RELATION BETWEEN DIETARY DIVERSITY AND NUTRITIONAL STATUS OF CHILDREN UNDER FIVE YEARS IN KITUI DISTRICT, KENYA

BY

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Declaration

I hereby **Lucy Wanjiru Kariuki** declare that this dissertation is my original work and has not been presented for the degree in any other university

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Date 25th August 2011

This dissertation has been submitted for examination with our approval as university supervisors

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Dedication

I dedicate this work to my parents who have seen me through my studies and have always encouraged me and guided me. Thank you and the almighty God bless you.

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Acronyms and Abbreviations

ANOVA	Analysis of Variance
DDS	Dietary Diversity Score
FANTA	Food and Nutrition Technical assistance
FAO	Food and Agriculture Organization
FSNAU	Food Security and Nutrition Analysis Unit
HAZ	Height for age Z –score
HDDS	Household Dietary Diversity Score
IDDS	Individual Dietary Diversity Score
ILSI	International Life Sciences Institute
KDHS	Kenya Demographic Health Survey
MUAC	Mid-Upper Arm Circumference
S.D.	Standard Deviation
TSF	Triceps Skinfold
WAZ	Weight for Age Z Score
WHO	World Health Organization
WHZ	Weight for Height Z-score

Operational Definition of Terms

Dietary Diversity Score: The Number of food groups consumed over a reference period

Household: A group of people living together and sharing food from the same pot

Household head: The person either male or female who is the main decision maker in the household especially on matters pertaining to the welfare of household members.

Purposive sampling: sampling a particular sample on purpose

Stunting: Low Height for Age index compared to a healthy, well-nourished child of the same age It is an indicator of chronic malnutrition

Underweight: Based on weight-for age, is a composite measure of stunting and wasting

Wasting: Is the result of weight falling below the expected weight of a healthy child of the same length or height.

Abstract

Dietary diversity has long been recognized by nutritionists as a key measure of the diet quality because nutrients essential for meeting nutritional requirements are not always found in sufficient amounts in a single food item. Increasing the variety of foods across and within food groups therefore increases the chances of adequate intake of nutrients by an individual. Children under the age of 5 years are among the most vulnerable to malnutrition and their diversity though may be different from that of adults, is still important in determining their nutrient intakes. Children also respond more readily to changes in food availability than adults. This study was designed to assess the association of dietary diversity with the nutritional status of children under five years of age.

A cross sectional study was carried out in March 2010 in Kitui district of Kenya on a sample of 283 non breast feeding children with their mothers/caretakers as respondents. Information was collected using a 24-hr individual dietary diversity questionnaire comprising of 14 food groups to determine the food group consumed. Dietary diversity scores were calculated to measure diet diversification. Anthropometric measurements of the weight and height of the children were taken and the age and sex of each child recorded. Results were analyzed using excel, JMP statistical discovery and ENA for SMART software's. Descriptive statistics, correlations and analysis of variance were performed with $P<0.05$ being considered as the statistically significant level of difference.

Results revealed that the children consumed 2 to 8 of the 14 food groups used in the evaluation, with a mean of 5 food groups. There was indication of low consumption

of animal products including milk, meat and eggs and high consumption of plant products. Stunting was at 47.3 %, underweight at 29.8 % and wasting at 4.6 %. It was shown that there was a highly significant positive correlation between total income received by the household and Individual Dietary Diversity Scores (IDDS). There was also a positive correlation between IDDS and nutritional indicators of stunting, wasting, underweight and MUAC. Nutritional status was found to improve with an increase in dietary diversity. Although consumption of animal product was low, the number of food groups consumed increased when money available to the household increased.

1 CHAPTER 1: INTRODUCTION

1.1 Background

Malnutrition is considered a global "silent hunger" which kills millions every year and saps long-term economic vitality. Nearly 12 million children under the age of five with over 4 million in Sub-Saharan Africa alone die annually; malnutrition causes at least 55% of these deaths (WHO, 1996).

Children under the age of five years are among the most vulnerable to nutritional deficiencies. These deficiencies may begin when the child is in mother's womb and continue until the child is 2 years old. During this period nutritional deficiency has adverse effect on child survival and growth. Chronic under-nutrition in early childhood results in diminished cognitive and physical development, which puts children at a disadvantage for the rest of their life. Among girls, chronic malnutrition can result in giving birth to low birth weight babies. Thus a vicious cycle of under-nutrition repeats itself, generation after generation (UNICEF 2009).

Dietary diversification is among the recommended methods for addressing malnutrition. Dietary diversity (DD) has long been recognized by nutritionists as a key element of high quality diet because nutrients essential for meeting nutritional requirements are not all usually found in a single food item. Increasing the variety of foods across and within food groups is recommended in most dietary guidelines internationally (Arimond and Ruel, 2004, WHO, 1996), because it is thought to ensure adequate intake of essential nutrients and to promote good health. Lack of dietary

diversity is a particularly serious problem among poor populations in the developing world (Popkin, 1994).

1.2 Problem Statement

Dietary diversity is recognized as an important contribution to the micronutrient status of individuals. However there is still very limited information on the connection between dietary diversity and nutritional status especially in areas where food availability is low (Ruel, 2003). Experience with the use of dietary diversity to measure dietary quality in such situation is scanty. Food availability in Kitui area of eastern Kenya is often poor and unpredictable due to frequent droughts and seasonality.

Inadequate diet diversification is a big problem among poor populations from the developing world: their diets are predominantly based on starchy staples often including little or no animal products or fruits and vegetables (Popkin, 1994).

Kitui, a semi-arid district in eastern Kenya, is among the most food-insecure districts in the country. It is frequently hit by drought. Micronutrient deficiencies particularly those of vitamin A, zinc and iron are quite common and among the highest in the country. Stunting and severe malnutrition in children are above the national average.

Despite the high levels of malnutrition, Kitui has a rich diversity of traditional local foods. Over 100 species have been recorded (Indaks study 1999). The disparity may be that these foods are only sporadically incorporated in local diets which greatly reduce their contribution to dietary nutrient intake. Another contributing factor could

be the seasonal nature of annual food availability. It is important therefore to determine how often and how much of these foods are consumed and how diverse the food is.

1.3 Justification of the Study

Dietary diversity (DD) has long been recognized by nutritionist as a key indicator of overall quality diets (Taren and Chen, 1993). Increasing dietary variety across and within food groups is recommended in most dietary guidelines (U.S. Department of Agriculture Human Nutrition Information Service, 1992) as well as internationally (WHO, 1996), because it is thought to ensure adequate intake of essential nutrients and promote good health. However this holds true in the context of adequate food consumption, a situation found to be quite uncommon in many communities in developing countries.

It is therefore of importance to establish the relationship between dietary diversity and nutritional status especially in areas that are prone to food scarcity and food insecurity. In this case dietary intake is highly affected. Children under the age of 5 years are likely to be among the most affected but they can also potentially help establish how diverse diets contribute to better nutrition and health because they respond more readily to changes in food availability than adults.

1.4 Objectives

1.4.1 General objective

To assess the relationship between dietary diversity, social economic and nutritional status of children under five years in Kitui district, Kenya

1.4.2 Specific objectives

1. To determine the socio-demographic and socio-economic characteristics of the households of the index children.
2. To assess the dietary diversity of the children
3. To assess the nutritional status of the children

1.5 Hypothesis

1. Dietary diversity is highly dependent on the income of the household
2. Children consuming diverse diet will have better nutritional status

2 CHAPTER: LITERATURE REVIEW

2.1 Malnutrition in children

Malnutrition is the condition that develops when the body does not get the right amount of vitamins, minerals, and other nutrients it needs to maintain healthy tissues and organ functions. It occurs in people who are either under-nourished or over-nourished. Infants and young children need extra nutrients (Encyclopedia of medicine).

Malnutrition may be mild enough to show no symptoms. However, in some cases it may be so severe that the damage done is irreversible, even though the individual survives. Worldwide, malnutrition continues to be a significant problem, especially among children who cannot fend adequately for themselves. Nutrition in early childhood has a lasting impact on the health and well-being in adulthood.

Poor nutrition leads to ill health and ill health contributes to further deterioration in nutritional status. These effects are most dramatically observed in infants and young children, who bear the brunt of the onset of malnutrition and suffer the highest risk of disability and death associated with it. In 2001, 54% of all childhood mortality was attributable, directly or indirectly, to malnutrition (WHO, 2005-2010).

Under-nutrition jeopardizes children's survival, health and development and it slows national progress towards development goals. Under-nutrition is often an invisible problem. World wide, stunting remains a problem of greater magnitude than underweight or wasting, and it more accurately reflects nutritional deficiencies and illness that occur during the most critical periods of growth and development in early

life. Stunting affects approximately 195 million children under five years old, underweight 129 million children under five years old and 13% of children under five years old are wasted in the developing world. (UNICEF, 2009).

We also have Protein energy malnutrition (PEM) that is also referred to as protein-calorie malnutrition. It develops in children and adults whose consumption of protein and energy is insufficient to satisfy the body nutritional needs. It is a problem in many developing countries, most commonly affecting children between the ages of 6 months to 5 years (Ngare and Muttunga, 1999).

2.1.1 Cause of Malnutrition in children

The causes of child malnutrition are complex and multidimensional, ranging from factors as fundamental as political instability and slow economic growth to highly specific ones such as infectious diseases. Women's educational and social status, national per capita food availability, and access to safe water are important underlying determinants of child nutritional status (WHO, 2005-2010).

2.1.2 Indicators of Nutritional status in children

Anthropometric data on height and weight is collected to permit the measurement and evaluation of the nutritional status of young children. This is done by measuring the height and weight of children under five years of age. Data is collected with the aim of calculating three indices—namely, weight-for-age, height-for-age, and weight-for-height—all of which take age and sex into consideration.

Height for age

Low height-for-age index identifies past under nutrition or chronic malnutrition. It cannot measure short term changes in malnutrition. For children below 2 years of age, the term is length-for-age; above 2 years of age, the index is referred to as height-for-age. Deficit in length-for-age or height-for-age is referred to as stunting (Cogill, 2001)

Children whose height-for-age is below minus two standard deviations from the median of the reference population are considered stunted or short for their age. Stunting is the outcome of failure to receive adequate nutrition over an extended period and is also affected by recurrent or chronic illness. According to the 2008 KDHS findings, 35 percent of Kenyan children are stunted, while 14 percent are severely stunted. Stunting levels increase rapidly with age, peaking at 46 percent among children in the second year of life and remaining at 32-35 percent among older children. Stunting levels are slightly higher for boys than girls and for rural children than for urban children. The prevalence of stunting varies by province from 29 percent in Nairobi to 42 percent in Eastern Province. Children of mothers with secondary or higher education are much less likely to be stunted than children whose mothers achieved only the primary level or never attended school (KDHS, 2008-09)

Weight for height

Low weight-for-height helps to identify children suffering from current or acute under-nutrition or wasting and is useful when exact ages are difficult to determine. Weight-for-length (in children under 2 years of age) or weight-for-height (in children over 2 years of age) is appropriate for examining short-term effects such as seasonal

changes in food supply or short-term nutritional stress brought about by illness. (Cogill, 2001).

Children whose weight-for-height is below minus two standard deviations from the median of the reference population are considered wasted (or thin). Wasting represents the failure to receive adequate nutrition in the period immediately before the survey, and typically is the result of recent illness episodes, especially diarrhoea, or of a rapid deterioration in food supplies. In Kenyan case 7 percent of the children are wasted, with 2 percent severely wasted. Wasting levels are highest for the ages 6-8 months, the period in which the child is being weaned and, consequently, is more vulnerable to illness. Wasting is markedly higher in North Eastern Province, where 20 percent of children under five years are wasted compared with 2 percent in Western Province.

Weight for age

Low weight-for-age index identifies the condition of being underweight, for a specific age. The advantage of this index is that it reflects both past (chronic) and/or present (acute) under nutrition (although it is unable to distinguish between the two) (Cogill, 2001)

Children whose weight-for-age is below minus two standard deviations (-2 SD) from the median of the reference population are considered underweight. The measure reflects the effects of both acute and chronic malnutrition. Sixteen percent of Kenyan children are underweight, with 4 percent classified as severely underweight. Peak levels of low weight-for-age are found among children aged 24–35 months, as well as

children in North Eastern Province and those whose mothers have no education (KDHS, 2008-09).

2.1.3 Micronutrient Malnutrition

Micronutrient malnutrition is a term used to refer to diseases caused by a dietary deficiency of vitamins or minerals. More than 2 billion people in the world today may be affected by Micronutrient malnutrition. Vitamin A deficiency, iron deficiency anaemia and iodine deficiency disorders are the most common forms of micronutrient malnutrition. People of all population groups in all regions of the world can be affected by micronutrient malnutrition. Although the most severe problems of micronutrient malnutrition are found in developing countries, people in developed countries also suffer from various forms of these nutritional problems. Micronutrient malnutrition is a major impediment to socioeconomic development and contributes to a vicious circle of underdevelopment, to the detriment of already underprivileged groups. It has long-ranging effects on health, learning ability and productivity. Micronutrient malnutrition leads to high social and public costs, reduced work capacity in populations due to high rates of illness and disability, and tragic loss of human potential. Overcoming micronutrient malnutrition is a precondition for ensuring rapid and appropriate development (FAO and ILSI, 1997).

2.1.3.1 Management of micronutrient malnutrition

There are four main strategies - dietary improvement, including increased production and consumption of micronutrient-rich foods; food fortification; supplementation; and global public health and other disease control measures - can be implemented to

overcome micronutrient malnutrition. Food-based strategies, which include food production, dietary diversification and food fortification, are the most sustainable approaches to increasing the micronutrient status of populations. These approaches not only prevent micronutrient deficiency problems but also contribute to general malnutrition prevention (FAO and ILSI, 1997).

Diet diversification: This involves people eating diverse micronutrient-rich foods and is key to the long-term prevention and control of micronutrient malnutrition. Programs that provide information on plant and animal sources of micronutrients, promote home gardens featuring micronutrient- rich plants, and teach food preservation, processing, and preparation techniques that retain micronutrients, are common (FAO and ILSI, 1997).

Fortification: This involves adding micronutrients to foodstuffs to ensure that minimum dietary requirement are met (Hongo, 2003). It has long been considered a medium-term approach in areas where micronutrients are not naturally available, but based on its success in industrialized countries, should now be considered a long-term intervention. While there are still technological problems with fortifying foods with more than one or two micronutrients at the same time, the combination of fortification and the large potential health gains in populations where deficiencies are prevalent means that food fortification is one of the most cost-effective health interventions (FAO and ILSI, 1997).

Supplementation: This is periodic administration of pharmacologic preparation of nutrients as capsule or tablets, or by injection when substantial or immediate benefits

are necessary for those at risk (Lindsay, 1998). A good example is supplementation with vitamin A which has been in existence as an intervention for over 20 years in some countries and it may, if additional approaches are not explored, be required in others for many years before VAD can be controlled as a public health problem. While supplementation with vitamin A capsules is an effective intervention, it should not be the exclusive approach as it is difficult to sustain over time and often does not reach the children most at risk (FAO and ILSI, 1997).

Public health interventions such as the control of infectious disease, oral rehydration therapy, intestinal parasite control, childhood immunization, and promotion of breastfeeding have tremendous impact on micronutrient status. In developing countries, 56 percent of child deaths are associated with malnutrition, although the identified cause of the deaths is often classified as one of the infectious diseases. Infectious diseases can also hinder appetite (and thus micronutrient intake), nutrient absorption and utilization (FAO and ILSI, 1997).

2.2 Methods of Dietary assessment

Dietary assessment encompasses food consumption at the national level (e.g., food supply and production), household level, and individual level. Food supply data, which are normally collected at national level, are useful for purposes, such as tracking trends in the food supply. Food supply data are not useful for identifying individuals or subgroups of the population at risk of inadequate nutrient intakes.

2.2.1 Household Surveys

The principle methods of assessment at the household level are: food accounts, inventories and household recall. Data generated by these methods are useful for

comparing food availability among different communities, geographic areas and socioeconomic groups, and for tracking dietary changes in the total population and within population subgroups. However, these data do not provide information on the distribution of foods among individual members of the household.

2.2.1.1 Food account method

Household members keep a detailed record of the quantities of food entering the household, including purchases, home produced food, gifts, and from other sources. No account of stock of foods is taken before or after the study period. It is a widely used method in household budget surveys. As with all dietary assessment methods, the method has both strengths and weaknesses. One main weakness is that data are confined to food brought into the home and does not include food consumed outside home (FAO, 2008).

2.2.1.2 Inventory method

This method is similar to the food account method. The additional element is that an inventory of stored food is made at the beginning and end of the survey period (FAO, 2008).

2.2.1.3 Household record

In the household record method, the foods presented for consumption to household members are weighed or estimated in household measures. Preparation waste and waste after eating are deducted, as should be food consumed by visitors. This method may be well suited to populations in which a substantial proportion of the diet is home produced rather than purchased (FAO, 2008).

2.2.2 Individual Surveys

Dietary surveys among individuals provide information that can be used to describe differences in intake of food and nutrients between subgroups. These methods depend on the ability of the subject to provide accurate information. Main methods for assessing present or recent diet include records, 24-hours (or 48-hours) recall, and food frequency questionnaires.

2.2.2.1 Food records

Food intake is measured at the time of eating, it is quantified by weighing and using household measures. Household members themselves usually record their food intake, although a fieldworker might keep the record. Prospective methods are associated with the fewest number of errors and are generally thought to be the most accurate methods available. (FAO, 2008).

2.2.2.2 24-hour recall

This widely used method involves asking subjects to recall and describe all intakes of foods and drinks in the previous 24 hours. This method usually requires a trained fieldworker/dietician/nutritionist to interview subjects, to assess portion weights and make appropriate enquires about types of food and drinks consumed and possible omissions of, for example, snacks. It is a much used dietary assessment method because it is simple, quick and inexpensive, but it is prone to reporting errors, including biased or inaccurate recalls of food intake and portion sizes (FAO, 2008).

2.3 Food frequency questionnaires (FFQ)

These questionnaires provide information about how often certain foods or foods from given food groups, were eaten during a time interval in the past, usually day, by either the household or an individual. The questionnaire can be self-administered or be administered through a short personal interview. The food list may range from a few questions to capture intake of selected foods and nutrients, to a comprehensive list to assess the total diet. The frequency responses can be open-ended or multiple choice, ranging from several times per day to number of times per year, depending on the type of food (FAO, 2008).

2.3.1.1 Dietary diversity

Dietary diversity is defined as the number of different foods or food groups consumed over a given reference period. Although most dietary diversity measures consist of a simple count of foods or food groups, some scales take into consideration the number of servings of different food groups (Guthrie & Scheer, 1981)

Considerable diversity in the daily diet is thought to be necessary for adequate nutrient intakes, to lessen the chances of deficient or excessive intake of a single nutrient, and to diminish exposure to food contaminants (FAO, 2008).

Past studies have shown that nutrients intake and children's nutritional status are positively related to the number of different foods consumed.

FFQ have been widely used in large epidemiological studies or to calculate a dietary diversity score which is simply the sum of the number of food groups consumed during the reference period. The larger this number, the more diversified the food intake is. Either the total score or the frequency of intake of foods by standardized food groups can be reported, or both. There is some evidence that the household

dietary diversity score is positively correlated with household dietary energy availability, and that the individual dietary diversity score is positively correlated with the adequacy of micronutrient intake of the individual (FAO, 2008).

2.3.2 Dietary diversity and socio-economic status

People may tend to diversify their diet as their income increases, largely because greater variety makes food more palatable and pleasant. In Mali Hatloy et al. 1998 found that dietary diversity increases with socio-economic status both in urban and in rural areas. Large differences in diversity between urban and rural households were found where urban households had a consistently higher dietary diversity than rural households. Women were found to have higher dietary diversity score when the indicator of property level of household was higher. Dietary diversity was linked to socio-economic status (Savy et al, 2006 a)

2.3.3 Dietary diversity and seasonal food shortages

Seasonality is recognized as a key element of food availability in many developing countries. Seasonal food shortages lead to weight loss and other anthropometric modifications in both men, women and children. Contrary to what might be expected, a higher dietary diversity score was reported in Burkina Faso during a period of cereal shortage compared to periods of plenty among the women. This was because the women managed to adapt their food consumption and took advantage of wild foods and other available foods. However the nutritional status was found to decline during cereal shortage season despite the increase in dietary diversity. (Savy et al, 2006 b).

2.3.4 Dietary diversity and nutritional status

Dietary diversity has been shown to be strongly associated with household socioeconomic status and links between socioeconomic status and child nutrition and health outcomes have long been established. Interpretation of associations between dietary diversity and nutritional status is therefore complicated by the fact that both are strongly linked to household socioeconomic factors. Families with greater incomes and resources tend to have more diverse diets, but they are also likely to have better access to health care, and better environmental conditions. Children in wealthier households are better off and grow better maybe because of improved nutrient adequacy. (Arimond and Ruel, 2004)

Dietary diversity is generally associated with child nutritional status, and the associations remain when household wealth and welfare factors are controlled for by multivariate analyses. Dietary diversity was significant as a main effect in 7 countries in multivariate models, and interacted significantly with other factors (e.g., child age, breastfeeding status, urban/rural location) in 3 of the 4 remaining countries. It has been shown that dietary diversity significantly associates with HAZ. Positive associations between dietary diversity and child nutritional status have been documented previously in Kenya, Mali, Latin America, Bnglandesh, Burkina faso and Senegal. Other studies in Congo and Burundi showed positive but not significant associations; however, sample sizes was relatively small

3 CHAPTER 3: RESEARCH SETTING AND METHODOLOGY

3.1 Study setting and description of the study area

3.1.1 Study site

This research was conducted in Kitui county of Eastern Province (Appendix 3). Kitui purposively was chosen for the following reasons: firstly it is easily accessible from Nairobi, secondly it had the basic conditions required for the investigation such as varied agro-ecological zones and thirdly, an existing project had put in place a good infrastructure of contacts and networks both at village level and at the level of institutions operating at the county.

The research site lies between the longitudes 37.80 – 38.20 E and latitudes 01.060—01.45 S and falls both on Kitui hills and surrounding lowlands. Altogether, 20 villages falling within the research site were identified for research.

3.1.2 Climate

Much of Kitui region is semi-arid, receiving 500-700 millimetres of rain a year. The Kitui hills, however, which constitute only a small area of the region, are the wettest, receiving an annual rainfall of about 800-1000 millimetres. Rainfall is bimodal with peaks in April (long rains - locally called Uua) and November (short rains called Nzwa or Mbua ya mwee). The short rains are more reliable and have a better distribution. The periods falling between June and September and January and March are usually dry. Rainfall reliability is estimated at only 40 per cent. Precipitation patterns are uneven both in space and time with evaporation rates reaching 100 per

cent (Opere1 et al, 2002). Most of the land in Kitui is therefore subject to frequent droughts, crop failures and famine.

3.1.3 Agriculture

Much of Kitui's population is dependent on subsistence agriculture. This is mainly as a result of frequent rain failure. In the wetter zones, which are expected to have a stable food situation, the productive capacity of the land is low and population pressure is high. Despite its dry nature, the district presents a number of opportunities. It is rich in traditional food resources and plant diversity is high.

The main crops grown in the area are maize, beans, green gram, cassava and cowpea. In addition there is Horticultural farming of kales, cabbages, tomatoes and other crops along the seasonal rivers.

3.2 Study Design

The research was cross-sectional and descriptive in nature. The food consumption data was collected using dietary diversity questionnaire.

Preliminary study was carried out to survey food commonly consumed in the area through focus group discussion, informal interviews and market surveys. The main study was performed by use of a structured questionnaire, to determine number of food groups consumed, food quantities and nutritional status.

3.3 Sampling Frame

The sampling frame consisted of all households with children between 6 months and 59 months with their mothers/caretakers as the respondents.

3.4 Sample size determination

The sample size was determined according to Fischer's (1991) formula using a prevalence of underweight among children below five years of age in Eastern Province of 19.8 (preliminary results KDHS, 2008-09) giving a total sample of 283 households to be studied.

The sample size will be determined according to Fischer's(1991) formula using a prevalence of stunting among children below five years of age in eastern province of 32.9 (KDHS 2003)

Fishers formula:

$n = \frac{Z^2pq}{d^2}$

n= the desired sample size (if the target population is greater than 10,000)
z= the standard normal deviate at the required confidence level
p= the proportion in the target population estimated to have characteristics being measured
q= 1-p
d= the level of statistical significance set

$= \frac{1.96^2 \times 0.24 \times (1-0.24)}{(0.05)^2}$

= 283 households

3.5 Sampling procedure

<u>Selection of villages</u>

A total of 130 main villages scattered in the county were identified for characterization. Factors considered during characterization included agroecological zone of village, vegetation type, soil type, altitude and distance to main markets. This characterization yielded 6 main clusters in a cluster dendrogram. Then 2-4

representative villages were selected from each cluster on random basis giving a total of 20 villages, but also limiting the distance from Kitui town to about 60 km drive.

Selection of households

In each of the 20 villages (Appendix 4), all households were listed with the help of the local administrators. Household members belonging to each household were also listed. On average, a village had about 150-200 households. A sub-set of households with children 6-59 months was developed. Then 15 households in each village were randomly selected for the study. Children nearing 59 months were deliberately excluded and replaced.

3.6 Recruitment and Training of Field assistants

Six research assistants, (four university graduates, two with secondary education), were recruited and thoroughly trained on interviewing techniques. All assistants were recruited from the area since they are conversant with the local culture, food taboos, language and all the rules related to eating patterns. The selected enumerators had two days of intensive training. The training consisted of brief explanation of the study objectives, aim and purpose of the study, a thorough review of the questionnaire, and role play of the interviewing techniques, taking anthropometric measurements and also training on the ethics during field work. The 24 hour recall also included practical measurements of foods consumed using the household measures while training included practical sessions of weight and height measurements of the children in a village near Kitui town.

3.7 Pre-testing of the questionnaire

This was done in one of the villages near Kitui town but not selected for the study. The pretest helped the principal researcher and the research assistants to familiarize themselves with the questionnaire (Appendix 2), and to assess time allocation to the questionnaire. The results of the pretest exercise were discussed and used to make judgments and correction to the data collection tools.

3.8 Questionnaire Administration

Prior to the actual data collection, verbal informed consent was obtained from the respondents. The enumerator explained to all the respondents the objectives, aim and purpose of the study. The respondents were assured that the information obtained would be treated with strict confidentiality and would only be exposed to public for the population information.

3.8.1 24 hour individual Dietary Diversity

The Individual dietary diversity questionnaire (FAO, 2008) consisting of 14 food groups was used to collect information on the foods and drinks consumed by the children the previous day and night. The food groups were (1)cereals,(2) fats and oils, (3)other vegetables, (4)legumes, (5)dark green vegetables, (6)other fruits, (7)vitamin A fruits, (8)white roots and tubers, (9)fresh meat, (10)milk and milk products, (11)eggs, (12)vitamin A vegetables, (13)roots and tubers, (14)organ meat and (15)fish.

Any food group consumed was given a score of 1 while any food group not consumed was given a score of 0. The total score was determined at the end of the interview by summing up the individual food scores.

3.8.2 Anthropometric measurements

Two anthropometric measurements, were taken twice for all the children and then an average was calculated. The respondents were asked to bring children to designated sites where their height, weight and mid upper arm circumference (MUAC) were measured and their age recorded.

Height

In assessing the height, the respondents helped the child in removing excessive clothing and shoes. Then the two assistants guided the child on standing up straight on the height board with feet together, knees straight and heels, buttocks and shoulder blade in contact with the vertical surface of height board. Measurement of height was done to nearest centimeters.

Weight

Weight of the children was taken using an electronic scale. The children were weighed with minimum clothing; they were guided by the field assistant on how to stand on the scale, upright and facing forward with minimum movements, for the ones who were below 2 years the scale was zeroed with the mother, who then held the child for weighing.

MUAC

MUAC of the children was measured using a MUAC tape. The assistant made sure that the work was at their eye level, for young children the respondent would hold the child during the procedure. The tape was wrapped around the mid-point of the child's left upper arm for measurements.

4 Chapter 4: Results

4.1 Demographic characteristics

Most of the households interviewed were of Kamba community. A total of 283 household with children between 12 and 59.9 months were studied, the youngest being 15.7 and the oldest 59.7 months. The mean household size was 6 people. All the respondents were female. While 13% of the respondents were grandmothers of the children, the others were their mothers.

The ages of the women respondents were between 18 and 80 years. Regarding marital status.84 % were monogamously married and the others either single (8%) or widowed (6%) as shown in table 1.

4.1.1 Education and marital status

The results of the education level of the respondents showed that 74% had either some or completed primary school education. 15% had some or completed secondary school and about 10% had some form of training. There were none who were university graduates as shown in table 1.

Table 1 : Education level and marital status of respondent

Characteristics	Percent
Education	
No education	7.06
Primary	74.18
Secondary	15.89
Tertiary education	2.77
Marital status	
Married	84.8
Single	7.63
Widowed	6.25
Separated/ divorced	0.03

4.1.2 Source of income

Among the household studied the main source of income was farming which was at 44% the other sources were casual labour (27%), business (14%) and employment (12%). The source of income for the mother/caretaker was mainly farming at 64%, casual labour at 11% as shown in table 2 .

Table 2 : Distribution of respondents by source of income

Source of Income	Percent
Farming	64.2
Casual labour	10.8
Business	5.4
Employment	1.2
Others	18.5

4.1.3 Total household income

The household income was the total amount of money earned by individual members of the household either from farm produce or casual labour and the amount of money from remittances.

The total income per month ranged from Ksh 0 to 18,500. The mean was Ksh 2,666 The income was grouped into 6 Categories. As shown in the table 3 majority of the households earned between Ksh 1000 and 3000 per month (39 %), few earned above Ksh 8000 (6.1%), and only 9.8 % were living below poverty line.

Table 3 : Distribution of respondent by household income

Amount of income per month	Percent (%)
1 (less than Ksh 85)(1 usd=85 Ksh)	9.8
2 (Ksh 85-1000)	18.0
3 (Ksh 1000-3000)	38.9
4 (Ksh 3000-5000)	18.4
5 (Ksh 5000-8000)	8.8
6 (above Ksh 8000)	6.1

N.B 1 usd = 85

Characteristics of the index children

A total of 283 children were studied, out of which 48.2% were female and 51.8% were male. The female to male ratio was 1:1.075, which is close to 1:1 ratio indicating that there was equal representation of both sexes in the study. The mean age of the children was 47.7 months.

4.2 Individual dietary diversity score

The individual dietary diversity scores were computed based on the 14 food groups (FAO, 2008). The mean number of scores for the food groups was 4.99 (S.D. 1.26). Children consumed between 2 and 8 food groups with majority consuming 5 out of the 14 food groups. Only 6% consumed 2 food groups and 1% consumed 8 food groups as shown in table 4. An ANOVA test showed no significant difference between the sexes and dietary diversity scores ($p>0.05$).

Table 4 : Distribution of children by IDDS

IDDS	N	Percent (%)	Cumulative percent (%)
2	18	6.1	6.1
3	13	4.4	10.5
4	56	18.9	29.4
5	103	34.7	64.1
6	82	27.6	91.7
7	22	7.4	99.1
8	3	1.0	100
Total	**297**	**100**	

4.3 Food groups consumed

As shown Figure 1, up to 99 % of the index children consumed cereals. While there was no child who consumed organ meat or fish: Meat and eggs were consumed by 5.3% and 2% of the children respectively. As shown in Figure1, also majority of the

children consumed cereals, legumes, dark green vegetables, fats and oils and other vegetables.

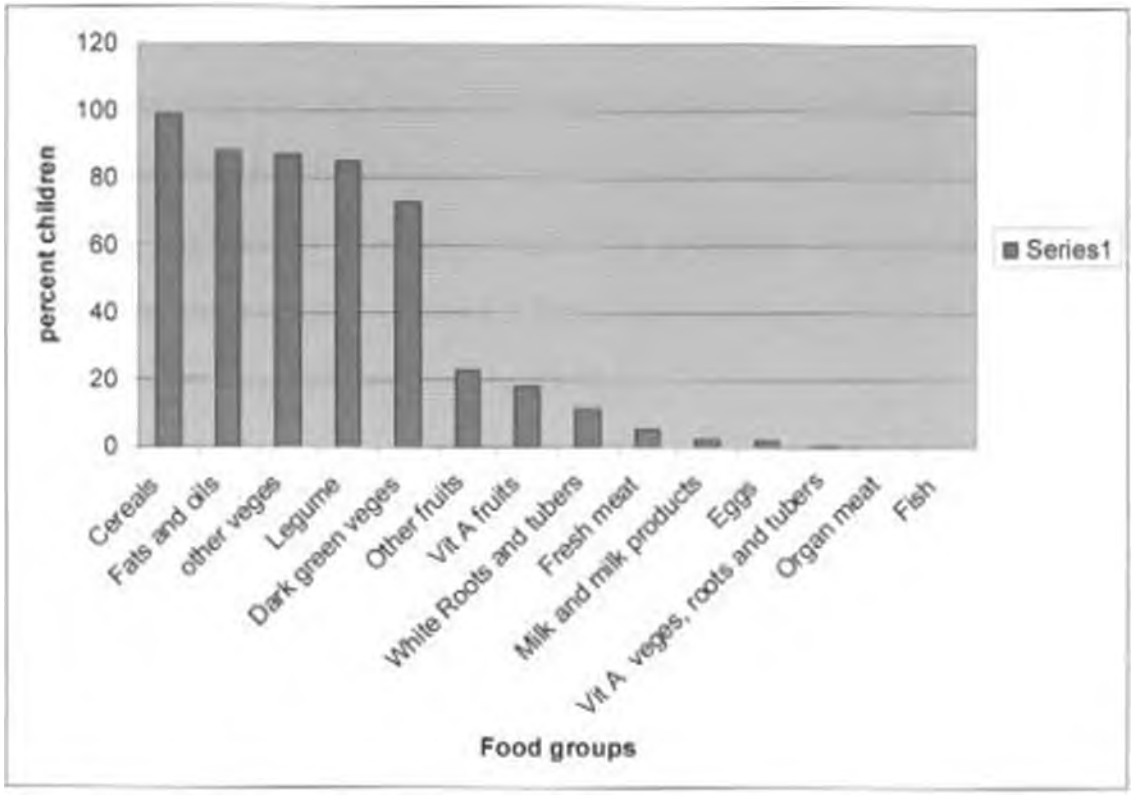

Figure 1 : Distribution of children by food groups

Analysis of food group's diversity by different ages was done. As shown in Table 5 majority of the children studied were between the ages of 36 to 59 months and the different ages consumed a mean of 5 food groups.

Table 5 : Distribution of the children by age and HDDS

		HDDS			
Age in Months	Number	Mean	Std Error	Lower 95%	Upper 95%
<25 months	3	5.33	0.73	3.90	6.76
25-35 months	8	4.5	0.44	3.63	5.38
36-47 months	109	5.06	0.12	4.82	5.29
48-59 months	159	4.94	0.10	4.74	5.13
60-71 months	18	5.33	0.30	4.75	5.92

4.4 Nutritional status of the children

Anthropometric data of 283 children were collected to permit the measurement and evaluation of the nutritional status. This was done by measuring the height and weight of all children under five years of age. Data were collected with the aim of calculating three indices—namely, weight-for-age, height-for-age, and weight-for-height—all of which take age and sex into consideration. The mid-upper arm circumference (MUAC) was also measured. As shown in Table 6 the mean age of the children was 48 months, mean weight 13.4 and mean height 98.5

Table 6 : Mean and median age, weight, height and MUAC of children

Characteristics	*Mean*	*Median*
Age in Months	48.1	48.9
Weight (kg)	13.4	13.2
Height (cm)	98.5	95.0
MUAC (cm)	14.8	14.8

4.4.1 Stunting (Height for age)

Prevalence of stunting among the children was found to be 47.3%. The level of mild stunting was at 29.8% and severe stunting was at 17.5%. As shown in the figure 2, there was no significant difference ($p>0.05$) between the Stunting for male and female children.

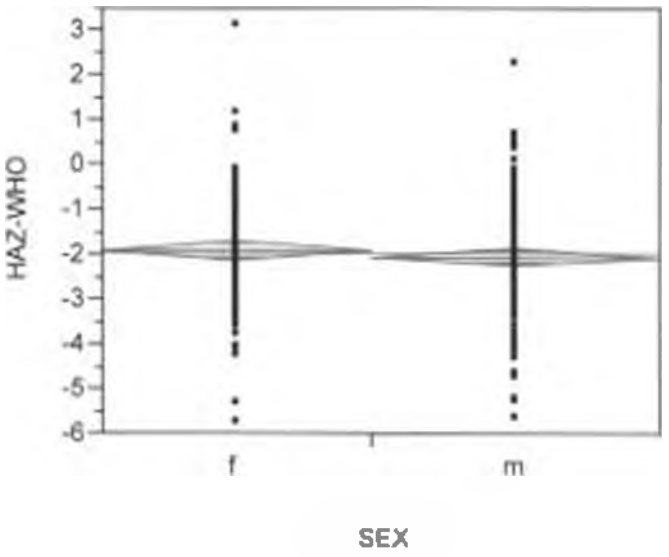

Figure 2 : Distribution of Height for age *Z*-score by to sex of the index children

4.4.2 Underweight (weight for age)

Prevalence of underweight among the studied children was at 29.8%. Moderate underweight was at 25.6 % and severe underweight was at 4.2%. When an ANOVA test was done of underweight by sex it showed that there was no significant difference between male and female prevalence of underweight.

4.4.3 Wasting (weight for height)

Wasting or global acute malnutrition is used to measure the seriousness of short term food shortage in an area, in this case it was 4.6%, and severe stunting was 0.4%. However there was no significance difference in wasting between the two sexes ($p < 0.05$).

4.4.4 Mid-upper arm circumference (MUAC)

MUAC was also used to measure the nutritional status of the children. In the table 7 below we find that according to MUAC there were no cases of severe malnutrition. Only a few were moderately malnourished and 89.3% had normal MUAC range

Table 7 : Distribution of the children by MUAC

Nutritional status	Count	Percent (%)
Normal (>13.5)	253	89.3
At risk (12.5-13.5)	26	9.2
Moderate malnutrition (11.0-12.5)	4	1.4
Severe malnutrition (<11.0)	-	-

4.5 Relation between Socio-demographic data and IDDS

The relationship between individual dietary score was done against some of the demographic data which had been collected for the respondent and the household which the children were part of. As shown in the table 8 there was a significant association between IDDS and source of income of the household ($p = <0.05$). Income of the household head was grouped into farming, employed, casual labour, business and any other work.

Table 8 : Relation between household demographic characteristics and IDDS

	N	IDDS	p-value
Marital status of respondent			
Single	23	4.7	0.33
Married	256	4.9	
Widowed divorced	22	5.3	
Education Level of the respondent			
None	20	4.6	0.62
Primary	220	5.0	
Secondary	18	4.9	
Tertiary	8	5.1	
Income of the household head			
Farming	123	5.1 ab	0.0015*
Casual labour	79	4.6 c	
Business	41	5.2 ab	
Employment	38	5.3 a	

A means comparison (all pairs, Tukey Hsd) between the different categories found that there was a significance difference in IDDS of households whose main source of income was from casual labour from the rest, for household whose source of income was from employment there was a difference in IDDS with the rest but the significance was not big.

4.5.1 Association between Total income of the household, IDDS and nutritional status

A correlation matrix using excel was done between the different attribute to see which ones correlated as shown in table 9

Table 9 : Correlation matrix : total income, IDDS, Nutritional status

	Total Income	Grouped income	IDDS	MUAC	WAZ-WHO	HAZ-WHO	WHZ-WHO
Total Income	1.00						
Grouped income	0.89	1.00					
IDDS	0.24*	0.21*	1.00				
MUAC	0.03	0.05	0.09	1.00			
WAZ-WHO	-0.02	-0.02	0.00	0.66*	1.00		
HAZ-WHO	0.06	0.03	-0.02	0.30*	0.75*	1.00	
WHZ-WHO	-0.09	-0.05	0.01	0.66*	0.65*	-0.01	1.00

**There is a strong correlation*

There was a positive correlation between total income received by the household and IDDS. There was negative correlation between nutrition indicators (HAZ-WHO, WHZ-WHO) with total income, but it was not significant. A Chi-Square test and ANOVA test were done to see if the correlation was significant. There was only a significant correction between IDDS and either total income or grouped income as shown in the figure 4 ($p < 0.05$).

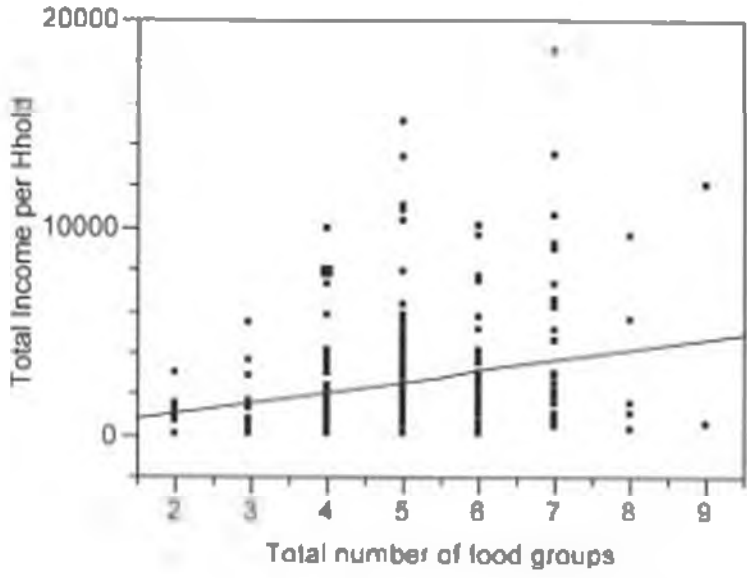

Figure 3 : Correlation between Total income per household and IDDS

4.6 Association between IDDS and Nutritional status

A correlation matrix was done between IDDS and the different nutritional status indicators (Height for Age, weight for Age and Weight for Height Z-scores as well as MUAC) as shown in Table 10.

Table 10 : Correlation matrix between IDDS and nutritional indicators

	IDDS	*MUAC*	*WAZ-WHO*	*HAZ-WHO*	*WHZ-WHO*
IDDS	1				
MUAC	0.119*	1			
WAZ-WHO	0.006	0.603*	1		
HAZ-WHO	0.003	0.264	0.761*	1	
WHZ-WHO	0.006	0.618*	0.618*	-0.035	1

Table 10 shows that there was positive correlation between IDDS and MUAC(Mid Upper Arm Circumfence), WAZ (wasting), HAZ (stunting), WHZ (underweight), although, the only correlation that was significant was between IDDS by MUAC (chi-square, $p<0.00$). MUAC was positively correlated to WAZ and WHZ but not to HAZ. There was a negative correlation between HAZ and WHZ

5 Chapter 5: Discussion

5.1 Introduction

The main objective of this study was to assess how individual dietary diversity and socio-demographic characteristics affects the nutritional status of children under five years. Individual dietary diversity scores were generated as a measure of dietary diversity for each child according to the methodology recommended by FAO (2008). This chapter discusses the results presented in Chapter 4.

5.2 Socio Demographic data

The respondents were mainly women who were aged between 18 -80 years, literacy level was at 95.9% with only 7% having not attended any form of education. Majority having either finished or had some primary education. The results compared well with the literacy levels of women nationally reported at 91.1% with 8.9% having not attended any form of education (KDHS, 2008-09) The mean household size was 6 persons per household, which is higher than the mean household size of 4.2 persons found in the KDHS, 2008-09.

5.3 Individual dietary diversity

Dietary diversity is a simple count of food items or food groups used in the household or by the individual over a certain time period, and are considered a potential 'proxy' indicator for nutrient adequacy (Ruel, 2002). It has also been shown that IDDS tends to change with seasonality and availability of food (Savy et al, 2006).

In this study the IDDS of index children was between 2 and 8 food groups with a mean score of 5 food groups. This study was done in March, which was time of plenty

and extended rains. Most of the food groups consisted of cereals, legumes, vegetables and fats and oils. It was during the harvest season and the rains had also extended and so green leafy vegetables were still available. Sufficient food rations were consumed and therefore it was possible during the period to use DDS as a measure of nutrient intake. The cut-off of the DDS of 5 is a good indicator of good nutritional status of a community that is eating adequately (FAO 2008).

The least consumed foods were fish/ fish products, this could mainly be attributed to the fact that eating of fish is not in the culture and there is no permanent source of fish in the area. Other least consumed foods at the time were roots and tubers for example cassava, sweetpotato. Cassava considered as a famine crop and its consumption becomes sufficient in times of drought and scarcity not in times of plenty. Sweet potatoes (*gateru*) were mostly planted in the banks of seasonal river soon after the rains, since they don't do well when there is plenty of rain.

Eggs and meat (fresh, organ), milk and milk products were also consumed in least amounts. Although milk was consumed as tea by most households it was not included in the scoring since the amount of milk used for making the tea was little. Only milk that was consumed alone was included in the scoring. This low consumption of animal product has been shown to be common in studies in other developing countries, with evidence of high consumption of starchy staples (Ruel 2002).

5.4 Nutritional status

Children whose height-for-age is below minus two standard deviations (-2 SD) from the median of the reference population are considered stunted or short for their age.

Stunting is the outcome of failure to receive adequate nutrition over an extended period and is also affected by recurrent or chronic illness. According to the results 47.3% of the children were stunted, while 17.5% were severely stunted. These results tally with the findings of earlier study for eastern province where the degree of stunting was reported as 41.9% stunted, while 17.1% are severely stunted (KDHS 2008-09). According to WHO global database stunting level of above 40% considered very high (Appendix 1). According to UNICEF 39% of children under five in the developing world are stunted and stunting rates are highest in Asia and sub-Saharan Africa.

Wasting represents the failure to receive adequate nutrition in the period immediately before the survey. Children whose weight-for-height is below minus two standard deviations (-2 SD) from the median of the reference population are considered wasted (also considered Global acute malnutrition). The results showed that wasting was at 4.6% and there was no case of severe wasting . Wasting below 5% is considered low according WHO global database (Appendix 1). This is mainly because there was plenty of food in the area during the time of the survey. This level of wasting in a population is considered acceptable.

Underweight reflects the effects of both acute and chronic malnutrition. Children whose weight-for-age is below minus two standard deviations (-2 SD) from the median of the reference population are considered underweight. From the results 29.8% of the children were underweight and only 4.2 were severely underweight. According to KDHS (2008-09) only 19.8% were underweight and 4.2% severely underweight in eastern province.

5.5 Socio-demography and Individual Dietary Diversity

There was only significant association between dietary diversity score and source of income of the household head. The main sources which were looked at included farming, casual labour, business and employment.

IDDS consumed by the different groups was from Employed, business, farming and casual labour from the most to least consecutively, IDDS consumed by the employed was different from the one consumed by Casual labour but with some similarities with the one consumed by those doing business and farming. Children where the household head was in employment seemed to have access to higher food diversity than the rest of the children.

There was also no relationship between education level of the respondent and the Dietary diversity of the children.

5.6 Social economic status and Individual Dietary Diversity

The results showed that there was a positive correlation between total income received by the household and the number of food groups consumed. For an increase in income there was increase in the number of food groups consumed. This agreed with the results of a studies done. In Mali (Hatloy et al. 2000) the results show that dietary diversity increases with socioeconomic status both in urban and in rural areas, and irrespective of the diversity indicator used (FVS or DDS). A large difference was found in diversity between urban and rural households, where urban households had a consistently higher dietary diversity than rural households. Even the lowest

socioeconomic group in urban areas had a higher dietary diversity than the highest socioeconomic group in rural areas. Another study done among preschool Ghanaian and Malawian children shows there is a differences in dietary diversity between households from different socioeconomic status groups (Ferguson et al, 1993).

5.7 Individual Dietary Diversity and Nutritional status

The results indicate that there is positive correlation between dietary diversity scores with the nutritional status but this was found not to be significant in the case of HAZ and WHZ but was significant with MUAC measurements. This is not consistent with other studies that have been done in developing countries that showed significant association between DDS and nutritional status. Data from DHS surveys from 11 countries showed that dietary diversity was significantly associated with child height for age Z scores as long as household wealth and welfare factors remained controlled (Arimond and Ruel, 2004). This was also shown by studies done in Bangladesh (Rah et al, 2010), Burkina Faso (Sawadogo et al, 2006),, Latin America (Ruel and Menon, 2002), they all showed that Dietary diversity was significantly associated with stunting in children between the ages of 6 to 59 months but was stronger in children above 12 months In a study done in Kenya on Toddlers (12 to 36 months) it showed a consistent and significant association between dietary diversity and nutritional indicators (MUAC, HAZ, WAZ, WHZ, ISF) (Onyango, Koski and Tucker, 1998)

Some studies have also found small to no association between dietary diversity and nutritional indicators. In the study done in Congo and Burundi (Ekesa et al)it was observed that there was no statistically significant relationship between dietary diversity and the three indices of malnutrition in DRC but there was a small

relationship between two indices of malnutrition (weight for age and height for age) and dietary diversity in the case of Burundi. Another study in Senegal (Ntab et al, 2005) showed that there was no association between 24 hr dietary diversity with HAZ

In the studies where there was significant association the sample size was mostly large and the children above 12 months apart from the case of Kenya where the sample size was small this could be attributed to the small age group focused on (12 to 36 months) and had three consecutive 24 hr recall period. In the other studies where there was no significant association the sample size was below 500 and this could have attributed to the small or no association between dietary diversity and nutritional status.

So the shortcoming of this study could have been the small sample size. Since there was already a positive correlation if the sample size had been large enough maybe there would have been significance and also correlate using the different age categories. But the positive significant correlation between Dietary diversity and MUAC, corresponds with the study done in Kenya as stated above

6 Chapter 6: Conclusions and Recommendations

6.1 Conclusions

A number of conclusions can be drawn from the study findings:

1. Nutritional status improved with an increase in dietary diversity: this was especially observed when using measurement commonly used for screening (MUAC). However improvement can be attributed to other factors like good health care and better hygienic environment.

2. The source of income greatly affected the group of food eaten in the home. For homestead where the head of the household was in employment seemed to have access to higher food diversity than the rest of the children with other sources of income like farming, casual labour and business. Number of food groups consumed in the household was found to increase when the total household income increased. This could be attributed to when the household has more money to spend they are likely to buy different types of foods either from Market, shop or from neighbors'.

3. There was no correlation between education level of the respondent and the number of food groups consumed by the children. Thus means whether one was more educated or not this did not affect their eating pattern, they more or less continued to consume the same kind of foods as before. A form of nutritional education may be able to change eating patterns but not education level

4. Consumption of animal products was found to be very low. This includes foods like milk, eggs and different kinds of meat. What was mainly consumed was plant based foods. This may because plant foods are relatively cheap and easy to access than animal products which are expensive and mostly considered during occasions.

6.2 Recommendations

This study showed that there was positive correlation between dietary diversity and nutritional status but it was not significant, does this mean that for there to be a relationship you always need big sample size above 500? There is need to be a review on the difference in association when using small and big sample size when associating dietary diversity and nutritional status.

There is need for community based nutritional education, where the mothers/ caregivers are educated more on the importance of good diet for their children and feeding children on different varieties of foods.

Need to sensitive communities on the importance of utilizing readily available foods in the community example wild vegetables and fruit to diversify diets

Need to have intervention programs which improve the nutritional status of children between 6 months and 2 years where there can be significance improvement in the health of the child, after that age there is little that can be done to improve the child's health.

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Appendices

Appendix 1 : Classification for assessing severity of malnutrition by prevalence ranges among children under 5 years of age

Indicator	Severity of malnutrition by prevalence			
	Low	Medium	High	Very high
Stunting	<20	20-29	30-39	> 40
Underweight	<10	10-19	20-29	>=30
Wasting	<5	5-9	10-14	>=15

**Source: WHO Global Database on Child Growth and Malnutrition, 1997*

Appendix 2 : Questionnaire

DIETARY DIVERSTY AND NUTRITIONAL STATUS OF CHILDREN BELOW THE AGE OF FIVE YEARS

Questionnaire ID……Household ID
……Area name……Date (dd/mm/yy)……Start Time……End Time……..
Interviewers Name……

Section one: General information

Variable	Response	Sex (1.male, 2. Female)	Age (yrs)
1. Name of the index child (all names)			
2. Name of respondent (all names)			
3. Name of household head (all names)			
4. Relationship of the respondent with the index child		1= Mother 2=Father 3. Grandmother 4.=Grandfather 5=Aunt 6. Sister 7=Other (specify_____	
5. Relationship of the household head with the index child			
6. Who decides what the child eats			
7. Marital status of the mother of index child	1. Single, 2=Married 3. Widowed 4. Divorced/separated		
8. Education level of Household head		1= some primary 2=completed primary 3=some secondary 4=completed secondary 5= vocational training 6=university 7=other	
9. Education level of mother of index child			

		colleges 8=none
10. Major occupation of household head		1=fulltime farmer, 2=religious leader, 3= casual labourer, 4=civil servant/teacher, 5= business person, 6=student, 7=other (specify)
11. Major occupation of mother of index child		

N.B. Please map out the relationship among people sharing the same pot (With the index child as the reference point)

12. a. How many household members do you have (Eating from the same pot)?

_____

12 b. Please provide information on the number of people:

i. Not attending school_____

ii. In primary school_____

iii. In secondary school_____

iv. In other learning institutions_____

12 c. Please provide information on adults living at home

Name	Age	Gender	Occupation	Relation with index child	Education level	Amount of money per month

13. **Remittances**

a Are there HH members living away who send money home to help? **1. Yes 2. No**

b If yes provide the following info?

Name	Age	Gender	Occupation	Relation with index child	Education level	Amount of money per month

Section 2: Food consumption

14. Please describe the foods that you consumed yesterday from the time you woke up till you went to bed (When composite dishes are mentioned, ask for the list of ingredients)

24 hr recall

	Child		
	Food	**Ingredients**	**Source**
	24 hr recall		
Breakfast			
	24 hr recall		
Snack			
	24 hr recall		
Lunch			
	24 hr recall		
Snack			
	24 hr recall		
Supper			
	24 hr recall		
Snack			

Fill the food groups based on the information recorded above. For any food group not mentioned, ask the respondent if a food item from this group was consumed.
Remember to ask if something was eaten outside of the home
Food groups for guidance: **(Cereals/grains and products, Pulses/legumes, White roots, tubers and plantains, Vit A rich vegetables and tubers, Dark green leafy vegetables, Vit A rich fruits, Other fruits, Organ meat, Flesh meat, Eggs, Milk and milk product, eggs, Fish and fish products, Fats & oils, Spices condiments and beverages)**

CODE	Food Groups	Varieties consumed(where possible)	Index child	
			Last 24 hours	Food source
1	Cereals			
2	White roots and tubers			
3	Vitamin A rich vegetable and tubers			
4	Dark green leafy vegetables			
5	Other vegetables			
6	Vitamin A rich fruits			
7	Other fruits			
8	Organ meat			
9	Flesh meat			
10	Eggs			
11	Fish and sea foods			
12	Legummes			
13	Milk and milk products			
14	Fats and oils			

CODE			Index child	
	Food Groups	Varieties consumed(where possible)	Last 24 hours	Food source

Section 3: Anthropometry

15. Anthropometry measurements of the index child

Has the child received Vit A in the last 6 Months	1. Yes 2. No
Child Sex (1= Male, 2=Female)	
Birth date (dd/mm/yy)	
Birth weight	

Measurement	Readings		
	1st	2nd	Average
Weight (kg)			
Height (cm)			
MUAC of the index child			

Contacts: Mobile number (indicate owner of phone) _____

Appendix 3 : Map of Kenya showing Kitui District

Appendix 3 Map of the villages