ASSESSEMENT OF INFANT AND YOUNG CHILD FEEDING PRACTICES AND NUTRITIONAL STATUS OF CHILDREN (0-23 MONTHS) IN FUNTUA LOCAL GOVERNMENT AREA, KATSINA STATE, NIGERIA

BY

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B.Sc. Biochemistry (A.B.U) 2012
P14SCBC8059

A THESIS SUBMITTED TO THE SCHOOL OF POSTGRADUATE STUDIES AHMADU BELLO UNIVERSITY, ZARIA, NIGERIA IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF THE MASTER OF SCIENCE DEGREE IN NUTRITION

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AHMADU BELLO UNIVERSITY,
ZARIA, NIGERIA

MARCH, 2019

DECLARATION

I declare that the work in this dissertation entitled"**ASSESSMENT OF INFANT AND YOUNG CHILD FEEDING PRACTICESAND NUTRITIONAL STATUS OF CHILDREN (0-23 MONTHS) IN FUNTUA LOCAL GOVERNMENT AREA, KATSINA STATE, NIGERIA"** was carried out by me in the Department of Biochemistry. The information derived from the literature has been duly acknowledged in the text and a list of references provided. No part of this dissertation was previously presented for another degree or diploma at this or any other Institution.

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Raulat, ISAH Signature/Date

CERTIFICATION

This dissertation entitled "**Assessment of Infant and Young Child Feeding Practices and Nutritional Status of Children (0-23 Months) in Funtua Local Government Area, Katsina State, Nigeria"** by RAULAT ISAH meets the regulations governing the award of the degree of Master of Science of Ahmadu Bello University, Zaria, and is approved for its scientific contribution to knowledge and literary presentation.

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DEDICATION

This study is dedicated to my dear Parents, Alhaji Isah Abdu and Late Hajia Amina Sani for their love, care and support which kept me moving till now and forever.

ACKNOWLEDGMENTS

I thank Almighty Allah for enabling me to carry out this research work.

My profound gratitude goes to my supervisors Prof K.M Anigo and Dr A. Salihu for their professional guidance, comments, suggestions, tireless efforts in assisting me during the course of this study, their constructive criticism, really improved the quality of this work.

My sincere appreciation goes to Prof. M.N. Shuaibu Head of Department, for making available all the facilities and enabling learning environment. I am also grateful to all the staff of Biochemistry Department.

My appreciation goes to the Director, Primary Health Care (PHC) Department, Honorable Chairman and District Head of Funtua Local Government Area for granting me permission to carry out my research work. I am indeed grateful to Malam Muntari Ahmad (Ward Focal Person) and Alhaji Sadik, all of PHC Funtua, Ward Heads, team members, entire management of Community Health Center Funtua, Malam Sani Head of Laboratory Unit ABU Medical Center and Malam Habeeb of ABU Medical Center for their contributions in data collection and laboratory analysis.

I am forever grateful to my parents for their maximum support and encouragement. May Allah (SWT) continue to protect, guide, bless and make Aljannatul Firdaus their final abode. Ameen. A lot of thanks to my Siblings, friends and class colleagues for their all-round support and encouragement during my study and source of inspiration.

ABSTRACT

Appropriate feeding practices are essential for the nutrition, growth, development and survival of infants and young children. Assessment of infant and young child feeding (IYCF) practices and nutritional status of children (0-23 months) in Funtua Local Government Area, Katsina State was carried out which incorporated qualitative and quantitative data collection techniques. Data was obtained using pretested semi-structured questionnaire with weight and length taken, in addition to their serum mineral status (Iron, Zinc, Copper and Calcium) using standard methods. Results indicated that early initiation of breastfeeding was practiced by 82.4% whereas exclusive breastfeeding was very low (5.1%) and continued breastfeeding up to two years was practiced by 60.6% of the respondents in the study area. Proportion of children that had minimum dietary diversity were low (5.3%) with minimum meal frequency of 38.8 and 5.3% for breastfed and non-breastfed children respectively, while Iron rich or iron fortified foods were consumed by 21.2% of the respondents and minimum acceptable diet for breastfed and non-breastfed was 4 and 8.3% respectively. Nutritional status of the children indicates stunting (55.7%), wasting (25.3%) and underweight (49.1%) showed significant correlation with breastfeeding practices. Serum minerals level of iron and zinc were low in 76% and 54% of the children respectively, as well as serum copper (69%) and calcium (60%). Haemoglobin and Packed Cell Volume were less than the recommended levels (≥11mgldL and ≥33% respectively). The high prevalence of malnutrition obtained in the study area may be due to the poor feeding practices. Further studies are needed to identify the barriers to optimize IYCF practices of caregivers in the study area

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LIST OF ABBREVIATIONS AND ACRONYMS

ARI	Acute Respiratory Infections
BF	BreastFeeding
BFHI	Baby Friendly Hospital Initiative
CF	Complementary feeding
CIRF	Consumption of Iron Rich Foods
DHS	Demographic and Health Survey
EBF	Exclusive Breast Feeding
EIB	Early Initiation of Breastfeeding
FANTA	Food Nutrition Technical Assistance
FMOH	Federal Ministry of Health
FMWYD	Federal Ministry of Women and Youth Development
Hb	Haemoglobin
IBFANI	International Baby Food Action Network
IFPRI	International Food Policy Research Institute
IYCF	Infant and Young Child Feeding Practices
LGA	Local Government Area
MAD	Minimum Acceptable Diet

MICS	Multiple Indicator Cluster Survey
MNCHW	Maternal Newborn Child Health Week
NBP	National Breastfeeding Policy
NBS	National Bureau of Statistics
NDHS	Nigeria Demographic and Health Survey
NPC	National Population Commission
NPHCDA	National Primary Healthcare Development Agency.
PCV	Packed Cell Volume
PHC	Primary health center
RTI	Respiratory Tract Infections
SD	Standard Deviation
SMART	Standardized Monitoring & Assessment of Relief & Transitions
SPSS	Statistical Package for Social Sciences
UN	United Nations
UNICEF	United Nations Children's Emergency Fund
USAID	United States Agency for International Development
USD	United State Dollar
WHO	World Health Organization

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background of the Study

Nutritional status is the state of the body with respect to each nutrient, body size and overall condition (WHO, 2013). It is a powerful factor in promoting health, preventing and treating diseases (WHO, 2013). Nutritional status affects immune response and response to medical therapies (Fieldman *et al.*, 2010). Globally, almost seven million children under the age of five die every year, and undernutrition directly or indirectly accounts for about 35% of all the deaths among these children (WHO, 2012). The risk factors of malnutrition are multifaceted and complex, these include poverty, seasonal supply of food, gender inequality, poor infant and young child feeding (IYCF) practices, limited access to healthcare, unsafe drinking water and poor sanitation (WHO, 2012). In Nigeria, an estimated 60% of all child deaths in the country are attributable to underlying malnutrition that results from poor infant and young child feeding and hygiene practices (FMOH, 2012).

Infant and young child feeding (IYCF) practice is a set of well-known and common recommendations for appropriate feeding of newborn and children less than 2 years of age (FMOH, 2012); it comprises of breastfeeding as well as complementary feeding which play a major role in determining the nutritional status of children (Das *et al.*, 2013). Optimal IYCF practices play an important role in reducing early childhood morbidity and mortality, as well as improving early child growth and development (FMOH, 2012). Global estimation showed that 41% of infants are exclusively breastfed for the first six months of life, while the majority of infants (60%) receive some other foods or fluids in the early months (WHO and UNICEF, 2018). Adequate nutrition is essential in early childhood to ensure healthy growth, proper organ formation and function, strong immune system, and neurological and cognitive development (UNICEF, 2012). Thus, Ogbo and Agho, (2015) reported that caregivers level of education, socioeconomic status, type of delivery and lack of access to healthcare services are among the factors affecting optimal lYCF practices.

Breastfeeding is the healthiest and least expensive feeding method that fulfils the infant's needs (Oche, 2011: Okafor *et al.,* 2014). It is considered as the most complete nutritional source for infants because breast milk contains the essential fats, carbohydrates, proteins, and immunological factors needed for infants to thrive and resist infection in the first year of life (Okafor *et al.,* 2014). Exclusive breastfeeding (EBF) for six months and continued breastfeeding to one year have been identified as the most effective preventive intervention method in reducing child morbidity (Sreedhara and Banapurma, 2013). It has been estimated that exclusive breastfeeding reduces infant mortality rate by up to 13% in low income countries (Jones *et al.,* 2003). Similarly, the work of Kayode *et al.* (2012) confirmed that breastfeeding of children for more than 18 months contributes immensely in reducing the risk of under-five mortality.

A revised set of population- based Indicators of IYCF was developed in 2007 which came up with a set of simple, valid and reliable indicators that measure food-related aspects of complementary feeding (including dietary variety and frequency of eating episodes), as well as current guidance on the feeding of non-breastfed infants and young children up to 24 months of age which was aimed at enhancing IYCF practices in order to reduce the risk of under-five mortality (WHO, 2008). This is also a major strategy for prevention of infant and child malnutrition (Bhutta *et al.,* 2010).

1.2 Statement of Research Problem

Malnutrition continues to be a problem of public health importance based on the reported number of infant and maternal deaths in Nigeria which was reported second highest in the world after India (UNICEF, 2012a; WHO, 2013). Suboptimal IYCF practices directly affect the nutritional status of children under two years of age and ultimately, impact child survival (Anjanaand Dattatreya, 2015). The NDHS (2013), reported a stunting prevalence of 37% among children under 5 years of age, while 29% and 18% were underweight and wasted, respectively. Also, Black *et al.* (2013) suggested that suboptimal breastfeeding increases the risk of child mortality in the first two years of life. Infant and Young Child Feeding practices in Nigeria, are characterized by low rates of early initiation of breastfeeding after birth, very low rates of exclusive breastfeeding (17%) and poor quality of complementary foods that result in deficiencies of vitamins and minerals (FMOH, 2012; NDHS, 2013). Thus, there is paucity of information and data on IYCF practices at community level especially in Northern Nigeria.

1.3 Justification

The critical one thousand days comprise of the period of pregnancy and the first two years of life which are the most crucial for positive impact on a child’s cognitive and physical development (WHO, 2013). Poor infant and young child feeding practices are one of the immediate factors causing malnutrition in children. As a result of high malnutrition cases in Katsina State, where all the local governments contributed to the overall status, many donor funded projects (Working to Improve Nutrition in Northern Nigeria, Save the Children etc.) are presently working to support and improve nutrition in the state, but Funtua Local Government is not part of the programme because, it is not among the top three Local Governments having a critical level of malnutrition although it is not malnutrition free, and there was no documented data on IYCF and nutritional status for the local government. This necessitated the need for this study, as it will aid in documenting an overall picture of the patterns of feeding practices of children in the first two years of life and their nutritional status in Funtua Local Government Area of Katsina State

1.4 Aim and Objectives

1.4.1 Aim

The aim of this study is to Assess Infant and Young Child Feeding (IYCF) Indicators and Nutritional Status of Children Under Two Years of Age in Funtua Local Government Area of Katsina State.

1.4.2 Specific Objectives of the work.

The specific objectives of the work are to;

i. Determine the Infant and Young Child Feeding practice indicators of children (0-23 months) in Funtua local Government Area.

ii. Determine the nutritional Status of children (0-23 months) based on anthropometric measurement.

iii. Correlate association between feeding practices and nutritional status of children (0-23 months) in the study area.

iv. Assess the micronutrient status (Fe, Zn, Cu and Ca) and Haematological parameters (Hb and PCV) of children (0-23 months) in Funtua Local Government Area.

1.5 Null Hypothesis

IYCF practices have no effect on the nutritional status of children (0-23 months) in Funtua LGA.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Preamble to Feeding Practices

Appropriate feeding practices are essential for the nutrition, growth, development and survival of infants and young children (Kumar *et al.,* 2006; Tessema *et al.,* 2013; Ekerette and Olukemi, 2016). The first two years of life are critical stages for a child's growth and development (WHO, 2013). Damage caused by nutritional deficiencies during this period could lead to impaired cognitive development and low human and economic productivity (Grantham *et al.,* 2007; Victoria *et al.*, 2008).

The major causes of malnutrition in the first two years of life are poor breastfeeding and complementary feeding practices which result in high rates of morbidity from infectious diseases (Murage *et al.,* 2011). The aspect of IYCF practice include early initiation of breast breastfeeding, exclusive breastfeeding for the first six months, continued breastfeeding, appropriate timing of introduction of complementary foods, and optimum quantity and quality of the foods consumed (WHO, 2010). Following the WHO/UNICEF recommendations on improving infant and young child feeding practices, Nigeria initiated several programs and policies to promote and support infant and young child feeding practices (FMOH,2012); these included Baby Friendly Hospital Initiative (BFHI) in 1992 (Ogunlesi *et al.,* 2004), National Breastfeeding Policy in 1998 by Federal Ministry of Women and Youth Development in 2000, National Policy on Food and Nutrition in 2001 and National Policy on Infant and Young Child Feeding in 2005 (FMOH,2005). Some improvements were observed in early or timely initiation of breastfeeding following the introduction of these programmes and policies, from 31.4% in 1990 to 39.2% in 2008 (UNICEF, 2012). In comparison to other developing countries such as Ethiopia, India and Indonesia where the national policy, strategy, and plans of action and health system framework to improve IYCF practices are poor, Nigeria has established a national legislative and health system framework to promote and support infant and young child feeding practices (UNICEF, 2012). Despite these initiatives, malnutrition, and early childhood feeding related diseases and mortality still remain problems of public health importance in Nigeria (NPC, 2013; Ogbo and Agho, 2015; Ogbo *et al.*, 2015). Although, there has been a drop in the proportion of children under 24 months of age who were fed in accordance with IYCF (breastfeeding and complementary feeding) guidelines in Nigeria, from 30% in 2009 (NPC, 2009) to 10% in 2014 (NPC, 2013).

2.2 Feeding Practices

2.2.1 Breastfeeding

The composition of breast milk undergoes changes in quality to meet the nutritional and immunological needs of the baby at different stages of child growth (Monika *et al*,.2004). The numerous benefits of breastfeeding are of public health relevance for developing countries as well as for industrialized nations. Breastfeeding is a cornerstone of healthy foundation that confers both short-term and long-term benefits to the child (WHO, 2001).

Short-term effects include; lowering the incidence of many infant and childhood diseases, including ear and respiratory tract infections (RTI), diarrhoea and sudden infant death syndrome (WHO,2001; Grummer and Mei, 2004).

It also reduces infections and mortality among infants as well as improves mental and motor development (Murage *et al.,* 2011). While the long-term outcomes of Sub-optimal breastfeeding practice are blood pressure, type-2 diabetes, serum cholesterol, overweight/obesity and reduced intellectual performance (Murage *et al.,* 2011; WHO,2013).

As a result of both the short and long term effects of sub-optimal breastfeeding practices, the Nigerian government introduced Maternal Newborn Child Health Week (MNCHW) along with other interventions designed to encourage appropriate feeding practices which include exclusive breastfeeding for the first six months of life, early initiation of breastfeeding with colostrum, timely and appropriate complementary feeding practices, and adequate micronutrient intake (particularly twice-a-year which consist of vitamin A, iron, iodine, and zinc supplementation and deworming of children above 12 months of age). These key nutrition-specific interventions were scaled up in health facilities across the nation (NPC, 2014)

2.2.2. Early Initiation of Breastfeeding

Early initiation of breastfeeding (EIB) is a simple and cost-effective intervention that benefits the health of both mothers and newborns (UNICEF, 2009). The WHO and UNICEF recommend initiation of breastfeeding within the first hour after birth (WHO/UNICEF, 2003). During the first hour after birth, sucking reflex of babies is most active and babies are more at alert (WHO, 2003). Early initiation of breastfeeding ensures more intake of the highly nutritious colostrum by the child. Colostrum is the first liquid that comes out and is produced during the first few days after delivery (UNICEF, 2009).

It contains high concentration of immunoglobulins, especially immunoglobulin A (IgA) which has a protective role against viral and bacterial pathogens in the gut (UNICEF, 2002). Analysis showed that 22% of neonatal deaths could be prevented if all infants are put to the breast within the first hour of birth (Edmond *et al.,* 2006).

To the mother, early suckling stimulates the release of prolactin, which helps in the production of milk, and oxytocin (responsible for the ejection of milk) and it is also interrelated with early contact that is important for mother-to-infant relationships that have long-lasting effects on health and development (WHO, 2010). If initiated soon after birth, breastfeeding helps the mother's uterus to contract encouraging expulsion of the placenta and reducing the risk of severe bleeding and infection (Dennis, 2005). Other benefits include decreased risk of subsequent breast and ovarian cancers and hip fractures (Gartner *et al.,* 2005). However, despite the benefits of EIB and the efforts made to help mothers by increasing community awareness about the benefits of early and exclusive breastfeeding and addressing harmful practices, such as discarding colostrum that may prevent optimal infant feeding (FMOH, 2012), the results of National Nutrition and Health Survey showed that 22% of mothers practice EIB within one hour after birth in the country respectively (NNHS, 2014; NDHS, 2013)

2.2.3 Exclusive Breastfeeding

Exclusive breastfeeding refers to feeding an infant with breast milk from the mother or a wet nurse or expressed breast milk without any additional solid or liquid foods, except for oral rehydration salt, syrups of vitamins, minerals and medicines (WHO, 2008).

Infants should be exclusively breastfed from birth to six months and continued to two years, with introduction of complementary food after the age of six months (WHO, 2003; National Coordinating Committee on Food and Nutrition, 2010). Exclusive breastfeeding confers immunity against childhood illnesses such as diarrhoea, pneumonia and measles and lowers susceptibility to obesity, type-2 diabetes and high blood pressure in later life (WHO/OECD, 2012). For mothers, breastfeeding enhances bonding, reduces the risk of breast and ovarian cancer, lowers rates of obesity and aids in fertility control (WHO/OECD, 2012).

Scientific evidence indicates that infants not exclusively breastfed are at increased risk of death from diarrhoea, pneumonia and neonatal sepsis (Jones *et al.,* 2003). Also, systematic review by Kramer and Kakuma (2004) and Oche*et al.,* (2011) confirmed that exclusive breastfeeding in the first 6 months decreases morbidity from gastrointestinal and allergic diseases, without any negative effects on growth. Conversely, non-EBF has been associated with high infant mortality, an increased susceptibility to diseases and risk of dying from pneumonia and diarrhoea; and several life-long defects such as cognitive abnormalities, poor academic performance, decreased productivity and impaired social and intellectual development (Setegn *et al.,* 2012). As a result of the effect of non-EBF, Nigeria introduced national nutrition strategy to promote exclusive breastfeeding through the first 6 months (NPC, 2012). Despite the importance of EBF, effects of non-compliance to EBF and the efforts of the national strategy, overall, only 17% of children less than 6 months are exclusively breastfed and this has remained unchanged since 2008 in Nigeria (NPC, 2009; NDHS, 2013). Exclusive breastfeeding status of children is therefore an issue of concern due to low percentage.

2.2.4 The Status and Benefits of Complementary Feeding Practices

The WHO recommends nutritionally-adequate, safe, age-appropriate complementary feeding starting at six months (WHO, 2003). From six months onwards, when breast milk alone is no longer sufficient to meet all nutritional requirements, infants enter a particularly vulnerable period of complementary feeding during which they make a gradual transition to eating family foods (Bhan, 2010).

Inappropriate timing in introduction of complementary foods deprives the infant of optimum nutrition, leading to under-nutrition, and increased mortality and morbidity (Hazir *et al.,* 2011). According to the new WHO indicators, the timeline is assessed by whether infants aged 6 to 8 months are receiving solid, semi-solid or soft food irrespective of being breastfed or not (WHO, 2010). Bottle feeding, fast foods and lack of proper family support are the most important barriers of appropriate complementary feeding practices followed by pre-lacteal feeding, formula feeding, commercial cereals, feeding during sleep and negative attitude of mothers/caregivers (Paul *et al.,* 2015). The WHO recommended meal frequency of 2-3 times a day for infants between 6-8 months old, 3-4 times daily for 9-11 months old and in case of 12-23 months old children, additional nutritious snacks should be offered 1-2 times per day, as desired (WHO, 2010). Studies in four anglophone West African countries have revealed that children who were given foods according to the timing set by the WHO are well-nourished when compared with children who were introduced to solids too early (Issaka *et al.,* 2014). Data from the

NNHS (2014) showed that more than 70% of children in Nigeria started receiving complementary foods at the appropriate age of 6-8 months. In case of dietary diversity and frequency, only 18% of children aged 6-23 months (breastfed and non-breastfed) received the minimum acceptable diet (NNHS, 2014).

In achieving dietary diversity, the use of fortified complementary foods, vitamin and mineral supplements may be necessary to ensure adequacy of particular nutrient intakes (Bhan, 2010). In order to guarantee satisfaction of the child's nutritional needs, complementary foods must be timely, adequate, innocuous, offered with the frequency and consistency that are adequate for the age, and must attend to the child's feelings of hunger and satiety (Parada, *et al.*, 2007). Meals should include adequate quantities of cereals, legumes and nuts, meat/poultry/fish, dairy products, eggs, as well as vitamin A-rich fruits and vegetables every day (UNICEF, 2011). A minimum of 4 out of the seven food groups is viewed as sufficient to meet the child’s needs. Overall, only 10% of children aged 6-23 months are fed appropriately based on recommended infant and young child feeding (IYCF) practices in Nigeria (NDHS, 2013).

2.3 Conceptual Framework of Malnutrition

The interplay between the two most significant immediate causes of malnutrition, inadequate dietary intake and illness tend to create a vicious cycle. A malnourished child, whose resistance to illness is compromised, is likely to fall ill and thus worsening malnutrition case (UNICEF, 2012). Factors that cause malnutrition such as poverty, seasonal supply of food, gender inequality, poor infant and young child feeding (IYCF) practices, limited access to healthcare, unsafe drinking water and inadequate sanitation

(WHO, 2012) predispose children to increased prevalence of malnutrition and infectious diseases like diarrhoea, coughs and colds. Infections cause loss of appetite, mal-absorption and metabolic and behavioral changes (UNICEF, 2016). These infections, in turn, increase the body's requirements for nutrients, which further affect the eating pattern of young children and how they are cared for (WHO,2013).

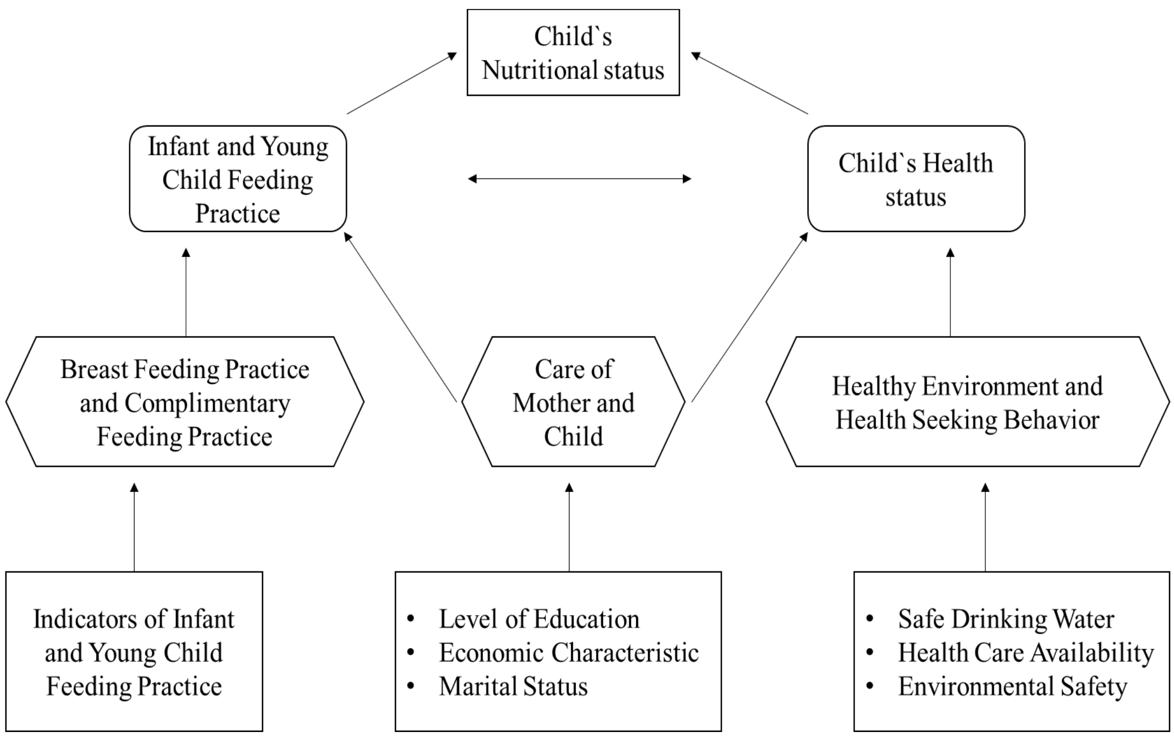

Figure 2.1 Conceptual Frame Work of Child Malnutrition. (Adapted from UNICEF2009, 2011 and 2012).

2.4 Maternal Demographic and Socio-economic Status Characteristics in relation to Child's Nutritional Status.

Level of education of caregivers was reported to have an inverse relationship with stunting and household income (WHO, 2013; Akinpelu *et al.,* 2014). A study conducted by Ojiako *et al.* (2009) in Kaduna and Kano states among pre-school children showed an inverse association of maternal level of education with nutritional status outcome.

Children in rural areas are more likely to be stunted (43%) than those in urban areas (26%), and the pattern is similar for severe stunting (26% in rural areas and 13% in urban areas) (Ojiako *et al.*, 2009).

2.5 Nutritional Status of Children in Relation to Feeding Practices

Nutritional status is an integral component of the overall health of an individual and provides an indicator of the well-being of children living in a particular region (Hazir*et al.*, 2011). Adequate growth and nutritional status of children are monitored by the use ofanthropometric indices (MICS, 2017).

Nutrition has a great impact on a child's life and feeding practices have a direct impact on the nutritional status and well-being of a child (Malla and Shrestha, 2004). In Sub-Saharan Africa, the prevalence of malnutrition among the group of under-fives was 41% (WHO, 2010). Results of NDHS (2013) showed that 37% of children under the age of 5 are stunted (chronic malnutrition), 18% were wasted (acute malnutrition), and 29% were underweight (combined malnutrition). Thus, from 2008 to 2013 there was 4% decline in the proportion of Stunting in Nigeria (NDHS, 2013). Nutritional status data are central to improving the health of the children in this generation and also for the overall development of developing countries in near future (NDHS, 2013).

2.6 Mineral Status

Minerals are nutrients that are needed by the body in minute amount, which play leading roles in the production of enzymes, hormones and other substances that help to regulate growth activities, cognitive development, functioning of the immune and reproductive systems, biochemical mediators for regulation of biological processes, for energy production, synthesis of ribonucleic acid and deoxy-ribonucleic (UNICEF, 1995). Minerals of known public health importance include zinc, iodine, iron, selenium and copper (UNICEF, 1998). These nutrients are normally brought prenatally by placental transfer to the fetus, and postnatally by breastfeeding (Piaget, 1997). Deficiency of these micronutrients which is commonly referred to as "hidden hunger" which has a significant impact on child health growth and development, making the children more vulnerable to develop frequent and more severe common day-to-day infections, thus triggering a vicious cycle of undernutrition and recurrent infections and also has effect on the economic development of communities and nations (Saaka *et al.*, 2015).

Micronutrient malnutrition is rampant in developing countries such as Nigeria, even moderate levels of deficiency can lead to serious adverse effects on various functions of the body (UNICEF, 2009), though it can affect any age group, young children and women of reproductive age tend to be at risk and almost two third of the deaths of children around the world are directly or indirectly associated with nutritional deficiencies (Caballero, 2002; WHO, 2013). It has been estimated that micronutrient deficiencies account for about 7.3% of the global burden of disease (WHO, 2012).

2.6.1 Iron

Iron plays a major role in energy utilization in the respiratory chain of mitochondria and production of red blood cells (Lozoff, 2000; Denis and Denis, 2005). Iron deficiency induces irreversible effects on the brain of children if occurred during pregnancy or the first year of life. Moderate anaemia occurring during infancy were shown to affect cognitive performance at school and these studies were controlled for socio-economical background of children and iron supplementation is not always able to revert the low cognitive abilities of the children (De Ungria *et al.,* 2000; UNICEF, 2011). Iron deficiency is the most prevalent nutritional problem in the world (Black *et al.,* 2008). Out of 2 billion global anaemia cases, iron deficiency alone accounts for 50% (Allen,2006). The review of national representative surveys from 1993 to 2005 by WHO showed that 42% of pregnant women and 47% of preschool children worldwide have anaemia (Black *et al.,* 2008). The major risk factors of Iron deficiency are low intake of meat, fish or poultry and high intake of cereals and legumes, low birth weight, pregnancy (Barghav *et al.,* 2001).

2.6.2 Zinc

Zinc is one of the most ubiquitous of all trace elements, found in virtually every tissue in the body, it is an essential mineral with a catalytic role in human metabolism, correct functioning of the immune system, antioxidant system, perpetuation of genetic materials including transcription of DNA, translation of RNA, cellular growth, differentiation and metabolism, reduce occurrence and recurrence of diarrhea, healing of wounds, repair of tissue, proper clotting of blood, correct thyroid function, metabolism of proteins, carbohydrates, fats, fetal development, and sperm production are among the importance of zinc. (Cunningam *et al.,* 1980; Cheesbrough, 2004; Lozoff *et al.,* 2000; UNICEF, 2011; Daelmans *et al.,* 2013).

The major source of zinc intake is through diet and when the supply of dietary zinc is insufficient, biochemical abnormalities and clinical signs may develop (Allen, 2001). Zinc deficiency can interfere with multiple organ systems particularly when it occurs during a time of rapid growth and development, such as infancy. Low intake of animal products, high phytate intake, persistent diarrhoea and malabsorption, and infection with intestinal parasites are considered to be the risk factors for zinc deficiency (UNICEF,2011). Zinc deficiency in children results in increased risk of diarrhoea, pneumonia, and malaria, as evidenced by many randomized placebo-controlled trials done in various populations in all regions of the world (Black *et al.,* 2008). Severe deficiency results in dermatitis, retarded growth, mental disturbance, delayed sexual maturation, and/or recurrent infections (Allen, 2006). Definitive data on prevalence of zinc deficiency are insufficient, but it is thought to be moderate to high in developing countries, especially in South Asia, most of Sub-Saharan Africa, and the Western Pacific. About 20% of the world's population could be at risk of zinc deficiency (WHO 2012). Worldwide, zinc deficiency is responsible for approximately 16% of lower respiratory tract infections,18% of malaria, 10% of diarrheal disease, and in total 1.4% of deaths (WHO, 2012).

2.6.3 Copper

Copper is present in human body as a constituent of some of the metalloenzymes like Cytochrome c oxidase of the mitochondrial electron transport, cytosolic superoxide dismutase and is also required for haemoglobin synthesis (Shis *et al.,* 2005). Copper deficiency in humans leads to demineralization of bones, depressed growth and gastrointestinal disturbances. while excess of copper causes liver cirrhosis, neurological disorders and dermatitis etc (Shis *et al.,* 2005). Copper, zinc, and iron have been associated with normal lymphocyte maturation and regulation of immune function (Chandra *et al.,* 1977; Cunningham *et al.,* 1980; Allen *et al.,* 1981; Chandre and Dayton, 1982; Ronulund and Suskind, 1983). Low levels of these minerals have been demonstrated in a variety of dysfunctions of the immune system, impairment of leukocyte function has been observed with copper deficiency (Ronulund and Suskind,1983).

2.6.4 Calcium

Calcium is one of the main bone-forming minerals and 99% of the body's calcium resides in the skeleton. There is now substantial evidence that adequate dietary calcium maximizes peak bone mass early in life (Johnston *et al.,* 1993) and prevents bone loss later in life (Reid *et al.,* 1995). The benefit of calcium on bone throughout the lifespan showed that 52 out of 54 randomized, controlled intervention trials of increasing calcium intake led to increased calcium balance, increased bone gain during growth, reduced bone loss in later years, or reduced fracture incidence (Connerty, 1996)

2.7 Haemoglobin (Hb) and Packed Cell Volume (PCV).

Haemoglobin is the oxygen-transport metallo-protein in the red blood cells while Packed cell volume (PCV) is a measurement of the proportion of blood that is made up of cells (Barghav and Scrimshaw, 2001). In children, 75% of iron is in the form of haemoglobin, a child having <11g/dl of Hb and <33% PCV is said to have low haemoglobin and low PCV which is termed "iron deficiency (ID)" and it is most prevalent between 6 to 24 months of age, a time of rapid brain growth and psychomotor development (Kazal, 2002). Impairment in psychomotor development and cognitive function in infants and pre-school children results in a deficit in work performance in adults (Peirano *et al.,* 2001).

CHAPTER THREE

3.0 MATERIALS AND METHODS

3.1 Materials/Equipment

3.1.1 Equipment

UNICEF Length Measuring Board, Seca Weighing Scale, 3ml Syringe and Needle, Blood Collection Tube, Microhaematocrit Centrifuge (Hematospin 1400); (Hawksley and Sons Limited, England), Spectrophotometer (SURECHEM, 2012), Haemoglobinmeter (STAT-site MHgb Meter, Stanbio Laboratory, Texas, USA).

3.1.2 Chemicals

All chemicals and reagents used were of analytical grade, except otherwise stated and were purchased from a reputable vending agent in Nigeria.

3.1.3Study Area

Funtua Local Government Area is located between Latitude 11°32′N 7°19′E and longitude 11.533°N 7.317°E, with area of 448 km^2 and a population of 225,571 (2006 Census). It comprises of eleven wards (Figure 3.1) which are Dukke, Dan Dutse, Goya, Anguwan Ibrahim, Maigamji, Makera, Nasarawa, Anguwan Musa, Maska, Sabon Gari and Tudun Iya (Reconnaissance Survey, 2012). Funtua Local Government was created in 1967, it is bordered to the South by Giwa Local Government Area, Kaduna State, East by Bakori Local Government, West by Dandume Local Government and North by (Mai ruwa Dam) Faskari Local Government. The inhabitants of the Local Government are predominantly Hausa and Fulani by tribe.

3.1.4 Study population

The study population are children between 0-23 months present in the study area.

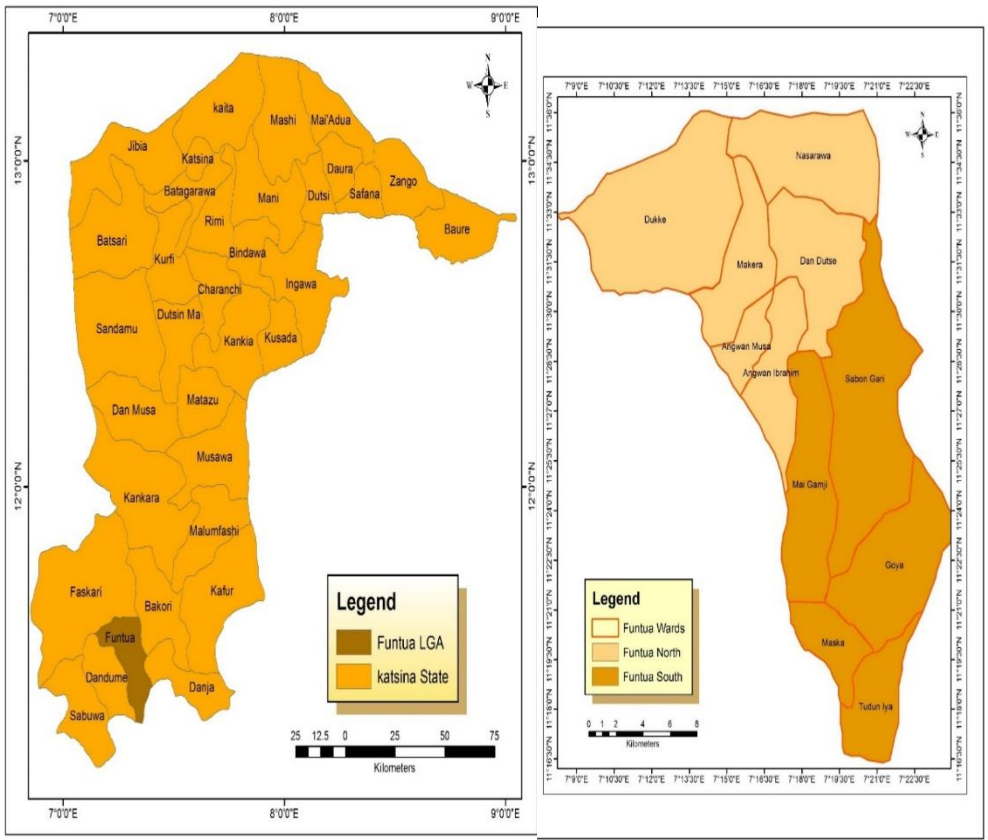

Plate 3.1 Administrative Map of Katsina State showing Funtua Local Government and its eleven wards. (Modified from Administrative Map of Katsina State, 2017)

3.1.5Inclusion and Exclusion Criteria

Mothers with apparently healthy children 0-23 months i.e. mother/child pair present in the study area were included while mothers with children more than 24 months i.e. mother/child pair or mothers with children less than 24 months who are visiting or sick requiring hospitalization present in the study area were excluded.

3.2 Methods

3.2.1 Study Design and Sampling Procedure

A cross-sectional descriptive study was carried out which incorporated qualitative and quantitative data collection techniques. Data was obtained from a multistage sampling technique which was used to select wards, communities and households. The number of households required per community was selected using probability proportional to size approach. The Local Government was stratified into North, Central and South. From each stratum, one ward was selected, from each ward, two communities were randomly selected. Housing units were enumerated and households were selected using Hat method and the youngest child less than two years was selected as the measuring unit. Information on demographic, socio-economic status and breastfeeding practice was obtained from caregivers using pre- tested interviewer administered questionnaires with WHO standard feeding indicators.

3.2.2 Sample Size

Sample size required was estimated using sample size formula for categorical data and adjustment for design effect of 1.5 and a non-response of 5%.

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

Where:

n = sample size

m= margin error allowed to have at 5%

t = is the standard normal deviation set at 1.96 (for 95% confidence level).

DEFF=Design Effect of 1.5

P = is the estimate of the proportion of the prevalence of underweight in Katsina State which is 29% (NDHS, 2013).

Non-response (NRR) 5%

$$n = \frac{1.96^2 \times 0.29(1-0.29)}{0.05^2} \times 1.5 + NRR\ (5\%)$$

n= 498

3.2.3 Ethical Approval

Ethical approval was obtained from Katsina State Ministry of Health. The cooperation of the Chairman of Funtua Local Government through the ward heads and community leaders was also sought. Informed consent of the caregivers assuring them of confidentiality of all the information provided were obtained.

3.2.4 Data collection

A team of five interviewers were recruited and trained for two days and the questionnaire used in the study was translated in Hausa and pretested on the study protocol and data collection. Averagely, the administration of questionnaire commenced at about 6 am and finished at 6 pm every day. Theinterview and the anthropometric measurements lasted for about 12 minutes for each child and the administered questionnaire was checked for completeness by the team leader.

3.2.5 Anthropometric measurement

Anthropometric measurements were taken according to the method described by Hossain *et al.,* (2005). Children (in light clothing) were weighed using Seca scale with a precision of 100g and the recumbent length was measured in centimeters to the nearest 0.1cm using UNICEF measuring board. The Z-scores outcome was used as the nutritional status for children according to the WHO (2006) criterion on the basis of length-for-age, weight-for-length and weight-for-age for stunting, wasting and underweight, respectively.

3.2.6 Survey questionnaire

The questionnaire was developed in English and translated into Hausa (the main language spoken in the area). The questionnaire contained 31 questions which were coded and contained six sections: (1) Background information (2) Demographic and Socio-economic status, (3) Child information and anthropometric measurements (4) Breastfeeding practice (5) Complementary feeding practice as presented in Appendix I.

3.2.7 Blood Sample Collection

Blood sample collection was done by the method described by Melissa *et al.* (2009) and Olujimi *et al.* (2014) considering the health and safety of both the collector and the subjects. Exactly 1.5ml of blood sample was collected intravenously by venipuncture from the median cubital vein in the cubital fossa of the fore arm after thorough cleaning of the site with cotton swab soaked with isopropyl alcohol using 3ml syringe and needle.

A drop of the collected blood was placed directly on haemoglobinmeter strip which gives direct reading for haemoglobin and PCV after inserting into the haemoglobin meter and the remaining collected blood was transferred into sample bottles and kept in an iced box. The collected samples were taken to Ahmadu Bello University Medical Center for mineral elements analyses (Iron, Zinc, Copper and Calcium).

3.3MineralElement Analyses

3.3.1 Determination of Serum Iron using Ferrozine method (Sharman and Bourdon, 1980)

Principle: The iron is dissociated from transferrin-iron complex in weakly acid medium. Liberated iron is reduced into the bivalent form by means of ascorbic acid. Ferrous ions give with ferrozine a coloured complex.

Transferrin $(Fe^{3+})^2 + e^- \xrightarrow{\text{Ascorbic acid}} 2Fe^{2+}$ + Transferrin

$Fe^{2+} \xrightarrow{\text{Ferro zine}}$ coloured complex

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

Procedure:

One hundred and two clean dry test tubes were arranged accordingly in a test tube rack. These include 100 tubes for test samples, 1 Blank and 1 Standard. Into each of the tubes, 1000µl of reagent was dispensed including blank and standard tubes. Two hundred (200 µl) microlitre of serum was pipetted and dispensed into corresponding labelled tubes, while blank tube contained 200 µl of distilled water. Each content was mixed and incubated in water bath at 37^0C for 5 minutes. Absorbance of each sample, blank and standard was taken at 562nm.

3.3.2 Determination of Serum Zinc using Water-soluble pyridylazo dye (Makino *et al*., 1982):

Principle:Zincreactswith 2-(5-pyridylazo)-5-(N-Propyl-N-Propyl-N-sulfo-propylamino)-phenol to produce a red colour complex. The absorbance measured is proportional to the concentration of total zinc in the sample.

Procedure

Three sets of clean dry test tubes were arranged accordingly in a test tube rack. These include 100 tubes for test Samples, 1 Blank and 1Standard. Into each of the tubes, 1000µl of reagent was dispensed in all the tubes and 50µl of serum was pipetted and dispensed into corresponding labelled tubes, while blank tube contained working reagent only. Each content was mixed and incubated for 5 minutes. Absorbance of each sample was taken at 560nm.

3.3.3 Determination of copper using color 3, 5- DiBr- PAESA (Akira *et al.*, 1989)

Principle: This is a colorimetric test that does not involve the deproteinization of the sample. At pH 4.7 in a buffered media, copper is released from ceruloplasmin complex and forms with the specific complexant 3,5-Dibromo-2-pyridinylazophenylethylamino-1-propanesulphonic acid (3-5 DiBr-PAESA) a stable blue colored complex. The colour intensity is proportional to the amount of copper present in the sample.

Procedure

Three sets of 102 clean dry test tubes were arranged accordingly in a test tube rack which include 100 tubes for test,1 Blank tube and 1Standard tube. Into each of the tubes, 1000µl of reagent was dispensed in all the tubes. 50µl of serum was pipetted and dispensed into corresponding labelled tubes, while blank tube contained 50µl of distilled water. Each content was mixed and incubated at 30^0C for 5min. Blank was used to zero the spectrophotometer and absorbance of standard and each sample was taken at 582nm.

3.3.4 Determination of serum calcium using Arsenazo III (Farell *et al.*, 1984)

Principle: Calcium with arsenazo III (1, 8-Dihydroxy-3,6-disulphur-2,7-nephthalene-bis(azo)-dibenzenearsonic acid) at neutral pH yields a blue colored complex. The intensity of the colour formed is directly proportional to the calcium concentraton in the sample.

Procedure

One hundred clean dry tubes for test, one Blank tube and one Standard tube were arranged in a test tube rack. Into each of the tubes, 1000µl of working reagent was dispensed in all the tubes. One hundred (100 µl) microliter of sample, standard reagent and distilled water was pipetted and dispensed into each corresponding sample tube, standard and blank tube respectively. Each content was mixed and incubated in water bath at 37^0C for 2 minutes and absorbance of each sample, blank and standard was taken at 650nm.

3.4 Haematological Analyses

3.4.1 Haemoglobin (hb) and Packed cell Volume

This was measured in the field using a Stanbio STAT-Site R Test Kit following the manufacturer's instructions (STAT-site MHgb Meter, Stanbio Laboratory, Texas, USA). Hb levels <11g/dl were classified as low haemoglobin, while results of PCV were expressed as percentages.

3.5 Statistical Analysis

Nutritional status was expressed in standard deviation (Z-scores) and presented as length-for-age (LAZ), weight-for-height (WHZ) and weight-for-age (WAZ) for stunting, wasting and underweight, respectively, which were calculated using WHO Anthro software v 3.2.2 2011(WHO, 2011). Infant and Young Child Feeding (IYCF) indicators were expressed in percentages. The data was analyzed using SPSS version 24. Spearman's correlation test was used to assess the association between the IYCF indicators and nutritional status of the children. Results with $P < 0.05$ were considered significant.

CHAPTER FOUR

4.0 RESULTS

4.1 Socio-Demographic Characteristics of Caregivers of Children (0-23 months)

As shown in Table 4.1, the findings in this study indicated 97.6% (487) of the caregivers were mothers, and the youngest caregiver was 15 years of age while the oldest was 50 years with a mean (SD) of 27.53 ±6.83 years. In case of marital status, 96.8% (483) of the caregivers were married, 1.2% (6) were separated while 2% (10) were widowed. More than two third of the caregivers (70.1% ;350) had children between one to five and 23.6% (118) had between six to ten children.

Table 4.2 showed main occupation practiced by 54% (270) of the caregivers was Artisan while 27.5% (137) were involved in petty trading. Household monthly income indicates 79.7% (398) earned less than 10,000 naira monthly(28 USD). There were 7.0% (35) of the caregivers that were not doing anything that brings income to the household and depended solely on their husband’s income. Caregivers had various levels of education ranging from no schooling to university education as shown in Table 4.2. Majority (45%) of the care givers had attended Islamiya School, while (44.1%) have completed junior and senior secondary school and 49.5% (247) were in polygamous family.

Table 4.1 Demographic Characteristics of Caregivers in Funtua Local Government Area, Katsina State

Characteristics	Frequency	Percentage
Caregivers		
Mother	487	97.6
Grandmother	8	1.6
Aunt	2	0.6
Others	1	0.2
Total	498	100
Age of caregiver		
15-29	289	58.0
30-44	199	40.0
45-60	10	2.0
Total	498	100
Mean(SD) Age=27.53±6.8		
Marital Status		
Married	483	96.8
Separated	6	1.2
Widowed	9	2.0
Total	498	100
Number of children		
1-5	350	70.1
6-10	118	23.6
11-15	26	5.2
16 or more	4	1.0

Table 4.2 Socio-Economic Characteristics of Caregivers in Funtua Local Government Area, Katsina State.

Characteristics	Frequency	Percentage
Main Occupation		
No occupation	36	7.2
Civil Servant	22	4.4
Farmer	3	.6
Trader/Business	137	27.5
Artisan	270	54.1
Others	30	6.0
Total	498	99.8
Household Monthly Income Naira(USD)		.
No income	35	7.0
<10000(<28)	398	79.7
10000-19999(28-55)	40	8.0
20000-29999(55-83)	11	2.2
40000-499999(83-139)	6	1.2
>50000(>139)	8	1.8
Total	498	100.0
Maternal Level of Formal Education		
None	5	1.1
Islamiya	228	45.8
Primary School Completed	58	11.6
Secondary school completed	162	32.5
Tertiary Education	45	9.0
Total	498	100
Type of family		
Monogamy	252	50.5
Polygamy	246	49.5

4.2 Infant and Young Child Feeding Practice Indicators of Children 0-23 months

As seen in Table 4.3, majority (80.8%) of the children were ever breastfed, and early initiation of breastfeeding was practiced by 82.4% whereas exclusive breastfeeding was very low (5.1%). Continued breastfeeding at one and two years was practiced by 93.4% and 60.6% of the respondents respectively and 50.6% of the caregivers observed appropriate feeding practice during illness by continuing to breastfeed, increased feeding frequency and amount of breast milk and food for children of 6-23months.

Table 4.4 shows complementary feeding was practiced by 82% and main food to which children were introduced was pap" kunu" whereas 46.4% used feeding bottle to give the foods (Table 4.4). Minimum dietary diversification was practiced by 5.3% of the caregivers by giving ≥4 food groups of grains, roots and tubers, legumes and nuts, dairy products, flesh foods, eggs, vitamin A rich foods and other fruits and vegetables except a food group that is used as a condiment to the children as shown in Table 4.4, and the percentage of breastfed children (61) aged 6-8 months who met the recommended minimum meal frequency, was 36.1% (22) while, breastfed children (185) between (9-23 months) had 2.7%(5) minimum meal frequency of three meals in a day whereas the minimum meal frequency for non-breastfed children between 6-23 months was 5.3%(5) as seen in Table 4.4. The minimum acceptable diet for breastfed and non-breastfed children (6-23months) was 4% and 8.3% respectively. while 21.2% (72) of 340 children that were between 6-23 months had received iron rich and or iron fortified foods (Table 4.4).

Table 4.3 Breastfeeding Practices of Children (0-23 months) in Funtua Local Government Area, Katsina State

Breastfeeding Practices	n=498	
	Frequency	Percentage
Children ever breastfed	401	80.6
Early initiation of breastfeeding (0-23 months) within one hour. (n=498)	411	82.4
Exclusive breastfeeding under six months (n=158)	8	5.1
Continued breastfeeding at one year for children 12-15 months (n=61)	57	93.4
Continued breastfeeding at two years for children 20-23 months (n=104)	63	60.6
Feeding during illness		
Yes	252	50.6
No	246	49.4

Table 4.4 Complementary Feeding Practices of Children (0-23 months) in Funtua Local Government Area, Katsina State

Complementary Feeding Practice among children 6-23 months old	**N=340**	
	Frequency	**Percentage**
Bottle feeding (n=498)		
Yes	272	54.6
No	226	45.4
Introduction of solid, semi-solid or soft food for children 6-8 months old (n=61)	50	82.0
Bottle Feeding (n=498)	231	46.4
Minimum dietary diversity for children 6-23 months old (n=340)	18	5.3
Minimum meal frequency for children 6-23 months old:		
2 times for breastfed infants 6- 8 months old (n=61)	22	36.1
3 times for breastfed children 9-23 months old (n=185)	5	2.7
4 times for non-breastfed children 6-23 months old (n=94)	5	5.3
Minimum acceptable diet for children 6-23 months old		
Breastfed (n=403)	16	4.0
Non-breastfed (n=95)	8	8.3
Consumption of iron-rich foods for children 6-23 months (n=340)	72	21.2

4.3 Nutritional Status of Children 0-23 months in Funtua Local Government Area Katsina State.

As shown in Table 4.5, Global Acute Malnutrition (overall wasting) was 25.3% with higher increase observed as the age increases ranging from 15.8% at 0-5months to 30.7% at 12-23months. Moderate Acute Malnutrition (MAM) was observed in 17.1% while 8.2% had Severe Acute Malnutrition (SAM).

Results from Table 4.6 showed total stunting of 55% and there is similar increase in the rate of stunting with age from 45.6% in 0-5months to 78.8% in children of 12-23months. Moderate stunting (< -2 SD) was observed in 39.8% while 15.9% of the children were severely stunted (<-3 SD).

Table 4.7 indicated overall record of underweight in the area of study as 49.1% and is lowest 21.1% in children 0-5 months and highest 63.5% at 12-23months. Moderate underweight (< -2 SD) was observed in 34.6% and Severe underweight (<-3 SD) was observed in 14.5% as seen in Table 4.7.

Table 4.5 Nutritional Status by Age Group (Weight-for-length) of Children (0-23 months) in Funtua Local Government Area, Katsina State

Age distribution (Months)	Weight-for-length (Wasting)		Total %
	SAM(<-3SD) %	MAM (<-2 ≥-3SD) %	GAM %
All age groups	8.2	17.1	25.3
0-5(145)	4.8	11.0	15.8
6-11 (102)	5.9	19.6	25.6
12-23 (226)	11.1	19.6	30.7

SAM= Severe Acute Malnutrition, MAM= Moderate Acute Malnutrition, GAM= Global Acute Malnutrition and SD= Standard Deviation.

Table 4.6 Nutritional Status by Age Group (Length-for-Age) of Children (0-23 months) in Funtua Local Government Area, Katsina State.

Age distribution (Months)	Length-for-age (Stunting)		Total stunting %
	(<-3SD) %	(<-2SD) %	
All age groups (460)	15.9	39.8	55.7
0-5 (134)	6.7	16.0	22.7
6-11 (99)	11.1	34.5	45.6
12-23 (227)	23.0	55.8	78.8

SD= Standard Deviation

Table 4.7 Nutritional Status by Age group (Weight-for-Age) of children (0-23 months) in Funtua Local Government Area, Katsina State

Age distribution (Months)	Weight-for-Age (Underweight)		Total Underweight%
	(<-3 S.D) %	(<-2 S.D) %	
All age groups (482)	14.5	34.6	49.1
0-5(148)	4.2	16.9	21.1
6-11(103)	17.5	38.8	56.3
12-23(231)	19.6	43.9	63.5

SD= Standard Deviation

4.4 Association between feeding practice indicators and Nutritional Status of Children 0-23 months in Funtua Local Government Area Katsina State.

Table 4.8 showed a positive correlation between nutritional status and feeding practices with r (496) = 0.664 and significant association between indices of nutritional status (stunting, wasting and underweight) and IYCF indicators ($p = 0.01$).

4.5 Serum Mineral Status (Fe, Zn, Cu and Ca), Haemoglobin and packed cell volume of Children (0-23 months).

For mineral elements shown in Figure 4.1, serum Iron, Zinc, Copper and Calcium levels were low in 76%, 54%, 69% and 60% of the children in the study area respectively while 78% and 76% of the children had low haemoglobin and packed cell volume concentrations respectively as seen in Figure 4.2.

Table 4.8 Association between Nutritional Status and Feeding Practice Indicators

Nutritional Status	n (%)	Feeding practice	n (%)	r value	P value
Wasting	112(22.5)	EIB	394(79.1)		
Stunting	225(45.1)	EBF	8(1.6)		
Underweight	161(32.3)	MAD	24(4.8)		
		CIRF	72(21.2)		
				0.644**	0.01*

*Statistically significant at $p<0.05$

**Correlation is significant at 0.01 level

EIB=Early initiation of breastfeeding, EBF= Exclusive breast feeding and MAD=Minimum Acceptable Diet and CIRF= Consumption of Iron Rich Foods

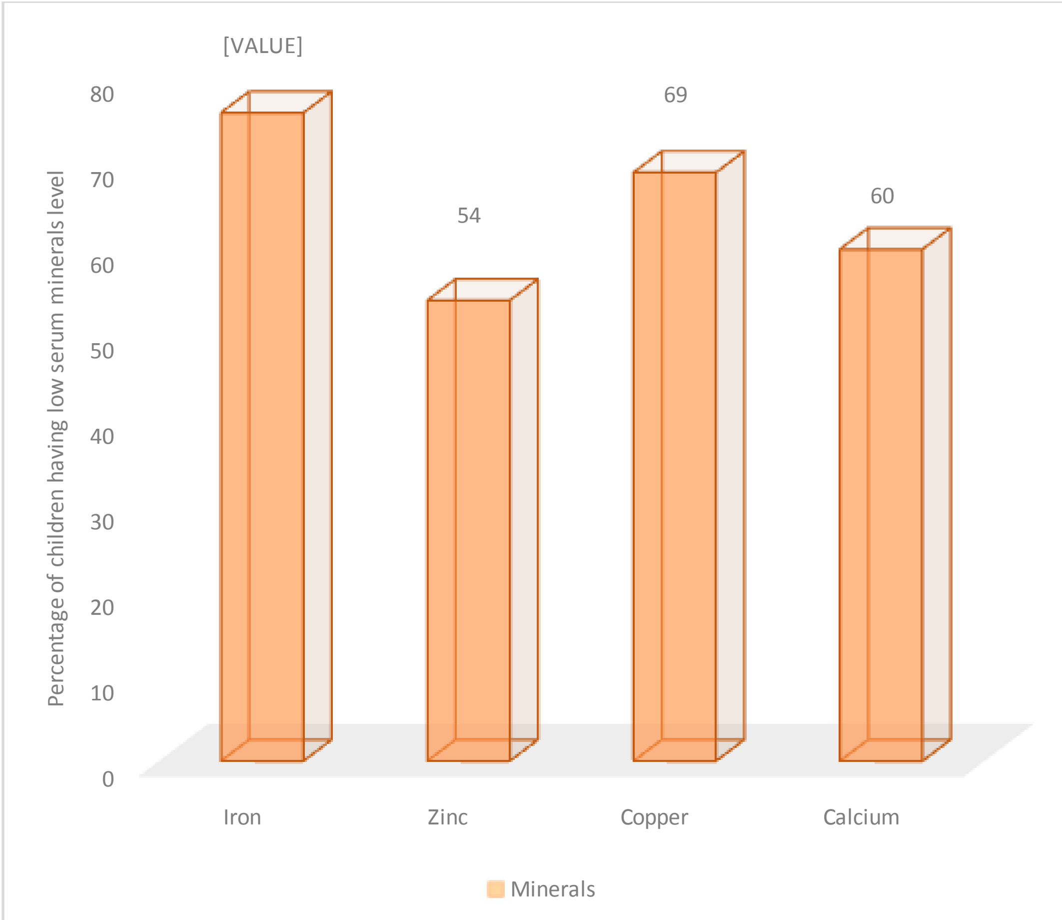

Figure 4.1 Serum mineral levels (Fe, Zn, Cu and Ca) of children 0-23 months in Funtua Local Government.

Values are expressed as: Iron; normal= 8-13mg/dL, Zinc; normal=6.8-10.7mg/dL, Copper; normal=0.8-1.5mg/dL, Calcium; Normal=8-13mg/dL while the abnormal values in this study were found to be < all the normal values for the respective minerals.

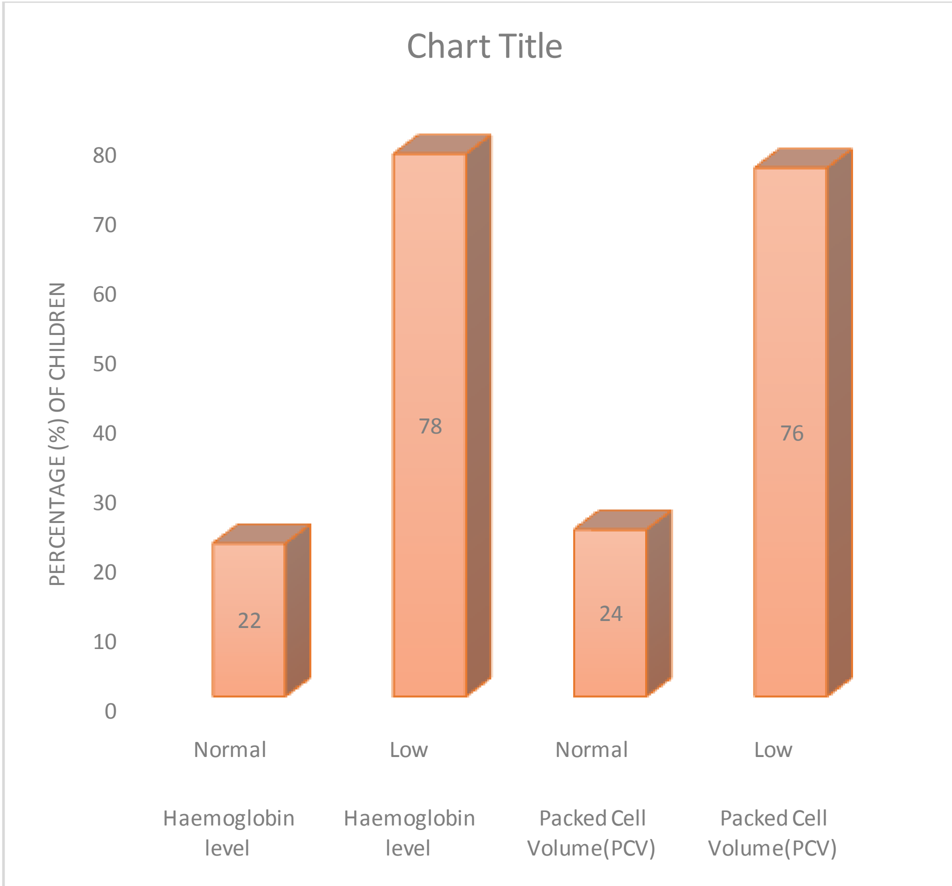

Figure 4.2 Percentage distribution of Haemoglobin and Packed Cell Volume of Children (0-23 months) in Funtua Local Government Area.

Values expressed as Normal Hemoglobin is ≥11mg/dL while abnormal is < 11mg/dL.
PCV normal is ≥ 33% while the abnormal PCV is < 33%

CHAPTER FIVE

5.0 DISCUSSION

A child's first 2 years of life is considered a critical "window of opportunity" for prevention of growth faltering and under-nutrition (Victora *et al.,* 2010). Causes of malnutrition in children are many and diverse, but it has been recognized that poor feeding practices by caregivers are a major contributing factor where assessment of breastfeeding practice is one of the key factors considered in IYCF and it is a strategy used in bringing down high infant mortality rate (Muliira and Nankumbi, 2015).

In the present study, most of the caregivers are the mothers while some are grandmothers, aunties and others who are married with half in a polygamous family. Marital status is known to influence the quality of care given to the child because both the parents are able to contribute to the care of the child by providing the basic needs, psychological support and general welfare (PAHO, 2003). Level of education of caregivers that have attended tertiary education in the present study agrees with National report, <10% of Nigerian women have attended tertiary education (NDHS, 2013). Half of the caregivers are artisans with low income of <10,000 Naira per month which according to the UN definition of poverty, any person earning < 1 dollar per day is considered to be poor (UNDP, 2016).

Breastfeeding can provide eye-to-eye contact, physical closeness and emotional bonding and it is essential for optimal child growth and development (WHO, 2010). Based on WHO (2007), there are four basic indicators of breastfeeding practices which are; early initiation of breastfeeding in children (0-23 months); exclusive breastfeeding of infants for six months, continued breastfeeding at 1 year (12-15 months of age) and continued breastfeeding at 2 years (20-23 months old) (UNICEF, 2011). A vast majority of our respondents in the present study breastfed their babies and this is quite similar to the findings of MICS, (2017) where 93.5% of Nigerian women breastfed their babies and the findings of Okafor *et al.* (2014) who reported that 91.2% of women were found to breastfeed their children in semi-urban community in Lagos.

Early initiation of breastfeeding serves as the starting point for continuous care for the mother and new born that can have long-lasting effects on health and development (WHO, 2010). Initiation of breastfeeding immediately after birth ensures that the new born receives the first milk (colostrum/ fore milk), which is rich in proteins, immunoglobulin, lactoferrin and growth factors that aid in treatment of autoimmune disorders and other diseases such as gastrointestinal conditions) (WHO *et al.*, 2010).

All children were put to the mother's breast within one hour after birth in this study. However, the result was in contrast with what was reported by Okafor *et al.,* (2014) that early initiation of breastfeeding in Lagos was 59.2%.

The WHO recommends exclusive breastfeeding for the first six months of life to achieve optimal growth, development and health (WHO, 2013). Despite the widely acknowledged benefits of exclusive breastfeeding (EBF) and its well-recognized role in averting infant mortality, adherence to the practice is very low globally (UNICEF, 2011). In the present study, EBF rate (5.1%) was lower than the 23.7% and 17% national exclusive breastfeeding rates recorded nationally (MICS, 2017 and NDHS, 2013), and this also disagrees with 82% compliance in Lagos (Okafor *et al.,* 2014). The rate of continued breastfeeding at 1 year and Continued breastfeeding for two years or beyond among children (18-23 months old) was high in the present study.

Complementary feeding covers the period from 6 to 24 months of age. This is the period when malnutrition starts in many infants as a result of transition from exclusive breastfeeding (as breastmilk is not enough at that time) to eating other foods, contributes significantly to the high prevalence of malnutrition in children less than five years of age world-wide (Heinig *et al.,* 2006; USAID, 2008; WHO, 2014).

Poor feeding practices and low-quality foods can affect future learning ability, economic productivity, immune response and reproductive outcomes (WHO, 2014). Cultural factors and taboos appear to have an important influence on mothers' infant-feeding practices and eating patterns of their children (Tamanna*et al.,* 2013; Beyene *et al.,*2015). The findings of this study showed that most of the children between 6-8 months old, had been introduced to solids, semi-solids or soft foods and this agreed with national report of MICS, (2017) where 79.1% of Nigerian children were introduced to solid, semi-solid and or soft foods at due age of 6-8 months. Optimal infant and young child feeding (IYCF) practices also include ensuring intake of diverse food groups (USAID, 2008), because low diversity is closely linked to inadequate or poor quality of diets (Arimond and Ruel, 2004). Minimum dietary diversity is defined by the proportion of children between 6-23 months who received food from 4 or more food groups in the past 24 hours (UNICEF, 2011). The food groups are grains, roots and tubers, legumes and nuts, dairy products, flesh foods, eggs, vitamin A rich fruits and vegetables and other fruits and vegetables (UNICEF, 2011) and this grouping is to ensure that chances that a child eats food from both plant and animal sources and promote intake of bioavailable iron, zinc and calcium, among other nutrients (WHO, 2001; WHO and UNICEF, 2003; UNICEF, 2016). The rate of dietary diversity in the present study is higher than national report of 11% (NDHS, 2013).

Proportion of breastfed children who received minimum meal frequency in the present study is lower than national report of 40.2% (MICS, 2017). The minimum acceptable diet is defined by the proportion of children (6-23 months of age) who received minimum dietary diversity and minimum meal frequency 24 hours preceding the study. In this study, proportion of both breastfed and non-breastfed children who met minimum acceptable diet were very low, and agreed with national report of 15.3% (MICS, 2017).

Nutritional status of a population is a prominent reflection of a nation's economic development and public welfare policies (UNICEF, 2011). Adequate growth and nutritional status of children are monitored by the use of anthropometric measurements, specifically length and weight, in combination with the age of the child (FANTA,2007). These are further classified as weight-for-age, length-for-age and weight-for-length and can be interpreted using the z-score classification system (FANTA, 2007). Thus, a child with weight-for-age (WAZ) or weight-for height (WHZ) of less than -2.0 standard deviation (SD) is classified as being underweight or wasted respectively. Similarly, a length-for-age (LAZ) of < -2.0 SD indicates stunting and z-score of <-3SD for all the indicators presents chronic malnutrition (FANTA, 2007). The rate of wasting which increased as the children's age is increasing in the present study agreed with national global acute malnutrition (GAM) report of 18% (NDHS, 2013). According to WHO criterion on classification of severity of malnutrition, any value $\geq$15% for GAM on weight-for-length is an indication of critical state and the need for immediate intervention (WHO, 2014).

World Health Organization (2004) reported that two out of five children are stunted in low-income countries. The findings on stunting in the present study is higher than national prevalence report of 37% but in line with the prevalence reported for Katsina State (59%) (NDHS, 2013). It is classified as serious according to WHO criterion of classification of severity of malnutrition (WHO, 2008). In this Study, the overall severe and moderate underweight is in line with Katsina State prevalence (NNHS, 2015). According to WHO (2008) criterion which classified a value of ≥30% for total weight-for-age as critical level.

All the nutritional status indicators showed a significant association ($p<0.05$) with IYCF practices. The hypothesis that there is no significant association between feeding practices and nutritional status of children (0-23 months) was rejected. The findings compare with those by Dinesh *et al* (2007), that improper complementary feeding is a significant risk factor for under nutrition among under-twos. They also compare with those of Amegah (2009) in Kwale District Kenya, concluding that feeding practices influence nutritional status in children. The findings further compare with the findings by Nti (2011), a study done in Ghana where dietary diversity was significantly related to nutritional status.

Healthy term infants with normal birth weight are born with a considerable endowment of iron and high haemoglobin levels. The two are usually sufficient to maintain the infants needs for growth during the first 6 months of life (Anderson and MacLaren, 2012). Consumption of iron-rich or iron fortified foods is therefore a recommended global infant and young child feeding strategy to fight Iron Deficiency Anaemia (IDA) (WHO, 2010b). The WHO recommended foods in this indicator are flesh foods (WHO/UNICEF 2003). Due to the simplicity of use in field settings and low cost, iron deficiency detected by only hemoglobin (Hb) measurement has been widely used as a proxy for detection of iron deficiency (Schneider*et al.,* 2005 and Shah *et al.*, 2010).

In the present study, many of the children had poor Feeding practices (consumption of iron rich foods and poor dietary diversity) which might be the reason why they had very poor serum mineral status and the result of serum mineral status in this study agrees with that reported by Zulfiqar and Hussain, (2004) with low haemoglobin and packed cell volume. In the present study, majority of the children had low packed cell volume < 33% and haemoglobin concentration <11 g/dL which was defined according to the WHO, (2001), Hb concentration <11 g/dL in younger children is defined as anemia and severe anemia when Hb was lower than 7 g/dL.

CHAPTER SIX

6.0 CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

The findings of this study revealed that most of the caregivers were married women of secondary school level of education and mostly artisans. Early initiation of breastfeeding (within 1 hour) was high (82.4%) most of the children were fed colostrum and Exclusive Breastfeeding rate was low (5%). Dietary diversity was also low (5.3%), minimum acceptable diet for breastfed and non-breastfed children was 4.0 and 8.3% respectively. Consumption of iron-rich foods was also low (21.2%).

The rate of undernutrition among children (0-23 months old) in Funtua Local Government Area was as follow; wasting 25.3%, Stunting 55.7% while underweight 49.1% and nutritional status showed significant association with IYCF indicators.

Serum mineral level of iron, zinc, copper and calcium were low in 76 ,54,69 and 60% of the children respectively, as well as haemoglobin and packed cell volume which were also low in 78 and 76% of the children respectively. These could be as a result of poor feeding practices of the caregivers (Feeding the children with low dietary diverse diet and non-intake of iron rich foods). Therefore, the null hypothesis was rejected.

6.2 Recommendations

i. Further studies are needed to identify the barriers to optimize IYCF practices of caregivers.

ii. Nutrition Education programs should be strengthened and implemented to promote exclusive breastfeeding and enhance sensitization on IYCF practices, and the effect of “Hidden hunger”.

iii. Mothers with low income should be supported through safety net-program to improve IYCF practice.

iv. There is need for regular nutritional surveillance for children 0 to 23 months of age, and interventions such as community health education, social support for caregivers, and the distribution of low-cost, ready-to-use foods for complementary feeding

REFERENCES

Akinpelu, A.O., Oyewole, O., Odole, A.C., and Tella,B.A. (2014). Nutritional Status of Nigerian Children from Urban Community using Different Reference Cut-offs. *African Journal Biomedical*, 17(2): 61-67.

Akira, A., Sumiko, Y., and Akio, N. (1989). Sensitive, direct colometric assay for Copper in serum. *Journal of Clinical Chemistry*, 35(4): 552-554.

Allen, J. I., Kay, N. E., and McClain, C. J. (1981). Severe zinc deficiency in human's association with reversible T lymphocyte dysfunction. *Annual International Medcine*. 9(5):154-157.

Allen, L.H. (2001). *Micronutrients: 2020 Focus five Health and Nutrition Emerging and Reemerging Issues in Developing Countries*. Brief 10 of the International Food Policy Research Institute.

Allen, L. (2006). Guidelines on Food Fortification with Micronutrients. World Health Organization. Geneva

Amegah, T. A. (2009). The Influence of Socio-Economic and Nutritional Characteristics on ChildGrowth in Kwale District of Kenya. *African Journal of Food Agriculture Nutrition and Development*, 9(7): 1570-1590.

Anderson, G.J. and McLaren, G. (2012). Iron physiology and pathophysiology in humans. *Nutrition and Health*,2(5):485-487.

Anjana, P. and Dattatreya, D. B. (2015). Assessment of Infant and Young Child Feeding Practices Among under-3 years Children in Urban Slums of Hubballi city. *International Journal of Medical Research and Health Science*, 4(4):763-767

Bhan, R. (2010). Complementary Feeding. *Indian Journal for the Practicing Doctor, 1(1),* 2004- 2010.

Bhargav A., Bouis H.E., and Scrimshaw, N.S (2001). Dietary intakes and socioeconomic factors are associated with the hemoglobin concentration of Bangladeshi women. *Journal of Nutrition*, 13(1):758–764.

Black R.E., Sazawal, S., and Ramsan, M. (2007). Effect of zinc supplementation on mortality inchildren aged 1–48 months: a community-based randomized placebo-controlled trial. *Lancet*, 36(9): 927–934.

Black, R.E., Victora, C. G., Walker,S. P., Bhutta, Z.A., Christian. P, M., de Onis, M. Ezzati, S., Grantham-McGregor, J. Katz, R.., and Martorell, R. U. (2013). Maternal and Child Nutrition Study Group. Maternal and child undernutrition and overweight in low- income and middle-income countries. *Lancet,* 38(2): 427-451.

Bhutta, Z.A (2010). Nutrition Interventions for Maternal and Child Health and Survival. Karachi, *Oxford University Press.*

Caballero, B. (2002). Global Patterns of Child Health: the role of nutrition. *Annual Nutrition Metabolism*.1(1): 37-41.

Chandra, R. K., Au, B., and Woodford, G. (1977). Iron Status, Immune Response and Susceptibility to Infection. In: H. Kies (ed.), Iron Metabolism. Ciba Foundation Symposium. *Elsevier/North-Holland Biomedical Press*, 5(1): 249-268.

Chandra, R. K and Dayton, D. H. (1982). Trace elements regulation of immunity and infection. *Nutrition Reserve,* 2(3): 721-733.

Cheesbrough, M. (2004). Laboratory Practice in Tropical Countries Part 2. Cambridge UniversityPress. Pg 299-312.

Child Feeding P ractices: Part 1. Geneva (2008). World Health Organization; UNICEF and WHO. Global Strategy. Breastfeeding critical for child survival. 1‐ 19. Retrieved from http://www.who.int/mediacentre/news/releases/2004/pr19/en/index.htmlL last accessed 5th june 2016.

Connerty, H.V. (1996). Role of Calcium in Child growth. *American Journal of Chemical Pathology*,45(3): 200-296.

Cunningham-Rundles, S., Cunningham-Rundles, C., Dupont, B., and Good, R.A. (1980). Zinc-induced activation of human B lymphocytes. *Clinical Immunological. Immunopathology*, 7(6): 115-122.

Daelmas, B.,Ferguson, E.,Lutter, C.K., Singh, N.,Pahon, H., Creed-Kanashiro, H., holdt,M., Mangasaryan,N., Cheung, E., Mir, R., Pareja, Rand Briend, A. (2013). Desighning Appropriate Complimentary Feeding Recommendations: Tools for Programmtic Action. *Journal of Maternal Child Nutrition*. 9(2): 116-130.

Das, N., Chattopadhyay, D., Chakraborty, S., and Dasgupta, A. (2013). Infant and young child feeding perceptions and practices among mothers in a rural area of West Bengal. *Analytical Medical Health Science Research,* 3(3): 370-375.

De Ungria M. R., Rao, J.D., Wobken, M., Luciana, C., Nelson, A., and Georgieff, M.K. (2000). Perinatal iron deficiency decreases cytochrome c oxidase (CytOx) activity in selected regions of neonatal rat brain. *Pediatrics Research*,4(8): 169-176.

Denis, L.A and Denis, V.D (2005). Spirulina as a food complement to improve health and cognitive development. Nutrition and cognitive development-Antena technologies. Retrieved from www.antenna.ch. last accessed 15th October 2015.

Dinesh, k., Goel, N. K., Mittal, P. C., and Misra, P. (2007). Influence of infant-feeding practices on nutritional status of under-five children. *Indian Journal of Pediatrics,* 2(73):417–21.

Edmond, K.M., Kirkwood, B.R., Amenga-Etego, S., Owusu- Agyei, S., and Hurt L.S. (2006). Effect of early infant feeding practices on infection-specific neonatal mortality: An investigation of the causal links with observational data from rural Ghana. *American Journal of Clinical Nutrition,* 8(6):1126-31.

Ekerette, E.U., and Olukemi. K.A. (2016). Complementary Feeding Practices Among Mothers and Nutritional Status of Infants inAkpabuyo Area, Cross River State Nigeria. *Springerplus,* 5(1)2073. Doi 10.1186/s40064-016-3751-7.

Farell, E. C., Kaplan, A., and Lawrence, A. (1984). *Clinical Chemistry.*The C.V Mobsy Company ST Louis Toronto Princeton.1051: 1051-1255.

Federal Ministry of Health (2005). National policy on infant and young child feeding in Nigeria. Abuja: Nutrition Division.

Feldman, M., Friedman, L.,and Brandt, L. (2010). *Sleisenger and Fordtran's Gastrointestinal and Liver Disease*: Pathophysiology, Diagnosis, Management. 9th edition. Philadelphia. pp 35-37.

FMOH (2012). Federal Ministry of Health Nigeria. Integrated infant and young child feeding counselling: A training Course.

Food and Nutrition Technical Assistance (FANTA) Project/Academy for Educational Development (AED), (2007). Working Group on Infant and Young Child Feeding Indicators. Developing and Validating Simple Indicators of Dietary Quality of Infants and Young Children in Developing Countries.

Gartner. L. M., Morton, J., Lawrence, R.A., Naylor, A.J., OHare, D., Shanla., R. J., and Eidelman, A.I (2005). Breastfeeding and the Use of Human Milk. *Academy of Pediatrics Section on Breastfeeding,* 115(2):496-506.

Grantham-McGregor, S., Cheung, Y. B., Cueto, S., Glewwe, P., Richter, L., and Strupp, B. (2007). Developmental potential in the first 5 years for children in developing countries. *Lancet*, *369(9555)***:** 60-70.

Grummer-Strawn, L.M., and Mei, Z. (2004). Does breastfeeding protect against pediatric overweight? Analysis of longitudinal data from the Centers for Disease Control and Prevention Pediatric Nutrition Surveillance System. *Pediatrics,* 113(2): 81-6.

Hazir, T., Upul, S., Agho, K., and Akram, D. (2011) Determinants of Inappropriate Timing of Introducing Solid, Semi-Solid or Soft Food to Infants in Pakistan. Secondary Data Analysis of Demographic and Health Survey 2006-2007. *Journal of Maternal Health and Child Nutrition,* 8(1): 655-662.

Heinig J., Follett, J., Ishii, K., Kavanagh-Prochaska, K., Cohen, R., and Panchula, J. (2006). Barriers to compliance with infant-feeding recommendations among low-income women. Journal of Human Lactation. 22(1) 114-119.

Hossain, M.I., Wahed, M. A., and Ahmed, S. (2005). Increased food intake after the addition of amylase-rich flour to supplementary food for malnourished children in rural Bangladesh. *Food Nutrition Bulletin*.2(6):323-329

Issaka, A.I., Agho, E. K., Andrew, N. P., Burns. P., Garry, J.S., and Micheal, J.D. (2014). Determinants of Solid, Semi-Solid or Soft Foods Among Infants 3-5 Months in Four Anglophone West African Countries. *Public medicine.* 6(7): 2602-2618.

Johnstone, S. A., Hubaishy, I., and Waisman,D.M.(1993). Regulation of Annexin I-Dependent Aggregation of Phospholipid Vescicles by Protein Kinase C. *Journal of Biochemistry,* 29(4): 801-807.

Jones, G., Steketee, R. W., Black, R. E., Bhutta, Z. A., and Morris, S. S. (2003). How many child deaths can we prevent this year. *The Lancet, 36(2):* 65-71.

Kayode, G.A., Adekanmbi, V.T., and Uthman O.A (2012). Risk factors and a predictive model for under-five mortality in Nigeria: evidence from Nigeria demographic and healthsurvey. *Bio Medical Center Pregnancy and Childbirth* 1(2):10-11. doi:10.1186/1471-2393.

Kazal, L.A. (2002). Prevention of iron deficiency in infants and toddlers. *American Fam Physician*.66(7): 1217-1224.

Kumar, D., Goel, N. K., Mittal, P.C., and Mitra, P. (2006). Influence of Infant Feeding Practice on Nutritional Status of Under-Five Children. *Indian Journal of pediatrics,* 73(5): 417-421.

Kramer, M.S. and Kakuma, R. (2004). The optimal duration of exclusive breastfeeding: a systematic review. *Advanced Experimental Medical Biology.* 55(4): 63-77.

Lozoff, B., Jimenez, E., Hagen, J., Mollen, E., and Wolf, A. (2000). Poorer Behavioral and Developmental Outcome More than 10 years After Treatment for Iron Deficiency in Infancy. Pediatrics, 105 (4). 137-138.

Makino, T., Saito, M., Horiguchi, D., and Kina, K. (1982). A Highly Sensitive Colorimetric Determination of Serum Zinc Using Water Soluble Pyridylazo Dye. *Journal of Clinical Chemistry*. 120(1): 127-135.

Malla, S., and Shrestha, S. M. (2004). Complementary Feeding Practices and its Impact on Nutritional Status of under Two Old Children in Urban Areas of the Kathmandu, Nepal. *Journal of Nepal Health Research Council.* 2 (1):245-249.

Melissa, K.T., Daniel, W. C., David, C., Andrew, K. G., William, E.G., Karl, E.K., William, R., Martin, S., Lynn. S., and Dean, E. B. (2009). Standard Operating Procedure for Serum and Plasma Collection: Early Detection Research Network Concensus Statement Standard Operating Procedure Integration Working Group. *Journal of Proteom Research,*8(1): 113- 117.

MICS. (2017). Multiple Indicator Cluster Survey 2016-2017, Survey Findings Results AbujaNigeria: National Bureau of Statistics and United Nations Children's Fund. pp. 32- 51.

Monika, S. and Raj,K. (2004). "Factors Affecting Infant Feeding Practices Among Women of Baijnath Block of Himachal Pradesh. *Journal of Human Ecology*. 16: 29-33.

Murage, E., Madise N.J., Jean-Christophe F., Catherine, K., Martin, M. K., Gitau T.G., and Nelly Y. (2011). Patterns and determinants of breastfeeding and complementary feeding practices in urban in formal settlements, Nairobi Kenya *BMC Public Health*,1(1):396 doi: 10.1186/1471-2458-11-396.

Muliira, J.K and Nankumbi,J, (2015). Barriers to Infant and Child Feeding Practices: A Qualitative Study of Primary Caregivers in Rural Uganda. *International Center for Diarrhoel Disease Research, Bangladesh*, 33(1): 106-116.

National Coodinating Committee on Food and Nutrition (2010). Malysian Dietary Guidelines. Retrieved from http://www.moh.gov.my/images/gallery/Garispanduan/diet/introduction.pdf. Last assessed 10th December 2015.

National Nutrition and Health Survey (NNHS) (2014 and 2015). Report on The Nutrition and Health Situation of Nigeria. National Bureau of Statistics main report, Abuja, Nigeria.

National Population Commission (NPC) [Nigeria] (2009). ICF macro. Nigeria demographic and health survey 2008. Abuja: National Population Commission and ICF Macro. National Population Commission and ICF Macro.

National Population Commission (NPC) [Nigeria] (2014). ICF international. Nigeria demographic and health survey 2013. Abuja, Rockville: NPC and ICF International. National Population Commission and ICF International.

National Population Commission Nigeria and ICF Macro. (2013). Nigeria Demographic and Health Survey (NDHS) 2013. Abuja, Nigeria: National Population Commission and reconnaissance survey.

NDHS (2013). Nigerian National Demographic and Health Survey. National Population Commission. *Official Gazette* of 2nd February, 2013. Abuja, Nigeria.

Nti, C.A. (2011). Dietary Diversity Associated with Nutrient Intakes and Nutritional Status of Children in Ghana. *Asian Journal of Medical Sciences,* 2(2): 105-109.

Oche, M.O., Umar A.S., and Ahmed, A.B. (2011). Mothers, breastfeeding, knowledge & practice, Kware. *African Health Sciences,* 11(3) 518 – 523.

Ogbo, F.A., Agho, K.E., and Page, A. (2015). Determinants of suboptimal breastfeeding practices in Nigeria: evidence from the 2008 demographic and health survey. *BMC Public Health*. 1(5):259-261.

Ogbo, F.A., Agho, K. E. (2015). Determinant of Suboptimal Breastfeeding Practices in Nigeria. Evidence from the 2008 Demographic and Health Survey. *Journal of Bio Medical Center Public Health*, 15(259): 1-12. DOI 10.1186/s12889-015-1595-7.

Ogunlesi, T.A., Dedeke O., Okeniyi, J., and Oyedeji, G. (2004). Infant And toddler feeding practices in the Baby Friendly Initiative (BFI) era in Ilesa, Nigeria. *The Internet Journal of Nutrition and Wellness*, 1(2): 356-360.

Ojiako, I., A., Manyong, V., and Ikpi, A. E. (2009). Determinants of Nutritional Status of Preschool Children from Rural Households in Kaduna and Kano States. *Nigeria Pakistan Journal of Nutrition 8 (9),* 1497-1505.

Okafor, I.P., Olatona, F.A., and Olufemi, O.A. (2014). Breastfeeding Practices of Mothers of Young Children in Lagos, Nigeria. *Nigeria Journal of Pediatrics*. 41(1) 43-47.

Olujimi, A. O., Aniekan. M. A., Emem A. B., Robert, S. J., Godwin, I., and Anyiekere. M. (2014). Prevalence of Anaemia among Pregnant Women at Booking in the University of Uyo Teaching Hospital, Uyo, Nigeria. *Journal of Bio Medical Research International.*Available at http://dx.doi.org/10.1155/2014/849080.

Pan American Health Organization (PAHO, 2003), World Health Organization. Guiding Principles for Complementary Feeding of the Breastfed Child. Geneva 8-26.

Parada, C. M., Carvalhaes, M. A., and Milena, T. J. (2007). Complementary feeding practices to children during their first year of life. *Revista Latino-Americana Enfermagem, 15(2),* 282-289.

Paul,S. K., Roy, S., Islam, Q.R., Marouf, M., and Arml.K. S. (2015). Barriers of Appropriate Feeding Practices in Under-2 Children. *Journal of Bangladesh College of Physicians and Surgeons,* 33(4): 195-201.

Piaget, J. (1997). The Language and Thought of the Child.OH: World Publishing Company (Cleveland).

Peirano, P., Algarin, M., and Garrido, C. M. (2001). Interaction of iron deficiency anemia and neuro functions in cognitive development. *Nestle Nutrition Workshop Serum Clinical Performance Programme*.5, 19-35.

Reid, R.E., Gariepy, J., Saund,A.K., and Hodges,R.S. (1995). Calcium Induced Protein Folding. *Journal of Biochemistry*. 25(6): 2744-2751.

Reconnaissance Survey. (2012). ICF Macro, Nigeria Demographic and Health Survey, Abuja Nigeria.

Ronnulund, R. D and Suskind, R. M. (1983) Iron, zinc, and other trace elements' effect on the immune response. *Journal of Pediatric and Gastroenterol Nutrition*, 2(3): 5172-5180.

Saaka, M., Wemako, A., Abizari, A., and Aryee, P. (2015). How well do WHO Complementary Feeding Indicators Relate to Nutritional Status of Children Aged

0-23 Months in Rural Northern Ghana? *BMC Public Health,*15: 1157.dio 10.1186/s12889-015:2497-7.

Schneider, J.M., Fujii, M.L., Lamp, C.L., Lonnerdal, B., Dewey, K.G., and Zidenberg-Cherr, S. (2005). Iron deficiency and iron deficiency anemia in (12-36-months old) children from low income families. *American. Journal of Clinical Nutrition,* 8(2): 1269–1275.

Setegn, T., Belachew, T., Gerbaba, M., Deribe, K., Deribew, A., and Biadgilign, S. (2012) Factors associated with exclusive breastfeeding practices among mothers in Goba district, south east Ethiopia. A cross-sectional study. *International Breastfeeding Journal,* 7(1): 17-24

Shah, F., Kazi, T.G; Afridi, H.I; Baig, J.A; Khan, S; Kolachi, N.F; Wadhwa, S.K; Shah, A.Q. (2010). Environmental exposure of lead and iron deficit anemia in children age ranged 1–5 years: A cross-sectional study. *Science Total Environment.40(8)*: 5325–5330.

Sharman, J. M and Bourdon, R. (1980). Manual Ferrozine Kit Method and Total Iron Binding Capacity Adapted for Use with Discrete Mechanized Analyzers. *Journal of Clinical Chemistry,* 2(5): 651-652.

Shi, L., Zhang J., Wang, Y, Caulfield LE, Guyer B. (2010). Effectiveness of an educational intervention on complementary feeding practices and growth in rural China: a cluster randomized controlled trial. *Public Health Nutrition,* 13(4): 556-65.

Shis, M.E., Olson, J.A., Snihe, M. and Ross, A.C. (2005). Modern nutrition in health and disease 10th edition. Lippincott Williams and Wilkins, 12(2): 201-220.

Singhal, A. (2009). The early origins of atherosclerosis. *Advanced Experimental Medical Biology,*4(6):51-58.

Sreedhara, M.S., and Banapurma, C. R. (2013). A study of nutritional status of infants in relation to their complementary feeding practices. *International journal of nutrition,* 18(1):39-41.

Tamanna, B., Azimul, S.K., Hoque, M.D., Rafiqul, I., Soofia, K., and Azanta R. S. (2013). Infant feeding practice of mother attending pediatric outpatient department in a tertiary care center. *Bangladesh Journal of Child Health,* 37 (3): 138-141.

Tessema M., Belachew T., and Ersino G. (2013). Feeding patterns and stunting during early childhood in rural communities of Sidama, South Ethiopia. *Pan African Medical Journal*, 14(75): 1630-1641.

UNICEF (1995). State of the World's Children 190-1995. One United Nations Plaza. New York NY 10017 USA. Published for UNICEF by *Oxford University Press* Pp 1- 33.

UNICEF (1997). State of the World's Children. One United Nations Plaza. New York NY 10017 USA. Published for UNICEF by *Oxford University Press*. Pp 1-107.

UNICEF (2002). State State of the World's Children. One United Nations Plaza. New York NY 10017 USA. Published for UNICEF by *Oxford University Press*. Pp 1-115.

UNICEF (2008). The State of the World's Children 2009. *Mother, Newborn and Child Health and Mortality Status*. United Nations Children's Fund, New York, USA.

United Nations Office on Drugs and Crime (2008). *UNODC handbook for prison managers and policymakers on women and imprisonment*. Vienna, United Nations Office on Drugs and Crime.

UNICEF (2009). The State of the World"s children. *New York Institute of Technology, New York*. Pp 8-28.

United Nations Children's Fund (UNICEF) (2011). At a glance, Nigeria. Retrieved fromhttp://www.unicef.org/infobycountry/nigeria_statistics.htmllast accessed 26th may 2016.

UNICEF (2012). Levels and Trends in Child Mortality Report 2012, in Child Mortality Report, Estimation, Editor, p. 32. UNICEF: New York USA.

United Nation Children's Fund – Nigeria (2016). *UNICEF*. *From the first hour of life*. New York: United Nations Children's Fund. Maternal and child health Retrieved from http://www.unicef.org/nigeria/children_1926.html.

United Nations Development Programme (2016). *UNDP and the Concept of Measurement of Poverty*. One United Nations Plaza. New York NY 10017 USA.pp.1-4.

USAID (2008). Improving complementary feeding practices: A review of evidence from South Asia, Evidence review series 2.

USAID/ UNICEF/ WHO, (2010). *Indicators for assessing infant and young child feeding practices.*Part 3, country profiles WHO press, Geneva, 11-23.

Victora, C.G, Onis. M., Hallal, P.C., Blossner, Mand Shrimpton, R. (2010). Worldwide timing of growth faltering: revisiting implications for interventions. *Paediatrics*, 12(5):3473-3480.

Victoria, C.G., Adair, L., Fall C, Hallal, P.C., Martorell, R., Richter, L and Sachdev, H.S. (2008). Maternal and Child Undernutrition Study G: Maternal and child undernutrition:consequences for adult health and human capital. *Lancet*, 37(1): 340-357.

World Health Organization (1991). *Definitions of key indicators*. Indicators for assessing breast feeding practices. Geneva:World Health Organization. (WHO/CDD/SER/91.14). pp 1‑ 14.

WHO (1995) Physical Status: *The Use and Interpretation of Anthropometry:* Report of a WHO Expert Committee. WHO Technical Report Series 854. Geneva.

WHO (1998). *Management of Severe Malnutrition*. A Manual for Physicians and Other Senior Health Workers. Geneva: WHO.

World Health Organization (2001), Global strategy for infant and young child feeding. The optimal duration of exclusive breastfeeding, in, Geneva, World Health Organization.

World Health Organization (2002). The optimal duration of exclusive breast feeding: Report of an expert consultation (WHO/FCH/CAH/01.24). Geneva: Fifty‑ fourth world health assembly. Resolution WHA 54.2 Infant and young child World Health Organization. pp. 1‑ 2.

WHO and UNICEF. (2003). *Global strategy for infant and young child feeding*. Geneva: World

WHO, UNICEF, IFPRI, UC Davis, USAID, FANTA, Macro International. (2008). Indicators for assessing infant and young child feeding practices. WHO press, Geneva.

WHO/PAHO (2003). Global Strategy for infant and young child feeding. World Health Organization. Geneva: principles for complementary feeding of the breastfed child. Washington, DC: Pan American Health Organization. Pp.1-37.

WHO/UNICEF (2003). Global strategy for IYCF 2003 WHO/UNICEF Global Strategy for Infant and Young Child Feeding. World Health Organization: Switzerland, Geneva.

WHO Multicentre Growth Reference Study Group (2006). Complementary feeding in the WHO Multicentre Growth Reference Study. *Acta Paediatrica*,45(10):27–37.DIO 10.1080/08035320500495456.

WHO (2007). The World Health Report. A Safer Future: Global Public Health Security in the 21st Century.WHO Press, 20 Avenue Appia,1211Geneva 27, Switzerland. Pp 1-60.

WHO (2008). Indicators for Assessing Infant and Young Child Feeding Practices. Part I. Definitions. World Health Organization, Geneva, Switzerland. Last accessed on 13th July 2016.

WHO, UNICEF, USAID, AED, UCDAVIS, IFPRI (2008). Definations of Indicators for assessing infant and young child feeding practices: Part 1. Geneva: World Health Organization. 1‑ 19

WHO, UNICEF, IFPRI, UC Davis, USAID, FANTA 2, AED. (2010). Macro International, (2010). Indicators for Assessing Infant and Young Child Feeding Practices Part 3 Country Profiles. *Geneva, World Health Organization press.* 6-59.

WHO (2010). Impact of early Initiation of Exclusive breastfeeding on New Born Deaths. Infant and Young Child Feeding. *Fact Sheet* N 342(1):1-6.

WHO Anthro for personal computers version 3.2.2, (2011): software for assessing growth anddevelopment of the world's children, WHO2010(http://www.whowho.int/child growth/software/en. last accessed 4th September 2015.

World Health Organisation (WHO) (2012). Children: reducing mortality (Fact sheet 178). Retrieved from http://www.who.int/mediacentre/factsheets/fs178/en/. last accessed 5th November 2017.

WHO/ OECD (2012). "Breastfeeding" in Health at a Glance: Asia/Pacific 2012, OECD Publishing.

World Health Organization (WHO) (2013). Guideline: Updates on the Management of Severe Acute Malnutrition in Infants and Children. Geneva: WHO.

WHO (2013). *Maternal mortality in 1990-2013, Federal Republic of Nigeria, in Maternal mortality in 1990-2013*, U. WHO, UNFPA, The World Bank, and United Nations Population Division Maternal Mortality Estimation Inter-Agency Group, Editor. Last accessed 7th July 2015 .

World Health Organization. (2014). Nutrition: Complementary feeding, exposures and health consequences. *Lancet*. 37(1): 243–260.

WHO and UNICEF (2018). Enabling Women to Breastfeed Through Better Policies and Programs. Global Breastfeeding Score Card, *Geneva*, *World Health Organization press*pp 4.

Zulfiqar, A.B. and Husein, L.D. (2004). The role of zinc in child health in developing countries: taking the science where it matters. *Indian Pediatrics*.41(3), 429-433.

APPENDICES

Appendix 1

NUTRITIONAL STATUS AND INFANT AND YOUNG CHILD FEEDING PRACTICE OF CHILDREN (0-23 MONTHS) IN FUNTUA LOCAL GOVERNMENT AREA KATSINA STATE.

SURVEY QUESTIONNAIRE

(This is to be used on a caregiver with child that is between 0-23 months of age)

SECTION 1: Background Information

Date……/…………/……… Questionnaire No……/……… State…………………. Ward……………………………………

Community…………………………………………….

Address……………………… HH Unit…………………… HH Number……………………….

Child Number…………Interviewers Name……………………………….

Signature……………

SECTION 2:Socio-economic and demographic information of caregiver

1. Care giver: 1= Mother 2= Father 3=Grandmother 4= Aunt [ ]
   5= Older siblings 6= Others (Specify)
2. Age of caregiver [ ]
3. Marital Status of caregiver: 1=Married 2=Single, never married
   3= Seperated

   4= Widowed 5=Declined response [
   ]

4. Type of family: 1= Polygamy 2= Monogamy [ ]
5. Household Size [ ]
6. Number of children [ ]
7. What is your main occupation?

   1=Civil servant 2= Farmer 3=Trader/Business 4=Artisan

   5=others (Specify) [ ]

8. What is your level of formal education? 1=None 2=Islamiyya Education

   3=Primary School completed 4= Junior Secondary School completed

   5=Senior Secondary School Completed 6=Tertiary Education [
   ]

9. Estimated household monthly income.
   1= < 5000 2=5000 – 9999 3=10,000 - 19,999 4=20,00O- 29,999
   5= 30000-39999 6=40000- 499999 7= >50,000 [ ]

Section 3: Child Information

10. What is the name of your last child? ……………………………………………………….
11. What is the age of your last child? ……………… Months
12. What is the sex of the child? 1=Female 2=Male [ ]

13. Weight……… kg 20. Length ……………. cm MUAC……… cm

Hb………g/dl PCV……… %

Section 4: Breastfeeding practices.

14. Did you breastfeed this child yesterday? 1=Yes 2=No [ ]
15. When did you start (Initiate) breastfeeding this child after birth?

    1=Immediately after delivery 2=Within 12 hours 3=within one day

    4=within two days 5=After two days 6=Others (Specify) [ ]
16. What do you do with the first yellowish milk (colostrum) that comes out when you started breastfeeding?

    1=Feed the child 2=Discard/throw away 3=Don't know 4=Others (Specify) …………. [ ]
17. FOR THOSE THAT DID NOT FEED THE BABY WITH COLOSTRUM, **ASK WHY?**

    ………………………………………………………………………………………

    ………………………………………………………………………………………
18. On the average, how many times do you breastfeed your child yesterday? [ ]

    1=<3 times 2=3-5 times 3=6-9 times 4=> 10 times

    5=Don't count but breastfeed on demand 6=Can't remember 7=Others (Specify)
19. When do you intend to stop breastfeeding this child?

    1=≤3 months 2=4-6 months 3=7-11months 4=12-15 months 5=16-19 months 6=20-23months 7=>24months [ ]
20. If less than 24 months, state the reasons for stopping before 24 months

    ……………………………………………………………………………….

    ……………………………………………………………………………….
21. Do you give your child any other food apart from breast milk and medicine before they are six months old?1=Yes 2=No [ ]
22. When did you start giving water to this baby?

    1=Immediately after birth 2=Specify exact age ……… Months

23. Did you give anything to the baby before starting (Initiating) breastfeeding?

1=Yes 2=No [ ]

24. If yes, what did you give?

1=Plain water 2=Glucose water 3=Honey 4=Milk formular

5=Others (Specify)……………… [ ]

Section 5: Complementary Feeding Practices

25. At what age (months) do you start to give your baby any other food apart from breastmilk?

1= Immediately after birth 2=specify exact age…... months [ ]

26. What do you usually use to give other foods apart from breastmilk to this child?

1= Cup/spoon 2=Feeding bottle 3=Plate/spoon [ ]

4= others (Specify) ……………………

27. Did this child eat any solid, semi-solid, or soft foods yesterday during the day or at night?

1=Yes 2=No [ ]

28. If 'YES' PROBE: What kind of solid, semi-solid, or soft foods did this child eat yesterday?

……………………………………………………………………………………

…………………………………………………………………………………….

29. How many times did this child eat solid, semi-solid, or soft foods other than liquids yesterday during the day or at night?

1=2 time 2= 3 times 3=4 times 4=> 4times

30. Tell me how you handle your child feeding during illness: PLEASE PROBE FOR:

a. Continue breastfeeding 1=Yes 2=No [ ]

b. Increase feeding (frequency and amount) 1=Yes 2=No [ ]

c. Increase fluid intake (frequency and amount) 1=yes 2=No [ ]

d. Other (Specify)……………………………………………

31. Please describe everything that this childate yesterday during the day or night, apart from breast milk whether at home or outside the home.

NAME OF FOOD	DESCRIPTION OF FOOD	MAJOR FOOD STUFF AND INGREDIENTS USED IN PREPARING FOOD	RECIPES/PREPARATION METHOD

Appendix II

Operational Definition of Terms

Complementary feeding: This refers to the provision of semi- solid and solid foods to children from 6 months of age in addition to breast milk to meet their daily nutrient requirements (WHO/UNICEF, 2010).

Continued breastfeeding at one year: Proportion of children 12-15 months who are fed breast milk (WHO/UNICEF, 2010).

Early Initiation of Breastfeeding: Proportion of children born in the last 24 months who were put to the breast within one hour of birth (WHO/UNICEF, 2010).

Exclusive breastfeeding: Refers to feeding a child below six months with breast milk only, be it directly from breast or expressed, with no addition of any liquid or solids apart from drops or syrups consisting of vitamins, mineral supplements or medicine, and nothing else 24 hours preceding the study (WHO/UNICEF, 2010).

Feeding practices: These refer to practices (both breastfeeding and complementary feeding) in feeding infants and young children based on WHO/UNICEF recommendations (WHO/UNICEF, 2011).

Malnutrition: In the technical nutrition community, malnutrition can refer to a child being both over and underweight, but for the purposes of this report we will take it to mean underweight

Nutritional status: This refers to the anthropometric status for children, weight-for-age, weight- for-Length and length-for-age indices.

Standard Definition of terms

Minimum dietary diversity: Refers to the proportion of children 6-23 months old who received food from 4 or more food groups from the 7 food groups based on a 24hour recall period. The 7 food groups are Grains, tubers and roots; Legumes and nuts; Dairy products (milk, yoghurt and cheese); Flesh foods (meat, fish, liver/organ meat, poultry); Eggs; Vitamin A rich fruits and vegetables (carrots, tomato, mango, watermelon, spinach, lettuce, cabbage etc.) and other fruits and vegetables (WHO/UNICEF, 2011).

Minimum meal frequency: Refers to the proportion of children 6-23 months old who met the recommended meal frequency; 2 times for breastfed children (6-8 months old), 3 times for breastfed children (9-23 months old) and 4 times for non-breastfed children (6-23 months old) based on a 24hour recall (WHO/UNICEF, 2010).

Minimum acceptable diet: Refers to the proportion of children who met the recommended minimum dietary diversity and meal frequency based on a 24hour recall period (WHO/UNICEF, 2010).

Stunting: The relationship between observed height to the expected height for the specific age and sex of the child (H/A) (WHO/UNICEF, 2010).

Underweight: The relationship between observed weight to the expected weight for the specific age and sex of the child (W/A) (WHO/UNICEF, 2010).

Wasting: This phrase refers to the relationship between body mass and body stature of the child (W/L) (WHO/UNICEF, 2010).

Z-scores: Measure of the degree of dispersion of the series of observations (L/A, W/A, W/L) with reference to the median of the series (WHO/UNICEF, 2010).

APPENDIX III

INTRODUCTORY NOTE AND INFORMED CONSENT

INFANT AND YOUND CHILD FEEDING PRACTICES AND NUTRITIONAL STATUS OF CHILDREN (0-23 MONTHS)IN FUNTUA LOCAL GOVERNMENT AREA, KATSINA STATE, NIGERIA

Assalamualaikum. My name is Raulat Isah, I am a post-graduate student of Ahmadu Bello University Zaria, Faculty of Life Sciences, Department of Biochemistry. I am carrying out a study on Infant and Young Child Feeding Practices and Nutritional Status of Children (0-23 months) in Funtua Local Government Area, Katsina State, Nigeria. The purpose of this study is to determine the child feeding practice indicators and the nutritional status. Therefore, children between 0-23 months will be included. If your child is among them, you will be interviewed.Weight, height and 1.5ml of blood sample from your child will be taken. Your responses will be taken with a lot of confidentiality and will only be used for the sole purpose of this study. The results of the entire study will however be availed to any interested respondent. I would like to know if you agree to participate. 1=Yes 2= No. If yeskindly sign below.

Signature/ Thumb Print; ………………………

APPENDIX IV

ETHICAL APPROVAL

Office Of The Honourable Chairman

FUNTUA LOCAL GOVERNMENT

Office Address: Local Government Secretariat Complex Funtua, Katsina State - Nigeria

All Correspondence to be addressed to the Hon. Chairman

Our Ref: *FLTG/ADM.055/VOL.I/163*

Date: *28th March, 2017*

The Head of Department,
Department of Biochemistry,
Faculty of Science,
Ahmadu Bello University (ABU),
Zaria.

RE: ETHICAL APPROVAL FOR THE CONDUCT OF MASTER DEGREE DISSERTATION TITLED "NUTRITIONAL STATUS AND INFANT AND YOUNG CHILD FEEDING PRACTICES OF CHILDREN (0 – 23 MONTHS) IN FUNTUA LOCAL GOVERNMENT AREA, KATSINA STATE" IN RESPECT OF RAULAT ISAH

Reference to your letter dated 6th February, 2017 on the above subject matter; I have been directed to convey to you the Local Government's "ethical approval" for the conduct of her research work through the Departments of Primary Health Care and Water Supply and Sanitation respectively.

2. Accordingly, the Local Government wishes her successful conduct of her research-work, please.

Thanks for the usual cooperation, please.

For:- *Hon. Chairman, Transition Committee Chairman,*
Funtua Local Government

TRAINING OFFICER
FUNTUA LOCAL GOVT.
KATSINA STATE
SIGN DATE

BASHIR MUHAMMAD
Training Officer