PREVALENCE AND DETERMINANTS OF MALNUTRITION AMONG UNDER- FIVE CHILDREN AND THEIR MOTHERS IN KUJE AREA COUNCIL OF THE FEDERAL CAPITAL TERRITORY, NIGERIA

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NIGERIA

SEPTEMBER, 2016

PREVALENCE AND DETERMINANTS OF MALNUTRITION AMONG UNDER- FIVE CHILDREN AND THEIR MOTHERS IN KUJE AREA COUNCIL OF THE FEDERAL CAPITAL TERRITORY (FCT) NIGERIA

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A DISSERTATION SUBMITTED TO THE SCHOOL OF POSTGRADUATE STUDIES, AHMADU BELLO UNIVERSITY, ZARIA

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD

OF A

MASTER OF SCIENCE DEGREE IN NUTRITION

DEPARTMENT OF BIOCHEMISTRY,

FACULTY OF SCIENCE

AHMADU BELLO UNIVERSITY, ZARIA

NIGERIA.

SEPTEMBER, 2016

DECLARATION

I declare that the work in this Dissertation entitled 'PREVALENCE AND DETERMINANTS OF MALNUTRITION AMONG UNDERFIVE CHILDREN AND THEIR MOTHERS IN KUJE AREA COUNCIL, FEDERAL CAPITAL TERRITORY,NIGERIA' has been carried out by me in the Department of Biochemistry, Ahmadu Bello University, Zaria. The information derived from the literature has been duly acknowledged in the text and the list of references provided. No part of this Thesis was previously presented for another degree or diploma at this or any other Institution.

OKORO Clementina Ebere

Name of Student	Signature	Date

CERTIFICATION

This dissertation entitled 'PREVALENCE AND DETERMINANTS OF MALNUTRITION AMONG UNDER FIVE CHILDREN AND THEIR MOTHERS IN KUJE AREA COUNCIL, FEDERAL CAPITAL TERRITORY, NIGERIA' by Clementina Ebere OKORO meets the regulations governing the award of the degree of Master of Science (Nutrition) at Ahmadu Bello University, Zaria, and is approved for its contribution to knowledge and literary presentation.

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(Dean, Postgraduate school)	Signature	Date

DEDICATION

This work is dedicated to God Almighty and to my late Dad, Chief Benedict U. Ezeugwu who constantly inspired me towards the completion of this work.

ACKNOWLEDGEMENTS

My most sincere gratitude goes to God Almighty whose love, mercy and grace has kept me going, he is my unlimited source of supply.

My heartfelt gratitude goes to my supervisors, O.A. Owolabi and Prof. D.B James for their priceless time, enthusiasm, constant assistance, valuable contributions, constructive criticisms, guidance and for ensuring that I complete this programme.

I sincerely thank the Head of Department, Postgraduate coordinator, and academic staff of Biochemistry Department for their invaluable contributions. My thanks also go to the Technical and Administrative Staff of the Department for all their assistance. I thank Dtn. Aloysius Maduforo for his kind assistance and contributions in the course of this work.

I express my deep appreciation to my husband, Mazi Kelvin Okoro and my children for their understanding during the period of this study. I will always remember all their contributions, may God reward them greatly. I thank my family for being there for me at all times, it really kept me going.

I also appreciate the Federal Capital Territory Administration and Kuje Area Council for granting me the opportunity to undertake this study. I thank all my Team members for the assistance they rendered to me. I acknowledge the contributions and assistance of National Population Commission FCT Director, Alhaji Bello S.Y., National Bureau of Statistics staff; Mr. Tunde Oladokun, Mr. Folorunsho Busari, Mr Fatai, who were there to contribute their quota during this work.

Finally, my appreciation goes to Dr. Bamidele Omotola, Mrs Ngozi Ikeliani, Dr. Rilwanu Mohammed, my colleagues and all those that constantly prayed and encouraged me through my studies.

ABSTRACT

Prevalence and determinants of malnutrition among 499 under-five (U5) children and their mothers (496) in Kuje Area Council, Federal Capital Territory was investigated through a cross-sectional survey using cluster sampling techniques based on probability proportion to size of Emergency Nutrition Assessment (ENA) for Standardized Monitoring and Assessment for Relief and Transitions (SMART) methodology. Malnutrition in the study area is unacceptably high with Global and Severe Acute Malnutrition at 12.8% and 5.4% respectively, stunting at 40.3% and underweight at 24.4%. For the mothers only 1.9% were underweight with about half (46%) overweight / obessed. Crude death rate was fifty-nine deaths per thousand live births (59/1000) with U5 years children mortality rate of 78/1000 and morbidity rate 17.2%. Majority of the children (79.5%) had fever, followed by cough (32.5%), malaria (29.8%), diarrhoea (27.3%). Mean U5 years children serum concentrations of Iron, Zinc, Calcium, Phosphorus, Vitamin A, Vitamin D and Haemoglobin levels respectively are 80.50±17.90µg/dl, 164.9±105.1mg/dl, 8.4±1.3mg/dl, 6.4±2.2mg/dl, 229.8±33.0 nmol/L, 89.1±82.1µg/L, 11.7±1.4g/dl, while that of their mothers are 85.69±30.69µg/dl, 153.76±97.28mg/dl, 8.54±0.98mg/dl, 5.82±1.90mg/dl, 131.76±130.98nmol/L, 118.11±115.28 µg/L, 12.55±1.03g/dl respectively. Feeding practices shows 30.6% initiated breastfeeding within 30 minutes of birth and 22.4% exclusively breastfed for up to 6 months. Determinants of malnutrition at $P< 0.05$ include childcare, place of delivery, immunization status, early initiation to breastfeeding, exclusive breastfeeding practices, use of colostrum and age. There is high prevalence of double burden of malnutrition among under-five children and their mothers in Kuje Area Council with multifactorial determinants.

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LIST OF ABBREVIATIONS

ABU	Ahmadu Bello University
AMAC	Abuja Municipal Area Council
BMI	Body Mass Index
Ca	Calcium
CMR	Crude Mortality Rate
DHS	Demographic Health Survey
EDTA	Ethylene Diamine Tetra-acetic Acid
ELISA	Enzyme linked Immunosorbent Assay
ENA	Emergency Nutrition Assessment
FAO	Food and Agriculture Organization
FCT	Federal Capital Territory
FFQ	Food Frequency Questionnaire
FGN	Federal Government of Nigeria
FMOH	Federal Ministry of Health
Hb	Haemoglobin
ICN	International Conference on Nutrition
KAC	Kuje Area Council

MDG	Millennium Development Goals
MICS	Multiple Indicator Cluster Survey
MNCHW	Maternal Newborn and Child Health Week
MUAC	Mid Upper Arm Circumference
NBS	National Bureau of Statistics
NDHS	Nigeria Demographic and Health Survey
NPC	National Population Commission
PEM	Protein Energy Malnutrition
RrHC	Road to Health Charts
SAM	Severe Acute Malnutrition
SCN	Standing Committee on Nutrition
SD	Standard Deviation
SMART	Systematic Monitoring and Assessment for Relief and Transition
UNICEF	United Nations Children's Fund.
USA	United States of America
WHO	World Health Organization
%:	Percentage

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background

Malnutrition is insufficient, excessive or imbalanced consumption of dietary energy and nutrients. It manifests in different forms, such as undernutrition, overnutrition and micronutrients malnutrition and results from either inadequate or excessive availability of energy and nutrients (Brown *et al.*, 2011). Malnutrition can occur in two forms; Primary malnutrition which results when a poor nutritional state is dietary in origin and secondary malnutrition is precipitated by a diseased state, surgical procedure, or medication. Diarrheoa, alcoholism, AIDS, and gastrointestinal tract bleeding are examples of conditions that may cause secondary malnutrition (Brown *et al.*, 2011).

Malnutrition in early childhood is associated with functional impairment in adult life as malnourished children are physically and intellectually less productive when they become adults. It decreases the educational achievement, labour productivity and economic growth of a country. Children that are malnourished tend to have increased risk of morbidity and mortality and often suffer delayed mental development, poor school performances and reduced intellectual achievement. Concurrent high levels of malnutrition worsen the health status and development potential of a child (Smith and Haddad, 1999).

Globally, nutritional status is considered the best indicator of the well-being of an individual (Dasgupta *et al.*, 2014). The nutritional status of a child is of particular concern because, early years of life are crucial for future growth and development. Under-five children represent the vulnerable and the most important target group where malnutrition

plays a pivotal role in their mortality and morbidity along with delayed mental and motor development during these formative years (Dasgupta *et al.,* 2014).

A widely used conceptual framework published by UNICEF in 1990 identifies three main underlying determinants of nutritional status: availability and access to food, the quality of feeding and care giving practices, and the health of the surrounding environment and access to health care services. Each of these determinants is a necessary but not sufficient condition on its own to good nutrition (ARDD World Bank, 2007)

1.2 Statement of Research Problem

The challenges of hunger and inadequate intake of food nutrients which hampers the nutritional status of children and women still remains an issue of concern in Nigeria. Worldwide, almost 7 million children die each year before they reach their fifth birthday, while India (24%) and Nigeria (11%) together account for more than one-third of all under-five deaths. Globally, undernutrition is responsible, directly or indirectly, for at least 35% of deaths in children less than 5 years of age (WHO, 2010; You *et al.,* 2011; UNICEF, 2014). The under – 5 mortality rate in Nigeria is 128 deaths per 1000 live births, which implies that one in every eight children born die before reaching their fifth birthday (NDHS, 2013).

Nigeria Demographic and Health Survey (NDHS) revealed that under-5 mortality rate decreased from 201 deaths per 1,000 live births to 128 deaths per 1,000 live births from 2003 to 2013 (NDHS, 2003; NDHS, 2013). However, Nigeria did not achieve the millennium development goals (MDGs) target of reducing the under-5 mortality to 64 deaths per 1,000 live births and the infant mortality to 30 deaths per 1,000 live births (FMOH, 2014).

The estimated maternal mortality ratio in Nigeria of 545 deaths per 100,000 live births in 2008 has increased to 576 deaths per 100,000 live births in 2013 (NDHS, 2008; NDHS, 2013). The NDHS (2008) also reported that 12% of Nigerian women are too thin, but 22% are overweight or obese. The proportion of overweight women is almost twice as high in urban areas as in rural areas (31% compared with 17%) and increases with age, education, and wealth.

Micronutrients deficiencies in Nigeria has remained a great public health concern. The last national Food consumption and micronutrient survey conducted over a decade ago 2001-2003, 29.5% of preschool children had Vitamin A deficiency, 24.8% of Nigerian children under 5 suffered from marginal vitamin A deficiency while 8% of pregnant women in Nigeria had night blindness. About 20% of the population were at risk of inadequate intake of zinc, 76.1% of pre-school children, 62% non-pregnant women and 66.7% of pregnant women were anaemic. One major cause of anaemia is iron deficiency (Maziya-Dixon *et al.*, 2004; Aminu, 2010; FMOH, 2013). An increased visibility of the problem of "hidden hunger" arising from micronutrient deficiencies is noticed in communities of the FCT. This calls for commitment of all stakeholders as a public health priority to undertake measures to make ending micronutrient deficiencies most especially, vitamin A, zinc, iodine, folate and iron deficiencies in FCT.

The findings from MICS survey in 2011 indicated a high prevalence of malnutrition amongst under-five children in the Federal Capital Territory (FCT). It showed that the prevalence of vital nutrition assessment indicators in FCT such as moderate (-2SD) stunting was 65.1%, moderate wasting 14.2%, and moderate underweight 46.8% (MICS, 2012). There is recently a reduction in these indices according to the report of NDHS

(2013) which indicated overall stunting to be 29.6%, wasting 18.8%, underweight 16% in the FCT. Concurrent high levels of malnutrition worsen the health status and development potential of a child and makes every strategy for health, education and prosperity an uphill struggle.

1.3 Justification

The mortality indices for children in Nigeria are ranked among the worst in the world. Nigeria ranks 9th in global assessment of under-five mortality rate and approximately one million children die annually in Nigeria before their 5th birthday (UNICEF, 2014). The role of adequate and sustainable surveillance particularly for nutrition assessment of children in the community cannot be over-emphasized, considering the efforts in promoting optimal childhood nutrition, growth and development.

Although several studies and attempts to reduce child mortality in Nigeria have been conducted, yet progress on reaching the desired target is still limited. Many of the previous studies were descriptive in nature and lacked detailed analysis of socioeconomic and proximate determinants of child and maternal malnutrition (Ajieroh, 2009).

None or little effort has been devoted to examining the key determinants of malnutrition among under-five children and their mothers in communities of Kuje Area Council of the FCT that will effectively guide nutrition interventions.

MICS survey in 2011 indicated a high prevalence of malnutrition amongst under-five children in the Federal Capital Territory (FCT). Hence, this study will provide information that can be used for nutritional surveillance and targeting programmes that would focus

more on populations most affected. More importantly, the survey will be instrumental for generating information that will form the basis for developing interventions for nutrition and other health programmes in the FCT as a whole.

1.4 Aim and Objectives of Study

1.4.1 Aim

The aim of the study was to determine the burden of malnutrition, specific determinants causing it by assessing the nutritional status among under-five children and their mothers in Kuje Area Council of the Federal Capital Territory.

1.4.2 Specific objectives;

The specific objectives of the study include;

i. Assessment of nutritional status and prevalence of malnutrition among under-five children mother pair in Kuje Area Council of Federal Capital Territory.
ii. Determine morbidity and crude death rate among under-five children and their mothers.
iii. Determine micronutrient (Vitamins A, Iron, Iodine, Zinc, Vitamin D, Calcium and Phosphorus) status of the under-five children and their mothers.
iv. Establish the determinants of malnutrition in the study area.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Concept of Malnutrition

United Nations Children's Fund, UNICEF (2010), described malnutrition as a condition that results from eating a diet in which nutrients are not enough or are too much such that it causes health problems. The nutrients involved can include Lipids, fats, proteins, carbohydrates, vitamins and minerals. Malnutrition is often used specifically to refer to undernutrition where there are not enough calories, proteins or micronutrients; however, it also includes overnutrition (Young, 2012). Undernutrition during the first 1000 days of life may result in permanent problems with physical and mental development impairment (UNICEF, 2010). Wardlaw *et al.* (2004) defined malnutrition as "failing health that results from long-standing practices that do not coincide with nutritional needs. In other words, malnutrition has been defined as a pathological state resulting from a relative or absolute deficiency or excess of one or more nutrients, it comprises of four forms; undernutrition, overnutrition, imbalance, and specific deficiency, (Srilankshmi, 2008).

2.1.1 Undernutrition

This is the condition which results when insufficient food is eaten over an extended period of time. This manifest in children as stunting, underweight, wasting, protein energy malnutrition (kwashiorkor, marasmus and marasmic-kwashiorkor).

2.1.2 Overnutrition

This is the pathological state resulting from the consumption of excessive quantity of food over an extended period of time. This usually manifest as obesity and overweight.

2.1.3 Imbalance

This is the pathological state resulting from a disproportion among essential nutrients with or without the absolute deficiency of any nutrient.

2.1.4 Specific deficiency

This is the pathological state resulting from a relative or absolute lack of an individual nutrient.

2.2 Prevalence of Childhood Malnutrition in Nigeria

Malnutrition in Nigeria is distributed in an extremely unequal way (Save the Children, 2012). Children from very poor families are twice as likely to be stunted and three-and-a-half times more likely to be severely stunted than children from well-off families. As a result, Nigeria, along with Afghanistan has been predicted to witness the largest increase in absolute numbers of stunting between 2015 and 2020 (Fenn, 2011).

Findings from NDHS (2013) report showed that 37 percent of children under age 5 years are considered to be short for their age or stunted, while 21 percent are severely stunted (below -3SD). The prevalence of stunting increased with age from 16 percent of children under 6 months to 46 percent of children 24-35 months and decreases to 37 percent among

children 48-59 months. Rural children are more likely to be stunted than urban children (43 percent compared with 26 percent). The report also stated that stunting is lowest in the South East (16 percent) and in other zones, stunting varies from 18 percent in South South to 55 percent in the North West. Among the states, stunting is highest among children in Kebbi (61 percent). Children of mothers with no education are more than three times as likely to be stunted (50 percent) as children of mothers who have completed more than secondary education (13 percent) (NDHS, 2013).

Eighteen percent of children are considered wasted or too thin for their height and 9 percent are severely wasted. Wasting peaks at age 9-11 months (27 percent). Differentials in wasting by other background characteristics are similar to those for stunting; however, the differences are small. Wasting among children is worse in the North West (27 percent) and North East (20 percent) zone (NDHS, 2013).

Twenty-nine percent of children are underweight (low weight-for-age), and 12 percent are severely underweight. The proportion of children underweight increases sharply at age 6-8 months (29 percent) and remains so up to age 36-47 months when it starts to decrease (NDHS, 2013). The impact of weaning and introduction of complementary foods can be seen in younger children: data on all the three indices show that the nutritional status of children deteriorates after age 6 months (NDHS, 2008; NDHS, 2013).

The recommendation to exclusively breastfeed children for the first six months of life is met for only 17 percent of children (NDHS, 2013). The report also indicated that complementary foods are often introduced early in Nigeria, with 23 percent of children

under age 6 months and 38 percent of children age 4-5 months consuming solid or semi-solid foods in addition to breast milk (NDHS, 2013). Bottle feeding among children below age 2 months is on the rise, even though it is not normally recommended. Sixteen (16) percent of infants under age 2 months are being fed using a bottle with a nipple. This proportion rises among children age 6-8 months to 17 percent (NDHS, 2013).

2.3 Conceptual Framework on the Causes of Malnutrition

The determinants of child malnutrition can be divided into three levels of causality: immediate, underlying, and basic whereby factors at one level influence other levels. The immediate determinants are dietary intake and health status. They are influenced by three underlying determinants: food security, care for mothers and children, and health environment quality (Smith and Haddad, 2000). The conceptual framework on the causes of malnutrition was developed in 1990 as part of the UNICEF nutrition strategy (Figure 2.1). The framework shows that causes of malnutrition are multisectoral, embracing food, health and caring practices. The framework is used at national, district and local levels, to help plan effective actions to improve nutrition. It serves as a guide in assessing and analyzing the causes of the nutrition problem and helps in identifying the most appropriate mixture of actions (UNICEF, 1990).

2.3.1 Immediate causes

The immediate determinants of child nutritional status manifest themselves at the level of the individual human being. They are dietary intake (energy, protein, fat, and micronutrients) and health status. These factors themselves are interdependent. A child

with inadequate dietary intake is more susceptible to disease. In turn, disease depresses appetite, inhibits the absorption of nutrients in food, and competes for a child's energy. Dietary intake must be adequate in quantity and in quality, and nutrients must be consumed in appropriate combinations for the human body to be able to absorb them (Smith and Haddad 2000; Rolfes *et al.*, 2011; Mahan *et al.*, 2012).

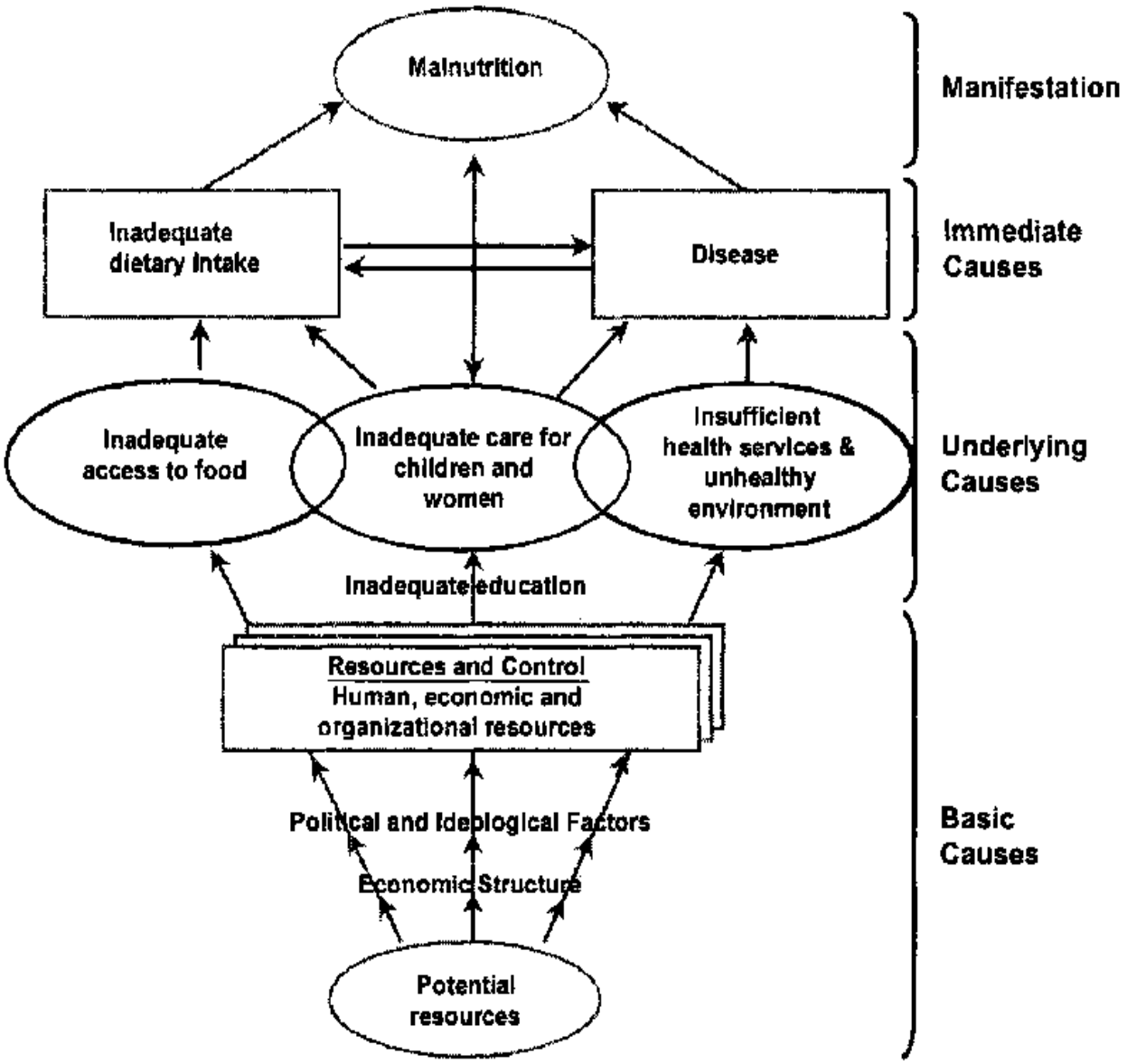


Figure 2:1 Conceptual Framework on the Causes of Malnutrition (Adapted from UNICEF, 1990).

2.3.2 Underlying causes

The immediate determinants of child nutritional status are in turn, influenced by three underlying determinants manifesting themselves at the household level. These are food security, adequate care for mothers and children, and a proper health environment, including access to health services. Associated with each is a set of resources necessary for their achievement (Smith and Haddad, 2000).

Food security is achieved when a person has access to enough food to lead an active and healthy life (World Bank, 1986). This definition provided a standard for further definitions and addresses the issues of availability, accessibility, as well as utilization of food for healthy living. The World Bank (1986) definition was subsequently augmented by FAO to include the nutritional value and food preferences. FAO, (1996) defined food security as a situation when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for a healthy and active life. The inclusion of "safe and nutritious" stresses food safety and nutritional composition while the addition of food preferences" changes the concept of food security from mere access to enough food, to access to the food preferred (Kuwornu *et al.,* 2013).

The resources necessary for gaining access to food are food production, income for food purchases, or in-kind transfers of food (whether from other private citizens, national or foreign governments, or international institutions). No matter how much food is available, no child grows without nurturing from other human beings. This aspect of child nutrition is captured in the concept of care for children and their mothers, who give birth to children

and who are commonly their main care takers after they are born (Smith and Haddad, 2000).

Household income may correlate well with household food security and child nutrition (Kuwornu *et al.,* 2013). Several studies have found nutritional status measured through energy and protein intake as one major indicator of poverty (Datt *et al.*, 2000; Kuwornu *et al.,* 2013). Other criteria used to identify the poor in the society are household income (Kuwornu *et al.*, 2013) employment (Fofack, 2002), asset holdings (Grootaert, 1997; Geda *et al.*, 2001) and food consumption expenditures (Greer and Thorbecke, 1986; Fofack, 2002).

Meeting the food needs of families in Sub-Saharan Africa remains a serious challenge. This challenge emerges due to widespread poverty and conflict (Smith *et al.*, 2000; Misselhorn, 2005; Oldewage-Theron *et al.,* 2006); drought, famine and other negative weather patterns exacerbated by global climate change (Rosenzweig *et al.*, 2001), degradation and deforestation (Baro and Deubel, 2006), increased food prices due to the growth in demand for biofuels (Trostle, 2008) and low agricultural productivity (Haile *et al.*, 2005). Combination of these factors restricts access to food for many in developing countries (Kuwornu *et al.,* 2013).

Care, another underlying determinant, is the provision by households and communities of "time, attention, and support to meet the physical, mental, and social needs of the growing child and other household members" (ICN 1992). Child nutritional status is dependent on care givers feeding practices and the use of psychosocial care. Examples of caring

practices are child feeding, health- seeking behaviors, support and cognitive stimulation for children, and care and support for mothers during pregnancy and lactation. The adequacy of such care is determined by the care giver's control of economic resources, autonomy in decision making, and physical and mental status. All of these resources for care are influenced by the care taker's status relative to other house hold members. A final resource for care is the care taker's knowledge and beliefs (Smith and Haddad, 2000).

More specifically, successful replacement feeding and complementary feeding requires not only that foods of adequate energy and nutrients be available or that infants be exclusively breastfed, but also requires a range of appropriate feeding practices by the caregiver. The amount of food that a child eats depends on the caregiver's caring attitude to the child (Sanders *et al.,* 1993). Also, good hygiene practice by caregivers is paramount for effective infant feeding practices. Some caregivers overlook the quality and safety of the home prepared food and drinking water they give to their children, but just feed the children to stop their hunger not minding the hygienic conditions and hence thereby predisposing their children to infectious diseases. Some caregivers store food especially prepared infant formula uncovered, exposing them to micro-organisms which contaminates the food and causes infections and diseases to the child (Brown *et al.,* 2010).

Caregiver's feeding practices that could affect a child's nutrient intake include; adaptation of feeding to the child's characteristics, taking into consideration psychomotor capabilities (such as use of finger foods, spoon handling ability, ability to munch or chew) and appetite, responsiveness of the caregiver to feeding situations such as; encouraging the child to eat,

offering additional foods, providing second helpings, stimulating eating through threats, timing of feeding, responding to poor appetite, and interacting positively with the child, appropriateness of the feeding situation, including the organization and regularity of feeding, supervision and protection of the child while eating, frequency of feeding and elimination of distractions during eating (Patric *et al.*, 1997; UNICEF, 2013). Psychosocial care is the provision of affection and attention to the child and responsiveness to the child's cues. It includes physical, visual, and verbal interactions.

The healthy development of a child has been found to depend on the development of a secure attachment or a close bond with a caregiver during infancy, from whom the child received abundant positive attention. Three categories of measures of psychosocial care can be described: direct measurement of child-caregiver interaction, assessment of the home environment, and assessment of the child's appearance (Werner, 1993).

Health environment and services, the third underlying determinant of child nutritional status, rests on the availability of safe water, sanitation, health care, and environmental safety, including shelter.

A key factor affecting all underlying determinants is poverty. A person is considered to be in absolute poverty when he or she is unable to satisfy adequately his or her basic needs, such as food, health, water, shelter, primary education, and community participation (Frankenberger, 1996). The effects of poverty on child malnutrition are pervasive. Poor households and individuals are unable to achieve food security, have inadequate resources

for care, and are not able to utilize (or contribute to the creation of) resources for health on a sustainable basis.

2.3.3 Basic causes

The underlying determinants of child nutrition are, in turn, influenced by basic determinants. The basic causes of malnutrition include the potential resources available to a country or community, which are limited by the natural environment, access to technology, and the quality of human resources. Political, economic, cultural, and social factors affect the utilization of these potential resources and how they are translated into resources for food security, care, and health environments and services (Smith and Haddad, 2000).

2.4 Classification of Malnutrition

The three combinations of anthropometric measurements that are usually used to categorize malnutrition are: low weight-for-age, an indicator of underweight; low height-for-age, an indicator of stunting; and low weight-for-height, an indicator of wasting. Wasting is an indicator of recent and severe malnutrition (acute malnutrition) and can be effectively used to determine the immediate impact of intervention programmes (Müller and Krawinkel, 2005). Marasmus is characterized by extreme thinness and a weight of below 60% of the reference weight for age (Duggan and Golden, 2006).

Table 2.1 WHO Classification of Malnutrition

	Moderate Malnutrition	**Severe Malnutrition**
Symmetrical oedema	**NO**	**YES**
Weight for height (wasting)	SD score > -3.0 and < - 2.0 > 70 % and < 80 % reference	SD score < - 3.0 < 70 % reference
Height for age (stunting)	SD score > -3.0 and < - 2.0 > 85 % and < 90 % reference	SD score < - 3.0 < 85 % reference

(Duggan and Golden, 2006)

2.4.1 Underweight

The underweight child is common and an important presentation of protein energy malnutrition (Sizer and Whitney, 2014). When a diet is insufficient in protein and/or energy there will be a slowing down of linear height, failure to gain weight or weight loss (Wittenberg, 2004; Sizer and Whitney, 2014), and this is seen when the child is exposed to an acute food shortage (Golden and Golden, 2000). These children are underweight and undersize, while at the same time they have relatively normal body proportions, e.g. weight-to-height ratios (Golden and Golden, 2000; Wittenberg, 2004).

Underweight children can also be stunted, wasted or both (UNICEF, 2009). Underweight children must be identified early through regular growth monitoring of weight and height (Wittenberg, 2004; UNICEF, 2009). Underweight children can easily be missed when both

weight and height are not showed on the road to health charts (RtHC). When growth monitoring is done and a child presents with a weight for age below the third percentile (less than 80% expected weight or less than 90% expected height), the child must be suspected of being malnourished (Wittenberg, 2004).

Underweight children have a dietary deficiency that is not severe and therefore do not produce a clinical disease or symptoms. There are no real physical signs and the serum albumin is only slightly reduced. Underweight children are however, still very susceptible to infections, such as gastro-enteritis, respiratory disease, measles and tuberculosis (Wittenberg, 2004).

In the developing countries of the world, Nigeria inclusive, 129 million of children younger than five years are underweight and 10% are severely underweight. Underweight is more prevalent in Asia than in Africa, with Asia showing rates of 27% and Africa rates of 21%. Progress is slow and Nigeria is not meeting the MDGs with the prevalence being 29% in 2013 (NDHS, 2013).

2.4.2 Stunting

Stunting is a greater problem than underweight and wasting (UNICEF, 2009) and is an indicator of nutritional deficiencies or status (Shetty, 2002; UNICEF, 2009) and illness that occurred during times of growth and development (UNICEF, 2009) usually in infants and children younger than five years (UNICEF, 2009).

Stunting is the first clinical sign of malnutrition (Piercecchi-Marti *et al*., 2006) and affects about 195 million children younger than five years in the developing world, where stunting affects about one in three children in Africa (UNICEF, 2009). Stunting can also be called failure to thrive or growth faltering, which refers to slow height gain or inadequate growth in the infant and young child. Stunting is an indication of chronic malnutrition and long-term insufficient diet because of a chronic energy deficiency (Müller and Krawinkel, 2005; Williams, 2005; Duggan and Golden, 2006).

Stunting which is due to long-term undernutrition, takes time to develop and to recover (Baker-Henningham and Grantham-McGregor, 2004). Growth failure is marked by both "thinness and shortness". "Nutritional" growth faltering is not only due to underfeeding but also due to infection (Golden and Golden, 2000), psychological disturbance, socio-economic deprivation and underlying illnesses (Williams, 2005). Stunting is a cumulative process that starts in utero, and there is substantial evidence that intrauterine growth is a strong predictor of postnatal growth (De Onis *et al.*, 2000).

Stunting is an indication of the height of the child compared to the height of a normal child of the same age (Golden and Golden, 2000). A "stunted" child is short for his or her appropriate height for age. A height-for-age less than 85% of the median (50%) represents an SD score of minus (-) 3SD and is classified as severe stunting (Williams, 2005).

A stunted child, living in a population with similarly sized children can appear to be thriving. Biological and cultural adaptation causes the body to look the same as the other children in the same environment. A child who is underweight for age and severely stunted,

may even appear plump (Duggan and Golden, 2006). Children appear normal, but when the age becomes apparent, it is obvious that the child is short. Height is more retarded than mental development, so the child's face looks inappropriate for their size (Golden and Golden, 2006). Stunting is also associated with a poor school outcome, where stunted children usually start school later, do not complete all grades and do not perform as well as children of the same age (UNICEF, 2009).

Children in rural communities are at a greater risk of becoming stunted than children living in urban areas. Children living in informal housing have the highest prevalence and the lowest is seen in children whose mothers are well educated. In Nigeria, the prevalence of stunting was highest in children living in traditional or informal housing, with poorly educated mothers and over 40% of children under the age of five are stunted in Nigeria (NDHS, 2013).

2.4.3 Wasting

Many of the world's children suffer from wasting, the deadliest form of malnutrition, called severe acute malnutrition (Sizer and Whitney, 2014). "Clinical wasting" is the term used to describe recent severe fat loss due to illness or severe food restriction (Duggan and Golden, 2006). Inadequate food intake leads to weight loss and growth retardation and when it is prolonged it leads to body wasting and emaciation (Torún, 2006; Sizer and Whitney, 2014). When growth is acutely affected, a child falls behind one who is actively growing (Golden Golden, 2000), with a body weight and height less than ideal for the child's age (Shetty, 2002).

Wasting is indicated as a low weight for height, occurring at any age (Shetty, 2002) and is used as an indicator for identifying severe acute malnutrition (UNICEF, 2009; Sizer and Whitney, 2014). A child is wasted when the weight for height is less than 70% of the median and is equal to a standard deviation score of –3SD (Williams, 2005). Wasting is the weight of the sick child compared to that of a normal child of the same height (Golden and Golden, 2000). Of the children younger than five years old in the developing countries, 13% are wasted and 5% are severely wasted (about 26 million). Africa and Asia are the two countries with high rates of wasting and exceed 15% (UNICEF, 2009). In Nigeria, 18% of children under five years are considered wasted or too thin for their height and 9 percent are severely wasted (NDHS, 2013).

2.5 Severe Acute Malnutrition (SAM)

Ten percent of the world's children suffer from SAM, identified by their degree of wasting. In children with SAM, lean and fat tissues have wasted away, burned off to provide energy to stay alive. They weigh too little for their height, and their upper arm circumference measures smaller than normal (WHO, 2012). In these children, loose skin on the buttocks and thighs often sags down and looks as if the child is wearing baggy pants. Sadly, such children are described as just "skin and bones." The child often feels cold, appears withdrawn or irritable, and is obviously ill (Sizer and Whitney, 2014).

The starving child faces this threat to life by engaging in as little activity as possible—not even crying for food. The body musters all its forces to meet the crisis, so it cuts down on any expenditure of energy not needed for the functioning of the heart, lungs, and brain.

Enzymes are in short supply, and the gastrointestinal (GI) tract lining deteriorates. Consequently, little food that is eaten often cannot be absorbed (Sizer and Whitney, 2014).

Each year, 7.6 million preschool-aged children, die as a result of SAM. Most of them do not starve to death, they die from the diarrhoea and dehydration that accompany infections (Sizer and Whitney, 2014).

2.6 Chronic Malnutrition

A much greater number, 25 percent of children worldwide, live with chronic malnutrition (Svedberg, 2011). They subsist on diluted cereal drinks that supply scant energy and even less protein; such food allows them to survive but not to thrive. Growth ceases because they chronically lack the nutrients required to grow normally (Krebs, 2011). These stunted children may be no taller at age 4 years than at age 2 years, and often suffer the miseries of malnutrition: increased risks of infection and diarrhea, and vitamin and mineral deficiencies (Sizer and Whitney, 2014).

A fully nourished developing brain normally grows to almost its full adult size within the first 2 years of life. When malnutrition occurs during these years, it can impair brain development and learning ability, effects that may become irreversible (Sizer and Whitney, 2014).

Table 2.2: Characteristics of Severe Acute Malnutrition and Chronic Malnutrition

	Severe Acute Malnutrition	Chronic Malnutrition
Food Deprivation	Current or recent	Long term
Physical Features	• Rapid weight loss • Wasting (underweight for height; small upper arm circumference) • Edema may be present	• Minimal height gains • Stunting (short for age)
World Prevalence Of Children Younger Than Age 5	5% to 15%	20% to 50%

(Sizer and Whitney, 2014). *Note: Vitamin and mineral deficiencies are common in both types of malnutrition.*

2.7 Assessment of Nutritional Status

Nutritional status is the state of the body with respect to each nutrient and to the overall state of the body weight and condition while nutrition assessment is the evaluation and measurements of nutritional variables in order to assess the level of nutrition or the nutritional status of the individual (Jonathan *et al.*, 2007). The body's nutritional health is determined by the sum of its nutritional status with respect to each needed nutrients. Nutritional assessment can also be defined as an in-depth evaluation of both objective and subjective data related to an individual's food and nutrients intake, life style and medical history (Mahan *et al.*, 2012). Pellet and Gosh (2006) also defined nutritional status as an

interpretation of information obtained from dietary, biochemical, anthropometry and clinical studies. The nutritional status of children has an impact on their health and development. The physical, mental, social and nutritional status of children, as well as other characteristics related to malnutrition should be evaluated periodically to monitor malnutrition and enable appropriate measures that can prevent its occurrence (Taguri *et al*., 2008).

The key indicator of chronic malnutrition is stunting, when children are too short for their age group compared to the WHO child growth standards. While wasting is a severe form of malnutrition resulting from acute food shortage compounded by illnesses. Wasting demands emergency nutritional interventions to save lives (NDHS, 2013). The impacts of feeding practices are evident in younger children. Data on all three indices (NDHS, 2013) showed that the nutritional status of children deteriorates after 6 months of age when children are introduced to complementary foods. Food consumption surveys are usually conducted for nutritional, medical and economic purposes.

The method of assessing nutritional status include; Anthropometric assessment, Biochemical assessment, Clinical assessment, and Dietary assessment.

2.7.1 Anthropometry assessment method

Simple measurements of weight, height and Mid Upper Arm Circumference and waist circumference can identify individuals who are obese, thin, stunted in growth or wasted. Simple anthropometry cannot however, determine if a malnourished infant is over-hydrated

or under- hydrated. Despite this, body weight is the best and most reliable of all anthropometric measurements because of its sensitivity, precision and objectivity (Cogil, 2003; Garrow, 2005).

It is important to assess the nutritional status of any population to detect the existence or otherwise of malnutrition. Nutritional anthropometry involves taking measurements of various physical dimensions and gross composition of the human body at different age levels and degree of nutrition. It is the simplest most reliable method to assess nutritional status of people (Motthram *et al*., 1992). Anthropometric measurement is frequently used to assess nutritional status of young children and adults. The use of anthropometrics is to evaluate individuals or populations and identify those in need of nutritional rehabilitation. Anthropometric measurements aim to assess body stores of protein and fat by measuring height, weight, hip, waist, mid-upper arm and head circumferences. These measurements are converted to indices, e.g. wasting (low weight-for-height), stunting (low height-for-age), underweight (low weight-for-age) and body mass index (weight/height^2). WHO (1998) reported that anthropometric data are valuable indicators of nutritional status.

2.7.1.1 Height and weight

The anthropometric measurements of height and weight are quite reliable indicators of nutritional status, especially infants (ACC/SCN, 2001). It was further observed that when measuring the growth of a child, one will be able to compare how a child is growing and how he should grow. It explains whether the child has the right weight for his age. A healthy child doubles his weight in the first 6 months of life and triples birth weight by the

time he is one year of age. A child getting taller will also gain weight if body proportions remain normal. A thin child will weigh less than a normal child of the same height.

2.7.1.2 Body mass index (BMI)

The body mass index provides a relation between body weight and body height and is defined as follows: BMI = body weight in kg/ (body height in m)^2. The BMI is usually calculated for a clinical assessment of overweight and obesity. In general, for adults, a good weight can be defined as a BMI between 18.5 and 25 kg/m^2; overweight is a BMI > 25 kg/m^2 and a BMI > 30 kg/m^2 strongly indicates signs of obesity with increased risk (Mahan *et al.,* 2012). Conversely, BMI values lower than 18.5 are indicative of undernutrition and thus increased mortality risk. Moderate under-nutrition can be defined as a BMI between 16 and 18 kg/m^2; a BMI < 16 kg/m^2 indicates severe undernutrition.

2.7.1.3 Mid upper arm circumference (MUAC)

A child's nutritional status could be obtained by measuring the mid upper arm circumference. It directly assesses the amount of soft tissue in the arm and measure of thinness. A tape measure is put round the child's upper arm and is measured in centimetres. A healthy child has a thick arm and a big arm circumference and a thin malnourished child has thin arms and a small circumference (Mahan *et al.,* 2012). It is also useful in the case of kwashiorkor where the baby's lower arm is swollen with fluids, the muscles of his upper arm is usually thin and has a small arm circumference. The mid upper arm circumference, is measured on a straight left arm (in right handed people) mid way between the tip of the shoulder and the tip of the elbow. It is an index of peripheral protein and fat stores. This is an accepted measure of acute under-nutrition. A reading of less than 11.5cm is severally

malnourished, 11.5cm- 12.4cm moderately malnourished while 12.5cm -13.4cm is mild and above 13.5cm is normal (Mahan *et al.,* 2012). Furthermore, anthropometric measurements of the arm provide an indirect evaluation of the other body compartments. The muscle is representative of the lean mass, while the adipose tissue is an index of the energy reserves. Other anthropometric measurements include; skin fold thickness, head circumference, head/chest ratio and waist circumference.

2.7.2 Indices estimated with anthropometry

Anthropometric measurements of children in the survey population are compared with the World Health Organization (WHO) Child Growth Standards. The use of the WHO Child Growth Standards is based on the finding that well-nourished children of all population groups for which data exist follow similar growth patterns before puberty. The internationally-based standard population serves as a point of comparison, facilitating the examination of differences in the anthropometric status of subgroups in a population and of changes in nutritional status over time (WHO, 2006a). Three standard indices of physical growth that describe the nutritional status of children include:

- height-for-age (stunting)
- weight-for-height (wasting)
- weight-for-age (underweight)

Each of these indices gives different information about growth and body composition that can be used to assess nutritional status (NDHS, 2013).

2.7.2.1 Height-for-age

Height-for-age is a measure of linear growth. A child who is below minus two standard deviations (-2 SD) from the median of the WHO reference population in terms of height-for-age is considered short for his/her age, or stunted, a condition reflecting the cumulative effect of chronic malnutrition. If the child is below minus three standard deviations (-3 SD) from the reference median, then the child is considered to be severely stunted. A child between -2 SD and -3 SD is considered to be moderately stunted (NDHS, 2013; WHO, 2006bc).

2.7.2.2 Weight-for-height

Weight-for-height describes current nutritional status. A child who is below minus two standard deviations (-2 SD) from the reference median for weight-for-height is considered to be too thin for his/her height, or wasted, a condition reflecting acute or recent nutritional deficit. As with stunting, wasting is considered severe if the child is minus three standard deviations (-3 SD) or more below the reference mean. Severe wasting is closely linked to mortality risk (WHO, 2006bc; NDHS, 2013).

2.7.2.3 Weight-for-age

Weight-for-age is a composite index of weight-for-height and height-for-age, and thus does not distinguish between acute malnutrition (wasting) and chronic malnutrition (stunting). A child can be underweight for his age because he is stunted, because he is wasted, or both. Weight-for-age is a good overall indicator of a population's nutritional health (WHO, 2006bc; NDHS, 2013).

2.7.2.4 Z-score means

Z-score means are also calculated as summary statistics representing the nutritional status of children in a population. These mean scores describe the nutritional status of the entire population without the use of a cut off. A mean Z-score of less than 0 (i.e., a negative mean value for stunting, wasting, or underweight) suggests that the distribution of an index has shifted downward and that most, if not all, children in the population suffer from undernutrition relative to the reference population (WHO, 2006; NDHS, 2013).

2.7.3 Biochemical assessment method

Biochemical assessment is checking to see if a person's blood or urine contains normal levels of certain chemicals or nutrients (Beaton *et al.*, 1990). This assessment is usually done in a hospital laboratory and it measures levels of nutrients in the biological fluid (urine and blood). Other sources of biochemical data relating to nutritional status can be obtained from examination of the plasma red blood cell, white blood cell, urine and tissues such as liver, bone and hair. The laboratory assessment detects marginal nutritional deficiencies in individuals especially when the diet history is questionable or unavailable. This is the most objective measure of nutritional status but the precision and accuracy are vulnerable to the methods and persons used (Beaton *et al.,* 1990). This method reflects some blood concentration of the true status of nutrients intake. Some biochemical tests are affected by non nutrition factor, for instance, if an individual has an injury, the person's white blood cell count will increase while the serum concentration decreases. Also, some drugs are significant with biochemical results for example antibiotic interferes with the determination of riboflavin by fluorescent method. Age, sex, place of residence and

physiological status alters the status of the body's minerals thereby affecting the biochemical assessment result. The advantages of biochemical method are: it is useful in detecting early changes in body metabolism and nutrition before the appearance of clinical signs. It is precise, accurate and reproducible (Mahan *et al.*, 2012). It is useful to validate data obtained from dietary methods e.g. comparing salt intake with 24-hour urinary excretion. Its limitations is that it is time consuming, expensive and needs trained personnel and facilities.

2.7.4 Clinical assessment method

This method involves detection of physical signs and vital signs. Clinical assessment is the method of physical examination of an individual's physical, medical, or living condition that increases his risk for developing malnutrition or poor health (Mahan *et al.,* 2012). They may include delayed growth and development as determined by comparing an individual or a group with normal values on the growth chart. General appearances of skin, eyes, tongue, rapid hair loss, touch sense and ability to walk. It is important to note that malnutrition signs may not be specific, that is, they may be due to non-nutrition factors which include harsh weather, poor hygiene or excessive exposure to sun.

This method of nutritional assessment is the most subjective method because the assessment is based on the researcher's views on the visible clinical signs (Mahan *et al.*, 2012). One of the advantages of this method is that it is relatively cheap and can be useful for a quick assessment. But its disadvantage is that accuracy of the record decreases when the nutrition status of the individual improves and some of the signs seen may be as a result

of non-nutritional condition. Also, clinical signs are mostly visible at the existence of the disease.

2.7.5 Dietary assessment method

This deals with a record of eating behaviour and food a person eats. It can identify possible nutrients imbalances. Information about the person's eating habits provides the background for developing realistic and attainable nutrition goals (Cataldo and Deruyune, 1999). Nutrient intake of humans can be assessed by five different methods. They are 24 hours dietary recall, food frequency questionnaire, dietary history, weighed food intake and combined methods. These methods are interrelated and reveal the source and amount of nutrients consumed and give presumptive evidence of dietary inadequacies in individual or specific population (Thompson and Byers, 1994).

2.7.5.1 Weighed food intake

Weighed food intake involves a record of food in term of weights, portion served and the plate weight. Detailed record of all ingredients used in preparation of meal as well as total cooked weight of meal items, cooked weight of individual portion and plate waste is taken. The meal eaten by the individual is weighed and contents are exactly calculated and translated to nutrients. This method is characterized by having a high degree of accuracy but it is expensive and needs time and efforts (FAO/WHO, 2001).

2.7.5.2 24-hour dietary recall

The 24-hour dietary recall consists of a listing of foods consumed the previous day or the 24 hour prior to the recall interview. Foods, drinks and amounts are recalled from memory with the aid of an interviewer who has been trained in methods for soliciting dietary information. A brief activity history may be incorporated into the interview to facilitate probing for foods consumed. The interview is usually conducted face to face but in some situations the recall is self-administered by the researcher though this approach does not yield sufficiently reliable data because of bias. This method is quick, easy and depends on short-term memory, but may not be truly representative of the person's usual intake (WHO, 1996; FAO/WHO, 2001).

2.7.5.3 Food frequency questionnaires (FFQ)

A food frequency questionnaire consists of a structured listing of individual foods or food groups. For each items on the food list, the respondent is asked to estimate the frequency of consumption based on specified frequency categories which indicate the number of times the food is usually consumed per day, week, month or year. Food frequency questionnaires are usually self- administered but may be interviewer-administered. The number or types of food items may vary, as well as the number and types of frequency categories. Some food frequency questions includes; the type of food, the usual food preparation methods, use of dietary supplements. The answers to these questions are then incorporated into the calculation of the nutrients intakes (WHO, 1996; FAO/WHO, 2001).

Food frequency questionnaires are usually used to rank individuals by intake of selected nutrients. Although this method is not designed for estimating absolute nutrients intakes, the method may be more accurate than other methods for estimating average intake of those nutrients having large day-to-day variability and for which there are relatively few significant food sources for example micronutrients (WHO, 1996). It is inexpensive, more representative and easy to use. Its limitation includes; long questionnaire and error with estimation of serving size.

2.7.5.4 Diet histories

Diet history is designed to assess usual individual intake. It consists of a detailed listing of the types of foods commonly consumed at each eating occasion over a defined time period. A trained interviewer probes for the respondent's customary pattern of food intake on each day of a typical week, month or year. The reference time frame is often the past month, several months or may reflect seasonal differences if the time frame is the past year. The interview compose of two parts; the first part establishes the overall eating pattern of the individual while the second part deals with food preferences, purchasing and the use of each food served to verify and clarify information given in the first part.

The diet history has advantages over other methods in that it estimates nutrient intakes over a long period of time. Its disadvantages are that it takes about one hour of careful questioning, and the interviewer must be a Nutritionist or Dietician experienced in obtaining diet histories. The most common fault of an inexperienced interviewer is probably that of suggestive answers (WHO, 1996).

2.7.5.5 Combined methods

Different types of dietary assessment methods may be combined to improve accuracy and facilitate interpretation of the dietary data. Comparison of the results from two methods permit adjustment of mean intake values obtained from the primary method. For example if a food frequency questionnaire is the primary method used, a more detailed method such as weighed food intake can also be used to provide more accurate estimates of intake distribution of the individual.

CHAPTER THREE

3.0 MATERIALS AND METHODS

3.1 Research Design

The study was a cross-sectional survey. Multi stage sampling techniques was used in selecting the populations that were studied. Probability proportion by size was applied in choosing 31 clusters for the survey using Emergency Nutrition Assessment (ENA) for Standardized Measurement And Relief Transition (SMART) software (2011) hence the enumeration area is vast and diverse.

3.2 Study Area

Kuje Area Council is one of the six Area Councils of the FCT, others are; Abaji, Abuja Municipal, Bwari, Gwagwalada, Kwali. FCT falls within latitude 7° 25' N and 9° 20' North of the Equator and longitude 5° 45' and 7° 39' of the equator. It shares boundaries with Gwagwalada and Kwali Area Council by west, with Abuja Municipal Area Council by the East, and by the South with Abaji Area Council and to the North by Bwari Area Council. It has 10 political wards with an administrative population estimate of 198,323 people (Projected Census Population, NPC, 2006) out of which under five children and Women of Child Bearing age account for about 39,785 (20% of Total Population) and 43,632 (22% of Total Population) respectively. The predominant tribes are Gbagyi, Gede, Gwandara, Ebira, Hausa and other tribes. There over 60 rural and semi urban localities with over 200 clusters (enumeration areas) in Kuje Area Council (NPC, 1996 Projection).

3.3 Study Population

Underfive children and their mothers were chosen in selected clusters to participate in the study.

3.4 Inclusion and Exclusion criteria

Eligible mothers of under-five children who were willing to participate and gave their consent were included in the study. Unwilling mothers of under five children /under five mother pair that are sick requiring hospitalization were excluded from the study. Under five children mother pair on visit were excluded.

3.5 Sample Size and Sampling

Considering prevalence of malnutrition and allowable absolute error (precision) of 5%, (0.05) design defect of 1.5, average Household size of 6, non-response Household of 3%. The minimum required sample size was selected from the selected 31 clusters using the sample size calculator of ENA (2011). The selected cluster (Appendix 1) was generated by ENA (2011) after entering the available clusters as provided by the NPC, and their population size. Household listing survey was carried out in the selected clusters and the eligible households numbered and eligible households were selected using simple random sampling by HAT methods. Consenting under five mother pair in the selected households participated in the study.

3.6 Ethical Clearance and Consent Form

Before the implementation of the project, extensive consultation was undertaken between the researcher, and the community heads of the selected communities. This was made

possible with the help of appropriate introduction by the Area Council and FCT Primary Health Care Board. Ethical clearance (Appendix ii) was approved by Federal Capital Territory, Health Research Ethics Committee. All ethical issues were adhered to; informed consent was obtained prior to the commencement of the study.

3.7 Data Collection

3.7.1 Tools for data collection

The tools used for the data collection include; infantometer, height board, questionnaire (Appendix iii), UNICEF weighing scale, MUAC tapes, ice packs, syringes, bottles etc.

3.7.2 Techniques for data collection

Questionnaire was administered to respondent**.** The interview was conducted with validated questionnaire after obtaining informed consent from household head or adult available. The questionnaire was designed keeping in mind the objectives of the study. To ascertain reliability, objectivity, simplicity and to remove any ambiguity, and necessary modification, it was judged by the supervisory team and other experts and necessary corrections were made to enhance the face validity and content validity. Pretesting of the questionnaire was done by administering the questions to a small number of representatives before the survey.

Relevant data on the factors related to malnutrition were obtained with the help of the schedule and review of any available relevant health records. For assessing the nutritional status of the subjects, dietary, biochemical examinations and anthropometric measurements

were carried out following standard operating procedures (Cogill, 2003). The data include weight, recumbent length (if the child is not able to stand without support), and height for children above 2 years and mid upper arm circumference for children above 6 months old and their mothers.

3.8 Anthropometry

3.8.1 Age determination

Age was determined using available records or using local calendars.

3.8.2 Weight determination

Weight was measured to the nearest 0.1 Kg using UNICEF Seca weighing scale with subjects in minimal clothing. The scale was occasionally checked for standardization to avoid faulty reading.

3.8.3 Length/height determination

Height was measured using a length/height board, with the participant standing on a firm/level surface and it was measured to the nearest 0.1 cm. Recumbent length was measured using an infantometer. Each measurement was done twice, and the mean of the two readings were recorded.

3.8.4 Mid upper arm circumference (MUAC)

The mid upper arm circumference was determined using a Shakir's strip (arm circumference non-stretch tape) to the nearest 0.1cm. The left arm was used, it was allowed to hang freely down by the side of the child, the arm half way between the point of the shoulder and the tip of the elbow was marked and the strip was placed round the marked point for measurement. The value - was recorded to the nearest 0.1cm.

3.9 Blood Sample Collection

The blood sample collection process was in line with methods described by Cheesbrough, (1998), and modified by Nwosu *et al*. (2014) considering the health and safety of both collector and subjects. Laboratory Scientists were engaged to collect the blood samples of the subjects. Blood samples (5ml) for each subject was collected intravenously by venipuncture from the ante-cubital vein in the ante-cubital fossa of the forearm after thorough sterilization of the site with spirit and swab, using sterile needle and syringe into sample bottles (Cheesbrough, 1998). Two (2) ml of the blood was carefully dispensed into sterile plain ethylenediaminetetracetic acid (EDTA) bottles for malaria test. Gentle shaking of the content provides proper mixing of the blood and prevents clotting.

Three (3) ml of blood sample was transferred into plain bottles without anticoagulant and allowed to clot inside a black polyethylene bag to avoid light degradation of vitamin A (WHO, 1994). Serum samples were obtained by centrifuging the clotted blood samples at 500 revolutions per minutes for 7minutes and later collected into a legibly labeled serum bottles. These were immediately tied in a black polyethylene bag to avoid isomerization of retinol and kept frozen in a refrigerator. It was thereafter transported under dark cover in a giostyle. The temperature inside the giostyle was maintained at $4^{o}C$ with frozen ice packs and taken for serum analysis at ABU Laboratory Services. The serum samples were run in triplicates for vitamin A, vitamin D, iron, zinc after which the mean values were taken.

3.10 Biochemical Analysis

Serum concentration of Albumin, Zinc, Iron, Calcium, Phosphorus and alkaline phosphatase activity were determined by colorimetric using SURECHEM SEMI AUTO-ANALYZER 2012.

3.10.1 Determination of Zinc using water –soluble pyridylate dye (1984)

3.10.1.1 Principle

Zinc formed with 2-(5- bromo-2-pyridylazo)-5(N-pyropyl-N-sulfo-propylamine)- phenol a chelate complex. The increase of absorbance was measured and was proportional to the concentration of total Zinc in the sample.

3.10.1.2 Procedure

Three sets of clean dry three test tubes were arranged accordingly in the test tube rack. These included tubes for test samples, blank and standard tubes. 1000µl of working reagent was dispensed including blank and standard tube. Fifty micro liter (50µl) of each sample was dispensed into corresponding labeled tube, while blank tube contained working reagent only, each content was mixed and incubated at 37^0C for 5min. Absorbance of each sample, blank and standard were taken at 560nm wavelength.

3.10.1.3 Calculation

$A_{(S)} = A_{(Sample)} - A_{(RBL)}$

$A_{(STD)} = A_{(Standard)} - A_{(RBL)}$

$Conc_{(STD)}$

$Conc_{(Sample)} = A_{(Sample)} - A_{(RBL)} \times Conc_{(STD)}$

$A_{(Standard)} - A_{(RBL)}$

Reference Values

Adults: 50 -- 175µg/dl

3.10.2 Determination of albumin using Silverman *et al.*, (1986)

3.10.2.1 Principle

Albumin in the presence of bromocresol green at slightly acid pH, produced a colour change of the indicator from yellow-green to green-blue. The intensity of the colour formed was proportional to the albumin concentration in the sample.

3.10.2.2 Procedure

Three sets of clean dry three test tubes were arranged accordingly in the test tube rack. These include tubes for test samples, Blank and standard into each of the tubes. 1000µl of working reagent was dispensed including blank and standard tube. Fifty micro liter (50µl) of each sample was pipette and dispensed into corresponding labeled tube, while blank tube contained working reagent only, each content was mixed and incubated at room temperature for 5min. Absorbance of each sample, blank and standard were taken at 630nm wavelength.

3.10.2.3 Calculations

$$\text{Albumin (µ/dl)} = \frac{\text{(A) Sample}}{\text{(A)Standard}} \times 5 \text{ (Calibrator Concentration)}$$

Reference Value: 3.5 – 4.0mg/dI

3.10.3 Determination of iron using Ferro Zinc method, 1980

3.10.3.1 Principle

Iron is dissociated from transferring – iron complex in weakly acid medium. Liberated Iron is reduced into the bivalent form by means of ascorbic acid. Ferrous ions give with Ferro Zinc a coloured complex.

Transferring $(Fe^{3+})_2 + e^-$ Ascorbic acid $2Fe^{2+}$ + Transferrin

Fe^{2+} Ferro Zinc Coloured complex

The intensity of the colour formed is proportional to the iron concentration in the sample.

3.10.3.2 Procedure

Three sets of clean dry three test tubes were arranged accordingly in the test tube rack. These include tubes for test samples, Blank and standard into each of the tubes. 1000µl of working reagent was dispensed including blank and standard tube. Two hundred micro liter (200µl) of each sample was pipette and dispensed into corresponding labeled tube, while blank tube contained 200µl of distilled water. Each content was mixed and incubated at 37^0C for 5min. Absorbance of each sample, blank and standard was taken at 562nm wavelength.

3.10.3.3 Calculations

Iron (µg/dL) = (A) Sample –(A)Sample Blank X 5 (Calibrator Concentration)

(A)Standard

Reference Values:

50 - 175µg/dl

3.10.4 Determination of Human Vitamin A (VA) ELISA Kit

Quantitative determinations of Serum vitamin A and D were carried out using Enzyme–linked immunosorbent assay (ELISA) test kits by WKEA Med Supplies Corp.

3.10.4.1 Principle of the Assay

This kit assay Human VA level in the sample, used purified Human VA antibody to coat microliter plate wells, make solid-phase antibody, then add VA to wells, combined VA antibody which with enzyme labeled, become antibody-antigen-enzyme-antibody complex, after washing completely, Substrate was added, substrate became blue colour and the enzyme-catalysed reaction was terminated by the addition of a sulphuric acid solution and the colour change was measured spectrophotometrically at a wavelength of 450nm. The concentration of VA in the samples was then determined by comparing the O.D of the samples to the standard curve.

3.10.4.2 Procedure

Sample was diluted and added to standard. Ten (10) Standard wells were set on the microtiter plate coated, standard 100µl was added to the first and the second well, Standard dilution 50µl was added to the first and the second well, mix; 100µl was taken out from the

first and the second well then added to the third and the fourth well separately. Standard dilution 50µl from the third and the fourth well was added, mixed; then 50µl was taken from the third and the fourth well separately and discarded. 50µl from the third and the fourth well were taken separately again and added to the fifth and the sixth well separately, then added Standard dilution of 50µl to the fifth and the sixth well, it was mixed; 50µl from the fifth and the sixth well was taken and added to the seventh and the eighth well, then added to Standard dilution 50µl to the seventh and the eighth well, mixed. The dilution procedure was repeated for the seventh, eighth, ninth and the tenth well. Diluted Fifty microliter solution was kept in each well. Set blank wells separately, Sample dilution 40µl to sample well, and then add 10µ then mix gently. It was Incubated for 30mins at 37^0C. prepare solution; 30-fold wash solution diluted 30-fold with distilled water and reserve. Manual washing was done; Removed incubation mixture by aspirating contents of the plate into a sink or proper waste container using squirt bottle. After manual washing, 50µl Enzyme Conjugate reagent was added to each well, except blank well. For colour, 50µl Substrate A and substrate B was added to each well, covered and incubated for 15mins at 37^0C. to stop the reaction; 50µl stop Solution was added to each well. Mixed well and determined the optical density of each well within 15mins by a microplate reader.

Reference value:

50nmol/L -1600nmol/L

3.10.5 Determination of Human Vitamin D (VD) ELISA Kit

3.10.5.1 Principle of the Assay

This kit assey Human VD level in the sample, use purified Human VD antibody to coat microliter plate wells, make solid-phase antibody, then add VD to wells, combined VD antibody which with enzyme labeled, become antibody-antigen-enzyme-antibody complex, after washing completely, Add substrate, substrate becomes blue colour at HRP enzyme-catalysed, reaction is terminated by the addition of a sulphuric acid solution and the colour change is measured spectrophotometrically at a wavelength of 450nm. The concentration of VD in the samples is then determined by comparing the O.D of the samples to the standard curve.

3.10.5.2 Procedure

Dilute and add sample to standard: set 10 Standard wells on the microtiter plate coated, add standard 100µl to the first and the second well, the add Standard dilution 50µl to the first and the second well, mix; take out 100µl from the first and the second well then add it to the third and the fourth well separately. The add standard dilution 50µl from the third and the fourth well, mix; then take out 50µl from the third and the fourth well separately and discard. Take out 50µl from the third and the fourth well separately again and add them to the fifth and th sixth well separately, then add Standard dilution 50µl to the fifth and the sixth well, mix; take out 50µl from the fifth and the sixth well and to the seventh and the eighth well, then add Standard dilution 50µl to the seventh and the eighth well, mix; take out 50µl from the seventh and the eighth well and add to the ninth and the tenth well, add

standard dilution 50µl to the nineth and the tenth well, mix, take out 50µl from the ninth and the tenth well discard. Keep 50µl in each well after diluting. Set blank wells separately, add Sample dilution 40µl to sample well, and then add 10µ then mix gently. Incubate for 30mins at 37^0C. Prepare solution; 30-fold (or 20-fold) wash solution diluted 30-fold (20-fold) with distilled water and reserve. Manual washing; Remove incubation mixture by aspirating contents of the plate into a sink or proper waste container using squirt bottle. After manual washing, add 50µl Enzyme Conjugate reagent to each well, except blank well. For colour add 50µl Substrate A and substrate B to each well, cover and incubate for 15mins at 37^0C. to stop the reaction ; add 50µl stop Solution to each well. Mix well. Determine the optical density of each well within 15mins by a microplate reader.

Reference value:

50µg/L -1000µg/L

3.10.6 Quantitative Determination of Calcium

3.10.6.1 Principle

Calcium with Arsenazo lll (1,8-Dihydroxy-3,6-disulpho-2,7naphthalene-bis(azo)-dibenzenearsonic acid), at natural pH, yields a blue coloured complex. The intensity of the colour formed is proportional to the calcium concentration in the sample.

Serum or plasma; Separated from cells as rapidly as possible.

Stability of the samples: Calcium is stable 10days at 2-8^0C .

Reference value:

Serum or plasma 8.8 - 10.2mg/dL

3.10.7 Determination of haemoglobin concentration

Haemoglobin concentration at the field was evaluated using Mission hb haemoglobin meter system through finger prick.

3.10.8 Malaria screening

Thick blood smears collected from both under five children and their mother were prepared on glass slides within 12 hours of collection to determine malaria parasite. The slides were fixed and stained with field stain (thick and thin), allowed to dry and observed under microscope for malaria parasite. The blood samples were stained in 3% giemsa solution, (Davey, 1986). The stained slides was then examined using x100 objectives in oil immersion.

3.11 Dietary Assessment

Food consumption pattern of the children and their mothers was determined using Food Frequency Questionnaires (FFQ) and 24 hour dietary recalls techniques (FAO/WHO, 1999). The mothers were asked to estimate from a food list the frequency in which they consume mentioned foods based on specified frequency categories indicated such as consumption per day, week, and month or never consumed. Also, mothers were asked to recall all foods, drinks and amounts consumed in the past 24 hours.

3.12 Data Analysis

Emergency Nutrition Assessment (ENA) software was used for anthropometry data analysis (ENA for SMART, 2011). Socio demographic data is presented as descriptive statistics of percentages, frequencies using statistical package for social sciences (SPSS) window version 20. Biochemical data is presented as Mean ± SD. A multi variable analysis was done to ascertain the relationship of under-nutrition / malnutrition with relation to other variables.

CHAPTER FOUR

4.0 RESULTS

4.1: Age and Gender Distribution of the Underfive Children Sampled In Kuje Area Council (KAC) of FCT

Age and gender distribution of the under five children in KAC of FCT is presented in Table 4.1. The results indicate that 49.7% of the samples were males and 50.3% were females. Children aged 6-17 months was 31.1%, and 54-59 months old children recorded the lowest (9%)

4.2 Prevalence of Acute Malnutrition Amongst the Under Five Children In Kuje Area Council (KAC) of FCT Abuja

The prevalence of acute malnutrition among the under five children in KAC of FCT based on Weight for Height z-score is shown in Table 4.2. The prevalence of Global acute malnutrition (GAM) was 12.8%. Prevalence of moderate acute malnutrition (MAM) and severe acute malnutrition (SAM) were 7.4% and 5.4% respectively.

4.3: Prevalence of Acute Malnutrition based on MUAC and by Gender Among the Under Five Children In Kuje Area Council (KAC) of FCT

Prevalence of acute malnutrition based on MUAC and by gender among the under five children in KAC of FCT Abuja is presented in Table 4.3. The result indicated that the GAM for both gender was 12.1%, 12.6% for boys and 11.6%. for girls. Also MAM for both gender was 8.5%, 8.1% for boys and 8.8% for the girls. SAM for both gender was 3.6%. 4.1% for boys and 2.8% for girls.

Table 4.1 Age and Gender Distribution of Underfive Children in Kuje Area Council of Federal Capital Territory

AGE (mo)	Boys		Girls		Total		Ratio
	Freq.	%	Freq.	%	Freq.	%	Boy:Girl
6-17	74	47.7	81	52.3	155	31.1	0.9
18-29	57	50.0	57	50.0	114	22.8	1.0
30-41	57	53.3	50	46.7	107	21.4	1.1
42-53	37	47.4	41	52.6	78	15.6	0.9
54-59	23	51.1	22	48.9	45	9.0	1.0
Total	**248**	**49.7**	**251**	**50.3**	**499**	**100.0**	**1.0**

Table 4.2 Prevalence of Acute Malnutrition Among Underfive Children Based on Weight for Height z-score, WHO references of Children in Kuje Area Council of Federal Capital Territory.

Prevalence	Weight for Height		Weight for Age		Height for Age	
	Freq.	%	Freq.	%	Freq.	%
GAM (<-2zscore)	73	12.8	144	24.4	232	40.3
	(10.3 - 15.9)		(21.0 - 28.2)		(35.3 - 45.5)	
MAM (<-2zscore and >=-3zscore)	42	7.4	80	13.6	107	18.6
	(5.4 - 10.0)		(11.3 - 16.2)		(15.4 - 22.2)	
SAM (<-3zscore)	31	5.4	64	10.9	125	21.7
	(3.9 - 7.5)		(8.3 - 14.1)		(17.4 - 26.7)	

GAM = Global Acute Malnutrition; MAM = Moderate Acute Malnutrition; SAM = Severe Acute Malnutrition; Values in parenthesis refers to the confidence interval

Table 4.3: Prevalence of Acute Malnutrition Based on Mid Upper Arm Circumference and Gender among Underfive children, Kuje Area Council.

Prevalence	All (n = 497)		Boys (n = 246)		Girls (n = 251)	
	Freq.	%	Freq.	%	Freq.	%
GAM (<-2zscore)	60	12.1 (9.6 - 15.0)	31	12.6 (9.0 - 17.3)	29	11.6 (8.4 - 15.7)
MAM (<-2zscore and >=-3zscore)	42	8.5 (6.5 - 10.9)	20	8.1 (5.4 - 12.1)	22	8.8 (6.1 - 12.4)
SAM (<-3zscore)	18	3.6 (2.2 - 6.0)	11	4.5 (2.2 - 8.7)	7	2.8 (1.2 - 6.2)

GAM = Global Acute Malnutrition; MAM = Moderate Acute Malnutrition; SAM = Severe Acute Malnutrition; Values in parenthesis refers to the confidence interval

4.4 Prevalence of Overweight by Gender Based on Weight for Height among Underfive Children, Kuje Area Council, FCT

Prevalence of overweight based on weight for height cut off's and by gender of under-five children is summarized in Table 4.4. Prevalence of overweight and severe overweight was 7.0% and 1.4% respectively. Among the boys, the prevalence of overweight was 7.6% and severe overweight was 1.7%. While, among the girls, the prevalence of overweight was 6.4% and severe overweight was 1.1%.

4.5 Nutritional Status of Mothers Based on Body Mass Index (BMI) and MUAC

The nutritional status of the mothers based on BMI and MUAC is shown in Figures 4.1 and 4.2. The result showed that 2.3% of the women were underweight, 28.5 % had pre-obesity and 17.8% were obessed. Pearson Chi – Square test showed that there is a significant ($P<0.05$) difference in their BMI among different age groups. Also, the MUAC showed that 6.3% of the mothers were moderately malnourished, and 12.6% were mildly malnourished.

4.6 Morbidity Among the Under Five Children in Kuje Area Council, of Federal Capital Territory.

Morbidity pattern of underfive children within a period of two weeks prior to the survey in KAC is presented in Table 4.5. The result revealed an overall morbidity of 17.2% and majority of the children (79.5%) had fever, followed by cough at 32.5%. Malaria, Diarrhoea and others were 29.8%, 27.3% and 2.7% respectively.

Table 4.4: Prevalence of Overweight by Gender Based on Weight for Height among Underfive Children, Kuje Area Council of Federal Capital Territory.

Prevalence	All		Boys		Girls	
	Freq.	%	Freq.	%	Freq.	%
Overweight (WHZ > +2)	40 (4.8 - 10.1)	7.0	22 (5.0 - 11.5)	7.6	18 (4.0 - 10.2)	6.4
Obesity (WHZ > +3)	8 (0.7 - 2.6)	1.4	5 (0.7 - 4.0)	1.7	3 (0.3 - 3.4)	1.1

Values in parenthesis refers to the confidence interval

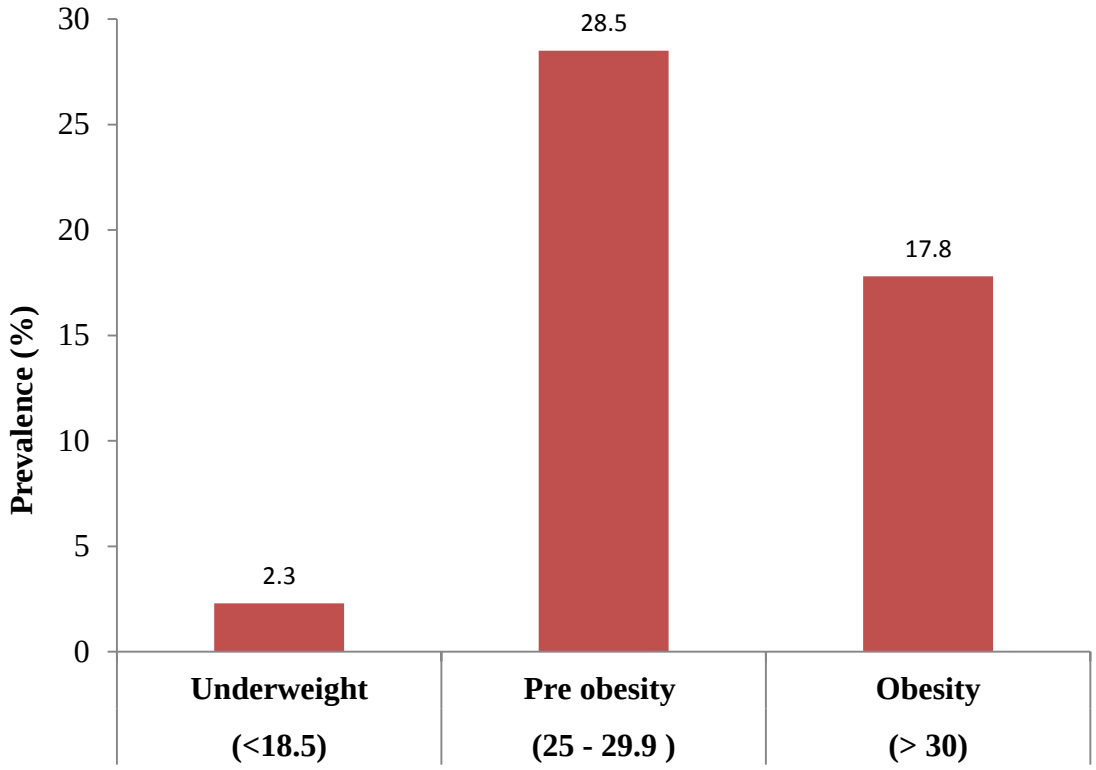


Figure 4.1: Prevalence of Malnutrition based on Body Mass Index among Mothers of Underfive Children in Kuje Area Council, Federal Capital Territory

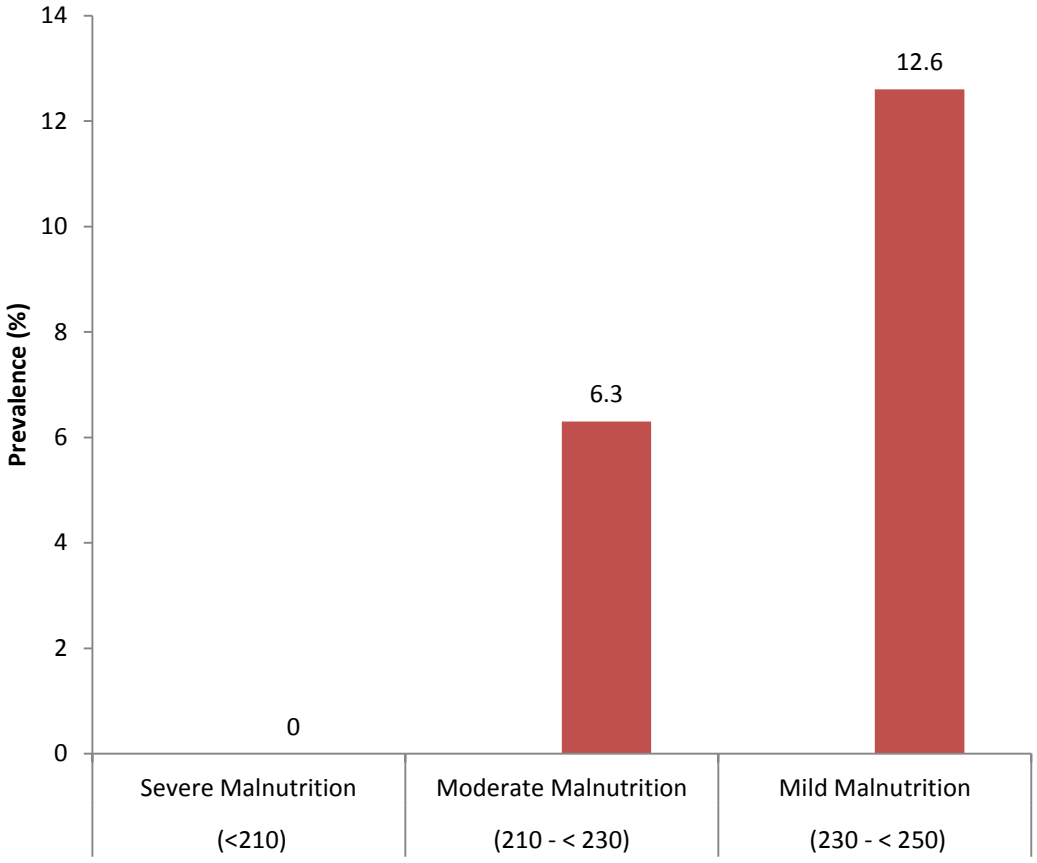


Figure 4.2: Prevalence of Malnutrition based on Mid Upper Arm Circumference among Mothers of Underfive Children in Kuje Area Council, Federal Capital Territory

Table 4.5 Morbidity Rate Among Under Five Children in Kuje Area Council, Federal Capital Territory.

Prevalence of illness **(n = 482)**	**Frequency**	**Percentage (%)**
Overall Morbidity	83	17.2
Morbidity Pattern		
Fever	66	79.5
Diarrhea	23	27.3
Cough	27	32.5
Malaria	36	29.8
Others	2	2.7

4.7 Mortality Rate in Kuje Area Council (KAC), Federal Capital Territory.

Crude death rate and child mortality rate in KAC is shown in Table 4.6 which indicates a crude death rate of fifty-nine deaths per thousand live births (59/1000), and under-five mortality rate (probability of dying before fifth birthday) of seventy-eight deaths per thousand live birth (78/1000).

4.8 Micronutrient Status of Underfive Children and their Mothers in Kuje Area Council, Federal Capital Territory.

Micronutrient Status of the respondents and their children is presented in Table 4.7. Vitamin A, Iron, Iodine, Zinc, Vitamin D, Calcium and Phosphorus were assessed. The results for the children showed that 36.4% were deficient in Vitamin D, many of the children had Vitamin A deficiency (28.1%), Zinc deficiency was 16.7%. Other micronutrients the children were deficient in include; Phosphorus 1.7%, Albumin 87.6%, Iron 12.5%, and Calcium.59.5%.

Micronutrient status of the women reveals deficiencies of Vitamin D, Vitamin A, Zinc, Phosphorus, Calcium to be 30.4%, 34.8%, 17.4%, 41.3% and 52.2% respectively. Also, 88.8% were deficient in Albumin while none of the women were deficient in Iron,

Table 4.6: Mortality Rate in Under Five Children in Kuje Area Council of FCT

Crude Mortality Rate (CMR)	
(Total deaths/10,000 people / day):	0.59
	(0.27-1.26)
U5MR :	
Deaths in children under five/10,000 children under five / day)	0.78
	(0.23-2.60)

Value in parenthesis is confidence interval at 95%

Table 4.7 Micronutrient Status of Mothers and their Under Five Children in Kuje Area Council of FCT

Micronutrients	Mothers		U5 Children	
	Mean ± SD	% Deficiency	Mean ± SD	% Deficiency
Minerals				
Iron (µg/dl)	85.69±30.69	0	80.5±17.9	12.50
Zinc (mg/dl)	153.76±97.28	17.4	164.9±105.10	16.70
Calcium (mg/dl)	8.543±0.978	52.2	8.4±1.30	59.50
Phosphorus (mg/dl)	5.820±1.90	41.3	6.4±2.20	1.70
Vitamins				
A (nmol/l)	131.76±130.98	34.8	229.8±33	28.10
D (µg/l)	118.11±115.28	30.4	89.1±82.90	36.40

4.9: Percentage Distribution of Some Biochemical Parameters among Under Five Children and their Mothers in Kuje Area Council (KAC) of FCT

Table 4.8 highlights the mean values of the biochemical parameters that were assessed. It reveals that the percentage deficiencies for haemoglobin were 15.1 and 16.7 for mothers and children respectively. 19.85 accounted for below and above normal range for alkaline phosphatase in children while 93.8 percent of the mothers had above normal range. Albumin deficiency was high amongst mothers (87.6%) and children (84.80).

4.10 Percentage Distribution of Some Health Parameters of Under Five Children and their Mothers in Kuje Area Council, Federal Capital Territory

Table 4.9 shows the percentage distribution of some health parameters of under five children and their mothers. The result reveals that 29.8, 15.5 percent were positive for malaria for children and mothers respectively. Ricket was manifested in 11.8 percent of the children and in 5.7 percent of mothers.

Table 4.8 Mean Value of Biochemical Parameters of Under Five Children And Their Mothers In Kuje Area Council, FCT

Biochemical Parameters	**Mothers (freq = 53)**		**U5 Children (freq =121)**	
	Mean ± SD	**% Deficiency / > normal**	**Mean ± SD**	**% Deficiency / > normal**
Variables				
Haemoglobin (hb) g/dl	12.55±1.03	15.10	11.70±1.40	16.70
Alkaline Phosphatase	753.52±360.23	93.8	779.10±376.90	19.8
Abumin	3.05±0.51	84.80	3.03±0.40	87.60

Table 4.9 Percentage Distribution of Some Health Parameters of Under Five Children and their Mothers in Kuje Area Council, Federal Capital Territory.

	Children (n=121)		Mothers (n = 53)	
Variable	Freq	%	Freq	%
Malaria				
Positive	36	29.8	8	15.4
Ricket				
Present	14	11.8	3	5.7

4.11: Food Consumption Pattern Among the Under Five Children in Kuje Area Council (KAC) of FCT

Food consumption pattern of the under-five children for food varieties according to WHO IYCF categorization (4 star diets) in Figure 4.3 have shown that majority of the children consumed staples, fats and vegetables. Less than half (47.6%) consumed legumes while 39.1% consumed animal sourced foods.

4.12: Socio Demographic Characteristics of Caregivers of Under Five Children in Kuje Area Council (KAC) of FCT

Demographics of households sampled in this study shown in Table 4.10 indicated that households were mainly headed (94.2%) by males and females headed 5.8%. Majority (99.2%) of the caregivers were females, 93.2% were married, and 32.9% had no education.

Gbagyi Ethnic group formed the majority (33.3%) of the tribe sampled, followed by Gede Ethnic group who were 16.8%, and others were 49.9%. Majority (40.8%) of the caregivers were farmers 14.1% were housewives or do not have any occupation, civil servants were 11.4% and traders 26.1%. The table also showed that 85.7% are monogamous family and 89.6% of mothers had parity of 1 to 4 parity. In addition, 47% of the caregivers earn below N7, 500 monthly, 34.3% earn between N7, 500 to N15, 000 monthly. Monthly expenditure on food by 80.3% of households is < N10, 000 monthly. Majority (72.0%) of the caregivers lived in peri urban settlements.

4.13 Determinants of Malnutrition amongst Under Five Children in Kuje Area Council (KAC) of FCT

Determinants of malnutrition amongst under-five children in Kuje Area Council (KAC) of FCT Abuja are presented in Table 4.11. It shows statistically some key determinant of malnutrition amongst under-five children in Kuje Area Council (KAC) of FCT Abuja. This revealed that with the exception of the variables, monthly income, educational and marital

status, all other parameter tested in this study were found to be statistically significant in affecting the child's nutritional status. The variables which were statistically significant at P = < 0.05 include: Child left in the care of another child (younger than 14 years old, place of delivery, Immunization status of the child, Early initiation to breastfeeding, Use of Colostrum, Exclusive breastfeeding and Age of child with other key determinants whichs includes, those receiving acceptable dietary diversified diet, amongst others.

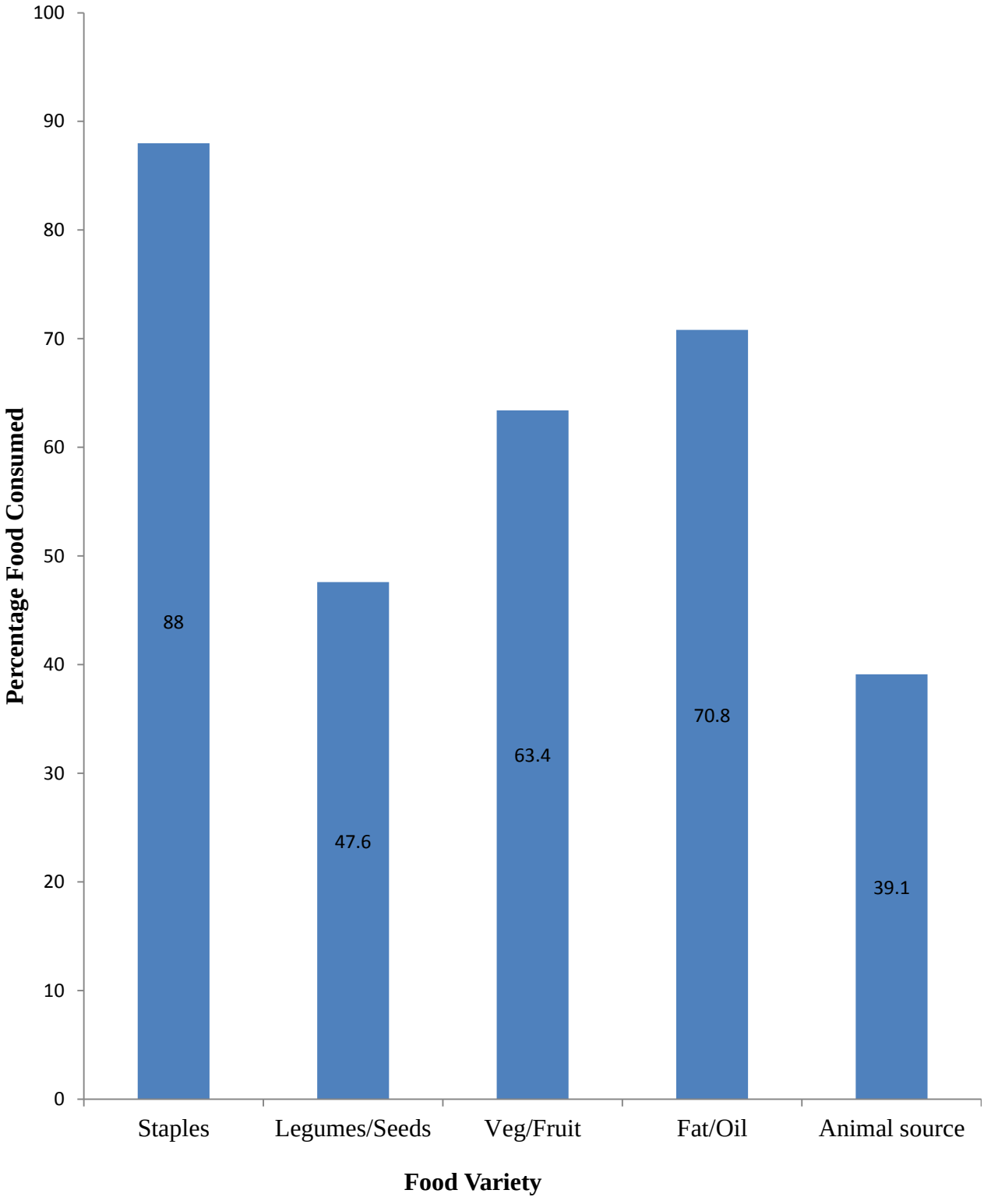


Figure 4.3. Percentage of Infant and Young Children who Consumed Various Food Varieties in Kuje Area Council, Federal Capital Territory.

Table 4.10: Socio Demographic Characteristics of Caregivers of the Underfive Children in Kuje Area Council, Federal Capital Territory

Socio demographic data	Variables	Percentage (%)
Sex of Household head	Male	94.2
Sex of caregiver	Female	99.2
Marital status	Married	93.2
Formal Education	None	32.9
	Primary school	39.4
	Secondary school and above	60.6
Ethnicity	Gbagyi	33.3
	Gede	16.8
	Others	49.9
Occupation of caregiver	Farmers	40.8
	Traders	26.1
	Civil Servant	11.4
	None/Housewife	14.1
Type of family	Monogamous	85.7
Estimated Monthly income of caregiver	Below N7500.00	47.0
	N7500-N15000	34.3
Estimated monthly expenditure on food	Below N10,000.00	80.3
Sector	Urban (Peri urban)	72.0
Parity	Below 4 children	89.6

Table 4.11: Determinants of Malnutrition amongst Under Five Children in Kuje Area Council (KAC) of FCT

Variables	Pearson Chi square	X^2	p value
Child left in the care of another child (< 14 years)	6.625		0.010
Place of delivery	11.840		0.008
Immunization status of the child	5.577		0.005
Early initiation	5.522		0.020
Colostrum	7.232		0.027
Exclusive Breastfeeding Feeding (0 – 3 months)	14.803		0.022
Exclusive Breastfeeding Feeding (3 – 6 months)	19.101		0.004
Age of child	9.501		0.050
Monthly Income (Women)	4.688		0.096
Marital Status	3.239		0.072
Educational Level	4.204		0.240

N = 483; P significant at <0.05

CHAPTER FIVE

5.0 DISCUSSION

Prevalence of malnutrition among under-five children is very high in many developing countries of the world (Babatunde *et al.,* 2011). This study assessed the prevalence of malnutrition among children aged 6 – 59 months. Global malnutrition, or "wasting", is defined as low weight for height or the presence of oedema. The population was made up of 49.7% males and 50.3% females this indicated an equal distribution of the subjects based on age and gender at a ratio of 1.0. The prevalence for global malnutrition, moderate malnutrition and severe malnutrition as shown in Table 4.2, this revealed that the children were malnourished in terms of wasting, underweight and stunting respectively. This could probably be because the children did not consume or absorb the right amounts and types of food and essential nutrients (Robert, 2013). SAM is the most dangerous form of malnutrition. SAM affects 20 million children under five years of age each year and contributes to 1 million child deaths per year. MAM contributes more to the overall burden of disease as compared to SAM, as it affects many more children (World Health Organization, World Food Programme, United Nations System Standing Committee on Nutrition and The United Nations Children's Fund, 2007). MAM also has a higher burden than SAM and currently affects 35 million children (Black, 2008). Prevalence of moderate acute malnutrition (MAM) was 7.4%, and the prevalence of severe acute malnutrition (SAM) was 5.4%. A study in the eight northern states revealed that the highest and lowest prevalence of severe acute malnutrition according to WHZ-score were reported in Sokoto at 4.4% and in Katsina at 1.6%. Children's Investment Fund Foundation (2014), stated that up to 1 million Nigerian children under age 5 years are affected by severe acute

malnutrition (SAM) each year. These children have severely low weight for their height and are at risk of dying unless given urgent attention (FMOH, 2014).

Weight-for-height reveals current nutritional status. A child who is below minus two standard deviations (-2 SD) from the reference median for weight-for-height is considered to be too thin for his/her height, or wasted, a condition describing acute or recent nutritional deficit (NDHS, 2013). Table 4.3 revealed the prevalence of severe wasting as 5.4% and moderate wasting 7.4% respectively. This shows that the total prevalence of wasting in the Area Council was 12.8%. This is higher than the global prevalence of 8% (i.e., weight-for-height below –2SD) in 2011 (United Nations Children's Fund, World Health Organization and The World Bank, 2012). Wasting is classified as severe if the child is minus three standard deviations (-3 SD) or more below the reference mean. Severe wasting is closely associated to mortality risk (NDHS, 2013). The 2013 NDHS surveys reported a higher national prevalence of wasting (18 percent) and 9 percent were severely wasted. FMOH (2014) stated that the percent of children in Nigeria who are wasted, or too thin for their height, has steadily increased over the last decade, rising from 11 percent in 2003 to 18 percent in 2013.

Weight-for-age is a combined index of weight-for-height and height-for-age, and thus does not differentiate between acute malnutrition (wasting) and chronic malnutrition (stunting). A child can be underweight for his age because he is stunted, because he is wasted, or both. Weight-for-age is a good overall indicator of a population's nutritional health (NDHS, 2013; United Nations Children's Fund, World Health Organization and The World Bank, 2012). In this study, the prevalence of underweight were 24.4%, moderate underweight

were 13.6% and severe underweight were 10.9%. This is lower than the national prevalence of 29 percent and 12 percent of severe underweight reported by NDHS (2013). A study in Sokoto state was found with the underweight children at 41% and Yobe state with prevalence similar to this study at 24% (UNICEF, 2012b). The underweight prevalence rate in this study also revealed that it is higher than the global prevalence of 16% in 2011(United Nations Children's Fund, World Health Organization and the World Bank, 2012). Acute malnutrition, underweight and stunting is said to peak within the first two years of life. This is a generally recognized pattern of commencement and peak of malnutrition. Protecting children from malnutrition particularly during the first 1000 days beginning from conception to 24 months of life is critical for their future development. This period is regarded as a window of opportunity to shape healthier and more flourishing future. Undernutrition during the first two years of life may result in deficits in both physical and cognitive well-being which in turn may cause similar deficits in future generations (UNICEF, 2012b; United Nations Children's Fund, World Health Organization and The World Bank, 2012).

Stunting is a condition that reflects the cumulative effect of chronic malnutrition. A child who is below minus two standard deviations (-2 SD) from the median of the WHO reference population in terms of height-for-age is considered short for his/her age, or stunted, if the child is below minus three standard deviations (-3 SD) from the reference median, then the child is considered to be severely stunted. A child between -2 SD and -3 SD is considered to be moderately stunted (UNICEF, 2012b; United Nations Children's Fund, World Health Organization and The World Bank, 2012). In this study, the

prevalence of stunting were 40.3%, moderate stunting were 18.6% and severe stunting were 21.7% higher than the global prevalence. The result in this study is also higher than the NDHS data which revealed that 37 percent of Nigerian children under age 5 years are considered to be short for their age or stunted, while 21 percent are severely stunted (below -3SD). As the same case with underweight, the prevalence of stunting increases with age in Nigeria from 16 percent of children under 6 months to 46 percent of children 24-35 months and decreases to 37 percent among children 48-59 months (NDHS, 2013).

The prevalence of overweight in children in this study was 7.0% (i.e., weight-for-height above +2SD) and severe overweight were 1.4% (i.e., weight-for-height above +3SD). It agreed with the global prevalence of 7% in 2011 (United Nations Children's Fund, World Health Organization and The World Bank, 2012). It is reported that the "increasing trends in child overweight have been noted in most world regions, not only developed countries, where prevalence is highest (15% in 2011). In Africa, the estimated prevalence under-five overweight increased from 4% in 1990 to 7% in 2011. The prevalence of overweight was lower in Asia (5% in 2011) than in Africa, but the number of affected children was higher in Asia (17 million) than in Africa (12 million)" (United Nations Children's Fund, World Health Organization and The World Bank, 2012).

Acute malnutrition occurs as a result of recent rapid weight loss or a failure to gain weight within a relatively short period of time. It is a measure of thinness and /or bilateral oedema. It occurs more commonly in infants and younger children, often during the stage when complementary foods are being introduced and children are more susceptible to infectious

diseases. A child with severe acute malnutrition (WHZ < -3; and /or MUAC <115 and /or bilateral oedema) has 9-fold increased risk of death compared to a child with no acute malnutrition (WHO/UNICEF 2009; NBS 2014). The prevalence of acute malnutrition for the children using MUAC and/or Oedema indicated a GAM, (sum of MAM and SAM) above the WHO acceptable threshold of 5%, though within the WHO crisis threshold of 15%. However, the SAM was 3.6% which was lower than 5% but the upper limit of the 95% confidence interval was higher than 5%. It is worth noting that this study was conducted between January and May, 2015 before the expected hunger gap which, in Nigeria, usually occurs between June and August. This implies that the children may have had inadequate food intake and/or poor utilization of food due to disease condition. This study corroborated with the report of UNICEF (2015) that stated that the prevalence of Global Acute Malnutrition rates in the northern states of Nigeria were 12 per cent. However, their statement that those northeast states significantly worse than the central and southern states is not confirmed in this study as the prevalence in this study is slightly higher. This study will not assume a general prevalence of Global Acute Malnutrition in Federal Capital Territory (FCT) to be 12.1% as the study was conducted only in a particular Area Council in the FCT.

The prevalence of malnutrition among mothers based on body mass index (BMI) mid upper arm circumference (MUAC) is shown in Figure 4.1. The result revealed the existence of double burden of malnutrition among the women. A total of 46.3% were either pre-obessed or obessed and 2.3% were underweight. Also, the MUAC result showed a total malnutrition level of 18.9%. This may be due to the poverty ravaging some parts of the

study area. Under-nutrition greatly impedes a countries' socioeconomic development and the potential to reduce poverty. Well-nourished women face fewer risks during pregnancy and child birth, and their children set off on firmer developmental parts, both physically and mentally. Obesity experts have long stated that the epidemic of obesity is a public health concern. It is causing enormous burden of morbidity and mortality resulting in great social, economic and human costs (Haslam and James 2005). In another study by Akarolo-Anthony, *et al.* (2014) it was revealed that in a "cross-sectional study among a random sample of 1058 adults, who were visitors and staff of a government worksite in Abuja, an urban city in Nigeria, the overall prevalence of overweight or obesity (body-mass index ≥ 25 kg/m^2) was 64% (74% of the women and 57% of the men)". This is higher than the result in the present study. This could be attributed to the affluence, civilization and food security of the subjects. Brown *et al.* (2011) stated that obesity in pregnant women has been attributed to increased rates of stillbirth, large-for-gestational newborns, and Cesarean-section. Also, some infants born to women who enter pregnancy obese are predisposed to becoming overweight during childhood and of developing type 2 diabetes later in life (Brown *et al.,* 2011). The increased risks appear to be partly related to fetal exposure to high levels of insulin and a propensity toward developing insulin resistance.

Health and nutrition issues such as inadequate food intake and disease have a direct link to malnutrition (ACF, 2011). Thus, issues pertaining morbidity, vitamin A supplementation, deworming, infant and young child nutrition, bed net coverage affect child's health. The overall morbidity in this study was 17.2%. Disease incidence for fever and malaria were 79.5% and 29.8%. This may be attributed to high anopheles mosquito breeding during the

season of the research and low use of bed nets. Diarrhoea accounted for 27.3% of morbidity cases. This could be attributed to a number of issues, such as effects of other diseases on child's health as well as poor hygiene and sanitation noted in the area. For example, hand washing at critical times was common. However, use of clean water and soap at these points to break faecal oral route was undertaken by only 24.5% while 0.4% used water and ash. A study by ACF International 2011 on integrated SMART Survey Nutrition, WASH, Food Security, and Livelihoods in Garbatulla District Kenya showed a similar result of 24.4% for hand washing with soap and water.

Under-five mortality rate is the probability of dying before the fifth birthday (MICS, 2012). Estimates of infant and child mortality rates can be used to prepare population projections. Information on childhood mortality is very important as it helps the health sector identify population groups that are at high risk in order to plan adequately for health interventions. One of the overarching Millennium Development Goals (MDGs) was to reduce Infant and Under-five mortality by two third between 1990 and 2015. MDG target was to reduce under-5 mortality to 64 deaths per 1,000 live births by 2015 (NDHS, 2013). Table 4.6 provides estimates of under-five mortality rate and crude death rate using ENA for SMART software. The under-5 mortality rate is 78 per 1000 while crude death rate is 59 per 1000. The Under-five mortality rate is far above the national target of 64 deaths per 1000 live births. Though both fall below the crude mortality rate (CMR) and under five mortality rate (U5MR) emergency thresholds in Sub Saharan Africa of 0.8 and 2.1 respectively (ACF, 2011).

Serum alkaline phosphatase is an enzyme that is extensively distributed in the body. According to Mahan *et al.,* (2012) higher than normal levels of Serum alkaline phosphatase could be increased with bone disorders, pregnancy in adult females, and some malignancies (Grant and Holick, 2005; Holick and Chen, 2008; Mahan *et al.,* 2012). In this study, 10.7% of the children had decreased level while 9.1% had increased levels of serum alkaline phosphatase and about 93.8% of the women had above normal levels of serum alkaline phosphatase. Some of the women were pregnant which could be a reason for the higher than normal levels and 5% of the mothers had deformed limbs suggestive of osteomalacia/rickets. Rickets is defined as a disease involving compromised mineralization of growing bones mainly in children. It is the consequence of not only of deprivation of vitamin D, but of deficiencies of calcium and phosphorus (Grant and Holick, 2005; Holick and Chen, 2008; Mahan *et al.,* 2012). Hence, result showed that 36.4% were deficient in Vitamin D, 16.7% were deficient in Zinc, 1.7% were deficient in Phosphorus and 59.5% were deficient in Calcium. Rickets is a feature of structural abnormalities of the weight-bearing bones. The consequence includes bowed legs and "knock knees". In this study, 11.8% of the children were clinically suspected to have rickets.

Malaria is a major cause of anaemia in sub-Saharan Africa, Other causes of anaemia include nutritional deficiencies, infections and haemoglobin disorders (Kayode and Adeolu, 2012). The result showed that 16.7% were deficient in haemoglobin and 12.5% were deficient in Iron among the children and 15.1% of the mothers were deficient in haemoglobin, 84.8% were deficient in Albumin, but none of the women were deficient in Iron.

Studies have shown that haemoglobin (Hb) concentration of persons with Vitamin A deficiency (VAD) increases by about 10 g/L when vitamin A supplements are provided (Kayode and Adeolu, 2012). Studies also suggest that vitamin A can improve hematologic indicators and enhance the efficacy of iron supplementation (Fishman *et al.,* 2000). Kayode and Adeolu, (2012) thus, suggested that Vitamin A deficiency (VAD) can predispose to anaemia. In this study, 28.1% and 34.4% of the children and mothers were deficient in Vitamin A respectively. World Health Organization (2008a) reported that the rates of anaemia among preschool aged children and pregnant women are 76% and 67%, respectively. It was also reported that one-third of preschool aged children are deficient in vitamin A (WHO, 2009). Adequate intake of micronutrients, particularly iron, vitamin A, iodine and zinc, from conception to age 24 months is critical for child growth and mental development (Mahan *et al.,* 2012). In a similar study among pre-schoolers in a peri-urban community in south east Nigeria showed that the 63% of the children were zinc deficient and 20% were iron deficient (Ibeanu *et al.,* 2012). The prevalence among the pre-schoolers is higher than this present study that reported 16.7% were deficient in Zinc, among the children. It is important to note that low serum or plasma zinc is normally associated with dietary intake (King, 1991). Serum zinc decreases when dietary intake is low such that homeostasis cannot be established however, it might be that other factors other than depletion could have been responsible for the low serum level. Such factors as meal time of the day (diurnal variation), stress, infection, hypoalbuminemia (as seen in this study to be 87.6% and 84.7% in the children and mothers respectively) (Wallock *et al.,* 1993 and King *et al.,* 1994) and low bioavailability from plant could have affected the serum level sources (Brown *et al.,* 2001).

Dietary diversity is essential for food security. In this study, majority of the children consumed staples, fats and vegetables. Less than half (47.6%) consumed legumes while 39.1% consumed animal sourced foods. FAO (2009) reported that fewer than 10% of households are food insecure as defined by available calories per capita in sub-Saharan Africa. Achieving food security, however, means ensuring quality and continuity of food access, in addition to quantity, for all household members. High rates of micronutrient deficiencies in Nigeria indicate that dietary diversity may be poor (FAO, 2009).

Breastfeeding practices and introduction of complementary foods are essential determinants of the nutritional status of children, especially those under age 2. Children with improved nutritional status have lower risk of mortality for children under age 5 and their psychomotor development are enhanced. Breast milk is the best food for the child under the age of 6 months because breast milk is uncontaminated and contains all the nutrients needed by children in the first six months of life. Introduction of complementary food to supplement breast milk before age 6 months is unnecessary and discouraged because of the risk of contamination, which may expose the child to the risk of diarrhoeal diseases. After age 6 months, breast milk should be complemented by other solid or mushy food to provide adequate nutrition to the child and preferably iron fortified cereals (Brown *et al.,* 2011; NDHS, 2013).

In this study, 33.1 % of the children were fed breast milk exclusively within the first 3 months, 22.4% children were breastfed exclusively from 3-6 months. This is higher than the national proportion of 17% of children being breastfed exclusively for six months

(NDHS, 2013). Breastfeeding, especially six months of exclusive breastfeeding, has a significant effect in the reduction of mortality from the two biggest contributors to infant deaths: diarrhoea and pneumonia (UNICEF, 2012). According to NDHS (2013) in Nigeria, children less than 6 months are more likely to be breastfed than older children. Ninety-six percent of children aged 6-8 months, followed by 91 percent of children aged 9-11 months in Nigeria are being breastfed. In this study the result is similar, 96.7% of the children sampled were breastfed, 3.3% were not breastfed. NDHS (2013) reported that the percentage of children in Nigeria who are still being breastfed decreases steadily with age, about 35 percent of children aged 20-23 months are breastfed. In this Area Council, 76% of the respondents' breastfed their babies for 1 to 2 years.

This study also revealed that about half of the respondents (49.1%) introduced complementary feeding before six months and 23.2% introduced it after six months while 27.7% had age appropriate timely introduction of complementary feeding. The results indicates that complementary foods were introduced early in the communities. This is however not different from the NDHS (2013) report that 23 percent of children under age 6 months and 38 percent of children age 4-5 months consuming solid or semi-solid foods in addition to breast milk. According to UNICEF (2009) a total of two-thirds of all new-borns do not receive breast milk within one hour of birth. This study revealed that 30.6% had early initiation to breastfeeding within 30 minutes of birth, 69.4% were fed after hours and days. This study also showed that 69.8% fed infants colostrum, however, 30.2% discarded it. Research evidence points to the impact of early initiation of breastfeeding on neonatal mortality. A study in rural Ghana in 2006 showed that early initiation within the first hours of birth could prevent 22% of neonatal deaths, and initiation within the first day, 16% of

deaths, while a study in Nepal found that approximately 19.1% and 7.7% of all neo-natal deaths could be avoided with universal initiation of breastfeeding within the first hour and first day of life respectively. The global rate of early initiation of breastfeeding remains below 40 per cent (UNICEF, 2012).

Household characteristics determines the socio-economic status (SES) of the household. Many years ago, Cattell (1942) defined socioeconomic status as the position of an individual on a social-economic scale that measures such factors as education, income, occupation, residence, health in some population, heritage and religion. The result of this study revealed that 5.8% of households were headed by females. Generally, households that are headed by females in Nigeria are vulnerable. Majority (99.2%) of the caregivers were females, 93.2% were married, 67.1 % had formal education, however, 60.6% of them have secondary education and above. 32.9% did not go to school. The educational level determines most times the earning capacity of individuals. Majority of the household's income level were very small this is because many of them had low level of education. Mothers' educational attainment affects the health of their children (NDHS, 2013). 47.0% of the caregivers earn below N7,500 monthly also 34.3% of them earn between N7,500 to N15,000 monthly. The income level have a profound impact on their nutrient intake. Aggarwal *et al*., (2005) reported that an increase in household income is associated with improved nutritional status of children.

CHAPTER SIX

6.0 CONCLUSION AND RECOMMENDATION

6.1 CONCLUSION

There is a high prevalence of double burden of malnutrition among under-five children and their mothers in Kuje Area Council with multifactorial determinants. These findings reinforce the importance of proper infant and child feeding practices and appropriate maternal care in prevention of malnutrition.

6.2 RECOMMENDATIONS

Based on the outcome of this study, the following recommendations are made;

i. High impact intervention programmes like Community Management of Acute Malnutrition, Infant and Young Child Feeding, Growth Monitoring and Promotion, Introduction of Micronutrient Powder are recommended to address the current nutritional situations.

ii. Further clinical and biochemical investigations are needed to unravel some of the poor nutritional disease and disorder observed (e.g rickets)

iii. Improved food security and livelihood, and increase intake of micronutrients by increased dietary diversity through consumption of nutritious foods, animal sourced foods, fruits and vegetables and micronutrient supplementation along with Community based Nutrition Services such as Community Growth Monitoring and Promotion, Community Nutrition Information Surveillance System, Community Management of Acute Malnutrition, etc is recommended.

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