
WINNIE CHEPNG'ETICH SAMBU

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A Mini thesis submitted in partial fulfilment of the requirement for the degree Master of Economics (Development Studies) in the Institute for Social Development, Faculty of Economic and Management Sciences, University of the Western Cape.

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March 2013
KEY WORDS

Anthropometry
Children
Dietary Diversity
Food Security
Malnutrition
Nutritional Status
Stunting
Underweight
Wasting
Z scores
### ABBREVIATIONS/ ACRONYMS

<table>
<thead>
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<tbody>
<tr>
<td>ACRWC</td>
<td>African charter on the Rights and Welfare of the Child</td>
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<td>BMI</td>
<td>Body Mass Index</td>
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<td>CRC</td>
<td>Convention on the Rights of the Child</td>
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<td>FAO</td>
<td>Food and Agricultural Organisation</td>
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<td>FSNS</td>
<td>Food and Nutrition Strategy Framework</td>
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<td>GMCs</td>
<td>Growth Monitoring Clinics</td>
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<td>GOK</td>
<td>Government of Kenya</td>
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<td>HAZ</td>
<td>Height-for-Age</td>
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<td>HDDS</td>
<td>Household Dietary Diversity Score</td>
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<td>HDI</td>
<td>Human Development Index</td>
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<td>HFIAS</td>
<td>Household Food Insecurity Access Scale</td>
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<td>KDHS</td>
<td>Kenya Demographic and Health Survey</td>
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<td>KIHBS</td>
<td>Kenya Integrated Household Budget Survey</td>
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<td>KNBS</td>
<td>Kenya National Bureau of Statistics</td>
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<td>KSHS.</td>
<td>Kenyan Shillings</td>
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<td>MDGs</td>
<td>Millennium Development Goals</td>
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<td>MPI</td>
<td>Multidimensional Poverty Index</td>
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<tr>
<td>MUACZ</td>
<td>Mid-upper arm circumference-for-age</td>
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<td>NFNSP</td>
<td>National Food and Nutrition Security Policy</td>
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<td>NGOs</td>
<td>Non-Governmental Organisations</td>
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<td>ROK</td>
<td>Republic of Kenya</td>
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</table>
USAID United States Agency for International Development
WAZ Weight-for-Age
WHO World Health Organisation
WHZ Weight-for-Height
UNICEF United Nations Children’s Fund

CONVERSION

1 USD= KSHS. 86.16 (08.03.2013)
ABSTRACT


W.C. SAMBU
MEcon mini-thesis, Institute for Social Development, Faculty of Economic and Management Sciences, University of the Western Cape

Kenya has continued to record decreasing child mortality rates in recent years, with available data showing that the under-five mortality rate was 85 per 1000 live births in 2010, down from 117 in 1997 (World Bank, 2012). However, the country continues to battle with poor anthropometric status of children (stunting, wasting and under-weight). The country also faces high incidences of food insecurity. It is estimated that one third of the country’s population is food and nutrition insecure, with about 10 million of Kenyans suffering from chronic food insecurity (ROK, 2011). The worst affected are children, who are deprived of sufficient nutrients required for proper growth and development.

This study seeks to analyse the relationship between household food security and the anthropometric status of children. Specific objectives include identifying the prevalence and predictors of poor anthropometry, identifying the extent of food insecurity in the country and investigating the link between food security and the anthropometric status of children.

The research uses data from the Kenya Integrated Household Budget Survey (2005/2006). The survey which was carried out for a period of 12 months covered the entire country and collected data on the demographic and socio-economic characteristics of the households. It also collected data on child anthropometric measurements and households’ food consumption patterns. The statistical software package STATA SE v.12 is used to run ordinary linear (OLS) and logistical regressions in order to analyse the relationship between household food security and the anthropometric status of children.

Results show that the prevalence of malnutrition is high in the country with stunting coming out as the main form of malnutrition. Dietary diversity, a measure of food security, is found to be highest in the urban areas. Results from the regression analysis show that a Household Dietary Diversity Score (HDDS) is positively associated with better anthropometry, with the prevalence of malnutrition decreasing with an increase in the score. The study also found that other risk factors associated with poor anthropometry are age of the child, gender, area of residence, diarrhoea, education, household size and income. The paper concludes with suggestions on measures that need to be put in place to curb child malnutrition.
DECLARATION

I declare that *Household Food Security and the Anthropometric Status of Children under Five: Evidence from the Kenya Integrated Household Budget Survey (2005/2006)* is my own work, that it has not been submitted for any degree or examination in any other university, and that all the sources I have used or quoted have been indicated and acknowledged by complete references.

WINNIE CHEPNG’ETICH SAMBU

MARCH 2013
This thesis is dedicated to my loving parents, who persistently encouraged me to pursue graduate studies.
ACKNOWLEDGEMENTS

I thank God whose grace has been sufficient throughout the duration of my studies, who continuously gives me much needed strength, and whose guidance has enabled me to get to where I am this day.

I wish to express my sincere and utmost gratitude to Professor Julian May for his excellent supervision and his assistance not just during the writing of this thesis, but also throughout the duration of my studies. His many hours of dedication, insightful comments, immense knowledge, and continuous feedback made the completion of this paper possible. I also want to thank him for introducing me to research on child anthropometrics! Professor May, I could not have wished for a better mentor!

I would like to thank the German Academic Exchange Service (DAAD) for financing my studies at the University of the Western Cape. I also wish to recognise the support of the staff at the Development Research Division: Ina Conradie and Iris Vernokohl. Thanks also to the academic and administrative staff of the Institute for Social Development, and the School of Government at the University of the Western Cape for their support. I will always be grateful to Priscilla Kippie who was ever ready and willing to assist.

I want to especially thank Katherine Hall of the Children’s Institute for her friendship, and for being extremely supportive of my studies and my internship at the Children’s Institute.

I am immensely grateful to Rodney and Eileen Jacobs and their children Reagan and Claire for their kindness and hospitality during my stay in Cape Town. I’ll always remember the Sunday afternoons spent (together with Sheila) discussing Eileen’s lovely recipes and deliberating on politics and current affairs in Africa. And to my dearest friend Sheila Wanjogu; thanks for being such wonderful company, and for always being so motivating.

I am also thankful to Joyce Marangu for all the tears and laughs, the long conversations on our beloved country Kenya, and the coffee and carrot cakes that accompanied the many delightful moments. My deepest gratitude goes to Fundi Ngundi for being such a great friend and for cheering me on during some of the most difficult moments of 2012. And to my classmates and friends: I will not forget the long hours spent in the library, the sleepless nights trying to beat deadlines and all the good times we’ve had together in Cape Town.

Last but not least, I cannot find enough words to express my gratitude to my family. I am eternally grateful to my parents, James and Mary Sambu, whose unconditional support has brought me this far. I have felt your love throughout the duration of my studies despite being far away from you both, and will never forget all the prayers, phone calls, emails, and messages of encouragements. As for Kipruto, Kenneth, Chemutai, Chepkorir, Collins, and Steve: very special thanks for being the best brothers and sisters ever. I draw my inspiration from you all!
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CHAPTER ONE

INTRODUCTION

1.1 Background

Food insecurity remains a major global concern despite efforts by national governments and the international community. Latest estimates show that 870 million people were undernourished between 2010 and 2012\(^1\), of which 852 million were in developing countries (FAO, 2012). Where food is available, the diets consumed are normally monotonous; cereal based and lack diversity (Bwibo & Neumann, 2003). These diets, many of which are staples, are low in micronutrient content or are in forms not easily absorbed when ingested (Ruel, 2002). The diets often contain little or no fresh vegetables and fruits, and are low in animal source foods rich in iron and Vitamin A (Nungo, Okoth & Mbugua; 2012). Recent food price surges have increased vulnerability while increases in income and urbanization trends in developing countries have also affected diet quality, resulting in more and more households consuming diets rich in high fat and sugars (Ruel, 2002). These poor diets have led to an increase in the incidence of malnutrition, present in many countries in the form of under or over-nutrition\(^2\). Over-nutrition encompasses excessive intake of macronutrients and/or energy foods, while under-nutrition refers to micronutrient deficiencies most commonly vitamin A, iodine, iron and zinc and protein-energy malnutrition (Faber & Wenhold, 2007). Many countries suffer from the double burden of malnutrition, where a large number of households with inadequate diets and micronutrient deficiencies suffer from under-nutrition while at the same time the existence of poor diets and diseases increase the prevalence of over-nutrition.

Many plans and strategies have been put in place to reduce food insecurity and malnutrition. An example is the Millennium development project, which includes two goals directly linked to food insecurity and child well-being; Millennium Development Goals (MDGs) 1 and 4. MDG1 strives to eradicate extreme poverty and hunger by halving the number of people suffering from hunger by 2015. However, the prevalence of underweight children under the age of five years, a proxy for food insecurity and an indicator of MDG1, remains high in developing countries. Statistics show that underweight prevalence is expected to rise to 26.8 percent in Africa by 2015, up from 24 percent in 1990 (number of underweight children will increase from 25.8 million to 43.3 million), with the rates in sub-Saharan Africa expected to

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\(^1\) As measured in terms of habitual consumption of dietary energy.

\(^2\) In this study, malnutrition shall refer to under-nutrition.
increase to 29.2 percent up from 26.8 percent in 1990 (de Onis et.al, 2004). The predicted increase in underweight children is attributed to HIV/AIDS, political and social instability, and lack of economic progress which prevents higher purchasing power for households who would want to enhance the quantity and quality of their dietary intakes (de Onis et.al, 2004).

MDG4 seeks to reduce the under-five mortality rates by two thirds. Malnutrition is closely linked to child mortality and is reportedly responsible for one thirds of global deaths of children under the age of five (You et.al, 2011). Diarrhoea, pneumonia and other infectious diseases, which are associated with under-nutrition, are partly responsible for the high number of deaths amongst children (UNICEF, 2009). Undernourished children normally struggle to fight off such illnesses, and while a child may survive the effects of under-nutrition, the probability of them being locked in a cycle of recurring illnesses increases (UNICEF, 2009). While recent reports show that the under-five mortality rate has decreased by 35 percent since 1990, this is not sufficient to achieve MDG4 by 2015 (You et.al, 2011).

Despite the alarming statistics presented above, the real causes of malnutrition are often not addressed, partly due to the fact that death certificates do not normally reflect the actual causes of a child’s death (Rawe et.al, 2012).

The widespread presence of poverty in developing countries appears to worsen food insecurity and malnutrition. Majority of the world’s population living on less than a dollar a day are found in developing countries. Poverty is a major determinant of under-nutrition, with previous studies showing that the proportion of children with the highest rates of malnutrition belong to households classified as poor (Grantham-McGregor et.al, 2007). Impoverished communities are often more at risk of poor nutritional statuses due to frequent exposure to risk factors and infections caused partly by crowding and inadequate sanitation (Caufield et.al, 2006). Other factors such as limited resources, cultural practices and beliefs, and biological weaknesses also contribute to poor nutritional statuses and result in distressing health consequences in women of reproductive age, and in children as well (Caufield et.al, 2006).

The presence of food security and proper nutritional status can have long lasting positive effects on the growth of a country. Food security is associated with better school performance and increased number of years of schooling (Alderman, Hoddinot & Kinsey; 2003). On the

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3 By 2008, the number of people living on less than 2005 PPP $ 1.25 a day was 1.3 billion in the world, of which 386 million were in sub-Saharan Africa (World Bank, 2012).
other hand, good nutrition can have a positive impact on future wages and income, and it is for this reason that early childhood development is considered a long term driver of a country’s economic growth and development (Hoddinot et.al, 2008). In contrast, nutritional deficiencies in school-age children can result in poor school enrolment, poor classroom behaviours and increased number of drop outs (von Braun et.al, 1992). Children who are malnourished spend less time in school and have lower education outcomes as compared to their peers who are not (Caufield et.al, 2006). Since the intellectual development of a child is affected by malnutrition, the likelihood of their future productivity and earning potential being affected is high; especially since children who are malnourished, if not properly taken care of, are likely to be malnourished as adults. This then means a reduction in the number of working hours, and a possible reduction in income.

At a micro level, food insecurity can have serious effects on intra-household arrangements. It often results in inefficient and or ineffective income-earning decisions in that households may be forced to dispose of their assets in the short term in an attempt to meet current food security needs but in the process, increase their vulnerability or risk to future food problems or shortages (von Braun et.al, 1992). In addition, people can destroy their environments and habitats in an attempt to secure their food supply, causing damages that may be irreversible (von Braun et.al, 1992). Poor nutritional status amongst children can also affect the ability of household members to generate resources. A poorly nourished child may force the mother or caregiver to stay at home and take care of the child, time which would have otherwise been spent on income generating activities.

While a number of studies have been carried out to establish the risk factors associated with child malnutrition, few have attempted to study the link between food security and the anthropometric status of children. To effectively fight malnutrition, it is important that further research be carried out to understand how food insecurity impacts on the anthropometric status of children. This mini-thesis tries to contribute towards filling this lacuna by analysing household data from the Kenya Integrated Household and Budget Survey (KIHBS) of 2005/2006.

1.2 Food Security and the Anthropometric Status of Children in Kenya

Kenya, just like many sub-Saharan countries continues to battle poverty, food insecurity and child malnutrition. The country is classified as low income by the World Bank and ranks 143rd on the Human Development Index (HDI). Due to its 2011 HDI of 0.509, the country is
considered to have low human development (UNDP, 2011). It also ranks 143rd on the 2011 Multidimensional Poverty Index (MPI), with 47.8 percent of its population deemed to be in multidimensional poverty.\(^4\)

The Kenyan government estimates that about one third of the country’s population is food and nutrition insecure, and about 10 million Kenyans suffer from chronic food insecurity (ROK, 2011). The worst affected by food insecurity are children, who are deprived of sufficient nutrients that are necessary for their growth and development. The country continues to face frequent droughts which only worsen the situation, result in more malnourished children and loss of crop and livestock, and aggravates the prevalence of food insecurity.

A 2008 Kenyan government report acknowledges the impact that under-nutrition has had on the country, recognises it as one of the biggest challenges the country faces and identifies it as a major public health issue. While the country’s under-five mortality rate has reduced from 117 in 1997 to 85 per 1000 live births in 2010 (World Bank, 2012), poor anthropometry remains a serious challenge. The 2008/2009 Kenya Demographic and Health Survey findings puts the proportion of stunted children under five at 35 percent, while the proportion of those who are wasted and under-weight children is 7 percent and 16 percent respectively (KDHS, 2008/2009). According to a 2012 Save the Children report, the worst affected regions in Kenya include the Eastern province where 42 percent of children are stunted. The report also illustrates differentials in the nutritional statuses of children in rural and urban areas. An estimated 37.5 percent of children under five who are stunted are found in the rural areas of Kenya, compared to just 26 percent in the urban areas. The arid and semi-arid areas of the country appear to be the worst hit, with persistent droughts inhibiting access to food and contributing to malnutrition. The report also attributes the increased levels of malnutrition in the country to lack of investment in nutrition programs and lack of political will to establish a framework for emergency preparedness.

In 2009, UNICEF predicted that the country would lose 80 billion Kenyan shillings over a 9 year period if the levels of stunting remained unchanged. UNICEF attributes this to the consequences of child stunting, which if not addressed causes adult stunting and which in turn reduces productivity by as much as 1.4 percent for every 1 percent decline in adult health status.\(^4\)

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\(^4\) Multidimensional poverty Index, developed by Oxford Poverty & Human Development Initiative (OPHI), reflects the multiple deprivations that people face in health, education, living standards.
productivity. However, the same report predicted economic gains through increased productivity of close to 14 billion Kenyan shillings if proper measures were put in place to reduce stunting.

In an attempt to remedy the situation, the Kenyan government set up a Food and Nutrition Strategy Framework (FSNS) in 2008 which strives to fight food insecurity by ensuring that all Kenyans do not only have access to food, but are able to consume diversified and nutritionally adequate diets throughout their life cycles. In 2011, the government developed a National Food and Nutrition Security Policy (NFNSP), which came after an earlier one in 2008. These policies are part of a wide range of measures that the government has attempted to put in place to eradicate food insecurity. However, little progress has been made.

1.3 Problem Statement

Kenya’s Vision 2030, an ambitious plan to get the country into a middle income status by 2030, aims to provide high quality life to all Kenyans through strategies that cover the economic, social and political pillars of the country (GOK, 2007). The success of this project is not possible without a healthy and productive nation, which has been shown to be affected by malnutrition. The country continues to battle high food insecurity levels, which has been identified as an underlying cause of malnutrition and child mortality, and which seem to be continuously fuelled by natural calamities, and escalating food prices. In addition, the government acknowledges that the nation faces inadequate dietary diversification (ROK, 2008). The country also continues to record high rates of child malnutrition. A number of studies have been carried out with a view to identify the risk factors associated with child malnutrition (e.g Bloss et.al, 2004; Kabubo-Mariara et.al, 2006; Lang’o, 2011). However, those that have sought to study the link between food security and the anthropometric status of children are scarce. On a more specific note, studies that have attempted to look at the impact of dietary diversification on the nutritional status of children are rare. To effectively fight malnutrition, it is important that additional research be carried out to understand how food insecurity impacts on the anthropometric status of children. Only then can proper measures be developed and implemented, and cause a positive and significant and change in the nutritional status of children.
1.4 **Objectives of the Study**

The study aims to analyse the relationship between household food security and child anthropometric status in Kenya. The specific objectives include:

- To identify the prevalence and predictors of poor anthropometric status of children in Kenya
- To identify the extent of food insecurity in Kenya
- To investigate the link between food security and the anthropometric status of children in Kenya

1.5 **Research Questions**

The study seeks to answer the following questions:

- What is the extent of stunting, wasting and underweight in Kenya?
- What are the contributing factors (age, gender, education of household head, wealth) to the poor anthropometric status in children under five years of age?
- Is there any significant difference in malnutrition prevalence amongst male and female children?
- What is the magnitude and distribution of food insecurity in Kenya?
- Does household food security measured as a dietary diversity index affect the anthropometric status of children when taking account of the households’ economic status?

1.6 **Significance of the Study**

Child malnutrition has been identified as the cause of one thirds of global deaths in children aged five years and below. In addition to causing death, malnutrition causes physical and mental damage to a child, resulting in poor education outcomes and negatively affecting their adult life. Food insecurity causes and aggravates malnutrition. Its effects on a child or/and household are far reaching and include substantial losses in productivity. The relationship between food insecurity and malnutrition goes both ways. Poor nutritional status may exist as a result of lack of sufficient and nutritionally adequate foods. Similarly, people’s ability to access food can be seriously hampered by poor nutritional status. Clearly, the effects of malnutrition and food security are widespread, and are a potential threat to the long term development of any country. There is an urgent need for the government of Kenya to put in
place effective measures to combat food insecurity and child malnutrition. However, this cannot be done without a proper understanding of the link between food insecurity and poor anthropometry. Results and findings from this research will not only contribute to existing academic literature but can be used by Kenyan government, researchers, policy makers, and other relevant stakeholders to develop and implement strategies that can uplift the lives of Kenyan children.

1.7 Thesis Outline

The study includes five chapters and is organized as follows. Chapter 1 introduced the concept of food security and malnutrition, and presented the research problem, research objectives and questions, and significance of the study. Chapter 2 presents the literature review and conceptual framework while chapter three discusses the analytical framework and research methodology. Results from the data analysis are contained in chapter four, which also discusses the findings with respect to other literature. The study concludes with chapter five which provides an overview of research findings, and gives policy recommendations.
CHAPTER TWO

LITERATURE REVIEW AND CONCEPTUAL FRAMEWORK

2.1 Introduction

This section reviews existing literature on food security and the nutritional status of children. It will begin with a discussion on food security, its definitions, indicators and various measures. A discussion on dietary diversity as an indicator of food security is also included. This will be followed by a scrutiny of the link between food security and poor anthropometry. As household food insecurity is not the only issue linked to poor nutritional statuses, the study will also review literature from Kenya and other developing countries on other risk factors that have been associated with poor anthropometry amongst children.

2.2 Food Security

Food insecurity is a phenomenon that continues to affect millions of people in many parts of the world. It is not only damaging to livelihoods, but also reduces self-sufficiency; it is a fundamental cause of malnutrition in people of all ages, causes morbidity and results in mortality (Young et. al, 2001). Concern over food security can be traced as far back as 1948, when the United Nations, through the Universal Declaration on Human Rights, included freedom from hunger and malnutrition in article 25:

“…everyone has the right to a standard of living adequate for the health and well-being of himself and of his family, including food, clothing, housing and medical care and necessary social services…..” (Universal Declaration on Human Rights, 1948)

Since then various definitions of food security have come up, ranging from those centred on global food supply, to those grounded on food access; and to Amartya Sen’s Entitlement approach in which needs and resources are mapped onto availability and access (Sen, 1981). More recently, the concept of adequate nutrition has been introduced into the definition of food security. According to Food and Agricultural Organisation (FAO), food security exists when:

“…. all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life” (FAO, 1996).

The access to secure food at all times is based on four main concepts; food sufficiency, access to food, security and time (Maxwell & Smith, 1992). Food sufficiency is reflected by the
calories needed by an individual to maintain a healthy life, access to food is reflected by the entitlement to produce, purchase or receive food; while security is shown by vulnerability, insurance and risk (Maxwell & Smith, 1992). Food security risks include natural, market, state and community risks which are caused or elevated by poor crop production, food supply variations, lack of employment and wages, poor health among other factors (Maxwell & Smith, 1992). Income risks such as lack of employment and wages reduce the capacity of a household to purchase foods, while risks related to conflicts can result in the disruption of markets, reduced productivity as a result of labour withdrawal, and in worse case scenarios cause displacements of communities (Maxwell & Smith, 1992). According to Maxwell & Smith (1992), individual or household security can be determined by channels through which food access is usually mediated, and by assets that act as buffers in case of food shortages; the most food insecure and vulnerable households are the ones which face the greatest probability of food entitlement failure, and have the least assets. Such households are normally forced to cope with the food insecurity by making changes to their food consumption, including reducing their dietary intake.

Food security is defined by time as either chronic, transitory or cyclical; chronic food security occurs when a household has a high risk of being unable to meet the food requirements of household members, transitory occurs when households face temporary food insecurity, while cyclical refers to a situation when there is a regular pattern in the occurrence of inadequate food access (Maxwell & Smith, 1992). The time dimension also emphasises the risk component of food security, since households may try to minimise future food insecurity by allocating resources in such a way that the adequacy of food access over time is optimised (Maxwell & Smith, 1992).

The inclusion of the words ‘safe and nutritious’ in the food security definition places an emphasis on the need for safe and nutritionally adequate food, while ‘food preferences’ implies that it is not enough for individuals to have access to food but that it is also important that they have access to the food that they favour (Pinstup-Andersen, 2009).

Young et.al (2001) bring in the concept of acute food insecurity, which they define as occurring when people experience large reductions in their sources of food and are unable to compensate the loss with new initiatives, if malnutrition prevalence is unusually high and cannot be explained by health factors, and if the people are employing coping strategies that damage their livelihoods in the long term (Young et.al, 2001).
It is important to note that food security does not imply nutrition security. Nutrition security goes beyond the concept of access and availability of food, and encompasses the use and utilisation of food in quality and quantity, as well as the distribution of food within a household (Reinhard & Wijayaratne, 2000). Benson (2004) also points out that nutrition security can only be achieved when the access to secure food is accompanied by adequate nutrition, a sanitary environment, and the necessary knowledge needed to ensure that members of the household have good health. Previous studies (UNICEF, 1990) have shown that food security is not enough to guarantee nutrition security, but is in itself just one important factor.

Household food security is an indicator of a household’s poverty level; particularly since it captures the inability of a household to access sufficient food vital for its members’ healthy growth (Hoddinott & Yohannes, 2002). Reinahrd & Wijayarate (2000) also emphasise that nutritional well-being is an important indicator of poverty and sustainable development, important not just for basic needs but also an essential input of development, through the creation of human capital with capacities to provide labour, education, finance and care.

2.2.1 Factors affecting Food Security

Food security is affected by many factors, either at a national, regional, household or even individual level. At a national, regional or local level, food availability is partly determined by variations in food production and high food prices which in turn could be a result of increased food storage costs, and failure to manage public food stocks adequately (von Braun et.al, 1992). Other exogenous events such as domestic policy changes, war, and weather conditions are also likely to affect food production (von Braun et.al, 1992). For instance, adverse weather conditions can cause droughts, which then results in serious food deficits. However, proper water control and management can help mitigate the effects of such adverse weather conditions and ensure continued production (Sahn, 1989). It is important to note that food availability at the international level does not mean that locals have access to it. This is because a country’s ability to import food is affected by factors such as international prices and foreign exchange availability (von Braun et.al, 1992).

Income is another important factor that can influence food security since it normally affects a household’s access to food. Households with extremely limited resources may be forced to choose between maintaining a flow of income through allocation of sufficient food to income earning members and giving first priority to the economically inactive members of the
households such as children or the elderly (von Braun et.al, 1992). If they choose the first option, then children suffer from lack of enough food and most probably end up becoming malnourished.

Food security can be boosted by food subsidy programs, which normally lead to price reductions and influence food availability and access (Kumar & Alderman, 1988). The effect of price reductions have a bigger impact on poor households as compared to non-poor ones, particularly because the poor spend a large share of their budgets on food, hence any decreases in food prices, result in an increase in their purchasing power (Pinstrup-Andersen, 1988). Particularly in the short run, food subsidies can increase food consumption, with evidence showing that low-income groups record the greatest improvements in food consumption (Kumar & Alderman, 1988).

A household’s food security can also be affected by intra-households differentials such as gender. Haddad et.al (1996) explores the importance of gender and the implications of different statuses of women in a household, focusing on its effect on food security and nutrition. Households where women have controlling power have proved to be more food secure and consequently, household members have better nutritional statuses (Haddad et.al, 1996). Poverty is also recognized as one of the factors that affect the food security status of a household, and which also affects the status of women. Haddad et.al (1996) point out that the poorer a household is, the poorer the women will be, resulting in a direct effect on the food security status of that household. This is partly due to the fact that in many contexts, and especially in developing countries, women are responsible for production, procurement and storage, preparation, consumption, and distribution of food within the household (Reinhard & Wijayaratne, 2000). The nutritional status of women can thus affect the food security of households since poorly nourished women are hardly able to carry out their daily chores many of which, as indicated above, revolve around food.

Benson (2004) maintains that access to food at a national level is also affected by the wealth of that country since capital enables people to access important amenities like education and health which are necessary for food and nutrition security. Developing countries are normally characterised by high levels of deprivations which inhibit the ability of households to own assets. This in turn hinders a household’s ability to generate wealth and causes low income, ultimately rendering households incapable of accessing food and other important social amenities that can enhance their food security.
2.2.2 Food Security Indicators and Measurement

The extent of food security can be measured at different levels, ranging from individual to household, national, regional and even global levels. Phillips & Taylor (1991) argue that while the unit of observation can vary depending on the intended purpose, it is more appropriate for a household to be the unit of analysis since the results can be aggregated and inferred to the general population. Sahn (1989) emphasises that national-level data may show the existence of food security, but disparities exist among households and even within the households, not all individuals have access to food. Phillips & Taylor (1991) also argue that the use of a nation as a unit of analysis is disadvantageous since it may not allow for identification of household needs (Phillips & Taylor, 1991), which are unique and may vary from one household to another. Due to the above reasons, the concept of household food security has gained prominence over the years and is increasingly used as a measure of well-being (Pinstrup-Andersen, 2009).

At the household level, food security is defined as the ability of a household to secure sufficient food that meets the daily dietary requirements of its members, either through production or purchase (Reinhard & Wijayartn, 2000). However, within a household, other factors affect individual food security. First, preferences play a huge factor in food security; a household may prefer to acquire other goods and services in place of food security, ignoring individual needs (Pinstrup-Andersen, 2009). Maxwell and Smith (1992) also point out that households are defined by different sizes, and members may have different opinions on food security and may also face different food security risks. Moreover, the needs of individuals in a household are diverse and it at times impossible for intra household food distributions to be based on every member’s requirements (Pinstrup-Andersen, 2009). This makes it difficult to establish the exact status of a household in as far as food security is concerned.

Household food security cannot be analysed without identification and accurate measurement of indicators. Just as in the case of the point of measurement (nation, household, or individual), indicators are determined by the different and diverse needs of user groups; governments often require quantitative data for purposes of planning and policy formulation while local communities and NGO’s normally require more qualitative data (Frankenberger, 1992).

Frankenberger (1992) divides food security indicators into two groups; those that reveal food supply and food access and those that serve as representations of food consumption, referred
to as *outcome indicators*. The indicators that reflect food supply include measures of agricultural production, market infrastructure, developed or underdeveloped institutions, and access to natural resources; while those that reflect food access include the strategies that households employ to enhance their food security. Outcome indicators can be either direct or indirect. While direct indicators are more widely used due to their ability to reflect actual food consumption, indirect ones are less popular and are used when the direct ones are unavailable or too costly to collect data on.

Boon (2009) identifies household income as an indicator of food access, emphasising that income (reflected by purchasing power) can determine a household’s access to food. Households characterised by low incomes are less likely to afford enough food. Nevertheless, the use of income as an indicator of food access is limited by the fact that income does not take into account the political, cultural, and spatial distance that may at times exist between households and food producers, leading to unequal distribution of food amongst individuals, households and regions (Reinhard & Wijayaratn, 2000). Therefore, the use of income as an indicator is only possible if assumptions are made based on the household income share that is spent on food (Pinstrup-Andersen, 2009). It is also important to note that the use of income is dependent on the prices of other goods and services and on a household’s behaviours and preferences (Pinstrup-Andersen, 2008). For instance, households may opt to spend a huge fraction of their income on education or on the purchase of long term assets, and may consequently reduce the amount of money spent on food items.

Apart from income, there are several other monetary and non-monetary indicators of food security. Smith & Subandoro (2007) outline and classify them into three groups: those that reflect quantity of food, those that reflect diet quality and those that reflect economic vulnerability. Diet quantity measures include food energy consumption, and the percentage of households or people who are energy-deficient. While food energy consumption is measured as the total energy in food that a household has acquired over a particular reference period, the percentage of households or people who are energy-deficient is measured by determining whether a household is able or not to acquire sufficient food that meet the dietary energy needs of its members (Smith & Subandoro, 2007). Diet quality measures include diet diversity, percentage of food energy from staples and the daily food consumption (quantities) per capita (Smith & Subandoro, 2007). While diet diversity reflects food variety in a diet, the percentage of food energy from staples is reflected by the percentage of energy found in food.
staples, and daily food consumption per capita is shown by the quantity of individual foods consumed (Smith and Subandoro, 2007).

Both diet quantity and quality reflect a household’s consumption. Consumption not only provides information on the ability of a household to access food, but it also shows food acquisition over time and a household’s behaviour patterns as pertains to food allocation (Pinstrup-Andersen, 2009). Behaviour and food preferences are however, affected by other factors which include gender. As previously mentioned, women are normally in charge of food production, preparation and consumption in a household, hence their ability or inability to perform these chores can affect food security either positively or negatively. For purposes of impact evaluation and assessment, the USAID uses indicators that reflect improved household consumption and nutrition and these include: increased number of eating occasions, increased number of different food and food groups consumed, and increased number of households consuming minimum daily caloric requirements (Swindle & Ohri-Vachaspati, 2005). Swindle and Ohri-Vachaspati (2005) maintain that data on the number of eating occasions is easy to collect and is inexpensive, but is however limited in its inability to reflect changes during periods of chronic food insecurity. It may also not mirror changes in the micronutrient content and diet imbalances (Swindle & Ohri-Vachaspati, 2005). There is also the issue of cultural differences where different communities have different customary practices; this is likely to affect the frequency and volume of food that is consumed in a day (Swindle & Ohri-Vachaspati, 2005). Some food security indicators require considerable resources and time to collect. For instance, the use of the percentage of households consuming minimum daily caloric requirements may be suitable as an indicator of food security, but is however, very costly, requires technical experts and is time consuming when it comes to data collection (Swindle & Ohri-Vachaspati, 2005).

Economic vulnerability, a monetary indicator, is measured by the percentage of expenditure on food, and is an indicator of a household’s current economic conditions (Smith & Subandoro, 2007). Households that spend a large proportion of their income on food are more vulnerable to food deprivations since any sudden decrease in income could result in a decrease in food consumption or in the quality of foods consumed (Smith & Subandoro, 2007).

While the concept of food security has been largely centred on a household’s access to food, Haddad et. al (1996) argues that this should be widened to include the dietary intake and
emphasis be placed on the quality of foods consumed. This is argued to be vital since a household’s purchasing power and food expenditure may not effectively reveal the intake of nutritionally adequate foods. In addition, increased expenditures on food may not adequately represent the nutritional status of household members. In many instances, the disease incidence results in the inability of individuals to utilize or consume foods, regardless of high or increased purchasing power and food expenditure. In addition, the use of diet quantity to measure food security is not indicative of the nutritional components contained in foods. Households may increase expenditure on one type of food and neglect others that have great nutritional benefits. All these factors have resulted in the increased use of indicators that reflect diet quality. One such indicator is dietary diversity.

Dietary diversity shows the different types of foods consumed and reflects the consumption of a wide variety of food across nutritionally diverse food groups (Kennedy et al., 2010). It is measured as the number of foods or nutritionally significant food groups that a household consumes (Ruel, 2002; Smith & Subandoro, 2007). Hoddinott & Yohannes (2002) maintain that dietary diversity is an attractive indicator of food security for several reasons. Firstly, a more varied diet is necessary for proper growth and healthy living, and is associated with improved birth-weight and child anthropometric status, improved haemoglobin concentrations and a reduction of risk of mortality from cardiovascular disease and cancer. Secondly, questions on dietary diversity can be asked at the household or individual level, allowing for intra-household analysis of food security. In addition, obtaining data on dietary diversity from the households is straightforward and relatively easier as compared to collecting information from other food security indicators such as daily caloric intake.

Dietary diversity has been found to be highly correlated with household income, with research showing that increased household income is likely to lead to improvements in the quantity and quality of food consumed (Swindle & Ohri-Vachaspati, 2005). A study by Langat et al. (2010) on small holder tea farmers in Nandi district of Kenya sought to determine the factors that influenced dietary diversity. The study was based on a household’s one week food consumption and used a household dietary diversity index based on eleven food groups that included cereals; white root and tubers; vegetables; fruit; meat; eggs; fish; legumes, nuts and seeds; milk; oil and fats; sweets; spices, beverages and miscellaneous. The study found that dietary diversity was significantly influenced by household income, savings, and off-farm income; with results showing that higher income led to higher dietary diversity indexes, probably due to households expanding their food expenditure to include more
varied. The study also found that increased off farm income was significantly associated with higher dietary diversity indexes, an indication that reliance on farm income alone could not guarantee food security in the study area. This was further demonstrated by the differentials in the income means. The mean farm and off-farm income was higher and reported at Kshs 11,133 per month, while the mean off farm income alone was Kshs. 7,922 per month. Another major finding was that higher dietary diversity scores were recorded in households who allocated more land for tea production instead of maize, perhaps an indication that proceeds from the cash crop were used to purchase more diverse diets. It is also possible that farmers who used their land for maize farming were more likely to rely solely on the maize for food consumption or that the proceeds received from the sale of maize were not enough to allow the households to purchase wide varieties of food.

However, the results obtained from Kenya by Langat et.al (2010) contrast with those obtained in a study carried out in China by Du et.al (2004), who sought to examine how rapid rises in income affected household dietary intakes. The study used data from a household survey in 1989, which was followed up by other similar surveys in 1991, 1993 and 1997. Results showed that dietary changes occurred with increase in income, especially among low and middle income groups where diets changed from traditional Chinese diets such as rice and wheat, to more high-energy density, high-fat and low-fibre diets. The findings showed that by 1997, the income elasticity of high fat foods was about 0.4, implying an increase of 10 percent in income resulted in a 40 percent increase in high-fat diets. While the high-fat diets became superior goods, traditional foods became inferior foods, and data showed that the income elasticity of consuming traditional foods were almost zero by 1997, an indication that decisions on consumption of foods in the group became independent of income (Du et.al, 2004). Results also indicated an increase in disease burden amongst the poor, probably due to the poor diets consumed. During eight-year period, the prevalence of overweight and obesity increased by almost double.

However, dietary diversity has generally been found to be highly correlated with caloric and protein adequacy and consumption (Swindle & Ohri-Vachaspati, 2005). Past studies have shown households with poor levels of dietary intake and diversity display low levels of per caput consumption and low availability of consumption, and households with increased diet diversity display higher levels of consumption and caloric availability (Hoddinott & Yohannes, 2002). A study by Hoddinott & Yohannes (2002) in ten countries (Bangladesh, Egypt, Ghana, India, Kenya, Malawi, Mali, Mexico, Mozambique and the Philippines) used
data based on 24 hour recall on individual intake and on caloric availability to examine the effectiveness of dietary diversity as a food security indicator. The study found that dietary diversity was positively associated with consumption, and caloric availability. Estimates showed that in the ten countries studied, a 1 percent increase in dietary diversity was associated with households experiencing between 0.65 and 1.11 percent increase in household per capita consumption. A 1 percent increase in dietary diversity was also associated with a 0.37 to 0.73 percent increase in household per capita caloric availability, while an increase in dietary diversity was associated with a 0.31 to 0.76 percent increase in caloric availability from staples; and a 1.17 to 1.57 percent increase in caloric availability from non-staples. The correlations reported between household dietary diversity, consumption and energy availability make dietary diversity a good indicator of food security (Ruel, 2002).

Comparisons between dietary diversity and other measures of household wellbeing show that it is a good indicator of food security. Selvester et al., (2008) conducted a study in the Chibabava and Gondola districts in Mozambique with the purpose of examining the use of the Household Food Insecurity Access Scale (HFIAS) and household Dietary Diversity Score (HDDS), in both the pre-harvest and post-harvest periods of the two districts based on two surveys carried out in 2006/2007. In the case of the HDDS, foods were classified into twelve food groups and a recall period of 24 hours used. Households were classified into 3 different terciles: low dietary diversity (3 or fewer food groups), medium dietary diversity (4 groups) and high dietary diversity (5 or more scores). The HFIAS, on the other hand, was composed of nine questions centred on the modifications made by households on their food consumption as a result of limited resources. Based on the questions and the 30 day recall period, the households were assigned scores ranging from 0 to 27, with higher scores reflecting poorer access to food, and consequently greater food insecurity. The results showed that the combined HFIAS mean of Chibabava and Gondola districts was lower in the post-harvest period, implying better food access. However, comparisons of the two districts showed that Chibabava district had less food security than Gondola in both periods. This can be attributed to the poor living conditions recorded in the district, the semi-arid climate that could only allow for one planting season, water shortages, and the fact that the district was more prone to shocks like droughts and floods. In the case of dietary diversity, results showed

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5 The HFIAS is a tool that assesses the problems experienced by a household in relation to food access in the preceding 30 days (FAO, 2008).
that combined HDDS means of both districts was lower in the post-harvest period, as compared to the pre-harvest period, perhaps due to the natural disasters that hit the provinces in early 2007, and just before the harvest. Chibabava’s HDDS worsened over the two periods, while that of Gondola remained stable, though higher than that of Chibabava. The stability of HDDS in Gondola over the two periods was attributed to the substitution of fruits, which were out of season in the first season, with other available foods such as tubers in the second season. The study also found a significant association between HDDS and HFIAS, with higher dietary diversity being associated with greater food security as measured by HFIAS. However, Selvester et.al (2008), did not find any significant associations between the nutritional status of women (as measured by body mass index) and the two food security measures. This could be due to the fact that HDDS was based on a one day diet, the HFIAS based on a 30 day recall while the BMI was based on adult weight over a longer period (Selvester et.al, 2008).

One of the most contentious issues on dietary diversity includes the recall period. Dietary diversity is assessed based on the recall of a household’s food consumption, which can vary across surveys and can be as short as one day, or as long as 15 days. Past studies show that dietary diversity scores are higher in studies with longer recall periods. To compare different recall periods and examine their impact on dietary diversity, Savy et.al (2005) conducted a study in rural Burkina Faso. The recall periods used were 1 and 3 days, and the number of food groups classifications were nine: cereals/roots/tubers; pulses/nuts; Vitamin A rich fruits/vegetables; other vegetables meat/poultry/fish; eggs; milk/dairy; oils/fats. However, the frequency and the amount of food were not taken into consideration. The 1 day recall period dietary diversity scores (DDS) were divided into three terciles; low dietary diversity (2 or fewer food groups), medium dietary diversity (3 food groups), and high dietary diversity (4 food groups and more). Unlike the 1 day recall period, the three day dietary diversity was divided into three terciles: low dietary diversity (3 or fewer food groups), medium dietary diversity (4 or 5 food groups), and high dietary diversity (more than five food groups), possibly due to the increased number of food groups consumed amongst households during the three day period. Results showed that the mean dietary diversity scores increased over the three days. This can be attributed to the fact that a 3 day period allowed the women to reach the food repertoire, and also since the DDS reached a plateau on the third day (Savy et.al, 2005). A comparison of the DDS and the nutritional status of women showed that their nutritional status was higher if the DDS was higher, regardless of the recall period.
Food Security and Anthropometric Status of Children

Food security has been found to be associated with the nutritional status of children. According to Reinhard & Wijayaratn (2000), poor anthropometry amongst children is in many cases, a reflection of inadequate food utilization within a household. Households that have access to sufficient food with the necessary dietary nutrients are less likely to have incidences of child malnutrition. In addition, the consumption of nutritious foods by pregnant women is important since it impacts positively on the growth and development of a child.

Child malnutrition takes different forms. **Stunting** refers to low height for age, and causes retarded linear growth (UNICEF, 2009). It is an indicator of poor child growth and is caused by poor nutrition and infections over a long period (Grantham-McGregor et. al, 2007). While globally child stunting has declined by 13 percent between 1990 and 2010, it has remained stagnant at about 40 percent in Africa, with Eastern Africa recording some of the highest rates in the world (de Onis, Blossner & Borghi; 2011). UNICEF (2009) reports that 90 percent of the children who are chronically stunted and live in developing countries are found in Asia and Africa. Due to these alarming figures, stunting remains one of the biggest problems of malnutrition. Compared to other indicators of malnutrition like wasting and underweight, stunting more accurately reflects nutritional deficiencies and illnesses that occur during the most important and crucial periods of early life.

**Wasting** refers to low weight for height and indicates deficit in weight relative to height that is caused by a deficit in tissue and fat mass (Fernandez, Himes & de Onis; 2002). It is normally caused by disease and inadequate nutrition over a shorter time and is an identifier of severe and acute malnutrition (UNICEF, 2009). It is associated with recent illnesses, which reflects current significant weight loss, or insufficient dietary intake that may be caused by food shortages and poor feeding practices (Olack et. al, 2011). Unlike stunting which is a slower and longer process, wasting is easily observable in children since dietary deficiencies and infections cause rapid weight loss (Garcia, 2012). Wasting is preferred by many as an indicator of malnutrition since it is considered easy to measure due to the omission of the age variable, and more relevant to current problems (Chotard et. al, 2006).

While stunting is an indicator of poverty, chronic diseases and low-socioeconomic levels, and wasting an indicator of a household’s lack of access to sufficient food intake and signifies hunger, **underweight** (low weight for age) is an indicator of food shortages (Reinhard & Wijayaratn, 2000). Underweight is considered to be more responsive to changes in time, and
to different causes (Chotard et.al, 2006), which makes it a suitable tool of analysing the effects of food security changes over different periods. Unlike stunting, the effects of underweight can be reversed through proper nutrition and health.

Previous studies have shown that food insecurity impacts negatively on the anthropometric status of children. Kiman-Murage et.al (2010) studied food security and nutritional outcomes among urban orphans in Nairobi, Kenya using data from a World-Bank funded study on the welfare of orphans and vulnerable children aged between 6 and 14 years in Korogocho and Viwandani slums, areas characterised by poor housing, lack of proper water and sanitation, and poor health among other indicators. Food security was measured using caregiver and child perceptions on hunger, regularity of meals, food access and food shortages. Nutritional status - as measured by stunting - was found be high at 26 percent. Results showed that orphans were more likely to experience food insecurity, with orphans having a significantly lower mean food security score as compared to non-orphans. A higher proportion of orphans as compared to non-orphans reported going hungry in the morning or going to school hungry. Findings also showed that paternal orphans were worse off than maternal ones and were more vulnerable with regards to food security, perhaps due to the fact that many fathers are the main income earners of households, therefore a loss made households loose their source of livelihood. Double orphans were not the most vulnerable as one would expect, perhaps because the possibility of double orphans being adopted into other households are high, thus protecting them from nutritional and food deficiencies (Kimani-Murage et.al, 2010). Despite this, the study found no significant differences in the nutritional status of orphans and non-orphans.

After the post-election crisis that hit Kenya in 2008, Olack et.al (2011) conducted a cross-sectional study in Kibera, one of the largest slums in Africa. The study which covered children aged between 6 and 59 months found that the prevalence of malnutrition was higher in the second year than in the first year of life. This was attributed to the fact that from the second year of life, children are no longer breastfed or fed by the carer and were more responsible for feeding themselves, and may therefore have less access to solid foods. Food shortages incidence was high in the study area, with 89.3 percent of caregivers reporting experiencing shortages. Of these, 52 percent dealt with the situation by reducing the amount of food eaten while 36 percent ate less expensive foods, meaning that children were likely to be affected by the change in the quantity and quality of food. It was also reported that 59.4 percent of the children ate less often when they were sick, possibly due to the inability of
their bodies to adequately utilise food. Unlike previous studies, the study found that the proportion of girls who were wasted were twice that of boys, with girls aged between 34 and 47 months, being significantly more likely to be wasted compared to boys of the same age. This is not the case with many other studies which have shown that male children are more prone to malnutrition. The prevalence of stunting was very high at 47 percent and was higher in 2008 than in 2005 amongst the same population, possibly due to the food shortages that hit the area as a result of the post-election violence. The rates of underweight and wasting stood at 11.8 percent and 2.6 percent respectively.

Kabubo-Mariara et.al (2006) used the 1998 and 2003 Kenya Demographic and Health Survey (KDHS) to study the nutritional status of children. Results from the 1998 KDHS showed that children whose household heads or parents/providers were engaged in some agricultural activities were more likely to be taller compared to children in households whose heads did clerical or office work, possibly an indication that households who were engaged in agricultural activities had more access to foods that had essential dietary nutrients required for better nourishment. However, results from the 2003 KDHS showed that employment in other sectors, except agriculture, was associated with better nutritional status’ with a child’s height for age z-scores likely to be 0.24 Z scores higher if the father was employed in the professional sector as compared to one whose father was employed in the agricultural sector (Kabubo-Mariara, Ndenge, Kirii; 2006).

Dietary diversity has also been found to be associated with better anthropometry. A study on food diversity and anthropometric status of rural Kenyan aged 12 to 36 months by Onyango, Koski & Tucker (1998), found that diet diversity was strongly associated with nutritional status measures (Weight-for-age, Height-for-age, Weight-for-height, triceps skinfold and mid upper arm circumference). Fully weaned children who consumed foods with low dietary diversity had the most stunting. Children who were fully weaned early had lower Z scores compared to those who were only partially weaned; the mean Height-for-age (HAZ) for fully weaned children with low dietary diversity was recorded at -2.6, while the mean HAZ for partially weaned children with low dietary diversity was -1.8. This can be explained by the fact that fully weaned children did not take breast milk which contains all the necessary nutrients needed for growth. Instead, many of them were introduced to solid foods and diets which did not necessary have the crucial nutrients needed. In the first month of life, 23 percent of children had been introduced to porridge while 86 percent of them had been
introduced to the same by the fourth month of life. Moreover, the study found that late introduction of cereals was significantly associated with higher HAZ.

Similar results were obtained in a study on the indicators of infant feeding practices by Arimond & Ruel (2002) who used data from *Ethiopia Demographic and Health Survey*. They found a strong and positive correlation between dietary diversity and HAZ among rural children in Ethiopia. In addition, the study found very large differences in the Z scores (1.2 Z score) between children who consumed from very few food groups and those who consumed foods from more than 7 food groups. Dietary diversity also came out as a good proxy of socio-economic status, with results showing that children who are fed from a higher number of food groups were likely to be better off in socio-economic status, subsequently resulting in better nutritional statuses. This is synonymous with other research which has shown that household dietary diversity is a good indicator of the socio-economic status of a household (Swindale & Bilinsky, 2006). Another study of dietary diversity and its association with child nutritional status in 11 countries conducted by Arimond & Ruel (2004) found significant associations between dietary diversity and HAZ in 7 out of the 11 countries, with Z score differences between low and high diversity groups ranging from 0.24 in Colombia to 0.59 in Zimbabwe. The countries included in the study were Benin, Ethiopia, Malawi, Mali, Rwanda, Zimbabwe, Cambodia, Nepal, Colombia, Haiti and Peru.

2.4 Other Risk Factors Associated with the Anthropometric Status of Children

Household food insecurity is not the only risk factor related to poor anthropometry. Previous studies have shown that various other factors are associated with poor anthropometry. The next section will review the literature based on the characteristics that have been associated with the anthropometric status of children. These characteristics are divided into child-related, household-related and community level characteristics. Child related characteristics include child demographics such as the age and gender. Household related characteristics include parent related characteristics such as education, marital status, and other household characteristics such as income, assets, and employment status. Community level characteristics are inclusive of health related factors such as immunization and diarrhoea. It also encompasses environmental factors such as water and sanitation.
2.4.1 Child Characteristics and Child Malnutrition

Age of the child

A child’s most important and crucial stage of life is the period beginning with the mother’s pregnancy up until two years old, as it is during this period that any nutritional deficiencies have an impact on the survival and growth of the child (UNICEF, 2009). Therefore, it is important that mothers and caregivers ensure that the children have access to adequate and nutritious foods, and are protected against health hazards such as unsafe water and sanitation. Under-nutrition can cause the immunological capacity of a child to reduce, affecting their ability to fight off diseases, causing further deprivations of essential nutrients. This in turn affects the physical growth of a child and may lead to chronic illnesses that are likely to have an effect on their adulthood (Kabubo-Mariara, Ndenge & Kirii; 2006). In addition, a child who suffers from malnutrition may not recover from it, increasing the probability of inter-generational under-nutrition. Girls who are malnourished during childhood are more likely to be malnourished as adults which make them more likely to give birth to children with low birth weight, who then eventually are at a high risk of becoming malnourished (UNICEF, 2009). Hence, a vicious cycle of malnutrition is created. Ultimately, poor nutritional statuses results in increased health care costs and poverty, and further worsens the food security status of a household.

The nutritional status of children has been shown to worsen with increase in age. Past studies, have found that malnutrition is less prominent in children aged 6 months and below, but appear to worsen thereafter. A study in a rural area in India (Tamil Nadu) by Steinhoff et.al (1986) found that the age was a major determinant of malnutrition. The prevalence of underweight was found to be highest in the age bracket of 48 and 60 months, where 51.9 percent of the children were underweight. Stunting was most common in age group 36-47, where 51.7 percent of the children belonging to this age group were found to be stunted. Underweight and stunting rates were lowest in age group 2-5 months, and more or less doubled in age group 12-23, a period synonymous with weaning. Wasting, on the other hand, was found to be highest at age 6-11 where 23.3 percent of the children were wasted, but however, reduced to 4.1 percent in age group 48-60, and its prevalence was lowest in age group 36-47. The high rates of wasting amongst children aged between 12 and 23 could have been caused by the drought that occurred during the survey period (Steinhoff et.al, 1986).
Across the greater Eastern Africa, studies conducted in Ethiopia showed a strong link between age and poor anthropometry. In a study on magnitude and determinants of children under five in Ethiopia, Teshome et.al (2009) found that the highest percentage of children who are stunted were in the 13-24 months age group. The lowest stunting rates were lowest amongst infants whose ages fell in the youngest age group of between 0-6 months, with results showing that children who were aged 7 months and above were at a significantly higher risk of being stunted compared to those who were aged below 7 months (Teshome et.al, 2009). The high stunting rates in the 13-24 age group can be attributed to the weaning period when children are introduced to household diets, that could possibly not match the nutritional components found in breast milk.

Similar results were recorded in Western Kenya, where a study on the prevalence and predictors of stunting, wasting and under-nutrition was undertaken by Bloss, Wainaina & Bailey (2004). The study covered the Ugunja Division in Siaya District of Kenya, and was conducted during the rainy season, a pre-harvest period also characterised by food shortages. The prevalence of underweight, stunting and wasting for children aged 5 years and below was found to be 30 percent, 47 percent and 7 percent respectively. A significant association was found between a child’s age and under-nutrition, with results showing that the prevalence of stunting, underweight and wasting was highest amongst children aged 13 to 24 months. 60 percent of children in their second year of life were stunted, 46 percent were underweight and 10 percent wasted. As compared to those who were aged between 0 and 12 months, the study found that children who were more than two years older were more likely to be stunted and underweight. This is possibly due to the fact that stunting takes longer to manifest, and could have developed during the first year of life when children were introduced to solid foods. Results also showed that having food introduced within the first six months was significantly associated with underweight. Findings from the study showed that 50 percent of the children were introduced to solid foods before they were 6 months old. In addition, 90 percent of respondents reported that they gave new-borns something besides breast milk within the first week of birth, with the most common foods being given including water, glucose solution, cow milk and porridge. The water given to the children was unsafe, with results showing that more than 60 percent of the respondents did not treat water, due to high costs of charcoal and energy sources needed for purposes of boiling water. Bloss, Wainaina & Bailey (2004) also attributed the high levels of under-nutrition in older children to lack of proper care by mothers, primarily since many worked as farm labourers and were frequently away in the
fields. Therefore, they were unable to allocate ample time to the care of their young ones. Since the study was only carried out in the pre-harvest season, it only collected data during the one period; hence the results represent information on one point in time and may miss the dynamics of food insecurity. It would have been useful if another study was carried out after the harvesting period, when food is abundant, so as to ascertain whether the risk factors would have had the same impact on the nutritional status of children. The authors also acknowledged the possibility of bias, especially in regards to the child’s age, since 10 percent of the children did not have growth monitoring cards, making it difficult to determine the exact age of the children, increasing the probability of under or over statement of malnutrition rates.

Another study in Western Kenya by Kwena et.al (2003) which sought to determine the age-group most at risk of malnutrition in a malaria intense rural district in Western Kenya found similar results. The study was conducted based on three cross-sectional surveys carried out between 1996 and 1998 to determine the impact of insecticide-treated bed nets (ITNs) on the nutritional status of children under the age of five. The prevalence of stunting, wasting and underweight was found to be 29.5 percent, 4.2 percent and 20.2 percent respectively, with results showing a decrease in Z scores with an increase in age. However, children in the first three months remained unaffected. Thereafter, the Z scores decreased swiftly from three months on, until 18-22 months, after which it remained low and stabilized from age 24-30 months. Children were at greatest risk of malnutrition in their second year of life (between 12 and 24 months). The decrease in Z-scores after three months and up to 18 months happened during the weaning period. The authors attributed the decrease to the fact that the period also coincided with the peak time for malaria morbidity and highest risk of iron deficiency. Due to the fact that the study was carried out based on surveys conducted at previous times and with different groups, the sample may not have been representative of the population. The number of children enrolled and age distribution varied with each survey, with the first cross-section oversampling infants and the second excluding children aged 36 months or more. This is likely to affected malnutrition rates, particularly due to the inaccurate age assessment (Kwena et.al, 2003), and sampling issues.

Gender

Literature shows that the gender of a child has an impact on the malnutrition, with many past studies showing that male children were more prone to malnutrition. Mahgoub, Nnyepi &
Bandeke (2006) found that the prevalence of all the forms of malnutrition (stunting, wasting and underweight) in Botswana was significantly higher in males. The cross-sectional study which was carried out in four districts of Botswana, found that 38.7 percent of children were stunted, 5.5 percent wasted and 15.6 percent underweight. 7.0 percent of the children who were wasted were boys compared to 3.5 percent who were girls, while 44.7 percent of stunted children were males, compared to 30.6 percent who were females. A similar pattern was observed in the case of underweight children, where 18.4 percent of the children suffering from this form of malnutrition were males, 6.6 percent more than the percentage of females suffering from the same condition. While the study was undertaken to be representative of the country, it was restricted to children aged below 3 years old, limiting the cross-analysis of malnutrition amongst males and females across different ages.

Similar results were recorded in Kenya by Ndeng’e (2005) who conducted a study on the determinants of non-monetary indicators of poverty using the 1998 and 2003 Kenya Demographic and Health surveys (KDHS). Ndeng’e (2005) found that male children are more likely to be malnourished as compared to female ones, with results showing that girls recorded higher HAZ, WHZ, and WAZ mean Z scores than boys in both the 1998 and 2003 surveys. In the 1998 DHS, the study found that 33.5 percent of males were stunted compared to 27.86 percent of females, while 7.25 percent of males were wasted compared to 6.8 percent of females. Likewise, 22.76 percent of males suffered from underweight, 3 percent more than females who suffered from the same problem. The same pattern was repeated itself in the 2003 KDHS, where the percentage of stunted males was 7 percent higher than that of females, and the fraction of males who were wasted and underweight was 2 percent and 5 percent more than that of females respectively. An analysis of male and female children by age group showed that both males and females recorded highest rates of malnutrition between 12 and 24 months, in both surveys, the weaning period during which children were introduced to family diets. However, this study was centred on children aged 35 months and less, and was therefore limited in its analysis of early childhood development.
2.4.2 Household Characteristics and Child Malnutrition

2.4.2.1 Parental Characteristics

Age of the mother

A cross-sectional study by Kariuki et.al (2002) in Kibera, Kenya, of children aged between 6 and 23 months found that 34.6 percent of the children were stunted, 6.2 percent were wasted, and 26.5 percent were underweight. The study identified one of the risk factors as having children early, with results showing that teenaged pregnancies were socially disadvantaged. In addition, 50 percent of the children whose mothers were aged between 15 and 19 years were found to be stunted. However, the risk of malnutrition appeared to decrease with increase in mother’s age, with prevalence of stunting amongst children whose mothers were aged over 25 years standing at 25 percent, half the percentage recorded for those children whose mothers were aged between 15 and 19. This is possibly due to the fact that a young mother is more likely to depend on others for provision of basic needs, while older mothers tend to have more experience in child care (Kariuki et.al, 2002). A contributing factor to the high rates of stunting amongst children whose mothers were young could also be the low levels of education among girls. The study found that most girls living in the slum did not proceed to secondary schools, partly due to the high cost of schooling. The lack of education amongst women in this group could also explain the large number of mothers who did not to take their children to growth monitoring clinics, possibly contributing to the high levels of malnutrition, since lack of proper monitoring does not allow early detection of malnutrition (Kariuki et.al, 2002).

Education

Bairagi (1980) studied the effect of maternal education on the nutritional status of children aged three years and less, during a pre and post- famine period in a rural area of Bangladesh. Maternal education was found to be significantly associated with the nutritional status of children: a child whose mother was illiterate was more at risk of malnutrition. Mothers were considered literate if they could read or write or had at least one year’s schooling. A high proportion of mothers (73.7 percent) had zero years of schooling while only 6.1 percent had between 6 to 10 years of schooling. The study also found significant interactions between the mother’s education and income, with children of literate mothers recording substantial improvements in nutrition with increase in income, compared to only minimal improvements.
for children with illiterate mothers, an indication that income was not the only constraint in the nutritional status of children and that education played an important role too. It is also possible that more literate mothers provided their children with better care, better food, or both (Bairagi, 1980).

Studies undertaken in sub-Saharan Africa have similar findings. As an example, results obtained by Adeladza (2009) in the Coast province of Kenya show that children whose mothers were non-educated were more likely to be underweight than those whose mothers had secondary education. The study also found that the educational attainment of mothers affected the socio-economic status of the households, particularly in those households headed by females. Children in female headed-households were more likely to be underweight, probably due to the high poverty levels in female-headed households. This could also be as a result of the mothers’ ages, since younger mothers may not have the relevant experience needed for proper care of children. Majority of the mothers (53 percent) were aged between 16 and 25 years, and of this, 62 percent of them did not have formal education.

However, there are instances in which mother’s education has not been found to have an impact on child nutritional status. A more recent study in rural Bangladesh on the socio-economic determinants of severe and moderate stunting among children aged five years and below by Kamal (2011) found that maternal education did not have any significant effect on the nutritional status of children. Instead, a father’s education was found to have a significant effect on the nutritional status, and showed an inverse association with both severe and moderate stunting. Children whose fathers had no formal education or had only primary and secondary education were 2.3 times, 1.9 times and 1.5 times respectively more at risk of malnourishment compared to those whose fathers had higher education (post-secondary), with the risk of malnutrition reducing with additional educational qualification. The insignificant effect of maternal education can be explained by the cultural beliefs of the community which recognise women as the weaker sex, hence preventing many of them from proceeding to higher education- only 4.4 percent of females had higher education. In addition, higher education appeared not to make any difference since women were unable to get lucrative jobs. Kamal (2011) attributed the insignificance of mother’s education on children’s nutritional status to the possibility that the mother’s education was already captured in the father’s educational status. A large number of households, 90.6 percent, were also found to be male-headed.
These results are similar to those obtained by Kariuki et.al (2002) from a study on the prevalence and risk factors of malnutrition in Kibera, Kenya which found no significant relationship between stunting and the mother’s educational level. However, the study by Kariuki et.al (2002) was centred on a small population; mothers of 132 children aged between 6 and 23 months. The slum also recorded a high school drop-out rate; hence the small number of girls/women who attended school may have been insignificant.

### 2.4.2.2 Other Household Characteristics

**Area of residence**

Regional disparities are widespread in developing countries, with levels of poverty, inequality and malnutrition reported to vary between urban and rural areas, and between region, provinces and districts. Children in rural areas appear to be worst affected by malnutrition, perhaps due to the low economic growth levels recorded, the lack of proper economic and social infrastructure, and the lack of other important amenities.

Sommerfelt & Stewart (1994) carried out a cross-comparison analysis carried out on child nutritional status using Demographic and Health Surveys conducted in 19 countries from sub-Saharan Africa, North Africa, Asia and Latin America, on children aged between 3 and 35 months. The study found that malnutrition was more pronounced in rural areas than in urban ones, in all the countries studied except Trinidad and Tobago, where no differences were recorded between rural and urban areas. The median rate of stunting for urban areas was 21 percent compared to 31 percent in rural areas. Wasting was also found to be more prevalent in rural areas in 9 countries, with the median wasting rates reported to be 2.4 percent for urban areas and 4.7 percent in rural areas. Underweight was found to be more pronounced in rural areas, where the median rate was 26 percent compared to 11.5 percent in urban areas.

In Democratic Republic of Congo, a study was carried out by Kandala et.al (2011) using the 2007 DHS to determine whether geographical location had any impact on the nutritional status of children aged less than five years old. The prevalence of stunting was high, with girls recording lower stunting rates compared to boys (41.7 percent versus 46.1 percent). The study also found that stunting was highest in Suid Kivu and Kasai-Occidental provinces at 46.1 percent in both areas, followed by Nord Kivu at 45 percent. The lowest prevalence of stunting was recorded in Kinshasa province where 16.4 percent of the children were stunted. Nord and Suid Kivu province belong to Eastern Congo, a region affected by violence and also characterised by poor management, high levels of corruption, and deterioration of socio-
economic status, worsened by the fall in mineral prices (Kandala et.al, 2011). In addition, the Eastern Congo has also been characterised by a decline in agricultural activity, particularly due to the high proportion of youths who have joined the mining sector. Kinshasa, on the other hand, is largely urban and characterised by higher education levels among women, accessibility to health facilities and safe drinking water, and higher caloric intake compared to other urban areas (Kandala et.al, 2011).

Kabubo-Mariara, Ndenge & Kirii (2006) used the 1998 and 2003 Kenya Demographic and Health Surveys data to analyse the nutritional status of children. In the case of chronic malnutrition, the results from the 2003 DHS indicated that rural children had significantly better nutritional status, but the results from 1998 showed a negative and insignificant association between rural areas and nutritional status. The study reported that some households and child characteristics were not very different in rural areas and in urban areas. For instance, in both rural and urban areas in both surveys, only 40 percent of the children had been fully immunized.

**Household size**

The size of a household can have an impact on the nutritional status of children. Large households result in competition for food amongst the households members. Young children, who have been introduced to the family diets, are more likely to be affected since they may be unable to get enough portions. A high fertility rate amongst women can also result in poor child care and feeding practices, as the mother may not have adequate time for her children. Maccorquodale & de Nova (1977) studied the link between family size and malnutrition, on children suffering from marasmus and kwashiorkor. The results showed that women of well-nourished children had a mean of 3.6 living children, lower than women of malnourished children, who reported a mean of 4.1 living children. The differences were significantly significant. Results also showed that a significantly higher proportion of women (68.3 percent) with well-nourished children had employed the use of contraception at some point, as opposed to 50 percent of mothers with malnourished children. The high percentage using contraception could explain the lower means of living children amongst women with well-nourished children.

Whyte & Kariuki (1991) carried out a qualitative research on malnutrition and gender relations in Western Kenya, with a view to examine mothers’ perceptions and explore the issues relevant to child malnutrition. The study found that the area was characterised by large
family sizes, and many women had co-wives. Many mothers were therefore in polygyny relationships, meaning that the husband’s resources had to be shared amongst the women and large number of children, or in some cases the husband devoted all their resources to one wife and neglected the others. Many women also reported that they had husbands who were away from home, working in towns and cities. Some of the men neglected their wives and children either economically, through lack of concern and responsibility and took up other wives in the areas of work.

**Income, assets and wealth**

Past studies show that the socio-economic status of a household affects nutritional status, with children from households with low socio-economic status, such as low income and few assets, recording poor anthropometry. This was demonstrated by Jeyaseelan & Lakshman (1997) who did a study on the risk factors of child malnutrition in South India and found that the risk of malnutrition was significantly higher for children whose households had low family income. Those children whose families had income less than Rs. 4,000 were one and a half times more likely to be malnourished compared to those children whose families had incomes greater than Rs. 8,000. Family income in this case was taken to included income from agriculture (cultivation of crops and selling of milk), agricultural labour, trade and commerce, and services. However, the results is likely to have been affected by an estimation bias, particularly because the authors reported that there was a high possibility that some households could have under-reported their incomes in fear of taxes, or for purposes of gaining subsidies (Jeyaseelan & Lakshman, 1997).

Kabubo-Mariara, Ndenge & Kirii (2006) used the 1998 and 2003 Kenya Demographic and Health Surveys data to examine the evolution of the determinants of children’s nutritional status and found household’s assets to be strongly correlated with the height of children, with evidence showing the rates of nutrition in Kenya improving, but at a decreasing rate, with assets. This was particularly evident in the study where it was established that an increase in the asset index by a point would result in an increase in the child’s height by between 0.19 and 0.45 Z scores in the 1998 and 2003 surveys respectively. However, the effect of assets on nutritional status was found to be long term and did not have much effect on current and short term nutrition.

The association between wealth and the anthropometric status of children was also examined by Abubakar et.al (2008) who conducted a study in the Coast province of Kenya to determine
whether the anthropometric status of children mediated the relationship between socio-economic status and the psychomotor development of young children. Maternal education and wealth index were measures of household socioeconomic status, while psychomotor development was measured using the Kilifi Development Inventory, which consisted of 69 items, scored through observation of a child’s performance in different activities on locomotor skills (movement in space, static and dynamic balance) and eye-hand coordination (children’s ability to manipulate objects and to coordinate motor movement). The study found that anthropometric status had a significant association with psychomotor performance, with children who had HAZ, WAZ and Mid-upper arm circumference-for-age scores (MUACZ) growth restrictions recording significantly lower psychomotor scores. Results also showed that anthropometric status fully mediated the influence of socio-economic status on development outcome. Through the three intervening variables (HAZ, WAZ and MUACZ), socio-economic status had a significant effect on psychomotor development. Socio-economic status was found to be positively associated with height, weight and MUACZ which were in turn had a positive association with psychomotor scores. Both maternal education and wealth index were positively associated with better anthropometric status and subsequently, better psychomotor scores.

Significant association have been found between anthropometric status and the socio-economic status like wealth index, with analysis showing that the more wealth a household had, the better the anthropometric status and consequently, the better the psychomotor status of children in that household (Abubakar et.al, 2008). This study was however restricted to children aged between 24 and 35 months, with Abubakar et.al (2008) arguing that environmental factors influence children more prominently at this age, and that there was a high probability of overestimation of growth problems if children aged below 24 months and those aged above 35 months were included. This is due to the fact that height measurements of children aged 2 years and above is taken while they are standing, and those below this age are measured recumbent (Abubakar et.al, 2008). However, this prevents comparisons on child malnutrition across ages. The study did not investigate other possible risk factors such as parenting behaviour, maternal age, maternal IQ, which the authors acknowledge may have been important and provided additional useful information.
Mother’s occupation

Rogers & Nadia (1988) argue that a woman’s socio-economic status is an important determinant of food intake, health and growth of her child. They maintain that an increase in women’s income is likely to lead to improvements in the nutritional status of children, particularly since women in many developing countries bear the sole responsibility of feeding and caring for children. However, results from several developing countries contradict this.

Abbi et.al (1991) studied the impact of maternal working status on the nutritional status of children in India and found that children whose mothers worked outside the home were at a significantly higher risk of being malnourished compared to those whose mothers didn’t, with children aged three years and below being the worst affected. Results showed that the risk of a child below the age of three having low WAZ, was significantly higher (1.7 times) if the mother worked, but was not significantly higher (1.4) times for children aged above 3 years and whose mothers were working. The risk of a child having low HAZ was significantly higher for those whose mothers worked and stood at 1.8 and 1.6 times for children aged below 36 months, and those aged between 36 months and 72 months respectively. A similar pattern was recorded for Vitamin A deficiency and Anaemia, where results showed that the risks were 1.4 and 1.5 times respectively in both age groups for children with working mothers. Significant results were however only recorded in the case of anaemia. On the other hand, the relative risk of having measles and severe diarrhoea was almost double and 1.5 respectively for children with working mothers. One of the possible explanations for these results could be the fact that most working mothers in the survey group barely had access to the income that they generated. The average per capita monthly income of families with mothers who were working was also significantly low at stood at Rs. 65, compared to Rs. 103 for families whose mothers did not work (Rs. 103). The study did not however, measure the time allocation of working mothers, which would have given provided a clearer picture of whether the poor nutritional status of working mothers’ children was a result of the amount time that these children spent or did not spend with their mothers.

Similar results have been reported in Kenya. A study on the socio-economic and nutritional characteristics of child growth in Coastal Kenya by Adeladza (2009), found that children whose mothers worked on farms were more likely to be wasted as compared to children whose mothers were housewives. Adeladza (2009) suggests that this could be as a result of the fact that mothers who work on farms often have to leave their children with older
siblings, relatives or neighbours who may not necessarily have the ability and knowledge on proper child care and nutritional requirements. He also attributes this to the fact that farming mothers solely relied on farm produce to meet food needs resulting in monotonous maize and cassava-based diet in the households, or were often forced to sell protein and vitamin rich foods for income purposes, and the receipts spent on non-food items. The high prevalence of malnutrition amongst children whose parents worked in farms can also be explained by the age of the child. The study was centred on children aged between 12 and 23 months, and results showed that the prevalence of stunting increased with age, with age group 20 to 23 months recording the highest prevalence of stunting. Adeladza (2009) maintains this was due to increased morbidity and inadequate food intake over a long period, and also to the lack of proper breastfeeding; only 5 percent of children were breastfed exclusively for the recommended 6 months, and a high percentage of children who received supplements by the age of 0 to 3 months (70 percent). Mothers who work in farms often have to leave their children with other caregivers who may not have the necessary skills needed for proper care of children. Also, it is possible that women who do not work on farms may be living in households with higher incomes which then free them from having to undertake such work.

These results are supported by Abubakar et.al (2011) who conducted a qualitative study on the maternal perceptions on factors contributing to severe under-nutrition among children in Kilifi Kenya. Mothers mentioned being overwhelmed and unable to take care of their children, particularly due to the numerous chores they had to conduct, resulting in them neglecting their children. Alternatively, they would leave their children with other caregivers who at times failed to provide adequate care. The women also pointed out that their status in the family affected the nutrition of the child, since they did not control family resources and often lacked the power to implement their knowledge on nutritional needs. Some mentioned that decisions on household food purchases were normally made by husbands or other relatives, rendering the women powerless to include nutritional requirements in the food baskets (Abubakar et.al, 2011).

2.4.3 Community Characteristics and Child Malnutrition

Vaccination

The health of a child plays an important role in a child’s nutritional status. As previously discussed, food security is not sufficient to ensure good nutrition (see 2.2). Rather, it must be combined with proper child care and health. One of the most important aspects of a child’s
health is vaccination, which prevent the occurrence of diseases. A cross-comparison study of child nutritional status using demographic and health surveys conducted in countries from sub-Saharan Africa, North Africa, Asia and Latin America, on children aged between 3 and 35 months by Sommerfelt & Stewart (1994), found that vaccination status of a child was significantly associated with the nutritional status. The likelihood of a child being malnourished was found to increase if the child did not have a health card, which was normally given after a child’s first vaccination. All children with a vaccination card had received at least some form of vaccination. The median level of stunting was found to be 41 percent for children whose mothers did not have a vaccination card compared to 32 percent of children whose mothers had the cards. Similar observations were made in the case of underweight, where it was found that the median level of underweight was 34 percent for children without a vaccination card, compared to 22 percent of children with a vaccination card. However, this information is limited to children aged 12 to 35 months, due to the fact that in many of the study countries, mothers were less likely to have health cards for children aged 6 months and below. The study also found that stunting was most prevalent among children with no vaccinations in eight of the countries (Egypt, Morocco, Tunisia, Sri Lanka, Bolivia, Brazil, Guatemala and Trinidad and Tobago), and the same was observed in the case of wasting.

**Water and sanitation**

A study on the impact of water improvements on diarrhoea cases amongst children in low-income urban communities in Brazil by Gross, et.al (1989) found that the incidence of diarrhoea was affected by the type of water supply. Households with access to public water supply had significantly lower incidence of diarrhoea, and the prevalence of diarrhoea reduced by 45 percent in households with piped water. Results also showed that 11.5 percent of the children suffered from diarrheal diseases. Diarrhoea was also found to be significantly associated with parental education, with the more education resulting in lower incidence of diarrhoea. Households who reportedly disposed of human excreta on the roadside or at their backyards were also found to have highest incidence of diarrhoea. In addition, the study found that duration of breastfeeding was associated with diarrheal diseases, with children aged up to one year significantly less affected by diarrhoea as compared to other groups. In this age group, children are breastfed, and hence the risk of infection is much lower (Gross, et.al, 1989).
Adewara & Visser (2011) used the 2008 Demographic and Health Survey to analyse the effects of different sources of water and sanitation on the anthropometric status of children aged 0 to 5 years in Nigeria. Access to pipe and borehole water were found to be positively associated with height-for-age and weight-for-age Z scores, with results showing that the height of a child living in a household with piped water was likely to be 0.14 Z scores higher than one whose households got water from a well. Interestingly, they found that the association between Z scores and borehole water was stronger than that of piped water, raising questions on the quality of piped water. The study also found that the proper disposal of human waste is crucial, with results showing that children in households with access to flush toilets were less at risk of malnutrition; a child who had access to a flush toilet was likely to have a height-for-age Z scores 0.3 higher than one who did not have access to one. However, since this study did not collect data on child related infections like diarrhoea, it is difficult to determine the effects of access to safe drinking water and improved sanitation on incidence of infections, and the relation to the anthropometric status of children.

In Kenya, a study by Njuguna & Muruka (2011) used data from sentinel sites ran by the Kenyan Government to investigate diarrhoea and malnutrition amongst children in a district in North Eastern province of Kenya. Results showed that 24.7 percent of the children were at risk of malnutrition (measured using the mid upper arm circumference (MUAC)) and that there was a strong and positive correlation between diarrhoea and malnutrition. In every 10 children, 9 suffered from bouts of diarrhoea every month, with the highest prevalence of diarrhoea being recorded in the months of July 2009-a period characterised by water scarcity and low milk yield- and in November 2009, the wettest month. The high prevalence of diarrhoea in July was also attributed to the long distances travelled in search of water due to low and poor quality of water supply. In November, due to the rains, the water supply was expected to be stable, but the water pipeline was reported to have broken down, causing households to use poor quality water. Poor disposal of human waste could also have contributed to the high levels of diarrhoea, particularly because only 1 in 9 households had pit latrines. Due to the large number of households, this translated to 49 people sharing one latrine. However, there is a possibility that the incidence of diarrhoea was understated since the data collected was based on district health records, and this prevented the inclusion of children who may not have had access to the health facilities.
2.5 Conceptual Framework

In order to draw together the theory concerning food security, dietary diversity and child malnutrition, as well as various drivers of child malnourishment found in empirical work, this study will employ the UNICEF Conceptual Framework of Malnutrition (1990). This provides a way of explaining the relationship between malnutrition and food insecurity. According to the framework, which is shown in figure 1, the determinants of malnutrition are divided into immediate, underlying and basic causes. Immediate causes include inadequate dietary intake and diseases, while underlying causes are grouped into three: inadequate access to food, inadequate care for mother and insufficient health services. Food insecurity, the determinant of interest, is represented by inadequate access to food. The lack of access to food and inadequate care for mother (both underlying causes) directly results in inadequate dietary intake, an immediate cause of malnutrition, which shows that children cannot consume foods that which they do not have access to. However, malnutrition is the result of the interplay of several factors which are controlled for in the study. As shown in the framework and as previously discussed, these factors include diseases caused by poor access to water and sanitation and lack of vaccinations among other factors. The framework shows that the relationship between disease and inadequate dietary intake is bi-directional. This means that inadequate dietary intake does not only result in disease, but that diseases also cause a reduction in dietary intake, possibly due to the inability of a sick child’s body to consume sufficient food. Children who lack proper care are more likely to develop diseases which can affect their dietary intakes and lead to malnutrition. On the other hand, mothers who are in poor health are also unable to take care of their children or feed them properly. Together with inadequate care for mother and child, insufficient health services cause diseases.
Figure 1: The UNICEF conceptual framework for malnutrition (UNICEF, 1990)

Malnutrition and death

Inadequate dietary intake

Inadequate access to food

Inadequate care for mother and children

Insufficient Health services

Disease

Formal and non-formal institutions

Political and ideological superstructure

Economic structure

Potential resources

Outcomes

Immediate causes

Underlying causes

Basic Causes

(Source: UNICEF, 1990)
Basic causes comprise of socio-economic factors like the wealth of a country, which was previously identified as important since it enables people to access important amenities -such as education- that are necessary for a household’s nutrition and food security enhancement (Benson, 2004). Poor countries are often characterised by households that lack assets and are more often unable to generate wealth, resulting in their inability to not only access food but to also have access to social amenities that can enhance and sustain their livelihoods. Other basic causes, as previously shown, include maternal education, household assets and income, and area of residence.

It is important to note that while child malnutrition may be as a result of food insecurity, changes in the nutritional statuses of children may also be caused by other causal factors such as those discussed earlier. The UNICEF framework shows that food security is an important determinant, but is not the only factor necessary for proper nutrition. Morbidity, caused by insufficient health services and inadequate care of mother and children, also affects the nutritional status. As some previous studies have shown (Reinhard & Wijayaratne, 2000; Benson, 2004), and as discussed earlier in this chapter, nutritional security can only be attained when food security is accompanied by proper health, sanitary environments, and adequate care of children. Due to the fact that food security is not the only cause of malnutrition, nutritional status must be used with other indicators such as seasonal patterns which are always reflected in weight loss that may be reversed when food supplies become abundant (Young, 2001). More accurate information on food security and child malnutrition can be obtained in a 12 month long survey, which can record the changes of nutritional status of children over time.

The UNICEF framework has been reinforced by studies which have shown an association between food security and the nutritional status of a child. A study on the causes of malnutrition in northern Kenya, Grobler-Tanner (2006) found that the immediate causes were food intake and diseases, while the underlying causes were inadequate household food security, inadequate feeding and care practices and poor health access. Recurrent and lengthy droughts, environmental degradation, low purchasing power and security and conflict issues in North Eastern province of Kenya were also identified as a threat to food security (Grobler-Tanner, 2006).

Despite the fact that the framework recognises food security as a cause of malnutrition, it does not directly take into account dietary diversity and stops at including dietary intake,
which normally refers to the quantitative intake of food and may not include diet quality. Studies such as those already discussed show that dietary diversity is positively associated with better nutritional statuses amongst children. It has also been identified as a strong and consistent predictor of the anthropometric status of children. Research shows that the inclusion of a variety of different foods from different sources is significant for the growth of a child. However, many communities in Sub-Saharan Africa have diets that are monotonous and bulky, resulting high rates of malnutrition amongst children and adults (Onyango, 2003).

2.6 Conclusion

This chapter reviewed literature on child anthropometry and food security. It began with an analysis of existing literature on risk factors associated with poor anthropometry in Kenya. This was followed by a scrutiny of literature on food security, its indicators and its relationship with the nutritional status of children. Existing literature point to a significant association between food security and the anthropometric status of child, with food insecurity found to be a significant predictor of poor anthropometry in many countries. Few studies have tried to use indicators of dietary diversity to explain variation in child nutritional status, but those that have been undertaken found it to be significantly associated with the anthropometric status of children. Other risk factors found to be associated with poor anthropometry amongst children include age and gender of the child, maternal education, and household size, mother’s occupation, household assets, income, immunization and presence.
CHAPTER THREE

ANALYTICAL FRAMEWORK, RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

This chapter presents the analytical framework that the research will follow. It will also expound on the data types and sources, and the sample design. A discussion on the data analysis methodology is also included. In addition, the chapter will review the study limitations, and end with an ethics statement.

3.2 Analytical Framework

The study will employ the use of an analytical framework that follows the household production framework of Becker (1965), Strauss & Thomas (1995) and Kabubo-Mariara, Ndenge & Kirii (2006). A household is the starting point for the analysis of nutritional status; due to the notion an individual’s nutrition is normally determined by decisions made both by the individual or the household that he or she lives in (Berhman & Deolaikar, 1988). Since the primary focus of this research is a child whose age falls below five years, it shall be assumed that decisions on the child’s nutrition are made predominantly at a household level.

In the model, a household is assumed to have a utility function through which it strives to maximise its preferences subject to a set of constraints. The household’s preference function is presented as:

\[ U = u(X, L, N) \]

The utility function of a household \( U \) is determined by \( X \) which represents the consumption of a vector of commodities, \( L \) which represents leisure and \( N \) which represents the nutritional status of children. Consumption \( (X) \) may be acquired through the market or produced at home (Strauss & Thomas, 1995) while the quality of children is indicated by \( N \) (Kabubo-Mariara, Ndenge & Kirii, 2006).

\( N \) is measured using the anthropometric status of children. The nutritional status of children is constrained by other factors which include child characteristics, household characteristics and community related characteristics (Kabubo-Mariara, Ndenge & Kirii, 2006). This is shown below:

\[ N = n(C, W, H, Z, \varepsilon) \]
Where $C$ represents household food consumption, $W$ represents the child-related characteristics, $H$ represents the household related characteristics $Z$ the community related characteristics and $\varepsilon$ is the child disturbance term (Kabubo-Mariara, Ndenge & Kirii, 2006).

Child specific characteristics include the age and gender of the child, while household characteristics include the mother’s education, parent’s age, marital status, income and dietary diversity, an indicator of household food security. Other important household characteristics include the household size and the assets of the household. The community specific characteristics include health and immunization, and access to safe water and sanitation.

Based on the above analysis, the Nutrition production function can be reduced further:

- $HAZ_i = f(\text{child-related features, household characteristics, community level characteristics, } \varepsilon_{ha})$
- $WAZ_i = f(\text{child-related characteristics, household characteristics, community level characteristics, } \varepsilon_{wa})$
- $WHZ_i = f(\text{child-related characteristics, household characteristics, community level characteristics, } \varepsilon_{wh})$

(Kabubo-Mariara, Ndenge & Kirii, 2006)

Where, $\varepsilon_{ha}$, $\varepsilon_{wa}$, and $\varepsilon_{wh}$ are random term errors and $i$ represent the $i$th group, defined by region, gender or time (Kabubo-Mariara, Ndenge & Kirii, 2006)

$HAZ$, $WAZ$ and $WHZ$ represent Height-for-age, Weight-for-age and Weight-for-height $Z$ scores. The use of $Z$ scores to determine the anthropometric status of children has been going on for decades and is supported by organizations like World Health Organisation (WHO). A $Z$ score (also referred to as a standard score) is the deviation of a child’s value from the median of a reference population divided by the standard deviation of the reference population (WHO, 2006). The $Z$ score indicates how far and which direction a measured value takes from the median.

$$Z \text{ score} = \frac{\text{observed value } (x) - \text{median reference value } (\bar{x})}{\text{standard deviation of the reference population } (\sigma)}$$

(Source: WHO, 1995)
Previously, the growth references were based on US data, which were however found not to be adequately representative, resulting in WHO implementing the use of child growth standards since 2006 that are based on a reference population in six countries; Brazil, India, Norway, Oman, USA and Ghana (WHO, 2006)

Wang & Chen (2012) point out the advantages of using Z scores for the purposes of analysing child growth. Firstly, the scores reflect the distribution of a reference population since they are calculated based on the distribution of a reference population. Secondly, Z scores are comparable across age, sex and measure. In addition, Z scores can be used for summary statistics and analysed as a continuous variable.

3.3 Study Context

Located in the eastern part of sub-Saharan Africa, Kenya is surrounded by Tanzania, Uganda, Ethiopia, South Sudan and Somalia. Its strategic position means that it has a lot of influence on political and economic happenings in the region; and consequently the country has for a long time remained the economic hub of the East African Community. Kenya’s population is largely rural, and women are the majority representing 50.3 percent of the populace. The most recent population census conducted in 2009 put the population at 38,610,097 (KNBS, 2010). Politically and administratively, the country is divided into eight provinces, though a recently adopted constitution introduced a county system of governance. Consequently, the country has 47 counties, the largest being Nairobi with a population of approximately 1.6 million people. Of the eight provinces, Rift Valley is the largest with a population of slightly over ten million (KNBS, 2010).

Poverty in the country is measured using the headcount index, which is the proportion of people living below the poverty line (Ravallion, 1996). The country has two poverty lines; overall and food poverty lines. The two were derived by the Kenya National Bureau of Statistics (KNBS) based on the Cost-of-Basic Needs (CBN) method, which estimates the cost for a consumption bundle that is taken to be adequate for the consumption needs of different sub-groups subjected to comparison (Ravallion, 2008). In the case of Kenya, the poverty lines were calculated differently for both urban and rural areas. The food poverty line currently stands at Kshs. 988 and 1,474 for rural and urban areas respectively, while the overall poverty lines are Kshs. 1,562 and Kshs. 2,913 for rural and urban areas respectively (KNBS, 2007). Based on this, the overall poverty in Kenya stands at 46 percent of the population, with rural areas having 49.1 percent of its population living in poverty and urban
areas stands at 33.7 percent (KNBS, 2007). In the case of food poverty, 45.8 percent of the population are poor, with rural areas recording poverty of 47.2 percent and urban areas having food poverty of 40.5 percent.

3.4 Data Types and Sources

This study used data from the Kenyan Integrated Household Budget Survey (KIHBS), an integrated survey conducted by the KNBS in 2005 and 2006. The cross-sectional data was collected for a period of 12 months starting May 2005. The survey’s main objective was to provide indicators and data to measure poverty and the standards of living in Kenya. The data was also used to estimate the standards of living in the country and for the measurement of the poverty lines.

The KIHBS research instruments included a 21 module household questionnaire, 14 day household diaries to keep record of consumption and purchasing, a market price questionnaire and a community questionnaire. The KIHBS collected extensive data on the demographic and socio-economic characteristics of all of the respondents. In addition, data on households’ food consumption was collected, showing the different food groups purchased and consumed in a week. Other indicators covered by the survey include health, child anthropometrics, labour, household characteristics, agricultural holdings, household enterprises, and transfers. The KIHBS data was used to update the urban Consumer Price Index (CPI) and create a rural one, since the previous urban one had been based on the 1993 Urban Household Budget Survey (KNBS, 2007).

3.4.1 Sampling Design, Weights and Survey Coverage

The clusters sampled in each district were selected with equal probability from the National Sample Survey and Evaluation Programme (NASSEP-IV). NASSEP-IV is a sampling of 1,800 clusters, selected with a probability that is proportional to size from a set of all Enumeration Areas (EA) used in the 1999 Kenyan Population and Housing Census (KNBS, 2007) and classified into strata. This selection of clusters resulted in an approximately self-weighting sample of households in each stratum. For purposes of data collection, the randomly sampled households were put in 1,343 clusters each with 10 households. Altogether, there were 857 rural clusters and 482 urban ones. Therefore, the total number of households that the survey covered was 13,430 households; 8,570 located in rural areas and 4,820 located in urban areas. The sample design used allows for derivation of estimates and
data analysis at national, provincial and district level. It also allows for rural and urban areas analysis. The year-long survey was organized into 17 cycles of 21 days each, during which enumerators conducted household interviews.

3.5 Data Analysis

KIHBS collected the anthropometric measurements of children aged between 5 and 60 months. It also collected information on the ages of these children. In this study, the ages of the children were imputed from the interview date and the dates of birth contained in the data. Where no such information was available, the given age of the child was used. The anthropometric measurements of the children were converted into Z scores of weight-for-age (WAZ), height-for-age (HAZ) and weight-for-height (WHZ), using the WHO Anthro and Macro for personal computers (STATA igrowup package) based on the WHO Child Growth standards. Weight is a sensitive indicator of acute deficiencies and height indicates chronic exposure to deficiencies and infections (UNICEF, 2009). In the calculation of Z scores, extreme or biologically implausible scores for each indicator were flagged as per the following system:

- **Length/height-for-age z-score**  
  HAZ < -6 or HAZ > 6
- **Weight-for-length/height z-score**  
  WHZ < -5 or WHZ > 5
- **Weight-for-age z-score**  
  WAZ < -6 or WAZ > 5

Based on this, 550 height-for-ages, 253 weight-for-heights and 92 weight-for-ages were found to be extreme and excluded from further analysis. The data was estimated and analysed using the Statistical software packages STATA. Stunting, wasting and underweight were used as indicators of acute and chronic malnutrition. The three forms of malnutrition were derived from the HAZ, WHZ, and WAZ respectively. Logistical regressions and Ordinary Least Squares (OLS) regressions were run to establish the relationship between household food security and the anthropometric status of children.

3.5.1 Dietary Diversity Scores

Several measures of dietary diversity have been suggested in the past; most common are the scores derived from individual foods or food groups consumed. FAO (2011) recommends the use of either the Household Dietary Diversity Score (HDDS) or the Women Dietary Diversity Score (WDDS), both of which are based on different food groups. Ruel (2002) maintains that the kind of score used depends on what one wants to reflect; if the use of the
score is to show socio-economic conditions and food security then foods should be grouped according to their economic value. If on the other hand the aim is to use the score to reflect nutrient adequacy, then the foods should be grouped according to specific nutrient component. The HDDS is used by FAO since it gives an indication of a household’s socio-economic access by including foods that require resources to acquire such as sugars, beverages and condiments (Kennedy, Ballard & Dop; 2011). On the other hand, the WDDS is used to show micronutrient adequacy of diets of women of reproductive age (Kennedy, Ballard & Dop; 2011). The HDDS is also preferred as a measure of food security since obtaining data from the households on it is straightforward and relatively easier as compared to collecting data from other indicators such as daily caloric intake (Hoddinott & Yohannes, 2002).

For the above reasons, this study employed the use of a HDDS based on a households’ one week food consumption recorded during the survey. For the purposes of analysing the HDDS, the Food and Agricultural (FAO) recommends that foods be classified into twelve groups which include:

- Cereals
- Root and tubers
- Vegetables
- Fruits
- Meat, poultry, offal
- Eggs
- Pulses, legumes and nuts
- Fish and seafood
- Milk and milk products
- Oils and fats
- Sugars and honey
- Beverages and other foods (miscellaneous)

However, HDDS has been criticised for several reasons. Firstly, it is based on a small number of food groups, which may limit the ability of the scores to detect differences in the mean score, especially where the sample size is small (Kennedy et.al, 2010). The tool is also limited in that it only shows consumption within the household and excludes out of house consumption, which normally comprise foods eaten in restaurants and cafe (Kennedy et.al,
2010). This can lead to possible underestimation of dietary diversity scores, especially in the urban areas where out of home food consumption is common (Kennedy et.al, 2010). Another limitation of HDDS is the portion size, which many argue, should be taken into consideration. Ruel (2002) maintains that failure to take into account the portion size can lead to an overestimation of the intake of certain foods or food groups. Another limitation surrounding the use of HDDS is the recall burden that households are subjected to. It is difficult for households to recall the exact size of each food consumed, and this may only be possible if households are given food diaries where records of consumption and portion size can be recorded. However, this is not only cumbersome and tiring for household members but it also expensive and requires expertise in data collection and analysis (FAO, 2007). Drescher, Thiele & Mensink (2007) also criticise dietary diversity scores for not distinguishing between healthy and unhealthy diets, and also for failing to take into consideration the number of foods, and distribution of individual food quantities. Nevertheless, taking this into account may be difficult and complicated, especially with weighting of different foods and determining which one carries more weight.

A major limitation of dietary diversity score is that there does not exist a universally recognised cut off point or target above or below which households can be classified as having high or low dietary diversity (Kennedy et.al, 2010). Most studies have resorted to defining this based on the distribution of dietary diversity distribution, using terciles or quantiles (Ruel, 2002).

The recall period also remains contentious. Recall periods have ranged from one day to as many as 15 days. While some argue that longer recall periods are subject to errors (Ruel, 2002), research also shows that longer periods are also able to properly capture a household’s diet possibly due to the fact that they have more time to acquire foods and hence this gives a better picture of consumption patterns (Savy et.al, 2005). Data on food acquisition and consumption collected by the KIHBS was based on a one week recall period.

3.6 Study Limitations

The study used survey data (KIHS, 2005/2006) and just like many other surveys, the possibility of non-response is always high. KNBS admits the occurrence of non-response, though it recorded a low non-response percentage of less than 1 percent, attributing the low incidence on the fact that a household was visited at least 10 times (KNBS, 2007). However,
the number of children whose anthropometric measurements are missing is high. Out of 11,461 children aged under-five years, 3,752 of them had missing heights while 3,707 weight measures were not recorded. This presents a possible biasedness problem since the prevalence of nutritional deficiencies (stunting, wasting and underweight) may have been either over or under estimated. Most notably in the case of wasting, which uses both the weight and height of children, it is likely that the results may not give a true representation of the nutritional deficiency since a high number of children (3,691) had both heights and weights missing. In addition 92 children lived in households that did not have data on household food consumption and dietary diversity scores.

Since the survey was designed to give district estimates, some variables may not be reliable due to the small samples, especially for districts which had only 17 clusters (KNBS, 2007).

3.7 Ethics Statement

This study used secondary data derived from Kenyan official statistics and, therefore, did not include any human subjects. Permission to use the data was obtained from the Kenya National Bureau of Statistics. The research was conducted in alignment with quality, integrity and ethical research standards. The results will be made available to policy makers, NGOs, research institutions, Kenyan government, and other relevant and interested parties.
CHAPTER FOUR
RESULTS: PRESENTATION AND DISCUSSION

4.1 Introduction

This chapter presents the results of data analysis. It will begin with a presentation of descriptive statistics on household demography and characteristics, followed by an analysis of child demographics and a discussion on child malnutrition. The chapter will also present results from bivariate (correlations) and multivariate (regressions) analysis, measures of association and causality. The bivariate analysis will be useful to determine how the nutritional status of children is associated with other factors, while the regression analysis will explain the relationship between household food security and the nutritional status of children. This will be followed by discussions and interpretation of results with reference to studies and literature on malnutrition from other countries.

4.2 Household Demography and Characteristics

4.2.1 Descriptive Statistics

The Kenya Integrated Household Budget Survey (KIHBS) was a nationwide survey and was therefore inclusive of both rural and urban areas. Out of the 13,158 households surveyed, 74.5 percent are located in rural areas while the rest are in urban areas. This is synonymous with the Kenyan government statistics which shows that the country’s population is largely rural. The distribution of households based on their area of residence is shown below.

Figure 2: Distribution of households by area of residence

A summary of statistics for selected household characteristics is displayed in table 1. The average household size is 5, and the largest household has 29 members. Households in rural
areas are larger than those in urban areas, with those in rural areas recording a mean of 6 members compared to a mean of 4 members in urban areas. A t-test carried out shows that the difference is statistically significant at the 95 percent confidence interval. In the case of education, the average number of years of schooling for all females in a household is 7.5 years. Households in urban areas, however, have higher education means compared to those in the rural areas; 8.5 years for urban areas and 7 years for rural ones. Again, a t-test carried out shows that the difference is statistically significant at the 95 percent confidence interval.

Table 1: Household statistics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Standard deviation</th>
<th>Median</th>
</tr>
</thead>
<tbody>
<tr>
<td>Household Size</td>
<td>5.09</td>
<td>2.8</td>
<td>5</td>
</tr>
<tr>
<td>Education-Average number of years in school (Females)</td>
<td>7.45</td>
<td>3.2</td>
<td>7</td>
</tr>
</tbody>
</table>

The average per adult equivalent total household expenditure on food and non-food items is Kshs. 40,939.51, with the household with the least expenditure recording total spending of Kshs. 190 and the household with the highest expenditure recording a total spend of Kshs. 2,300,801. The figure below shows a kernel density estimate, graphically represented. The graph is shifted to the right, where high incomes are distributed across a smaller population. On the contrary, the kernel peak is sharp and concentrated around one place, implying that majority of the households have low incomes.
The distribution of low income amongst majority of the households can further be explained by the figure below which displays the Lorenz curve and the gini coefficient. The gini index is an inequality measure and graphically represented by the Lorenz curve (Bellu, 2006). The gini index can take up any value from 0 percent to 100, with the former showing perfect equality. In the case of Kenya, and as shown below, the gini coefficient is 47; indicating that inequality is quite high in the country\(^6\).

\(^6\) However, when compared to South Africa, Kenya’s gini is low. As of 2009, South Africa had a gini index of 63.1, one of the highest in the world (World Bank, 2013).
4.2.2 Distribution of Poverty (Overall) amongst Households

As aforementioned in the previous chapter, poverty in Kenya is measured using the headcount index\(^7\), which is derived from the total household expenditure on food and non-food items. The overall poverty lines are Kshs. 1,562 and Kshs. 2,913 for rural and urban areas respectively, and are based on household consumption of food and non-food items, (KNBS, 2007). Food items consumption aggregates, based on a one week consumption, is comprised of four components: food consumption from purchases and consumption from own production, own stock and gifts, and other sources (KNBS, 2007). Non-food items include non-regular items such as medical care, personal care, communication and transport; expenditure on non-food items such as personal goods, recreation and domestic services during the past month; and expenditure on clothing items during the past month (KNBS, 2007). The use of poverty measures based on monetary indicators such as expenditure remains popular despite criticisms due to its simplicity, and also because other measures are complicated and difficult to implement (Ravallion, 1996). KNBS (2007) further emphasises that the expenditure is preferred over other wellbeing indicators like income because it is easier to collect data on. It is also preferred due to the fact that consumption is not tied to short-term fluctuations, and is less variable than income (KNBS, 2007). Slesnick (1993) argues that if income is used as a measure, poverty rates can change from time to time due to

\(^7\) There are different ways in which money-metric poverty measures can be reported. For example: the headcount, depth, and severity. However, for the purpose of this study, the headcount index shall be reported.
incomes changes and households in lower income deciles may not be adequately represented by households with temporary reductions in income and are falling below the poverty line. However, money-metric measures of poverty such as expenditure have been criticised for ignoring other dimensions of well-being. In addition, others have criticised the use of poverty lines, such as those employed in this study, for violating the monotonicity and transfer axioms (Sen, 1982)\(^8\), and for not considering the extent of poverty for those who lie below the poverty line (Sen, 1981). Deaton (2001) also argues that the use of consumption data from surveys is subject to scrutiny, especially since consumption measures use long lists of items, which tend to change slowly and may not necessarily reflect increase in the consumption of goods and services that may not have been known a decade before.

The results obtained from the empirical analysis show that out of the 13,158 households surveyed, 38.3 percent of households are poor and 61.7 non-poor as measured by the overall poverty line. Poverty appears to lean towards households in rural areas. This is evident from the figure below which shows that there are more households in the rural areas that are classified as poor, compared to those in the urban areas. Of the households that reside in rural areas, 42 percent live in overall poverty while those that are poor in the urban locations constitute 27.4 percent. The proportion of households that are not poor and reside in the rural and urban areas is 58 percent and 72.6 percent respectively. The differences observed in poverty across urban and rural zones are statistically significant at the 95 percent confidence interval.

**Figure 5: Distribution of overall poverty among rural and urban areas**

![Bar chart showing distribution of overall poverty among rural and urban areas](chart.png)

Pearson chi2 (1) = 277.3626  Pr = 0.000

\(^8\) As per the monotonicity axiom, a reduction in income of a person below must lead to an increase in the poverty measurement (Sen, 1982). Similarly, in the transfer axiom, a transfer of income from person below poverty line to a person who is richer should result in an increase in the poverty measure (Sen, 1982).
4.2.3 Distribution of Poverty (Food) amongst Households

The Kenyan food poverty line is centred on consumption of food items only and is calculated based on the cost of consuming 2,250 kilocalories per adult equivalent per day, in a manner that is consistent with food tastes and preferences in urban and rural areas; and stands at Kshs. 988 for rural areas and Kshs. 1,474 for urban areas (KNBS, 2007).

Out of the 13,158 households that participated in the survey, 36.7 percent are food poor. A further analysis of the distribution of food poverty amongst rural and urban households reveals that the percentage of households who are food poor is 38.6 percent for rural areas and 31.27 percent for urban areas. However, compared to overall poverty, the percentage of households who are classified as poor based on the food poverty line increases for urban locations from 27.4 percent to 31 percent but reduces from 42.0 percent to 38.6 percent for rural zones. A possible reason for this could be the availability of food in rural areas, which are largely agricultural. In many cases, rural households have their own land which they cultivate or they use to practice some form of agriculture, therefore enhancing their food access. The differences in food poverty as observed across the areas of residences are statistically significant as shown by a chi-square test result below.

Figure 6: Food poverty by area of residence

<table>
<thead>
<tr>
<th>Area of Residence</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rural</td>
<td>38.60%</td>
</tr>
<tr>
<td>Urban</td>
<td>31.27%</td>
</tr>
</tbody>
</table>

Pearson chi2 (1) = 100.7269  Pr = 0.000

4.2.4 Distribution of Overall and Food Poverty across Provinces

There exists inequality in well-being across provinces. An analysis of overall and food poverty in the eight provinces of Kenya yields the following results which are statistically significant. Nairobi province has the lowest incidence of overall and food poverty when
compared to other provinces. However, the proportion of households living in overall poverty in Nairobi province is smaller than the one living in food poverty by more than 5 percent, probably due to the fact that the province is urban and agricultural activities are limited, thereby affecting food access. However, the province has the lowest prevalence of overall and food poverty. Central province comes second after Nairobi. This could be due to the fact that the province has abundant water resources, and reliable rainfall which allows residents to harness water for use (Odumbe, 2007). The province is also largely agricultural, with production of both food and cash crops such as tea, coffee, wheat and horticultural products; which are sold to the nearby urban markets in Nairobi or abroad, providing income for the residents (Odumbe, 2007). In provinces classified as largely rural (Coast, Eastern, North-Eastern, Nyanza, Rift Valley and Western), the proportion of those households that are food poor is smaller than those who are in overall poverty. Households in rural areas are more likely to practice agriculture due to the availability of land, and rely on this as their source of food and income. The prevalence of poverty is most pronounced in North Eastern, a sparsely populated province, and which has the highest incidence of overall and food poverty with the former standing at 66.17 percent, and the latter 57.69 percent.

Table 2: Distribution of overall and food poverty across provinces

<table>
<thead>
<tr>
<th>Province</th>
<th>Overall poverty</th>
<th>Food poverty</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Poor Non-poor</td>
<td>Poor Non-poor</td>
</tr>
<tr>
<td>Nairobi</td>
<td>19.63% 80.37%</td>
<td>24.75% 75.25%</td>
</tr>
<tr>
<td>Central</td>
<td>24.16% 75.84%</td>
<td>24.82% 75.18%</td>
</tr>
<tr>
<td>Coast</td>
<td>45.62% 54.38%</td>
<td>44.58% 55.42%</td>
</tr>
<tr>
<td>Eastern</td>
<td>43.24% 56.76%</td>
<td>37.34% 62.66%</td>
</tr>
<tr>
<td>North Eastern</td>
<td>66.17% 33.83%</td>
<td>57.69% 42.31%</td>
</tr>
<tr>
<td>Nyanza</td>
<td>41.43% 58.57%</td>
<td>39.37% 60.63%</td>
</tr>
<tr>
<td>Rift valley</td>
<td>40.30% 59.70%</td>
<td>39.18% 60.82%</td>
</tr>
<tr>
<td>Western</td>
<td>46.83% 53.17%</td>
<td>42.95% 57.05%</td>
</tr>
</tbody>
</table>

Pearson chi2(7) = 616.4195
Pr = 0.000

Pearson chi2(7) = 386.8787
Pr = 0.000

### 4.2.5 Households’ Sources of Drinking Water

Table 3 below shows the households’ main sources of drinking water. The proportion of households who use rivers, ponds or streams to get drinking water is 21.3 percent and those that fetch from unprotected wells or springs is 12.9 percent. Only 22.3 percent of the
households have access to piped water, either inside the dwellings (8 percent) or out in the yard (14.3 percent). A very small proportion (0.1 percent) use bottled water for drinking.

Table 3: Main source of water for drinking

<table>
<thead>
<tr>
<th>Main source of water for drinking</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Piped into dwelling</td>
<td>7.97</td>
</tr>
<tr>
<td>Piped into plot/yard</td>
<td>14.32</td>
</tr>
<tr>
<td>Public tap</td>
<td>11.68</td>
</tr>
<tr>
<td>Tube well/borehole with pump</td>
<td>6.46</td>
</tr>
<tr>
<td>Protected dug well</td>
<td>7.47</td>
</tr>
<tr>
<td>Protected Spring</td>
<td>9.14</td>
</tr>
<tr>
<td>Rain water collection</td>
<td>9.14</td>
</tr>
<tr>
<td>unprotected dug well/springs</td>
<td>12.88</td>
</tr>
<tr>
<td>Rivers/ponds/streams</td>
<td>21.27</td>
</tr>
<tr>
<td>tankers-truck/vendor</td>
<td>4.40</td>
</tr>
<tr>
<td>Bottled water</td>
<td>0.08</td>
</tr>
</tbody>
</table>

An investigation on water source by the area of residence reveals that many households in rural areas fetch water from unsafe sources. This is illustrated by figure 7 below. While 97.4 percent drink water from unprotected wells and springs, approximately the same percentage of households get drinking water from rivers and streams. In contrast, households in urban areas have more access to safe drinking water piped (into dwelling or yard), a public tap or bottled water. The differences recorded in the sources of water across the areas of residence are statistically significant at the 95 percent confidence interval.
The water sources can further be divided into two groups: protected and unprotected. Protected water sources include piped water, public tap, borehole, protected dug well and spring, rain water collection and bottled water. Unprotected sources include unprotected dug well/springs, rivers/ponds/streams, and tankers-trunk vendors. As displayed in the table below Nairobi province leads in access to protected water sources, where 97.3 percent of households have access to such sources. The highest percentages of households with access to unsafe water sources are Eastern and North Eastern provinces, at 50.9 percent and 65.4 percent respectively. The differences in water sources across provinces are statistically significant at the 95 percent confidence interval.

Table 4: Protected and unprotected water sources

<table>
<thead>
<tr>
<th>Province</th>
<th>Unprotected water sources</th>
<th>Protected water sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nairobi</td>
<td>2.73%</td>
<td>97.27%</td>
</tr>
<tr>
<td>Central</td>
<td>38.62%</td>
<td>61.38%</td>
</tr>
<tr>
<td>Coast</td>
<td>34.72%</td>
<td>65.28%</td>
</tr>
<tr>
<td>Eastern</td>
<td>50.85%</td>
<td>49.15%</td>
</tr>
<tr>
<td>North Eastern</td>
<td>65.41%</td>
<td>34.59%</td>
</tr>
<tr>
<td>Nyanza</td>
<td>39.49%</td>
<td>60.51%</td>
</tr>
<tr>
<td>Rift valley</td>
<td>46.16%</td>
<td>53.84%</td>
</tr>
<tr>
<td>Western</td>
<td>35.45%</td>
<td>64.55%</td>
</tr>
</tbody>
</table>

Pearson chi2 (7) = 672.5512  Pr = 0.000
4.3 Household Food Consumption and Dietary Diversity

4.3.1 Household Food Consumption

Table 5 below shows the distribution of food groups amongst households. Of the 13,158 households surveyed, almost all of them (99 percent) consumed cereals; an observation synonymous with past research that has shown that Kenyan diets are mostly cereal-based (Bwibo & Neumann, 2003). Animal source foods record the lowest consumption; with only about 35 percent of households consuming fish and seafood, 61.2 percent consuming meats and another 35.4 percent consuming eggs. This is perhaps due to the cost of animal source foods which is normally higher than that of cereals and vegetables. In addition, most households normally purchase animal source foods, but in contrast have easier access to cereals and vegetables, which they can easily grow in their farms, or in their backyards.

<table>
<thead>
<tr>
<th>Food Groups</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cereals</td>
<td>98.90</td>
</tr>
<tr>
<td>Roots and tubers</td>
<td>76.71</td>
</tr>
<tr>
<td>Pulses</td>
<td>79.98</td>
</tr>
<tr>
<td>Vegetables</td>
<td>95.26</td>
</tr>
<tr>
<td>Meats, poultry and offal</td>
<td>61.16</td>
</tr>
<tr>
<td>Fish and seafood</td>
<td>34.95</td>
</tr>
<tr>
<td>Eggs</td>
<td>35.41</td>
</tr>
<tr>
<td>Milk and milk products</td>
<td>87.25</td>
</tr>
<tr>
<td>Oils and fats</td>
<td>94.01</td>
</tr>
<tr>
<td>Fruits</td>
<td>75.32</td>
</tr>
<tr>
<td>Sugars and honey</td>
<td>91.63</td>
</tr>
<tr>
<td>Spices, beverages and other misc.</td>
<td>99.20</td>
</tr>
</tbody>
</table>

An analysis of food groups’ consumption by province yields the results shown in table 6. Households in Nairobi appear to have access to more food varieties, recording high consumption rates across all food groups. In contrast, households in North Eastern province, which is largely rural, record the lowest consumption of roots & tubers (31.4 percent), vegetables (33.1 percent), meats, poultry & offal (46.7 percent), fish & seafood (0.2 percent), eggs (approximately 12 percent), and fruits (10.9 percent). The area was characterised by droughts from 2004 (KNBS, 2007), causing high livestock mortality rates which resulted in loss of livelihoods (Grobler-Tanner, 2007). The area has a climate which is erratic and characterised by long dry spells and unreliable rainfalls; this situation is often worsened by
the inadequate supply of water (Odumbe, 2007). Empirical results from this survey also show that poverty is widespread in the province (see 4.2.4). Districts like Mandera, Garissa, and Wajir, which belong to this province, are characterised by poor road networks which hinder access to markets and deter supply of affordable food items (Odumbe, 2007). All these factors offer a possible explanation for the low levels of consumption amongst food groups like fish and seafood, and fruits.
Table 6: Consumption of food groups by province

<table>
<thead>
<tr>
<th>Province</th>
<th>Cereals</th>
<th>Roots &amp; tubers</th>
<th>Pulses</th>
<th>Vegetables</th>
<th>Meat, poultry &amp; offal</th>
<th>Fish and seafood</th>
<th>Eggs</th>
<th>Milk &amp; milk products</th>
<th>Oils &amp; fats</th>
<th>Fruits</th>
<th>Sugars &amp; honey</th>
<th>Spices &amp; beverages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nairobi</td>
<td>96.82%</td>
<td>82.60%</td>
<td>68.64%</td>
<td>96.06%</td>
<td>79.61%</td>
<td>41.83%</td>
<td>55.67%</td>
<td>90.56%</td>
<td>94.81%</td>
<td>89.22%</td>
<td>90.59%</td>
<td>96.27%</td>
</tr>
<tr>
<td>Central</td>
<td>98.09%</td>
<td>93.37%</td>
<td>87.06%</td>
<td>97.96%</td>
<td>55.73%</td>
<td>6.58%</td>
<td>37.24%</td>
<td>95.81%</td>
<td>95.09%</td>
<td>75.87%</td>
<td>89.43%</td>
<td>98.92%</td>
</tr>
<tr>
<td>Coast</td>
<td>98.30%</td>
<td>69.68%</td>
<td>80.30%</td>
<td>93.44%</td>
<td>60.15%</td>
<td>64.04%</td>
<td>26.76%</td>
<td>70.61%</td>
<td>70.02%</td>
<td>82.13%</td>
<td>91.90%</td>
<td>98.53%</td>
</tr>
<tr>
<td>Eastern</td>
<td>98.37%</td>
<td>72.14%</td>
<td>90.40%</td>
<td>93.65%</td>
<td>54.02%</td>
<td>4.19%</td>
<td>26.06%</td>
<td>85.21%</td>
<td>84.66%</td>
<td>71.54%</td>
<td>90.01%</td>
<td>98.10%</td>
</tr>
<tr>
<td>North Eastern</td>
<td>99.98%</td>
<td>31.35%</td>
<td>80.22%</td>
<td>33.12%</td>
<td>46.70%</td>
<td>0.24%</td>
<td>11.96%</td>
<td>92.99%</td>
<td>91.68%</td>
<td>10.90%</td>
<td>95.05%</td>
<td>96.66%</td>
</tr>
<tr>
<td>Nyanza</td>
<td>97.97%</td>
<td>79.84%</td>
<td>69.92%</td>
<td>98.68%</td>
<td>53.80%</td>
<td>75.16%</td>
<td>37.27%</td>
<td>79.52%</td>
<td>79.06%</td>
<td>87.16%</td>
<td>87.96%</td>
<td>99.03%</td>
</tr>
<tr>
<td>Rift Valley</td>
<td>98.41%</td>
<td>68.32%</td>
<td>79.71%</td>
<td>94.97%</td>
<td>65.54%</td>
<td>19.38%</td>
<td>35.99%</td>
<td>92.41%</td>
<td>92.04%</td>
<td>63.49%</td>
<td>93.53%</td>
<td>98.76%</td>
</tr>
<tr>
<td>Western</td>
<td>98.17%</td>
<td>80.27%</td>
<td>74.80%</td>
<td>98.39%</td>
<td>60.20%</td>
<td>71.44%</td>
<td>32.46%</td>
<td>84.30%</td>
<td>83.65%</td>
<td>82.12%</td>
<td>90.44%</td>
<td>98.70%</td>
</tr>
</tbody>
</table>
A look at overall poverty status and household food consumption in the table below shows that consumption of animal source foods is low amongst poor households. Only 38.7 percent of households which are poor consume meats, offal and poultry compared to 74.3 percent of non-poor households who consume from the same food group. A small proportion of poor households consume eggs (18.2 percent), compared to 45.6 percent of non-poor households which consume from the same group. Animal source foods such as meat, chicken, fish and seafood are relatively more expensive than cereals and vegetables and since poor households are characterised by poor socio-economic status their ability to purchase and consume from the more expensive food groups is inhibited. Fish and seafood appears to be scarce, with results revealing low consumption for both poor and non-poor households: 33.4 percent and 35.4 percent respectively. A possible explanation for this could be the lack of access to the food group which is mostly found at the coastline in the Coast province, or in areas situated around lakes such as Lake Victoria in Nyanza province. Amongst poor households, the most consumed food groups include cereals, and spices and beverages, while the least consumed is eggs. The inclusion of sugars and honey in a diet indicates a change in a household’s socio-economic status since its shows the ability of a household to access or purchase food (Swindale & Bilinsky, 2006). The difference in the percentage of poor and non-poor households which consume from the sugars and honey, and the spices food group is however small. This could be possibly due to the fact that the two food groups are comprised of items that are long-lasting. Reports suggest that many Kenyan households purchase goods in bulk and consume them for long periods (KNBS, 2007); hence the availability of sugars and spices in both poor and non-poor households. The differences in food groups’ consumption across the overall poverty status are statistically significant at the 95 percent confidence interval.
Table 7: Food groups by overall poverty status

<table>
<thead>
<tr>
<th>Food Groups</th>
<th>Overall Poverty Status</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Poor</td>
</tr>
<tr>
<td>Cereals</td>
<td>97.24%</td>
</tr>
<tr>
<td>Roots and tubers</td>
<td>62.44%</td>
</tr>
<tr>
<td>Pulses</td>
<td>72.33%</td>
</tr>
<tr>
<td>Vegetables</td>
<td>89.70%</td>
</tr>
<tr>
<td>Meats, poultry and offal</td>
<td>38.67%</td>
</tr>
<tr>
<td>Fish and seafood</td>
<td>33.43%</td>
</tr>
<tr>
<td>Eggs</td>
<td>18.23%</td>
</tr>
<tr>
<td>Milk and milk products</td>
<td>76.26%</td>
</tr>
<tr>
<td>Oils and Fats</td>
<td>89.38%</td>
</tr>
<tr>
<td>Fruits</td>
<td>60.26%</td>
</tr>
<tr>
<td>Sugars and honey</td>
<td>86.19%</td>
</tr>
<tr>
<td>Spices, beverages and other miscellaneous</td>
<td>97.64%</td>
</tr>
</tbody>
</table>

4.3.2 Household Dietary Diversity Score

Figure 8 below shows the distribution of households based on Household Dietary Diversity Score (HDDS), which is the summation of scores of the 12 possible food groups that a household can consume from. Food groups from which households consume are given a score of 1, and the HDDS is then calculated as the sum of all the food groups with the scores of 1. As shown below, out of the 13,158 households, less than 1 percent consume from one food group while 22.3 percent consume from 10 different groups. Approximately 9 percent of the households consume from all the 12 food groups.
Swindale & Bilinsky (2006) recommend that the HDDS targets be set based on the average dietary diversity of the 33 percent of the households with the highest diversity. The group with high dietary diversity represents the group with a score that is equal to or greater than the average HDDS for 33 percent of the households with the highest dietary diversity (upper tercile of dietary diversity). Based on this, the mean HDDS for 33 percent of the households with highest dietary diversity is 10.74. For the purposes of this study, the HDDS will be divided into three groups: low, medium and high dietary diversity. Table 8 displays the distribution of households based on these three groupings. Out of the 13,158 households, 54.0 percent of the households consume diets that are of medium dietary diversity, while only 29.4 percent consume highly diversified diets.

Table 8: Dietary diversity groups by number of households

<table>
<thead>
<tr>
<th>Dietary Diversity</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Diet Diversity</td>
<td>16.63</td>
</tr>
<tr>
<td>Medium diet diversity</td>
<td>54.00</td>
</tr>
<tr>
<td>High diet diversity</td>
<td>29.37</td>
</tr>
</tbody>
</table>
An analysis of dietary diversity groupings against households’ areas of residence reveals the results shown in the table below, which are statistically significant at the 95 percent confidence interval. Urban households appear to have higher dietary diversity compared to rural ones. Of the households that reside in urban areas, 45.0 percent consume foods with high dietary diversity, more than 4 times those whose consumption is composed of low dietary diversity in the same area. Compared to urban areas, only 24.1 percent of households in rural areas consume foods with high dietary diversity. More households in rural areas (18.9 percent) than in urban areas (10.1 percent) consume foods low in dietary diversity. Food variety is normally greater in urban areas than in rural ones, due to the vast supply of food markets and the ease of accessibility (FAO, 2007).

Table 9: Dietary diversity by households' areas of residence

<table>
<thead>
<tr>
<th>Dietary Diversity</th>
<th>Rural Households</th>
<th>Urban Households</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low dietary diversity</td>
<td>18.87%</td>
<td>10.08%</td>
</tr>
<tr>
<td>Medium dietary diversity</td>
<td>57.08%</td>
<td>45.02%</td>
</tr>
<tr>
<td>High dietary diversity</td>
<td>24.05%</td>
<td>44.91%</td>
</tr>
</tbody>
</table>

Pearson ch2(2) = 748.5318 Pr = 0.000

Poor households are usually characterised by lack of food access. In most cases, where food is available, it is often monotonous and lacks proper dietary composition. This is illustrated in the graph below which shows that poor households consume foods low in dietary diversity. Of the households that consume foods low in dietary diversity, 70.2 percent are poor while only 14.7 percent of households who consume foods with high dietary diversity are classified as poor. A chi-square test confirms that the differences in dietary diversity levels across the different poverty status are statistically significant at the 95 percent confidence interval.
Figure 9: Dietary diversity groups by overall poverty status

Pearson chi2 (2) =1.9e+03  Pr = 0.000

Figures 10 and 11 below display positively sloped trend lines, indicating a rise in HDDS with increase in income\(^9\). The horizontal straight lines cutting through the trend lines represent the respective overall poverty lines. The figures show that higher household incomes are associated with higher HDDS, in both urban and rural areas. In both cases, HDDS appear to rise with every increase in the household income, even before households attain the point where the overall poverty lines cross the trend lines.

\(^9\) The horizontal axis represents income which is expressed in logarithm form.
Figure 10: HDDS and household income (urban areas)

Figure 11: HDDS and household income (rural areas)
4.4 Child Demographics and Characteristics

The total number of children aged 60 months and below is 11,461. The figure below shows the distribution of the children by gender. The number of males is slightly higher than that of females, with the former constituting 50.8 percent and the latter 49.2 percent. The figure also shows that there are more males than females in all age groups except 12-23 and 48-60 where female population is slightly higher than that of males.

![Figure 12: Population pyramid](image)

More children live in rural areas than in urban ones; 85.1 percent of children live in households located in the rural areas, while only 14.9 percent live in households that belong to locations classified as urban.

<table>
<thead>
<tr>
<th>Area of residence</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rural</td>
<td>85.14</td>
</tr>
<tr>
<td>Urban</td>
<td>14.86</td>
</tr>
</tbody>
</table>

A look at the distribution of children across provinces displays the results in figure 13 below. Rift Valley, the largest province in Kenya, has the highest percentage of children, standing at 27.3 percent. This is followed by Eastern at 15.8 percent. On the other hand, Nairobi, the smallest province in size, has the lowest percentage of children aged less than 5 years (4.9 percent).

---

10 For the purposes of this study, “child” will refer to a child who is aged 5 years and below.
4.5 Child Malnutrition

The kennel density graph below shows the distribution of the height-for-age, the weight-for-age and the weight-for-height Z scores. The mean HAZ, WAZ and WHZ scores are -1.64, -0.91, and 0.092 respectively. The HAZ mean is lowest, a sign that there are more children who have low height for age, than there are those who have low WAZ and WHZ. The peak of HAZ is lower and to the left of the WAZ and WHZ peaks, which suggests that more children had poorer heights-for-ages as compared to the other two anthropometric indices. The WHZ peak is tilted to the right of the HAZ and WAZ peaks, showing that fewer children have low weights-for-heights as compared to ones who have low HAZ and WAZ.
The mean HAZ for females is -1.4 while that of males is -1.7; showing that females are taller for their age as compared to their male counterparts. The mean WAZ for females is -0.8 and that of males -1.0. Results from the study also show that the mean WHZ for females is higher than that of males; with females recording a mean 0.1 and males -0.01. A t-test carried out shows that the difference in the means of the two groups (females and males) for HAZ and WAZ is statistically significant. The above results show that the means of females is higher than that of males for all the three categories of Z scores; an indication that females record better anthropometric measurements than their male counterparts.

4.5.1 Prevalence of Stunting, Wasting and Underweight

4.5.1.1 Stunting

Children whose HAZ fall below the minus two standard deviations (-2 SD) from the WHO median of the reference population are considered to have low height-for-age or stunted. From the table below, it is clear that the rates of stunting among children under the age of five are high in Kenya. 2,963 children are stunted representing 43.5 percent of the population.
A child who’s HAZ score falls below the -3 WHO median of the reference population threshold are classified as severely stunted. 1,533 (21.42 percent) of the children are severely stunted.

4.5.1.2 Wasting

A child whose WHZ falls below the minus two standard deviation (-2 SD) from the WHO median of the reference population is considered to be wasted. The rates of wasting among children are not as high as those of stunting. The number of children who have low weight-for-height is 473 (6.5 percent).

Table 12: Prevalence of wasting in children under five years

<table>
<thead>
<tr>
<th>Wasting</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wasted</td>
<td>6.51</td>
</tr>
<tr>
<td>Not wasted</td>
<td>93.49</td>
</tr>
</tbody>
</table>

Approximately 2 percent of the children have WHZ z-scores which are below -3 WHO median of the reference population and are therefore classified as severely wasted.

4.5.1.3 Underweight

A child is categorised as underweight if their WAZ is below minus two standard deviation (-2 SD) from the WHO median of the reference population. As demonstrated in the table below, 19.1 percent of the children are too light for their age.

Table 13: Prevalence of underweight in children under five years

<table>
<thead>
<tr>
<th>Underweight</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underweight</td>
<td>19.05</td>
</tr>
<tr>
<td>Not Underweight</td>
<td>80.95</td>
</tr>
</tbody>
</table>
Children whose weight-for-age fall below the minus three standard deviations (-3 SD) from the WHO median of the reference population are considered severely malnourished. The proportion of children who are severely malnourished (WAZ<-3) is 5.7 percent.

4.5.2 Percentage of Children Suffering from more than one form of Malnutrition

The proportion of children who are stunted is 43.5 percent while those who are wasted and underweight are 6.5 percent and 19.1 percent respectively. Stunting is the highest form of malnutrition followed by underweight. The prevalence of wasting is not as high as that of stunting and underweight. Other studies (Smuts et.al, 2008; Ekesa, Blomme & Garming, 2011) have also found stunting to be the most common form of malnutrition, and wasting the lowest. A child can suffer from multiple problems of malnutrition. Each indicator can overlap the other; stunted children can experience wasting or underweight, while some children can experience all the three forms of malnutrition (Nandy & Miranda, 2008). Nandy and Miranda (2008) also argue that the use of each of the above indicators separately does not adequately reflect the overall burden of malnutrition, and suggest the use of a composite index of anthropometric failure (CIAF) that takes into account the three forms of malnutrition. The figure below shows the proportion of children affected by more than one form of malnutrition at the same time. Less than 2 percent of the children are both stunted and wasted, while 14.5 percent are stunted and underweight.

Figure 15: Proportion of children suffering from more than one form of malnutrition
4.5.3 Child Malnutrition and Gender

As already suggested, poor anthropometry appears to be more prominent among male children. This is further elaborated by the figure 16 which shows the malnutrition rates against the gender of a child. In all forms of malnutrition, there are higher numbers of male children affected compared to the female ones. The proportion of females who are stunted (44.9 percent) is less than those of males who suffer from the same problem (55.1 percent). A chi-square test reveals that the differences in malnutrition across sex are significant at the 95 percent confidence interval.

Figure 16: Prevalence of stunting, wasting and underweight by gender

![Bar chart showing prevalence by gender]

Stunting: Pearson chi2(1) = 30.8669 Pr=0.000
Wasting: Pearson chi2(1) = 9.2864 Pr =0.002
Underweight: Pearson chi2(1) = 32.5454 Pr =0.000

The above results are similar to past research which has shown that malnutrition is more pronounced in male children than in female ones. An analysis of Kenya Demographic and Health Survey (1998 to 2003) found that male children were more likely to suffer from malnutrition than females (Ndeng’e, 2005). Results from Democratic Republic of Congo also show that male children have higher rates of stunting, wasting and underweight, as compared to females (Ekesa, Blomme & Garming, 2011).

4.5.4 Prevalence of Stunting, Wasting, Underweight by Area of Residence

Figure 17 below presents an analysis of child malnutrition by area of residence. Stunting, wasting and underweight are higher in rural areas than in urban areas. A chi-square test
reveals that the differences in stunting and underweight across the two areas of residence are statistically significant at the 95 percent confidence interval. Rural areas are normally characterised by poor economic and social infrastructure, including lack of access to health and education facilities. Standards of living are also generally lower in rural areas. Past research show that rural areas in Africa are characterised by low school enrolment rates, higher infant mortality rates and low proportion of births attended by skilled health professionals (Sahn & Stifel, 2002).

**Figure 17: Prevalence of stunting, wasting, underweight by area of residence**

![Figure 17: Prevalence of stunting, wasting, underweight by area of residence](image)

<table>
<thead>
<tr>
<th>Condition</th>
<th>Test</th>
<th>Value</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stunting</td>
<td>Pearson</td>
<td>$\chi^2(1) = 82.9650$</td>
<td>$P = 0.000$</td>
</tr>
<tr>
<td>Wasting</td>
<td>Pearson</td>
<td>$\chi^2(1) = 1.8546$</td>
<td>$P = 0.173$</td>
</tr>
<tr>
<td>Underweight</td>
<td>Pearson</td>
<td>$\chi^2(1) = 44.1216$</td>
<td>$P = 0.000$</td>
</tr>
</tbody>
</table>

An examination of malnutrition by province shows that stunting is highest in Eastern and North Eastern provinces of Kenya with each recording 53.8 percent and 48.1 percent prevalence. The high rates of malnutrition in the Eastern province can be explained by the high levels of food insecurity and low production of food caused by persistent droughts and fuelled by an erratic climate and unreliable rainfall (Odumbe, 2007). The province is also largely rural and is characterised by scarce water resources which are also inadequate and unsafe resulting in proliferation of water borne diseases (Odumbe, 2007). Poverty is also widespread, and the presence of poorly developed food markets with high and unpredictable food prices appear to worsen the situation (Odumbe, 2007). Wasting is highest in North Eastern province and lowest in Central. The high prevalence of wasting in North Eastern Kenya (22.5 percent) can be attributed to the droughts that hit the area from 2004 (KNBS, 2007), and resulted in high livestock mortality rates and loss of livelihoods (Grobler-Tanner, 2007). North Eastern also records a high prevalence of underweight (26.6 percent). In
addition to lack of food access, northern Kenya is also characterised by poor child feeding practices, poor access to public health, lack of access to safe water, poor sanitation and low literacy rates among women (Grobler-Tanner, 2007). Previous results also show that households in the province record the lowest rates of consumption across majority of the food groups (see 4.3.1) and majority of households do not have access to safe drinking water (see 4.2.4). Nairobi, an urban area, has the lowest prevalence of stunting and underweight.

**Table 14: Prevalence of stunting, wasting, underweight by province**

<table>
<thead>
<tr>
<th>Province</th>
<th>Stunting</th>
<th>Wasting</th>
<th>Underweight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nairobi</td>
<td>32.98%</td>
<td>3.48%</td>
<td>11.66%</td>
</tr>
<tr>
<td>Central</td>
<td>40.71%</td>
<td>2.78%</td>
<td>12.59%</td>
</tr>
<tr>
<td>Coast</td>
<td>45.86%</td>
<td>5.16%</td>
<td>20.87%</td>
</tr>
<tr>
<td>Eastern</td>
<td>53.77%</td>
<td>8.9%</td>
<td>28.19%</td>
</tr>
<tr>
<td>North Eastern</td>
<td>48.09%</td>
<td>22.5%</td>
<td>26.62%</td>
</tr>
<tr>
<td>Nyanza</td>
<td>43.66%</td>
<td>7.66%</td>
<td>14.05%</td>
</tr>
<tr>
<td>Rift valley</td>
<td>40.02%</td>
<td>7.12%</td>
<td>18.49%</td>
</tr>
<tr>
<td>Western</td>
<td>40.12%</td>
<td>3.26%</td>
<td>17.56%</td>
</tr>
</tbody>
</table>

### 4.5.5 Prevalence of Stunting, Wasting and Underweight by Age Groups

The table below shows the prevalence of stunting, wasting and underweight across different age groups. There are no malnutrition rates for children aged 0 to 5 months because they were not included in the anthropometric measurements during the survey. Stunting and underweight rates appear to be lowest for those children aged between 6 and 11 months, but increase in the second year of life. Stunting rates increase by more than 18 percent amongst children from the first year to the second year of life, and increase by almost 4 percent in the case of underweight. Wasting is prominent amongst those aged between 6 and 11 months, perhaps due to the possible introduction of solid foods into a child’s diet that may not meet the nutritional requirements. The age group 48-60 seems to record the highest percentage of underweight children (21.4 percent). Generally, malnutrition rates appear to be higher with older children. These results are similar to previous studies which have shown that malnutrition is more pronounced among older children. In a study of the socio-demographic profiles and anthropometric status of 0 to 71 month children in the Eastern Cape and KwaZulu-Natal provinces of South Africa, Smuts et.al (2008) found that malnutrition prevalence increased by almost double from the first to the second year of life, possibly due to the introduction of family diets to children as they are weaned.
Table 15: Rates of stunting, wasting, underweight by age groups

<table>
<thead>
<tr>
<th>Age Groups</th>
<th>Stunting</th>
<th>Wasting</th>
<th>Underweight</th>
</tr>
</thead>
<tbody>
<tr>
<td>6-11</td>
<td>30.61%</td>
<td>8.33%</td>
<td>14.33%</td>
</tr>
<tr>
<td>12-23</td>
<td>48.98%</td>
<td>7.00%</td>
<td>18.29%</td>
</tr>
<tr>
<td>24-35</td>
<td>45.85%</td>
<td>6.33%</td>
<td>20.44%</td>
</tr>
<tr>
<td>36-47</td>
<td>46.30%</td>
<td>6.06%</td>
<td>18.09%</td>
</tr>
<tr>
<td>48-60</td>
<td>38.39%</td>
<td>5.99%</td>
<td>21.38%</td>
</tr>
</tbody>
</table>

4.5.6 Child Malnutrition Status by Diarrhoea

Diarrhoea has been identified as one of the risk factors associated with child malnutrition and causes child mortality. Previous studies have shown that diarrhoea is a serious health problem and one of the leading causes of under-five mortality (Schoeman et.al, 2010). The results presented below show that in Kenya, 1,023 (11 percent) children were reported to have had diarrhoea 2 weeks prior to the survey interview.

Figure 18: Proportion of children under 5 who suffered from diarrhoea 2 weeks prior to interview

Figure 19 displays the proportion of children who had diarrhoea and are also malnourished. Of the 628 of the children who had diarrhoea and are malnourished, 52.1 percent of them are stunted, while the proportion of those who are wasted and underweight is 6.4 percent and 24.8 percent respectively. The fraction of children who were stunted and had diarrhoea is highest, followed by those who are underweight. As shown below, a chi-square test run reveals that the results are statistically significant at the 95 percent confidence interval.
4.5.7 Child Malnutrition by Poverty Status

The proportion of children who are stunted, wasted and underweight is higher amongst poor households compared to those that are non-poor, based on both the overall and food poverty lines. This is illustrated in the figures below which shows the different rates of malnutrition against the poverty status of a household. A chi-square test confirms that all the results are statistically significant at the 95 percent confidence interval. With the overall poverty line, stunting prevalence is higher amongst poor households at 59.4 percent. The same pattern repeats itself with wasting and underweight, with the fraction of those in poor households being 59.2 percent and 64.6 percent respectively compared to those in non-poor households (40.8 percent and 35.4 percent respectively). However, the fractions of children who suffer from malnutrition and belong to poor households reduce in the case of food poverty. Generally, poor households are often unable to afford the necessary nutrient requirements and provide the care and support needed to ensure that children are not malnourished; this could account for the high rates of malnutrition amongst the poor. Previous analysis on household dietary diversity shows that a small percentage of poor households consume highly diversified diets (see 4.3.2). The results displayed below are statistically significant at the 95 percent confidence interval.
Figure 20: Child malnutrition by overall poverty status

![Figure 20: Child malnutrition by overall poverty status](image)

Stunting: Pearson chi2(1) = 55.5172, Pr = 0.000  
Wasting: Pearson chi2(1) = 17.5560, Pr = 0.000  
Underweight: Pearson chi2(1) = 84.4211, Pr = 0.000

Figure 21: Child malnutrition by food poverty status

![Figure 21: Child malnutrition by food poverty status](image)

Stunting: Pearson chi2(1) = 21.5619, Pr = 0.000  
Wasting: Pearson chi2(1) = 27.6339, Pr = 0.000  
Underweight: Pearson chi2(1) = 40.8121, Pr = 0.000
4.5.8 Child Malnutrition by Household Dietary Diversity Score (HDDS)

The rates of malnutrition are higher for those households with low dietary diversity scores, as compared to those who have high dietary scores. Stunting, wasting and underweight rates for those with low dietary diversity are 50.2 percent, 10.9 percent and 26.9 percent respectively, while the rates for those with high dietary diversity scores are 37.9 percent, 5.8 percent and 16.3 percent respectively. The prevalence of stunting, wasting and underweight appear to reduce with increase in the household dietary diversity level. As shown below, these differences in malnutrition rates across dietary diversity levels are statistically significant at the 95 percent confidence interval. High rates of malnutrition are associated with poor households (see 4.5.7). Similarly, poor households are characterised by low dietary diversity; 70.5 percent of households that consume low dietary diversity are poor (see 4.3.2). All these are possible contributing factors to the high fraction of malnourished children whose households consume foods low in dietary diversity.

Figure 22: Malnutrition prevalence by household dietary diversity levels

<table>
<thead>
<tr>
<th>Dietary Diversity</th>
<th>Stunted (%)</th>
<th>Wasted (%)</th>
<th>Underweight (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>50.17</td>
<td>10.93</td>
<td>26.85</td>
</tr>
<tr>
<td>Medium</td>
<td>44.18</td>
<td>5.47</td>
<td>17.86</td>
</tr>
<tr>
<td>High</td>
<td>37.91</td>
<td>5.81</td>
<td>16.28</td>
</tr>
</tbody>
</table>

Low dietary diversity: Pearson chi2(2) = 36.8996  Pr =0.000
Medium dietary diversity: Pearson chi2(2) = 76.2539  Pr =0.000
High dietary diversity: Pearson chi2(2) = 88.0720  Pr =0.000
4.6 Bivariate Analysis

4.6.1 Household Dietary Diversity and Food Expenditure

A pairwise correlation indicates that dietary diversity has a moderately strong positive correlation with household food expenditure. The relationship is significant at the 95 percent confidence interval. This shows that households that have high food expenditures are likely to consume more diverse diets. Dietary diversity has a low positive but significant correlation with household income of 0.2, an indication that households with increasing incomes also display increasing household dietary diversity scores and signifying that the households are able to allocate more of their expenditure to foods that are more diverse in nature. These results are similar to past findings obtained in Bangladesh which found a strong correlation between dietary diversity and per capita total food expenditure (Throne-Lyman et al., 2010).

<table>
<thead>
<tr>
<th>Correlation coefficient</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total food expenditure</td>
<td>0.4164</td>
</tr>
<tr>
<td>Household income</td>
<td>0.2498</td>
</tr>
</tbody>
</table>

4.6.2 Correlations between Malnutrition Rates and Other Risk Factors

4.6.2.1 Height-for-age (HAZ)

HAZ displays a positive and significant association with household dietary diversity scores and the average years of schooling for all females in a household; an indication that households with increasing HDDS scores and education years for females have children who display higher height-for-age scores. Household size and the age of the child have an inverse association with HAZ. The table below shows that households with increasing sizes display decreasing HAZ scores, while older children display lower HAZ scores. This is synonymous with earlier analysis on malnutrition and age, which showed that prevalence of stunting, wasting and underweight, was highest amongst older children (see 4.5.5).

<table>
<thead>
<tr>
<th>Correlation coefficient</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>HDDS</td>
<td>0.0638</td>
</tr>
<tr>
<td>Education (females)</td>
<td>0.0662</td>
</tr>
<tr>
<td>Household size</td>
<td>-0.0401</td>
</tr>
<tr>
<td>Age of child in months</td>
<td>-0.0473</td>
</tr>
</tbody>
</table>
4.6.2.2 Weight-for-height (WHZ)

An analysis presented below shows low, positive but significant associations between HDDS and education (average years of schooling for all females), a sign that households with high HDDS and increasing education years also display higher WHZ scores. Just like HAZ, WHZ scores have a negative but significant relationship with the size of the household and the age of the child. This shows that households with increasing sizes and whose children are older display lower WHZ scores. Previous analysis shows that the prevalence of wasting was high among older children (see 4.5.5).

<table>
<thead>
<tr>
<th></th>
<th>Correlation coefficient</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>HDDS</td>
<td>0.1170</td>
<td>0.0000</td>
</tr>
<tr>
<td>Education (females)</td>
<td>0.0650</td>
<td>0.0000</td>
</tr>
<tr>
<td>Household size</td>
<td>-0.0501</td>
<td>0.0000</td>
</tr>
<tr>
<td>Age of child in months</td>
<td>-0.0585</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

4.6.2.3 Weight-for-age (WAZ)

Weight-for-age Z scores appear to increase with an increase in the HDDS and the number of years of education. This is evident from the table below which shows the correlation results; all of which are significant. However, the household size and age of the child have negative association with the WAZ; an indication that the Z scores decrease with increase in the size of the household and with the age of the child. The positive association between HDDS and WAZ is similar to other studies in Burundi which found a positive association between WAZ and dietary diversity (Ekesa, Bloome & Garming, 2011).

<table>
<thead>
<tr>
<th></th>
<th>Correlation coefficient</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>HDDS</td>
<td>0.1622</td>
<td>0.0000</td>
</tr>
<tr>
<td>Education (females)</td>
<td>0.1135</td>
<td>0.0000</td>
</tr>
<tr>
<td>Household size</td>
<td>-0.0848</td>
<td>0.0000</td>
</tr>
<tr>
<td>Age of child in months</td>
<td>-0.1379</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

4.7 Multivariate Analysis

This section presents the results of multivariate analysis carried out. Linear regressions are used to explain the relationship between HAZ, WHZ and WAZ, and household dietary diversity. Logistic regressions results are also carried out to explain the relationship between
the three indicators of malnutrition—stunting, wasting and underweight—and HDDS. The multivariate analysis is based on the model shown in chapter three, where dietary diversity is included as one of the household characteristics that influence the well-being of children. As was evident in the literature review, other risk factors such as age and sex of the child, education, household size, residence area, diarrhoea and income have also been associated with poor anthropometry. Consequently, the multivariate analysis in this section will also include them in the model.

4.7.1 Ordinary Least Square Regression

4.7.1.1 Height-for-age (HAZ)

The results of the linear regression model with HAZ as the dependent variable are shown in the table below. The model has an F statistic of 24.8, and is statistically significant as a whole showing that the independent variables explain the dependent one better than a flat line. The r-squared is 0.05 percent, which indicates that the independent variables in the model explain 5 percent of the variation of the dependent variable holding all other variables in the regression constant. Focusing first on the independent variable of interest; an increase in HDDS by 1 percent results in a predicted increase in HAZ by 1.8 percent. However, the effect of HDDS on HAZ is not statistically significant at the 95 percent confidence interval. Except for HDDS and education, all other variables are statistically significant at the 95 percent confidence interval. Household size has a negative association with HAZ, signifying that an increase in the size of a household by 1 percent results in a predicted decrease in HAZ by 2.9 percent. The results also show a positive relationship between HAZ and the area of residence, which has a coefficient of 0.5. This implies that children living in households located in urban areas have 0.5 times higher HAZ than those living in rural areas. Empirical results suggest that HAZ is lower in older children. An increase in the age of the child by 1 percent causes a predicted decrease of HAZ by 0.7 percent, an indication that older children display lower Z scores. In the case of diarrhoea, children who did not have any diarrhoea two weeks prior to the interview have on average 0.4 times higher Z scores than those who did. Z scores appear to be lower for male children. This is indicated by the results which show that male children have on average 0.3 times less Z scores than their female counterparts. HAZ appears to increase as households move into higher income groups. The results displayed in the table below indicate that a movement of a household from a lower income group to a
higher one, there is a predicted increase in the HAZ of a child living in that household by 16.1 percent.

Table 20: Linear regression results (HAZ)

| Variable                           | Coefficient | Robust Std. Err. | t     | P>|t|   |
|------------------------------------|-------------|------------------|-------|-------|
| Household Dietary Diversity Score (HDDS) | 0.0177392   | .0199721         | 0.89  | 0.374 |
| Education (females)                | 0.0158212   | .0097459         | 1.62  | 0.105 |
| Household Size                     | -0.0285766  | .0096033         | -2.98 | 0.003 |
| Area of residence (0=rural, 1=urban)| 0.4542831   | .0848004         | 5.36  | 0.000 |
| Age of child (months)              | -0.0068631  | .0018813         | -3.65 | 0.000 |
| Diarrhoea (0=yes, 1=no)            | 0.415929    | .0917108         | 4.54  | 0.000 |
| Gender (0= female, 1=male)         | -0.2713138  | .0570812         | -4.75 | 0.000 |
| Household income (5 deciles)       | 0.1609923   | .0273219         | 5.89  | 0.000 |

Number of observations=6,860
F (8, 6865)= 24.80
Prob>F=0.0000
R squared=0.0487

4.7.1.2 Weight-for-Height (WHZ)

Table 21 displays the results of the linear regression on WHZ and HDDS. The model as a whole is statistically significant, with an F statistic of 3.9 and the R2 shows that this model to predict a larger share of the variation in the dependent variable. As in the case of HAZ, the effect of HDDS on WHZ is not statistically significant at the 95 percent confidence interval; though the results show that an increase in the dietary diversity score by 1 percent results in a predicted increase of WHZ by 1.7 percent. Empirical results from the survey also show that household size has a negative association with WHZ which is statistically significant at 95 percent confidence interval. For every increase in household size by one, there is a predicted decrease of WHZ score by 2.2 percent. The outcomes also show that an increase in the age of child by 1 percent results in a predicted decrease of WHZ scores by 0.5 percent, an indication than older children are more likely to display lower Z scores than younger ones.
As in the case of HAZ, children living in households with higher incomes have better WHZ scores than those whose incomes are on the lower side. This is depicted in the table below which shows that for every movement of a household from a lower income group to a higher one, there is a predicted increase in the WHZ of a child living in that household by 4.7 percent.

Table 21: Linear regression results (WHZ)

| Variable                                      | Coefficient | Robust Std. Err. | t    | P>|t| |
|------------------------------------------------|-------------|------------------|------|-----|
| Household Dietary Diversity Score (HDDS)       | 0.0172058   | .0150912         | 1.14 | 0.254 |
| Education (females)                            | 0.0117865   | .0080187         | 1.47 | 0.142 |
| Household Size                                 | -0.022752   | .0076617         | -2.97| 0.003 |
| Area of residence (0=rural, 1=urban)           | -0.0535206  | .0736839         | -0.73| 0.468 |
| Age of child (months)                          | -0.0044765  | .0016516         | -2.71| 0.007 |
| Diarrhoea (0=yes, 1=no)                        | -0.0240094  | .0677762         | -0.35| 0.723 |
| Gender (0= female, 1=male)                     | -0.0491412  | .0462123         | -1.06| 0.288 |
| Household income (5 deciles)                   | 0.0472091   | .0218828         | 2.16 | 0.031 |

Number of observations= 6829
F (8, 6865)= 3.94
Prob>F=0.0001
R squared=0.0093

4.7.1.3 Weight-for-Age (WAZ)

A linear regression of WAZ and other independent variables reveals the results below. The model as a whole has an F statistic of 34.4 and is statistically significant at the 95 percent confident interval. The r-squared is 0.7 showing that the independent variables in the model explain 7 percent of the variation in WAZ. All the independent variables results are statistically significant at the 95 percent confidence interval. There is a positive relationship between WAZ and HDDS, showing that WAZ increases with the increase in the household dietary diversity score. For every 1 percent increase in HDDS, there is a predicted increase of WAZ by 4.1 percent. In the case of education, an additional year of schooling results in a predicted increase of WAZ by 2.4 percent. A similar pattern is seen in the case of household size, where an increase in the size of a household by one member results in a predicted
decrease of WAZ for a child living in that household by 3.5 percent. Children living in urban areas appear to have higher Z scores compared to those living in rural ones. Results illustrated in the table below show that on average children living in urban areas have Z scores that are 0.2 times higher than those living in rural areas.

Older children display lower weight-for-age Z scores. This is evident from the table below which shows that an increase in the age of a child by 1 percent results in a predicted decrease of WAZ by 1.2 percent. In the case of diarrhoea, children who do not have diarrhoea have 0.3 times higher WAZ than those who have. Similarly male children have Z scores which are 0.2 times lower than those of their female counterparts, indicating that male children are more at risk of malnourishment. As in the case of HAZ and WHZ, a household belonging to a higher income group is likely to have better WHZ. Results illustrated below show that the movement of a household from a lower income group to a higher one results in a predicted increase in WHZ of 11.1 percent for a child living in that household.

Table 22: Linear regression results (WAZ)

| Variable                          | Coefficient | Robust Std. Err. | t       | P>|t| |
|----------------------------------|-------------|------------------|---------|-----|
| Household Dietary Diversity Score (HDDS) | 0.0409333   | .0138685         | 2.95    | 0.003 |
| Education (females)              | 0.0242746   | .0072344         | 3.36    | 0.001 |
| Household Size                   | -0.0349165  | .0077458         | -4.51   | 0.000 |
| Area of residence (0=rural, 1=urban) | 0.1984621   | .0613116         | 3.24    | 0.001 |
| Age of child (months)            | -0.0122577  | .0014025         | -8.74   | 0.000 |
| Diarrhoea (0=yes, 1=no)          | 0.2638138   | .0678492         | 3.89    | 0.000 |
| Gender (0=female, 1=male)        | -0.1706738  | .0410087         | -4.16   | 0.000 |
| Household income (5 deciles)     | 0.1108188   | .0189776         | 5.84    | 0.000 |

Number of observations= 7281
F (8, 6865)= 34.38
Prob>F=0.0000
R squared=0.0747
4.7.2 Logistic Regression Models

4.7.2.1 Stunting

The table below shows results from a logistic regression of stunting, HDDS and other control variables. The Wald chi-square is 155.5 and the p value is 0.0000, showing that the model as a whole is statistically significant at 5 percent significance level. A likelihood ratio test gives a p value of less than 0.05, showing that the inclusion of HDDS as a predictor model results in a statistically significant improvement in the model. Except for HDDS and the age of the child, all other results are statistically significant at the 95 percent confidence interval. Household dietary diversity score has an odds ratio of close to 1.00, showing that it has no effect on the odds ratio; hence this also explains why it is not significant. Were it significant, then the odds of a child being stunted compared to one who is not would decrease by a factor of 0.99. In the case of education, the odds of a child being stunted decreases by a factor of 0.97 for each increase in school years, showing that higher education years are associated with a reduction in the probability of a child being stunted. In contrast, the odds of a child being stunted increase by a factor of 1.03 for every increase in household size, an indication that large households are associated with increase in the probability of children in that house being stunted.

In the case of area of residence, living in rural areas is associated with stunting. The table shows that the odds of a child being stunted decreases by a factor of 0.66 for a child living in urban areas as compared to one living in a rural area. Similarly, the odds of a child being stunted decreases by a factor of 0.67 for a child who did not have diarrhoea compared to one who did, an indication that a child having diarrhoea increases the risk of that child being stunted.

Male children are more at risk of being stunted. Results displayed in the table below show that the odds of being stunted increase by a factor of 1.38 for a male child as compared to a female one. In the case of income, a higher income group is associated with a decreased risk of a child being stunted. Regression results show that the odds of a child being stunted decreases by 0.82 units with every movement of a household from a lower income group to a higher one.
Table 23: Logistic regression results (Stunting)

| Variable                                           | Coefficient | Std. Err. | Z    | P>|z| |
|----------------------------------------------------|-------------|-----------|------|------|
| Household Dietary Diversity Score (HDDS)           | .9933253    | .0211337  | -0.31| 0.753|
| Education (females)                                | .973856     | .0112014  | -2.30| 0.021|
| Household Size                                     | 1.031087    | .0137153  | 2.30 | 0.021|
| Area of residence (0=rural, 1=urban)               | .6630456    | .0713907  | -3.82| 0.000|
| Age of child (months)                              | 1.001045    | .0022091  | 0.47 | 0.636|
| Diarrhoea (0=yes, 1=no)                            | .6715193    | .0707325  | -3.78| 0.000|
| Gender (0=female, 1=male)                          | 1.375827    | .0928275  | 4.73 | 0.000|
| Household income (5 deciles)                       | .8202801    | .0261399  | -6.22| 0.000|

Number of observations=6,860
Wald chi2 (8)= 155.50
Prob>chi2=0.0000
Pseudo R2=0.0316

Likelihood ratio test:
chi2(2)=627.23279
Prob > chi2=6.28e-137

4.7.2.2 Wasting

Wasting or low height-for-weight is caused by food insecurity, and disease. The table below shows the results from the logistic regression run on wasting as the dependent variable and HDDS as the independent one, together with other control variables. The model as a whole is statistically significant and has a likelihood ratio chi-square of 29.7. Just as in the case of stunting, a likelihood ratio test done to show the impact of including HDDS in the model gives a p value of less than 0.05. Hence the inclusion of HDDS as a predictor model results in a statistically significant improvement in the model. Apart from the HDDS, all other results are not statistically significant.

The results show that an increases of HDDS by a factor of 0.89 reduces the odds of a child being stunted indicating that a more diverse diet is adequate for better nutritional status of a child.
Table 24: Logistic regression results (Wasting)

| Variable                                      | Coefficient | Std. Err. | Z     | P>|z|  |
|-----------------------------------------------|-------------|-----------|-------|------|
| Household Dietary Diversity Score (HDDS)      | .8922556    | .0320078  | -3.18 | 0.001 |
| Education (females)                           | .9982532    | .0225757  | -0.08 | 0.938 |
| Household Size                                | .9977081    | .0271756  | -0.08 | 0.933 |
| Area of residence (0=rural, 1=urban)          | 1.228152    | .2528879  | 1.00  | 0.318 |
| Age of child (months)                         | .9922686    | .0044394  | -1.73 | 0.083 |
| Diarrhoea (0=yes, 1=no)                       | 1.082083    | .1946185  | 0.44  | 0.661 |
| Gender (0= female, 1= male)                   | 1.206777    | .1588178  | 1.43  | 0.153 |
| Household income (5 deciles)                  | .9190096    | .0575504  | -1.35 | 0.177 |

Number of observations= 6,829
Wald chi2 (8)= 29.72
Prob>|chi2|=0.0002
Pseudo R2=0.0133

Likelihood ratio test:
chi2(2)= 16.623282
Prob >chi2= 0.00024564

4.7.2.3 Underweight

Table 25 displays results from a logistic regression. The model is statistically significant with a likelihood ration chi-square of 119.7. Except for education and area of residence, all other results are statistically significant at the 95 percent confidence interval. To determine the effect of including the HDDS in the model, a likelihood ratio test is performed and gives a p value of less than 0.05, showing that the inclusion of HDDS as a predictor model results in a statistically significant improvement in the model.

Higher dietary diversity scores are associated with better nutritional statuses. This is illustrated in the table below which shows that the odds of a child being underweight compared to one who is not reduce by a factor of 0.93 for every increase in HDDS.

Empirical results illustrated in the table below shows that the odds of a child being underweight increase by 1.05 with an increase in household size by one, implying that children living in larger households are more at risk of being underweight compared to their counterparts. Similarly, older children appear to be more at risk of malnutrition compared to
younger ones. Results illustrated below show an increase in age by one month results is associated with an increase in the odds of a child being underweight by a factor of 1.01. Diarrhoea appears to be one of the strong indicators of malnutrition in the model; the odds of a child being underweight reduce by a factor of 0.62 for children who did not suffer from diarrhoea two weeks before the survey. On the contrary, the odds of a child being underweight increase by a factor of 1.29 for male children compared to female ones, signifying that male children are more at risk of being underweight. Just as in the case of stunting, higher income levels are associated with the reduced probability of a child being underweight. As illustrated below, the odds of being underweight reduce by a factor of 0.84 for every movement of a household from a lower income group to a higher one.

Table 25: Logistic regression (Underweight)

| Variable                                      | Coefficient | Std. Err. | Z      | P>|z| |
|-----------------------------------------------|-------------|-----------|--------|-----|
| Household Dietary Diversity Score (HDDS)      | .932325     | .0237901  | -2.75  | 0.006|
| Education (females)                           | .9800243    | .0150237  | -1.32  | 0.188|
| Household Size                                | 1.047235    | .0172065  | 2.81   | 0.005|
| Area of residence (0=rural, 1=urban)          | .7685374    | .1037338  | -1.95  | 0.051|
| Age of child (months)                         | 1.009134    | .0028106  | 3.26   | 0.001|
| Diarrhoea (0=yes, 1=no)                       | .6218881    | .077028   | -3.83  | 0.000|
| Gender (0=female, 1=male)                     | 1.287331    | .1075493  | 3.02   | 0.003|
| Household income (5 deciles)                  | .8370367    | .0339156  | -4.39  | 0.000|

Number of observations=7,281
LR chi2 (8)= 119.67
Prob>chi2=0.0000
Pseudo R2=0.0325
Likelihood ratio test:
chi2(2)= 24.558067
Prob > chi2 = 4.648e-06

4.8 Discussion of Regression Results

4.8.1 Malnutrition and Dietary Diversity

Dietary Diversity is dependent on the socio-economic status of a household. Households with low income levels often display low dietary diversity scores since their food expenditure is
low. Results from bivariate analysis have shown that the HDDS is highly correlated with food expenditure; low food expenditure results in low dietary diversity scores (see 4.6.1). Low food expenditure and household income show patterns of poverty. Descriptive figures also show that poor households have higher rates of stunting; wasting and underweight (see 4.5.7). Poor households are often characterised by low incomes which in turn normally result in low food expenditure. In addition, poor households are also characterised by monotonous diets and consume from fewer food groups. Monotonous diets lack dietary diversity and lack adequate nutrition, and hence this increases the risk of children being malnourished. A diverse diet is thus necessary for the proper growth of a child. Descriptive statistics also show that a high percentage of poor households do not consume animal source foods, which are considered to be rich in nutrient content required for proper growth. Past research has shown that consumption of animal source foods result in better nutritional status of children (Bwibo & Neumann, 2003).

Controlling for the influence of income reveals significant association between some aspects of malnutrition and Household Dietary Diversity Score (HDDS). WAZ scores increase by a factor of 4.1 percent for every increase in HDDS by 1 percent. Interestingly, while a positive relationship was observed between WHZ and HDDS, it was not found to be significant. However, logistic results showed a significant association between HDDS and wasting, with the odds of a child being wasted decreasing with increase in the dietary diversity score. The same was observed in the case of underweight. However, HAZ and stunting were not found to be significantly associated with HDDS. This is probably because low HAZ and stunting that is represents, result from past shocks which take longer to manifest. Hence an analysis based on a one week dietary diversity may not adequately reflect the effects of HDDS on HAZ and stunting. Results from the bivariate analysis found significant associations between HDDS and HAZ, WHZ, and WAZ scores when correlation analysis was carried out (see 4.6.2). This is also clear from the descriptive analysis which showed that malnutrition rates are lower amongst households that have high dietary diversity scores as compared to those who have low dietary diversity scores (see 4.5.8). These results support the hypothesis that a household’s dietary diversity level has an effect on the nutritional status of a child, holding other predictors of child nutritional status constant, including household income. Dietary diversity thus appears to exert an influence on some aspects of child malnutrition than is independent of current household economic status.
Previous studies have found similar results. A study of dietary diversity and child nutritional status in eleven countries in Africa, Asia and Latin America by Arimond & Ruel (2006) found significant associations between HAZ and dietary diversity in seven out of the eleven countries studied. Onyango & Koski (1998) also found positive significant associations between dietary diversity and HAZ, WAZ, and WHZ scores in Western Kenya, with dietary diversity found to be the strongest and most consistent predictor of the anthropometric status of children. Hatloy et.al (1999) found associations between dietary diversity scores, stunting and underweight in Mali, with those children living in households with low dietary diversity being at more than double the risk of being malnourished. Rah et.al (2001) established that lack of dietary diversity was a strong predictor of stunting in rural Bangladesh. However, empirical results from this study did not find such strong associations, perhaps due to the controlling of household income, which as previously discussed is correlated to dietary diversity scores.

4.8.2 Malnutrition and Other Risk Factors

4.8.2.1 Education

Empirical results from the linear and logistic regressions show that malnutrition increase with a reduction in the number of schooling years. Results show that education is positively and significantly associated with WAZ. In the case of logistic regression, a significant relationship was observed between stunting and education, but no significant associations were observed in the case of wasting and underweight. The association observed between stunting, and education shows that lack of or poor education can have a negative effect on the long term nutrition of a child. These results reiterate the role of maternal education in the nutritional status of children. In Kenya, the caretakers of children are mostly females, and range from a child’s mother to other female siblings and members of the household. Well-educated caretakers are better equipped to deal with illnesses when they occur, and are also more informed on the dietary needs of a child. Therefore, it is of paramount importance for caregivers to have adequate knowledge needed to make informed decisions on child growth, nutritional statuses, and more diverse diets.

This result accord with past studies that have shown that maternal education is associated with better nutritional status. A study in the KwaZulu-Natal and Eastern Cape provinces of South Africa found that low maternal education was a determinant of underweight (Lesiapeto
et.al, 2010), with children whose mothers had low education being more at risk of being underweight. Ajao et.al (2010) also found a substantial association between maternal education and stunting in Nigeria, with results showing that educated women were more likely to be knowledgeable about nutrition and child health.

**4.8.2.2 Age of the child**

The likelihood of a child being malnourished appears to rise with an increase in the child’s age. Linear regression results show that there is negative and significant relationship between HAZ, WHZ, and WAZ and the age of the child, with the Z scores decreasing with an increase in the age of the child. Logistic regression results also show that the risk of a child being underweight increases with age. A previous analysis shows that malnutrition rates were higher amongst older children (see 4.5.5). Stunting is highest for children aged 12-23 months, while the age groups recording the highest rates of wasting and underweight are 6-11 and 48-60 respectively. Once again, past studies show similar results. Lesiapeto et.al (2010) found, in KwaZulu-Natal and Eastern Cape provinces in South Africa, that a child is more at risk of being stunted or wasted as they grew older. In Ethiopia, Teshome et.al (2009) found that the highest percentage of children who are stunted were in the second year of life. Similarly, older ages were also found to be associated with stunting and underweight in Zambia (Nzala et.al, 2011).

The high rates of malnutrition amongst older children can be attributed to the introduction of household diets once children attain the six month age bracket and begin to be weaned. At this stage the children are vulnerable to diarrhoea and inappropriate feeding practices (Abalo, 2009), hence increasing the risk of them being malnourished. In addition, households’ diet may not be adequate in energy and protein, which are important for a child’s growth and development (Olack et.al, 2011). The rise in malnutrition could also be as a result of the continued accumulation of deprivation over time, and which ultimately leads to long-lasting malnutrition.

**4.8.2.3 Household size**

Linear regression results show a significant association between household size and HAZ, WHZ and WAZ, with an increase in household size resulting in lower Z scores. This shows that children living in large households are more likely to record poor Z scores compared to those who live in smaller households. Logistical regression results found significant
associations between household size, stunting and underweight, showing that the risk of a child being either stunted or underweight increased if the child belonged to a large household. However, no significant associations were found between wasting and household size. This is similar to past research in Nigeria which found no significant association between family size and poor nutritional status of children (Ajao et al., 2010).

### 4.8.2.4 Residence area

Children living in rural areas are more prone to malnutrition. Linear regression results indicate that children who live in the urban areas have higher HAZ and WAZ compared to their counterparts in the rural areas. Logistical regression results also show a significant relationship between the area of residence, stunting and underweight, with the risk of malnutrition increasing for children who live in rural areas. Research in other countries has found similar results. A study of child malnutrition in urban and rural areas using demographic and health survey data from 36 developing countries (in Asia, sub-Saharan Africa, Latin America, and Caribbean) by Smith, Ruel & Ndiaye (2005) found that child nutritional status was better in urban areas than in the rural ones, with urban areas recording significantly higher HAZ means.

Differentials in child’s nutritional status in the urban and rural areas could be as a result of the inequalities that exist between these two areas. Descriptive results show that the prevalence of poverty is higher in rural areas (see 4.2.2). Rural households are also deprived in many ways, and lack important infrastructure like health and education. Access to safe water is limited (see 4.2.5). In addition, many households in rural Kenya rely on agriculture solely for their livelihoods, growing only a few crops that may not adequately cater for their nutritional requirements. This is illustrated in the descriptive statistics which shows that diets in rural areas are less diverse compared to the ones in the urban areas (see 4.3.2), perhaps because households in urban areas have access to developed food markets through which they can purchase food rich in variety. Earlier analysis also shows that education mean is higher in urban areas (see 4.2.1). According to Smith, Ruel & Ndiaye (2005), women in urban areas are far more likely to be educated as compared to those in the rural areas. Lack of proper education means that mothers and caregivers are not equipped with information that is important for the growth of a child.
4.8.2.5 Child health (diarrhoea)

The relationship between diarrhoea and malnutrition is bidirectional. Diarrhoea and other infections affect the nutritional status of children reducing their dietary intake and depriving them of nutrients essential for growth (Brown, 2003). On the other hand, malnutrition also increases the risk of a child contacting diarrhoea, since the poor nutritional status has a negative impact and weakens the child’s body mechanism, in effect making the child prone to more infections (Brown, 2003). Undernourished children are at a higher risk of severe and frequent bouts of diarrhoea, which worsen nutritional statuses due to decreased food intake, reduced nutrient absorption and increased child’s nutritional requirements during repeated diarrhoeal episodes. The presence of diarrhoea has also been found to reduce a child's caloric intake (Martorell et.al, 1980).

Empirical results from the linear regression indicate a positive and significant relationship between diarrhoeal incidence, and HAZ and WAZ. Children who did not have diarrhoea two weeks prior to the survey record higher HAZ and WAZ scores. Logistic regression results also indicate that the risk of stunting and underweight reduce for those children who did not have diarrhoea two weeks prior to the interview, probably due to the fact that malnourished children are less able to fight off infections. Similar results were observed by Lesiapeto et.al (2010) who found that a child was more likely to be undernourished if they had experienced gastrointestinal symptoms like diarrhoea, partly due to under-nutrition being more prone to gastrointestinal issues due to its sensitivity to existing infections.

4.8.2.6 Gender

Male children are more at risk of malnourishment, and this is evident from linear regression results which show a decrease in Z scores if a child is male. A similar observation was made in logistic regressions which showed an increase in the risk of stunting and underweight if a child is male. These results support the hypothesis that male children are more prone to malnutrition. Descriptive results confirm the regression findings and show that malnutrition rates are more prominent among males compared to their female counterparts. They also show that the mean HAZ, WAZ and WHZ for females are higher than those of males (see 4.5 & 4.5.3).

Similar results have been obtained in other countries. Lesiapeto et.al (2010) found that male children were more likely to be stunted and underweight in KwaZulu Natal and Eastern Cape
provinces of South Africa. Teshome et.al (2009) also made similar observations in Ethiopia, where male children recorded the highest rates of stunting. A study in Zambia by Nzala et.al (2011) attributed the high rates of malnutrition amongst male children to cultural practices that required male toddlers eat with their fathers, which then resulted in fewer meals per day for the children. The same practice is widespread in Kenya and could offer a partial explanation to the high rates of malnutrition among male children.

**4.8.2.7 Household income**

Children who belong to households with low incomes are more at risk of malnutrition. This is shown in the regression results where lower income groups are found to be associated with lower HAZ, WHZ and WAZ. Similarly, stunting and underweight are seen to decrease with every movement of a household from a low income group to a higher one. However, income does not appear to have any significant effect on wasting, possibly due to the fact that wasting is a short term condition and is normally associated with existing child and household conditions.

An increase in income is normally associated with increased food expenditure as households with higher incomes are likely to spend more on food quantity and quality, resulting in consumption of foods rich in dietary diversity. Earlier correlation analysis confirms this and shows that income is positively associated with HDDS (see 4.6.1). By controlling for HDDS, the regression also shows that income has an impact on child malnourishment that is independent of dietary diversity, and by implication, food insecurity. This would be both through the quantity of food consumed, as well as the effect of poor living conditions.

**4.9 Conclusion**

This section presented the results of descriptive statistics, bivariate and multivariate analysis. Evidence points to a high prevalence of malnutrition in the country, and low consumption of highly diversified diets. Only a small fraction of households consume diets that are highly diversified. Results also show that Household Dietary Diversity Score is a significant predictor of child malnutrition, with children living in households with lower HDDS recording lower HAZ, WAZ and WHZ, subsequently increasing the probability of them being stunted, wasted or underweight. Other risk factors associated with poor nutritional statuses were found to be the age of the child, gender, the area of residence, education, diarrhoea, and household size.
CHAPTER FIVE

CONCLUSION, RECOMMENDATIONS AND FUTURE RESEARCH

5.1 Introduction

This chapter presents the general conclusions based on the findings in chapter four and will also give recommendations. Finally, the section will discuss possible areas for future research.

5.2 Conclusion

The main objective of this study was to analyse the relationship between household food security and the anthropometric status of children aged five years and below. Specific objectives were: to identify the prevalence and predictors of poor anthropometric status of children in Kenya, to analyse the extent of food insecurity in Kenya and to investigate the link between food security and the anthropometric status of children in Kenya.

It is against these research objectives that the research was carried, using data from the Kenya Integrated Household Budget Survey (2005/2006). The research shows that the highest form of malnutrition is stunting, with underweight coming in at second place. Wasting is the least common form of malnutrition. The prevalence of stunting (44 percent) is more than double that of underweight (19 percent) and more than six times higher than the occurrence of wasting (7 percent). The prevalence of malnutrition is higher in rural areas than in urban ones. Eastern province, a largely rural province, has the highest prevalence of stunting and underweight while North Eastern the highest incidence of wasting and underweight. Only 29 percent of households consume diets with high dietary diversity. Urban areas were found to have higher dietary diversity when compared to rural areas, with results showing that a high percentage of those who consumed foods with low dietary diversity were from rural areas.

- Household dietary diversity has been found to be positively associated with height-for-age (HAZ), weight-for-age (WAZ) and weight-for-height (WHZ), with an increase in household dietary diversity score causing an increase in the Z scores, a sign that children belonging to households who consume more diverse diets have better anthropometry. Results also showed that the prevalence of stunting, wasting and underweight are lower in households that have high HDDS, as compared to those
who don’t. This effect of HDDS on child malnourishment is independent of the effect of income.

- Empirical results show that older children are more at risk of being malnourished, compared to younger ones. Children aged 6 to 11 months record the lowest forms of malnutrition. However, the prevalence of malnutrition more or less doubled in their second year of life.

- Male children are more prone to malnutrition. This is evident from the research which has shown that male children record the highest rates of malnutrition for stunting, wasting and underweight. Regression results also show that a male child has lower HAZ, WAZ and WHZ, and that the risk of being stunted, wasted or underweight is higher for males.

- Children living in urban households are less likely to be malnourished. Empirical results have shown that children in households that reside in rural areas have low HAZ, WAZ and WHZ as compared to those living in urban households. Stunting, wasting and underweight were also found to be lower in urban areas as compared to rural ones.

- The effects of diarrhoea were evident from the study. Children who had diarrhoea were found to be more at risk of malnutrition. The relationship between diarrhoea and the nutritional status of children is bidirectional; in that diarrhoea is not only a cause of poor anthropometry but is itself also caused by poor anthropometry.

- The study found that education and nutritional status have a positive relationship; higher education results in better nutritional statuses. HAZ and WAZ increased for children living in households that had higher number of years of education for all females. Stunting, wasting and underweight were also found to reduce with increase in the average number of education years for all females in a household.

5.3 Recommendations

5.3.1 Food Security and Dietary Diversity

It is evident that poor dietary diversity is associated with poor nutritional status amongst children, and as this measure is used as an indicator of food insecurity, that food insecurity results in poor child outcomes. Therefore, the introduction of more diverse diets into a household is of paramount importance. Kenyan diets are monotonous, cereal based and unequally distributed within households (Bwibo & Neumann, 2003). Animal source foods
have been found to be the least consumed among households, despite past research showing that children in households consuming animal source foods had better nutritional status, performed better in cognitive tests, and achieved better results in school (Bwibo & Neumann, 2003). There is therefore an urgent need to ensure that households have access to a wide variety of foods. Dietary diversity can be enhanced through even the simplest means which include strengthening of home garden practices. While home gardening has been in the past been practised in some parts of the country, the effect on food security has been minimal partly due to the low yields reported and partly due to neglect of these farms (Musotsi, Sigot & Onyango; 2008). Home gardening can be enhanced through selective crop production that focuses on foods that contribute to the nutritional needs of a household (Smuts et.al, 2008).

Dietary diversity is affected by the access to food. Food policies such as subsidies can have a huge impact on a household’s access to food. It increases the income share of a household, which then allows them to purchase more diversified foods, or allocate the additional income to other important amenities and services such as health services, nutrition, training and education which lead to increased and improved human capital that positively impacts labour productivity, higher incomes and expanded entrepreneurships (Pinstrup-Andersen, 1988).

The nutritional statuses of children appear to worsen as they grow older, possibly due to the increase in the probability of negative things happening to them as they grow older. This occurrence could also be due to the household diets that children are introduced to after weaning, which may not be diverse enough and may lack the essential nutrients needed by a child. The World Health Organisation (WHO) guidelines recommend that children be exclusively breastfed for six months, because the mother’s milk contains all the nutritionally suitable nutrients. Other research also shows that children who are exclusively breastfed for 6 months, are less likely to be malnourished compared to those who are not.

5.3.2 Child Health

Quality health care is important and necessary for the proper growth of a child. The effects of infections such as diarrhoea do not just result in poor anthropometry but can also lead to mortality. Surprisingly, diarrhoea can be cured by simple home-made solutions. Despite this, caregivers seem not to be aware of such remedies, and the number of deaths attributed to diarrhoea in developing countries is high. The prevention of such infections can also be done through better sanitation and provision of clean and safe drinking water.
Immunization is central to a child health and can go a long way in preventing malnutrition. Vaccinations are more accessible today than they were ten years ago and it is up to the mothers or caregivers, nurses and doctors to ensure that early vaccinations are carried out.

5.3.3 Inequalities in Nutritional Statues of Children (Rural and Urban Differentials)

Rural areas in developing countries are often characterised by poor economic and social infrastructure. Health and Education facilities are in deplorable conditions, while transport infrastructure is poorly maintained and often left in deteriorating states. Results from the study show that the average number of years of education is higher in urban areas than in rural ones. These severe shortcomings always put the communities living in this area at a more disadvantaged position and often contribute to poor health and nutritional status of children (Schoeman et.al, 2010). There is, therefore, an urgent need to ensure that communities living in these areas have access to education and healthcare. Through schooling and basic education, women and caregivers can attain basic knowledge on nutritional requirements of their children. Road networks need to be upgraded, rehabilitated and properly maintained so as to ensure that communities not only have access to education and health facilities, but that they are also able to access food markets where they can acquire wider food varieties. One way through which food security and infrastructural development can be attained is through labour-intensive public works which are instrumental in addressing numerous problems that face developing countries; poverty, food insecurity, unemployment and poor infrastructure\(^\text{11}\). At the household level, labour-intensive works can provide employment, positively affect income levels and increase the distributional effects of assets (von Braun, Teklu & Webb; 1992). The increased real income can be used to enhance the food security status of a household and also improve the nutritional status of household members (von Braun, Teklu & Webb; 1992). In addition, the construction of infrastructure such as health facilities, water and sanitation systems can contribute to disease alleviation and improve nutritional security.

5.3.4 Education

The access to education infrastructure has been shown to increase the socio-economic status of people. It has also been found to result in better nutritional status amongst children. Subsequently, the skills of care-givers should be developed with higher level education so as

\(^\text{11}\) Public programmes that do not only provide employment but also generate physical infrastructure through labour-intensive means (von Braun, Teklu, Webb, 1992).
to equip them with knowledge that is needed to ensure better nutritional statuses of their children (Schoeman et.al, 2010). Hospitals, clinics and health centres should be equipped with qualified personnel who educate the mothers and caregivers on the most important diets for a child once they attain the 6 months age bracket. Schoeman, et.al (2010) reiterate the importance of breastfeeding and recommends that nursing capacities should be strengthened and human resource constraints be addressed so as to ensure long term continuity in the provision of essential health and nutritional information to mothers who need to be continuously advised on safe infant feeding practices.

5.3.5 Growth Monitoring

Growth monitoring has a positive effect on a child’s health, since children who attend such centres receive food supplements, and the mothers offered information on proper child feeding practices (Adeladza, 2009). The Kenyan government should ensure the improvement of service delivery of Growth Monitoring Clinics (GMCs) which are supposed to monitor the progress of children. A survey carried out found that only 17.3 percent of clinics in Kenya conduct proper growth monitoring (Wamae et.al, 2009). Clinics should have a qualified nurse and other personnel who educate caregivers and assist in monitoring the situation of children. The growth monitoring clinics do not just monitor the progress of children through assessment of their anthropometric status, but can also serve as a platform for educating mothers on infant feeding practices and on proper caregiving. The clinics can also serve as a form of human capital development potential, with the involvement in nurses creating jobs and resulting in human development. However, it is important that parents be made aware of such initiatives and encouraged to take their children for monitoring. Lack of parental support for growth monitoring clinics can make it difficult to report on a child’s progress (Faber et.al, 2009).

5.3.6 Health Sector Reforms

The need for proper health care means that qualified personnel and better health infrastructure should be made available. Unfortunately, in Kenya, health care facilities are often left in poor conditions, and personnel are often unable to cope with the large number of sick children. The number of health facilities in the country has increased over the years and stood at 8,006 in 2011 (KNBS, 2012). However, these facilities are often not well equipped and lack enough personnel. There is need for the Kenyan government to provide better health
facilities, equipped with the proper equipment and required medication needed to cope with infections and diseases that affect children.

Through the Abuja Declaration in 2001, Heads of African States and Governments (including Kenya) committed themselves to ensuring that necessary resources are not only made available, but are utilized effectively and efficiently. The leaders also pledged to allocate at least 15 percent of their annual budgets to the improvement of the health sector. Unfortunately, the percentage of annual budget that has been allocated by the Kenyan Government is yet to meet this target.

5.3.7 Child Rights Framework

There is need for the formulation and implementation of a National policy that ensures that the interests of a child such as better nutrition are properly recognised. On a global level, Kenya is a signatory to the Convention on the Rights of the Child (CRC) and African Charter on the Rights and Welfare of the Child (ACRWC) which require countries to reduce child mortality, and combat disease and malnutrition through the provision of sufficient nutritious foods. The Convention also requires that parents and all segments of society have access to education and are equipped with basic knowledge on child health and nutrition. On a national level, the Kenyan constitution recognises the rights of a child to basic nutrition and health care (GOK, 2010).

A rights framework is important for monitoring the progress of children and measuring outcomes. However, the existence of a child rights framework has not made much of a difference in the Kenya. Based on the National Food and Nutrition Policy, the Kenyan government set up the Nutrition and Food Security Framework to ensure the provision of nutritionally adequate foods (ROK, 2008). Despite this, the implementation of the framework is slow and lacks political backing. A UNICEF report (2009) points out that nutrition is not a major issue in the political agenda of the country, and adequate recognition has not been duly paid to the importance of nutrition on the country’s development. There exists an urgent need for the government to pay more attention to nutritional matters. The government should also operate within the existing child rights framework and safeguard the provision of basic nutritional requirements for children. In addition, the government should also explore the possibility of publishing an annual report on the status of children in the country, something that is necessary for policy formulation, monitoring and evaluation of child nutritional interventions. This has been done in other countries like South Africa, where
the Children’s Institute at the University of Cape Town, publishes the Child Gauge; a report that monitors the well-being of children.

5.4 Areas for Further Research

Based on research findings, there is need to explore the causes of disparities in nutritional statuses of children living in rural and urban areas. There is also need to explore the causes of differentials and unequal access to basic needs, amongst rural and urban households. In addition, future research should concentrate on examining the huge gaps observed in nutritional status and food security in the provinces of Kenya.

A future possible research area is the creation of a universal Household dietary Diversity Score (HDDS) target which to date is non-existent. For the purposes of comparisons across groups and countries, a universal HDDS target needs to be developed. Lastly, a prospective research area is the comparison of HDDS and other measures of household food security in Kenya, and how they relate to the nutritional status of children.

However, it has to be recognised that dietary diversity in only one of many factors that influence the nutritional outcomes of children. There is no doubt that poverty, in all its multiple dimensions, has to be reduced if Kenya is to improve the position of its children.
BIBLIOGRAPHY


APPENDIXES

Appendix I: Provincial map of Kenya

(Source: Kithiia & Dowling, 2010).
Appendix II: Malnutrition rates: A comparison of different studies undertaken in different parts of Kenya

<table>
<thead>
<tr>
<th>Author</th>
<th>Year of study</th>
<th>Location</th>
<th>Sample size</th>
<th>Age bracket of children studied</th>
<th>Malnutrition rates</th>
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<tr>
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<td></td>
<td></td>
<td></td>
<td>Stunting</td>
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<td>Kariuki et.al</td>
<td>2002</td>
<td>Kibera, Nairobi Province</td>
<td>353</td>
<td>6 to 23 months</td>
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<td>6.2%</td>
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<td></td>
<td></td>
<td>26.5%</td>
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<td>Bondo, Western Kenya</td>
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<tr>
<td>Bloss et.al</td>
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<td>Ugunja, Nyanza Province</td>
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<td>&lt;60 months</td>
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</tr>
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<td>Olack et.al</td>
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<td>1,310</td>
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