

**PREVALENCE AND DETERMINANTS OF MALNUTRITION AMONG  
PRIMARY SCHOOL CHILDREN IN KILIFI DISTRICT, KENYA**

A DISSERTATION PRESENTED IN PARTIAL FULFILMENT OF THE  
REQUIREMENTS FOR THE DEGREE OF MASTER OF MEDICINE IN  
PAEDIATRICS AND CHILD HEALTH IN THE UNIVERSITY OF NAIROBI

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## **DECLARATION**

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

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## **DEDICATION**

This work is dedicated to my loving parents Professor Gasparly Tunje and Caroline Chizi Tunje.

You are truly inspirational.

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## **ABBREVIATIONS**

<b>AIDS</b>	Acquired Immunodeficiency Syndrome
<b>FAO</b>	Food and Agricultural Organization
<b>IQ</b>	Intelligence Quotient
<b>KDHS</b>	Kenya Demographic Health Survey
<b>KFSSG</b>	Kenya Food Security Steering Group
<b>KNBS</b>	Kenya National Bureau of Statistics
<b>MUAC</b>	Mid -upper arm circumference
<b>NCHS</b>	National Center for Health Statistics
<b>PEM</b>	Protein Energy Malnutrition
<b>SD</b>	standard deviation
<b>UNICEF</b>	United Nations International Children's Fund.
<b>WHO</b>	World Health Organization

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## **ABSTRACT**

### **BACKGROUND**

Childhood malnutrition remains a major public health problem in developing countries and a major contributor to global disease burden. Hunger and malnutrition among children in developing countries continue to impair health, quality of life, and survival. Under nutrition in school children is an underlying factor in low school enrolment, school absenteeism, poor performance and early school dropout. Children stunted at school-age are likely to have been exposed to poor nutrition since early childhood and that the degree of stunting tends to increase throughout the school-age years. However, children can exhibit catch-up growth if their environment improves. Healthy and well nourished children perform better in school, which translates to increased productivity as adults and eventually economic growth of a nation. To achieve the first Millennium Development Goal to “eradicate extreme poverty and hunger,” nutrition action needs to be intensified.

**Objectives:** To determine the prevalence of malnutrition among school children aged six to twelve years in Kilifi District using anthropometric methods and to evaluate association between moderate to severe malnutrition and socio-demographic factors.

**Methods:** This was a descriptive cross-sectional study conducted in public primary schools in Kilifi District. Multi-stage sampling method was used to select the schools and the participants in class one to four in the selected schools were randomly selected. A total of 338 children were seen and interviewed and anthropometric measurements taken. Data was computed using Epi-info software 2002 to convert it to nutritional indicators of weight for height, height for age and weight for age. Using Z scores and cut off of -2SD, children were grouped into different categories of nutritional status.

**Results:** The overall prevalence of malnutrition was 27.5% with the most common form being stunting at 16.6%, while wasting and underweight were 2.7% and 8.3% respectively. Age was

the only socio-demographic factor strongly associated with stunting ( $p=0.016$ ) but not with wasting and underweight. Both males and females were equally affected in all forms of malnutrition. Presence of school feeding programme in a school did not have any significant association with the current nutritional status of the children as the food supply was not regular and children were expected to buy but were not able to afford it.

**Conclusion:** The prevalence of malnutrition among school children in this area is significantly high and stunting like in other studies is the most common form of malnutrition in this age group.

**Recommendation:** Nutritional surveillance programs need to be established in order to detect early the children at risk of malnutrition and intervene promptly. Effective school feeding intervention should be supported. Further studies are required to determine the long term implications of linear growth retardation in school children in this area.

# **1 BACKGROUND AND LITERATURE REVIEW**

## **1.1 INTRODUCTION**

Malnutrition generally refers to under-nutrition and over-nutrition. It can also be defined as the cellular imbalance between supply of nutrients and energy and the body's demand for them to ensure growth, maintenance, and specific functions. (1)

Childhood malnutrition remains a major public health problem in developing countries and a major contributor to global disease burden (2). Hunger and malnutrition among children in developing countries continue to impair health, quality of life, and survival. It is estimated that a child dies every six seconds from hunger related causes and one out of four children in developing countries are underweight (3).

Poor health and malnutrition are important underlying factors for low school enrollment, absenteeism, poor classroom performance, and early school dropout, as reflected in the World Declaration on Education for All (4). In developing countries, an estimated 99 million children of primary-school age are not enrolled, and of those enrolled, only 78% complete primary school. Most children who fail to complete are from sub-Saharan Africa and south Asia. Only around half of the children enroll in secondary schools. Furthermore, children in some developing countries have much lower achievement levels than children in developed countries in the same grade (5)

School-age children are particularly vulnerable to under nutrition as the priority in nutrition interventions is often to prevent malnutrition during fetal development and the first years of life – the most critical period for growth and development (6). Stunting is widely believed to occur mainly in early childhood (mostly by three years of age), and through a cumulative process. Children stunted at school-age are likely to have been exposed to poor nutrition since early childhood and that the degree of stunting tends to increase throughout the school-age years.

However, children can exhibit catch-up growth if their environment improves. This suggests that interventions in school-age children can supplement efforts in the preschool years to reduce levels of stunting and related effects on children's health and education (7). Intensified nutrition action in school children can lead to achievement of the Millennium Development Goals 1 and 2: To halve the proportion of people who suffer from hunger around the world, and to ensure that all children are able to complete a full course of primary school.

Good health and nutrition are not only essential inputs but also important outcomes of basic education of good quality. Children must be healthy and well-nourished in order to fully participate in education and gain its maximum benefits. Early childhood care programs and primary schools which improve children's health and nutrition can enhance the learning and educational outcomes of school children. Education of good quality can lead to better health and nutrition outcomes for children, especially girls, and thus for the next generation of children as well (8).

Assessment of growth in children not only serves as one of the best global indicators of children's nutritional status but also provides an indirect measurement of quality of life of an entire population. Improving the nutrition of women and children will contribute to overcoming some of the greatest health challenges facing the world, including the burden of chronic and degenerative disease, maternal mortality, malaria and AIDS.

## **1.2 EPIDEMIOLOGY**

### ***Globally***

Stunting affects approximately 178 million children under 5 years old most of whom live in Sub-Saharan Africa and South-central Asia. One hundred and sixty million (90%) stunted children live in just 36 countries, and make up 46% of the 348 million children in those countries. About 55 million children are wasted, of whom 19 million have severe wasting (7).

One of the largest studies of anthropometric status of rural school children in low income countries (Ghana, Tanzania, Indonesia, Vietnam and India) found the overall prevalence of stunting and underweight to be high in all five countries, ranging from 48 to 56% for stunting and from 34 to 62% for underweight. Second, in all countries there was a trend for z-scores for height-for-age and weight-for-age to decrease with age, thus as children got older they became progressively shorter relative to the reference population. Third, the boys in most countries tended to be more stunted than girls and in all countries boys were more underweight than girls (7).

### ***Regionally***

Despite marked improvements globally in the prevalence of malnutrition, rates of under-nutrition and stunting have continued to rise in Africa, where rates of under-nutrition and stunting have risen from 24% to 26.8% and 47.3% to 48%, respectively, since 1990, with the worst increases occurring in the eastern region of Africa. Thirteen per cent of children under 5 years old in the developing world are wasted, and 5 per cent are severely wasted (an estimated 26 million children (9)).

### ***Nationally***

Data available focuses on children under five years of age. Comparison of the KDHS 2003 and that of 2009 indicates almost no change in the proportion of children who are stunted wasted and underweight (10). KDHS 2009 report indicates 35% of children under five years are stunted 14% severely stunted. Levels of stunting increase with age with peak at 46% among children in second year of life and remaining 32-35% among older children. Stunting is slightly higher in boys than girls and for rural children than for urban children. Prevalence of stunting varies by province from 29% in Nairobi to 42% in Eastern Province. Seven per cent of children in Kenya are wasted and 2% severely wasted. Highest rates are for ages 6-8months which coincides with

period of weaning. Wasting is higher in North Eastern Province 20% compared to 2% in Western Province. Sixteen per cent are underweight 4% severely underweight peak levels of low weight for age found among children 24-35months and in North Eastern Province (11).

In Kenya, information on nutritional status of school children is hard to find. A study done by Chesire in 2008 on determinants of malnutrition among school children in peri-urban slum community of Kawangware, Nairobi showed that 30.2% of children were stunted, 14.9% were underweight while 4.5% were wasted (12).

### ***Malnutrition in school children worldwide***

The prevalence of stunting, underweight and wasting varies by region and sub-region throughout low income countries. Stunting is an indicator of past growth failure and is associated with chronic insufficient protein and energy intake, recurrent infection, sustained inappropriate feeding practices and poverty (7).

Underweight among school-age children, like stunting, can reflect a broad range of insults such as prenatal under-nutrition, deficiencies of macro- and micro-nutrient, infection and, possibly, inadequate attention by care givers (7).

Wasting, which reflects acute malnutrition, is not as common as either stunting or underweight in school-age children. Nevertheless, wasting rates can change rapidly in situations of acute food crisis, with school-age children, adolescents in particular, becoming severely malnourished in such situations (7).

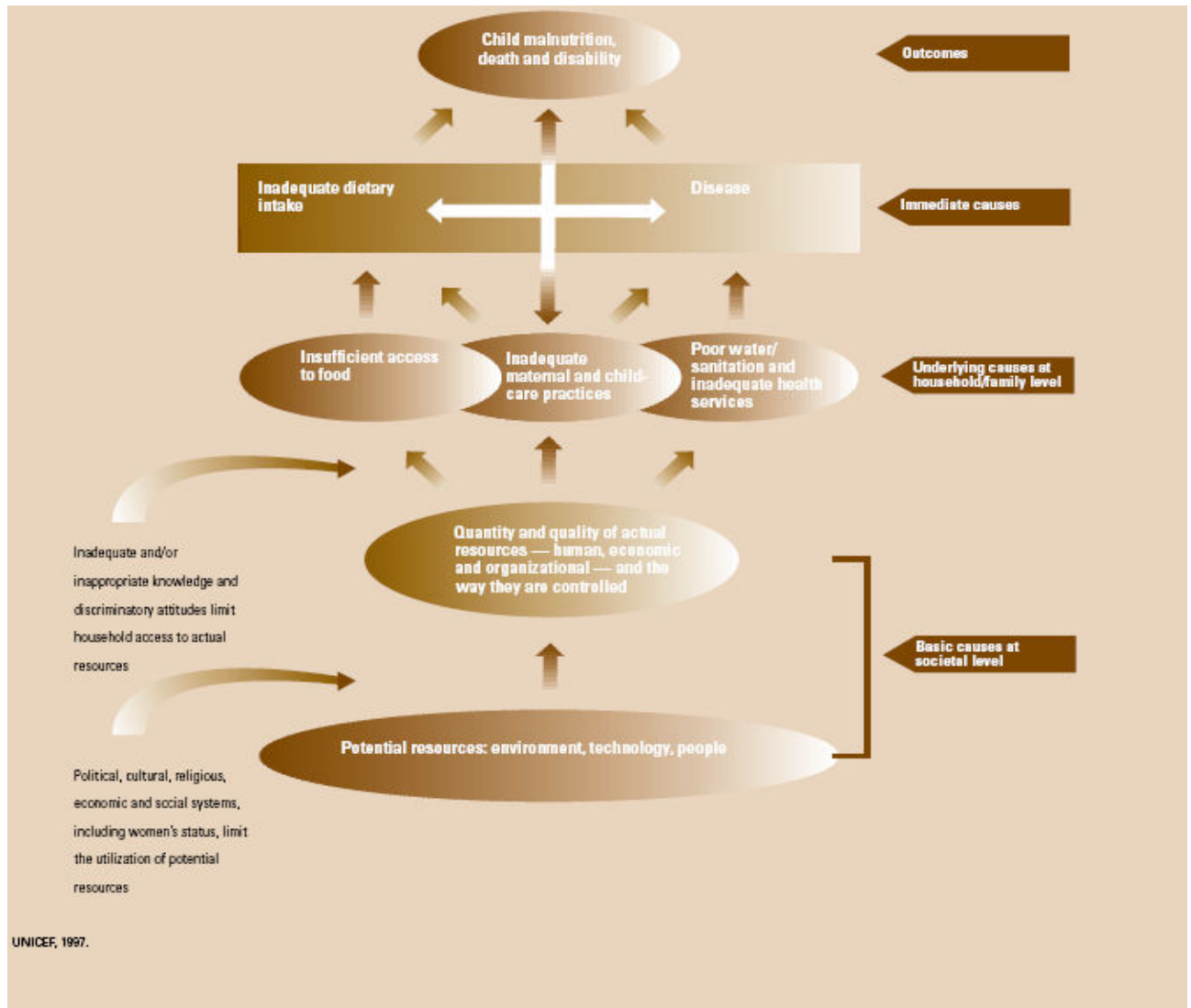
Table 1 summarizes the prevalence rates of malnutrition in school children in some of the countries in the world. High rates of malnutrition were observed among the low socioeconomic countries compared to those in higher economic status.

**Table 1: Summary of Prevalence Rates of Malnutrition in School Children**

Study site	Year	Age (years)	Stunting %	Wasting %	Underweight %
Magu district, Tanzania(13)	2000	7-18	52.5	43	43
Ejisu-juaben district, Ghana(14)	1995	5-9	54.9	44.3	
Ife central local government, Nigeria(15)	2007	12-14	27.6	16.8	61.2
Kwazulu, South Africa(16)	2001	8-10	7.3		0.7
Dhankuta and Sunsari districts, Eastern Nepal(17)	2004	5-15	21.5	10.5	61

### **1.3 CAUSES OF MALNUTRITION**

The causes of malnutrition are numerous and multifaceted. The most immediate determinants are poor diet and disease which are themselves caused by a set of underlying factors; household food security, maternal/child caring practices and access to health services and healthy environment. These underlying factors are influenced by basic socio-economic and political conditions (18).



**Figure 1 Conceptual Framework of Malnutrition (18)**

### **Food Security**

Hunger is stunting hundreds of millions of children in the developing countries. In developing countries, inadequate food intake is secondary to insufficient or inappropriate food supplies. In some areas, cultural and religious food customs may affect food intake. In rural areas, household food security may depend on access to land and other agricultural resources to guarantee sufficient domestic production. In urban areas, where food is largely bought on the market, a



range of foods must be available at accessible prices to ensure food security (18). FAO (Food and Agricultural Organization) estimates that 1.02 billion people are undernourished worldwide according to 2009 report (19). In Kenya, a total of 9.9 million people are affected by food insecurity, 1.5 million of whom are school children potentially to be included in the expanded school feeding programme. Results from the 2010 short rains assessments coordinated by the Kenya Food Security Steering Group (KFSSG) indicate that an estimated 1.6 million people remain highly or moderately food insecure (20).

### **Infections / Illnesses**

It is indisputable that infectious diseases have an important and significant impact on the growth of individual children. Diarrhoeal diseases and lower-respiratory infections have been particularly implicated in this regard. Children with chronic illness are also at risk for nutritional problems due to poor intake of nutrients, increased caloric demands or impaired organ function for synthesis of nutrients.(19)

### **Water and Sanitation**

Water supply, sanitation and hygiene given their direct impact on infectious diseases especially diarrhea are important for preventing malnutrition. Both malnutrition and inadequate water supply are linked to poverty.(19)

### **Socioeconomic Status**

Socioeconomic inequality in malnutrition is present throughout the developing world. Study done by Van De Poel et al in 47 countries in developing world showed that the better-off suffer less from malnutrition and that the resultant inequality is more pronounced for stunting than wasting(21).

## **1.4 CONSEQUENCES OF MALNUTRITION IN SCHOOL CHILDREN:**

### **Physical and Cognitive Development**

The period of children's most rapid physical growth and development is also the period of their greatest vulnerability. Adequate nutrition (providing the right amount of carbohydrates, protein, fats, and vitamins and minerals) is essential during the antenatal and early childhood period.

A study done by Friedman et al in Western Kenya suggests that school aged children in the developing world do not experience 'type A' catch up growth (accelerated growth velocity following an insult to growth) but continue to accrue greater height deficits with age if they remain in the same environment.(22)

Significant brain formation and development takes place beginning from the time the child is in the womb. Early studies of malnourished children showed changes in the developing brain including a slowed rate of growth of the brain, lower brain weight, thinner cerebral cortex, decreased number of neurons, insufficient myelination and changes in the dendritic spines. More recently, neuro-imaging studies have found severe alterations in the dendritic spine apparatus of cortical neurons in infants with severe protein calorie malnutrition. These changes are similar to those described in patients with mental retardation of different causes (23).

### **Economic Productivity**

Improving nutrition in early childhood leads to substantial increases in wage rates which suggests that investments in early childhood nutrition can be long term drivers of economic growth. This is according to study done on effect of a nutrition intervention on economic productivity in Guatemalan adults which showed an increase of US dollars 0.67 per hour (46% increase in average wages ) among those who received a more nutritious supplement compared to those who received a less nutritious supplement(24).

## **School performance**

Recent studies have found that severe stunting in the first two years of life is strongly associated with lower test scores in school-age children (age 8-11). However, deficits in children's scores were smaller at older ages, suggesting that adverse effects may decline over time. In addition, lower test scores are related to later enrollment, increased absenteeism and repetition of school years among stunted children. This indicates that stunted and non-stunted children can benefit similarly from education. (7, 25)

## **1.5 MEASUREMENT OF NUTRITIONAL STATUS**

Health or nutritional status of a child is usually assessed in three ways:

- a. anthropometric indicators
- b. biochemical indicators
- c. clinical indicators

### **Anthropometry**

Anthropometry is the measurement of growth and body composition. Changes in body dimensions reflect the overall health and welfare of individuals and populations. Anthropometry is used to assess and predict performance, health and survival of individuals and reflect the economic and social well being of populations. Anthropometry is a widely used, inexpensive and non-invasive measure of the general nutritional status of an individual or a population group (26).

Three indices are commonly used in assessing the nutritional status of children; weight-for-age; length-for-age or height-for-age; and weight-for-length or weight-for-height.

**Weight-for-age:**

Low weight-for-age index identifies the condition of being **underweight**, for a specific age. The advantage of this index is that it reflects both past (chronic) and/or present (acute) undernutrition (although it is unable to distinguish between the two). Underweight, based on weight-for-age, is a composite measure of stunting and wasting and is recommended as the indicator to assess changes in the magnitude of malnutrition over time (26).

**Height-for-age:**

Low height-for-age index identifies past undernutrition or chronic malnutrition. It cannot measure short term changes in malnutrition. For children below 2 years of age, the term is length-for-age; above 2 years of age, the index is referred to as height-for-age. Deficits in length-for-age or height-for-age is referred to as **stunting**. Stunting is an indicator of **past growth failure**. It is associated with a number of long-term factors including chronic insufficient protein and energy intake, frequent infection, sustained inappropriate feeding practices and poverty. In children over 2 years of age, the effects of these long-term factors may not be reversible. Data on prevalence of stunting in a community may be used in problem analysis in designing interventions. Information on stunting for individual children is useful clinically as an aid to diagnosis. Stunting, based on height for- age, can be used for evaluation purposes but is not recommended for monitoring as it does not change in the short term such as 6 - 12 months (26, 27).

**Weight-for-height:**

Low weight-for-height helps to identify children suffering from current or acute under nutrition or **wasting** and is useful when exact ages are difficult to determine. Weight-for-length (in

children under 2 years of age) or weight-for-height (in children over 2 years of age) is appropriate for examining short-term effects such as seasonal changes in food supply or short-term nutritional stress brought about by illness. Causes include inadequate food intake, incorrect feeding practices, disease, and infection or, more frequently, a combination of these factors. Wasting in individual children and population groups can change rapidly and shows marked seasonal patterns associated with changes in food availability or disease prevalence to which it is very sensitive. Weight-for-height is not advised for evaluation of change in non-emergency situations since it is highly susceptible to seasonality (27, 28)

### **Mid-Upper Arm Circumference (MUAC)**

MUAC is relatively easy to measure and a good predictor of immediate risk of death. It is used for rapid screening of acute malnutrition from the 6-59 month age range. MUAC can be used for screening in emergency situations but is not typically used for evaluation purposes.

### **Biochemical indicators**

Laboratory tests are useful in identifying nutritional deficiencies before clinical findings are evident for example iron deficiency. They can be used to monitor recovery from malnutrition that occurs as a complication of illness. The most valuable biochemical studies are: hemoglobin and red cell indices, serum pre-albumin and serum albumin levels.

**Hemoglobin and red cell indicators:** are used to identify children with nutritional deficiencies of iron, folate or vitamin B<sub>12</sub> or with anemia of chronic disease.

**Pre-albumin and albumin:** serum pre-albumin (transthyretin) and albumin are good indicators of the adequacy of short and long term dietary intake respectively. Serum pre-albumin concentrations fall rapidly with poor dietary intake and rise to low-normal values within 10 days of initiation of therapy. Thus is a good predictor of protein and energy adequacy of diet and

serves as sensitive marker of acute malnutrition. It's a negative acute phase reactant and concentrations fall in presence of infections. Albumin is used as indicator for long term dietary intake. Serum albumin is inversely correlated with morbidity and mortality.

### **Clinical indicators**

This is an essential feature of nutritional survey. It is the simplest and most practical method of ascertaining nutritional status of a group of individuals. It utilizes specific and non-specific physical signs that are known to be associated with malnutrition and deficiency of vitamins and micronutrients. Key aspects of clinical assessment includes: nutritional history, features seen in hair, angles of mouth, gums, nails, bones ,skin ,eyes, tongue, muscles and thyroid. Edema of both feet is an important clinical indicator.

Edema is the presence of excessive amounts of fluid in the intracellular tissue. Edema can be diagnosed by applying moderate thumb pressure to the back of the foot or ankle. Edema is diagnosed only if both feet show the impression for some time. The presence of edema in individuals should be recorded when using weight-for-height for surveillance or screening purposes. When a child has edema, it is automatically included with children counted as severely malnourished, independently of its wasting, stunting, or underweight status. This is due to the strong association between edema and mortality (29).

### **1.6 CLASSIFICATION OF MALNUTRITION**

In 1977, wasting and stunting system of classifying malnutrition was proposed and recommended by WHO. It used data from United States National Center for Health Statistics (NCHS) as international reference data. This was based on assumption that children worldwide have much the same growth potential at least up to seven years of age. Environmental factors such as infectious diseases and unsafe diet and poverty appear to be far more important than

genetic predisposition and are the cause of deviations from reference data. Drawback of this system is that body mass index for age only starts from 9 years and covers a limited percentile range (31)

In 2006, WHO published new child growth standards for attained weight and height to replace the recommended 1977 NCHS/WHO child growth reference. These new standards were based on breastfed infants and appropriately fed children of different ethnic origins raised in optimal conditions and measured in a standardized way. For the children above 5 years and adolescents, WHO merged data from NCHS/WHO reference (1-24 years) with data from the under-fives growth standards cross-sectional sample to result in smooth transition at 5 years for height for age, weight for age and body mass index for age (32). The new WHO child growth standards are now recommended for use in many countries.

## **1.8 STUDY JUSTIFICATION**

There is increasing evidence, that the high level of nutritional deprivation combined with the heavy burden of disease in the school age children has negative consequences for a child's long term overall development (8).

More than 200 million school years and 630 million IQ points are lost each year because of the poor health and nutritional status of school age children (8).

There has been increase in poverty levels in the midst of natural disasters like drought as well as conflict in the recent past which put children at risk of malnutrition. More than 60 million children go to school hungry every day and about 40% of them are in Africa (8).

The focus on nutrition has been on children under five years with little emphasis on school age children. Malnutrition in this group can be prevented. Children can exhibit catch up growth if their environment improves (7) Early intervention will therefore improve overall development which translates to more productive adults and eventually economic growth.

This study will provide valuable information on the magnitude of malnutrition among school age children in coastal rural Kenya. The information obtained can form basis for further studies to compare the magnitude of the problem in other regions of this country with similar environment.

The study will contribute to the development of strategic interventions to improve the nutritional status of children in the district as well as in other regions facing similar problem.

### **1.9 RESEARCH QUESTION**

What is the prevalence and socio-demographic factors associated with malnutrition among school children in Kilifi District?

### **1.10 STUDY OBJECTIVES**

#### ***Primary Objective***

To determine the nutritional status of school children age six to twelve years living in Kilifi District using anthropometric methods.

#### ***Secondary Objective***

To evaluate selected socio-demographic factors associated with poor nutritional status among these children aged six to twelve years living in Kilifi District.



## **2 METHODOLOGY**

### **2.1 STUDY DESIGN**

This was a descriptive cross-sectional study.

### **2.2 STUDY AREA (33)**

The study was carried out in public primary schools in Kilifi District in the Coastal Province of Kenya. The larger Kilifi district covers an area of 7,750 Km<sup>2</sup> and has a population of 678,702 persons (KNBS-2008) square. The district borders Malindi to the north, Taita Taveta to the west, Kwale and Mombasa to the south, and the Indian Ocean to the east. It was recently divided into three districts; Kilifi, Ganze and Kaloleni district. The current Kilifi district is further divided into three divisions namely Bahari, Chonyi, and Kikambala.

The larger district is classified as one of the poorest in Kenya. Ganze constituency now the new Ganze district which comprises Bamba, Ganze and Vitengeni divisions is considered the poorest constituency in the country where 66.8 percent of the district population live on less than a dollar per day. The district has six livelihood zones, namely cash cropping/ dairy farming, food cropping, fishing and mangrove harvesting, formal employment/ waged labor/ business, marginal mixed farming, and ranching. Mixed farming is the pre-dominant livelihood zone.

Generally, Kilifi district is moderately food insecure. Rainfall performance impacts directly on crop and livestock production. The district receives bi-modal type of rainfall but relies on long rains for crop production. The main sources of water for domestic and livestock use are piped water schemes, dams/pans, shallow wells, boreholes, scooping of dry river beds, and roof catchment. Only about 40% of people getting water from open sources boil or treat water before consuming it. Latrine coverage in the district is about 48%. Most schools have latrines but the latrine pupil ratio is very low.

Data from nutritional surveys indicate reduction in malnutrition in under fives although more children are being admitted with severe malnutrition and related illnesses mainly between age 12 months and 36 months. The new Kilifi district has a total of 167 primary schools; 110 public and 57 private schools. Sixty nine public schools were on school feeding programmes in term one of 2010. In the year 2010, the district enrolled about 71,990 pupils in public schools and 9,477 pupils in private schools .With the free primary education programme, enrolment rate is expected to rise every year.

### **2.3 STUDY POPULATION**

The study population comprised school children aged six to twelve years enrolled in public primary schools in Kilifi district.

### **2.4 INCLUSION CRITERIA**

- Children 6-12 years who were enrolled in sampled primary schools in Kilifi District.
- Children for whom informed written consent was obtained from the parent(s) or legal guardian(s) through the head-teachers to participate in the study.
- Children who gave assent to participate in the study.

### **2.5 EXCLUSION CRITERIA**

- All children who had obvious physical deformities.

### **2.6 CLINICAL DEFINITIONS**

**Stunting;** refers to low length or height for expected length or height of a child of same age of less than -2SD

**Wasting;** refers to low weight for expected weight of a child of the same height of less than - 2SD

**Under-weight;** refers to low weight for expected weight of a child of the same age of less than - 2SD

**Z-SCORE (or SD score);** It is defined as the deviation of an individual's value from the median value of a reference population divided by the standard deviation of the reference population.

The new WHO child growth standards references were used.

## **2.7 SAMPLING METHOD.**

Multistage Random sampling method was used. Two divisions were randomly selected from the three divisions in the district in the first stage. In the second stage, four schools, two from each selected division were randomly selected. A proportion of pupils in each selected school were randomly selected from class one to class four to comprise the desired sample size .The number in each school comprised 25% of the total sample. Only one pupil was found to be above the age group required hence the data collected from this pupil was not analyzed. A total of 338 children were included in the study.

## **2.8 SAMPLE SIZE DETERMINATION.**

Since stunting is more common than other forms of malnutrition like wasting and underweight, prevalence of stunting was used as (P) in the calculation of the sample size. The formula below was used;

$$N = \frac{Z^2 * P(1-P)}{D^2}$$

N is the desired sample size

Z is the value representing 95% confidence interval

D is the precision with which to measure prevalence of the study  $\pm 5\%$

P is the estimated prevalence (based on study by Chesire and value used is for stunting at 30.2%.

Study was done in Kawangware, peri-urban slum in Nairobi among school age children six to twelve years and a sample size of 384)

Substituting the above formula the desired sample size was **323**

## **2.9 ETHICAL CONSIDERATIONS**

Approval was sought from the Kenyatta National Hospital Scientific, Research and Ethics Committee and Ministry of Education. Consent was sought from the parent(s) or guardian(s) through the head teachers to allow the children to participate in the study. Assent was sort from the eligible children before participation in the study. Children participated voluntarily and those who did not participate were not discriminated against in any way.

Information collected was kept securely and confidentiality was maintained. Identity of the children was kept confidential. No harm was done to any child. Relevant information on the outcomes of the study shall be given to the schools and the individual child and parent/ legal guardian where possible. Findings of this study will be used to formulate interventions to improve nutritional status of school children in the entire district.

## **2.10 DATA COLLECTION PROCEDURE**

Recruitment of study assistants was done and they underwent training on the objectives and the procedures of the study. The study assistants comprised of two qualified and certified nurses from Kilifi district hospital and two third year students in Bachelor of Science degree in Foods, Nutrition and Dietetics with good field experience in nutritional surveys.

The principal investigator visited the schools in the study area and sought permission from the school heads to carry out the study in their schools. Pre-testing of the study questionnaire was done in one of the selected schools and corrections were made subsequently.

The principal investigator gave a health education talk to the teachers and students in every school under study to explain the objectives of the study and to understand more on the role of nutrition assessment. Then consent forms were issued to the head teachers or their deputies on behalf of the parents or guardians of the children.

Assent was required from the sampled children before administration of the questionnaire.

The study assistants administered the questionnaire in pairs to each sampled child. The children were the respondents to the questionnaire. Children with the questionnaire filled then proceeded to the next phase and had their anthropometric measurements taken. The principal investigator took the measurements of height, weight and mid-upper arm circumference with assistance of one of the study assistants. Thereafter every child was informed about their nutritional status individually.

All questionnaires filled were verified by the principal investigator to ensure correct documentation of data. They were securely stored to await analysis. This process was repeated in all the schools sampled.

## **2.11 ANTHROPOMETRIC MEASUREMENTS**

In this study anthropometry was used to measure nutritional status of the children.

### ***Weight***

Weight was measured using a very sensitive bathroom digital scale. The scale was placed on a flat surface and adjusted to read 0.00kilograms. Weight was taken without shoes and with

minimal light clothing. Weight was taken to the nearest 100grams. It was done three times and the average recorded as the weight of the participant. The scale was adjusted to always read 0.00 before taking each child's weight.

### ***Height***

Height measurements were taken using a portable stadiometer. Height was taken without shoes with heels, buttocks, shoulder head aligned looking straight ahead with arms hanging loosely on the sides. Head piece was lowered from the top to the head compressing the hair and making contact with the top of the head. The height was taken to the nearest centimeter. This was done three times and the average was recorded as the height of the participant.

### ***Mid Upper Arm Circumference***

Mid upper arm circumference was measured using a MUAC tape that is color coded with red/yellow/green. It was taken on the left upper arm with the arm hanging freely by the side. The point midway between the acromion process and the olecranon identified and marked. The circumference was taken to the nearest 0.1centimeter (millimeter). The measurement was taken three times and the average of the three readings recorded as the mid upper arm circumference.

## **2.12 DATA MANAGEMENT AND ANALYSIS**

Data was entered into computer software, cleaned and all errors corrected using the original data collection tool. Data was analyzed using the Epi-Info 2002 software package and SPSS version 17.0. Raw data was entered into the computer and variables were computed to nutritional status indices of weight for age, height for age and weight for height. Epi-info was then used to transform the data into Z-scores so that using a cut-off of -2SD, the children were grouped into malnourished and well nourished, stunted and not stunted, wasted and not wasted, underweight and not underweight. Prevalence of malnutrition was expressed as a proportion in percentage.

Using SPSS programme, various cross tabulations were done. Chi –square test was used to test significance of various associations. MUAC measurements data collected in this study was not analyzed as the other parameters were considered adequate for determining the nutritional status of children in this study.

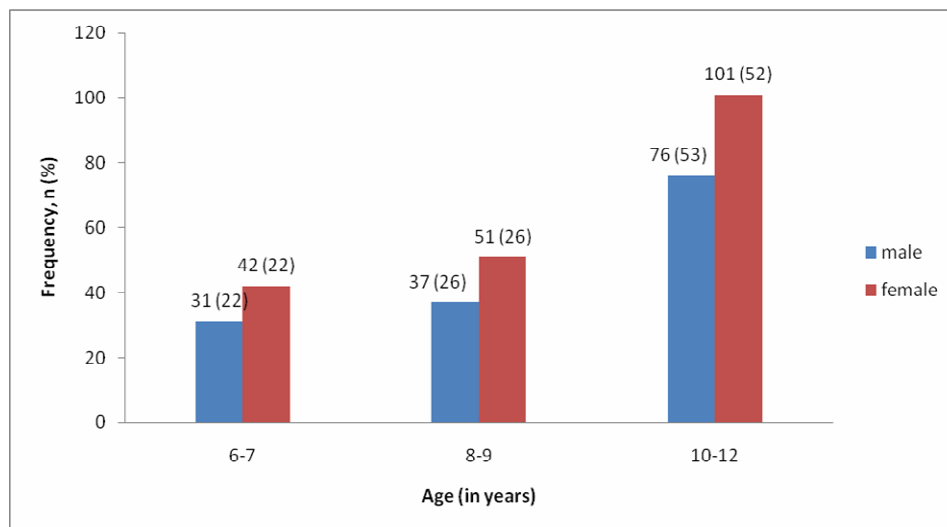
### **3 RESULTS**

The study was carried out in the months of May to July during the second term of the year 2010. A total of 338 children were seen and interviewed. Nutritional status of the children was determined using three indicators namely; weight for height, weight for age and height for age. The three indicators were used to establish significant associations between nutritional status and various independent variables.

#### **Socio-Demographic Characteristics of Study Population**

##### **Distribution of children by age and sex**

The study population was fairly distributed with males being 144(42.6%) and females 194(57.4%). The distribution across the age groups was similar among males and females (fig 2)



**Figure 2 Distribution of children by age and sex**

##### **Caretaker characteristics**

There were five children out of the total three hundred and thirty eight who came from one orphanage and therefore the caretaker characteristics were the same. Eighty four percent of the households from which the children came were headed by males, 82.5% of whom were married. Thirty four percent of the caretakers had attained at least primary education while a small



percentage (6.2%) did not have any formal education. In employment, 84.9% of caretakers were employed either as casual workers, self employed or on permanent employment.

**Table 2 Caretaker characteristics**

Characteristic	Factor level	Frequency, n (%)
Sex	Male	285 (84.3)
	Female	53 (15.7)
Marital Status	Married	280(82.8)
	Not married	58(17.2)
Education level	None	21 (6.2)
	Primary	115 (34.0)
	Post primary	128(37.9)
	Don't know	74(21.9)
Employment Status	Unemployed	28(8.3)
	Employed	287(84.9)
	Don't know	23(6.8)

**Household characteristics**

About 72.5% of the children were able to get on average more than two meals per day. Households that had total number of children between 3 to 5 were 53.8% and half of them were school going age. Among the respondents, 68.3% were between 1<sup>st</sup> and 3<sup>rd</sup> born in the order of birth.

**Table 3 Household characteristics**

Characteristic	Factor level	Frequency, n (%)
Meals per day	One	10 (3.0)
	Two	83 (24.6)
	More than two	245 (72.5)
No of Children in household	< 3	54 (16.0)
	3 to 5	182 (53.8)
	>5	102(30.2)
No of Children in household going to school	< 3	103 (30.5)
	3 to 5	183 (54.1)
	>5	52(15.4)
Birth Order	1 <sup>st</sup> to 3 <sup>rd</sup>	231 (68.3)
	4 <sup>th</sup> to 6 <sup>th</sup>	81 (24.0)
	> 6 <sup>th</sup> birth	26 (7.7)

### **Housing characteristics**

Sixty six per cent of the houses in which the children lived had between one to three rooms. Those who had more than four rooms were households that rented out some of the rooms. This kind of commercial housing is a common finding in this area. The most common source of water is community tap with 73.4% of children accessing it and about 26.6 % getting their water from either a river, a stream or a borehole. For human waste disposal, 78.1% children had a pit latrine in their homes while 8.3% of them did not have appropriate form of disposal. Such children commonly use the bushes near their homes to dispose their waste.

**Table 4 Housing characteristics**

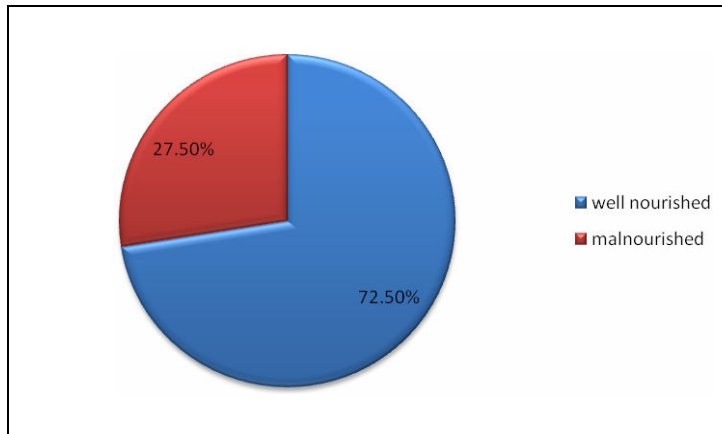
<b>Characteristic</b>	<b>Factor level</b>	<b>Frequency, n(%)</b>
No. of rooms	1-3	225 (66.6)
	>3	113(33.4)
Water source	Community tap	248 (73.4)
	Stream	2 (0.6)
	Borehole	28 (8.3)
	Other	60 (17.8)
Toilet type	Pit latrine	264 (78.1)
	Flush	46 (13.6)
	None	28 (8.3)

### **School feeding programme**

Majority of the children in the schools under study were not on a school feeding programme at that time. Some schools had some form of feeding programme going on that required the children to pay a small fee in order to receive the portions. Those who received food in school were 110 (32.4%) while those not on a feeding program were 228 (67.5%).

## **Prevalence of malnutrition (N=338)**

Overall prevalence of malnutrition was found to be **27.5%**



**Figure 3 Prevalence of malnutrition**

## **Distribution of Nutritional Status.**

The most common form of malnutrition in this population was stunting (HA) at the rate of 16.6% while underweight (WA) and wasting (WH) were found to be 8.3% and 2.7% respectively.

**Table 5 Distribution of nutritional status of the children**

<b>Nutrition indicator</b>	<b>Nutritional status</b>	<b>Frequency, n (%)</b>
<b>Weight for height(WH)</b>	Not wasted(>-2SD)	329 (97.3)
	Wasted (<-2SD)	9(2.7)
<b>Weight for age( WA)</b>	Not underweight (>-2SD)	310 (91.7)
	Underweight (<-2SD)	28 (8.3)
<b>Height for age(HA)</b>	Not stunted (>-2SD)	282(83.4)
	Stunted (<-2SD)	56 (16.6)

## Associations

### Association between Nutritional Status and Age.

Age was a significant factor for stunting ( $p=0.016$ ) but not for wasting and underweight ( $p=0.497$ ;  $p=0.106$  respectively). The older the child, the more likely to be stunted.

**Table 6 Association between nutritional status and age**

Nutritional indicator	Factor (age in years)	N	Nutritional status (Z-score)		P value
			<-2SD	≥-2SD	
Wasting(WHZ)	6-7	73	3 (4.1)	70 (95.9)	0.497*
	8-9	88	1 (1.1)	87 (98.9)	
	10-12	177	5 (2.8)	172 (97.2)	
Stunting(HAZ)	6-7	73	9 (12.3)	64 (87.7)	0.016**
	8-9	88	8 (9.1)	80 (90.9)	
	10-12	177	39(22.0)	138 (78.0)	
Underweight(WAZ)	6-7	73	4 (5.5)	69 (94.5)	0.106*
	8-9	88	4 (4.5)	84 (95.5)	
	10-12	177	20(11.3)	157 (88.7)	

\*p value >0.05 indicating that there was no significant association between age of children and their nutritional status.

\*\*p value <0.05 indicates that there was strong significant association between age of the children and their nutritional status

### Association between Nutritional Status and Sex

There was no significant association between the sex and stunting, underweight and wasting.

Wasting was similarly present among males as females (2.8% versus 2.6%, OR 1.1(0.3-4.1).

Underweight was similarly present among males as females (8.3% versus 8.2%, OR 1.0(0.5-

2.2). Males were similarly stunted as females (19.4% versus 14.4%, OR 0.6(0.3-1.3)

**Table 7 Association between nutritional status and sex**

Nutritional indicator	Sex	N	Nutritional status Z-score		OR(95% CI)	P value
			<-2SD	≥-2SD		
<b>Wasting (WHZ)</b>	Male	144	4 (2.8)	140(97.2)	1.1 (0.3 to 4.1)	0.910**
	Female	194	5 (2.6)	189(97.4)		
<b>Stunting (HAZ)</b>	Male	144	28(19.4)	116(80.6)	0.6 (0.3 to 1.3)	0.195**
	Female	194	28(14.4)	166(85.6)		
<b>Underweight(WAZ)</b>	Male	144	12 (8.3)	132(91.7)	1.0 (0.5 to 2.2)	0.977**
	Female	194	16 (8.2)	178(91.8)		

\*\*chi square

### Association between Wasting and Caretaker Factors

There was no significant association between wasting of the children and the caretakers' marital status, education level or the employment status. The children whose caretakers were married were similarly wasted as those whose caretakers were not married (2.5% versus 3.4% OR 0.7(0.1 to 3.5). The children whose caretakers were employed were similarly affected as those whose caretakers were not employed (2.1% versus 7.1% OR 0.3(0.1 to 1.4).

**Table 8 Association between wasting and caretaker factors**

Factor	N	WH Z-Score		OR(95% CI)	p-value
		<-2, n (%)	≥-2, n (%)		
<b>Marital Status</b>					
• Married	280	7 (2.5)	273 (97.)	0.7 (0.1 to 3.5)	0.683**
• Not married	58	2 (3.4)	56 (96.6)		
<b>Education level</b>					
• None	21	0	21 (100)	-	-
• Primary	115	3 (2.6)	112 (97.4)		
• Post primary	128	3 (2.3)	125 (97.7)		
<b>Employment Status</b>					
• Employed	287	6 (2.1)	281 (97.1)	0.3 (0.1 to 1.4)	0.105**
• Unemployed	28	2 (7.1)	26 (92.9)		

\*\*chi square

**Association between Underweight and Caretaker Factors.**

There was no significant association between underweight levels and the caretakers' marital status, level of education or employment status. The children whose caretakers were married were similarly underweight as those whose caretakers were not married (7.5% versus 12% OR 0.6(0.2 to 1.5). The children whose caretakers were employed were similarly underweight as those whose caretakers were not employed (8.4% versus 10.7 OR 0.7(0.2 to 2.7).

**Table 9 Association between underweight and caretaker factors**

Factor	N	WA Z-Score		OR	p-value
		<-2, n (%)	≥-2, n (%)		
<b>Marital Status</b>					
• Married	280	21 (7.5)	259 (92.5)	0.6 (0.2 to 1.5)	0.251**
• Not married	58	7 (12)	51 (88)		
<b>Education level</b>					
• None	21	2 (9.5)	19 (90.5)	Reference	1
• Primary	115	11 (9.6)	104 (90.4)	1.1 (0.0 to 5.4)	0.691**
• Post primary	128	7 (5.5)	121 (94.5)	1.8 (0.2 to 11)	0.819**
<b>Employment Status</b>					
• Employed	287	24 (8.4)	263 (91.6)	0.7 (0.2 to 2.7)	0.671**
• Unemployed	28	3 (10.7)	25 (89.3)		

**\*\* Chi-square**

**Association between Stunting and Caretaker Factors.**

The level of stunting was not associated with the caretakers' marital status, level of education or their employment status. The children whose caretakers were married were similarly stunted as those whose caretakers were not married (15.7% versus 20.7% OR (0.7(0.4 to 1.5). The children whose caretakers were employed were similarly stunted as those whose caretakers were not employed (18.1% versus 10.7% OR (1.8(0.5 to 6.3).

**Table 10 Association between stunting and caretaker factors**

Factor	N	HA Z-Score		OR	p-value
		<-2, n (%)	≥-2, n (%)		
<b>Marital Status</b>					
• Married	280	44 (15.7)	236 (84.3)	0.7 (0.4 to 1.5)	0.354**
• Not married	58	12 (20.7)	46 (79.3)		
<b>Education level</b>					
• None	21	5 (23.8)	16 (76.2)	Reference	
• Primary	115	24 (20.9)	91 (79.1)	1.2 (0.3 to 3.9)	0.990**
• Post primary	128	14 (10.9)	114 (89.1)	2.5 (0.7 to 9.0)	0.198**
<b>Employment Status</b>					
• Employed	287	52 (18.1)	235 (81.9)	1.8 (0.5 to 6.3)	0.103**
• Unemployed	28	3 (10.7)	25 (89.3)		

\*\* Chi-square

**Table 11 Association between malnutrition and school feeding programme (n=338)**

The presence or absence of a school feeding programme did not have significant association with the level of stunting, wasting, and underweight.

School feeding programme	N	Wasting (WHZ)		OR(95% CI)	p- value
		<-2SD	≥-2SD		
<b>No</b>	<b>228</b>	6 (2.6)	222 (97.3)	1.0 (0.2-3.9)	0.959
<b>Yes</b>	<b>110</b>	3 (2.7)	107 (97.2)		
		Underweight (WAZ)			
<b>No</b>	<b>228</b>	22 (9.6)	206 (90.4)	1.9 (0.7-4.7)	0.190
<b>Yes</b>	<b>110</b>	6 (5.5)	104 (94.5)		
		Stunting (HAZ)			
<b>No</b>	<b>228</b>	40 (17.5)	188 (82.5)	1.3 (0.6-2.3)	0.487
<b>Yes</b>	<b>110</b>	16 (14.5)	94 (85.5)		

## **4 DISCUSSION**

The aim of this study was to determine the prevalence and determinants of malnutrition among primary school children in coastal rural Kenya. The overall prevalence of malnutrition was found to be 27.5%. This finding was different from what was found in another study by Chesire in 2008 on determinants of under-nutrition among school age children (6-12 years) in a Nairobi peri-urban slum of Kawangware who found higher overall prevalence of malnutrition at 49.6%. This difference may be partly explained by the fact that the two areas are of different environments and the children in these areas are from different socio-economic status.

In this study, the most common form of malnutrition was stunting at 16.6%. This is similar to other several studies done that have shown stunting to be the most common form of malnutrition in school children although the rates are different. In the study by Chesire, 30.2% were stunted. In another large study done in five low income countries, the rate of stunting ranged from 48% to 56%. The difference in the stunting rates may be due to the fact that the school aged children who were not enrolled in schools at the time of my study were not included in the study. One study in Ghana compared the health of enrolled and non enrolled children and showed that there were considerable differences between enrolled and non enrolled children. Non enrolled children of both sexes were significantly smaller in height than enrolled children of same age range (34)

The children who were underweight in this study accounted for 8.3%. This rate is comparable to that found in Chesire's study (14.9%). Other studies show higher rates of 34% to 62%. The level of wasting at 4.5% was comparable to other studies done elsewhere. Wasting in this age group is not common unless in situations of acute food crisis that could affect food security.

Age in this study was found to significantly affect nutritional status. Like in other studies, older children were more stunted than the younger ones ( $p=0.016$ ) but not so for wasting and



underweight. In the large study in the five low income countries of Ghana, Tanzania, Indonesia, Vietnam and India, there was a trend for z-scores for height-for-age and weight-for-age to decrease with age, thus as children got older they became progressively shorter relative to the reference population. A longitudinal study of changes in height and weight of school-age children on Pemba Island, Zanzibar showed the prevalence of stunting increased with age (14% prevalence in seven year olds increasing to 83% in 13 year olds) and peaked in girls at age 12 then declined when they entered their pubertal growth spurt. In boys, however, the prevalence of stunting rose steadily up to age 13 years and then slowly declined. Boys accumulated a height deficit of 11.9cm and girls a height deficit of 8.5cm compared to the reference population (35)

There was no significant association between the sex and nutritional status. Wasting was similarly present among males as females (2.8% versus 2.6%, OR 1.1(0.3-4.1). Underweight was similarly present among males as females (8.3% versus 8.2%, OR 1.0(0.5-2.2). Males were more stunted than females (19.4% versus 14.4%, OR 0.6(0.3-1.3).

Other socio-demographic factors like the caretaker characteristics had no significant association with nutritional status of the children. Wasting, underweight and stunting levels were similar among those on school feeding programme to those not on feeding programme (wasting 2.6%, 2.7% OR 1.0 (0.2-3.9), underweight 9.6%, 5.5% OR 1.9 (0.7-4.7), stunting 17.5%, 14.5% OR 1.3 (0.6-2.3).

School feeding programs can help to get children into school and help to keep them there, through enhancing enrollment and reducing absenteeism; and once the children are in school, the programs can contribute to their learning, through avoiding hunger and enhancing cognitive abilities. These effects may be potentiated by complementary actions, especially deworming and providing micronutrients. Implementation of school feeding programs is associated with increased enrollment, particularly for girls. A recent meta-analysis of WFP

survey data from 32 countries in Sub-Saharan Africa (Gelli, Meir, and Espejo 2007) grouped 4,000 primary schools according to the type and length of the school feeding program: those with established programs (on-site meals or take-home rations), those with programs of less than 12 months, and those that had yet to initiate a program and so could serve as proxy controls. During the first year of school feeding assistance, absolute enrollment increased by 28 percent for girls and 22 percent for boys. After the first year, enrollment trends varied according to the type of program. When only on-site meals were provided, there was a change only in the first year of the program; after that the rate of absolute enrollment of girls reverted to levels similar to those before implementation. However, in the highest primary grade, with school feeding programs combining on-site feeding and take-home rations, girls' absolute enrollment increased by 46 percent per year, more than twice the yearly increase in the same grade in schools implementing only on-site feeding. The provision of take-home rations appeared to support the progression of girls through the primary school grades, suggesting a reduction in the dropout rate of female students, particularly in the higher primary school.(6).

## **CONCLUSION**

The aim of this study was to determine the prevalence of malnutrition in primary school children in rural Kenya in Kilifi District and it was found to be overall 27.5% of the study population. The most common form of malnutrition being stunting at the rate of 16.6%, while wasting and underweight were 2.7% and 8.3% respectively. Age was the only socio-demographic factor strongly associated with stunting ( $p=0.016$ ) but not with wasting and underweight. Both males and females were equally affected in all forms of malnutrition. Presence of school feeding programme in a school did not have any significant association with the nutritional status of the children.

### **STUDY STRENGTHS**

This study is among the first school based studies in this area to evaluate the nutritional status of school children. The findings of this study can be used to compare the level of malnutrition in this age group in other areas of this nation with similar environment.

### **STUDY LIMITATIONS**

Involving the parents/guardians to respond to some of the questions would have been advantageous but due to financial constraints and time limits this was not feasible.

### **RECOMMENDATIONS**

1. Nutrition surveillance programs need to be established in schools in collaboration with the Education sector in order to detect early those children at risk of malnutrition and intervene promptly.
2. Further studies are required to determine the long term implications of linear growth retardation in school children in this area.

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## APPENDICES

### ANNEX 1: QUESTIONNAIRE

#### PREVALENCE AND DETERMINANTS OF MALNUTRITION AMONG SCHOOL CHILDREN IN KILIFI DISTRICT

Questionnaire No ..... Date of interview .....

Name of interviewer .....

#### Personal Data for child 6-12 years (respondent)

Child's name .....

Date of birth (dd/mm/yyyy) .....or Age:        years        months

Sex            male                female   

Name of school .....

Present class .....

Weight .....Kilogrammes.

Height .....Centimetres

Mid upper circumference .....Centimetres

#### DATA ON HOUSING

1)    **How many rooms are in the house? (Including kitchen if not separate).....**

2)    **What is the roofing of the house?**   

a) Iron sheets b) Makuti c) Tiles d) Others (Specify).....

3)    **What is the type of walls for the house?**   

a) Mud b) Bricks c) Timber d) Other (Specify) .....

4)    **What is the type of floor in the house?**   

a) Earth b) Cemented c) Other (Specify) .....





- 5) **What is the main type of fuel used for cooking?**  
 a) Gas b) Paraffin c) Charcoal d) Firewood e) Other (Specify) .....
- 6) **What is the main source of water?**   
 a) Community tap b) Stream c) Borehole d) Other (Specify) .....
- 7) **What type of toilet do you use at home?**   
 a) Pit latrine b) Flash toilet c) None

**HOUSEHOLD DATA**

- 8) **What is the main source of food in the household?**   
 a) Bought b) Home grown c) Donated d) Other (Specify) .....
- 9) **How many meals do you eat per day at home?**   
 a) One b) Two c) More than two
- 10) **How many meals are you given at school per day?** .....
- 11) **How many people live in the household?** .....
- 12) **How many children are in the household?** .....
- 13) **How many children go to school in the household?** .....
- 14) **What is your birth order?** .....

**DATA ON HEAD OF HOUSEHOLD**

Name .....

Age .....

Sex            male                    female       

15) **Marital status**

- a. Single b) married c) divorced/separated d) widowed

**16) What is his/her Educational level?**

- a. None
- b. Primary
- c. Secondary
- d. Post secondary
- e. Adult education
- f. Don't know

**17) Employment status**

- a. Casual
- b. Self employed
- c. Unemployed
- d. Don't know
- e. Employed

## **ANNEX 2: CONSENT EXPLANATION FORM**

My name is Dr. Dorcas Supa Tunje, a post graduate student in Master of Paediatrics University of Nairobi. I am conducting a research study on malnutrition among school children aged 6-12 years enrolled in primary schools within Kilifi District

### **Purpose of the study**

To assess the prevalence and determinants of malnutrition among the school children 6-12 years in Kilifi District.

### **Procedure**

If you agree your child to join this study he/she will be asked questions relating to his/her socio demographics, any illness during the study time and information about your home will also be required. Upon completion of the questionnaire, measurements of his/her weight, height and mid upper arm circumference will be taken.

Participation in this study is voluntary and you can choose to opt out of the study at any stage without any penalty.

### **Risks**

No danger will be associated with the study. The procedure done will be on external body and will be non-invasive

### **Benefits**

The results of the assessment will be given to your child and to you individually. Nutritional advise will be given to you and your child appropriately and free of charge.

### **Confidentiality**

All information collected will be kept securely and used only for data analysis and not for other purposes not indicated in the study.

If you agree that your child join this study you will be required to sign a consent form

If you have any questions you can contact any of the following;

DR DORCAS S.TUNJE

P.O. BOX 17665 00100 GPO NAIROBI

TEL: 0733 220 543

OR

PROF ELIZABETH M. OBIMBO

TEL: 0722 720 402

OR

PROF.FRED WERE

TEL: 0722 718 770

**ANNEX 3: CONSENT FORM**

I.....the head teacher /deputy of  
.....school on behalf of the parent(s)/ guardian(s) to the children, have  
read the above explanation and after being well informed by Dr. Dorcas Supa Tunje and  
understood do agree that the children participate in the study on **PREVALENCE AND  
DETERMINANTS OF MALNUTRITION AMONG PRIMARY SCHOOL CHILDREN  
IN KILIFI DISTRICT.**

I am also aware that I can choose to withdraw them from the study at any point without any  
penalty.

SIGNED.....

WITNESS.....

DATE.....