sampled households

	Frequency	Percent
Christian	156	98.1
Muslim	3	1.9
Total	159	100.0

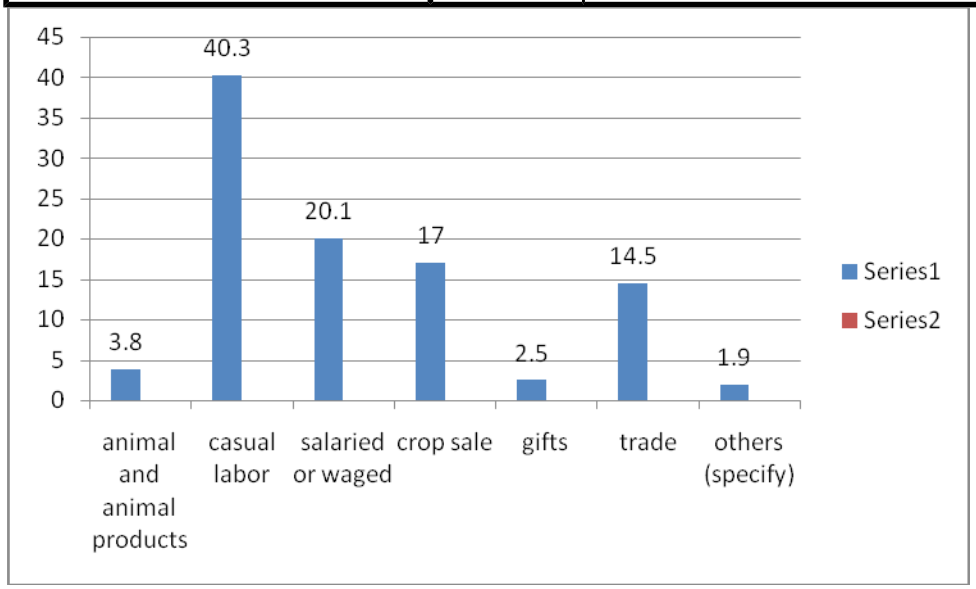


Most of the household members (98.1%) within the sampled households were of the Christian faith while 1.9% were Muslim.

4.1.4 House hold income

The table below summarizes the main source of household income within the sampled households

	Frequency	Percent
animal and animal products	6	3.8
casual labor	64	40.3
salaried or waged	32	20.1
crop sale	27	17.0
gifts	4	2.5
trade	23	14.5
others (specify)	3	1.9
Total	159	100.0



Most of the households (40.3%) were reported to get their income from casual labor, followed by 20.1% which reported to get it from salaries/wages, then 17% who reported to get it from crop sale, then 14.5 who reported to gain their household income from trade. 3.8% reported to gain it from sale of animal and animal products, 2.5% from gifts while 1.9% reported to gain their household income from other unspecified sources.

4.2 Breastfeeding

4.2.1 Initiation of Breastfeeding

The table below indicates when the indexed child's initiation of breastfeeding was done after birth or whether the child was given infant formulae after birth

	Frequency	Percent
Within 30 Min	88	55.3
One Hour	67	42.1
Infant Formulae	2	1.3
Total	157	98.7

Most mothers (55.3%) reported to had initiated breastfeeding within the first 30 minutes while 42.1% reported to had initiated after 1 hour. Another 1.3% reported that the indexed child was given infant formulae before the initiation of breastfeeding.

4.2.3 Exclusive Breastfeeding

The table below indicates the frequency and percentage of indexed children who were exclusively breastfed for the first six months of life.

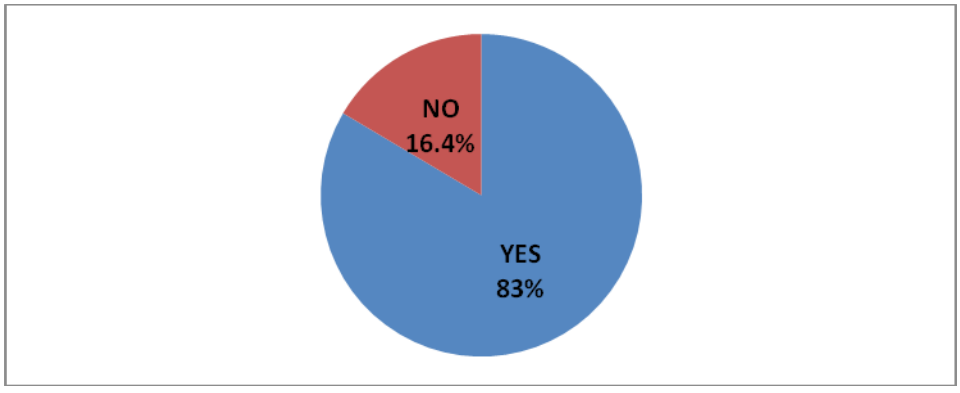
	Frequency	Percent
Yes	79	49.7
No	79	49.7
Total	158	99.4

It was found that the exclusive breastfeeding rate and the non exclusive breastfeeding rates were equal at 49.7%.

4.3 Vitamin A supplementation

The table below indicated the frequency and percentage of Vitamin A supplementation

	Frequency	Percent
Yes	132	83.0
No	26	16.4
Total	158	99.4



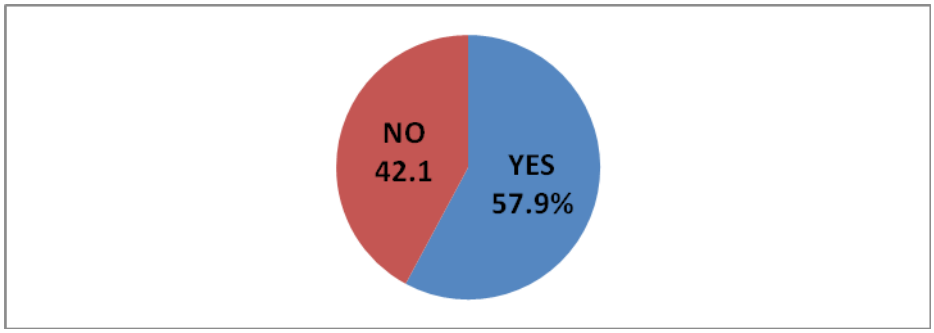
Analysis showed that 83% of the mothers/caregivers reported that the indexed children had received vitamin A supplementation while 16.4% reported no supplementation.

4.4 Health Status and Health Seeking Behavior

4.4.1 Child Signs of Illness in Last 2 Weeks of the Survey

The table below shows the frequencies and percentages of indexed children who were reported to have shown signs of illness the 2 weeks prior to the survey:

	Frequency	Percent
yes	92	57.9
no	67	42.1
Total	159	100.0

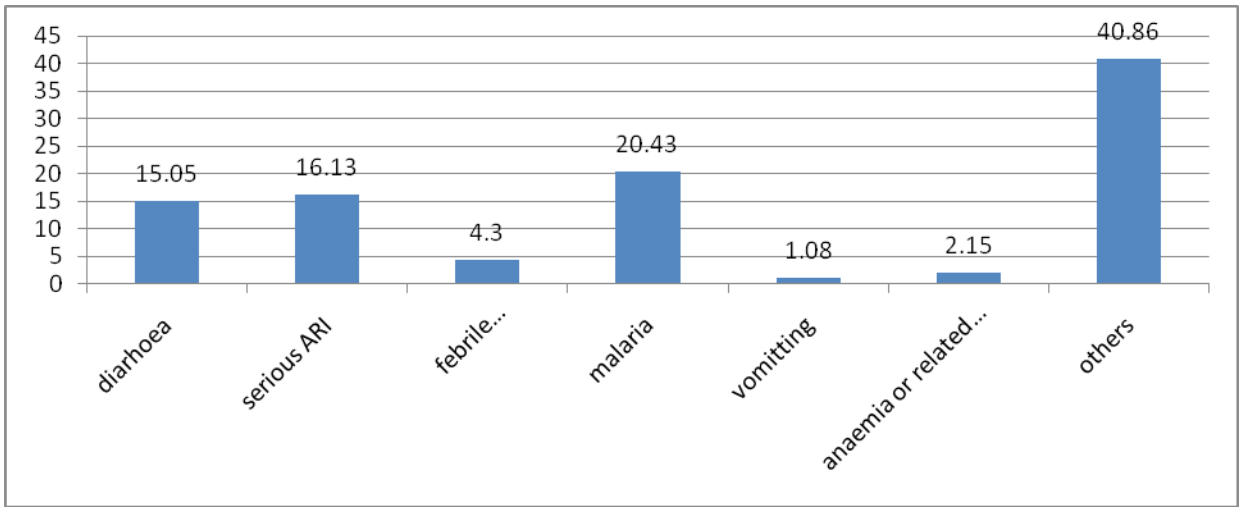


Most of the indexed children (57.9%) were reported to had shown signs of illness while 42.1% were reported to had not shown signs of illness the 2 weeks prior to the survey.

4.4.2 Disease Child Suffered in Last 2 Weeks Prior to the Survey

The table below shows the types of diseases the indexed children suffered from in the 2 weeks preceding the survey.

	Frequency	Percent
Diarhoea	14	15.05
Serious ARI	15	16.13
Febrile illness/suspected measles	4	4.30
Malaria	19	20.43
Vomitting	1	1.08
Anaemia or related symptoms	2	2.15
Others	38	40.86
Total	93	100.00



It was reported that most of the children has suffered from other diseased apart from the listed ones and this was mainly coughing. Of the listed diseases, malaria was the most common at 20.4%, followed by serious acute respiratory infections which were at 16.3%, then diarrhea which was at 15.05%, then ferbrile illnesses/suspected measles at 4.3%, then anaemia/related symptoms at 2.15% and the least common was vomiting at 1.08%.

4.4.3 Source of Medical Assistance

The table below summarizes the source of medical assistance sought for the children who showed symptoms of illness

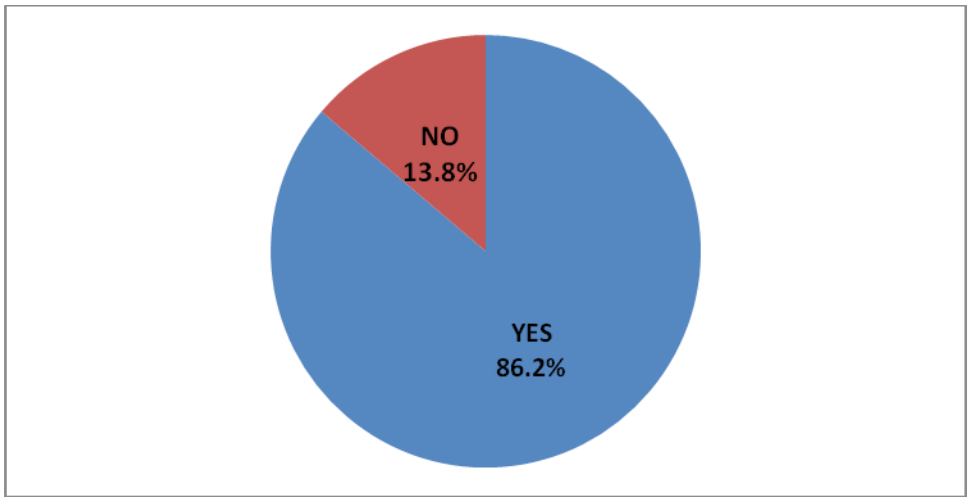
	Frequency	Percent
No Assistance Sought	8	8.6
Own Medication	17	18.3
Private Clinic	10	10.8
Public Health Facility	51	54.8
Pharmacy	7	7.5
Total	93	100.0

Medical assistance was mainly sought from public health facilities (54.8%), followed by own medication at 18.3%, then private clinics at 10.8%, then pharmacies at 7.5%. 8.6% reported not to have sought medical assistance.

4.4.4 Presence of mosquito net

The table below summarizes the frequencies and percentages of households that owned mosquito nes.

	Frequency	Percent
yes	137	86.2
no	22	13.8
Total	159	100.0



It was found that 86.2% of the households owned mosquito nets while 13.8% did not. The following table indicates a summary of households that utilized the mosquito nets on the indexed child during the night that preceded the day of interview.

		Child slept under net in last 24hours	
		Yes	No
		Count	Count
Presence of mosquito net	Yes	130	7
	No	0	22

Out of the 137 households that reported to own a mosquito net, seven children were reported not to had slept under one the night preceding the survey.

4.4.5 Child Dewormed in Last 6 months

The table below summarizes the frequency and percentage number of indexed children who had been dewormed the 6 months preceding the survey.

	Frequency	Percent
yes	68	42.8
no	90	56.6
Total	159	100.0

It was found that only 42.6% of the children had been dewormed while 56.6% had not been dewormed the 6 months preceding the survey.

4.4.6 Access to health facilities

The tables below summarize the frequencies of the distance, mode of transport and time taken to access health facilities

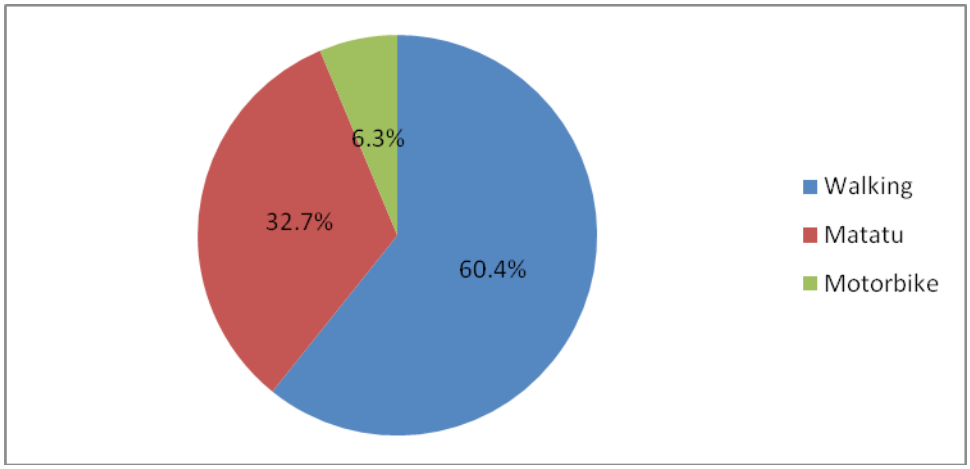
	Frequency	Percent
Less than 5 Kms	107	67.3
6-10 kms	14	8.8
More than 10 kms	4	2.5
Total	125	78.6

Most respondents (67.3%) stated that there were health facilities less than 5kms from their households. 8.8% stated the health facilities were 6-10kms from their households while 2.5 % states that the health facilities were more than 10 kilometers from their households

4.4.7 Mode of transport

	Frequency	Percent
Walking	96	60.4

Matatu	52	32.7
Motorbike	10	6.3
Total	158	99.4



Most of the respondents 60.4% reported that they walked to the health facilities,32.7% stated that they used matatu to access the heath facilities while 6.3% stated that they used motorbike to access the health facilities

Time taken to access health facility

	Frequency	Percent
Less than 15 minute	45	28.3
Between 15-30 minutes	78	49.1
Between 31-60 minutes	28	17.6
Above 60 minutes	8	5.0
Total	159	100

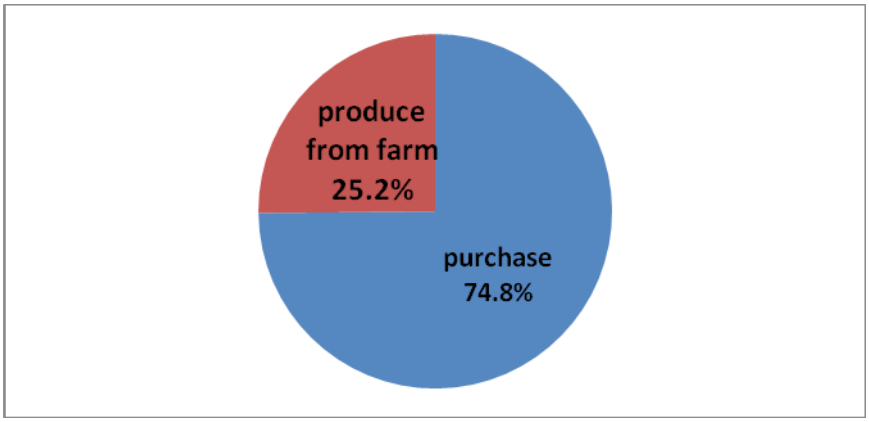
28.3% reported that they used less than 5 minutes to access the health facilities from their households while most reported to use 15- 30 minutes to access the health facilities from their households. 17.6% stated that the health facilities were between 30 minutes to one hour from their households and 5% reported to use more than one hour to access the health facilities.

4.5 Food security

4.5.1 Main source of food

The table below indicated the sources of food for the households as reported by the interviewees.

	Frequency	Percent
Purchase	119	74.8
Produce from farm	40	25.2
Total	159	100.0

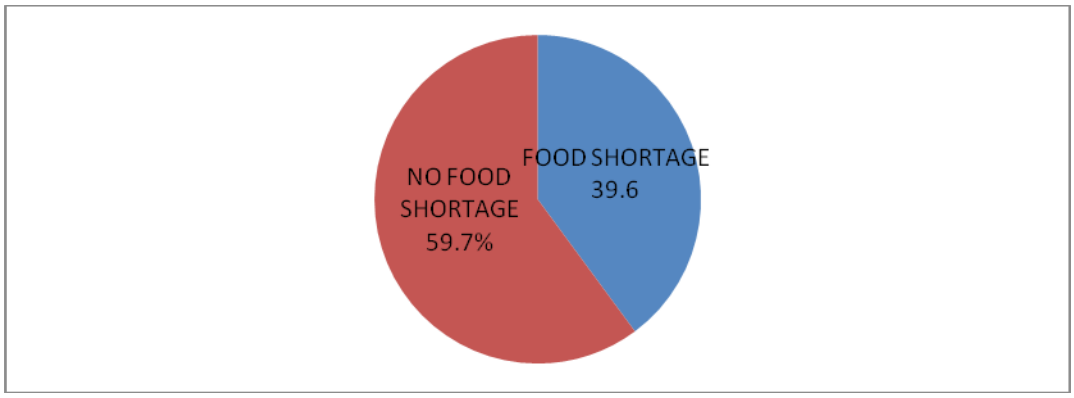


Most (74.8%) reported that their main source of food was through purchase while the other 25.2% reported that their main source of food for the households was through farm production.

4.5.2 Food Shortage

The table below shows the frequency and percentage distribution of food shortage for the study group.

	Frequency	Percent
Yes	63	39.6
No	95	59.7
Total	158	99.4

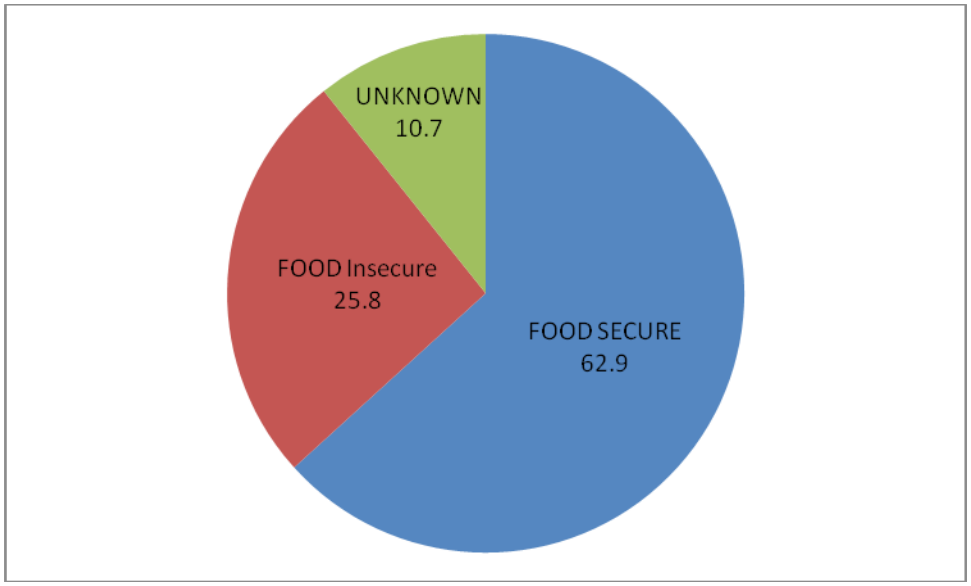


It was found that 39.6% reported to have experienced food shortage while 59.7% reported not to have experienced food shortage.

4.5.3 Category of Household

The table below indicated the categorization of households in terms of food security as reported by the interviewees.

	Frequency	Percent
Food secure	100	62.9
Food insecure	41	25.8
Do not know	17	10.7
Total	158	99.4



Most (62.9%) reported that they could say their households were food secure, while 25.8 reported that they could categorize their households as food insecure. 10.7% reported that they did not know whether their households were food secure or not.

4.6 Food frequency

4.6.1 Starches/Carbohydrates

The following table summarizes the food consumption frequency of the various carbohydrates consumed by the indexed children in the sampled households.

	Porri-dge	Pota-toes	Chips	Cass-ava	Ugali	Chap-atti	Mandazi	Bread	Rice	Green bananas	Bread/ Biscuit
One-two times	27.0	42.1	22.6	17.6	3.1	30.2	20.8	35.2	42.8	22.6	28
Three-four times	8.2	18.2	6.3	2.5	5.0	2.5	13.2	10.1	20.8	30.2	7
Five-six times	1.3	6.3	5.7	4.4	.6	8.2	1.9	6.9	5.0	6.9	6
Daily	45.3	13.8	9.4	1.9	88.7	.6	49.7	14.5	12.6	13.8	11
After two weeks		.6		.6		2.5	1.9	.6	1.3	1.3	2
Once a	3.8	8.2	6.3	6.9		23.3		8.8	7.5	5.7	17

months											
Seasonal	3.1	5.7	11.9	20.1		13.8	5.0	9.4	3.8	8.2	25
Never	11.3	5.0	37.7	45.9	2.5	18.9	7.5	14.5	6.3	11.3	62
Total	100.0	100.0	100	100.0	100	100.0	100.0	100.0	100	100.0	100

On analysis (see histogram on the next page) it can be seen that the most consumed source of carbohydrate was ugali that was consumed by 88.7% of the indexed children on a daily basis. This was followed by mandazi which was consumed by 49.7% of the indexed children on a daily basis and followed by porridge which was consumed by 45.3% of the indexed children on a daily basis.

The least consumed carbohydrate foods included biscuits/cakes with 62% of the indexed children having never consumed them, cassava with 45.9% of the indexed children having never consumed it, and chips with 37.7% of the indexed children having never consumed it.

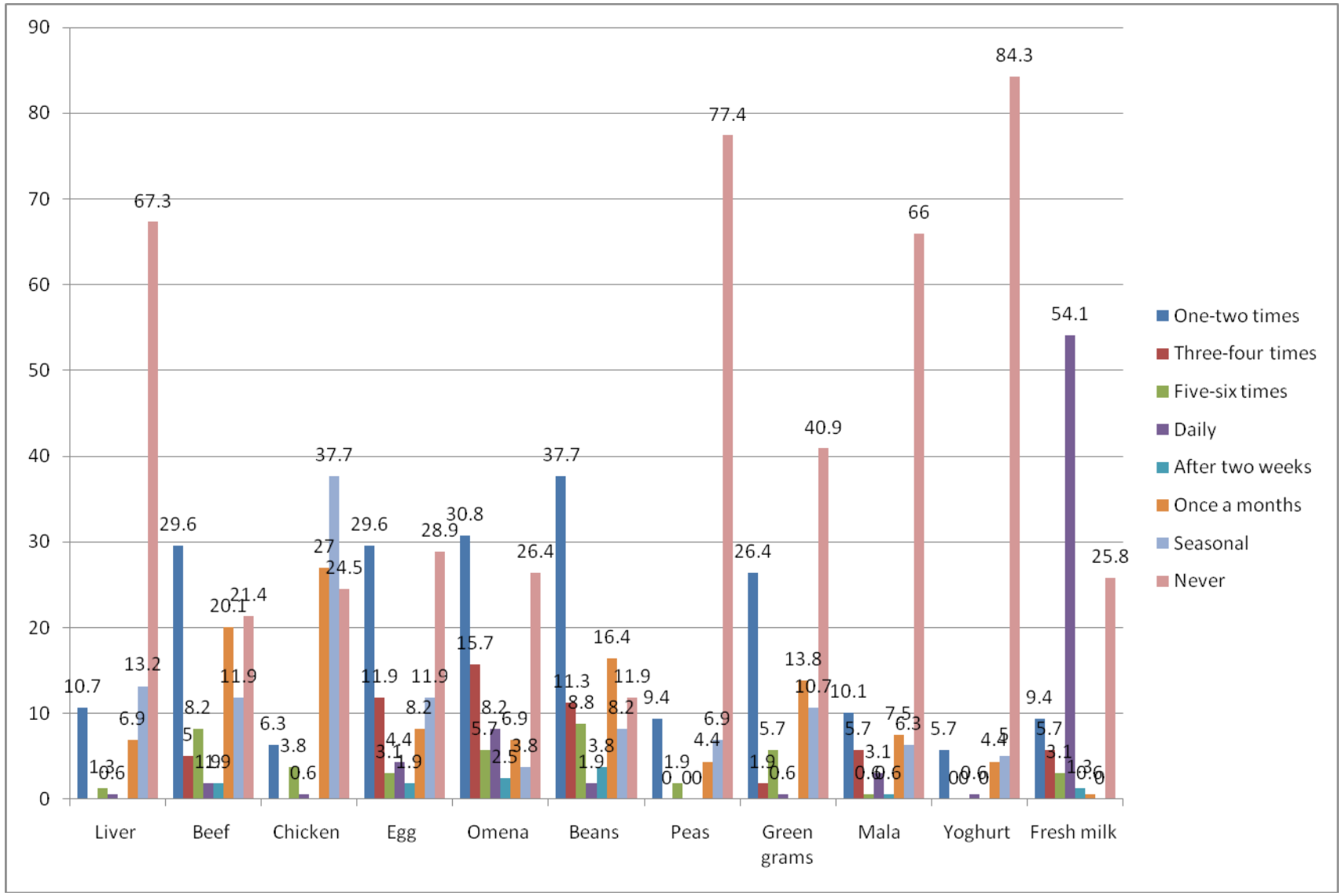
4.6.2 Proteins

The following table summarizes the food consumption frequency of the various protein foods consumed by the indexed children in the sampled households.

	Liver	Beef	Chicken	Egg	Omena	Beans	Peas	Green grams	Mala	Yoghurt	Fresh milk
One-two times	10.7	29.6	6.3	29.6	30.8	37.7	9.4	26.4	10.1	5.7	9.4
Three-four times		5.0		11.9	15.7	11.3		1.9	5.7		5.7
Five-six times	1.3	8.2	3.8	3.1	5.7	8.8	1.9	5.7	.6		3.1
Daily	0.6	1.9	.6	4.4	8.2	1.9		.6	3.1	.6	54.1
After two weeks		1.9		1.9	2.5	3.8			.6		1.3
Once a months	6.9	20.1	27.0	8.2	6.9	16.4	4.4	13.8	7.5	4.4	.6
Seasonal	13.2	11.9	37.7	11.9	3.8	8.2	6.9	10.7	6.3	5.0	
Never	67.3	21.4	24.5	28.9	26.4	11.9	77.4	40.9	66.0	84.3	25.8
Total	100.0	100.0	100	100.0	100	100.0	100.0	100.0	100	100.0	100

From this, it can be seen that (see histogram on the next page) fresh milk is the most common protein food consumed with 54.1% of the indexed children consumed milk on a daily basis. Omena, eggs and beans are also common sources of protein with omena being consumed by 8.2% of the indexed children on a daily basis, 5.7% consuming it 5-6times, 15.7 consuming it 3-4 times a week and 30.8% consuming it 1-2 times a week. 4.4% of the children were reported to take eggs daily, 3.1% 5-6times a week, 11.9% consuming it 3-4%, and 29.6% consuming it 1-2 times a week.

The least consumed protein sources included yoghurt with 84.3% reported to have never consumed it. 77.4% were to had never consumed peas with only 6.9% reporting to had only consumed it seasonally and another 4.4% reported to consume it once a month. Liver was also least consumed with 67.7% reported to had never consumed it, 13.2% consuming it seasonally and 6.9% consuming it once a month.

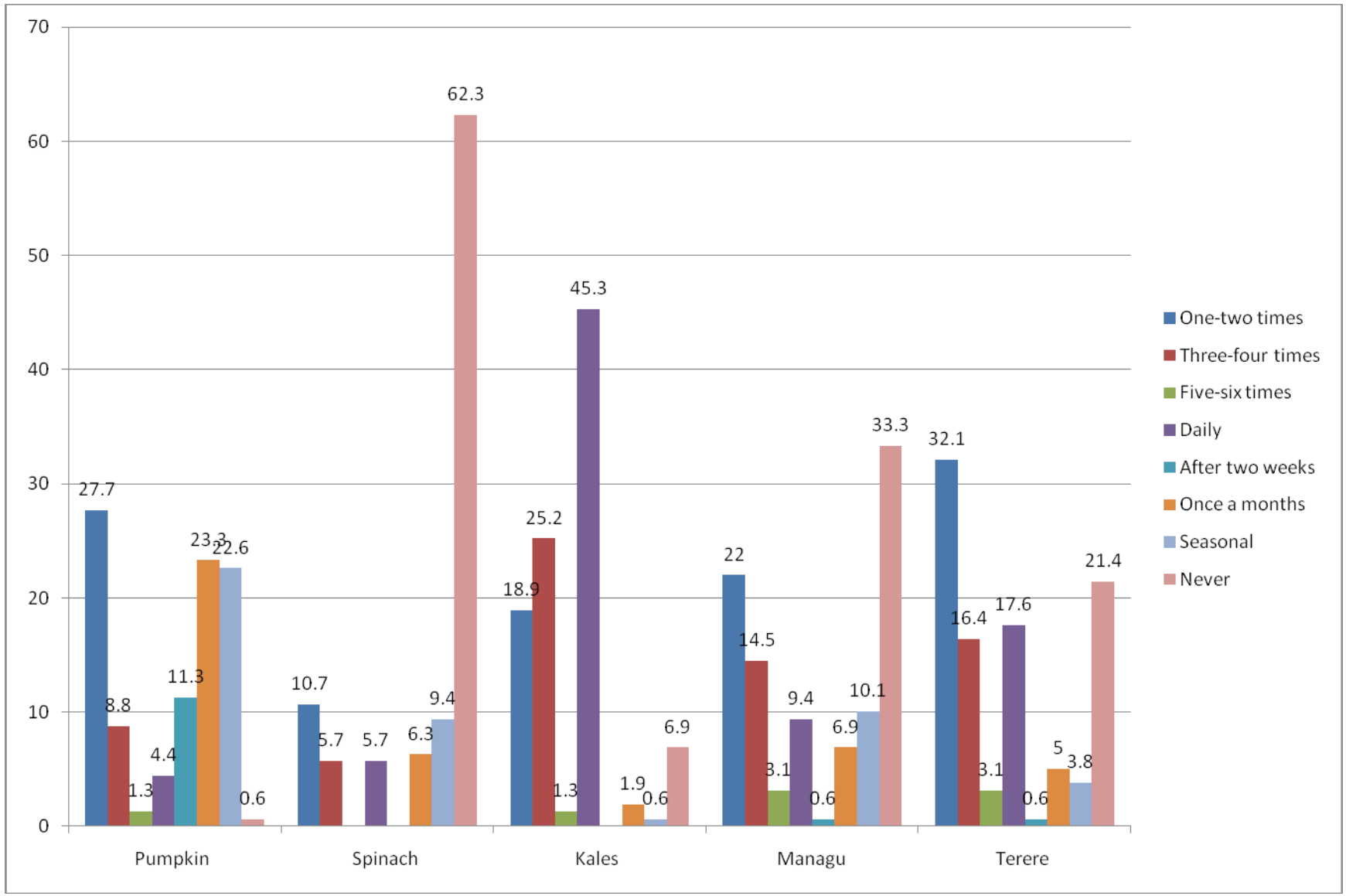

90
80
70
60
50
40
30
20
10
0
Liver
Beef
Chicken
Egg
Omena
Beans
Peas
Green grams
Mala
Yoghurt
Fresh milk
One-two times
Three-four times
Five-six times
Daily
After two weeks
Once a months
Seasonal
Never

4.6.3 Vegetable

The following table summarizes the food consumption frequency of the various vegetables consumed by the indexed children in the sampled households.

	Pumpkin	Spinach	Kales	Managu	Terere
One-two times	27.7	10.7	18.9	22.0	32.1
Three-four times	8.8	5.7	25.2	14.5	16.4
Five-six times	1.3		1.3	3.1	3.1
Daily	4.4	5.7	45.3	9.4	17.6
After two weeks	11.3			.6	.6
Once a months	23.3	6.3	1.9	6.9	5.0
Seasonal	22.6	9.4	.6	10.1	3.8
Never	.6	62.3	6.9	33.3	21.4
Total	100.0	100.0	100	100.0	100

As shown in the histogram on the next page Kales was the most consumed vegetable with 45.3% of the indexed children were reported to had consumed it on a daily basis and another 25.2% consumed it 3-4 times a week. Terere was also highly consumed with 17.6 reported to had consumed it daily, 16.4% consumed it 3-4 times a day and 32.1% consumed it once every week. Spinach was the least consumed vegetable with only 5.7% reported to had consumed it daily, 5.7% 3-4 times a day and 10.7% once a week. Pumpkin was also among the least consumed with 4.4% consuming it daily, 1.3% 5-6 times a week, 8.8% 3-4 times a week and 27.7 once a week.


70
60
50
40
30
20
10
0
Pumpkin
Spinach
Kales
Managu
Terere
27.7
8.8
1.3
4.4
11.3
23.3
22.6
0.6
10.7
5.7
5.7
6.3
9.4
62.3
18.9
25.2
1.3
45.3
1.9
0.6
6.9
22
14.5
3.1
9.4
0.6
6.9
10.1
33.3
32.1
16.4
3.1
17.6
0.6
5
3.8
21.4
One-two times
Three-four times
Five-six times
Daily
After two weeks
Once a months
Seasonal
Never

4.6.4 Fruits

The following table summarizes the food consumption frequency of the various fruits consumed by the indexed children in the sampled households.

	Ripe bananas	Avocado	Pineapple	Pawpaw	Watermelon	Mango	Oranges
One-two times	29.6	21.4	11.3	15.1	5.0	33.3	24.5
Three-four times	23.3	13.8	1.9	3.8	1.9	16.4	15.1
Five-six times	4.4	1.9	3.1	1.9		1.9	2.5
Daily	15.1	18.9	1.3			7.5	6.3
After two weeks	1.3	.6	6.9			1.3	
Once a months	8.2	3.1	19.5	5.0	3.8	5.0	8.2
Seasonal	11.9	28.3	55.3	24.5	6.9	24.5	18.2
Never	6.3	11.9	.6	49.7	82.4	10.1	25.2
Total	100.0	100.0	100	100.0	100	100	100

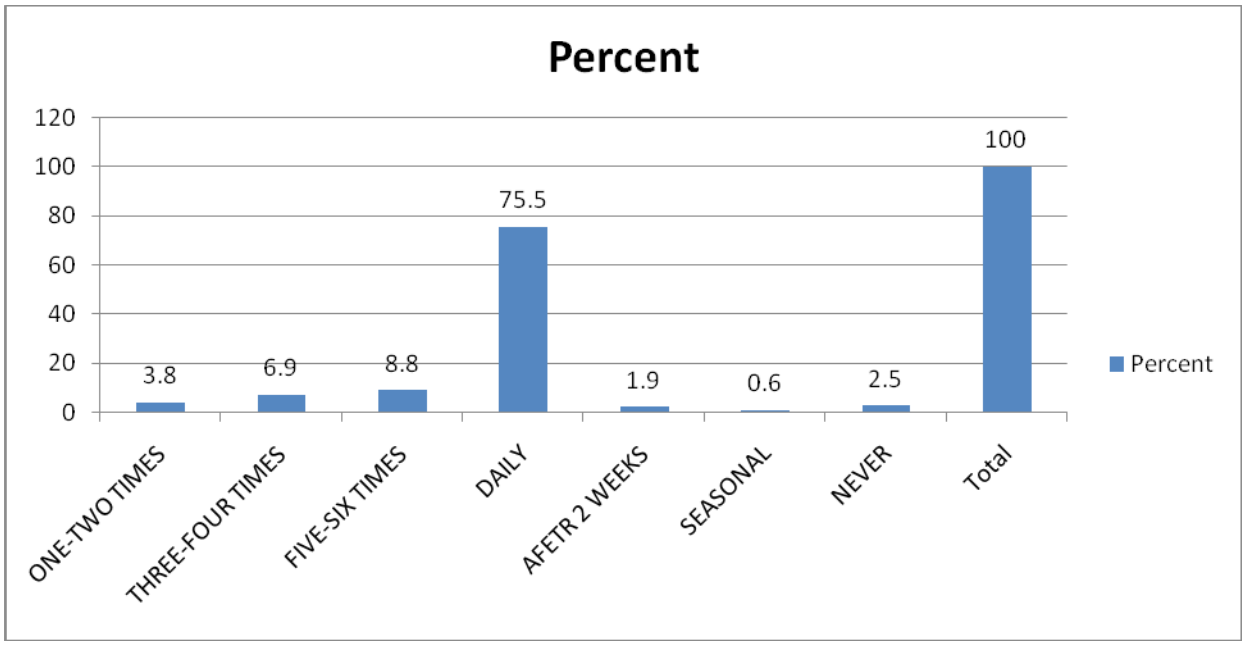
As shown on the histogram in the next page, avocado and ripe bananas are the most consumed foods with avocado being consumed by 18.9% of the indexed children daily, 13.8% 3-4 times weekly and 21.4% 1-2 times a week while ripe bananas were consumed by 15.1% daily, 4.4% 5-6 times a week, 23.3% 3-4 times a week and 26.9% 1-2 times a week.

Watermelon and pawpaw were the least consumed fruits with 82.4% reported to have never consumed watermelon, 49.7% reported to had never consumed pawpaw, 24.5% reported to consume it seasonally, and 5% having consumed it once a month.

4.6.5 Fats and Oils

The following table summarizes the food consumption frequency of the fats/oils and margarine consumed by the indexed children in the sampled households.

	Frequency	Percent
ONE-TWO TIMES	6	3.8
THREE-FOUR TIMES	11	6.9
FIVE-SIX TIMES	14	8.8
DAILY	120	75.5
AFETR 2 WEEKS	3	1.9
SEASONAL	1	.6
NEVER	4	2.5
Total	159	100.0



As shown in the histogram above, most indexed children (75.5%) consumed fat/oil/margarine in their food on a daily basis, 8.8% consume 5-6 times a week, 6.9% consumed 3-4 time a week and 3.8% consumed once every week. 1.9% consumed after every two weeks, 0.6% consumed seasonally while 2.5% had never consumed fat/oil/margarine.

CHAPTER FIVE: DISCUSSION

This paper presents data on malnutrition among children aged 6 – 59 months living in Chavakali. This is the first study to assess malnutrition among children aged 6 – 59 months living in Chavakali.

5.1 Nutrition status

The overall prevalence for stunting in children aged 6 – 59 months in the study location was 21.5%. This prevalence indeed indicates that chronic malnutrition is a problem within the community.

The overall prevalence of wasting among the children aged 6 – 59 months is 2.5% However male children have a higher weight for height 0.57 than female children 0.38 which implies male children are well nourished than female children. The prevalence of low weight for age (a combination of chronic and acute malnutrition) is 8.9% with only 1 of the entire sample size of 158 was chronically malnourished.

5.2 Feeds and feeding practices

Analysis revealed that processed foods were the least consumed in Chavakali. This included biscuits and cakes among the carbohydrates and yoghurt among the protein sources. Most mothers initiated breastfeeding at the right time i.e. within the first 30 minutes after birth but only half of the sampled population practiced exclusive breastfeeding for the first months of life. Micronutrients such as vitamins are obtained from consumption of fruits mostly seasonally however 83% of the population had never consumed watermelons. Vitamin A supplementation is well received among the children although 26 children did not receive the supplement. In addition most of the children in the households surveyed consumed fats and oils daily in their diet. Fats and oils are an important source of caloric intake and if fortified can provide essential micronutrients.

5.3 Food production

Despite Chavakali being in a rural set up more than half of the food consumed in the sampled households was purchased. This may be because agriculture in Chavakali is mostly rain fed and small scale therefore cannot meet the dietary needs and requirements of the households. However most households sampled considered themselves food secure. This however may be

contradicted by the fact that as many as 63 households had experienced food shortage in the period preceding the survey. In addition some households did not know whether to define themselves as food secure or insecure perhaps due to misunderstanding of the meaning of the term.

5.4 Deworming

Most children surveyed had not been dewormed preceding the survey. The danger of intestinal worms is that they usually attach themselves in the small intestine and absorb digested food preventing it from being absorbed into the child's body and thus denying him/her very valuable nutrients. They as well predispose the children to more frequent bouts of diarrhoea which likely will cause malnutrition if mismanaged.

5.5 Malaria and other illnesses

The most commonly suffered illness among the children sampled was malaria. However, more nets need to be availed to the 13.4% who do not own mosquito nets and malarial education done to sensitize the 4.4% who own mosquito nets but leave their children to sleep without one. Diarrhoea was also a major concern affecting 15% of the children. Diarrhoea if mismanaged can likely cause malnutrition among children aged 6 – 59 months old.

5.6 Access to health facilities and health seeking behaviour

27% of the population didn't consult a public or private health facility or a pharmacy when their children fell unwell. Health facilities are accessible to most reporting to access health facilities in less than an hour walking/

CHAPTER SIX: CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

The prevalence of stunting (both moderate and severe) in Western Kenya is 34% according to the Kenya Demographic and Health Survey (2008-2009) and in our study population it is 21.5%. This implies chronic malnutrition is an issue of concern in Chavakali. This study identified food insecurity to be a contributing factor to the stunting identified. Food production is inadequate to meet dietary needs leading to most households being forced to buy food to supplement the agricultural production. In addition, illnesses such as malaria contribute negatively to the nutrition status of the children.

Diarrhoea as well as intestinal worms was also a contributing factor for the malnutrition observed in the children. Based on the results we suggest that the local authorities should strive to improve agricultural production in Chavakali so that food security can be assured. In addition, control of malaria should be an issue of concern among the local authorities.

6.2 Recommendations

Nutrition and agricultural education needs to be enhanced so as to improve on the IYCF practices, with the adaptation of kitchen gardens to diversify in fruit, vegetable and small livestock production which will in turn lead to less dependence on the market for purchase of food commodities but rather rely on the market on diversification of foods that cannot be produced within the local climatic conditions and soil types. This would also reduce the number of households considered as food insecure and this would result to improved nutrition status of the children under 5 years and the overall population as well.

Exclusive breastfeeding programs need also to be enhanced so as to reduce the rate complementary feeding before children reach an age of 6 months.

Health seeking behavior need to be enhanced through advocacy and education programs as a large proportion of the population was observed not to seek professional medical assistance when their children showed signs of illnesses and also a large proportion to have given medication to the children on their own (self medication) with over the counter drugs which is not recommended. Coverage of deworming programs should also be enhanced so as to reduce the proportionate population of children under 5 years who are not dewormed.

The government should also enhance access to credit facilities and production resources such as seeds and fertilizer, etc, so as to reduce the percentage of the population relying on casual labor as their main source of income. Improved production resources will also increase household income that will translate to improved food access and improved standards of living.

REFERENCES

1. Abo-Shousha S.A., Hussein M.Z., Rashwan I.A. and Salama M. (2005) Production of proinflammatory cytokines: granulocyte-macrophage colony stimulating factor, interleukin-8 and interleukin-6 by peripheral blood mononuclear cells of protein energy malnourished children. *Egypt J Immunol* 12, 125-131.
2. Ahmed T., Ali M., Ullah M.M., Choudhury I.A., Haque M.E., Salam M.A., Rabbani G.H., Suskind R.M. and Fuchs G.J. (1999) Mortality in severely malnourished children with diarrhoea and use of a standardised management protocol. *Lancet* 353, 1919-1922.
3. Ahmed T., Rahman S. and Cravioto A. (2009) Oedematous malnutrition. *Indian J Med Res* 130, 651-654.
4. Alam N.H., Hamadani J.D., Dewan N. and Fuchs G.J. (2003) Efficacy and safety of a modified oral rehydration solution (ReSoMaL) in the treatment of severely malnourished children with watery diarrhea. *J Pediatr* 143, 614-619.
5. Ali S.S., Karim N., Billoo A.G. and Haider S.S. (2005) Association of literacy of mothers with malnutrition among children under three years of age in rural area of district Malir, Karachi. *J Pak Med Assoc* 55, 550-553.
6. Ambrus J.L.S. and Ambrus J.L.J. (2004) Nutrition and infectious diseases in developing countries and problems of acquired immunodeficiency syndrome. *Exp Biol Med (Maywood)* 229, 464-472.
7. anthelminthic treatment improves growth, appetite and anemia in Zanzibari preschool children. *J Nutr* 134, 348-356.
8. Antwi S. (2008) Malnutrition: missed opportunities for diagnosis. *Ghana Med J* 42, 101-104.
9. Azevedo Z.M., Luz R.A., Victal S.H., Kurdian B., Fonseca V.M., Fitting C., Camara F.P., Haeffner-Cavaillon N., Cavaillon J.M., Gaspar Elsas M.I. and Xavier Elsas P. (2005) Increased production of tumor necrosis factor-alpha in whole blood cultures from children with primary malnutrition. *Braz J Med Biol Res* 38, 171-183.
10. Beisel W.R. (1995) Herman Award Lecture: Infection-induced malnutrition-from cholera to cytokines. *Am J Clin Nutr* 62, 813-819.
11. Beisel W.R., Blackburn G.L., Feigin R.D., Keusch G.T., Long C.L. and Nichols B.L. (1977) Proceedings of a workshop: impact of infection on nutritional status of the host. *Am J Clin Nutr* 30, 1203-1371, 1439-1566.
12. Berkowitz G.S. and Papiernik E. (1993) Epidemiology of preterm birth. *Epidemiol Rev* 15, 414-443.
13. Bhan M.K., Bhandari N. and Bahl R. (2003) Management of the severely malnourished child: perspective from developing countries. *BMJ* 326, 146-151.
14. Black R.E., Morris S.S. and Bryce J. (2003) Where and why are 10 million children dying every year? *Lancet* 361, 2226-2234.
15. Brabin B.J. and Coulter J.B.S. (2003) Nutrition associated disease. In *Manson's tropical diseases*, pp. 561-580 [G.C. Cook and A.I. Zumla, editors]. London: Saunders
16. Castaneda C., Dolnikowski G.G., Dallal G.E., Evans W.J. and Crim M.C. (1995) Protein turnover and energy metabolism of elderly women fed a low-protein diet. *Am J Clin Nutr* 62, 40-48.
17. Cederholm T., Wretlind B., Hellstrom K., Andersson B., Engstrom L., Brismar K., Scheynius A., Forslid J. and Palmblad J. (1997) Enhanced generation of interleukins 1 beta and 6 may contribute to the cachexia of chronic disease. *Am J Clin Nutr* 65, 876-882.
18. Chandra R.K. (1991) 1990 McCollum Award lecture. Nutrition and immunity: lessons from the past and new insights into the future. *Am J Clin Nutr* 53, 1087-1101.

19. Conley D. and Bennett N.G. (2001) Birth weight and income: interactions across generations. *J Health Soc Behav* 42, 450-465.
20. Constans J., Pellegrin I., Pellegrin J.L., Peuchant E., Simonoff M., Sergeant C., Fleury H., Clerc M., Leng B. and Conri C. (1995) Plasma interferon alpha and the wasting syndrome in patients infected with the human immunodeficiency virus. *Clin Infect Dis* 20, 1069-1070.
21. Coss-Bu J.A., Klish W.J., Walding D., Stein F., Smith E.O. and Jefferson L.S. (2001) Energy metabolism, nitrogen balance, and substrate utilization in critically ill children. *Am J Clin Nutr* 74, 664-669.
22. Cundiff D.K. and Harris W. (2006) Case report of 5 siblings: malnutrition? Rickets? DiGeorge syndrome? Developmental delay? *Nutr J* 5, 1.
23. Cytokine & Cells Online Pathfinder Encyclopedia (2002) Acute phase reaction.
24. Davies M.G. and Hagen P.O. (1997) Systemic inflammatory response syndrome. *Br J Surg* 80, 920-935.
25. de Onis M. and Blossner M. (2003) The World Health Organization Global Database on Child Growth and Malnutrition: methodology and applications. *Int J Epidemiol* 32, 518-526.
26. de Onis M., Blossner M., Borghi E., Frongillo E.A. and Morris R. (2004) Estimates of global prevalence of childhood underweight in 1990 and 2015. *JAMA* 291, 2600-2606.
27. de Onis M., Frongillo E.A. and Blossner M. (2000) Is malnutrition declining? An analysis of changes in levels of child malnutrition since 1980. *Bull World Health Organ* 78, 1222-1233.
28. de Onis M., Monteiro C., Akre J. and Glugston G. (1993) The worldwide magnitude of protein-energy malnutrition: an overview from the WHO Global Database on Child Growth. *Bull World Health Organ* 71, 703-712.
29. Delgado A.F., Okay T.S., Leone C., Nichols B., Del Negro G.M. and Vaz F.A. (2008) Hospital malnutrition and inflammatory response in critically ill children and adolescents admitted to a tertiary intensive care unit. *Clinics (Sao Paulo)* 63, 357-362.
30. Delpeucha F., Traissaca P., Martin-Prévela., Massambaa J.P. and Mairea B. (1999) Economic crisis and malnutrition: socioeconomic determinants of anthropometric status of preschool children and their mothers in an African urban area. *Public Health Nutrition* 3, 39-47.
31. Devi Yasoda P. and Geervani P. (1994) Determinants of nutrition status of rural preschool children in Andhra Pradesh, India. *Food Nutr. Bull* 15, 335-341.
32. Doumas B.T., Watson W.A. and Biggs H.G. (1971) Albumin standards and the measurement of serum albumin with bromcresol green. *Clin Chim Acta* 31, 87-96.
33. Duggan C., Watkins J.B. and Walker W.A. (2004) Nutrition in Pediatrics:basic science, clinical application.
34. Dulger H., Arik M., Sekeroglu M.R., Tarakcioglu M., Noyan T., Cesur Y. and Balahoroglu R. (2002) Pro-inflammatory cytokines in Turkish children with protein-energy malnutrition. *Mediators Inflamm* 11, 363-365.
35. Duncan G.J. (1996) Income dynamics and health. *Int J Health Serv* 26, 419-444.
36. Dunin-Wasowicz D., Rowecka-Trzebicka K., Milewska-Bobula B., Kassur-Siemienska B., Bauer A., Idzik M., Lipka B. and Marcinski P. (2000) Risk factors for cerebral palsy in very low-birthweight infants in the 1980s and 1990s. *J Child Neurol* 15, 417-420.
37. Elizabeth K.E. (2009) Cytokine response in malnutrition. *Indian J Med Res* 130, 12-13.
38. Enwonwu C.O. and Ritchie C.S. (2007) Nutrition and inflammatory markers. *J Am Dent Assoc* 138, 70-73.
39. Ezzati M., Lopez A.D., Rodgers A., Vander Hoorn S. and Murray C.J. (2002) Selected major risk factors and global and regional burden of disease. *Lancet* 360, 1347-1360.

40. F.A.O. (2004) Undernourishment around the world.In: The state of food insecurity in the world 2004. Rome: Food and Agriculture Organization of the United Nation.
41. Fong Y., Moldawer L.L., Shires G.T. and Lowry S.F. (1990) The biologic characteristics of cytokines and their implication in surgical injury. *Surg Gynecol Obstet* 170, 363-378.
42. Gabay C. and Kushner I. (1999) Acute-phase proteins and other systemic responses to inflammation. *N Engl J Med* 340, 448-454.
43. GDHS (2003) Nutrition of young children and mothers in Ghana: Ghana Demographic Health Survey.
44. Giovambattista A., Spinedi E., Sanjurjo A., Chisari A., Rodrigo M. and Perez N. (2000) Circulating and mitogen-induced tumor necrosis factor (TNF) in malnourished children. *Medicina (B Aires)* 60, 339-342.
45. Golden M.H.N. and Ramdath D. (1987) Free radicals in the pathogenesis of kwashiorkor. *Proc Nutr Soc* 46, 53-68.
46. Gonzalez-Barranco J. and Rios-Torres J.M. (2004) Early malnutrition and metabolic abnormalities later in life. *Nutr Rev* 62, S134-139.
47. Gornall A.G., Bardawill C.J. and David M.M. (1949) Determination of serum proteins by means of the biuret reaction. *J Biol Chem* 177, 751-766.
48. Gracey M. (1999) Nutritional effects and management of diarrhoea in infancy. *Acta Paediatr Suppl* 88, 110-126.
49. Grimble R.F. (1996) Interaction between nutrients, pro-inflammatory cytokines and inflammation. *Clin Sci (Lond)* 2, 121–130.
50. Hamer C., Kvatum K., Jeffries D. and Allen S. (2004) Detection of severe protein-energy malnutrition by nurses in The Gambia. *Arch Dis Child* 89, 181-184.
51. Hoffer L., Shils ME, Olson JA, Shike M, Ross AC, (1999) Metabolic consequences of starvation. 645-666.
52. Hoffer L.J. (2001) Clinical nutrition: 1. Protein-energy malnutrition in the inpatient. *CMAJ* 165, 1345-1349.
53. Hulst J., Joosten K., Zimmermann L., Hop W., van Buuren S., Buller H., Tibboel D. and van Goudoever J. (2004) Malnutrition in critically ill children: from admission to 6 months after discharge. *Clin Nutr* 23, 223-232.
54. Kazeem A., Oshikoya I. and Senbanjo O. (2009) Pathophysiological changes that affect drug disposition in protein-energy malnourished children. *Nutrition & Metabolism* 6, 50.
55. Khanum S., Ashworth A. and Huttly S.R. (1994) Controlled trial of three approaches to the treatment of severe malnutrition. *Lancet* 344, 1728-1732.
56. Kwena A.M., Terlouw D.J., de Vlas S.J., Phillips-Howard P.A., Hawley W.A., Friedman J.F., Vulule J.M., Nahlen B.L., Sauerwein R.W. and ter Kuile F.O. (2003) Prevalence and severity of malnutrition in pre-school children in a rural area of western Kenya. *Am J Trop Med Hyg* 68, 94-99.
57. Leenstra T., Petersen L.T., Kariuki S.K., Oloo A.J., Kager P.A. and ter Kuile F.O. (2005) Prevalence and severity of malnutrition and age at menarche; cross-sectional studies in adolescent schoolgirls in western Kenya. *Eur J Clin Nutr* 59, 41-48.
58. Lesourd B. (1995) Protein undernutrition as the major cause of decreased immune function in the elderly: clinical and functional implications. *Nutr Rev* 53, S86-91; discussion S92-84.
59. Malave I., Vethencourt M.A., Pirela M. and Cordero R. (1998) Serum levels of thyroxine-binding prealbumin, C-reactive protein and interleukin-6 in protein-energy undernourished children and normal controls without or with associated clinical infections. *J Trop Pediatr* 44, 256-262.
60. Manary M.J. and Brewster D.R. (1997) Potassium supplementation in kwashiorkor. *J Pediatr Gastroenterol Nutr* 24, 194-201.

61. Manary M.J., Broadhead R.L. and Yarasheski K.E. (1998) Whole-body protein kinetics in marasmus and kwashiorkor during acute infection. *Am J Clin Nutr* 67, 1205-1209.
62. Marano M.A., Fong Y., Moldawer L.L., Wei H., Calvano S.E., Tracey K.J., Barie P.S., Manogue K., Cerami A., Shires G.T. and et al. (1990) Serum cachectin/tumor necrosis factor in critically ill patients with burns correlates with infection and mortality. *Surg Gynecol Obstet* 170, 32-38.
63. Mayatepek E., Becker K., Gana L., Hoffmann G.F. and Leichsenring M. (1993) Leukotrienes in the pathophysiology of kwashiorkor. *Lancet* 342, 958-960.
64. Meremikwu M.M., Ekanem E.E. and Asindi A.A. (1992) Severe protein energy malnutrition in Calabar,Nigeria: Comparative study of factors affecting outcome of 82 cases. *Nig. J. Med* 2, 214-219.
65. Millward D.J. and Jackson A.A. (2004) Protein/energy ratios of current diets in developed and developing countries compared with a safe protein/energy ratio: implications for recommended protein and amino acid intakes. *Public Health Nutr* 7, 387-405.
66. Mishra S.K., Bastola S.P. and Jha B. (2009) Biochemical nutritional indicators in children with protein energy malnutrition attending Kanti Children Hospital, Kathmandu, Nepal. *Kathmandu Univ Med J (KUMJ)* 7, 129-134.
67. Morlese J.F., Forrester T., Badaloo A., Del Rosario M., Frazer M. and Jahoor F. (1996) Albumin kinetics in edematous and nonedematous protein-energy malnourished children. *Am J Clin Nutr* 64, 952-959.
68. Muller O. and Krawinkel M. (2005) Malnutrition and health in developing countries. *CMAJ* 173, 279-286.
69. Muller O., Garenne M., Kouyate B. and Becher H. (2003) The association between protein-energy malnutrition, malaria morbidity and all-cause mortality in West African children. *Trop Med Int Health* 8, 507-511.
70. Muñoz C., Arévalo M., López M. and Schlesinger L. (1994) Impaired interleukin-1 and tumor necrosis factor production in protein-calorie malnutrition. *Lancet* 14, 347-352.
71. Muñoz C.M.S., Liana Schlesinger M.D. and Jean-Marc C. (1995) Interaction between cytokines, nutrition and infection. *Nutrition Research* 12, 1815-1844.
72. Murray C.J. and Lopez A.D. (1997) Global mortality, disability, and the contribution of risk factors: Global Burden of Disease Study. *Lancet* 349, 1436-1442.
73. Neumann C.G., Jelliffe D.B., Zerfas A.J. and Jelliffe E.F. (1982) Nutritional assessment of the child with cancer. *Cancer Res* 42, 699s-712s.
74. Niger T., Khatun S., Sultana M., Islam N. and Kazuhiro O. (2010) Determinants of Malnutrition among the Children under 2 Years of Age. *Pak. J. Nutr.* 1, 27-34.
75. Nti C.A. and Lartey A. (2006) Young child feeding practices and child nutritional status in rural Ghana. *International Journal of Consumer Studies* 31, 326–332.
76. Odebode T.O. and Odebode S.O. (2005) Protein Energy Malnutrition and the Nervous System: the Impact of Socioeconomic Condition, Weaning Practice, Infection and Food Intake, an Experience in Nigeria. *Pakistan Journal of Nutrition* 5, 304-309.
77. Oshiro I., Takenaka T. and Maeda J. (1982) New method for hemoglobin determination by using sodium lauryl sulfate (SLS). *Clin Biochem* 15, 83-88.
78. Owor M., Tumwine J.K. and Kikafunda J.K. (2000) Socio-economic risk factors for severe protein energy malnutrition among children in Mulago Hospital, Kampala. *East Afr Med J* 77, 471-475.
79. Oyedejo G.A., Olamijulo S.K., Osinaike A.I. and et al. (1996) Secular trends in growth of children aged 0-6 years in a rural Nigerian community. *Ann. trop. Paediat.* 16, 11-17.

80. Pelletier D.L., Frongillo E.A., Jr., Schroeder D.G. and Habicht J.P. (1995) The effects of malnutrition on child mortality in developing countries. *Bull World Health Organ* 73, 443-448.
81. Phillips R.S., Enwonwu C.O. and Falkler W.A. (2005) Pro- versus anti-inflammatory cytokine profile in African children with acute oro-facial noma (cancrum oris, noma). *Eur Cytokine Netw* 16, 70-77.
82. Pinstrup-Andersen P., Burger S., Habicht J.P. and Peterson K. (1993) Protein-energy malnutrition. In *Disease control priorities in developing countries* [D.T. Jamison, W.H. Mosley, A.R. Measham and J.L. Bobadilla, editors]. New York: Oxford University Press.
83. Powell-Tuck J. (1997) Penalties of hospital undernutrition. *J R Soc Med* 90, 8-11.
84. Rahman A.M., Mannan M.A. and Rahman M.H. (2007) Serum iron and total iron binding capacity in severely malnourished children Bangladesh *J Pharmacol* 2, 61-65.
85. Rhodus N.L., Cheng B., Myers S., Miller L., Ho V. and Ondrey F. (2005) The feasibility of monitoring NF-kappaB associated cytokines: TNF-alpha, IL-1alpha, IL-6, and IL-8 in whole saliva for the malignant transformation of oral lichen planus. *Mol Carcinog* 44, 77-82.
86. Roubenoff R., Roubenoff R.A., Cannon J.G., Kehayias J.J., Zhuang H., Dawson-Hughes B., Dinarello C.A. and Rosenberg I.H. (1994) Rheumatoid cachexia: cytokine-driven hypermetabolism accompanying reduced body cell mass in chronic inflammation. *J Clin Invest* 93, 2379-2386.
87. Sauerwein R.W., Mulder J.A., Mulder L., Lowe B., Peshu N., Demacker P.N., van der Meer J.W. and Marsh K. (1997) Inflammatory mediators in children with protein-energy malnutrition. *Am J Clin Nutr* 65, 1534-1539.
88. Savino W. (2002) The thymus gland is a target in malnutrition. *Eur J Clin Nutr* 3, 46-49.
89. Schofield C. and Ashworth A. (1996) Why have mortality rates for severe malnutrition remained so high? *Bull World Health Organ* 74, 223-229.
90. Scrimshaw N.S., CE T. and JE G. (1968) Interactions of nutrition and infection. Geneva: World Health Organization.
91. Stenvinkel P., Barany P., Heimburger O., Pecoits-Filho R. and Lindholm B. (2002) Mortality, malnutrition, and atherosclerosis in ESRD: what is the role of interleukin-6? *Kidney Int Suppl*, 103-108.
92. Stephensen C.B. (1999) Burden of infection on growth failure. *J Nutr* 129, 534S-538S.
93. Stoltzfus R.J., Chway H.M., Montresor A., Tielsch J.M., Jape J.K., Albonico M. and Savioli L. (2004) Low dose daily iron supplementation improves iron status and appetite but not anemia, whereas quarterly
94. Sullivan D.H. (2001) What Do the Serum Proteins Tell Us About Our Elderly Patients? *J Gerontol A Biol Sci Med Sci* 2, M71-M74.
95. Sysmex (2007) Principle for automated leukocyte differentiation with XE Family analysers, making use of bioimaging technology. *The Cell Analysis Center – Scientifi c Bulletin Part 4*.
96. UNACC (2000) Fourth report on the world nutrition situation. Geneva: United Nations Administrative Committee on Coordination/Sub-Committee on Nutrition,.
97. UNESCO/WHO (2002) How does nutrition affect a child's development: who.int/nut/pem.htm.
98. UNICEF (2006a) High Level Meeting "West African leaders' commitment to fight malnutrition": The Global Alliance for Improved Nutrition.
99. UNICEF (2006b) Malnutrition the challenge: United Nations Children‟s Fund
100. Vaisman N., Schattner A. and Hahn T. (1989) Tumor necrosis factor production during starvation. *Am J Med* 87, 115.
101. Waterlow I.C. (1992) Causes of edema and its relation to kwashiorkor. In *Protein energy malnutrition*. London: Edward Arnold.
102. WHO (1991) Indicators for Assessing-Breast-Feeding practices. Geneva: World Health Organization.

103. WHO (1998) Report of the Division of Child Health and Development. 1996-1997. Geneva: WHO.
104. WHO (1999) Management of severe malnutrition: a manual for physicians and other senior health workers. Geneva.
105. WHO (2000a) The management of Nutrition in Major Emergencies. Geneva: World Health Organization.
106. WHO (2000b) Management of the child with a serious infection or severe malnutrition. Guidelines for care at the first-referral level in developing countries. Geneva.
107. WHO (2005) Nutrition: Challenges: World Health Organization.
108. WHO and UNICEF (2004) Joint statement on the management of acute diarrhoea. Geneva: The Organization.
109. Woodward B. (1998) Protein, calories, and immune defenses. *Nutr Rev* 56, S84-92.
110. Yamano S., Atkinson J.C., Baum B.J. and Fox P.C. (1999) Salivary gland cytokine expression in NOD and normal BALB/c mice. *Clin Immunol* 92, 265-275.
111. Zere E. and McIntyre D. (2003) Inequities in under-five child malnutrition in South Africa. *Int J Equity Health* 2, 7.

APPENDIXES

APPENDIX 1. Data matrix

Data collection methods	Indicators	Variables	Equipment
Anthropometry	W/A W/H H/A	Weight , Height , Age	Salter scale Bathroom scales Height boards MUAC tapes
Biochemical methods	Iron status Geohelminthes	Haemoglobin	Stool containers, Haemoque machine, gloves, microscope
Dietary assessment	Food frequency questionnaire 24 hour recall Dietary diversity		Questionnaire
WASH	• Waste disposal practices • Number of households with latrines • Number of households with running water • Deworming		Questionnaire

APPENDIX 2. Gannt chart

MONTH EVENT	**January**	**February**	**March**	**April**
Selection of the research title and study site				
Development of the proposal				
Field visit and Data collection				
Data entry and analysis				
Preparation of final project report				
Presentation of Final Report				
Reporting/ giving feedback				

Appendix 3. Questionnaire

Hello, my names are _____, I am student from UNIVERSITY OF NAIROBI, am conducting research about the prevalence and associated risk of protein energy malnutrition. I will appreciate your participation and that of your child in this research. Participation is voluntary. There is no risk involved in this study; the information obtained from this research is for academic purposes only.

1. Name of interviewer----------
2. Household number----------
3. Date of the interview----------
4. Name of the district----------
5. Name of the division_____
6. Name of the location_____
7. Name of the village----------
8. Relation of the respondent to the child----------1= mother 2=father

   4=0ther(specify) [ ]
9. Age of the respondent----------
10. Sex---------- 1= male 2=female [ ]
11. Marital status---------- 1=married 2=divorced 3=widow

    4=others [ ]
12. 10. Education level of the respondent ---------- 1=primary 2= secondary

    level
    3= college level 4=university [ ]

DEMOGRAPHY

	NAME	SEX	AGE	RELATION	EDUCATION		RESIDEN	PARENTAL

				TO HHH	YERS		T	STATUS

11.How many people are staying in this household?

CODES:

SEX

1= male

2= female **Occupation**

PARENTAL

1=house wife

1= both parents alive

2=employed 2=father only alive

3=self employed 3=mother only alive 4= both parent dead 4=none

EDUCATION

0= no

1=primary

2=Secondary

3=university

MARITAL STATUS

Relation to HHH

1=house HH

2= wife

3=son

4= daughter

5=nephew

6=niece

7=G.child

8=G.parent

9=other

1=single

2=married

3=divorce

4=widowed

5=others(specify)

12. How long have you lived in this area?.....years

13. Where was your original home?..... (District)

SOCIO-ECONOMIC

14. Are you working? 1= yes 2= NO [ ]

15. What is your specific occupation? 1=none 2=hawker 3=farming 4= milk seller 5= others [ ]

16. How much money do you earn? Per day---------ksh, per week----------ksh, per month--------ksh
17. How often do you buy food in a week? 1=once 2=twice 3=daily [ ]
18. How much money do you spend on food? a)a day----- b)week------- c)month----
19. What is the father's monthly income?..... Ksh
20. What is the total household income?..... Ksh
21. Observe and/or ask for ownership of the following.

1= yes 2= No

Radio [ ]

Bicycle [ ]

T.V set [ ]

Motorbike [ ]

22. Observe and record

a) Type of the roof for the main house

1= grass thatched 2= tins 3= iron sheets 4= tiles [ ]

b) Materials used for the floor.

1= mud 2= cow dug 3= cement 4= others (specify) [ ]

c) presence of a kitchen 1= yes 2= No [ ]

23. a).how many rooms has the main house have?.....

b) Ownership of house 1= rented 2=owned [ ]

c) if rented how much per month…… Ksh

24. observe for the presence of a latrine 1= yes 2= No [ ]
a) what is your source of water [ ]

1=well 2=stream 3=borehole 4= protected spring
5= others (specify
b) How many jerry cans do you use per day?.....c) How much per jerry can?.....

Ksh
25. .how do you dispose off your refuse? [ ]

1= burning 2= burying 3= rubbish pit 4= compound 5= others

……[ ]

26 .observe and record general sanitation [ ]

1= poor 2=good 3=very good

27. ANTHROPOMETRY MEASURES OF ALL CHILDREN(6-59 MONTH) IN THE

ID NO			Z-SCORE
AGE(months)			
WEIGHT (KG)			
HEIGHT(CM)			

HOUSEHOLD.

28. Check for the presence of the following

1=yes 2= No
a) Edema (press the finger on the forehead and see if depression will form) [ ]
b) Sunken eyes[ ]
c) Protruding stomach[ ]
d) Dehydrated skin[ ]
e) Emaciated ribs [ ]

f) Tin grey hair [ ]

28. Birth order……..

29.Birth spacing from the previous child……. Yrs…….. Month

BREASTFEEDING AND FEEDING PATTERN

30. IS this child exclusively breastfed for six month? 1= yes 2= NO [ ]

31. Is this child currently breastfeeding 1=yes 2=NO [ ]

32. (if yes),how often do you breastfeed him/her per day 1=1-2 times 2=3-5 times a day 3= 6-8 times a day 4=>8 times a day [ ]

33. If no ,how long did you breastfeed this child---------months

34 .If stopped breastfeeding before 24months, what were the reasons? 1=mother was pregnant 2=mother was sick 3=child refused 4=others(specify) [ ]

35. Has this child introduced to other foods other than breast milk? 1= yes 2= NO [ ]

36. If yes at which age was the food introduced------months

37. Why did you decide to introduce these foods? 1=advised at the clinic 2= child was old enough 3=others [ ]

38. Which food did you first introduce to the child? 1= cow milk 2= camel milk 3= formulas 4= porridge 5= others [ ]

39. Did you prepare special meals for this child? 1= yes 2=no [ ]

40. If yes how often 1=always 2=rarely 3=never [ ]

41. How is this child`s food served and eaten? 1=together with other children in one plate 2=individually 3=others(specify) [ ]

42. How many times is this child fed in a day? 1-once 2=twice 3=4times 5=>4times [ ]

43. How many times is the child fed on the following food?

Milk

Beans

Meat

Fish

Chicken

Eggs

Green vegetables

Fruits 1=once daily 2=twice daily 3=more than twice daily 4=once in a week 5= occasionally

6=never [ ]

44. In your opinion, which five food do you consider is the best for the children? (list them in their order of importance)1. 2. 3. 4. 5.

45. Do encourage your child to eat when he/she has poor appetite? 1=yes 2=no [ ]

46. If yes how do you do it? 1=I use a stick 2=prepare attractive food 3= others(specify) [ ]

47.If no why? 1=lack of time 2=lack of patience 3=child should not be pressured to eat [ ]

NUTRITION KNOWLEDGE

48 .was this child unwell in the last seven days?

1= yes 2= No [ ]

49 .(if ye0s, list the illness

50.How do you tell that a child is a sick?----------

51.Do you know of a disease called kwashiorkor (calolweynad)? 1=yes 2=no [ ]

52. Do you know of a disease called marasmus (cagarshow)? 1=yes 2=no [ ]

53.How can you tell that a child has kwashiorkor or marasmus?

SYMPTOMS	**SCORE**
KWASHIORKOR	
MARASMUS	
TOTAL	

(1 correct symptoms = 1mark)

CHILD CARE

54. Do you leave this child in the care of the others? [ ]1=yes 2= No

55. If yes ,how many hours in a day?.....(hrs)

56. Who take care of this child when you are away? [ ]

1= older siblings 2= grandmother 3= neighbors 4= maid

5= others(specify)

57. Observe and record the physical appearance of the child and his playing environment [ ]

Physical appearance

1= clothes 2= nose unwiped 3= face unwashed 4= body dirty

58. How many times are clothes of this child washed [ ]

1= everyday 2= once a week 3=twice a week 4= three times a week

59. How often is this child bathed [ ]

1=everyday 2= once a week 3= twice a week 4= three times a week

5= more than 3 times in a week