INFLUENCE OF HOUSEHOLD SOCIO-ECONOMIC CHARACTERISTICS AND FOOD INTAKE ON NUTRITIONAL STATUS OF CHILDREN AGED 6-59 MONTHS FROM BANANA-DEPENDENT HOUSEHOLDS IN IZIMBYA WARD, TANZANIA

BY

DIGO EDITH AWUOR

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DECLARATION

I declare that this is my original work and has not been presented for a degree award at neither Maseno University nor any other university. No part of this thesis may be reproduced without the permission of neither the author and/or Maseno University nor Bioversity International

Candidate:

Digo Edith Awuor

(PG/MSc./00083/2010)

Signature…… Date……

Declaration by Supervisors

This thesis has been submitted with our approval as the supervisors

Dr. Omondi Okeyo David

CEO

Kenya Nutritionists and Dietitians Institute, Nairobi-Kenya

Signature…… Date……

Dr. Ekesa Beatrice Nakhauka

Country Representative

Scientist-Nutritional Research for Development

Bioversity International-Uganda

Signature…… Date……

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DEDICATION

This work piece of work is dedicated to my late father Dr. Moses Olweny Digo who passed away while awaiting my defense, my loving mother Jeyne Olweny Digo who persistently prayed and pushed me to finish this process and my wonderful sons Moses Trevor and Marcus Travy who was born when I was doing this write-up.

ABSTRACT

A child's entire life is largely determined by the food consumed during his first years of life. Since childhood is the most vulnerable phase in human life, nutritional inadequacies may hamper the development of the body. The nutritional status results from nutrient intakes and their interaction with other factors. Children under five require increased iron intake for rapid growth; however, insufficient absorbable iron intake leads to iron deficiency, which has health consequences such as increased perinatal mortality, delayed mental and physical development, negative behavioral consequences, and impaired physical performance. Some of these negative effects of iron deficiency are irreversible and lead to poor school performance and decreased productivity later in life. The WHO estimates that about 190 million children under five are vitamin A deficient, with about 5.2 million affected by night blindness. Children in this age group have increased vitamin A requirements to support rapid growth and fight infections. Severe vitamin A deficiency can cause visual impairments, anaemia and weakened immunity. The human body needs to have a sufficient amount of protein daily to support the growth and maintenance of various body functions. Insufficient protein intake may cause many health complications such as swelling, fatigue, skin problems, irritability, muscle wasting and eventual death from infections. In Tanzania, poor nutritional status is largely driven by food insecurity; hence, consumption of a diverse diet is critical and essential to alleviate micro and macronutrient deficiencies. In Northwestern Tanzania, some households are mostly dependent on banana as their staple food. This study aimed to investigate the influence of household socio-economic characteristics, food and nutrient intake on the nutritional status of children aged 6-59 months from banana-dependent households. The study setting was Izimbya Ward in Bukoba Rural District Tanzania; a cross-sectional study design was adopted. A sample of 206 households were randomly selected and their caregivers recruited into the study. These caregivers were interviewed using a structured questionnaire to collect information on socio-economic status, trends in food availability and frequency of food consumption, dietary diversity and iron, vitamin A and protein intake. In addition, anthropometric measurements were taken using a portable weighing machine, a height board and MUAC tape. Logistic and linear regression, was used to establish the association between nutritional status and household socio-economic characteristics and food and nutrient intake. Socio-economic characteristics of the households were mostly low. This study showed that 34% of children aged 6-59 months were moderately stunted, 27.4% were underweight and 12.8% were wasted. 58.5% of the households recorded low dietary diversity. Nutrient intake shortfalls results were 26.2% in vitamin A, 51.9% in iron, and 30.1% in protein shortfalls. All variables investigated showed that low economic status and low dietary diversity contributed to poor nutritional status of the children. These results highlight the need for government interventions to educate and provide subsidies for rural households to access foods that offer more diversity especially sustainable sources of iron and proteins.

TABLE OF CONTENT

LIST OF ABBREVIATION AND ACRONYMS

FANTA	**:**	Food and Nutrition Technical Assistance
FAO	**:**	Food and Agricultural Organization
FFQ	**:**	Food Frequency Questionnaire
Ht	**:**	Height
ID	**:**	Iron Deficiency
IDA	**:**	Iron Deficiency Anaemia
KHDS	**:**	Kagera Health and Development Survey
SDGs	**:**	Sustainable Development Goals
MDGs	**:**	Millennium Development Goals
MUAC	**:**	Mid-upper Arm Circumference
RDA	**:**	Recommended Dietary Allowance
SCN	**:**	Standing Committee on Nutrition
SD	**:**	Standard Deviation
SSA	**:**	Sub-Saharan Africa
TDHS	**:**	Tanzania Demographic Health Survey
UNICEF	**:**	United Nations International Children's Emergency Fund
VAD	**:**	Vitamin A Deficiency
Wt	**:**	Weight
WHO	**:**	World Health Organization

OPERATIONAL DEFINITION OF TERMS

Food intake: This was measured using food frequency questionnaire, child feeding practices, special meal preparation, average number of meals and a numerical count of a number of different/unique foods consumed which were derived from the 24-hour dietary recall, so as to find out the quality and diversity of diets of children aged 6-59 months. The numerical count determined dietary diversity with 1-3 rated as low dietary diversification, 4-6 rated as moderate dietary diversification and >6 rated as highly dietary diversification.

Iron: This was measured in terms of iron rich foods consumption frequency. This was assessed quantitatively based on the number of times a child aged 6-59 months within an eligible household was fed on iron rich-foods.

Protein: This was measured in terms of protein rich foods consumption frequency. This was assessed quantitatively based on the number of times a child aged 6-59 months within an eligible household was fed on protein rich-foods.

Vitamin A: This was measured in terms of vitamin A rich foods consumption frequency. This was assessed quantitatively based on the number of times a child aged 6-59 months within an eligible household was fed on vitamin A rich-foods.

Nutritional status: This was measured by the levels of chronic manifestation of nutrition inadequacy (stunting), acute inadequacy (wasting) and underweight, based on the WHO classification in Z-scores and the reference standards using ENA software for SMART.

Household Socio-economic characteristics: factors influencing dietary diversity and nutrient intake were measured by finding out the age of the caregiver, education level of the caregiver, main source of income of the household, household size, housing conditions (walling, roofing),

and decision making structure of the household. Specific characteristics of the child including age, gender and birth order were included as controls

Nutrient intake: was measured using a retrospective 24-hour dietary recall. The nutrient intake measured included; proteins, vitamin A and iron. The results obtained were compared to the recommended dietary allowances (RDA's) of children of this age

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

CHAPTER ONE
INTRODUCTION

1.1 Background Information

Food insecurity, malnutrition and ill health continue to persist in many developing countries (FAO, 2021; FAO et al., 2020) . These problems tend to be severe in Africa due to inequality in resource allocation (Siddiqui et al., 2020). The nutritional status of a child plays an important role in the growth and development of the child (FAO et al., 2020). However, despite efforts by Sub-Sahara Africa countries, children's nutritional status remains poor (FAO, 2021). The Millennium Development Goals (MDGs) sought to eradicate extreme poverty and hunger by reducing the prevalence of underweight children. The Sustainable Development Goals (SDGs) aim to end preventable deaths of newborns and children under 5 years of age by 2030. They also aim to end hunger, achieve food security and improve nutrition and to promote sustainable agriculture. The key to achieving these goals lies in identifying the household socio-economic factors that influence the nutritional status of the under-five year old children. Household socio-economic status can significantly enhance or hinder a person's quality of life and nutritional status. Curie and Goodman for instance, argue that children of families with low socio-economic status are likely to have lower health status at birth not necessarily because of worse genetic endowment, but because of the circumstances surrounding gestation and birth (Currie & Goodman, 2020). Similarly, low wealth/income can adversely affect child health through malnutrition, poor hygienic conditions and improper utilization of health care services. Living conditions such as place of residence, access to health services and basic social amenities like water and sanitation can help improve the health of the child (Fox & Heaton, 2012; Wenner et al., 2017). Another important contributor of a child's development is educational status of the parent as it creates a reasonable knowledge on proper feeding (Chou et al., 2010; Desai & Alva, 2009).

The empirical literature on factors that influence the nutritional status of the child have provided evidence on important factors. Factors such as maternal education, have been reported to influence the nutritional status of the child. For instance, studies have argued that children born in educated and wealthy households get better care than their counterparts born in less educated and wealthy households (Chou et al., 2010). Other, child specific characteristics that have also been argued in the literature to affect child health are the age of the child, gender of the child, and birth order of the child (Björkegren & Svaleryd, 2017; Brenøe & Molitor, 2018; Hill & Upchurch, 2009). Africa as a continent has suffered the effects of low socio-economic status and therefore affecting the health of people therein. Children are the most vulnerable population to deleterious effects of low income and bad health. Food consumption especially in rural areas is dependent on what is easily and readily available. Consumption of bananas in East Africa reaches 250kg per capita; the highest consumption rate in the world (Marimo et al., 2019; Swennen & Vuylsteke, 2001). Tanzania, the average consumption between 2001-2010 was 84kg/person/year (Kilimo Trust, 2013). Bananas are highly nutritious with large amounts of carbohydrates, phosphorus, calcium, potassium, Vitamin A (some cultivars) and Vitamin C (Aïtchédji et al., 2010; Ubi et al., 2016). Scientific evidence, however, has shown that having a diverse source of food exposes individuals to many different nutrients, therefore improving their health (Hunter & Fanzo, 2013). In Bukoba District in Tanzania, there is no information regarding the nutritional status of children residing in banana-dependent households. Therefore, this study examines the influence of household socio-economic characteristics, food and nutrient intake on nutritional status of children aged 6-59 months from banana-dependent households-Izimbya Ward, Bukoba District, Tanzania.

1.2 Statement of the Problem

The socio-economic status of a household has shown an association with the health status of the children. Different socio-economic characteristics have been identified, including income, education level of parents, and access to different foods. The most common nutritional problems are protein, iron, vitamin A and iodine deficiencies. Approximately 300 million children, who suffer from growth retardation due to protein-energy malnutrition, also suffer from vitamin A and iron deficiencies. Inadequate intake of these tri-nutrients results to over 2.7 million deaths every year (Micronutrient Initiative, 2007), 60% of children under-five are affected by iron deficiency (SCN News, 2002) whereas, more children suffer from growth retardation due to protein-energy malnutrition (Batool et al., 2015). In 2015, more than 2.7 million Tanzanian children under 5 years of age were estimated to be stunted and more than 600,000 were suffering from acute malnutrition, of which 100,000 were severe cases. In parts of Tanzania, bananas form a basic source of nutrition for majority of the households. Bananas are rich in carbohydrates, phosphorus, calcium, potassium. Vitamin A and C are also present, but only in some species of bananas. However, lack of diversity in food sources has shown to reduce the nutrient diversity and health outcomes. Therefore, there is a need to understand the characteristics of socio-economic status of banana-dependent residents of Izimbya Ward, Bukoba District, Tanzania, and how these influence the nutritional status of children 6-59 months.

1.3 Objectives

1.3.1 Main Objective

To establish the influence of household socio-economic characteristics, food and nutrient intake on nutritional status of children aged 6-59 months from banana-dependent households of Izimbya Ward, Bukoba District-Tanzania

1.3.2 Specific Objectives

1. To describe the socio-economic characteristics of households with children aged 6-59 months from banana-dependent households of Izimbya Ward, Bukoba District-Tanzania
2. To determine the food and specific nutrient intake of children aged 6-59 months from banana-dependent households of Izimbya Ward, Bukoba District-Tanzania
3. To assess the nutritional status of children aged 6-59 months from banana-dependent households of Izimbya Ward, Bukoba District-Tanzania

1.4 Research Questions

1. What are the socio-economic characteristics of households with children aged 6-59months of Izimbya Ward, Bukoba District-Tanzania?
2. What is the food and specific nutrient intake of children aged 6-59 months from banana-dependent households of Izimbya Ward, Bukoba District-Tanzania?
3. What is the nutritional status of children aged 6-59months of Izimbya Ward, Bukoba District-Tanzania?

1.5 Justification of the Study

Approximately 29% of the world's population suffer from micronutrient malnutrition (Bailey et al., 2015). According to a study, it is stated that the most common micronutrient deficiencies are iron and vitamin A; nearly 2 billion people are iron deficient (Camaschella, 2015), and vitamin A deficiency remains the most common cause of preventable childhood blindness worldwide (WHO/UNICEF & World Bank, 2011). Protein energy malnutrition is also common among children, with Africa being the only region in the world that has experienced increased stunting numbers from 1990-2018 (WHO/UNICEF & World Bank, 2011).

Chronic malnutrition is more common in rural areas (45%) than urban areas (32%) (TDHS, 2011). Izimbya ward is characterized by banana-dependent households and may experience very distinct nutritional status as there is high potential to consume bananas quite often with high risk of limited diet diversity; consequently, whether this may have a positive or negative impact on the nutritional status of children aged between 6-59 months is not yet well established. However, the potential contribution of banana-based systems to the nutritional status of children aged 6-59 months of smallholder households in banana growing region of Izimbya Ward, Tanzania is not yet well established. The nutritional status of children is directly related to the socio-economic competence of the family (Siddiqui et al., 2020). This gap informed the need to assess the nutritional status of children within banana-dependent households as a unique setting.

1.6 Scope and Delimitation of the Study

The geographical scope of the study was Izimbya Ward in Bukoba District, Tanzania. It was selected based on its high dependency on bananas and plantains and high levels of food insecurity. This study sought to establish the influence of household socio-economic characteristics, food and nutrient intake on nutritional status of children aged 6-59 months from banana-dependent households of Izimbya Ward, Bukoba District-Tanzania. Nutrients that are of public health concern are a number however, this study was only limited to three nutrients; iron, vitamin A and protein, which are the most common subjects of nutritional deficiencies in the world.

1.7 Limitation of the Study

There are various important nutrients but the study was limited to only three nutrients these were iron, vitamin A and protein. This study attempts to link up the three nutrients with nutritional status however; it may not show isolated effect of the nutrients on nutritional status but rather a relationship. No priority was given to biochemical analysis. There was an

assumption that bananas are the main diet for all households to be interviewed. This study relied on information that was given directly by the respondents, which may not necessarily be accurate. To overcome this, the respondents were thoroughly probed so as to obtain the correct information. Demographic factors such as religion were left out but could need attention. This is because nutritional status may be influenced by cultural practices associated with religion.

1.8 Assumptions of the Study

This study was based on self-reported information and hence the assumption that the study respondents were honest and gave true information. This study was carried out in banana-dependent households thus the assumption that all the households selected were banana-dependent.

CHAPTER TWO
LITERATURE REVIEW

2.1 Household Socio-economic Characteristics

Household socioeconomic resources might influence children's future life. Household heads should secure, either from own production or through purchases, adequate food that is sufficient, safe and nutritious for meeting the dietary needs of all its members at all times for a healthy and active life (FAO et al., 2020). Equitable intra-household food distribution should be exercised and the special needs of young children met (FAO, 2021).

Studies reviewed on household socio-economic characteristics presented the outlined variables: age, sex, level of education, main source of income, primary sources of energy and source of water available to households, ownership of assets and amenities (such as TV, radio set, computer, bicycle, motorcycle, car or phone) and estimated annual household income (TDHS, 2011). Information on these characteristics provide the socioeconomic context for explaining and understanding issues on household food security and food consumption patterns, status of child health care, nutritional status, macronutrient and micronutrient status of children under-five. Poor nutritional status has significant health and economic consequences, the most serious of which is an increased risk of death. Three studies that assessed the socio-economic link with nutrition concluded a positive correlation (Burchi et al., 2011). This may be attributed to the fact that households with limited economic resources may experience a challenge of obtaining a balanced and adequate diet (Siddiqui et al., 2020). Although parents' educational attainments, incomes, and occupations are related, each component may affect children's nutritional status in different ways. However, a number of interventions state that data on socio-economic characteristics are limited.

2.1 1Household Size

The household size is deemed an important household socio-economic characteristic because it is associated with the welfare of the household (Lanjouw & Ravallion, 1995). Tanzanian

households consist of an average of 5.0 people and almost half (47%) of the household members are children under 15 years of age (TDHS, 2011).

2.1.2 Income

Household income directly impacts the health and nutritional status of the house occupants, especially children (Siddiqui et al., 2020). A study carried out in Nigeria revealed that comparisons across primary occupations of household heads showed that families headed by farmers were the most severely affected by food insecurity. The level of severity decreased as one moved from households headed by farmers to those headed by traders, artisans, civil servants, and fishermen (Babatunde et al., 2008). A substantial area of Tanzania is fully utilized for subsistence farming to enable the inhabitants to earn their living, cattle keeping, poultry and piggery husbandry are also undertaken (Lokina et al., 2011).

A study carried out reported that improving women's financial status through employment is a means to improving children's nutrition status. Employment of women has been shown to have positive effects on the health and nutrition status of children, this is so because households of working mothers usually have greater food expenditures and also higher levels of food sufficiency. However, this was in contrast to findings in Bangladesh that reported that women's employment increases the prevalence of poor nutritional status among children under-five years, as more time is likely to spent at work with less time accorded to a child's nutritional needs (Jakaria et al., 2021). A study carried out in Uganda concluded that there were some relationships associated with main occupation and nutrient intake (Nankinga et al., 2019). Household socio-economic status is closely associated with income, captured in multi-dimensional poverty analyses (TDHS, 2011). Low incomes have been cited as perpetuating food inaccessibility, especially of the poor. According to a systematic review for policymakers in 2012, it stated that increasing the overall household income is crucial in eradicating malnutrition (Siddiqui et al., 2020), this concurs with a number of studies, which stated that increases in income are clearly important for reducing child malnutrition. Greater

incomes at the household level allow families to spend more on food and have a more diversified diet, clean water and hygiene and in turn good nutrition status.

2.1.3 Access to Water, Sanitation and Hygiene

Inadequate water can indirectly cause certain types of malnutrition. Izimbya Ward has plenty of water sources such as springs, rivers and Lake Victoria, most of the water pipes are concentrated in shopping centers. Among the challenges faced are low coverage of water supply especially in rural areas and low community awareness on water and sanitation issues (Domenech, 2016).

2.1.4 Level of Education

Women with secondary and higher education desire fewer children than women with no education (3.7 versus 6.0) (TDHS, 2011). A study reviewed stated that mothers' education has a stronger impact on girls' long-term nutrition status whereas; fathers' education has a stronger impact on that of boys. Rahman et al (2008) revealed that as the levels of parent's education and caregiver exposure to media increased, the prevalence of severe and moderate underweight decreased significantly (Rahman et al., 2008).

A survey conducted by NFCNS (2001-2003) found out that 48.7% of the respondents had no form of education. Most of the literate household heads did not complete primary school and there was a progressive decline in the percentage of literate household heads as the educational level rose, however this study did not relate this finding to nutrition status. A study carried out in Gaza found an inverse relationship between the level of maternal education and the magnitude of the prevalence of both acute and chronic malnutrition (Abdeen et al., 2003), this finding confers with that of Kabubo-Mariara *et al*. (2009), which showed that maternal education is one of the key factors in child nutritional status in Kenya (Kabubo-Mariara et al., 2009). Stunting is least common among children of more educated mothers and those from wealthier households (TDHS, 2011). The study concluded that lack

of education is linked to a general lack of knowledge regarding healthy child feeding practices (Abdeen et al., 2003).

2.1.5 Ownership of Goods

A study carried out by Anderson et al, (2010) found out that there was a trend in the association between selected household possessions and the nutritional status of the child with ownership of the selected items protecting against malnutrition (Anderson & Whitaker, 2010). These possessions were deemed fit as proxy for the socioeconomic status of the household. Children from households that have access to electricity within the home, own a radio, television, and refrigerator and own their house had lower prevalence rates for all 3 measures of nutritional status. The prevalence of stunting was 9.7% among children from households with electricity compared to 17.6% of children from households without electricity ($p = 0.050$). Prevalence of wasting was higher among children from households without a radio (19.0% versus 5.3%, $p = 0.033$) or television (10.8% versus 3.9%, $p = 0.021$) (Anderson & Whitaker, 2010). According to TDHS (2010) 60% of Tanzanian households owned a radio and 46% had a mobile phone. Thirteen percent of households had a television (TDHS, 2011).

In conclusion, socioeconomic characteristics may improve nutrition status and break the vicious cycle of malnutrition (Kumar & Singh, 2013).

Despite several reports and various national programs geared towards combating malnutrition status in Tanzania, the focus is on national data whereas, malnutrition is much worse in rural areas than in urban areas (TDHS, 2011)with limited information in a unique setting as banana dominated region. Assessment of household socio-economic characteristics and knowledge on protein, iron and vitamin A intake as supplied by food consumption can play an important role in accelerating the efforts for good nutrition status.

2.2 Food and Nutrient Intake

FAO research in Uganda and West Africa shows that the most immediate problem for many households is food and malnutrition (FAO, 2020). The major under-nutrition problems are protein-energy malnutrition (PEM) and deficiencies of the micronutrients vitamin A, and iron (Grover & Ee, 2009). Staple diets are frequently plant based and consumption of flesh foods such as red meat, poultry and fish is low thus leading to nutritional deficiencies (Akbulut & Yeşilkaya, 2021). Recommended Dietary Allowances (RDA) of macro (protein) or micronutrients (iron and vitamin A) make up the levels of intake of the essential tri-nutrients to be adequate to meet the known nutrient needs of children under-five years. Inadequate food intake is a consequence of insufficient food available at the household level, improper feeding practices, or both. Improper feeding practices include both the quality and quantity of foods offered to children under-five years (Brown, 1991). Over one third of Tanzanians live below the poverty line (TDHS, 2011) with almost 60% of Tanzanian households reporting difficulty in meeting food needs (TDHS, 2011). The prevalence of poverty is especially high in rural areas, where 87% of the population lives, and is highest among households who solely depend on agriculture (FAO, 2020).

2.2.1 Diet Diversity and Nutritional Status

Lack of dietary diversity and poor quality of habitual diet in much of the developing world contribute to deficiencies. In Sub-Saharan African countries, diets of children aged 6-59months are predominantly based on starchy foods with little or no animal products and few fresh fruits and vegetables (Paul et al., 2011; Ruel, 2003). Diversified diets are required to supply full range and quantities of nutrients that are required to support rapid growth from 6 months onwards (Muhimbula & Issa-zacharia, 2010).

Dietary diversity has been recognized as an indicator of food security, with consumption of more food groups suggesting better nourishment, better nutritional outcomes and improved nutrient intake. Consumption of ≤ 3 food groups was considered as low dietary diversity,

consumption of 4and 5 food groups was considered as medium dietary diversity while consumption of ≥ 6 food groups was considered high dietary diversity this was according to (FAO, 2006). According to TDHS (2011) only 32% of children aged under-five were fed four or more food groups (TDHS, 2011).

Dietary diversity was advocated in the recently updated guidance for complementary feeding of infants and young children (WHO/UNICEF & World Bank, 2011). It is against this background that dietary diversification with nutrition education focuses on improving the availability, access to and utilization of foods with a high content and bioavailability of protein, iron and vitamin A over a period of time. According to Prakash, this is possible by promotion of household gardening, small livestock rearing and fishing, thereby offer the opportunity of increased yields and the potential to improve the nutrient intake content of staple foods thus contributing to better nutrition status (Shetty, 2009). However, other studies have shown that an increase in dietary diversity is associated with socio-economic status and household food security (Hoddinott & Yohannes, 2002). Protein-energy malnutrition levels is affected by economical, seasonal and climatic conditions, education and sanitation levels, food production and prevalence of disease (FAO, 2021; WHO/UNICEF & World Bank, 2011). Protein-energy malnutrition (PEM) is common worldwide in young children (Stephenson et al., 2000), and is central to childhood mortality in developing countries causing the deaths of 6 million children annually (FAO, 2021).Proteins are found in both animal and plant foods.

Iron deficiency is the most widespread dietary deficiency in the world affecting close to two billion people or one-third of the world's population (Thompson, n.d.) and has the highest prevalence in developing countries (Soh et al., 2004). Iron deficiency particularly affects young children (Soh et al., 2004), and results as a consequence of dietary patterns and associated factors (Muñoz et al., 2000; Wieringa et al., 2016). Dietary inadequacy of iron is

likely to occur in developing countries like Tanzania where staple diets are predominantly plant based and consumption of animal protein foods such as meat, fish and poultry is often small (Soh et al., 2004). Flesh foods are rich sources of readily available iron whereas origin of plant-based foods, are notably cereals, legumes, nuts- contain high levels of phytate, and dietary fiber. These components inhibit iron absorption to various degrees (Hunt, 2002). As a result, the amount of iron absorbed from such diets is often low, even when the intake of the trace mineral appears adequate. This is unfortunate because even moderate deficiency of iron has far-reaching consequences on child nutritional status and health. The inadequate intake of food rich in animal protein as well as vegetables and fruits suggest that children under-five years will suffer from iron deficiency and growth retardation which may aggravate their nutritional status(McLean et al., 2009).

Vitamin A deficiency is widespread in Sub-Saharan Africa (WHO, n.d.) and is a major public health problem among children under-five years (WHO, n.d.) predisposing children under-five years to increased risk of morbidity, mortality and disability (McLaren & Kraemer, 2012; West Jr., 2002). High rates of infection and inadequate dietary intake are well-recognized causes of vitamin A-deficiency. Vitamin A intake is often inadequate because of the seasonality of food sources; there is limited data on the patterns and determinants of dietary intake of different sources of vitamin A (Ramakrishnan & Darnton-Hill, 2002). Improving vitamin A status of deficient children would not only save a half a million children from going blind each year, but would also lead to a marked reduction in childhood mortality annually saving a million or more lives (Sommer & West, 1996) and gear towards attaining sustainable development goal number 3.

Bananas as an individual food item are widely cultivated in the tropics consumed as fruits and in some parts as a staple food. They are mainly consumed locally and are of vital importance to food security of millions of people (Frison & Sharrock, 1998). The different

forms in which bananas are prepared and consumed include: cooked green, cooked ripe, cooked in the peel, steamed, juiced, ripened for desert, roasted, chipped and fried, or dried and floured to make a host of confectionaries, pastas (Kikulwe et al., 2007).

In Izimbya ward it is assumed that bananas play a major role in meeting the dietary needs of the people since the crop is harvested throughout the year, it ensures food and income security at the household level. It is against this background that this study set out to assess the dietary diversification of banana-dependent households, iron, vitamin A and protein intake and nutritional status of children aged 6-59months residing in this unique setting.

2.2.2 Nutritional Status of Children Aged 6-59 months

Adequate nutrition is essential throughout the human life cycle, particularly during periods of rapid growth such as pre-school years. Malnutrition, the condition resulting from improper nutrition, is a global concern and an important issue in the Public Health sector (Sharma, 2012). This is so because the prevalence of malnutrition is one of the leading causes of child morbidity and mortality (Sharma, 2012). In Africa, approximately 45 million children under-five years (<5) suffer from malnutrition (Arimond & Ruel, 2004)which is a precise indicator of nutritional status. A previous study expressed malnutrition according to scientifically tested body parameters such as weight, height, age or a combination of these (Rahman et al., 2008). Children under-five years suffer from one or more of forms of nutritional status characterized by stunting (height-for-age), underweight (weight-for-age), and wasting (weight-for-height) and have a significantly higher risk of poor nutritional status than well-nourished children (WHO, 2021). A number of studies use the WHO/NCHS cut off points which classify the nutrition status in Z-scores into; normal, mild, moderate and severe. Consequently, it is important to note that the risk of death (in this age group) increases with descending Z-scores for all categories of nutritional status indicators (Black RE et al., 2008). Surveys conducted earlier showed that stunting was the most prevalent form of malnutrition

in Sub-Saharan Africa (UNICEF, 2009). Evidence Matters (2012) showed that over 40 percent of children under-five years in countries such as Ethiopia, Niger and Nigeria are stunted. In Africa, Tanzania is ranked the 3rd most affected with malnutrition (TDHS, 2011). In Tanzania in 2015, more than 2.7 million under 5 years were estimated to be stunted (UNICEF, n.d.).

According to UNICEF (2009) report, Tanzania has chronically undernourished children, with 44% of children under-five years suffering from stunting (HAZ) 4% wasted (WHZ) and 22% are underweight (WAZ) (UNICEF, 2009). As much as Tanzania has made some progress in reducing malnutrition, all three indicators of nutritional status (stunting, wasting and underweight) show declining trends, attainment of the respective targets of Sustainable Development Goals are not likely to be met unless extra efforts is put, this is so because, improving nutrition status is a precondition for accelerating progress towards attainment of SDG targets. A study conducted by Brian Thompson concluded that increasing the consumption of nutritionally adequate diet is the only sustainable and long-term solution to overcoming protein, vitamin A and iron deficiencies. In Tanzania, 43% of children under five years suffer from Vitamin A deficiency, while 58% of the children have anaemia (FAO, 2020). There have been interventions put in place in some regions in Tanzania to encourage Vitamin A consumption through education, provision of supplements and encouraging backyard growing and purchase of Vitamin A rich foods, with additional monitoring of these interventions (Kidala et al., 2000). Intake of nutritionally diverse foods reduces the chances of malnutrition. However, many households in Tanzania rely on mostly starchy foods including maize-based porridge, steamed-mashed banana served with beans, banana cooked with beans, banana cooked with groundnut sauce, stiff porridge (*Ugali*) served with beans and sardines, and cassava cooked with beans (Ekesa et al., 2019). This study showed that these foods were below the minimum amount of iron and Vitamin A required for

development of children under five years in North-Western Tanzania (Ekesa et al., 2019). Bukoba District, rely on bananas as their staple food and is the most consumed food by children. Information on the nutrition of children from specific banana-dependent households in Izimbiya Ward in Bukoba district is lacking. It is therefore pertinent to undertake a cross-sectional survey to generate current data on all aspects of nutritional status of children under-five from banana-dependent households of Izimbya ward in Bukoba District, Tanzania. The information should be useful to all agencies focusing in nutrition to understand the dietary deficiencies of children in this location at a small-scale and identify tailor-made ways of improving the household characteristics and supplementing their nutritional needs based on scientifically proven deficiencies.

2.3 Operational Conceptual Framework

UNICEF conceptual framework (UNICEF, 1990) and extended by Engle (Engle et al., 1999), formed the basis for adoption and development of measurable variables for this study. A number of studies have been carried that adopted the causative conceptual framework to examine the determinants of the nutritional status of children. This framework breaks the determinants into three levels of causality namely: underlying, immediate and basic determinants.

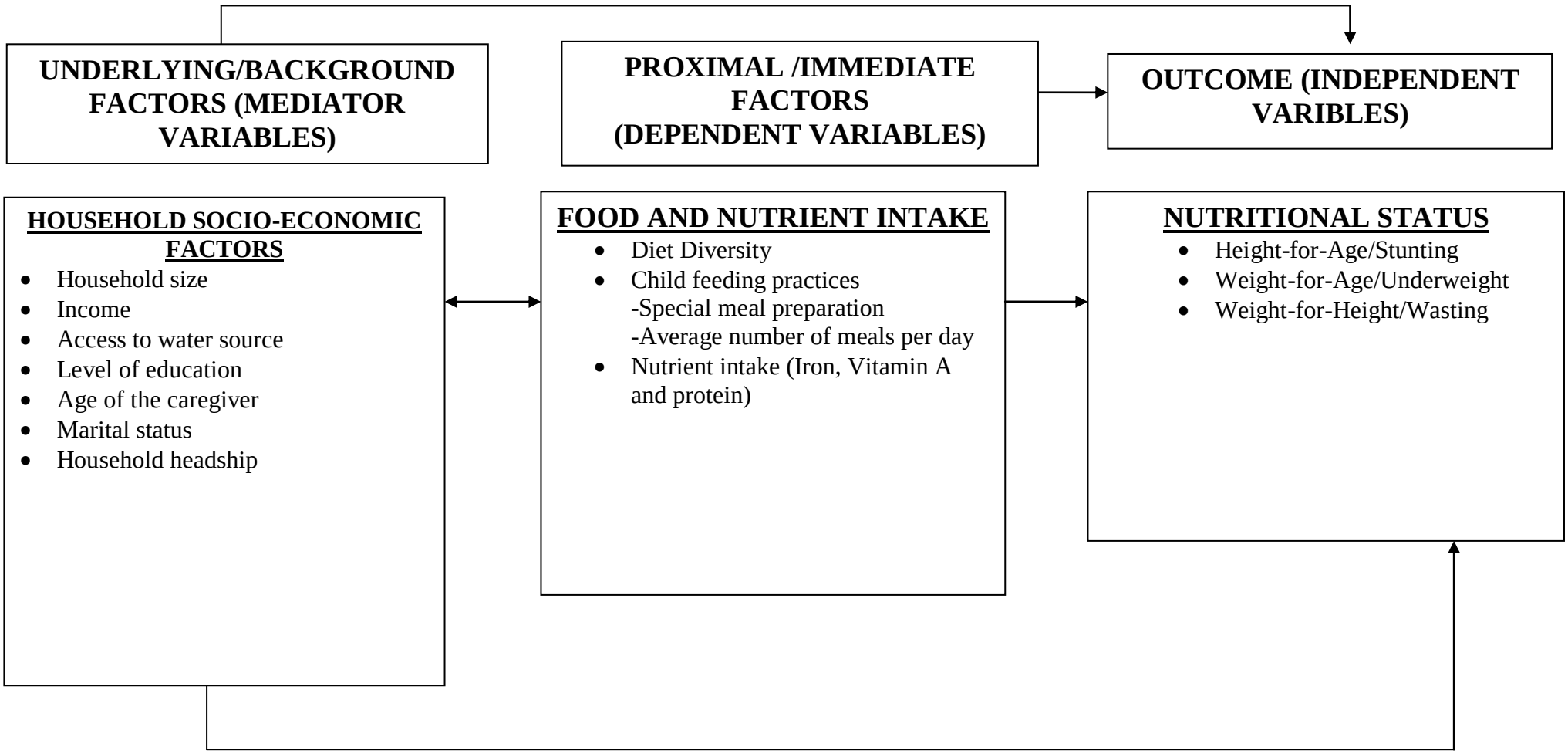

Figure 2.1 Determinants of nutritional status (Modified from the UNICEF Conceptual framework, 1990)

CHAPTER THREE
METHODOLOGY

3.1 Area of Study

This study was conducted in Izimbya Ward (Appendix 1)which is located in Bukoba Rural District of Kagera Region in Northwestern Tanzania, on the western shores of Lake Victoria. Lying on latitude 1.52157 and longitude 31.42376, Izimbya Ward is about 70 Kilometers South East of Bukoba town and it borders Lake Ikimba to the Northeast and Makuru Ward. The villages within Izimbya Ward are covered with plantation of bananas and coffee. The Ward was selected purposively basing on high production and dependence on bananas for both food and income and high cases of malnutrition. It is characterized by bimodal rainfall between October to December and March to May. Most of the locals are subsistence farmers with tea, coffee and plantain being the major cash crops while bananas, maize, sweet potatoes, cassava and yams are the main food crops. A previous study has also been done on Bukoba town to assess the Iron and Vitamin A content in children's food (Ekesa et al., 2019). However, the study looked at the town in a general view. This micro-spatial study, only looking at banana dependent households in Izimbya Ward is necessary to better understand the current nutritional status and specific needs of these households to more accurately guide policy makers in their interventions.

3.2 Study Design

This study adopted a cross sectional study design. The study design was deemed fit as it used to assess the relationship between nutritional status (an outcome) and other variables at once in a specific defined population over a short period of time.

3.3 Study Population

A pre-study household listing done revealed a study population of 620 households within the Ward with children aged between 6-59 months from banana-dependent households in Izimbya Ward, Tanzania. This study recruited a sample size of caregivers of children from 206 households selected from the total 620 eligible households

3.3.1 Inclusion criteria

This included caregivers of children aged between 6-59 months from banana-dependent households in Izimbya Ward, Tanzania.

3.3.2 Exclusion criteria

This excluded caregivers of children aged between 6-59 months from banana-dependent households in Izimbya Ward, Tanzania who were sick or physically challenged.

3.4 Sampling Size Determination and Sampling Procedure

3.4.1 Sampling Size Determination

The sample size for the cross-sectional survey was calculated using Fisher's formula:

$$n = \frac{t^2 \times p(1-p)}{m^2}$$

Where n= required sample size, t= confidence level at 95% (standard value of 1.96) p= estimated proportion of children aged 6-59 months with regard to total population of the area, m=margin of error at 5% (standard value of 0.05).

Izimbya Ward has a total population of 16,916 and the proportion of children aged 6-59 months to the general population is 16%. The study needed households with at least a child aged 6-59 months, the number of children aged 6-59 months to be sampled was therefore equal to the number of households visited;

$$n = \frac{1.96^2 (0.16 \times 0.84)}{0.05^2}$$

n= 206 children aged 6-59 months (206 households with at least one child aged 6-59 months)

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n= 206 children aged 6-59 months (206 households with at least one child aged 6-59 months)

3.4.2 Sampling Procedure

A household listing was used for the quantitative phase. A household listing with 620 eligible households with children aged 6-59 months were selected to participate in the study. The participants in the study were systematically selected from every third household from a given point. The 620 eligible households that were listed was arrived at by the village head who went round the four villages in Izimbya Ward and listed all households with children aged between 6-59 months using a household listing form (Appendix 2). During the interviewing process the ages of the children was counter checked by verifying the date of

birth from the child health card. In an event that two eligible children aged between 6-59 months were from the same household, preference was given to the younger child.

3.5 Data Collection Tools

3.5.1 Questionnaires

This questionnaire (Appendix 4) aided in collection of data on nutrition, household socio-economic data, observation checklist was also incorporated in the questionnaire to collect data on the physical structures to assess the household socio-economic characteristics. The structured questionnaires were developed and written in English.

3.5.2 24-hour Dietary Recall Form

The dietary recall (Appendix 5) was used to collect information on food intake of the household members including that of the reference child within the same household. A numerical count of different food groups consumed by a child aged 6-59 months in a meal was used to determine how diverse the meal was. Hence a numerical count of 1-3 food groups consumed was rated as low dietary diversity, 4-6 food groups consumed was rated as moderate dietary diversity and >6 food groups consumed was rated as high dietary diversity

3.5.3 Anthropometrics Assessment

The weighing scale was used to obtain the weight measurements of the reference child. The height board was used to take the height measurements of the reference child.

3.6 Data Collection Procedures

According to Mugenda and Mugenda (2003), quality of research study depends to a large extent on the accuracy of the data collection procedures (Mugenda & Mugenda, 2003). The data collection instrument or tools used to collect data must yield the type of data the research investigator can use to accurately answer the research questions.

3.6.1 Questionnaire

Visits were made to the sampled households and interviews carried out during the home visits. The interviewee filled-in the questionnaire that covered data on age and sex of the child. Information collected on socio-economic status of the household included gender of household-head, marital status of caregiver, education level of caregivers, access to and source of water, access to health facility, household average income per month and housing condition indicators.

3.6.2 24-hour Dietary Recall Form

The dietary intake of all household members was recorded from the respondents who were caregivers of children aged 6-59 months and only one child was considered in each household that was eligible for the interview. In an event that two reference children aged between 6-59 months were found in an eligible household, then the younger one was selected.

3.6.3 Food Frequency Questionnaire

This tool was used to identify the varied foods locally available and consumed every month.

3.7.3 Anthropometric Assessment

Anthropometric measurements taken included the weight, height and age of child.

Bathroom weighing scale: was used to obtain the weight measurements. The weighing scale was zeroed and the child had minimal clothing, no shoes and measurements of the child (kg) were taken three times, average got and recorded for children aged between 24-59 months.

A height board: was used to take the height measurements (cm) of children under-five years, children under-five years aged between 24-59 months stood straight as the height measurements were taken thrice, the average got and recorded. Age was measured in terms of months. The data together with information on age of the child was used to establish the

nutrition status of the child. The structured questionnaires were filled during the interviewing process. ENA software for SMART was used to combine raw data on age, sex, height and weight and to compute nutrition indices weight-for age, height-for age and height-for weight. These computed data were assessed relative to the World Health Organization z-scores.

3.6.4 Food Frequency Questionnaire

This tool was used to identify the varied foods locally available and consumed every month. The plants and animals acquired from the natural habitats were also retrieved. Thereafter, the foods listed were grouped according to those foods-rich in iron, vitamin A and protein.

Quantitative dietary measurement was done for all the foods consumed by children aged between 6-59 months. The quantity and quality of dietary intake was assessed by, retrospective 24-hour dietary recall; food aid models were used to determine the estimated food portions consumed by the reference child. The amount of food consumed by the household was recorded in kilograms whereas the quantity consumed by the reference child was taken in grams. Three sets of food models comprising of cup, plate and spoon of varied sizes were shown to the respondent during the interviewing process to aid in establishing the quantity of food consumed by the child aged between 6-59 months. Child feeding practices indicators included; who gave advice on what the reference child is fed on, who mostly fed the child, decision maker on child feeding practices and preparation of special meals for the reference child. A numerical count of different food groups consumed by a child aged 6-59 months in a meal was derived from the 24-hour dietary recall and this determined how diverse the meal was. Hence food intake of 1-3 food groups consumed was rated as low dietary diversity, 4-6 food groups consumed was rated as moderate dietary diversity and >6 food groups consumed was rated as high dietary diversity. The actual food intake quantities were entered into the Harvard plus software which then calculated varied nutrients however,

interest was derived on the three nutrients quantities and the results were compared to the recommended dietary allowances (RDA's) of children of this age group.

3.7 Pre-testing

To determine the effectiveness of the structured questionnaire, the tool was pre-tested before it was administered in actual setting. 10% of the sample size was used for pre-testing at Izimbya B, within Izimbya Ward. The pre-test was done so as to determine the strengths and weaknesses concerning the questioning format and wording. Also included during this exercise were the order, flow and timing.

3.8 Reliability and Validity

3.8.1 Validity

The content validity of the data collection instruments was evaluated by experts in the field of research. Construct validity was determined by pre-testing and correcting the data collection instruments accordingly to ensure their ability to collect valid data. To minimize errors in measurements, standardization of weighing scale was done by measuring a standard weight (1 kg) twice a day in the morning and in the evening and was zeroed before weighing.

3.8.2 Reliability

Cronbach's alpha test which is a measure of internal consistency was used to test the reliability of the questionnaire if it was able to test what it was intended to measure. This was done in SPSS version 22 after pre-testing of the questionnaire and the results were 0.79, this means that the items in the questionnaire had acceptable internal consistency.

3.9 Data Analysis

Quantitative data generated from the structured questionnaire were described using mean, normal distribution test and skewness to assess accuracy of measurement and nature of distribution of data for all items measured. Data analysis involved stages such as data clean

up, examining and evaluating data that was collected. Data clean up entailed editing, coding and tabulation so as to detect any anomalies in the responses and assign specific numerical values to the responses for further analysis. Before processing the responses, the completed structured questionnaires were cross-checked for completeness and consistency.

Frequency tables, charts and graphs were used to summarize data on dietary diversity and tri-nutrient intake. Tests of proportion were used to show how many children aged 6-59 months were meeting their RDA and how many consume meals that were diversified. Pearson's correlation (r^2) was used to show effect of dietary diversity/tri-nutrient intake on nutrition status and dietary diversity/tri-nutrient intake on household socio-economic factors.

Anthropometric data: were analyzed based on Z-scores generated using ENA software and results exported to SPSS version 22.0 for further statistical analysis.

Dietary diversity: Frequency tables and graphs were used to summarize data on diet diversity. Test of proportion was used to show how many children aged between 6-59 months were meeting their RDA and how many consumed meals that were diversified. Data on 24-hour dietary recall were converted into nutrients using The Harvard Plus software and entered into SPSS version 22.0 for further analysis.

Logistic regression was used to determine the relationship between socio-economic characteristics, food and nutrient intake and nutritional status.

3.10 Ethical Considerations

This study sought and obtained a letter of clearance from Maseno University-School of Graduate Studies and ethical clearance from Maseno University Ethical Review Committee of Maseno University (Appendix 3). Other approval also sought included written consent from local community leaders. Prior to participation, introductions were done, objectives and methodology of the study explained to the participants. The respondents were also informed

of the assurance that their identity and personal particulars were to be kept confidential and anonymous. Participation was voluntary and would withdraw from the study at any time without being forced to give any reason. The researcher sought consent (Appendix 2) of the caregivers' of children aged 6-59 months (respondents) and assured them of confidentiality before the interviewing process began. Stored data did not include names of the interviewees hence it was not possible to determine the identity of the respondents. Data was stored in the Bioversity International datasets bank and findings disseminated did not have any information on household identities. The study involved verbal interviews and observations and did not involve any invasive operations.

CHAPTER FOUR

RESULTS

4.1 Household Socio-economic Characteristics

The household socio-economic factors thought to have influence on food and nutrient intake and nutritional status included, individual household characteristics such as gender of household-head, marital status of caregiver, education level of caregivers, access to and source of water, access to health facility, household average income per month and housing condition indicators. Described below are the results of the analysis of these socio-economic demographic characteristics of our study participants.

4.1.1 Household Demographics

Table 4.1 presents the distribution of households by individual characteristics these included gender, proportion of caregivers who were household heads and the marital status of the caregiver. Out of the 206 caregivers interviewed 20.9% were male whereas 79.1% were female. In addition, out of the 206 caregivers interviewed, only 27.8% were household heads. Monogamous marriages were dominant among the respondents (79.5%) while single respondents accounted for 2.4% of the study participants.

Table 4.1: Distribution of Households by Demographic Characteristics n=206

Characteristics	Proportion (%)
Gender	
Male	20.9
Female	79.1
Proportion of respondents who are head (n=206)	27.8
Marital status	
Single	2.4
Monogamously married	79.5
Polygamous married	10.2
Widowed	4.4
Separated/divorced	3.4

4.1.2 Income

42.6% of the caregivers interviewed depended on arable farming whereas 37.7% depended on mixed farming. 7.8% of the participants were involved in personal businesses, employment and brick making accounted for 2.9% each, and 2.5% of the participants were casual laborers. Cattle farming and mat/broom making both recorded 1.5% in their households.

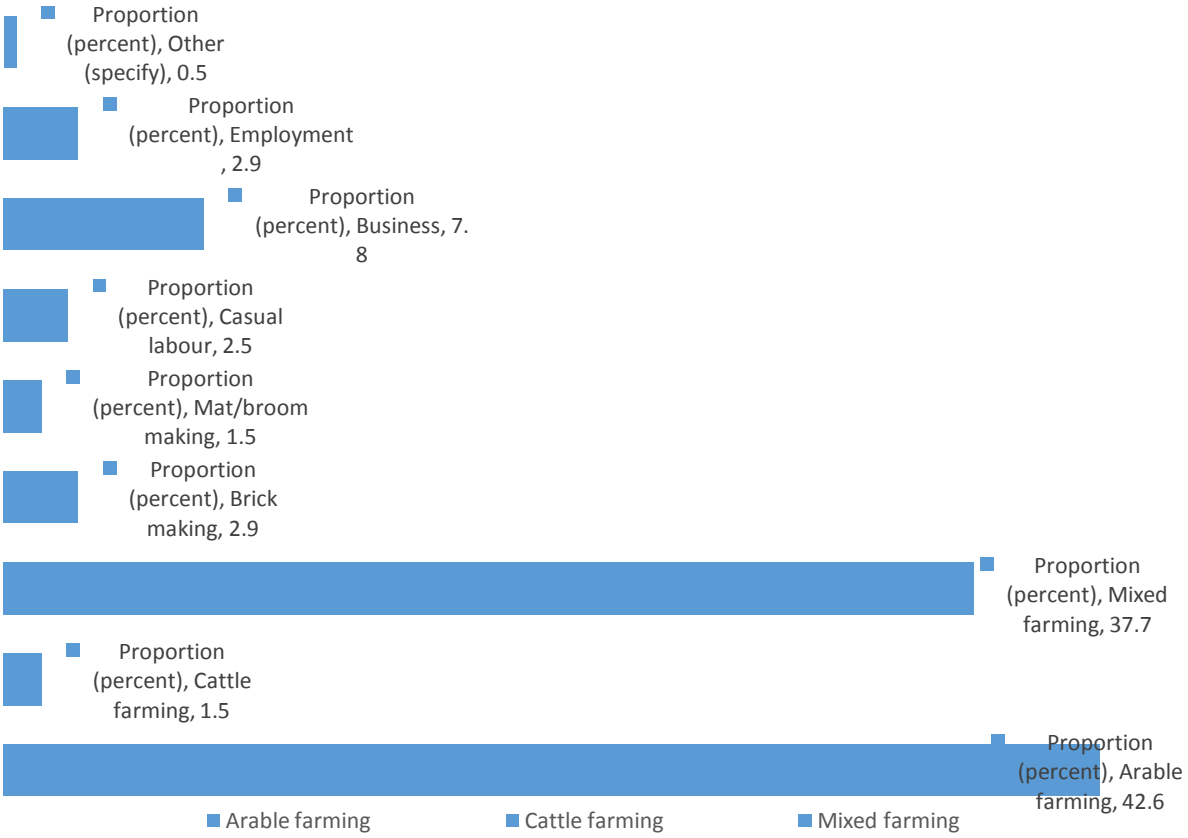

Figure 4.1: Distribution of the Households by Main Source of Income

4.1.3 Water Source and Access

The main source of water was perceived to have an influence on the health status and ultimately the nutritional status. Distance to the main source of water was stressed to the caregivers; the walking distance to the water source was recorded. The results showed that the majority of participants (47.6%) relied on pump wells as their main source of water, while 26.7% got their water from a dam. 11.7% relied on water from a shallow well and 9.2% on springs. The least used sources of water were tap water at 3.9% and other sources at 1%. In

terms of distance travelled to access water, the greater percentage of caregivers (27.5%) travelled between 0.2km to 0.5km, followed by 1.1-2km (19.6%). The rest of the distances; <0.1km, 0.6-1km, and 2.1-3km. The minority (10.5%) had to travel more than 3km to access water as shown on Table 4.2.

Table 4.2: Distribution of the Household by Water Source and Access

Indicator	Proportion (%)
Main source of water	
Spring	9.2
Shallow well	11.7
Pump well	47.6
Dam	26.7
Tap/piped water	3.9
Other (specify)	1.0
Distance to the main source of water	
<0.1km	14.4
0.2-0.5km	27.5
0.6-1km	16.3
1.1-2km	19.6
2.1-3km	11.8
>3km	10.5

4. 1.4 Level of Education

Figure 4.3 shows education level of the caregivers in terms of the number of years spent in formal schooling. According to the results it shows that majority of the caregivers education level was 7 years spent in school or primary level. A smaller section of the participants made it to secondary education. The average number of years spent in school is 5.96 years.

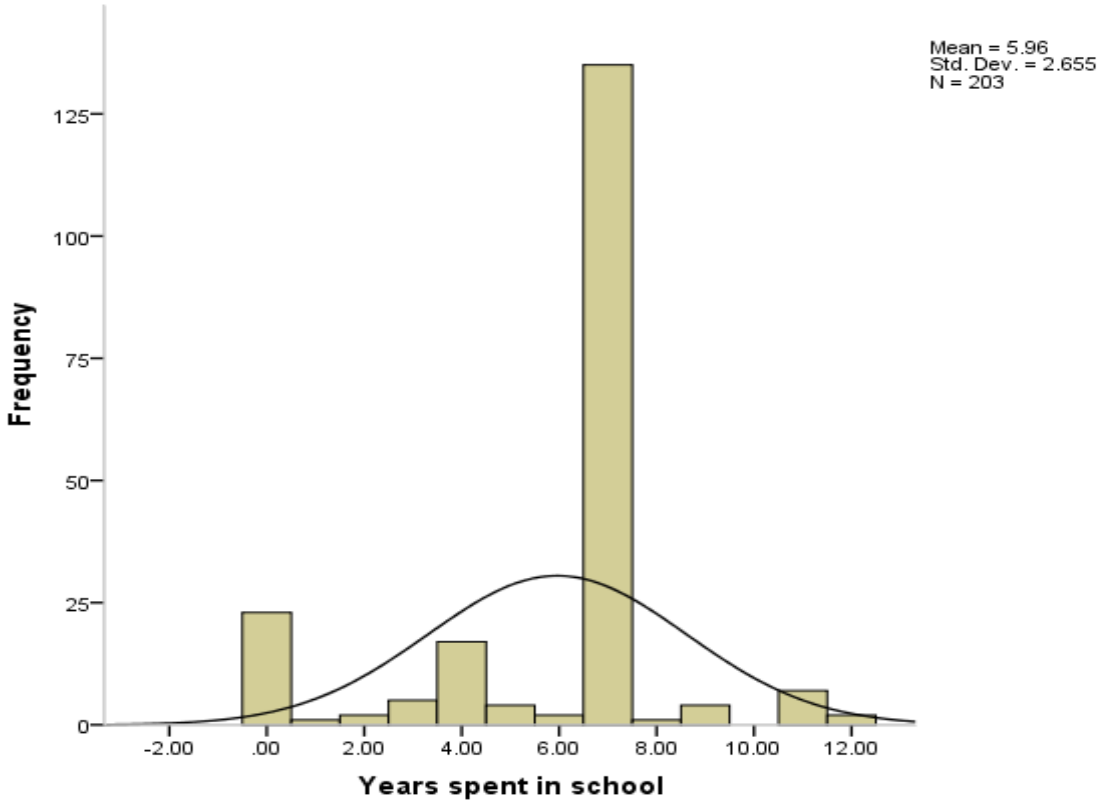

Figure 4.2: Distribution of the Caregivers by Number of Years Spent in School

4.1.5 Age of Caregiver

The ages of the caregivers of children aged 6-59 months was varied. Figure 2 presents the frequency distribution of age of the caregivers in years. Majority of the respondents were more than 40 years old. The frequency distribution of the respondents' age had a mean of 33.97.

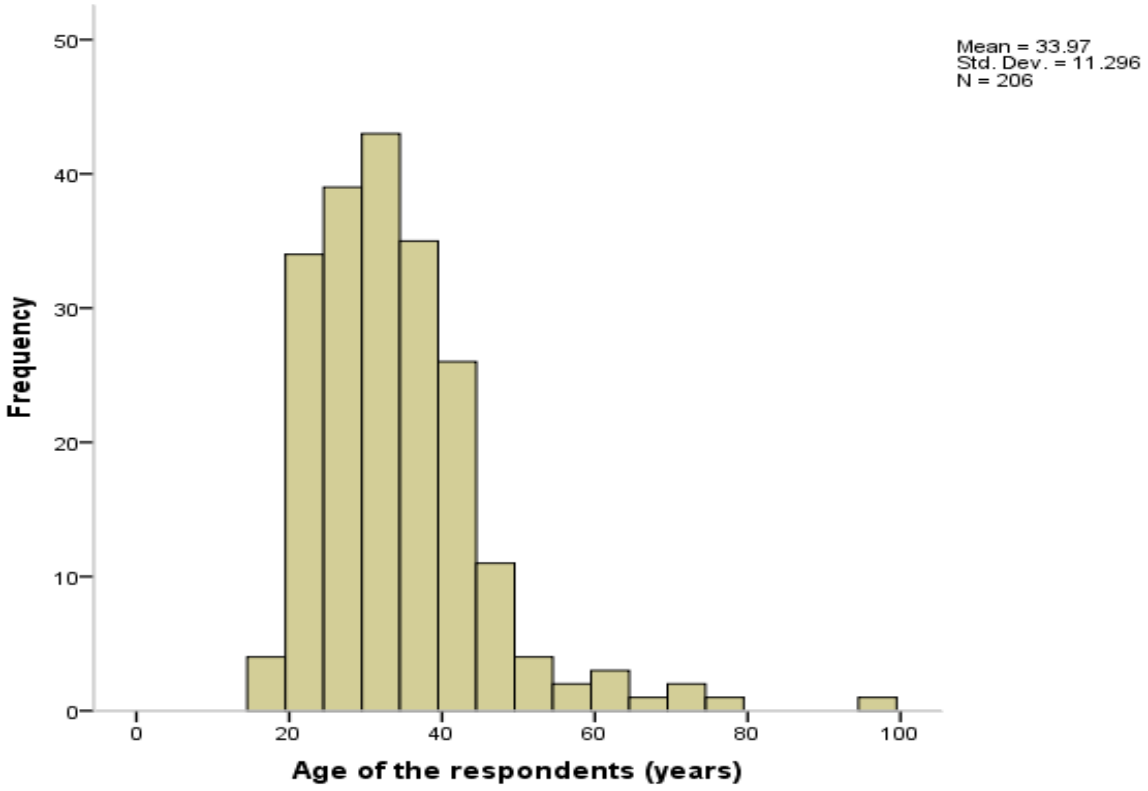

Figure 4.3: Distribution of the Respondents by Age

4.1.6 Housing Type and Materials

Housing characteristics indicators that were observed included the walling, roofing and floor material. Out of the 206 caregivers of these households interviewed, 66.3% of them had houses with mud/un-burnt bricks as walling material while 33.7% had burnt brocks or blocks. On roofing material, iron sheets recoded 64.1% and grass roofs accounted for 33.5%. However, tiles recorded 0% frequency. Mud recorded 74.5% as flooring material, while cement was in 20.1% and tiles in 3.4% of the households.

Table 4.3: Distribution of Households by Housing Indicators
n=206

Indicator	Proportion (percent)
Walling material	
Mud/un-burnt bricks	66.3
Burnt bricks/blocks	33.7
Roofing material	
Tile	0.00
Grass	33.5
Iron sheet	64.1
Floor material	
Mud	74.5
Cement	20.1
Tiles	3.4

4.1.7 Access to Health Facility

Table 4.4 shows the distribution of households by access to health facility. This was assessed by the walking distance to the health facility. Out of the 206 respondents, majority of the caregivers (30.4%) walked over 3 kilometres to access a health facility, whereas 1.5% of the caregivers' walked less than 0.5kms to access a health facility. Most of the respondents were distributed between traveling 0.5km to 3km (23.5%, 21.6% and 23.0% respectively).

Table 4.4: Distribution of Households by Access to Health Facility

Indicator	Proportion (%)
Distance to health facility	
<0.5km	1.5
0.5-1km	23.5
1.1-2km	21.6
2.1-3km	23.0
>3km	30.4

Table 4.5: Relationship between Household Socio-economic Characteristics and Nutritional Status

Household Socio-economic Characteristics	Height-for-Age		Weight-for-Height		Weight-for-Age	
	Adjusted Odds	95% C.I	Adjusted Odds	95% C.I	Adjusted Odds	95% C.I
Age	0.983	0.937-1.032	0.983	0.849-1.138	1.023	0.957-1.095
Male HH	0.954	0.799-1.139	1.234	0.110-13.879	1.124	0.589-2.146
Marital status	1.026	0.612-1.721	11.598	0.471-285.574	1.533	0.635-3.703
Household size	1.107	0.906-1.352	5.371	0.997-28.942	0.956	0.700-1.307
Water source	0.997	0.948-1.049	1.322	0.465-3.756	1.025	0.885-1.188
Years spent in school	1.109	0.970-1.268	1.353	0.753-2.432	1.089	0.929-1.277
Income	1.04	0.952-1.136	0.699	0.402-1.215	1.188	0.892-1.582
Type of wall	1.134	0.488-2.634	0.026	0.000-3.633	1.855	0.559-6.158
Type of roof	0.968	0.503-1.863	6.18	0.214-178.320	0.714	0.298-1.709
Type of floor	1.785	0.888-3.587	3.712	0.155-89.069	1.518	0.493-4.673

4.2 Food and Nutrient Intake

The second objective sought to investigate the food intake of the children targeted from each household. This was done to understand the quality and quantity of nutrients consumed, and to understand the impact of such nutrition on their overall health status. This objective investigated the dietary diversity including the frequency of consumption of different food groups and dietary diversity scores. Also investigated were the child feeding practices including who advises on the child's feeding, who makes decisions about the feeding practices, who feeds the child, and the preparation of special meals. Finally, the nutrient intake was also investigated.

4.2.1 Dietary Diversity

Table 4.6 shows the frequency of food consumption pattern in a 24-hour period however, two food groups were not of interest these were sweets and sugars and spices, condiments, beverages and alcohol, the two were not considered because of their less nutrition-value.

4.2.2 24-hour Dietary Diversity Pattern

Majority of the respondents had three meals a day, breakfast, lunch and dinner. The most consumed meals were lunch (n=418) and dinner (n=388). White roots, tubers and bananas were predominantly consumed (n=45, n=142 and n=130 for breakfast, lunch and dinner respectively), followed by legumes, nuts and oil seeds which were majorly consumed at lunch and dinner (n=118 and n=106 respectively). Consumption of cereals and grain products came third, and were mostly consumed form breakfast, followed by fish which was mostly consumed for lunch and dinner (n=73 and n=59 respectively). The consumption of both organ meats and insects was very negligible in the 24-hour preceding the interview.

Table 4.6: Frequency of Food Group Consumption Distribution

Food group	Proportion (%)					
	Breakfast	**MDM Snack**	**Lunch**	**AL Snack**	**Dinner**	**BDT Snack**
(Expected frequency=5.9%)	(n=331)	(n=120)	(n=418)	(n=73)	(n=388)	(n=5)
Cereals and grains products	75	26	48	12	53	0
White roots, tubers and bananas	45	12	142	10	130	1
Vitamin A rich vegetables, tubers and bananas	0	0	8	0	6	0
Dark green leafy vegetables	0	0	1	0	3	0
Other vegetables including mushrooms	0	0	5	0	8	0
Vitamin A rich fruits	0	1	0	0	0	0
Other fruits even wild	1	3	1	2	1	0
Organ meats	0	0	0	0	0	0
Flesh meats	0	0	7	0	8	0
Eggs	2	0	0	1	0	0
Fish	0	0	73	4	59	0
Legumes, nuts and oil seeds	0	1	118	10	106	1
Insects	0	0	0	0	0	0
Milk	14	12	2	11	3	2
Oils and fats	0	0	10	0	10	0

4.2.3 Summative 24-hour Food Group Proportions

The proportion of white roots, tubers and bananas was the highest and recoded a 25.5%, = while legumes, nuts and oil seeds recoded were second at 17.7%, followed by 16% consumption of cereals and grains. Fish was the fourth ranking food group at 10.2%. Both organ meats and insect consumption was very negligible (0%). Vitamin rich foods were rarely consumed, recording between 0-1% frequency.

Table 4.7: Distribution of the Study Participants by Overall Proportion of Food Groups and Z-Test for Proportions

Food group (n=1335) (Expected frequency=5.9%)	Proportion (%)	z-score	CI	P-value
Cereals and grains products	16	-8.36	-0.08: -0.12	<0.0001
White roots, tubers and bananas	25.5	-13.92	-0.17: -0.22	<0.0001
Vitamin A rich vegetables, tubers and bananas	1	6.94	0.06: 0.04	<0.0001
Dark green leafy vegetables	0.3	8.35	0.07: 0.04	<0.0001
Other vegetables including mushrooms	1	6.94	0.06: 0.04	<0.0001
Vitamin A rich fruits	0.1	8.99	0.07: 0.05	<0.0001
Other fruits even wild	0.6	7.72	0.07: 0.04	<0.0001
Organ meats	0	-	-	-
Flesh meats	1.1	6.75	0.06: 0.03	<0.0001
Eggs	0.2	8.56	0.07: 0.04	<0.0001
Fish	10.2	-4.08	-0.02: -0.06	<0.0001
Legumes, nuts & oil seeds	17.7	-9.45	-0.09: -0.14	<0.0001
Insects	0	-	-	-
Milk	3.3	3.21	0.42: 0.01	0.0013
Oils and fats	1.5	6.02	0.06: 0.03	<0.0001

4.2.4 Dietary Diversity Score

Consumption of 1-3 food groups was considered as low dietary diversity, 4-6 food groups was moderate dietary diversity whereas consumption of >6 food groups was considered as high dietary diversity. The figure below presents findings from the study that majority of children aged 6-59 months were having low dietary diversity. Of the 206 children under-five 58.5% were having low dietary diversity 39.5% showed moderate dietary diversity while only 2% of them were having highly diversified diets.

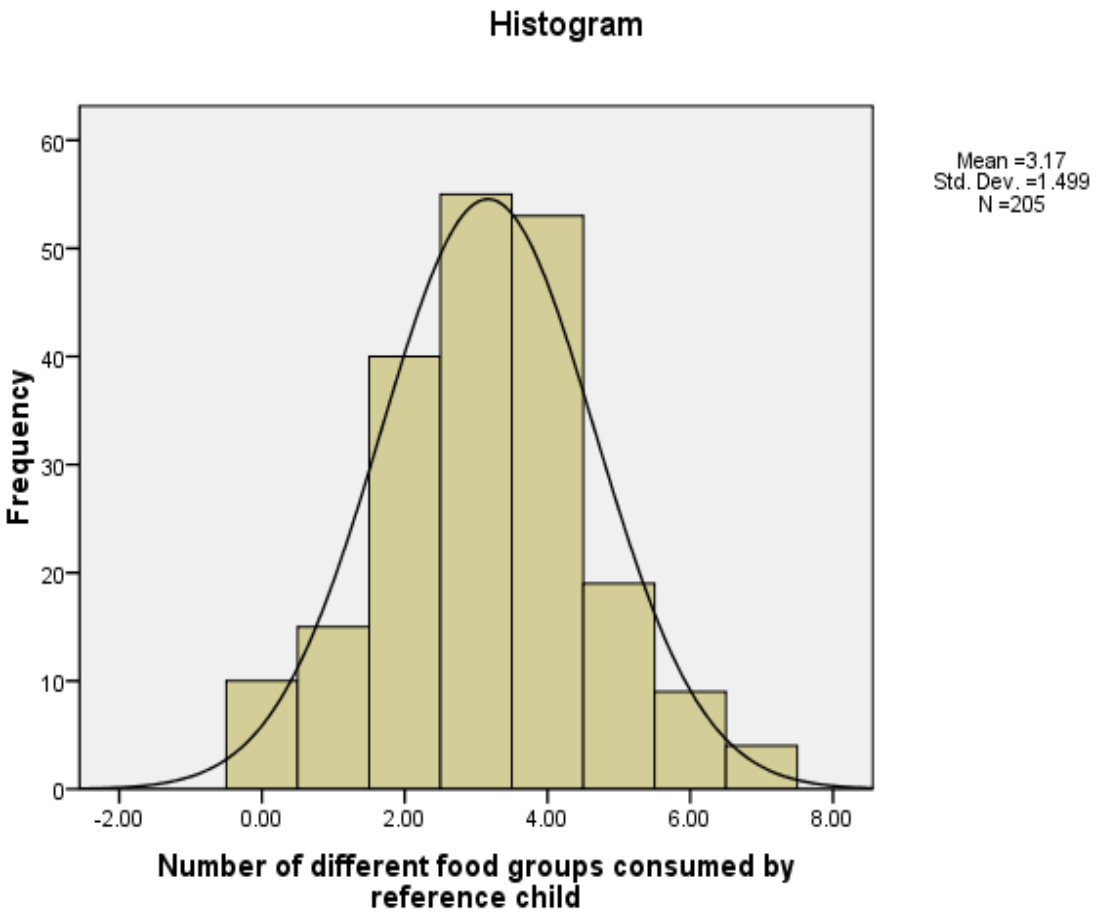

Figure 4.4 Distribution of Reference Children by Number of Food Groups Consumed

4.2.5 Child Feeding Practices

4.2.5.1 Who gives advice on what Child is fed on

66.1% which is the majority of the household respondents interviewed noted that they get advice from health professionals on what to feed the child. This was followed by advice from their mothers (20.6%), and neighbors or friends (13.1%). Mothers-in-law recoded the lowest frequencies at 3.0% followed by grandmothers (4.8%) as giving advice on what the reference child is fed on.

Table 4.8: Proportion of who gives advice on what the Reference Child is fed on

Indicators (Expected frequency=16.67)	Proportion (%)	z-score	CI	P-value
Health professional	66.1	-11.7754	-0.58:-0.41	<.0000*
Mother	20.6	-1.0256	-0.11:-0.04	<.0022
Mother-in-law	3.0	4.7867	0.08:0.12	<.0001*
Grandmother	4.8	3.9652	0.06:018	<.0125
Friend/Neighbor	13.1	1.0192	-0.03:-0.10	<.0029
Others	12.0	1.3555	-0.02:-0.11	<.0000*

*p≤0.05

4.2.5.2 Who mostly feeds the Child

Of the respondents interviewed it resulted that 94.0% of mothers mostly feed the reference child, followed by fathers at 33.1%. Other family members showed lower feeding frequencies; 15.5% by sisters, 11.0% by grandmothers and 8.1% by brothers.

Table 4.9: Proportion of Household Members who mostly feed the Reference Child

Indicators (Expected frequency=50%)	Proportion (%)	z-score	CI	P-value
Mother	94.0	-9.9455	-0.53:-0.35	<.0000*
Sister	15.6	7.4363	0.25:0.43	<.0382
Father	33.1	3.4804	0.07:0.26	<.0277
Brother	8.1	9.3666	0.33:0.51	<.0069
Grandmother	11.0	8.5969	0.30:0.48	<.0000*
House help	0.0	∞	∞	∞

*p≤0.05

4.2.5.3 Decision Maker on Child feeding Practices

Results showed that mothers most frequently made decisions on child the feeding practices (90.5%). Fathers recoded 29.2%, grandmothers 12.1% and sisters 6.9%. Brothers recoded the lowest frequency at 2.9% as decision makers on child feeding practices.

Table 4.10 Proportion of Decision Makers on Child Feeding Practices

Indicators (Expected frequency=50%)	Proportion (%)	z-score	CI	P-value
Mother	90.5	-8.991	-0.49:-0.32	<.0000*
Father	29.2	4.3163	0.11:0.30	<.0163
Sister	6.9	9.695	0.34:0.52	<.0832
Brother	2.9	10.8377	0.39:0.56	<.0037
Grandmother	12.1	8.313	0.29:0.47	<.0000*

*p≤0.05

4.2.5.4 Preparation of Special Meals

63.7% of caregivers do not prepare any special meals for the reference child while 36.3% of the respondents showed that they prepare special meals for the reference child.

Table 4.11 Proportion of Caregivers who prepare Special Meals for the Reference Child

Indicator (Expected frequency=50%)	Proportion (%)	z-score	CI	P-value
Yes	36.3	2.8073	0.04:0.23	.0000*

*p≤0.05

Of the 36.3% of respondents who prepare special meals for the reference child, 25.7% recoded that they have the time to prepare the special meals, while 24.6% noted that they have information about importance of the special meals. 19.1% made special meals because the children could not eat the family meals. The 63.7% of respondents who did not prepare special meals for the child gave varied reasons with 29.7% recoding that the child is old

enough to rely on family meals. The minority, 2%, recoded that they do not know how to prepare, while 6% said they did not know what to prepare.

Table 4.12: Proportion of reasons given by Caregivers for preparing and not preparing Special Meals

Indicators (Expected frequency=50%)	Proportion (%)	z-score	CI	P-value
Reasons for preparing special meals				
Have the time	25.7	5.0848	0.15:0.34	<.0001
Have information	24.6	5.3305	0.16:0.35	<.0001
Child not old to rely on family meals	19.1	6.5947	0.22:0.40	<.0001
Reasons for not preparing special meals				
Lack of time	12	8.3387	0.29:0.47	.0416
No food	23.7	5.5331	0.17:0.36	<.0012
Do not know what to prepare	6	9.9455	0.35:0.53	<.0558
Do not know how to prepare	2	11.106	0.40:0.56	<.0060
Child old enough to rely on family meals	29.7	4.2081	0.11:0.30	<.0007
Do not know why should prepare	3.9	10.5446	0.38:0.55	<.0281

*p≤0.05

4.2.6 Nutrient Intake (Iron, Vitamin A and Protein)

Table 4.13 shows mean of nutrient intake; iron recoded a mean of 11.64, protein recoded a mean of 51.99 while vitamin A recoded a mean of 879.76. Table 4.14 shows the proportion of food consumed by children that meets the Recommended Dietary Allowance (RDA).

Table 4.13: Mean Nutrient Intake n=206

Nutrient indicators	Mean	SD	Skewness
Iron (g)	11.64	9.12	1.14
Vitamin A (IU)	879.76	1196.03	3.029
Protein (g)	51.99	50.62	2.526

Table 4.14 shows the mean, standard deviation (SD) and skewness of iron, vitamin A and protein intake.

Table 4.14: Proportion meeting RDA for Nutrient Intake

Nutrient indicators	Proportion (%) Children meeting RDA	Proportion (%) Children not meeting RDA	z-test	CI	P-Value
Iron (g)	48.1	51.9	-0.55	-0.17:0.1	0.5855
Vitamin A (IU)**	73.8	26.2	6.83	0.34:0.61	<0.0001
Protein (g)**	69.9	30.1	5.71	0.26:0.53	<0.0001

*p≤0.05

4.3Nutritional Status of the Reference Children

The nutritional status assessment of children aged 6-59 months was carried out and the indicators used were wasting (weight for height), stunting (height for age) and underweight (weight for age). World Health Organization (WHO) cut off points was used to classify the nutrition status in Z-scores into; normal, mild, moderate and severe.

The nutritional indicator with the highest prevalence was stunting; with 62.8 % being moderately stunted and 34 % severely stunted. This was followed by underweight with 27.4 % moderately underweight and 12.9 % severely underweight. The indicator with the lowest prevalence was wasting with 12.8 % were moderately wasted and 10 % severely wasted.

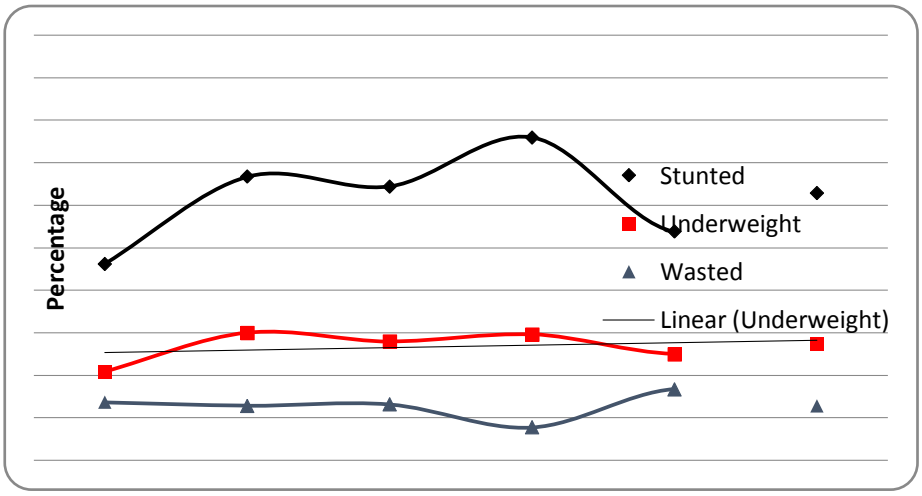

Figure 4.5 Prevalence of Nutritional Indicators

4.3.1Weight-for-Length/Height (Wasting)

Out of 180 children, 12.8 % were moderately wasted (< -2 SD) and 10 % severely wasted (< -3 SD). The mean Z-score was 0.63 ± 1.52. The 48-60 month age group had the highest wasting prevalence of 16.7% while the lowest was recorded for the 36-47 month age group as 7.7 %. The lowest mean (0.23 ± 1.17) was for the 36 to 47 month old. There were no severely wasted children between 12-47 months. No significant relationship existed between sex and the prevalence of wasting or between age group and the prevalence of wasting. There was also no significant difference between the mean Z-score for boys and girls or between the combined mean Z-score for all age groups.

Table 4.15: Distribution of weight-for length/height (%) for both sexes across various age groups

Age groups		N	Weight-for-length/height %						
			% < -3SD	% < -2SD	% > +1SD	% > +2SD	% > +3SD	Mean	SD
6 to 11	Boys	10	20	20	40	20	0	1.17	1.19
	Girls	12	8.3	8.3	41.7	25	16.7	1.04	2.1
	Combined	22	13.6	13.6	40.9	22.7	9.1	1.09	1.76
12 to 23	Boys	15	0	6.7	26.7	13.3	6.7	0.49	1.39
	Girls	32	9.4	15.6	25	12.5	3.1	0.26	1.53
	Combined	47	6.4	12.8	25.5	12.8	4.3	0.34	1.47
24 to 35	Boys	34	11.8	14.7	44.1	20.6	2.9	0.99	1.48
	Girls	27	11.1	11.1	33.3	22.2	11.1	0.91	1.44
	Combined	61	11.5	13.1	39.3	21.3	6.6	0.96	1.45
36 to 47	Boys	10	10	10	10	10	0	0.07	1.07
	Girls	16	0	6.3	31.3	6.3	0	0.32	1.25
	Combined	26	3.8	7.7	23.1	7.7	0	0.23	1.17
48 to 59	Boys	15	13.3	13.3	40	20	6.7	0.71	1.98
	Girls	9	22.2	22.2	22.2	0	0	-0.01	1.35
	Combined	24	16.7	16.7	33.3	12.5	4.2	0.47	1.79
Total	Boys	84	10.7	13.1	35.7	17.9	3.6	0.75	1.5
(6 to 59)	Girls	96	9.4	12.5	30.2	14.6	6.3	0.53	1.54
	Combined	180	10	12.8	32.8	16.1	5	0.63	1.52

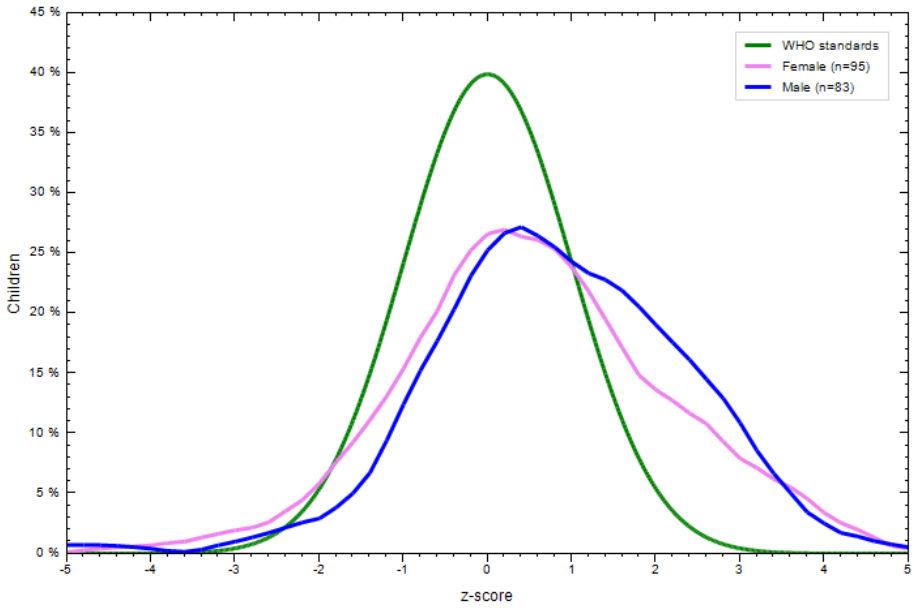

Figure 4.6: Prevalence of Weight for Height Z-score (wasting) based on Sex

4.3.2 Length/Height-for-age (Stunting)

Of the 188 children assessed, 62.8 % were moderately stunted (< -2 SD) and 34 % severely stunted (<-3 SD). The mean Z-score was -2.44 ± 1.37. The prevalence was higher in boys than girls with 69.4 % of the boys moderately stunted and 40 % severely stunted compared to the 57.3 % girls that were moderately stunted and 29.1 % severely stunted. No significant relationship exists between sex and the prevalence of stunting. The 36 to 47 month old age group recorded the highest prevalence of 75.9 %. The lowest mean was recorded for the 24 – 35 month age group as -2.58 ± 1.39. No significant relationship existed between sex and prevalence of stunting. There was also no significant difference between the mean Z-score for boys and girls or between the combined mean Z-score for all age groups.

Table 4.16: Distribution of Length/height-for-age (%) for both Sexes across various Age Groups

Age groups (months)	Sex	n	Length/height-for-age (%)			
			% < -3SD	% < -2SD	Mean	SD
6-11	Boys	10	20	50	-1.84	1.65
	Girls	16	31.3	43.8	-2.02	1.73
	Combined	26	26.9	46.2	-1.95	1.67
12-23	Boys	16	62.5	81.3	-3.05	1.19
	Girls	32	28.1	59.4	-2.24	1.67
	Combined	48	39.6	66.7	-2.51	1.56
24-35	Boys	32	43.8	75	-2.85	1.53
	Girls	27	22.2	51.9	-2.25	1.16
	Combined	59	33.9	64.4	-2.58	1.39
36-47	Boys	11	36.4	72.7	-2.61	0.65
	Girls	18	38.9	77.8	-2.48	1.1
	Combined	29	37.9	75.9	-2.53	0.94
48-59	Boys	16	25	56.3	-2.39	1.02
	Girls	10	30	50	-2.36	0.85
	Combined	26	26.9	53.8	-2.38	0.94
Total (6-59)	Boys	85	40	69.4	-2.65	1.33
	Girls	103	29.1	57.3	-2.26	1.38
	Combined	188	34	62.8	-2.44	1.37

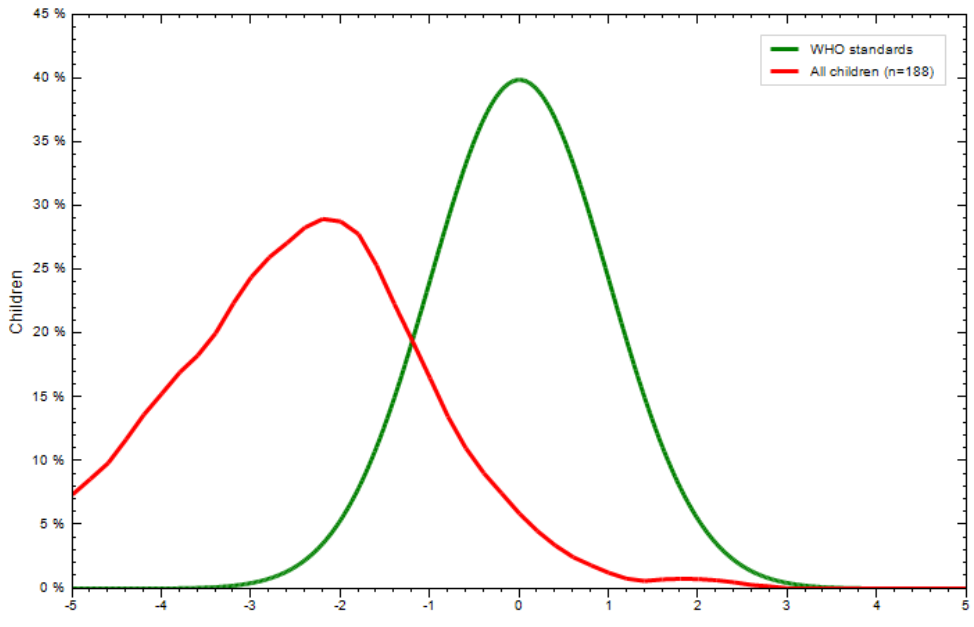

Figure 4.7: Prevalence of Height for Age Z-score (stunting)

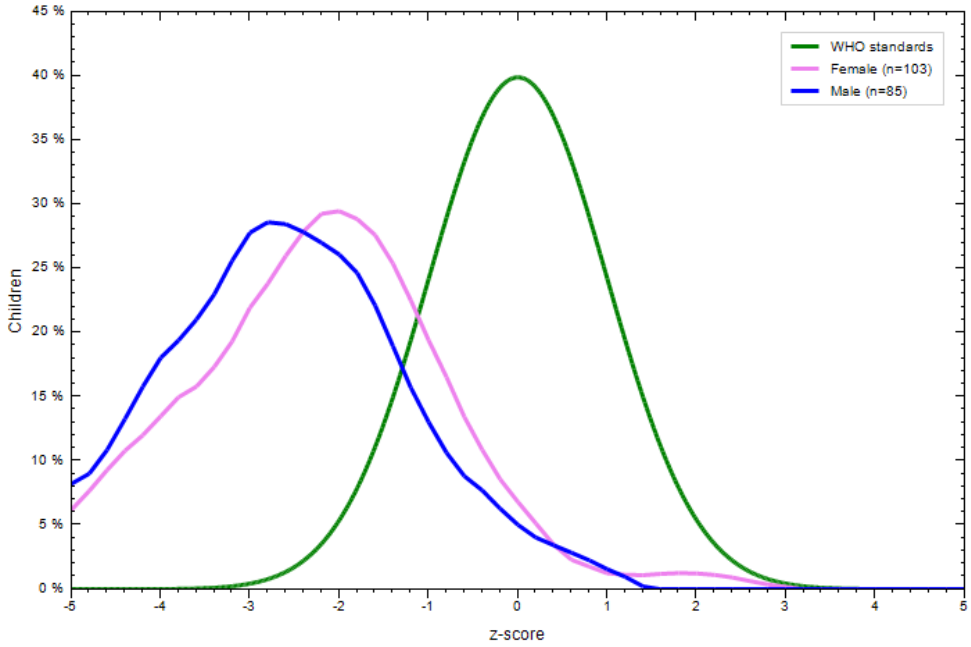

Figure 4.8: Prevalence of Height for Age Z-score (stunting) based on sex

4.3.3 Weight-for-age (Underweight)

Out of 186 children whose Z-scores were valid, 27.4 % were moderately underweight (<-2 SD) and 12.9 % severely underweight (<-3 SD). The mean Z-score for all the children was -0.91 ± 1.28. There were more underweight girls (29.4 %) than boys (25 %). No significant relationship exists between sex and the prevalence of underweight. The age group with the highest prevalence of underweight for both sexes was 36-47 months (29.6%).The lowest recorded mean was for the 48-60 month age group as -1.16 ± 1.06. No significant relationship existed between sex and the prevalence of underweight. There was also no significant difference between the mean Z-score for boys and girls or between the combined mean Z-score for all age groups.

Table 4.17 Prevalence of Weight for Age Z-score

Age groups		n	Weight-for-age (%)			
			% < -3SD	% < -2SD	Mean	SD
6-11	Boys	10	20	20	-0.1	1.06
	Girls	14	14.3	21.4	-0.56	1.71
	Combined	24	16.7	20.8	-0.39	1.5
12-23	Boys	15	6.7	20	-1.07	1.11
	Girls	35	14.3	34.3	-0.93	1.5
	Combined	50	12	30	-0.97	1.37
24-35	Boys	34	14.7	32.4	-0.92	1.12
	Girls	27	14.8	22.2	-0.82	1.01
	Combined	61	14.8	27.9	-0.88	1.06
36-47	Boys	10	10	30	-1.43	0.79
	Girls	17	0	29.4	-0.89	1.69
	Combined	27	3.7	29.6	-1.08	1.45
48-59	Boys	15	13.3	13.3	-0.97	1.05
	Girls	9	22.2	44.4	-1.53	1.03
	Combined	24	16.7	25	-1.16	1.06
Total	Boys	84	13.1	25	-0.93	1.09
(6-59)	Girls	102	12.7	29.4	-0.88	1.42
	Combined	186	12.9	27.4	-0.91	1.28

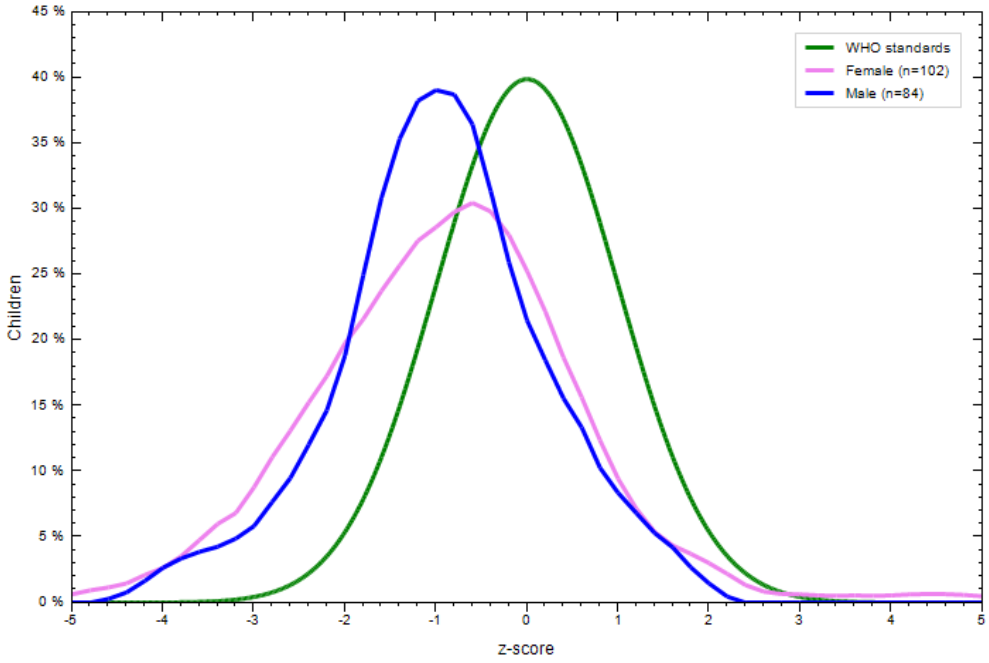

Figure 4.9: Prevalence of Weight for Age Z-score (underweight) based on Sex

4.3.4 MUAC-for-age

Of the 205 children, 8.8 % were moderately malnourished (< -2 SD). More girls (9.6 %) were malnourished compared to boys (7.8 %). No significant relationship exists between sex and the prevalence of malnutrition. The mean Z-score for MUAC was -0.59 ± 0.99. The 24 to 35 month-old age group had the highest prevalence of under nutrition at 12.2 % while the lowest mean was recorded for the 36 to 47 month age group with -1.03 ± 0.86. According to the MUAC indicator, there were no severely malnourished children. There was a significant relationship between age group and the prevalence of malnutrition based on MUAC (p = 0.005) and a significant difference between the combined mean Z-scores for the age groups (p = 0.001). There was no significant difference between the mean MUAC Z-scores for boys and girls and no significant relationship between sex and the prevalence of malnutrition based on MUAC.

Table 4.18: Distribution of MUAC-for-age (%) for both Sexes across various a Age Groups

Age groups (months)	Sex	n	Mid-upper arm circumference-for-age (%)						
			% < -3SD	% < -2SD	% > +1SD	% > +2SD	% > +3SD	Mean	SD
6-11	Boys	11	0	9.1	9.1	0	0	0.09	0.92
	Girls	20	0	0	5	5	0	-0.05	0.87
	Combined	31	0	3.2	6.5	3.2	0	0	0.88
12-23	Boys	16	0	6.3	6.3	0	0	-0.61	0.99
	Girls	35	0	11.4	5.7	0	0	-0.48	1.2
	Combined	51	0	9.8	5.9	0	0	-0.52	1.13
24-35	Boys	36	0	13.9	0	0	0	-0.87	0.86
	Girls	30	0	10	6.7	0	0	-0.47	0.96
	Combined	66	0	12.1	3	0	0	-0.69	0.92
36-47	Boys	11	0	0	0	0	0	-0.96	0.73
	Girls	19	0	10.5	0	0	0	-1.07	0.94
	Combined	30	0	6.7	0	0	0	-1.03	0.86
48-59	Boys	16	0	0	6.3	0	0	-0.44	0.85
	Girls	11	0	18.2	0	0	0	-0.95	0.94
	Combined	27	0	7.4	3.7	0	0	-0.65	0.91
Total (6-59)	Boys	90	0	7.8	3.3	0	0	-0.64	0.91
	Girls	115	0	9.6	4.3	0.9	0	-0.55	1.05
	Combined	205	0	8.8	3.9	0.5	0	-0.59	0.99

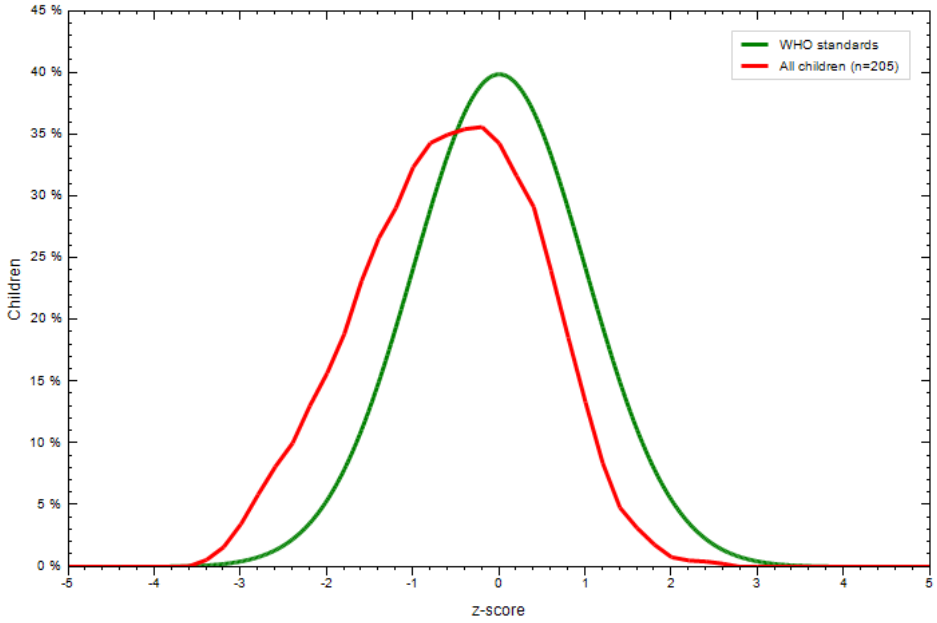

Figure 4.10: Prevalence of Malnutrition using MUAC Z-scores

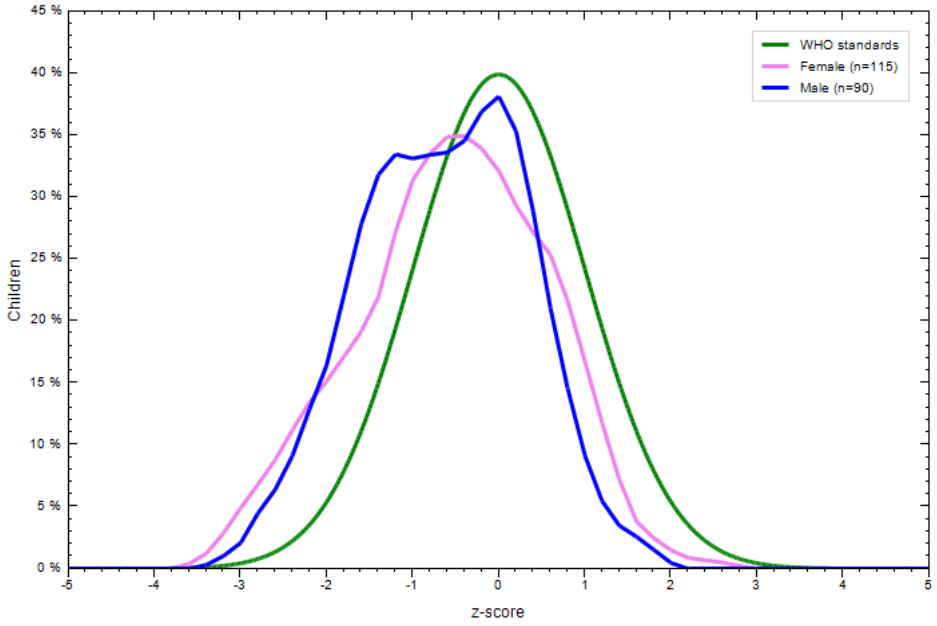

Figure 4.11: Prevalence of Malnutrition using MUAC Z-scores based on Sex

4.4 Relationship between Food and Nutrient Intake and Nutritional Status

Household socio-economic factors, diet diversity, child feeding practices and nutrient intake were subjected into logistic regression model to determine the relationship with height-for-age, weight-for-age and weight-for-height indices, out of the four factors only diet diversity had insignificant influence on height-for-age.

Table 4.19 Relationship of Nutritional Status on Household, Food and Nutrient Intake Indicators

	Height-for-Age		Weight-for-Age		Weight-for-Height	
	Adjusted Odds	**95%CI**	**Adjusted Odds**	**95%CI**	**Adjusted Odds**	**95%CI**
Diet Diversity						
Number of Different food Groups Consumed	0.306	0.02-4.18	1.748	0.12-25.28		0.000-
Child Feeding Practices						
Preparation of Special Meals	0.793	0.35-1.78	4.088	1.34-12.47	17.537	0.08-3816.06
Average Number of Meals per Day	0.493	0.23-1.06	0.398	0.14-1.14	0	0
NutrientIntake						
Iron	0.945	0.88-1.01	1.018	0.94-1.10	0.741	0.42-1.30
Vit A	1	1.00-1.00	1	1.00-1.00	1	0.999-1.00
Protein	1.002	0.99-1.01	0.99	0.997-1.00	1.058	0.92-1.21
Household Socio-economic Factors						
Household Size	1.147	0.93-1.42	0.984	0.70-1.38	6.413	0.54-75.95
Income	1.003	0.81-1.25	1.226	0.86-1.76	0.554	0.17-1.78
Access to Water	1.745	1.17-2.61	1.861	1.04-3.32	1.533	0.12-20.22
Level of Education	1.135	0.97-1.32	1.19	0.97-1.45	1.229	0.24-6.22
Age of Caregiver	0.984	0.94-1.04	0.99	0.92-1.07	0.962	0.63-1.46
Marital Status	1.02	0.58-1.80	1.345	0.56-3.24	831.05	0
Male Headed Households	0.947	0.80-1.12	1.189	0.56-2.51	103.764	0.004-266.73

CHAPTER FIVE
DISCUSSION

5.1 Household Socio-Economic Characteristics

Findings of this study reveal that there are averagely seven people per household. This finding concurs with that of the TDHS (TDHS, 2011) which indicated that Tanzanian households consist of averagely 5.0 people. Findings of this study validates studies conducted by (Arimond & Ruel, 2004; Burchi et al., 2011; Hoddinott & Yohannes, 2002; Ruel, 2003) that assessed the socio-economic link of families with nutritional status of young children and concluded that the outcomes were positive. Household income is likely to be a strong confounding variable as lower income levels correlate with lower levels of maternal education. Engagement of majority of households from Izimbya Ward on arable and mixed farming enabled them to secure reliable means of livelihood. This positively impacted on nutritional status of children below 5-years. This finding concurs with a previous study which revealed that farming enabled Tanzanians to earn their living as much as cattle keeping, poultry and piggery husbandry (Snyder et al., 2020). This engagement in arable farming shows that the households have potential for getting better nutrition if they incorporate more vitamin A, iron and protein rich foods for consumption. This shows the need for more community engagement and education on nutrition and viable options for this population.

In general, the ease of water access in a household greatly reduces the risk of malnutrition in children (Snyder et al., 2020). For instance, children in households that do not have a private tap were found to be at greater risk of being malnourished than are those in households with private taps (Christiaensen & Alderman, 2004). Almost half of the study participants' households relied on pump wells as their main source of water whereas tap/piped source of water recorded the

lowest frequency. Since pump wells are treated and thus fit for human consumption, it impacts positively on health status and ultimately on the nutritional status of children.

In addition, the study showed that majority of the study participants accessed their water between 0.2km to 2km away, with the majority between 0.2km to 0.5km. This shows improved water access for most respondents. However, those who go longer distances were almost half of the households, highlighting the need for more water access points for the residents of Izimbiya Ward to contribute to the improvement of their health. This finding concurs with those of a study done in Malawi which concluded that a household's access to water is linked with its socioeconomic status. Without an adequate supply of good-quality water, the risk of food malnutrition arise.

Findings of this study revealed that majority of the caregivers education level was 7 years spent in school or primary level. This majority explains the observed 50/50 nutritional status of the children targeted for this study. This 50/50 status is observed by the 50% of children meeting iron and protein RDA, and 73% meeting Vitamin A RDA. Seven years of school means that the majority of the caregivers only got to grade seven in the Tanzanian education system, which marks the end of primary school. Primary school education is the most basic level, and many individuals who drop out of school at this stage only have basic knowledge of life skills drawn from primary education. Secondary education foor caregivers has been shown to positively impact the health status of children (Byaro & Mpeta, 2021). Caregivers who receive even minimal education are generally more aware than those who have no education of how to utilize available resources for the improvement of the nutritional status of their families and that of their under-five children. This agrees with other studies that have stated that a mothers education

levels significantly affects the nutritional status of children (ACC/SCN, 2000; Nahikian-Nelms, 1997).

Based on the results of this study on housing conditions majority of respondents in Izimbya ward live in poor conditions. This is evidenced by the majority of respondents having houses with mud/unburnt brick walls, iron sheet roofs and mud flooring. Poor living conditions goes along with low income, which contribute to low nutritional status of reference children because of the unavailability of sufficient quality and quantity of foods, and the ability to afford other diverse foods to supplement the readily available ones. This may negatively impact on the nutritional status of children below five years. This observation concurs with those of Ekesa (Ekesa et al., 2011) empirical study conducted in Burundi and DRC which concluded that nutritional status of pre-school children is not only influenced by dietary diversity but by several intertwined factors such as underlying socio-economic and institutional factors which ultimately affect the quantity, quality and affordability of food as well as nutrition status.

5.2 Food and Nutrient Intake

In this study, it was observed that white roots, tubers and bananas were predominantly consumed, followed by legumes, nuts and oil seeds which were majorly consumed at lunch and dinner. Consumption of cereals and grain products came third, whereas the consumption of both organ meats and insects was very negligible in the 24-hour preceding the interview. Based on the findings of this study, it is concluded that majority of household members and their children consumed white roots, tubers and bananas. This meant that residents of Izimbya ward regarded these categories of foods as their staple food. Results of this study validates findings of (Ekesa et al., 2011; Ruel, 2003)which revealed that: in Sub-Saharan African countries, diets of pre-school

children are predominantly based on starchy foods with little or no animal products and few fresh fruits and vegetables. The diets consumed tend to be low in a number of micronutrients. However, the micronutrients contained are often in a form that is not easily bio-available, thus resulting in malnutrition. Bananas are widely cultivated in the tropics consumed as fruits and in some parts as a staple food. They are mainly consumed locally and are of vital importance to food security of millions of people (Frison & Sharrock, 1998). On the contrary, findings of Swindale et al (2006) concluded that dietary diversity reflects on household access to a wide variety of foods; hence it can be used as a proxy of the nutrient adequacy for individuals and young children (Swindale & Bilinsky, 2006). Diversified diets are therefore required to supply the full range and quantities of various nutrients.

Diversified diets are required to supply full range and quantities of nutrients that are required to support rapid growth from 6 months onwards (Muhimbula & Issa-zacharia, 2010). Dietary diversity has been recognized as an indicator of food security, with consumption of more food groups suggesting better nourishment, better nutritional outcomes and improved micronutrient intake. Dietary diversity is measured as the number of individual food items or food groups consumed over a given reference period.

Findings of this study revealed that almost half of children aged 6-59 months were meeting the recommended iron dietary allowance, three quarters of children aged 6-59 months were meeting the recommended vitamin A dietary allowance while more than half of children aged 6-59 months were meeting the recommended protein dietary allowance. These results show that there is some knowledge about the importance of nutrition diversity, and a good number of children are feeding as they should. However, there is need to expand the reach of iron, Vitamin A and

protein rich foods through governmental outreach and donor intervention for rural populations in northwestern Tanzania. The prevalence of iron deficiency anaemia in children has been reported in different levels in areas of Tanzania, highlighting it as a public health concern (Hadley & Decaro, 2015; Lweno et al., 2021; Mamiro et al., 2005). Vitamin A deficiency was reported as highly prevalent more than 10 years ago in Tanzania. Supplementation has been used to alleviate the effects of poor eyesight, anaemia and pneumonia (Fawzi et al., 1998; Mwanri et al., 2000; Wedner et al., 2000). Wasting due to protein deficiency has also recently been reported at 28% (Gowele et al., 2021).

Iron deficiency is a widespread public health concern, which is likely to occur due to dietary inadequacies more so in developing countries where staple diets are predominantly plant based and consumption of animal protein foods such as red meat, poultry and fish is often minimal because of economic, cultural and religious constraints (Soh et al., 2004). Prevalence data from a number of studies indicated that normal dietary intakes of iron are insufficient to cover for increased requirements for a child's development. Diets that are heavily dependent on one grain or starch as the major staple often lack sufficient iron intake. Iron is found in meats, poultry, fish, grains, some cereals, and dark leafy greens (such as spinach). Iron-deficiency anemia is the most common form of nutritional deficiency worldwide. This type of nutritional deficiency develops slowly and does not manifest symptoms until anemia becomes severe. Poor nutritional status is more often associated with inadequate or unbalanced diets. Inadequate nutrient intake is a consequence of insufficient food availability at the household level coupled with improper feeding practices.

Vitamin A has been widely documented on as an essential micronutrient for the immune system. Vitamin A plays a major role in maintaining the epithelial tissue in the body. Vitamin A is found in breast milk, carrots, liver, eggs, butter, fish, mangoes, papayas, red palm oil, carrots, pumpkins and dark green leafy vegetables. It is commonly believed that the major cause of the high rate of vitamin A deficiency is an inadequate diet.

Proteins are required to build new tissue and are derived mostly from animal sources such as meat, milk and eggs. Animal by-products contain essential amino acids that cannot be produced by the body and hence have to be obtained from food. Protein from cereals and pulses do not provide the sufficient balanced essential amino acids. It is therefore paramount that to obtain the correct balance without protein from the animal sources, cereals and pulses must be combined when planning a meal.

5.3 Nutritional Status of Children aged 6-59 months

Stunting was the most prevalent indicator of nutritional status, followed by underweight and wasting. Severe forms of these indicators were also observed in the targeted children on this study. Wasting had the lowest prevalence of the indicators. This can be attributed to the sufficient consumption of starches in form of bananas and roots. Wasting was mostly observed in children between 48 to 59 months, with similar numbers between boys and girls. This group has a high demand for starches and proteins because they are at the most active stages of their lives (CDC, 2021). Therefore, if this demand is not met, wasting is inevitable. Stunting was the most observed indicator with 40% of children severely stunted. This is attributable to the lack of consumption of sufficient protein and vitamins, and mostly consuming starches (WHO, 2022). Underweight children were also due to insufficient consumption of a balance of nutrients. In addition to iron, vitamin A and protein, many other nutrients are required for healthy children.

An empirical study conducted by Chapagain et al (2013) in Nepal revealed that malnutrition is very high due to cultural, social-economical, educational and political structure of Nepal with approximately 50% of children in Nepal being undernourished out of which 49% are stunted, 39% are underweight and 13% are wasted (Chapagain, 2013). Underweight and stunting are highly prevalent public health problems in developing countries. Approximately 45 million children under-five years (<5) suffer from malnutrition in Africa (Behrman et al., 2004). The prevalence of stunting (height-for-age) in children under-five years in East Africa averages about forty eight percent (48%) (ACC/SCN, 2000), which is the highest in the world. Findings of this study revealed that levels of stunting in children aged 6-59 months were high. The results obtained from this study tallies with records from the TDHS 2010 which recorded thirty five percent (35%) and the TDHS 2004-2005 recorded thirty eight percent (38%) (TDHS, 2011). According to UNICEF (2009), Tanzania is ranked 10th worldwide with chronically undernourished children with forty four percent (44%) of children under-five suffer from stunted growth, four percent (4%) were wasted and twenty two percent (22%) were underweight while an astounding seventy two percent (72%) were anaemic (UNICEF, 2009). According to the MDG Report (2015) it states that both underweight and stunting 2015 targets were not achieved, thus it is worth noting that malnutrition is prevalent and more so stunting (United Nations, 2015).

CHAPTER SIX
CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

It is clear from the result of this study that iron deficiency is still a serious public-health issue in Izimbya Ward, Tanzania. The biggest contributor to this deficiency for our study subjects was the low socio-economic status of the children's caregivers as evidenced by the different household characteristics tested. The most promising strategies is increasing the iron supply by improving the diet through diversification with iron dense foods

The food and nutrient intake data obtained could be used to design nutrition intervention programs targeted at this reference group. Intensive nutrition education to promote consumption of the animal products and education through providing information about the kinds of foods that may increase the intake and absorption of iron is paramount. The study concluded that dietary diversification is possible by the promotion of rearing and keeping of small animals such as chicken.

Children in the study showed highest levels of stunting, followed by underweight and wasting. This was again attributable to the lack of diverse nutrient-rich foods. This status in Izimbiya Ward can be improved by the government's involvement in providing manageable options to diversify nutrition, such as subsidies on manure for farming and feeds for small animals.

6.2 Recommendations for Caregivers

Based on the findings, the researcher made the following recommendations for caregivers:

1. Caregivers should be enlightened on diet diversity and bio-availability of nutrient dense foods so as to further improve on the nutritional status of children of this age-group.

2. The caregivers can be educated on modification of local diets to improve on iron, vitamin A and protein contents.

6.3 Recommendations for Further Research

Based on the findings, following recommendations were made for further research:

1. A replication of the same study targeting children aged 6-59 months from banana dependent households in an urban set up in Tanzania should be initiated in order to validate findings of this study.
2. Investigation of the nutritional status of children from other households whose staple food is not bananas, for example Ugali or rice.
3. A study to assess the willingness of caregivers to adapt new methods of preparing foods to increase nutrient value, and ability to grow different crops and keep small animals.

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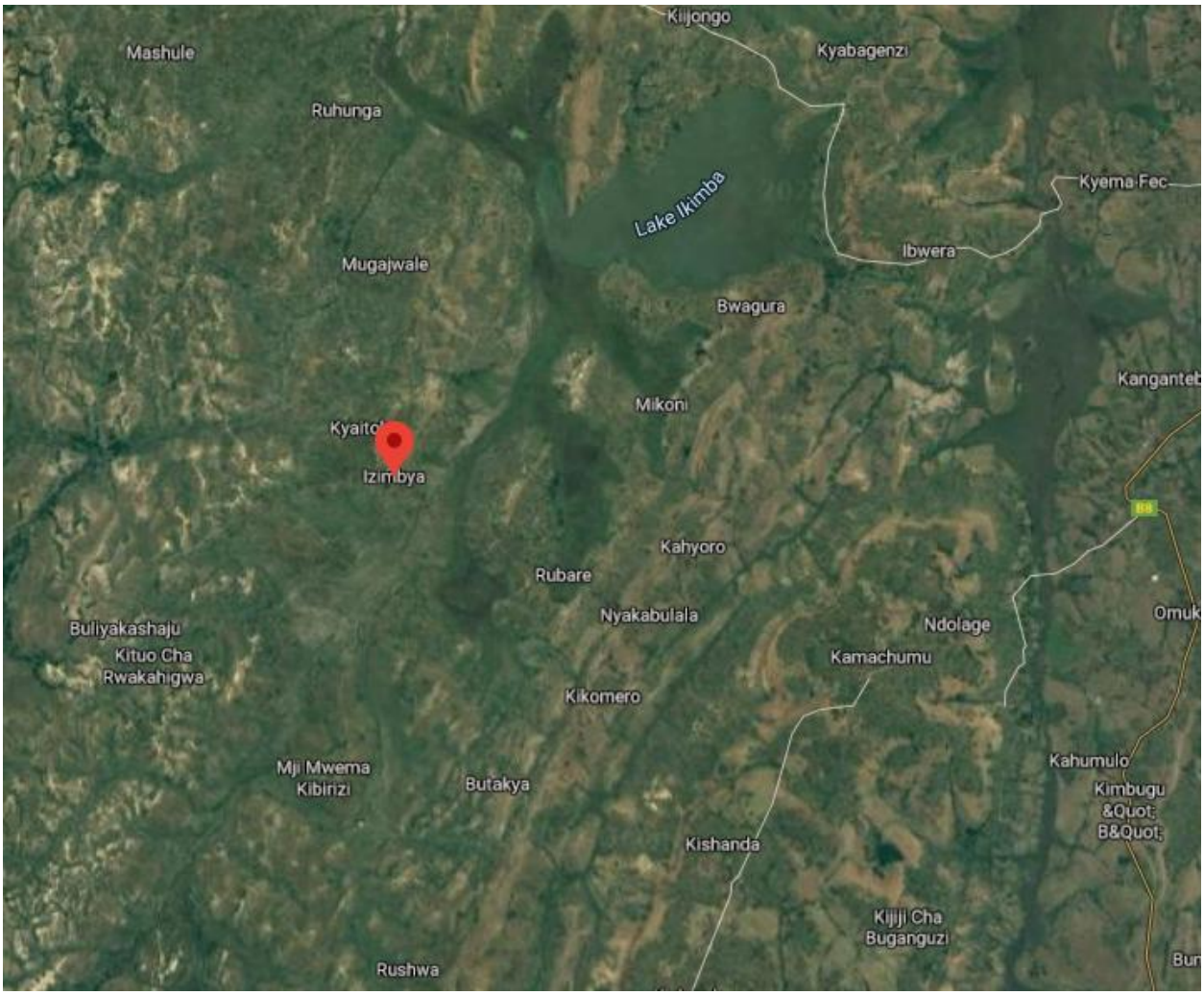
APPENDICES

Appendix 1: Map of Izimbya Ward



Appendix 2: Consent by Participants

Study Title: Influence of household socio-economic characteristics, food and nutrient intake on nutritional status of children aged 6-59 months from banana-dependent households of Izimbya Ward in Bukoba Rural District, Tanzania

Investigator	**Position in the study**	**Institutional affiliation**	**Contact information**
Digo Edith	Candidate	Maseno University	Private Bag, Maseno Tel: 0712-096365
Dr. Okeyo David	Supervisor	Kenya Nutritionists and Dietitians Institute	Private Bag, Nairobi Tel: 0723-471371
Dr. Ekesa Beatrice	Supervisor	Bioversity International	Box 24384, Kampala Katalima Road-Uganda Tel: +256-782-849593

RESEARCHER'S STATEMENT

We are requesting you to participate in this research study. The purpose of this form is to furnish you with information that you will need to help you decide whether to take part in the study or not. Please listen carefully as I read this form. You may ask questions about what we will ask you to do, the risks, the benefits, your rights as a volunteer, or anything else about the research or this form that is not clear to you. When all of your questions have been answered, you can decide if you want to take part in the study or not. This process is called "informed consent". If you agree to take part in this study after we have described it to you and answered any questions you have to your satisfaction, we will give you a signed copy of this form for your records.

Purpose of the study:

The purpose of this study is to establish the influence of household socio-economic characteristics and food and nutrient intake on nutritional status of children aged 6-59 months from banana-dependent households within the community. We would like to assess the diversity of diets consumed thus caregivers and community in general can improve the nutrition status of children aged between 6-59 months.

Procedures for the study:

The study will be carried out in Izimbya Ward, Tanzania. We shall engage members of the community. We will visit your home once to collect information. This is what will happen at each visit: At enrolment visit:

- You will be given a unique study number which will be used to label your structured questionnaire.
- We will ask you questions on what you know about food and nutrient intake, nutritional status.
- The interview will take about one hour in the privacy of your home.

If you agree to participate in the study and you have a child aged 6-59 months, we will also ask you to allow us to take his/her MUAC, weight and height measurements.

Risks, stress, or discomfort:
It is possible that someone who should not have this information about your being in the study may see it. This breach of confidentiality may make you upset. There may be other risks, stresses or discomforts of joining the study that we don't know about now.

Benefits of participating in the study:
There will be no direct benefit to you as an individual if you agree to participate in this study. However, your participation will provide information that will help us get a clear picture of the nutrition status of children aged 6-59 months.

Volunteerism and other information:
Your participation in this study is absolutely voluntary and you may decide to withdraw your participation before or during the interview without penalty. Remember that it is still possible to decline to participate even after signing this consent form.

Remember, the information obtained in this study will be used mainly for the purpose described in this consent form. We would like to re-assure you that the data and any publication from this study will not contain information that will reveal your identity as a participant. Only Ms. Edith, Dr. Okeyo and Dr. Ekesa and the study staff, will have access to information that link your name on the consent form you have signed or put your mark on and your study number. Data obtained from this interview will be kept in the safe custody of Ms. Edith and Bioversity International dataset bank for 1 year after the end of the study, after which they will be destroyed.

We will make every effort to keep the information that you give confidential; however, no system of protecting your confidentiality can be perfect or completely secure. It is still possible that someone could find out you participated in this study and find out information about you. Should you have any question about the study, please feel free to get in touch with Ms. Edith, Dr. Okeyo and Dr. Ekesa through the address and phone number given on the first page of this document.

PARTICIPANT'S STATEMENT:

The purpose of this interview has been explained to me. I volunteer to take part in this interview. I have had a chance to ask questions. If I have questions later, I can ask the researchers listed in the front page of this document.

_____ _____

Signature Date

OR (for those unable to sign)

Thumbprint (right hand)		Date _____ (To be filled by the recruiting staff)

Appendix 3: Ethical Approval Letter

MASENO UNIVERSITY ETHICS REVIEW COMMITTEE

FROM: SECRETARY - MUERC

DATE: 7th July, 2014

TO: Digo Edith Awuor
PG/MSc/083/2010
School of Public Health and Community Development
Maseno University, Maseno, Kenya

REF: MSU/DRPC/MUERC/00086/14

RE: Proposal Reference Number MSU/DRPC/MUERC/00086/14: ***Influence of Iron, Vitamin A and Protein Intake on Nutrition and Health Status of Children Aged 6-59 Months from Banana Dependent House- Holds of Izimbya Ward, Tanzania.***

MUERC is pleased to inform you that your proposal application was reviewed and discussed in the Committee meeting held on 26th June 2014.

In its review, the Committee noted the following Minor corrections to be made before Ethics clearance can be granted.

i) It is unclear why written informed consent will not be provided. The investigators cannot just rely on oral consent from study participants.
ii) It is also unclear who will have access to the collected data, and how it will be stored to ensure confidentiality.
iii) Attach copy of the consent form.
iv) What are the safety issues in the current study and how will they be addressed?

The Committee granted the Investigators thirty (30) working days to make corrections and submit a final draft proposal to MUERC Secretariat for consideration and approval.

Please submit **one copy of corrected draft proposal** and a signed cover letter detailing the sections (page numbers and paragraphs) where corrections are made.

Thank you.

Yours faithfully,

DIRECTORATE OF RESEARCH PUBLICATION & CONSULTANCIES 11 JUL 2014 MASENO UNIVERSITY

Dr. Bonuke Anyona
Secretary - MUERC
Cell phone: +254 721 543 976; +254 733 230 878
Email: sbonuke@gmail.com

MASENO UNIVERSITY IS ISO 9001:2008 CERTIFIED

Appendix 4: Classifications of Dietary Diversity

Cut-off point	Classification
1 to 3 food groups	Low diversity
4 to 5 food groups	Moderate diversity
>6 food groups	High diversity

Source: FAO, 2006

Appendix 5:Malnutrition Classifications by World Health Organization (WHO)

Cut-off point	Classification
<-1 to > -2 Z score*	Mild
<-2 to > -3 Z score*	Moderate
<-3Z- score*	Severe

Source: World Health Organization Child Growth Standards 2006

Appendix 6: Household Listing Form

Household number _____

Household size _____

Number of children under-five years _____

	Coded Numbers of Household Members	**Age**	**Sex**
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			

Appendix 7: Food Frequency Questionnaire

Purpose of this food frequency table is to collect information of local foods commonly grown and consumed throughout the year. The list of foods thus creates the dietary diversity of the households on monthly basis for a whole year (with last year as the reference period).

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Cereals and Grains Maize flour												
Green maize												
Millet												
Sorghum												
Rice												
Wheat products												
Roots and Tubers Cooking bananas												
Plantain bananas												
Sweet cassava												
Bitter cassava												
Irish potatoes												
White sweet potatoes												
Orange sweet potatoes												
Arrow roots												
Cocoyam												
Yam												
Vegetables Cow peas leaves												
Yam leaves												
Bean leaves												
Pumpkin leaves												
Cassava leaves												
Sweet potato leaves												
Sukuma wiki/Kales												
Amaranth leaves												
Mushrooms												
Cabbage												
Tomatoes												
Onions												
Others (specify)……..												
Legumes and Nuts Beans												
Groundnuts												
Sesame seeds												
Soya beans												
Bambara nuts												
Others (Specify)……..												
Animal protein Termites												

Grasshoppers												
Eggs												
Large fish												
Small fish												
Organ meat												
Flesh meat												
Milk												
Others (specify)……..												
Fruits Mangoes												
Avocado												
Pawpaw												
Passion												
Pineapple												
Jack fruit												
Tree tomatoes												
Oranges												
Others (Specify)……..												

Appendix 8: Questionnaire

Introduction

My name is ……..I am a student, undertaking a study aimed at investigating "influence of household socio-economic characteristics, food and nutrient intake on nutritional status of children aged 6-59 months from banana-dependent households." I'd like to ask you a few questions regarding the title. Your participation will be voluntary and the information you give will be treated with high confidentiality. Your sincere and true responses will enormously contribute to the achievement of the aim of the study.

Instruction

Enter code(s) whereappropriate and any other comment should be filled in the spaces provided.

Caregivers Questionnaire: Household socio-economic status, Dietary Intake, Nutrition and Health Status

1.	Questionnaire ID	
2.	Date of interview (dd/mm/yyyy)	

SECTION I

GENERAL HOUSEHOLD INFORMATION

	Variable	**Choices**	**Code**
3.	Gender of respondent/caregiver	1=Female, 2=Male	
4.	Age of respondent/caregiver in years	(Enter the respondents age in years)	
5.	Is respondent/caregiver the household head (if No go to question 8)	1=Yes, 0=No	
6.	If the respondent/caregiver is not the Household Head (HHH) who is the household head	1. Spouse, 2=Mother, 3=Father, 4=Sister, 5=Brother, 6=Grandmother, 7=grandfather, 8=Auntie, 9=Uncle, 66=Other (Specify)	
7.	Marital status of respondent/caregiver	1=Single, 2=Monogamously married, 3=Polygamous married, 4= Widowed, 5=Separated/Divorced, 66=Other (Specify) ……	
8.	Number of children aged under-five years	(Enter the total number of children under-five)	
9.	Household size	(Enter the total number of people/persons who reside and take meals in the house)	
10	Water What is the main source of water nearest to you	1=Spring, 2=Shallow well, 3=Pump well, 4=Dam, 5=Tank at home, 6=Tap/piped water, 7=River, 8=Lake, 66=Other (Specify).....	
11	Education Level of education of the caregiver	(Enter the number of years spent in school)	
12	Livelihood Main source of livelihood/income	1=Employed, 2=Business person, 3=Arable farming,4=Cattle farming, 5=Mixed farming, 6=Casual laborer, 7=Fisherman, 8=Businessman/woman,66=Others(specify)	
13	Housing indicators Type of wall	1=Mud/un-burnt bricks, 2=Burnt Brick/Blocks, 3= Stone, 66=Others (specify)……	

13.1	Type of roof	1=Grass, 2=Iron sheet, 3=Tiles	
13.2	Type of floor	1=Mud, 2=Cement, 3=Tiles	
14.	What is the average number of meals taken per day in your household	1=One meal per day 2=Two meals per day 3=Three or more meals per day	
15	When you do not have enough food in your household what do you normally do to ensure you can still have food	1= Do nothing/stay hungry 2= Rely on food aid 3= Borrow from relatives/friends 4= Work for food/money 5=Reduce the number of meals 6=Reduce the quantity of food prepared 66=Other (Specify)……	

Household and Reference Child Dietary Diversity

Introduction: The following questions examine the food consumption pattern of your (household) in the last 24 hours. Please describe the foods (meals and snacks) that you or any member of your household ate or drankyesterday during the day and night. Include only foods consumed at home, not those purchased and consumed outside of the home. Start with the first food eaten in the morning. When composite dishes are mentioned ask for ingredients. Basing on the community food list, probe for meals and snacks not mentioned. [**Fill column on food group after the interview].**

To establish quantity and quality of food consumed by the reference child in the last 24hrs preceding the survey, three sets of food models (cup, bowl, spoon) of different sizes will be used: The enumerator will have the models with them and they will show them to the mother/respondent during the interview.

Appendix 9: Household and Reference Child 24-hour Dietary Recall

	Groups & varieties consumed	Food group	No. People served			Main Source	Cooking method	Ingredients	Amount of ingredients (Kg)	Amount cooked for HH (kg)	Amount consumed (kg)	Amount consumed by reference child (gms)
			i)> 15 y	ii)6 - 14y	iii) 5y							
	Breakfast											
	Snack Mid-Morning											
	Lunch											
	Snack-Mid afternoon											
	Dinner											
	Snack-Before bed											

	Groups & varieties consumed	Food group	No. People served			Main Source	Cooking method	Ingredients	Amount of ingredients (Kg)	Amount cooked for HH (kg)	Amount consumed (kg)	Amount consumed by reference child (gms)
			i)> 15 y	ii)6 - 14y	iii) 5y							

***Food groups**: 1= Cereals, grains & products, 2=white roots, tubers & bananas, 3=Vit. A rich veges, tubers & bananas, 4=Dark green leafy veges, 5=Other veges including mushrooms, 6=Vit. A rich fruits, 7=Other fruits even wild, 8=organ meats (iron rich), 9=Flesh meats, 10= Eggs, 11=Fish, 12=Legumes, nuts & oil seeeds, 13=Insects, 14=Milk & products, 15=oils & fats, 16=Sweets&sugars, 17= Spices, condiments, beverages & alcohol*	***Main source** 1=Farm, 2=Market/shop 3= Gift 4= Food aid 5=Gathering/hunting 66=Other Specify)…… …..*		***Method of preparation** 1=Raw, 2=Boiling 3=Roasting, 4=Frying 5=Stewing 66=Other specify…… ……..*	

To Take the anthropometric measurements of child under-five following standard procedures (one decimal point for all measurements)

	Measurements	1st reading	2nd reading	3rd reading	Average
	Height (in cm)				
	Weight (in Kg)				
	MUAC (in cm)				

Child feeding practices

	Who do you ask for advice when you have questions regarding feeding of your child?***Do not read out the list, probe for further responses. More than one answer is possible***RECORD 1= Yes, 0= No		
	Health Professional, Hospital		
	Mother		
	Mother-in-law		
	Grandmother		
	Friend/Neighbor		
	Father		
	66 Others (specify)		
	Who within the household mostly feeds the child? ***Do not read out the list, probe for further responses. More than one answer is possible*** RECORD 1=Yes, 0= No		
	Mother		
	Father		
	Sister		
	Brother		
	Grand mother		
	Househelp		

	66 Other (Specify)…….		
	Who makes decisions on what is fed to the under-five child? ***Do not read out the list, probe for further responses. More than one answer is possible*** RECORD 1=Yes, 0= No		
	Mother		
	Father		
	Sister		
	Brother		
	Grand mother		
	Grandfather		
	66 Other (Specify)……..		
	In the last one month did you prepare special foods for your child? 1=Yes 0= No		
	If Yes, where did you get the information on how to prepare special foods? RECORD 1=Yes and 0=No		
	Health professional/Hospital		
	Media(radio, television)		
	Mother-in-law		
	Friend/Neighbor		
	Social groups		
	66 Others(specify)		
	If **NO**, why don't you prepare special foods for your child? RECORD 1=Yes, 0= No		
	Lack of time		
	No food		
	Don't know what to prepare		
	Don't know how to prepare		
	Child is old enough to eat family food		
	Don't know why I should do that		
	66 Other (Specify)…….		