

**DETERMINING THE HEALTH AND  
NUTRITIONAL STATUS OF 6-10 YEAR-OLD  
SCHOOL CHILDREN IN COFFEE  
PLANTATIONS OF THIKA MUNICIPALITY,  
KENYA.**

BY

MAKENA FAITH (Bsc.FOND)

A/56/7729/2003

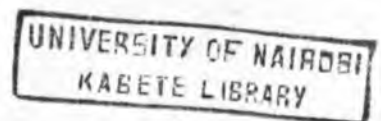
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A DISSERTATION SUBMITTED TO THE  
DEPARTMENT OF FOOD SCIENCE NUTRITION AND  
TECHNOLOGY IN PARTIAL FULFILMENT OF THE  
REQUIREMENTS FOR THE DEGREE OF MASTER OF  
SCIENCE IN APPLIED HUMAN NUTRITION IN THE  
COLLEGE OF AGRICULTURE AND VETERINARY  
SCIENCES, UNIVERSITY OF NAIROBI.

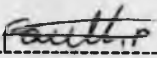
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## DECLARATION

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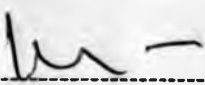
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**PROFESSOR M.W.OKOTH**

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Date-----21/09/2010-----

## **DEDICATION**

**This dissertation is dedicated to my dear husband, Joseph Waweru, for his continued support even during the most difficult times in the whole process of writing to completion. His endless support and encouragement is unequalled and it is for this reason that I dedicate this dissertation to him.**

## ACKNOWLEDGEMENT

A considerable amount of assistance was given to me during the preparation of this thesis.

I would like to acknowledge the financial support by Joseph Waweru in the production of this dissertation during the process of writing until completion of this dissertation, Joseph Waweru, who tirelessly supported me financially.

I would also like to acknowledge Professor M.W. Okoth for his advice and encouragement during the completion period of this work. I would not forget Sophia Ngala for all her moral support and encouragements.

I wish to remember all the field team that I worked with during data collection and for their patience even when we had to work on Sundays and in the evenings

Furthermore, I would not forget all the plantation managers who allowed me to collect data in their farms.

I would also like to remember the statisticians who helped me to analyse my data. Last but not least I would like to acknowledge my mom, Joy Ringeera; my little children, Victor, Mwaura and Pamela Wanjiru for their moral support and patience during my absence.

## DEFINITIONS

**Food security:** The access by all people at all times to the food needed for a healthy life.

**Conceptual framework:** A diagram of a set of relationships between factors that are believed to impact or to lead to a certain target condition.

**Household:** One person who lives alone or a group of persons related or unrelated who share food or make common provisions for food and possibly other essentials for living. This is the smallest and most common unit of production, organisation and consumption in societies.

**Population:** The entire group of people that is the focus of the study.

**Z-Score:** The deviation of an individual's value from the median value of a reference population divided by the standard deviation of the reference population.

**Malnutrition:** Refers to disorders resulting from an inadequate or from failure to absorb or assimilate dietary elements.

**Nutritional status:** This is the situation or condition of the body in relation to nourishment.

**School age child:** Children of the school age in this study are defined as those who aged between 6-10 years.

**Care taker:** Refers to any person providing care to a child.

**Health:** A state of physical, social, mental and psychological well being and not just the absence of disease.

**Morbidity:** Ill health or disease.

**Nutrition:** The science of food, the nutrients or other substances therein, their action, interaction and balance in relation to health and disease

**Growth:** Increase in size.

**Household head:** Refers to the person who is the major decision maker on household income and expenditure patterns.

**Index child:** A child from the sampling frame randomly selected for the purpose of data collection to carry out the study.

**SPSS:** Statistical computer software that perform analytical functions like standard deviation, multiple regression analysis and variance.

**Overweight:** Overweight is defined as body mass index between the 85<sup>th</sup> and 94<sup>th</sup> percentiles.

**Obesity:** Is defined as, or at above the 95<sup>th</sup> percentile of the NCHS/CDC BMI-for –age percentiles curves.

**Protein energy malnutrition:** The kind of malnutrition which results from insufficient intake of carbohydrate, protein and other nutrients.

**Anthropometry: The measurements of the variations of the physical dimensions and the gross composition of the human body at different age levels and degrees of nutrition.**

## ABBREVIATIONS

ACC/SCN: Administrative Committee on Coordination Standing Committee on Nutrition of the United Nations.

ANP: Applied Nutrition Programme.

ASAL: Arid and Semi Arid Lands.

CBS: Central Bureau of Statistics

CI: Confidence Interval.

FAO: Food and Agriculture Organisation.

GOK: Government of Kenya.

HAZ: Height-for-age Z-Score.

HFA: Height -for-Age.

NGO: Non Governmental Organisation.

PEM: Protein Energy Malnutrition.

UNICEF: United Nations Children's Fund.

URI: Upper Respiratory Infection.

WFA: Weight-for-Age.

WAZ: Weight-for-Age Z-Score.

WFA: Weight-for-Height

WHZ: Weight-for-Height Z-Score.

IDA: Iron Deficiency Anemia.

IDD: Iodine Deficiency Disorder.

VAD: Vitamin A Deficiency.

SPSS: Statistical Package for Social Scientists.

SD: Standard Deviation.

Kcal: Kilocalories.



**RDA: Recommended Daily Allowance.**

**DDO: District Development Office.**

**HHH: House Hold Head.**

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## ABSTRACT

The physical growth of school children aged 6-10 years, is the result of both environment and genetic factors and the interaction between the two. In poor populations the main factors affecting the physical growth of school age children are the environmental factors experienced before puberty. Malnutrition among the school age child is as a result of poor food consumption patterns, illness, poor sanitation and poor health and hygiene practices. Studies show that malnutrition is implicated in more than half of all child deaths world wide. Millions of survivors are left crippled, vulnerable to illness and intellectually disabled. It imperils women, families, and ultimately, the viability of whole societies. Child malnutrition is observed in school age children of low income populations in plantations.

The objective of this study was to determine the health and nutritional status of school age children in coffee plantations, and to achieve this a cross sectional study was carried out in Thika municipality, Thika district, Kenya. The sample size was 280 house holds in the community with school age children (6-10 years) as the target group and care takers as respondents. A structured pre-tested questionnaire was used to gather all the needed information. In the study, anthropometric indices (Z-Scores) were used to determine the nutritional status of the children. The information gathered using the structured questionnaire included: Demographic characteristics of the household, socioeconomic factors of the house holds, sanitation factors and house hold food frequency and information about the index child.

Simple descriptive statistics, chi-square test and correlation analysis were used to analyse the data with a  $p < 0.05$  being statistically significant. Data was



entered, cleaned and analysed using SPSS and Epi-info (version 6) software. There are significant relationships between underweight and source of income being significant at  $p < 0.05$ . The tests also showed that there were significant differences in family size, type of toilet and stunting ( $p < 0.05$ ). Correlation showed that there were significant differences between sex and all three forms of malnutrition the relationship being significant at  $p < 0.05$ . The correlation analysis also showed significant relationships between wasting, underweight, stunting and other variables (household head, source of income family size, disease, etc) the relationship being significant at  $p < 0.05$ . The study showed that 17% of the study children were below -2SD with 20% of the boys being below -2SD while 14.2% of the girls being below -2SD.

The study concluded that the school age child's nutritional status was influenced by access and availability of food, income and morbidity. Wasting and stunting were the most common forms of malnutrition among children aged 6-10 years in the coffee plantations. The study found that school age children are a vulnerable group to malnutrition and quick action need to be taken by all the stakeholders to improve their nutritional status. It is recommended that active growth monitoring of the school children to be implemented as it is an easy and inexpensive tool for health professionals to obtain information on the health and nutritional status school age population.

## CHAPTER 1

### 1.0 INTRODUCTION

The success of child survival programmes and the expansion of basic education coverage have resulted in a greater number of children reaching school age with a higher proportion attending primary school (World Bank, 2000).

However there is increasing evidence that the high level of nutritional deprivation and the heavy burden of disease in this age group has negative consequences for child's long term overall development.

An understanding and awareness of the heavy burden of malnutrition and disease among school age children is growing although until recently there have been relatively few large scale surveys that document the levels of morbidity in any detail. While a better picture of the health and nutrition status of this age group is being built, the true extent of the burden of ill health and malnutrition is still not known (Partnership of Child Development 1998).

The main nutritional problems facing the school age child include: stunting, underweight, anaemia, iodine deficiency and vitamin A deficiency. In countries experiencing the nutrition transition, overweight and obesity are increasing problems in the school age child.

The main health problems facing the school age children are malaria, helminth infections, diarrhoeal diseases, respiratory infections and the direct and indirect effects of HIV/AIDS. Much of the disease burden derives from the poor environmental conditions in which children live including exposure to biological,

chemical and physical hazards in the environment and lack of resources essential for human health.

Each year, more than 10 million children die, and the vast majority of child deaths are in developing countries (Black et al, 2003). Although childhood immunization programs have led to substantial reductions in measles, poliomyelitis, diphtheria, tetanus, and whooping cough, worldwide about 2.5 millions children under five years of age still die every year as a result of vaccine-preventable diseases (WHO/UNICEF, 2005). More child deaths could be prevented through optimal use and wider coverage of currently existing vaccines (Jones et al, 2003; WHO/UNICEF, 2005; CDC, 2006). In many developing countries, immunization coverage has increased only marginally since the early 1990s, and an estimated 27 million infants were not immunized in 2003 (WHO/UNICEF, 2005). Child survival interventions, such as basic childhood immunizations, may not be reaching the children who need them the most (Bryce et al 2003)

Malnutrition is responsible for human and economic waste of consequential proportions. Malnutrition during childhood affects growth potential and results in poor physical and cognitive development as well as lower resistance to illness. Malnutrition kills, maims and disables (WHO, 1995). Among children in developing countries, malnutrition is an important factor contributing to illness and death. Malnutrition in children leads to permanent effects and to their having diminished health capital as adults.

## 1.1 STATEMENT OF THE PROBLEM

Kenya, like many other tropical countries, is an agricultural country. It relies on agriculture as the major economic activity. Thus there are different farming systems some of which have adverse effects on the population, for example, displacement of householders for plantations, child labour, poverty and many more. Thika district is one of the country's districts with vast masses of land under irrigated plantations; there are 71240 irrigation schemes in the district (GOK, 1994).

The lower parts of the district have erratic rainfall pattern mainly receiving 116mm to 965mm. The area is prone to drought and resultant famine. In the district all forms of poverty including food and absolute poverty are experienced and indeed poverty incidence is taking upward trend due to factors such as unemployment, collapse of agricultural sector, collapse of industries, poor infrastructure and rise in HIV/AIDS (GOK, 1994).

The population in Thika plantations is one of the vulnerable groups to high risk of ill health and malnutrition in the district. This population experiences all problems related to food insecurity as portrayed in the United Nations Children's fund (UNICEF) framework for causation of malnutrition. On the one hand they do not have an established level of food production to achieve food security and on the other hand they are exposed to high risk of diseases caused by herbicides, pesticides, wet weather conditions and poor sanitation. Because of increased poverty, households involve children in labour to add to the household incomes. As such the necessary child care and feeding needed by these children leaves a lot to be desired. In spite of the high level of poverty in these plantations there has

been an increase in the number of children in the families. Malnutrition rates in Thika district are reported to be as high as 22%.

It is therefore important to establish the level of malnutrition in these children and community as a prerequisite for intervention. The main aim of this study is to provide information on the nutritional status and health of the children in the coffee plantations. It will also sensitise policy makers on the health and nutritional status of the age group.

## 1.2 JUSTIFICATION

There are more children of school age, and more children going to school than ever before. Around 90% of the world's children survive beyond their 5<sup>th</sup> birth day (UNICEF, 1995). However, ill health nutrition compromise the quality of life of this age group and their potential to benefit fully from the education they get.

Recent studies show that nutritional problems in school age children may be greater and wider spread than previously thought. The scale of nutritional problems in school age children may have been previously underestimated. Thus more data on the health and nutrition of school age children are needed to assess the scale of their problems (ACC/SCN, 1998).

Plantations are major source of income in Thika district. Coffee plantation workers and their families provide the most needed labour. The workforce lives in the plantations and their health and welfare is generally the responsibility of the management. The casual labourers provide the needed labour at very low wages, approximately one dollar per day. This has led to increased poverty among the population.

No data is available on the health and nutritional status of the school age group in Thika coffee plantations. It is for this reason that this study was carried out to investigate the health and nutritional status of school age children in coffee plantations in Thika district.

### 1.3 PURPOSE OF THE STUDY

The purpose of this study was to determine the health and nutritional status of school age children in coffee plantations in Thika municipality, Thika district.

### 1.4 OBJECTIVES

#### 1.4.1 MAIN OBJECTIVE

To determine the health and nutritional status of school age children (6-10 years) and the factors associated with malnutrition among the age group in Thika district, Kenya.

#### 1.4.2 SPECIFIC OBJECTIVES

- To determine the demographic, social economic and the food consumption patterns of the study population.
- To determine the dietary intake, morbidity levels, and nutritional status of the school age children.

### 1.5 HYPOTHESES

- Children in the coffee plantations meet the recommended daily allowances (RDA) of protein 1gm/kg bodyweight to 1800-2000kl calories/day and calorie.

- There are high levels of morbidity among school age children in Thika coffee plantations.

## 1.6 EXPECTED BENEFITS OF THE STUDY

The study will provide important information on the health and nutritional status of the school age children. This will help the society to promote the health and nutrition needs of this otherwise neglected group. The beneficiaries of this study will include among others:

- ✓ The government: The information in this dissertation will help the government to design relevant policies and influence decision making to avert malnutrition in this age group.
- ✓ The non governmental organisations (NGOs): The information will help NGOs during interventions to focus not only on improving school attendance but also on the overall physical, mental and psychological growth even to adulthood.
- ✓ Schools: school age children attend school .This study will help curriculum developers to incorporate health and nutrition subjects so that children can learn more about food, their dietary intake, and basic health issues.
- ✓ Parents: Parents /care takers prepare meals for their children. This study will help them to improve parenting so that they can improve child care and thus provide necessary dietary needs.
- ✓ Local research institutions: This study will help the researchers to look more into the nutritional requirements of the age group which has been assumed to have no nutritional deficiencies.

- ✓ Nutrition professionals: Nutrition counselling has always focused on the mother or care taker. This study will help the policy maker or programme manager to involve the school age child in making basic decisions on the right diet now and into their adulthood.

## 1.7 ASSUMPTIONS OF THE STUDY.

The study assumed that all the respondents would cooperate and give the information that was required without hesitation; that all the respondents would avail themselves to give information and that the time allocated for data collection would be enough and that no disruptions would be experienced.



## CHAPTER 2

### 2.0. LITERATURE REVIEW

Malnutrition is implicated in more than half of all child deaths worldwide – a proportion unmatched by any infectious disease. Yet it is not an infectious disease. Millions of its survivors are left crippled, vulnerable to illness and intellectually disabled. It imperils women, families and ultimately, the viability of whole societies. Malnutrition too is a violation of children's rights.

Yet the worldwide crisis of malnutrition has stirred little public alarm.

Malnutrition is not a simple matter of whether a child can satisfy her or his appetite. A child who eats enough to satisfy immediate hunger can still be malnourished. Malnutrition is largely an invisible emergency. Three quarters of the children who die worldwide of malnutrition related causes are mildly to moderately malnourished and betray no outward signs of problems.

### 2.1 WORLD'S SITUATION OF SCHOOL AGE CHILDREN

Height census conducted in Latin America showed that the situation is common in school age children in this region. In four of eleven countries surveyed, more than one third of children in school are stunted. In Peru and Guatemala prevalence are 48% and 51%, respectively. Their rates are similar to those found in other countries in other regions. Information on the growth of school age children that is generated in a consistent manner across countries and over time is difficult to find (ACC/SCN 2000).

The actual number of school age children affected is known. While there are many cost effective approaches to reducing VAD, sub-clinical deficiency still

affects probably up to 250 million pre-school children and unknown number of school age children, adolescents and pregnant women. Sub-clinical VAD contributes enormously to elevated morbidity and mortality in many age groups.

Higher proportion of boys than girls are stunted in all countries. This is attributed to behavioral patterns associated with gender. In most of the countries, boys aged six to nine in general spend more time outside the home than girls do. Proximity to the household may allow girls better physical access to available food.

## 2.2 THE GROWTH OF SCHOOL AGE CHILDREN

The physical growth of school-aged children six to ten years is the result of both environment and genetic factors and the interaction between these factors. (Bengoa,1971). In poor populations the main factors affecting the physical growth of school age children are environment factors experienced before puberty (Habicht et al, 1979). These include poor food consumption patterns, illness, lack of sanitation, and poor health and hygiene practices.

The potential for catch up growth among stunted children is thought to be limited after age two, particularly when children remain in poor environments (Mortorell et al, 1994). Stunting at age two years is significantly associated with later deficits in cognitive ability, further emphasizing the need to prevent early stunting, (Mendez and Adair, 1999).

As a result of this slower physical growth and development, the body's needs for certain nutrients, most notably calories and protein, is not as high as

during infancy. Interestingly, the body naturally compensates for this, and, as a result, it is not at all uncommon to see a young child with a decreased or inconsistent appetite.

On the other hand, as children enter school and begin to participate in organized sports and other activities that result in an increase in physical activity, their appetite and food intake usually increases.

Starting school and participating in other structured activities place new social, emotional, and mental demands on children. Consequently, the school-age years are characterized by intense development in social and cognitive skills.

Without adequate nutrition, children will experience physical and mental fatigue, have difficulty concentrating on learning tasks, and will ultimately exhibit slower cognitive and behavioral development.

### 2.2.1 NUTRIENT NEEDS

It is important for school-age children to meet the recommended intake levels of all essential vitamins and minerals. The Dietary Reference Intakes for this age group are shown in the table below. The nutrients highlighted below are of special important:

### 2.2.2 CALORIES

Caloric needs vary depending on the child's current rate of growth, the amount of physical activity, and the child's metabolism. It is important that children consume energy. However, many children, especially those who are not physically active, tend to consume too many calories. Children aged 2 to 3 years, 4 to 6 years, and 7 to 10 years require approximately 1300, 1800, and 2000 calories, respectively.

### 2.2.3 PROTEIN

The amount of protein needed per kilogram of body weight decreases after infancy and early childhood, from 1.2 gram/kg at 3 years to 1 gram/kg at 10 years. On average, children in the United State consume considerably more protein than is required for health. Protein deficiency is relatively rare in children living in the United States, but may be seen in children with severe food allergies, in those on strict vegan diets, or in those who have limited access to food.

### 2.2.4 FAT

Many children consumers too much dietary fat, which can lead to excessive calorie consumption and weight gain. As a result, nutrition experts believe that by the age of 5, children should follow adult recommendations for the consumption of fat. These recommendations suggest that total fat intake not exceed 30% of calories and saturated fat should account for no more than 10% of total calories. In addition, cholesterol intake should not exceed 300 mg per day.

School feeding has been shown to improve school performance in both developing and industrialized countries (Miller and Marck, 1996). Simply alleviating hunger helps children to perform better. Children who are hungry have more difficulty concentrating and performing complex tasks.

Studies in Jamaica have shown that children who were wasted, stunted or previously undernourished benefited from feeding programmes.

## 2.3 MALNUTRITION AND ITS ETIOLOGY

### 2.3.1 MALNUTRITION DEFINED

Malnutrition has been cited as both a cause and effect of underdevelopment.

Defined malnutrition as the pathological condition brought about by inadequacy of one or more essential nutrients that the body cannot make which are necessary for survival, growth and reproduction and for the capacity to work, learn and function in society.

What is malnutrition?

Malnutrition is any physical condition resulting either from an inappropriate or inadequate diet, such as a diet that either provides too much or little of necessary nutrients, or from a physical inability to absorb which lead to poor appetite and malabsorption, poverty, and lack of access to food, sanitation and/or health services. Malnutrition causes disease and death, and has a negative impact on both quality of life and learning. A list of important conditions of malnutrition which affect pre-school and school-age children is presented in Table.

Malnutrition includes overnutrition, nutritional deficiencies and undernutrition

Which impair health, intellectual activity, adaptive behaviour, education, productivity and well-being, and can lead to death?

## 2.3.2 FORMS OF MALNUTRITION IN SCHOOL AGE CHILDREN

### 2.3.2.1 PROTEIN – ENERGY MALNUTRITION (PEM)

This is ranked as the major form of malnutrition in school age children in Kenya. In Jamaica, a developing country, PEM is also ranked first among the four major deficiencies affecting school age children. PEM affects the growth and development of the child. There is a synergistic relationship between PEM and disease in causing mortality; even mild PEM doubles the risk of dying from infectious diseases.

Protein energy malnutrition causes a range of conditions which differ in their signs and severity. These conditions include;

1. Stunting-This is a physical indicator of chronic and long term malnutrition and is often linked to poor mental development.
2. Wasting- This is an indicator of acute under nutrition.
3. Underweight- This is an indicator of both chronic and acute under nutrition.

Stunting is widely believed to occur mainly in early childhood and through a cumulative process. Children stunted at school age are likely to have been exposed to poor nutrition since early childhood, and the degree of stunting tends to increase throughout the school age years. Underweight among school age children can reflect a broad range of insults such as prenatal under nutrition, infection and inadequate attention by caregivers. Wasting is not as common as either underweight or stunting in school age children.

### 2.3.2.2 IRON DEFICIENCY ANAEMIA.

Iron deficiency (ID) is the most common nutritional disorder in the world and is estimated to affect more than 2 billion people of whom 1.2 billion suffer from iron deficiency anemia. Insufficient intake of iron rich foods is the major cause of ID. It can also be caused by parasitic infections particularly hookworms and malaria, and deficiency of other nutrients (Hall, et al, 2001). There is little evidence to suggest any recent decrease in the prevalence of anemia (Masion, et al, 2001). It is estimated that 53% or 210 million school age children suffer from IDA. The highest prevalence is reported in Asia (58.4%) followed by Africa (49.8%) (ACC/SCN, 1998).

### 2.3.2.3 IODINE DEFICIENCY AND IODINE DEFICIENCY DISORDERS (IDD).

Iodine deficiency affects about 1.6 billion people worldwide and estimated 60 million school age children. The consequences of iodine deficiency include severe mental retardation, goiter, hypothyroidism, abortion, stillbirths and low birth weight and mild forms of motor and cognitive deficits. Recent studies of IDD in school children in Egypt, Swaziland and South Africa show prevalence rates between 35 and 70% indicating a severe public health problem depending on area studied (El-Sayed, et al, 1998).

### 2.3.2.4 VITAMIN A DEFICIENCY (VAD).

Mild or sub clinical VAD causes impaired immune function, increased severity of some infections and an increased risk of mortality from infectious diseases and is widely recognized as an important cause of blindness in children. It is estimated that 85 million school age children are at increased risk of acute

respiratory and other infections because they are deficient in vitamin A (Del Rosso, 1990).

School age children have not been considered an at risk group of VAD in the past. Little is known about an occurrence or effects of VAD in this age group. However, a small number of recent studies conducted, suggest that VAD is a public health problem in school age children, for example, a study of the effect of micronutrient fortified biscuits on the nutritional status of primary school children from South Africa, found that 40% of the children had subclinical VAD (Van Stuijvenberg et al, 1999).

#### 2.3.2.5 MULTIPLE MICRONUTRIENT DEFICIENCIES.

Single micronutrient deficiencies seldom occur in isolation but instead, interact and tend to cluster. For example, iron deficiency and VAD often co-exist in the same population. School age children like most populations in low income countries, suffer from multiple micronutrient deficiencies. Data is not available on the extent of the problem in the age group. However, inference can be made on the pre school children: 13-27% of Pre- School children are estimated to have two or more micronutrient deficiencies, suggesting that 100 million pre-school children are affected (Mason et al, 2001).

#### 2.3.2.6 OVERWEIGHT AND OBESITY.

Overweight and obesity is becoming highly prevalent in low income countries where improvements in socioeconomic conditions and rapid urbanization are causing a nutrition transition. A rapid shift in the composition of diet, reduced activity patterns and a subsequent shift in body composition characterizes this transition.



Countries undergoing a nutrition transition have high levels of stunting which is believed to be a risk factor for obesity. It is suggested that the increased risk of obesity among stunted children will lead to considerable problems with obesity in low income countries over the coming decades (Popkin et al, 1996). In 1995, an estimated 17.6 million children in low income countries were overweight (ACC/SCN, 2000 a). Available data suggest that the problem of obesity begins in pre-school children, becoming more evident among school age children.

### 2.3.3 MALNUTRITION

The causality for malnutrition and ways to address it are laid out in the multisectoral conceptual framework developed by the United Nations Children's Fund (UNICEF) in 1990 shown in Figure 2.1. The framework is comprehensive, incorporating both biological and socioeconomic causes and encompasses causes at both micro and macro levels. It breaks down the Determinants of child nutritional status into three levels of causality; immediate determinants, underlying determinants, and basic determinants. An understanding of the causes of malnutrition is important to appreciate the scale and depth of the problem, the progress achieved to date and the possibilities for further progress that exist.

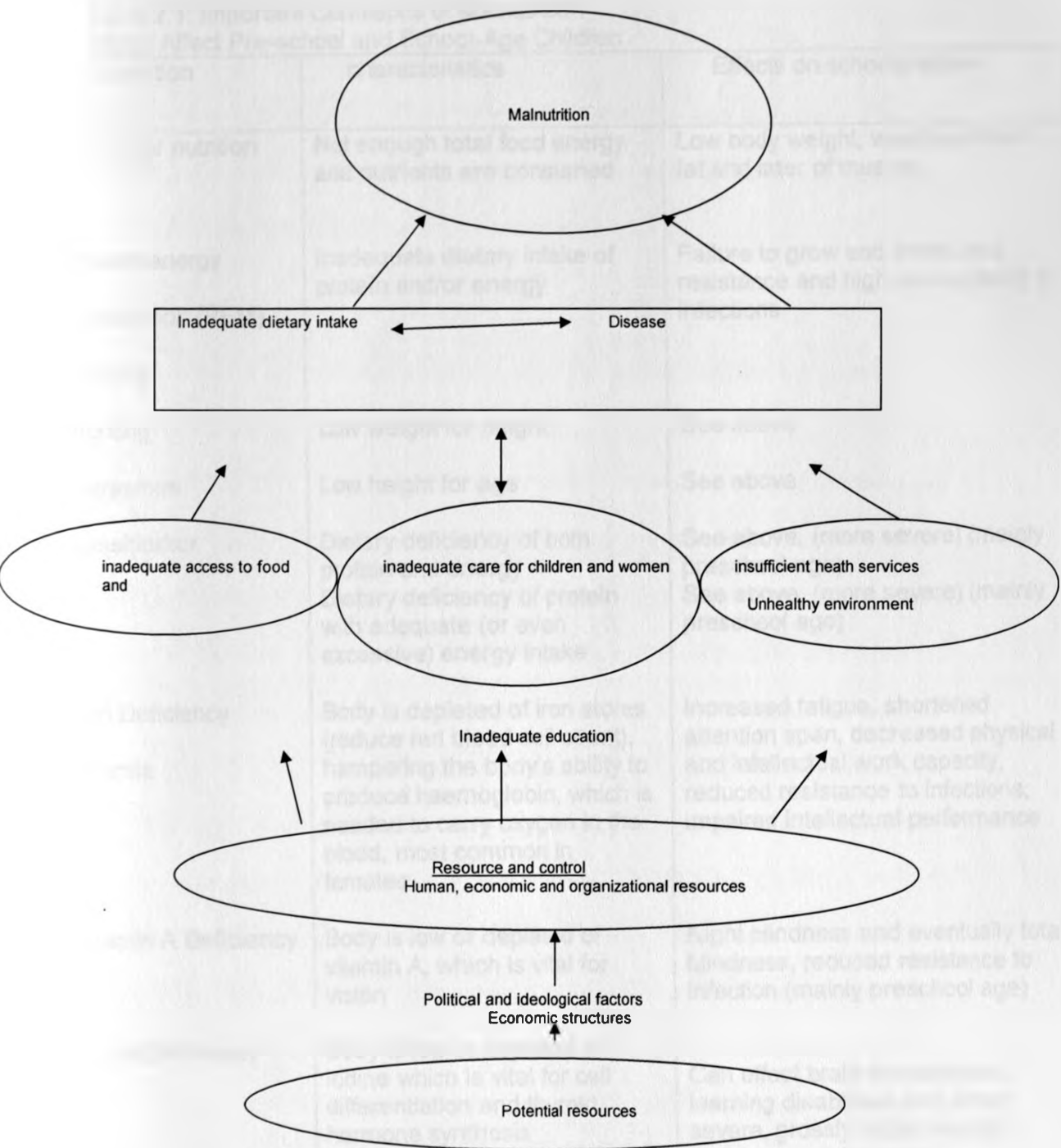


Figure 2.1; Conceptual framework of the causes of malnutrition,  
Source: UNICEF, 1990

Table 2.1: Important Conditions of Malnutrition Which Affect Pre-school and School-Age Children

condition	characteristics	Effects on schoolchildren
Under nutrition	Not enough total food energy and nutrients are consumed	Low body weight, wasting of body fat and later of muscle
Protein-energy malnutrition (PEM)	Inadequate dietary intake of protein and/or energy	Failure to grow and thrive, less resistance and high susceptibility to infections
wasting		
stunting	Low weight for height	See above
marasmus	Low height for age	See above
kwashiorkor	Dietary deficiency of both protein and energy Dietary deficiency of protein with adequate (or even excessive) energy intake	See above, (more severe) (mainly preschool age) See above, (more severe) (mainly preschool age)
Iron Deficiency Anemia	Body is depleted of iron stores (reduce red blood cell count), hampering the body's ability to produce haemoglobin, which is needed to carry oxygen in the blood, most common in females	Increased fatigue, shortened attention span, decreased physical and intellectual work capacity, reduced resistance to infections, impaired intellectual performance
Vitamin A Deficiency	Body is low or depleted of vitamin A, which is vital for vision	Night blindness and eventually total blindness, reduced resistance to infection (mainly preschool age)
Iodine Deficiency	Body is low or depleted of iodine which is vital for cell differentiation and thyroid hormone synthesis	Can effect brain development, learning disabilities and, when severe, grossly impair mental development; impaired reproductive performance
Over nutrition	More food energy is consumed than expended, resulting in excess of body fat	Elevated blood cholesterol and high blood pressure, associated with increased adult mortality

### 2.3.3.1 IMMEDIATE CAUSES

The two most significant immediate causes of malnutrition are inadequate dietary intake and illness. The interplay between the two immediate causes creates a vicious circle. A malnourished child, whose resistance to illness is compromised, falls ill and malnourishment worsens.

### 2.3.3.2 UNDERLYING CAUSES

Three clusters of underlying causes lead to inadequate dietary intake and infectious disease. These are inadequate access to food in a household, insufficient health services and an unhealthy environment, and inadequate care for children and women. Household food security depends on access and availability of food. There may be abundant food available on the market, but poor families cannot afford it and thus are not food secure. An essential element of good health is access to affordable, good quality health services. In as many as 35 of the poorest countries, 30 – 50 percent of the population may have no access to health services at all. The lack of ready access to a safe water supply and proper sanitation and unhygienic conditions in and around homes has significant implications for the spread of infectious diseases. More than 1.1 billion people still lack access to safe water, and about 2.9 billion people lack access to adequate sanitation. Care is manifested in the ways a child is fed, nurtured, taught and guided and is the responsibility of the family and community. Most critical caring behaviors include: feeding, protecting children's health, providing emotional support and cognitive stimulation for children and caring for and supporting mothers.

### 2.3.3.3 BASIC CAUSES

Political, legal and cultural factors may defeat the best efforts of households to attain good nutrition. These include the degree to which the rights of women and girls are protected by law and custom: the political and economic system that determines how income and assets are distributed and the ideologies and policies that govern the social

### 2.4 NUTRITION AND HEALTH DURING PERIODS OF ACCELERATED GROWTH

During the last decade, the growth of children in the developed countries accelerated due to better health care and diet. Malnutrition during accelerated growth can affect present and later development more significantly than during other periods

Nutrition applies as the most decisive factor especially during the periods of development when changes in velocity of growth and endocrine status occur e.g. age from four to eight or nine to thirteen years. Even during earlier periods including the fetal one, nutrition has an immediate or delayed effect on growth. Further effects later in life can, however, modify this. Under normal physiological conditions and diet, during pre-pubertal and pubertal periods, body composition such as nutritional characteristics undergoes marked changes along with an increase of body mass index. Some recent studies showed that the range of food intake would result in an adequate growth and development. In addition the impact of nutrition is dependent on other factors: genetics and physiological adaptation to various energy intake, output and balance since early life.

There exists a continuum of nutritional consequences during growth depending on the range of energy intake, character duration and beginning of different diets also as related to energy output.

## 2.5 HEALTH PROBLEMS OF THE SCHOOL AGE CHILDREN

The poor, particularly the children in low income countries carry the greatest burden of morbidity and mortality. Much of the burden results from hazards within their homes or their immediate environment (Cairncross et al, 1996). High levels of malnutrition, and it's known synergistic relationship exacerbate their vulnerability to disease particularly diarrhoeal disease, helminth infections, acute respiratory infections (ARI) and malaria. For the urban poor in low income countries, children are exposed to diseases of poor sanitation and overcrowding and chronic and heart and lung diseases. School children living in poor urban areas are also at a high risk of injury from road traffic accidents. For children in low economic countries, many of the health problems of childhood are associated with lack of clean water and poor sanitation.

### 2.5.1 DIARRHOEAL DISEASES.

Diarrhea is the passage of loose or liquid stools more frequently than is normal for the individual. It is a symptom of intestinal infection caused by viral, bacterial and parasitic organisms. One of the most common means of infection is through water contaminated by human faeces. If severe or persistent, the fluid loss and dehydration associated with diarrhea may be life threatening especially in infants, young children, the malnourished or people with impaired immunity.

The total global number of diarrhea episodes may be as high as 4000 million (WHO, 1996). WHO estimates that 3.3million children die from intestinal infections such as cholera, typhoid or infectious hepatitis every year? Most of diarrhoeal disease burden occurs in children in developing countries. Approximately 90% of diarrhoeal disease burden is related to environmental factors or poor sanitation and lack of access to clean water and safe food (Hubley, 1998).

### 2.5.2 HELMINTH INFECTION IN THE SCHOOL AGE CHILDREN.

It is estimated that over 35% (320 million) of school age children are infected with roundworm, 25% (233million) with whipworm and 26% (239million) with hookworm (Chan, 1997). As the intensity of infection is the central determinant of the severity of morbidity, it is the school age child who is most at risk. For girls and boys aged 5-14 years in low income countries, intestinal worms account for 12 and 11%respectively of the total disease burden of this age group. Children with chronic worm infections and large number of worms may be stunted and underweight which can lead to long term retardation of mental physical development, even death in severe cases. Worms can also contribute to malnutrition through lack of appetite, malabsorption and anemia through loss of blood.

### 2.5.3 MALARIA IN SCHOOL AGE CHILDREN.

Recent preliminary estimates suggest mortality among school aged children is between 5-14% lower than among younger children. This implies that malaria may still account for 10-20% of all-cause deaths among school age children.

Children aged 5-9 years experience between 0.25-2.3 malaria attacks per annum and children aged 10-20 years experience between 0.1-1.3 attacks per annum (Brooker et al, 2000). Malaria can cause iron deficiency and anemia.

#### 2.5.4 HUMAN IMMUNODEFICIENCY VIRUS (HIV) ACQUIRED IMMUNE DEFICIENCY SYNDROME (AIDS) AND SCHOOL AGE CHILDREN

Approximately 40 million people throughout the world are now living with HIV/AIDS, with 70% of these people living in the sub-Saharan Africa including almost 3 million children under the age of 15 (UNAIDS/UNICEF/USAID, 2002). Throughout the world, HIV infection prevalence is lowest in the 5-14 year old age group, and AIDS mortality does not have its primary effect on school age children. However, the indirect effects are enormous. Children may suffer physically, socially and psychologically through death or illness of members of their family, including parents. Over 13 million children under the age of 15 have lost their mother or both parents to aids, most of them in the Sub-Saharan Africa. Orphans run a greater risk of becoming stunted and malnourished and may miss out on schooling, due to lack of funds. A study in Cote d'Ivoire found that when a family member had AIDS, food consumption dropped by 41% as family income in turn fell by 52%-67, and expenditure on health care for AIDS related illness, quadrupled.



### 2.5.5. NUTRITIONAL ANAEMIA.

Iron deficiency anemia is the most prevalent form of malnutrition, affecting around 50% of pregnant women worldwide, and the eighth leading cause of disease in girls and women in developing countries.

1. It has been indicated that around 600-700 million of the world's population have iron deficiency anemia by WHO criteria.
2. Nutritional anemias occur frequently in both developing and industrialized countries. In industrialized countries, the prevalence of iron deficiency anemia is much lower and usually varies between 2% and 8%.
3. The prevalence of iron deficiency (inclusive of anemic and non-anemic individuals) ranges from 12 to 18% in women in North America, Europe and Asia. The estimated prevalence in South East Asia is 50-70%.
4. In females of childbearing age in poor countries, prevalence rates range from 23% in South America to 64% in South Asia.
5. Prevalence rates are usually considerably higher in pregnant women, with an overall mean of 51%.

The most common cause of anemia is a deficiency of iron; but it may also be caused by deficiencies of folates, vitamin B12 and protein. Some anemias are not caused by nutritional factors, but by congenital factors and parasitic disease such as malaria. This study attempted to estimate the prevalence of anemia among pre-school and school-aged children in two rural areas of Odogbolu Local government areas, and to determine whether its cause was nutritional or could be attributed to malaria.

## 2.6 : GAP IN KNOWLEDGE

Information on the growth of school age children that is generated in a consistent manner across countries and over time is difficult to find (ACC/SCN, 2000 b).

Very little or no information is available in Thika district on the nutritional status of school children in coffee plantations (GOK, 1994).

## CHAPTER 3

### 3.0 STUDY SETTING AND METHODOLOGY

#### 3.1 STUDY AREA

The study was carried out in Thika municipality, Thika district, in central province of Kenya. The district came into existence in 1996 having been carved from Kiambu and Murang'a districts. The district has a total area of 1960.2 square kilometers, and is administratively divided into six divisions namely; Thika municipality, Kakuzi, Gatanga, Kamwangi, Gatundu, and Ruiru. Thika municipality is the second smallest of the six divisions taking up to 11.23% of the total area. The division has two locations namely Gatuanyaga and Thika municipal (GOK, 1994).

The district has a bimodal rain pattern, that is, long and short rains. Rainfall ranges from 965mm to 2130mm with least rainfall in the arid and semi arid region (ASAL). The district has a diverse topography ranging from 1060m to 3550m above the sea level. It has a mean temperature of 20 degrees Celsius with a range of 8 to 30 degrees Celsius.

The flat topography characterized by low rainfall and well drained soils makes it suitable for irrigated plantation farming mainly coffee, pineapples, and beef. With an exception of irrigated farming, agricultural activities and the type of crops grown are heavily determined by rainfall patterns. The northern and western parts receive 1500 mm annual rainfall. Tea, coffee and dairy farming are the dominant economic activities. In semi arid areas to the east, with low and unreliable rainfall, there is cattle rearing and drought resistant crop

production. The district does not produce enough food for its consumption and thus it relies on importation of food from the neighboring Rift Valley Province (GOK, 1994).

The district has 247 public primary schools and 95 private primary schools. There is one district hospital (GOK, 1994) with several rural health centers and dispensaries.

The district has a number of rivers, sub- surface water and dams. Although there are abundant water sources, the ASAL region depends on shallow wells, springs, bore holes and swamps as sources of domestic water. Bore holes remain the main source of water in the region (GOK, 1994).

The main prevalent diseases in the district are kwashiorkor, anemia, marasmus, malaria, diarrhea, measles, eye infection, and pneumonia (GOK, 1994).

### 3.2 STUDY POPULATION

The study population consisted of school age children aged 6-10 years and their households in coffee plantations, Thika municipality.

### 3.3 SAMPLING FRAME.

The sampling frame consisted of all households in the study area with school children aged 6-10 years, with the household heads or the care takers as the respondents.

### 3.4 STUDY DESIGN.

This was a cross sectional survey in which factors affecting the populations were looked into within the two months of the study. The study was both descriptive and analytical. The sampling procedures were purposive, systematic and simple random sampling.

### 3.5 SAMPLE SIZE DETERMINATION

The sample size was determined by use of Fisher's formula (Fisher et al, 1991) with a 95% confidence level. The prevalence level of malnutrition in Thika district is 22.0 % (GOK, 1994). The statistical formula used to determine the sample size was;

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

Where:

n=desired sample size

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

p=the proportion in the target population expected to be malnourished, that is 22%=0.22(in Thika district).

q=1-p, the expected proportion of children not presenting malnutrition in the study community, that is, 1-0.22=0.78.

d= the degree of accuracy desired set at 0.05

Inserting the above values into the formula gave a sample size of 263 households. An attrition of 10% of the sample size (263) was added for any

drop outs of the study subjects within the study period. This gave the actual sample size of 289 households. 30 households of the 289 households filled a 24-hour recall questionnaire (Appendix 1 section D).

### 3.6 SAMPLING PROCEDURE

Multistage sampling was used to select the households. Municipality division was purposely selected as the study area. The division has a fairly large number of coffee plantations in the district and was considered to be a representative of the whole district. Karimenu was purposively selected and the study sites were also purposively selected. The households were systematically sampled, that is households with children aged 6-10 years. Simple random sampling was used to get the study subjects-every household with children aged 6-10 years was eligible for the study. The sampling interval was after every one household. The first household was selected and thereafter the sampling interval was followed. Every second household was selected from the list until the sample size was achieved –when the household head was absent or the index child was absent the next nearest household was visited. A 24-hour recall was conducted on every 9<sup>th</sup> household.

### 3.7 SURVEY INSTRUMENTS

#### 1. The questionnaire (Appendix 1):

The relevant information for the study was collected from the respondents by use of a pre-tested structured questionnaire. The questionnaire had the following sections:

- Demographic information such as age, sex.
- Socioeconomic characteristics.
- Health and sanitation.
- Food frequency questionnaire.
- 24 hour recall.
- Characteristics of the index child.

## 2. Weighing and measuring equipment.

The height of the index child was measured using a height measuring board which was calibrated in centimeters with a maximum height of 175cm and an accuracy of 0.1cm. The weight of the index child was taken by use of a bathroom scale calibrated to 100g interval with a maximum of 120 kilograms. A kitchen weighing scale with an accuracy of 1.0g was used to weigh quantities of ingredients used in the preparation of the different dishes and for all the foods consumed by the index child in the last 24 hours prior to the interview. A 250ml cup was used to estimate the amount of beverages and fluids taken by the child within the last 24 hours. All the equipment was portable and durable.

## 3.8 RECRUITMENT AND TRAINING OF FIELD ASSISTANTS.

a) Recruitment: Four enumerators were successfully recruited from the area of study. These were two men and two women who had completed their form four education. They understood both English and Kiswahili and had a good command of the local language. The principal investigator was assisted by the chief and village elders to come up with these competent individuals.

b) Training: A two-day intensive training was carried out. On the first day the trainees were informed on the study objectives aim and purpose of the study, in the morning session and the questionnaire was thoroughly reviewed in the afternoon session. On the second day, morning session, training covered interview techniques and use of survey instruments .In the after session training was on how to administer the questionnaires and on importance of good public relations and ethics .Training was exclusively done by the principal investigator.

c) Pretesting: A pilot study was carried out in 30 households in an area similar to area of study setting. The study was aimed at evaluating the validity, clarity, acceptability and reliability of the survey tool and the ease of data analysis after the survey. Pretesting also helped the research assistants gain relevant skills and efficiency required during the actual data collection. The results of the pretest were discussed by the principal investigator and field assistants. This helped make relevant adjustments to the study tool. Guidance and counseling was given to research assistants depending on areas of interest before actual data collection.

### 3.9 DATA COLLECTION

In recognition of the authorities and the community at large, the purpose, objectives and data collection procedures were explained and expounded by the investigator. This helped the community to understand who we were and what we were doing, so that the investigator got their approval.

Below is a list of materials and equipment that were used by the interviewers during data collection:



- Equipment bag
- Prenumbered questionnaires
- Extra questionnaires
- Envelops to put the completed and not completed questionnaires
- Bathroom scale
- Height measuring board
- Stapler and staples
- Pencils and pencil sharpeners
- Erasers, pens, clipboard
- Two kilogram maize flour pack
- 250 ml cup
- Table and tea spoon
- Kitchen weighing scale

### 3.10 ADMINISTRATION OF THE QUESTIONNAIRES

Informed consent was obtained from the care takers of the study children before the actual data collection. This helped the care taker to give the relevant information to the interviewers and allow them to take the measurements freely.

#### 3.10.1 ANTHROPOMETRIC MEASUREMENTS

##### 3.10.1.1 HEIGHT MEASUREMENTS

Height measurements were taken while standing. The procedure was as follows;

- The measuring board was placed on a smooth level, flat hard surface against a wall.

- The index child was asked to remove shoes, sandals, sock and any other heavy clothing.
- The child was then assisted to stand with its back against the measuring board. The assistants were asked to help keep the child calm and composed.
- The child was positioned with bare feet together. The position of the heels, buttocks, shoulders and back of the head were well checked to make sure that they touched the board.
- The child's chin was held to make sure that the child was looking straight up.
- The head piece was adjusted so that it was level.
- The head piece was then lowered until it was firm on top of the head, and pressed gently to ensure that it was in contact with the head.
- The child's height was then read to the nearest 0.1cm and the reading was recorded immediately.
- The head piece was then removed and the instruction repeated for the second measurement so as to calculate the average measurement of the height.

### 3.10.1.2 WEIGHT MEASUREMENTS

The children's weight was taken using a bathroom scale since the children could be able to stand. The procedure was as follows:

- The bathroom scale was placed on a flat level surface to ensure that it was stable.

- The scale was adjusted 'to zero' using a two kilogram pack of maize floor.
- The mother/caretaker was requested to undress the child, removing all the heavy clothing.
- The child was then asked to stand on the bathroom scale.
- The child's weight was then read having made sure that the child was not supporting itself on anything. The weight was read to the nearest 0.1kg.
- The procedure of reading and recording the child's weight was repeated, for the second weight so as to get the average weight of the child.
- The child was then removed from the scale and dressed up.

### 3.10.2 DIETARY DATA

In this survey, a 24 hour dietary recall and food frequency recall were used.

#### 3.10.2.1 THE 24 HOUR DIETARY RECALL

A 24 hour recall was carried out on a sub-sample of 30 households in which the mother/caretaker was the respondent. Here the respondent was asked to remember in detail the type and quantity of foods consumed by the index child during the previous 24 hours. The foods eaten or drunk were measured by use of a kitchen scale in grams to the nearest 0.1gm. The weight of raw or cooked foods were measured. The measurements were also taken by volume using 250ml cups and by items like one egg, two medium tomatoes, and five potatoes. The values of these measurements were then converted into grammes (solid foods) and millitres (drinks and beverages).

### 3.10.2.2 FOOD FREQUENCY RECALL.

The respondents were asked to say how often they consumed the listed foods; daily, weekly, monthly, yearly or never.

### 3.10.3 DETERMINATION OF AGE.

In this survey age was determined by asking the mother or the care taker when the child was born, supported by the clinic card of the child where available. In cases where the clinic card was not available and the respondent could not remember the actual year, he or she was asked to mention any political, social or climatic condition at the time of the index child's birth. This ensured that the accurate age of the child was recorded.

### 3.11 DATA QUALITY CONTROL

To make sure that the data collected was valid, reliable, and accurate various measures were put into place;

- i. Training of the research assistants. The principal investigator trained assistants for two days on the various activities they were to carry out.
- ii. Two anthropometric measurements were taken on each index child and the average calculated. This ensured that the measurements were not vastly different from each other.
- iii. The principal investigator closely supervised the enumerators to ensure that the right procedures were followed.
- iv. The bathroom scales were calibrated every morning before starting on the activities of the day, with known weights to minimize instrument bias by 'zeroing' the instruments.
- v. Subject bias was minimized by telling the respondents the importance of the research. This was important especially when collecting

information on the 24 hour recall so that the respondents could not withhold information due to embarrassment or to influence the research.

- vi. Observer bias was reduced by taking two measurements of both weight and height.
- vii. The filled up questionnaires were cross checked and corrected for incompleteness and clarity of information, this was done by the principal investigator.

### 3.12 ETHICAL CONSIDERATIONS

Informed consent was obtained from the household head or the care taker of the index child. The study used non invasive tools to collect data from the population. More also, the mother or the care taker was asked to undress his/her own child. Each respondent was assured that the information he/she gave was private and confidential. During the actual data collection, the enumerators explained the importance of assessing the health and nutritional status of the children and the procedures to be used. Research permit was obtained from the Ministry of Education. The chief and village elders of the study sites were also informed about the research, its purpose and objectives for their approval. The study proposal was approved by the Board of Postgraduate Studies, University of Nairobi.

### 3.13 DATA PROCESSING AND ANALYSIS

Data was entered and analyzed at the Applied Nutrition Program (ANP) Unit computer room-Upper Kabete campus, University of Nairobi using the following programmes:

- Data entered and cleaned in SPSS.

- Anthropometric data was converted to nutritional indicators by use of the EPI-INFO nutritional package.
- The statistical package for social scientists (SPSS Version 6) was used for data analysis.



## CHAPTER 4

### 4.0 RESULTS

The survey was carried out in a population sample of 280 eligible households.

The response was 100% with 75.4% of the respondents being males. Both descriptive and analytical analysis was used to present the results.

#### 4.1 DESCRIPTIVE ANALYSIS

This involved both the demographic and socioeconomic characteristics of the households in the survey sample.

##### A. The demographic information.

a) Age; the population consisted mainly of persons aged 14 years and below with the population comprising of 60% whereas the other remaining population constituting 40% as shown in figure 4.0.

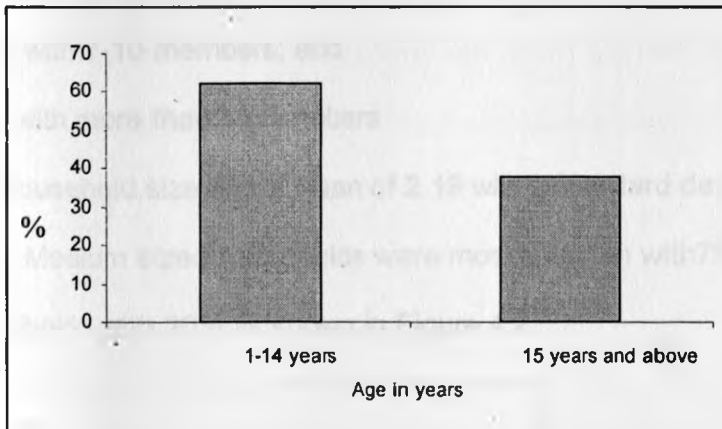


Figure 4.0: Age distribution of the population.

b). Sex of the household head; the study showed that 75% of the households were male headed with female headed households being 25% as shown in Figure 4.1 below.

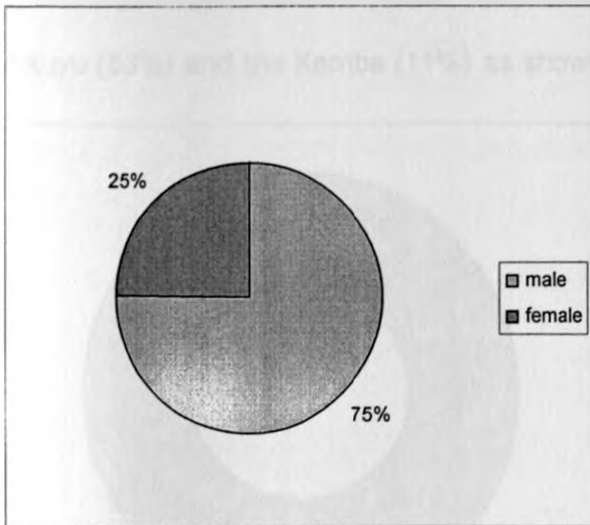


Figure 4.1; Proportion of the sex of household head

c) The household size: The households had a wide range of sizes. The household sizes were classified into three categories: small with less than 3 members. Medium sized households were households with 3-6 members.

Large with 7-10 members; and

extra with more than 10 members.

The household size had a mean of 2.19 with a standard deviation of

0.922. Medium sized households were most common with 75%, and large households with 20% as shown in Figure 4.2.

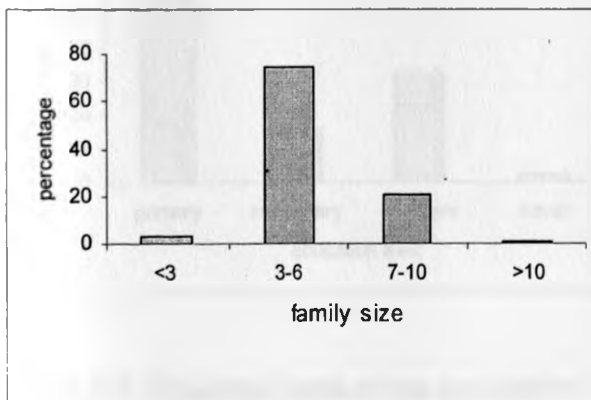


Figure 4.2: Proportions of family size



d) Ethnicity of the household head; the population mainly consisted of the Kikuyu (83%) and the Kamba (11%) as shown in Figure 4.3.

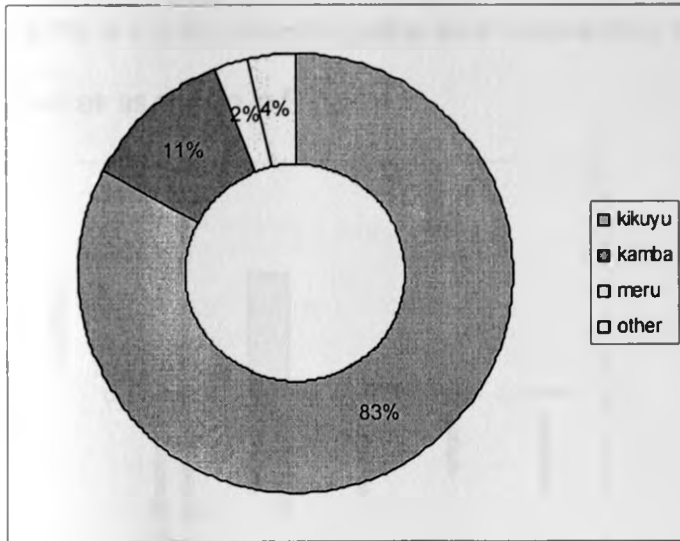


Figure 4.3: Ethnicity of household head

e). The households were also examined for their level of education. Of the surveyed population 65% had primary education and only 4% had secondary education. 30% of the population were below school age and only 1% had never gone to school as shown in Figure 4.4.

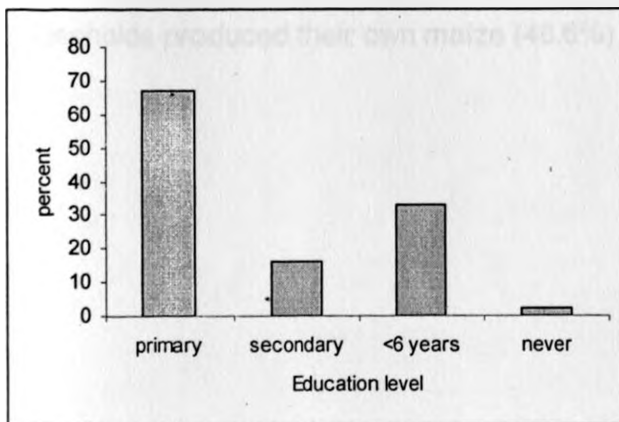
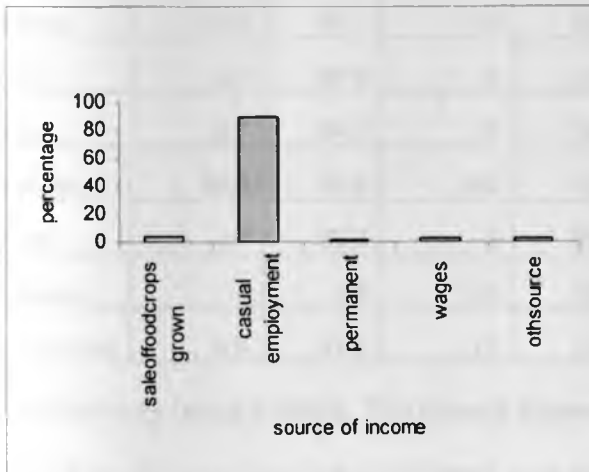


Figure 4.4: Education level of the population.

**B. Socioeconomic information.**

a) Source of income; the main source of income was casual employment with 89.6% of the households getting their income from this source and a few other sources as shown in Figure 4.5.



**Figure 4.5: Major sources of income**

b) Source of foods.

The respondents named the main sources of the listed foods in the last three months before the study. The results showed that almost half of the households produced their own maize (48.6%) as shown in Table 4.0

Table 4.0: Sources of the listed foods.

food	percent		frequency	
	own production	bought	own production	bought
maize	48.6	51.4	136	144
potato	6.8	93.2	19	261
beans	17.9	82.1	50	230
milk	2.1	97.9	6	274
eggs	5.7	94.3	16	264
sukuma	54.6	45.4	153	127
fruits	0.7	99.3	2	278
bananas	15	85	42	238
arrowroots	8.9	91.1	25	255

c). Commonly bought foods: The results showed that the most commonly bought foods were maize flour (32.6%) and rice (21.1%) while fat and maize were the least bought foods, 6.8% and 4.3% respectively as shown in

Figure 4.6

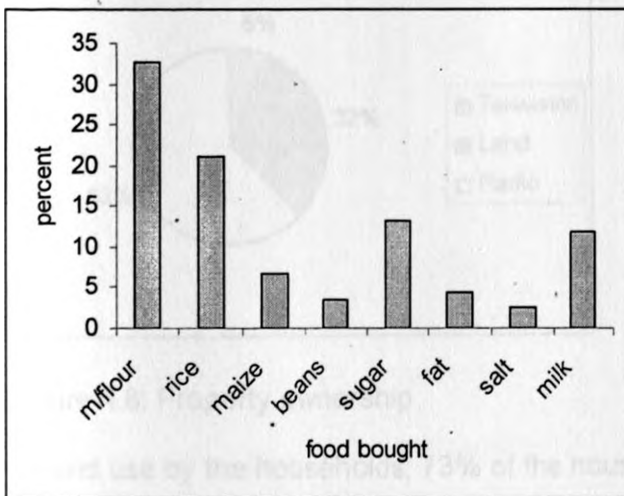


Figure4.6: Foodstuffs bought by households within Three months before the study.

d) Expenditure on food: The study showed that over 48% of the households spent 50 to 70 shillings on food every day and at least 41% of the households

spent 80 to 100 shillings on food as shown in Figure 4.7.

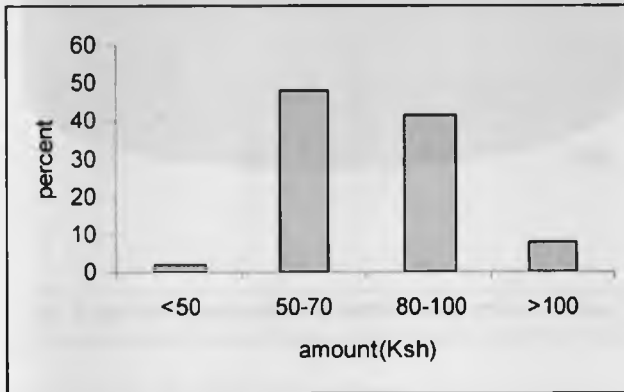


Figure 4.7: Amount of money spent on foods

e) Property ownership; 62% of the households owned a radio, 32% owned land and 6% owned a television set as shown in Figure 4.8.

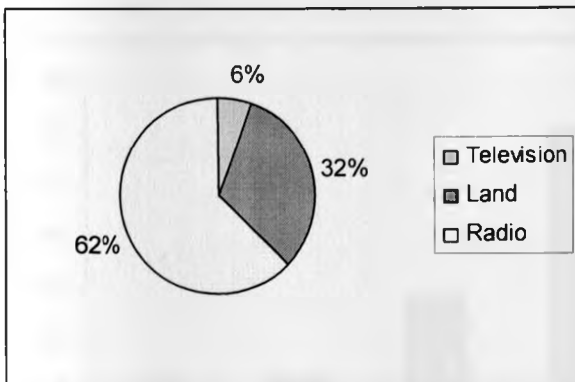


Figure 4.8: Property ownership

f) Land use by the households; 73% of the households that owned land used the land for food production. 8% of the households used their land for food for consumption and for sale as shown in Figure 4.9.

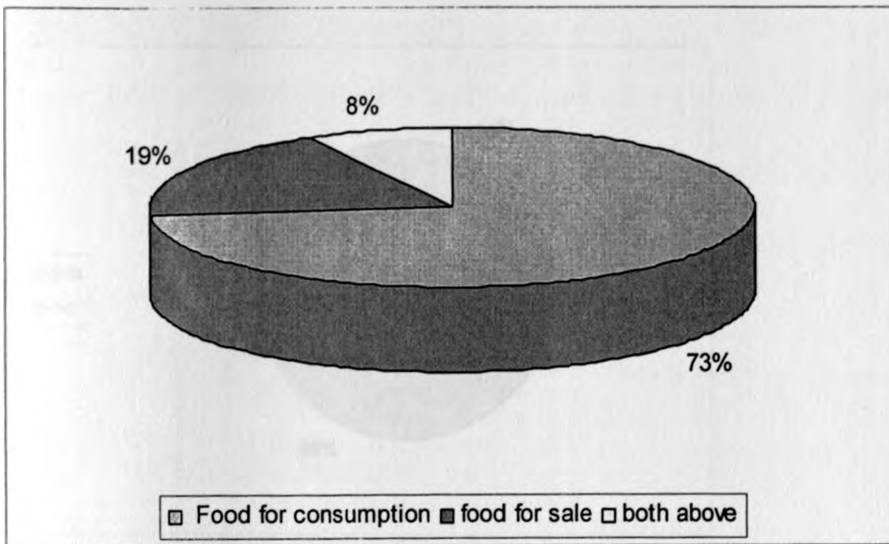


Figure 4.9: Land use by the households.

g) Source of water: 49% of the households used open public wells as the source of water. A few households used tap water as the main source of water (2.5%). The sources of water are shown in Figure 4.10.

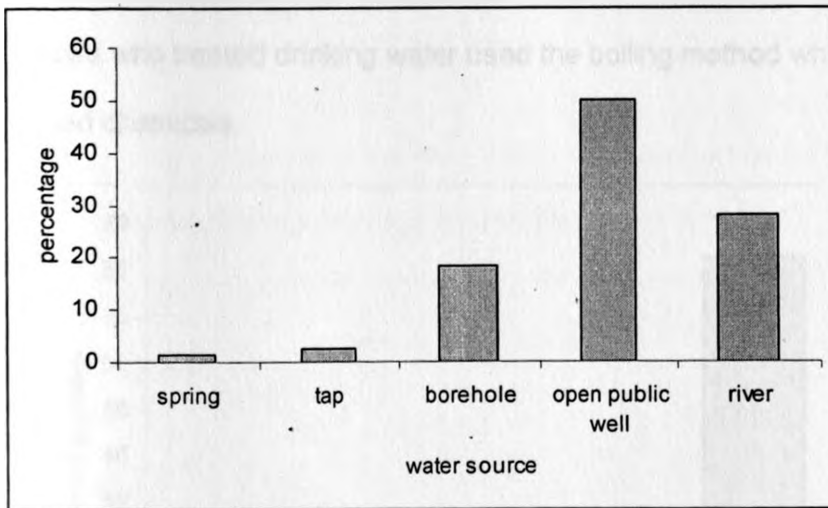


Figure 4.10: Source of water

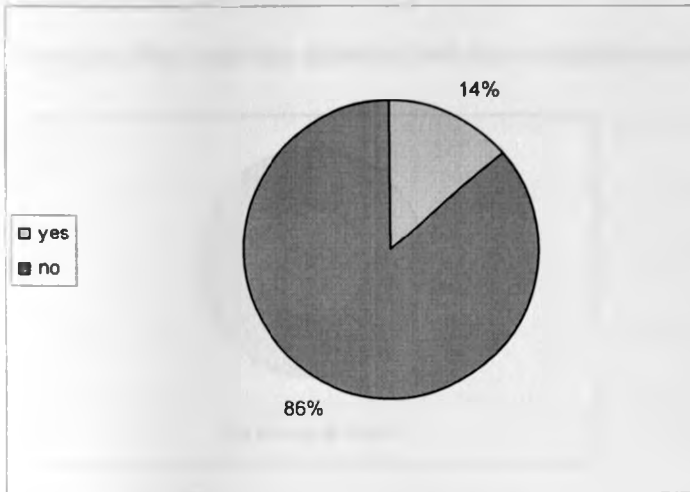


Figure 4.11: Source of water

h) The study showed that 86% of the households did not treat drinking water and only 14% of the households treated drinking water as can be seen in Figure 4.11.

Figure 4.11: Proportion of households that treated drinking water

j) Methods used to treat drinking water; figure 4.12 shows that over 80% of those who treated drinking water used the boiling method while less than 10% used chemicals.

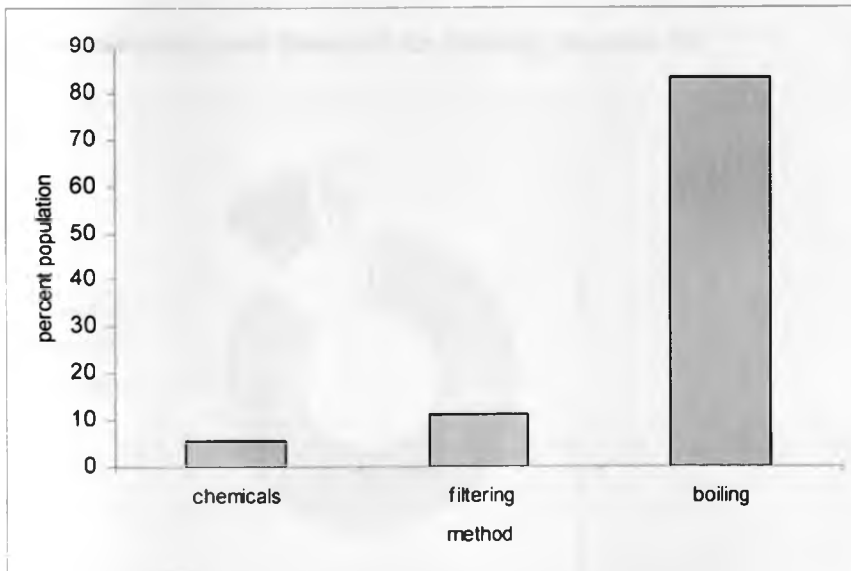


Figure 4.12: Water treatment methods.

k) Only 12.1% of the households burnt their waste while all the others dumped their wastes outside their homesteads as shown in Figure 4.13.

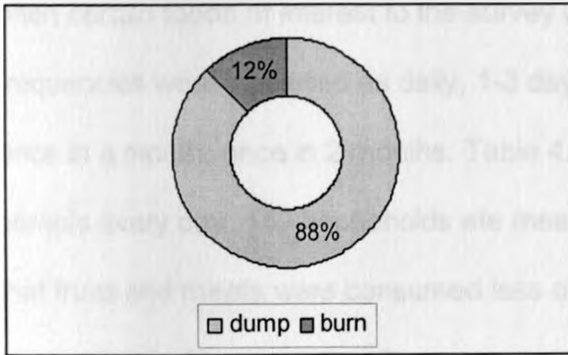


Figure4.13: Methods of waste disposal

l) 86.1% of the households used a pit latrine (Table 4.1).

Table4.1: Type of toilet

Type of toilet	Frequency	Percent
Pit latrine	241	86.1
Toilet flushable	3	1.1
Bush	36	12.9

All the households under survey (100%) used paraffin for lighting and 86% of the households used firewood for cooking, figure 4.14.

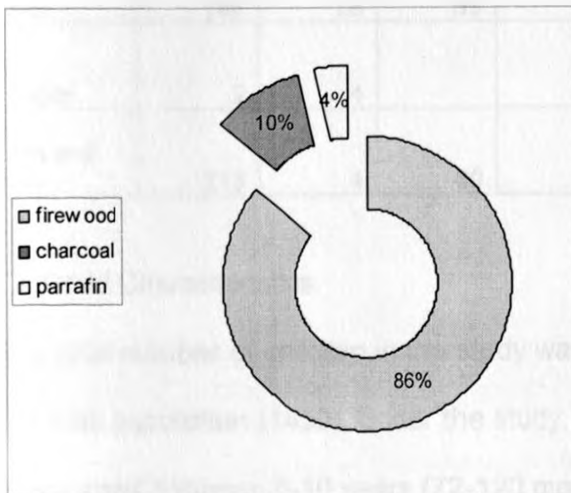


Figure.4.14: Cooking fuel

n) Food consumption frequency: this section of the survey was to find out how often certain foods of interest to the survey were eaten by the household. The frequencies were classified as daily, 1-3 days, 4-6 days, once in 2 weeks, once in a month, once in 2 months. Table 4.2 shows that 275 households ate cereals every day. 152 households ate meat once a month. The table shows that fruits and meats were consumed less often with 105 households consuming fruits once a month.

Table 4.2: Food consumption frequency

Food	daily	1-3 days a week	4-6 days a week	once in two weeks	once a month	once in two months
cereals	275	5	-	-	-	-
legumes	9	215	7	41	8	-
vegetables	184	17	74	4	-	1
fruits	4	39	3	88	105	41
root tubers	15	195	10	41	17	2
tea with milk	186	28	63	3	-	-
meats	2	4		34	152	88
fats and oils	213	4	60	1	2	-

### C. Child Characteristics.

The total number of children in the study was 280. This represented 18.9% of the total population (1450), under the study. The children under study were those aged between 6-10 years (72-120 months), the school age children.



a). Age; the survey involved children of school ages 6 to 10 years. Children aged 10 years constituted 24.5% of the index child population as shown in Figure 4.15 while children aged 6 years were 13.7%.

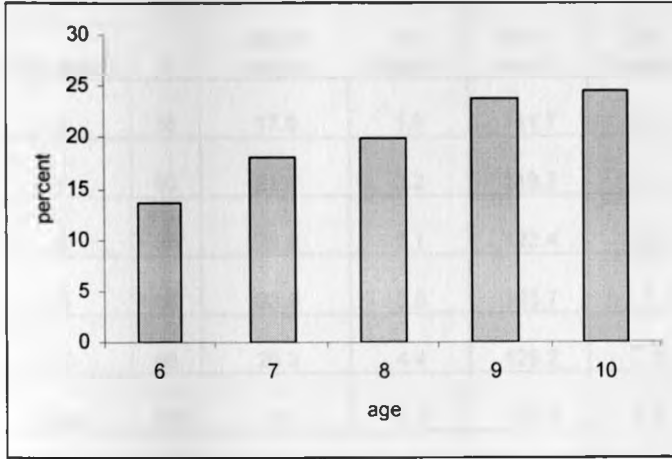


Figure 4.15: Age distribution of the children

b). Sex: over 50% of the children under survey were females as show in Figure 4.16.

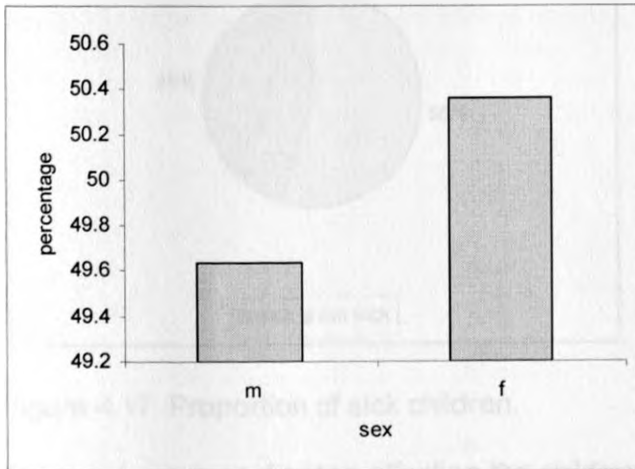


Figure 4.16: Sex of the children.

c). Anthropometric measurements: the weights and heights of the children were taken and their means and standard deviations calculated. The mean weight of children aged 6 years was 17.8 kg with a standard deviation of 1.9

as shown in Table 4.3 below. The mean height of children aged 8 years was 123.4cm with a standard deviation of 5.8.

Table 4.3: Weight and height of children.

Age(years)	N	Mean weight	Std. Deviation	Mean height	Std. Deviation
6	38	17.9	1.9	111.7	5.7
7	50	21.1	3.2	118.7	5.7
8	55	23.4	3.1	123.4	5.8
9	66	23.9	3.5	125.7	7
10	68	26.2	4.4	129.2	7.6
Total	278	23	4.3	122.9	8.6

d). Morbidity; the study showed that over half of the children (55%) were sick within two weeks before the study was carried out as shown in Fig.4.17

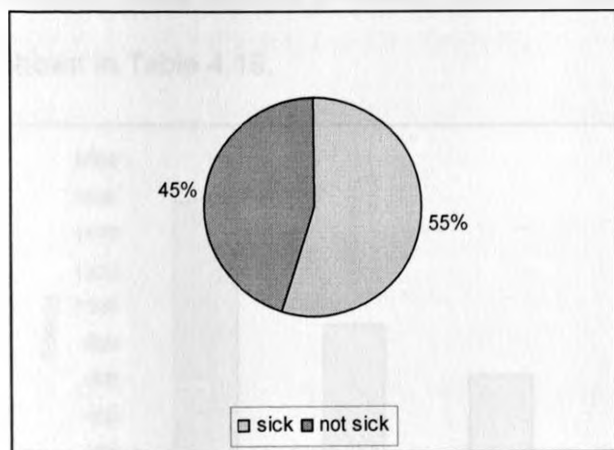


Figure 4.17: Proportion of sick children.

The most common disease affecting the children was colds and coughs. Over 20% of the children suffered from this disease followed by headache with 10% as shown in Figure 4.18. Diarrhea and stomachache were least affecting the children with less than 5%.

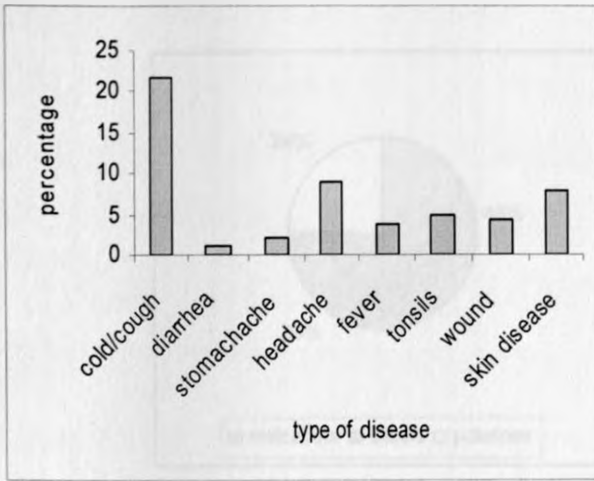


Figure 4.18: Diseases affecting the index child

e) Dietary intake; a 24 hour recall was conducted to determine the caloric (Kcal) and protein (grams) intakes of the index child. Figure 4.19 shows that maize contributed 1600 Kcal and was the main source of energy for the children. Other sources of energy included potato, rice and maize flour as is shown in Table 4.19.

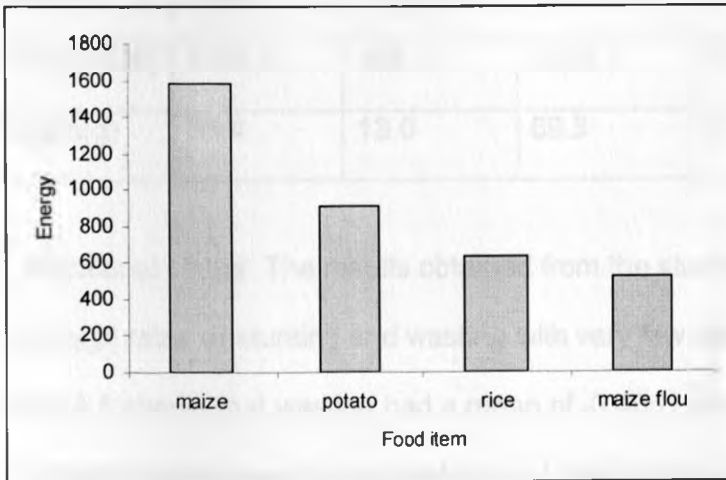


Figure 4.19: Sources of energy

However maize flour was the highest source of protein (45%) for the age group contributing 42.05g protein followed by beans as shown in figure 4.20.

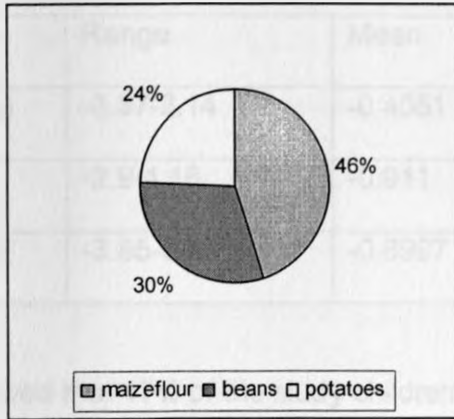


Fig4.20: Sources of protein

Table 4.4 shows the total energy and protein intake of the children. The total energy intake of the children was approximately 2101Kcal with a mean of 1377Kcal and a standard deviation of 426.2. The protein had a range of 56Kcal and a standard deviation of 13.0.

Table 4.4: Nutrient intake of the children.

Nutrient	Total	Minimum	Maximum	Mean	Std deviation
Energy(Kcal)	2101.0	458.2	2559.2	1377.3	426.2
Protein(g)	56.4	13.0	69.3	37.2	13.0

f). Nutritional status: The results obtained from the study showed that there were high rates of stunting and wasting with very few cases of underweight.

Table 4.5 shows that wasting had a mean of -0.4051 and a standard deviation of 0.9545. Stunting was the highest form of malnutrition with a standard deviation of 1.0933 as shown in Table 4.5. Underweight was the least form of malnutrition with no cases of severe malnutrition.

Table 4.5: Nutritional status of the children.

Z-Score	Range	Mean	Standard deviation
WHZ (Wasting)	-3.37-2.14	-0.4051	0.9545
WAZ (Underweight)	-2.9-1.18	-0.911	0.8913
HAZ (Stunting)	-3.85-3.48	-0.8997	1.0933

The study showed that 17% of the study children were malnourished with children aged 8 years being the most malnourished (23.6%) compared to the other age groups as shown in table 4.6. Stunting was the most prevalent form of malnutrition with 9.1% of the children being stunted. The table shows that 12% of the boys were stunted, while 6% of the girls were stunted.

Table 4.6: Prevalence of malnutrition in study children.

Age group	Sex	No. in age group	No. below -2 SD			Percentage below -2 SD
			WHZ	WAZ	HAZ	
6.0-6.9	Boys	22	0	1	0	4.6
	Girls	16	2	0	0	12.5
	Combined	38	2	1	0	7.9
7.0-7.9	Boys	28	3	1	0	14.3
	Girls	22	1	2	0	13.6
	Combined	50	4	3	0	14
8.0-8.9	Boys	20	2	1	3	30
	Girls	35	3	1	3	20
	Combined	55	5	2	6	23.6
9.0-9.9	Boys	30	2	0	6	26.7
	Girls	35	1	1	2	11.1
	Combined	65	3	1	8	18.2
10.0-10.9	Boys	42	1	0	8	21.4
	Girls	26	0	0	3	11.5
	Combined	66	1	0	11	17.6
Total	Boys	142	8	3	17	20
	Girls	134	7	4	8	14.2
	Combined	276	15	7	25	17

## 4.2 ANALYTICAL RESULTS

The analysis was performed using a chi-square test and correlations. The factors considered in the analysis included; demographic and socioeconomic factors, morbidity and dietary intake, age and sex of the index child. The chi-square test showed that there were significant relationships between underweight and source of income being significant at  $p$  value  $< 0.05$ . The tests also showed that there were significant differences in family size, type of toilet and stunting ( $p < 0.05$ ) as shown in table 4.7.

Table 4.7: Chi-square results of various factors and malnutrition.

Variable	WHZ p-value	WAZ p-value	HAZ p-value
Household head	0.84	0.411**	0.512**
Family size	0.626	0.423**	0*
Income source	0.13**	0.008*	0.921
Amount spent on food	0.818	0.487**	0.201**
Diseases	0.483	0.97	0.677
Type of toilet	0.956	0.735	0.003*
Source of water	4	0.842	0.238**

Correlation analysis was performed to determine the relationship between ages, sex, energy and protein intake of the index child. Table 4.8 shows that there were significant differences between sex and all three forms of malnutrition the relationship being significant at  $p$  value  $< 0.05$ . There were also significant differences between age, sex and underweight as well as stunting ( $p < 0.05$ ) as shown in table 4.8 shows.

Table 4.8: Relationship between various factors and malnutrition.

	WHZ p-value	WAZ p-value	HAZ p-value
Age	0.119	-0.173	-0.261
Sex	0.038	0.02	0.018
Kcal	-0.087	0.073	0.143
Protein	0.127	0.308	0.205

The correlation results showed that there were significant relationships between age and wasting, underweight and stunting ( $p < 0.05$ ) as shown in Table 4.9.

Table 4.9: Relationship between age group and wasting, underweight and stunting.

AGE	WHZ p-value	WAZ p-value	HAZ p-value
72	-1.258	-1.704	-1.806
84	0.686	-1.15	-1.2200
96	0.1340	0.79	0.66
108	0.1300	0.539	0.33
120	0.3700	0.10	-3.4

The correlation analysis also showed significant relationships between wasting, underweight, stunting and other variables the relationship being significant at  $p < 0.05$ . There was a great relationship between source of income and the three forms of malnutrition. The relationship between family size, source of income, amount of money spent on food, diseases type of toilet and underweight were very significant ( $p < 0.05$ ) as Table 4.10 shows.

Table 4.10: Correlation results of various factors and malnutrition.

Variable	WHZ p-value	WAZ p-value	HAZ p-value
Household head	0.018*	0.049*	0.029*
Family size	0.027*	-0.05*	0.015*
Income source	-0.096*	-0.06*	-0.018*
Amount spent on food	0.01*	-0.062*	-0.075*
Diseases	0.086	-0.038*	-0.018*
Type of toilet	0.045*	-0.019*	-0.174*
Source of water	0.091	0.031*	0.097

\*p-value significant Significance at  $p < 0.05$

Not marked: p-value not significant



## CHAPTER 5

### 5.0 DISCUSSION

This study was investigating the health and nutritional status of school age children at Thika plantations. The study focused on the demographic, socioeconomic, health characteristics, dietary intake and food consumption frequencies, as factors that directly or indirectly affect the nutritional status of the study population.

#### 5.1 DEMOGRAPHIC AND SOCIOECONOMIC FACTORS

From the results obtained, the population consisted of more females than the males. Most of the population has attained a primary education which limits the source of income to casual labor. This explains the poor economic status of the households since returns from casual labor are low and irregular. The population was largely composed of persons less than 14 years medium sized households were dominant with more male headed households. The population consisted mainly of the dependent age group and this explains why the greatest percentage of income was used for food purchase so as to feed the young ones.

The medium sized households and small household sizes could be attributed to awareness of the importance of smaller families. The poor sanitary conditions could be attributed to poor plantation management and not ignorance by the study population.

However, the skin diseases, wounds and incidences of stomachache could be attributed to the poor sanitary conditions of the general environment. Poor environmental conditions and poor sanitation are major causes of illnesses in

the school age children (Cairncross, et al, 1996). A significant number of children were sick thus, accepting the hypothesis that there are high morbidity levels among school age children in the coffee plantations in Thika municipality. Most of the house holds did not produce their own food but relied on purchase. This explains why the population spent 75% of their income on food purchase. Thus a monotonous kind of diet of maize flour and kale was most preferred by the population. A monotonous diet could lead to deficiency of other essential micronutrients in the body (ACC/SCN, 2000).

## 5.2 DIETARY PATTERNS AND DIETARY ADEQUACY

Both quantity and quality of food consumed are important in determining the well being of an individual. The body requires certain amounts of the various nutrients on a daily basis for proper growth. A limitation in any of these will have negative consequences on an individual's nutritional status (FAO, 2005)

The most frequently consumed foods were maize flour and vegetables. Thus these were the main source of protein and energy among the school age children. Since these were consumed on a daily basis, the index children were able to meet their caloric and protein recommended dietary intakes (RDA) of 1g/kg body weight 1800-2000 kcal, thus accepting the hypothesis that school children in the coffee plantations, Thika municipality met their RDA. However, it is worth noting that the protein sources were mainly from plant origin which is of low biological value. The results showed that there was low consumption of fruits and meat being consumed twice a year and once in two months respectively. The very low intake of fruits was responsible for the poor healing of wounds and the presence of skin diseases. Fruits are essential

source of vitamin C which plays a major role in the healing of wounds(Ann,et al,2003) and vitamin A which is essential in for good eyesight and lack of vitamin A leads to blindness in children (ACC/SCN,2000). Meat is a good source of iron. Lack of iron in the body leads to IDA which affects 210 million school age children (WHO, 2000).

### 5.3 NUTRITIONAL STATUS OF THE SCHOOL AGE CHILD

The study revealed that stunting increased with age with children aged 10 years being most stunted(11%).The severity and prevalence of stunting and underweight have been found to increase with age, with order children diverging further from the reference medians for height (Shahabuddin et al, 2000), In this study approximately 5.4%,3.0% and 9.1% of the children were found to be wasted, underweight and stunted, respectively, as shown in Table 4.6 This study revealed that children were more wasted and stunted than underweight. Wasting could be explained by the fact that there were draught and famine months that prevailed in the area before the study was conducted. Stunting is widely believed to occur mainly in early childhood and through a cumulative process. Children stunted at school age are likely to have been exposed to poor nutrition since early childhood, and the degree of stunting tends to increase throughout the school age years (ACC/SCN, 2000). Underweight among school age children can reflect a broad range of insults such as prenatal under nutrition, infection and inadequate attention by caregivers. In this study there were few cases of underweight children. This could be explained by the fact that the care takers had quality time to take care of their children, prepare meals and to feed their children. This finding

also agrees with other findings on the prevalence of stunting among school age children from low income households in less developed countries which indicate that shortness-for-age is a common nutritional problem among these school age children compared to wasting (Ahmed et al., 1991)

## CHAPTER 6: CONCLUSIONS AND RECOMMENDATIONS

### 6.0 CONCLUSIONS

The study whose aim was to determine the health and nutritional status of school age children (6-10 years) in coffee plantations, in Thika district concluded that the females dominated the population and this did not influence the nutritional status of the children. Education level of the females and males was similar, meaning that the population was not totally ignorant of basic health practices. The study population was dominated by the dependent age group. This affected the total dietary intake of the households. There were high levels of poverty because the households earned less than a dollar per day. This is a risk factor to malnutrition of the age group. The dietary record revealed, food availability and access as limiting factors to having a mixed diet for the index child. This led to a monotonous kind of diet regardless of culture and or tribe. The most common ailments among the age group were colds and coughs, skin disease and wounds, headache and stomachache. Ailments negatively affect the nutritional status of the children. The study revealed that there was poor sanitation with majority of households without a pit latrine and water. Poor sanitation is directly associated with ailments or diseases and this can be detrimental to nutritional status.

Cereals formed the basic diet, thus energy was paramount and to some extent protein. However, the population could be lacking other essential nutrients especially the micronutrients. Wasting and stunting were the most common forms of malnutrition among children aged 6-10 years in the coffee plantations. However a few cases of underweight were reported as shown in Table 4.6. Two major implications of linear growth retardation among primary

school children are; 1. The process of stunting may be associated with concurrent risks of health and development of school age children. 2. Stunting in school age children may result in shorter adult height, which decreases work capacity and increases reproductive risks for women (WHO 1995). Both stunting and wasting vary significantly according to the children's age and gender-as the children get older, they are at a greater risk of being stunted but not wasted. Male children compared to their female counterparts have a higher prevalence of stunting and wasting (Table 4.6).

## 6.1 RECOMMENDATIONS

### General Recommendation.

School age children are a vulnerable group to malnutrition and quick action need to be taken by all the stakeholders to improve their nutritional status so that they can be productive now and in future. As this study found that underweight, stunting and wasting are still prevalent among this age group, there is a need for the Ministry of Education and Ministry of Health to adopt a more intensive approach to address health and nutrition issues in this age group. Health and nutrition monitoring are essential so that effective interventions can be implemented to alleviate and consequently eliminate the health and nutritional problems among these children. It is recommended that active growth monitoring of the school children be implemented as it is an easy and inexpensive tool for health professionals to obtain information on the health and nutritional status of the school age population.

Other specific recommendations include:

1. It is important to note from the study that household food production was too low due to lack of land ownership. The government should formulate land policies to ensure that casual laborers have at least a kitchen garden so that they can be able to produce basic foods like vegetables.
2. The study considered the health and nutritional status of the age group. However, consequences of these to education, and other activities were not considered. Studies should be carried out to find out the outcome of health and nutritional status or education, etc.

3. The ministry of public health should ensure that there are policies for plantations to maintain good housing, sanitation and water.
4. The study revealed that there were high stunting levels among the school age children. It is important to identify whether the height deficits accrued during the 6-10 years of growth are made up of through pubertal growth.
5. Nutrition programmes and interventions should be implemented to determine to what extent school age stunting is preventable.
6. Poor environment and sanitation were linked to stunting. Basic education of the children and the community should be made paramount to sensitize the general population on the importance of good sanitation and its implication on their health
7. The dietary intake of the population shows a low consumption of some foods like, fruits, meat and eggs. Thus it would be appropriate to carry out a study to determine the nutritional status of the children in relation to specific micronutrients.
8. This study did not put into account child care practices which are a major cause of malnutrition among children below five years. Thus a study on care practices should be carried out to show whether the nutritional status of school age children is affected by poor child care practices.



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APPENDIX: Questionnaire

Questionnaire no. -----

Date of interview-----

Name of interviewer-----

Sex of house head-----

- 1. Male
- 2. Female

Ethnicity of house head-----

SECTION A: DEMOGRAPHIC INFORMATION.

- 1. How many people are there in your household that you have cooked and eaten with in the last three months?

Give their details below:

SERIAL NO.	NAME	AGE(YEAR)	AGE(MONTH)	RELATIONSHIP	EDUCATION	SEX
1						
2						
3						
4						
5						

- Relationship to HHH
- 1. Head of household
  - 2. Wife
  - 3. Son
  - 4. Daughter.
  - 5. Others

- Sex
- 1. Male
  - 2. Female

- Education
- 1. Primary
  - 2. Secondary
  - 3. University
  - 4. N/a
  - 5. None

**SECTION B: SOCIAL ECONOMIC AND SANITATION.**

2. what has been the main source of the following foods in your household in the last three months;

- i. Own production
- ii. Bought
- iii. Other sources

<u>FOOD</u>	<u>SOURCE</u>
Cereals (maize, rice, sorghum, millet)	-----
Roots and tubers (potatoes, arrowroots)	-----
Legumes (beans, peas, black beans)	-----
Livestock products (milk, eggs, meat)	-----
Vegetables (cabbage, kale, carrots)	-----
Fruits (oranges, passion, avocado)	-----

3. What is/are the source(s) of income for the house holds of these sources, please rank from the one that gives you the highest to the lowest amount of money. (Tick the appropriate and rank)

Income source	Rank
1. Sale of food crops grown	
2. Sale of animals	
3. Casual employment	
4. Permanently employed	
5. Wages	
6. From relatives	

4. Please list at least 5 foodstuffs you have bought in the last one week and how much have spent on each of these foods. Include retail foodstuffs like, cooking fat, salt, bread, flour, sugar.

<u>FOOD</u>	<u>AMOUNT</u>
i.	
ii.	
iii.	
iv.	
v.	

5. Do you own any of the following: 1.yes 2.no 3.none?

a) Radio-----

b) Radio and TV-----

c) TV-----

d) None of above-----

6. Do you own land? 1. Yes 2.No

7. If yes, how do you use it?

a) Food production for consumption

b) For production for sale

c) The two above

8. What type of toilet do you have?

a) Pit latrine

b) Toilet flushable

c) Bush

9. What is the main source of water?

a. Spring

b.Tap water

c.Bore hole

d.Open public oil

e.Harvsted rain water

10. Do you treat drinking water? 1. Yes 2.No

11. If yes what method do you use?

1. Chemicals 2.filtering 3.boiling

12. How do you dispose your garbage?

1. In a pit 2.burn 3.other (specify) -----

13. What is your main source of fuel for?

13a. Lighting? a) Electricity b) Paraffin

13b. Cooking? a) Firewood b) Charcoal c) Paraffin

SECTION C: HOUSEHOLD FOOD FREQUENCY

14. Ask mother/caretaker

What foods does your family eat and how often are they eaten. Give

example.

<u>FOOD</u>	<u>FREQUENCY</u>
1. Cereals	-----
2. Legumes	-----
3. Vegetables	-----
4. Fruits	-----
5. Root tubes	-----
6. Tea with milk	-----
7. Meats	-----
8. Fats and oils	-----
9. Others	-----

SECTION D: INFORMATION ON THE INDEX CHILD

Serial number of index child-----

Date of birth (years) -----

Clinic attendance card available-----1, Yes 2.No

15. Ask the mother or care taker the following questions about the index child and fill in the table below.

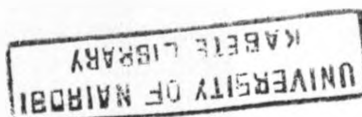
a) Starting yesterday morning what did (mention name of index child)eat.

b) What amount of food was served to the child?

c) Did the child live any of the food, if yes, what amount.

d) Ask the child whether it ate any food from the neighbors. If it says yes ask how much and what foods were eaten

Index child 24 hour dietary intake recalls.



Time	Dish	Name of ingredient	Amount of ingredient in family food	Amount served to child(a)	Amount left by child(b)	Amount consumed by child(a-b)	Amount eaten by child outside home
Breakfast							
Lunch							
supper							

SECTION E: MORBIDITY AND ANTHROPOMETRIC MEASUREMENTS OF THE INDEX CHILDREN

Serial no. of index child-----

Date of birth of index child-----

Clinic card available----- 1.Yes 2.No

16. Has (mention the name of the index child) been sick in the past two weeks? 1. Yes 2. No

If yes, what disease (Ask to see the hospital card if the child attended clinic)

1. Cold/Cough    3. Stomachache    5. Fever    7. Tonsils  
 2. Diarrhea    4. Headache    6. Skin disease    8. Wound

17. Please allow me to measure your weight and height

Weight (kg)    Weight 1 -----    Weight 2 -----    Average -----

Height (cm)    Height 1 -----    Height 2 -----    Average -----