2019

Feeding Practices and Nutritional Status of Infants in Northwest Nigeria

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The Office of the Provost

Walden University
2019

Abstract

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by

Michael Enwere

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

Public Health

Walden University

November 2019

Abstract

Infants and young children in the Northwest province of Nigeria are susceptible to malnutrition. Inappropriate and inadequate breastfeeding and complementary feeding result in stunting, underweight, and wasting. The purpose of this cross-sectional study was to examine current feeding practices of infants not older than 2 years and their nutritional status in Northwest Nigeria. The theory of planned behavior was adopted in this research. With a total sample size of 3,861, multiple linear regression was adopted as a predictive analysis to delineate the correlation between two or more independent variables and one continuous dependent variable. Also, adopted was an independent *t* test to demonstrate the statistical difference between the mean of the dependent variable and that of the independent variable. The coefficient of determination (R^2) indicated that the change in underweight associated with exclusive breastfeeding (EBF) was 8.1%. The overall regression model was significant, $F(18, 879) = 4.29$, $p < .05$, adj. $R^2 = .06$ predicted underweight in infants under 6 months of age. The coefficient of determination (R^2) indicated that the changes in underweight associated with age appropriate complementary (CP) feeding was 8.0%. The overall regression model was significant, $F(18, 2{,}944) = 14.29$, $p < .05$, adj. $R^2 = .08$. The model predicted underweight in infants 6–24 months of age. The results from this study can be used in the reinforcement of EBF and age appropriate CP guidelines and policies by the extension of paid leave, implementing flexibility in working hours, and private space to breastfeed.

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Dedication

This dissertation is dedicated to my family, my wife, in particular, Nkechi Enwere, for her unwavering support, sacrifices, and single-handedly supporting our boys Nathan and Jamin, who at all times lived and acted their ages over the last six years while I was busy working and or fully engaged in school work. I also dedicate this dissertation to my mother, Gold Enwere, and my siblings, Blessing, Mercy, and Kingsley, for all their support and prayers during my study at Walden University. Not forgetting my late father, Godfrey Enwere, who taught me the value of education, but passed away a few years before my completing this degree program; I know how proud he would have been. I will always be grateful to everyone mentioned for encouraging me to achieve my personal goal.

Acknowledgements

I thank God almighty for His mercies, love, and sustenance in all these years. To Him, I owe all my gratitude. I want to express sincere gratitude to my committee members: especially Dr. Tolulope Osoba, my chair, and Dr. Jagdish Khubchandani, for guiding me in this journey, as well as to University Research Reviewer, Dr. Mehdi Agha. I thank them all for their time and careful consideration of this research project. Special thanks also go to Dr. Onu Adamu for his excellent advice on my statistical analysis. It is imperative for me to acknowledge and thank Pastor Sam Odu for his prayers and encouragement, which strengthen my faith. Lastly, I would like to thank my family members and all of my friends who have supported me through my doctoral journey.

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Chapter 1: Introduction to the Study

Infant and young child feeding (IYCF) practices are a determining factor in the optimal development of infants. Appropriate nutrition for the infant and young child (IYC) is vital at ensuring adequate growth, good health, and development of IYC to their full potential (World Health Organization, Multicentre Growth Reference Study Group 2009). The role IYCF practices play in child nutrition is documented in nutrition literature (Brown, Dewey, & Allen, 1998; World Health Organization, 1995). Nevertheless, attempts aimed at measuring and quantifying IYC feeding practices to evaluate its effect on the nutritional status of IYC have been hindered by methodological difficulties (Ruel & Menon, 2002). IYC feeding practices are comprised of chains of interconnected behaviors that must be considered concurrently, which are challenging to outline into a couple of variables that correctly demonstrate these practices. For instance, the recommendation for a 7-month-old infant's feeding practices is comprised of breastfeeding and complementary nutrients fortified foods at least thrice a day while assisting and encouraging the child to feed (Ruel & Menon, 2002).

Outline of the Study

Two biological factors affecting infant growth are nutrition and hormones (Bogin, 1999). The advancement of infant feeding has come a long way; historically, infant feeding has evolved from wet nursing to the feeding bottle and then to the use of infant formula. Wet nursing was commonly practiced as a substitute to the natural mother's breast milk in situations where the nursing mothers are unable to breastfeed due to ill health or death. The way the society perceives wet nursing, and the development of the baby bottle and the use of animal milk, paved the way for formulas comprised of nutrients in concentrations comparable to human milk (Stevens, Patrick, & Pickle, 2009).

The National Bureau of Statistics, Federal Government of Nigeria (2014) noted about 7 million children are born in Nigeria yearly, and only about 25% of these children 0–6 months of age enjoy exclusive breastfeeding (EBF). The Federal Ministry of Health (FMOH), Nutrition Division, Abuja (2005) concluded that over 50% of IYC are introduced to complementary feeding (CF) earlier than 6 months; most times, these foods have low nutrient content, mostly insufficient in terms of essential nutrients. Maternal demographics and infant feeding decisions concerning the duration of breastfeeding, exclusively or partial breastfeeding, and timing of solid foods or formula introduction primarily is dependent on the maternal, household, and societal factors (Renu, 2015). Disaggregated data from all of the geopolitical zones in Nigeria established that the prevalence of acute malnutrition in the Northwest province of Nigeria is 10.2%, which is the highest in the country (National Bureau of Statistics, Federal Government of Nigeria, 2014).

About 50-70% of malaria fever, upper respiratory tract infections, diarrheal disease, and measles in children are directly linked to malnutrition, and a little above 60% of the 10.9 million under-5 mortality results from either a direct or an indirect exposure from malnutrition (World Health Organization [WHO], 2003). Over 65% of IYC mortality can also be attributed to inappropriate feeding practices (WHO & UNICEF, 2009).

Public Health Impact

Malnutrition leads to impaired cognitive ability, stunted physical growth, or even death. Malnutrition has negative consequences for the socioeconomic development of any nation; malnutrition also accounts for 60% of the 10.9 million mortalities recorded yearly among IYC under the age of 5 in emerging nations (WHO, 2002). Peña and Bacallao (2000) noted that, decades ago, malnutrition and chronic diseases were perceived as two unrelated medical conditions despite occurring simultaneously; this dichotomy has hindered the advancement of these chronic diseases. Malnutrition affects all segments of the society, but IYC are largely the most susceptible, essentially because of their growth and development is dependent on good nutrition (Blossner, De Onis, & Prüss-Üstün, 2005). Kramer (1987) maintained that the 23% mortality ratio of IYC below the age of 5 in emerging economics was due to poor perinatal conditions, and a majority of these deaths occurred within the first 28 days postnatal and were largely attributed to low birth weight.

Importance to Quantify the Public Health Problem

Numerous issues are responsible for the high incidence of IYC malnutrition; some of these issues include political uncertainty and sluggish economic growth as well as the prevalence of communicable diseases and low educational level (Frongillo, de Onis, & Hanson, 1997). These estimates provide information on preventable diseases, thereby indicating the potential health achievements from various interventions deployed in the prevention of malnutrition (Blossner et al., 2005). The WHO (2002) argued that estimating the disease burden of malnutrition provides insight for policymakers to eradicate malnutrition. Policymakers should classify the sections of a population most vulnerable and reallocate resources where they are most needed. The findings of nutrition research are distributed to policymakers and stakeholders to advocate for sustainable nutrition interventions and policy change and a better allocation of resources to positively affect the most vulnerable segment of the society (Unite for Sight, 2015).

Infant and Young Child Feeding Policy

Up until 2 years of age, a child is in a critical phase of growth and development, during which appropriate nutrition should be given to guarantee the attainment of all of the child's developmental milestones. Causes of malnutrition in developing countries are multifaceted, but short-term causes of malnutrition in the first 2 years of the young child's life are inappropriate breastfeeding (BF) and CF practices combined with high incidence of infections (National Population Commission Federal Republic of Nigeria, 2008). In Nigeria, only about 13% of babies 0–6 months of age enjoy EBF, and approximately 35% of infants are introduced to CF much earlier than required; these foods essentially are of poor nutritional values, lacking in basic minerals and vitamins (National Population Commission Federal Republic of Nigeria, 2008).

To reduce IYC mortality and morbidity due to poor feeding practices, a national policy on IYCF was enacted in 2010. This policy reaffirmed that the Nigerian government was committed to optimal feeding of all IYC while implementing the global strategy for IYCF to improve the chances of IYC survival (FMOH, Department of Family Health, Abuja, 2010). The policy maintained that EBF for the first 6 months of life of all children should be promoted, except contraindicated due to medical reasons; introduction of CF should be safe, appropriate, nutritionally adequate, and accessible locally from 6 months of age (FMOH, 2010). The Nigerian government shall aim to train community healthcare personnel to protect, promote, and support optimal IYCF in all circumstances. If the nursing mother is unable to breastfeed, caregivers/mothers shall be counseled and supported in the adoption of wet nursing by retroviral negative woman or the use of commercial infant formula (FMOH, 2010).

The Rationale for the Study

León-Cava, Lutter, Ross, and Martin (2002) noted that BF offers a diversity of short- and long-term benefits to IYC and the caregiver. Scholars have demonstrated that IYC, who are not breastfed, are 6 to 10 times most probably will die in their first month of life, when compared to IYC who are breastfed (Bahl et al., 2005). A range of acute and chronic diseases, such as diarrhea and pneumonia, are known to affect IYC who are fed with infant formula. In most cases, the incidences of these diseases are of higher severity, which is responsible for high infant mortality (Bachrach, Schwarz, & Bachrach, 2003; De Zoysa, Rea, & Martines, 1999).

Several scholars have demonstrated that IYC who were breastfed possess higher cognitive abilities, which is about 3.2 points higher than children fed with formula; for children born with low birth weight, breastfed children have about 5.18 points higher (Anderson, Johnstone, & Remley, 1999). Daniels and Adair (2005) maintained that prolonged length of breastfeeding is correlated with greater intelligence in later part of infancy, producing adults who are intellectually sound. Dewey and Adu-Afarwuah (2008) argued that the introduction of CF is done at an incorrect age or where the feeding is inappropriate negatively affects the growth of the infant. Introduction of CF at about the 6th month is considered as good timing, and the periods between 6 and 23 months is the highest point where growth falters (Abeshu, Lelisa, & Geleta, 2016).

Potential Positive Social Change Implications of the Study

EBF has been demonstrated to significantly influence the reduction of IYC morbidity and mortality (Nabulsi et al., 2014). Guo et al. (2013) argued that the burden of some chronic diseases and its associated cost could be significantly reduced by the practice of EBF because this feeding practice has demonstrated a reduction in the onset of obesity-associated with protracted ill-health and a host of other illnesses that affect IYC. A lack of BF guidance in the healthcare setting is correlated with delays in the timing of BF commencement (Horii, Guyon, & Quinn, 2011). Identification of various obstacles preventing the adoption of EBF by caregivers in developing countries will provoke the development of new approaches by healthcare workers in the campaign of EBF. Guo et al. (2013) noted that IYCF practices are frequently associated with long-term incidences of non-communicable diseases irrespective of their socioeconomic status (SES).

In promoting IYC health, the education, encouragement, and support of caregivers to practice EBF for at least 6 months postnatally followed by the introduction of CF while still breastfeeding are all vital measures that should be considered. Agbaere (2015) noted that positive social change implications also comprise of an understanding of how mothers/caregivers and IYC attributes can recognize early onset of certain diseases such as postpartum depression and malnutrition in IYC through an intensification of appropriate infant feeding practices awareness.

Background of Study

Child undernutrition, according to Maleta (2006), is defined as a state of unhealthiness caused by inadequate ingestion of energy and other vital nutrients needed for growth and other bodily functions. Child undernutrition is widespread in developing nations, and it has accounted for significant rises in death toll and overall disease burden in developing economies (Black et al., 2008). In this study, I focused on examining the correlation between IYCF practices and their nutritional status. I examined feeding practices data and how they affect the nutritional status, specifically the micronutrient deficiencies of infants, in Northwest Nigeria.

Arifeen et al. (2001) argued that the leading contributing factor to IYC death in Nigeria was poor BF practices, noting that babies below 6 months of age who are poorly breastfed are at least 5 times more susceptible to dying from pneumonia and about 7 times more likely to suffer and die from diarrhea. The WHO (2017a) argued that prompt and continuous BF should be encouraged; commencement of BF should be within an hour postnatally and continued exclusively for 6 months before the introduction of CF whilst breastfeeding for 2 years or beyond.

IYC are the hardest hit victims of malnutrition (Black et al., 2013). Undernutrition cumulatively—comprising of fetal growth restriction, stunting, wasting, and lack of vitamin A and zinc combined with suboptimal BF—is responsible for the annual death of 3.1 million children or 45% of all infant mortality in 2011 (Black et al., 2013). Children who are found in the poorest quartile of the Nigerian population are about four times more undernourished when compared to children from the richest population quartile (National Bureau of Statistics, UNICEF & UNFP, 2011). Akombi et al. (2017) argued that stunting is one risk factor for the poor mental and physical development of young children 5-years-old and below.

To date, the survival strategies of children have been implemented in various United Nations Children's Fund (UNICEF) focused on local government areas in all of the states in Nigeria, which involves a population of approximately 5 million IYC not older than 5 years (UNICEF, 2007). The federal government of Nigeria in 2007 created the Integrated Maternal, Newborn, and Child Health (IMNCH) strategy, which was inspired by successful infant and child survival strategies in various African countries (UNICEF, 2007).

IYCF involves several feeding practice methods that are required to guard against malnutrition. The primary reason for these practices is to guarantee adequate nutrition, growth and development, and the survival of children (FMOH, 2014). The World Health Assembly policy framework noted a global strategy for the survival of children (WHO, 2003). This survival strategy for children could be achieved by reinforcing previous and ongoing accomplishments, mostly in the areas of the *Baby-Friendly Hospital Initiative* (WHO & UNICEF, 2009), International Code of Marketing of Breast-Milk Substitutes (WHO, 1981), and the *Innocenti Declaration on the Protection, Promotion, and Support of Breastfeeding* (WHO, 1990).

Universally, IYC are faced with growth challenges such as stunting, wasting, overweight, and obesity. Developing healthy eating behavioral habits is influenced by responsive parenting behaviors and the consumption of healthy foods (Black & Aboud, 2011). Feeding IYC involves social interaction between the infant and caregiver through verbal and nonverbal communication; therefore, there is a need to encourage nursing mothers and caregivers to practice responsive feeding adopting the principle of psychosocial care, which includes ensuring physical safety, calming the infant, and ensuing social connectedness (National Policy on Infant and Young Child Feeding in Nigeria, 2010).

Harbron, Booley, Najaar, and Day (2013) noted that responsive feeding is a reciprocal relationship enjoyed between an IYC and the caregiver, which is usually characterized by the nursing mother's or caregiver's ability to recognize hunger and fullness through verbal or nonverbal signals, which follows with an immediate and appropriate response. Aboud, Shafique, and Akhter (2009) argued that important constituents of responsive feeding that are known to be both effective and helpful in stimulating food consumption are the caregiver's positive response to infants by way of smiling, maintaining eye contact, and speaking encouraging words; patient and slow pace of feeding the infant; meticulously observing to know when to stop feeding if the IYC who shows signs of satiety; readily making available food; and encouraging the young child to feed him or herself.

Liu and Stein (2013) argued that the most challenging nutritional phase of IYC is the first 3 years of their life, because their feeding abilities and desires vary with their motor, cognitive, and social development. The WHO (2002) noted that the principles that guide appropriate CF of a breastfed infant should possess the following criteria: well-timed: This implies that solid and semi foods are introduced to the child the moment the basic requirement for energy and nutrients surpasses the quantity provided through EBF or formula supplemented BF; sufficient: This implies that foods provided to infants and young children should have adequate quantities of micronutrients, protein, and energy to achieve their nutritional requirements (WHO, 2002a): safe. This means that the process of storing, preparing, and feeding infants is carried out with utmost level of hygiene (WHO, 2002a): proper feeding. This means that infants are fed consistently at the slightest sign of appetite until satiety is achieved, and this should be regularly practiced to encourage the consumption of sufficient food appropriate for their age (WHO, 2002a).

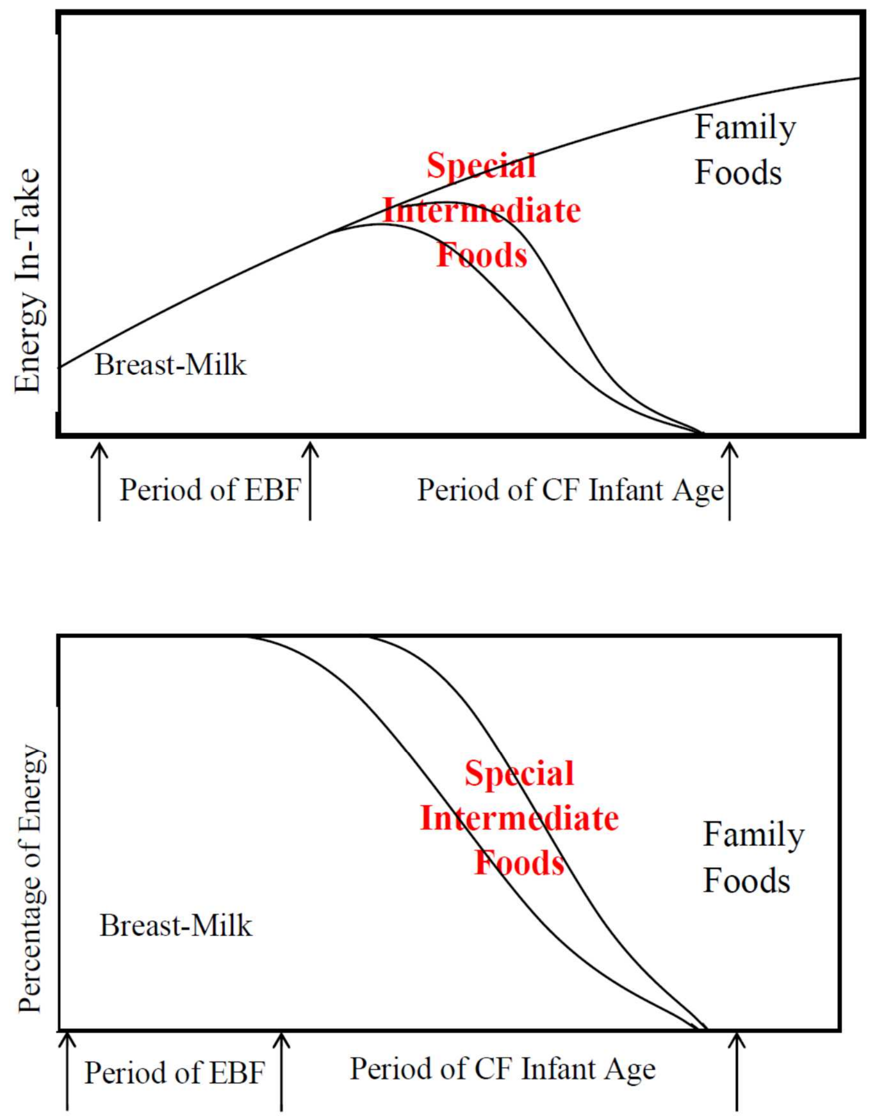

Figure 1. Contributions of various food sources to infant energy in-take relative to age.

Note: Reprinted from “Nutrient Density in Complementary Feeding of Infants and Toddlers” by N. W. Solomons and M. Vossenaar, 2013, *European Journal of Clinical Nutrition, 67*(5), p. 501. A diagrammatic representation of the correlation between increasing age through the first 24 months of life, increasing the capacity of the IYC to consume dietary energy and the various dietary formats supplying intake.

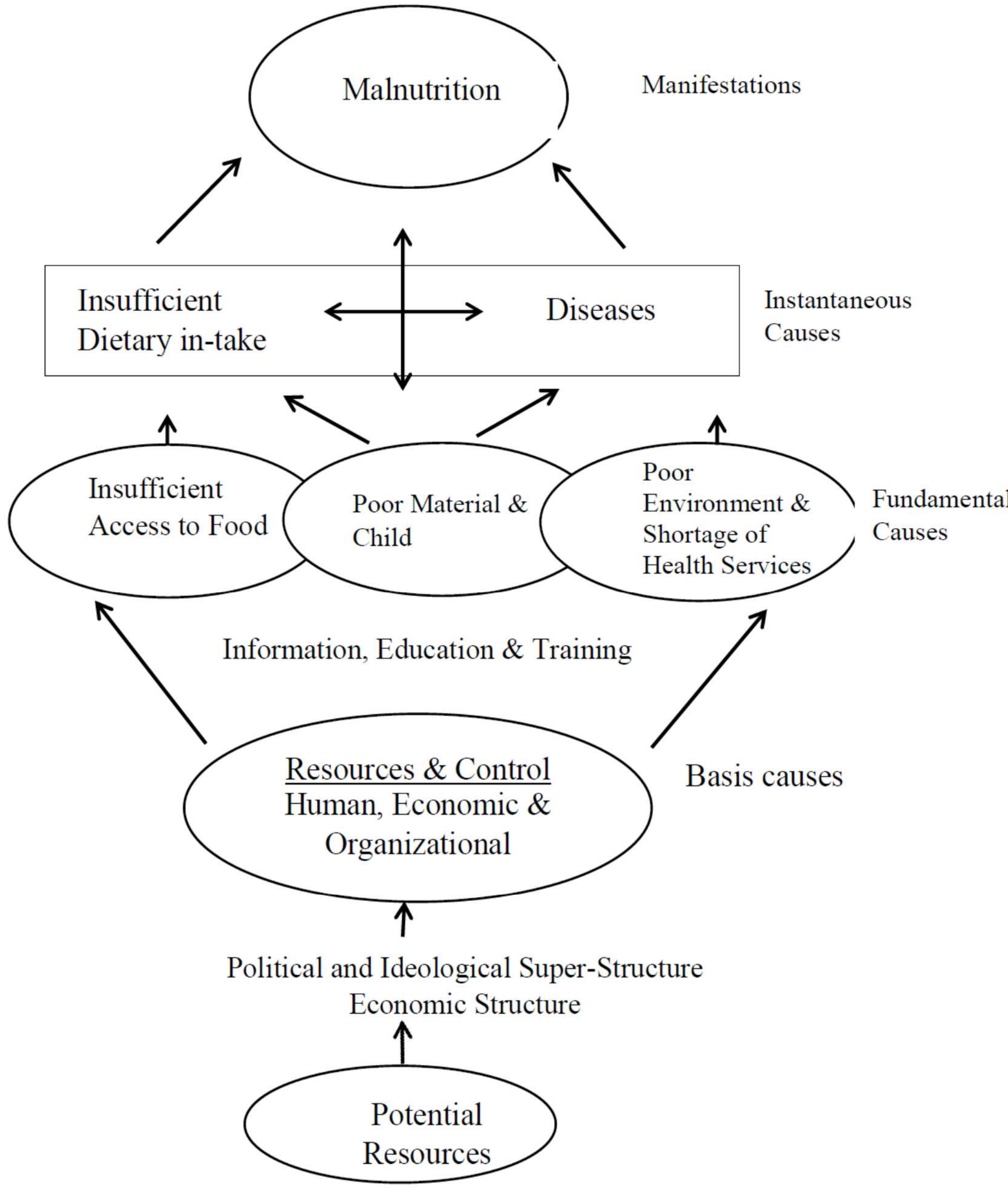

Figure 2. The determinant of malnutrition: A conceptual framework by UNICEF.

Note: Reprinted from *A Review of Nutrition and Food Security Approaches in HIV and AIDS Programs in Eastern and Southern Africa* (p. 8), by D. Panagides, R. Graciano, P. Atekyereza, L. Gerberg, and M. Chopra, 2007. The most commonly used framework adopted to understand the cause of malnutrition, which illustrates a logical assessment and analysis of the causes of malnutrition in society.

The Need of the Study

The significance of appropriate nutrition for IYC cannot be overemphasized, because it guarantees good health, growth, and development of IYC. Poor nutrition predisposes IYC to various illness, and it accounts for the increased number of illnesses and death among IYC in low- and middle-income countries (WHO, 2009). Between the period of conception and the child's second birthday, there is an opportunity to guarantee appropriate growth and development of IYC through appropriate nutritional feeding (Cusick & Georgieff, 2016).). With effective interventions, attainment of global coverage of optimal BF could obviate 13% of IYC mortality universally, while appropriate CF practices could further reduce the death of IYC by at least 6% (Jones, Steketee, Black, Bhutta, & Morris, 2003). In this study, I identified various barriers affecting the adoption of recommended IYCF practices in Northwest Nigeria and also interventions designed to overcome these barriers.

Problem Statement

Malnutrition in IYC is a public health concern in developing nations. Over 33% of all infant deaths globally can be indirectly linked to malnutrition, even though it is hardly registered as a direct cause (Bain et al., 2013). In 2001 it was observed that malnutrition in developing countries accounted for 54% of all infant mortalities; in addition, impoverishment of households remains the primary contributing factor to this public health problem (Bain et al., 2013). UNICEF (2016b) maintained that children are the most nutritionally susceptible segment of the population. Malnutrition among infants is generally higher in the northern states of Nigeria, where epidemics, famines, and incessant flooding are persistent and compounded by insurgency (UNICEF, 2016b). In 2016, it was estimated that a little over 475,000 IYC suffered from severe acute malnutrition in this region of the country (UNICEF, 2016b).

Malnourished children are also highly susceptible to morbidity due to infections as well as impaired immunity, which predisposes them to recurrent infections; this cycle usually results in a high infant and child mortality rate (Ramachandran & Gopalan, 2009). UNICEF (2013b) noted that some efforts had been made to encourage appropriate feeding practices of children, which involves early initiation to BF within 60 minutes postnatal. IYC are to be offered breastmilk exclusively for 6 months, and immediately after then, an appropriate complementary food that is either in solid or semisolid form, while the child is breastfed continuously until age 2 or beyond (WHO, 2017a). Much more needs to be done by policymakers and stakeholders to increase the numbers of mothers who adopt these appropriate feeding practices, particularly in developing nations, to enhance their children's wellbeing and attainment of their developmental milestones.

Feeding a child appropriately during his or her 1,000 days window of opportunity, that is from the day the child is conceived up to the 24th month, is essential for the wellbeing of that child, thus guaranteeing the achievement of the child's optimum development (WHO, 2016). The WHO (2017a) and UNICEF (2015a) endorsed the adoption and practice of EBF in the first 26 weeks and immediately after then introducing adequate CF while continuously BF for up age 2 or beyond. However, a little more than 5 million babies in Nigeria suffer deprivation from vital nutrients and antibodies that immunizes them against diseases and even death because they are not breastfed exclusively (UNICEF, 2016b).

Annually, about 7 million babies are born in Nigeria, and approximately only about 25% of these babies enjoy exclusive breastfeeding 0–6 months of age; the mortality rate for a non-breastfed baby is 14 times higher in the first 6 months when compared to an EBF baby (UNICEF, 2016b). A little over 2.7 million IYC not older than 5 years of age die yearly in Nigeria, and these deaths are directly linked to undernutrition (WHO, 2017a). The rates of infant and young child breastfeeding are considerably lower in the Northwest region of Nigeria, which records about 10% EBF rate compared to other regions of the country (Rossi, 2014).

Inappropriate and inadequacy of age-appropriate CF practice in IYC in terms of quantity and quality results in growth faltering (Awogbenja & Ugwuona, 2010; Kruger & Gericke, 2003; Mushaphi, Mbhenyane, Khoza, & Amey. 2008). Awogbenja and Ugwuona (2010) noted that caregivers who introduced CF too early, before 6 months of age, were at risk of their infants becoming malnourished; therefore, poor CF practices of caregivers can be directly associated to the poor nutritional status of IYC and consequently malnutrition.

Purpose

The purpose of this study was to identify a correlation between current feeding practices of infants not older than 2 year in Northwest Nigeria and their nutritional status with the intent of identifying gaps in the recommended IYCF practices in Nigeria. The independent variables of IYCF practices included caregivers' demographic domains such as caregivers' age, educational level, norms, maternal parity, and annual household income or poverty level. According to Johnson et al. (1994) a low level of education of nursing mothers or caregivers, whether formal or informal, is known to hinder the quality of overall IYC care practices in Ghana; therefore a well-tailored, organized nutrition education will increase the knowledge of nursing mothers and caregivers This eventually will impact on the nutritional status of IYC. The outcome variable was the nutritional status of IYC.

Research Questions and Hypotheses

RQ1: Is there a correlation between EBF for the first 6 months of an infant's life and nutritional status of the infant in Northwestern Nigeria?

$H_1$1: EBF in the first 6 months of infant's life correlates with nutritional status of the infant in Northwestern Nigeria after controlling for poverty level, educational level, age, and norms.

$H_0$1: EBF in the first 6 months of an infant's life, does not correlate with the nutritional status of the baby in Northwestern Nigeria after controlling for poverty level, educational level, age, and norms.

RQ2: Is there a correlation between age-appropriate CF from 6 to 24 months of age and nutritional status of the infant in Northwestern Nigeria?

$H_1$2: Age-appropriate CF from 6 to 24 months of age is correlated to the nutritional status of the infant after controlling for poverty levels, educational levels, age, and norms.

$H_0$2: Age-appropriate CF from 6 to 24 months of age is not correlated to the nutritional status of the infant after controlling for poverty levels, educational levels, age, and norms.

Theoretical Framework

The theory of planned behavior (TPB) connects individuals' beliefs with their behavior, and it predicts an individual's intention to be engaged in a given behavior at a particular time and place. The TPB was introduced for the improvement of the predictive power of the theory of reasoned action (Ajzen, 1991). LaMorte (2016) noted that the TPB successfully predicts and explains widespread of health behaviors and intents, including alcohol and tobacco use, use of healthcare services, and BF. This theory is used to understand how behavioral intents influence behavior change, while hosts of other environmental factors act as vital moderators of change (LaMorte, 2016).

Women of child-bearing age carry certain beliefs and attitudes regarding infant feeding practice (IFP) that they acquired over the years through their interaction in their social and cultural environment. The beliefs, attitudes, and knowledge of IFP could have been developed through an individual quest for information, especially during antenatal and postnatal periods (Gage et al., 2012). This was predominantly true for women who had a higher level of education (Newby, Brodribb, Ware, & Davies, 2014). IFPs will likely be carried out based on developed knowledge, attitudes, and beliefs of women, and these actions influence the overall wellbeing of IYC.

The TPB suggests that the process of carrying out a particular behavior will depend on the degree of a person's behavioral intent (Sheehan, Schmied, & Barclay, 2013). This kind of intent for BF of infants involves attitudes and subjective norms or perceptions of other people's attitudes towards this kind of behavior (Lawton, Ashley, Dawson, Waiblinger, & Conner, 2012). The decision-making process can support in shaping theory-centered interventions whose aim and purpose is to motivate the initiation of breastfeeding and prolong BF duration (Sheehan et al., 2013). This framework was used to understand nurturing behaviors as regards to mother-infant feeding interaction and decisions of parents. The principles of TPB provide the premise for studying the gap in knowledge in feeding practices and nutritional status of IYC not older than 2 years in Northwest Nigeria.

Nature of Study

Quantitative research encompasses analyzing data that are numerical in nature with the general intention of creating causal and effect association. In this quantitative study, secondary data analysis was used to examine IYCF practice and their nutritional status. The study was a cross sectional descriptive study, where data collection on the entire study population was carried out at a particular period to test the correlation between malnutrition and some factors of importance. I used a cross-sectional study to provide snapshots of the frequency of malnutrition in the Northwest Nigeria at a particular time interval. The study population included all mothers/caregivers who have infants below the age of 2 and who came from Northwest region of the country.

This study independent variables were poverty levels, educational levels, maternal age, and norms of the nursing mother/caregiver; these variables were capable of changing or controlling the outcome of the study. The dependent variable was the nutritional status of the IYC, while the covariate variable that had the potentials to alter the findings of the study was feeding mode (breastmilk, formula, or mix feeding). The secondary data of the variables were obtained from Multi-Indicator Cluster Survey (MICS, 2017). Data on stunting, wasting, and underweight were analyzed. The data analysis was carried out with the use of SPSS. Chi-square tests were carried out to compare categorical variables, correlation analyses, and multiple linear regression, which clarified the association between a continuous dependent factor and several independent factors. The entire statistical calculation was carried out at a 95% confident interval.

Definitions of Terms

Complementary feeding (CF): Introducing family diets that are willingly ingested, which is digestible by infants from 6th months of life, where only breastmilk becomes insufficient, thus not meeting the energy and nutritional requirements of the child; these foods introduce CF rather than replacing it (World Vision International, 2017).

Educational levels: The various educational levels in Nigeria are established on the 6-3-3-4 system, which comprises three learning process levels in an institution (primary, secondary, and tertiary; Nuffic, 2017).

Exclusive breastfeeding (EBF): The practice of feeding IYC with breastmilk alone; this process excludes all forms of foods and fluids, even water for a period of 6 months commencing not longer than 60 minutes after birth (WHO, 2017).

Infant formula: A preparation from cow milk also containing essential constituents that is substituted for breast milk for feeding infants (Shiel, 2018a).

Maternal age: The age of the nursing mother at the time of giving birth (Shiel, 2018b).

Nutritional status: A person's health condition that is impacted by sufficient consumption and use of essential nutrients (Todhunter, 1970).

Poverty levels: The levels at which an individual is extremely impoverished; poverty levels have been conceptualized as low income or low consumption of nutritious foods (Olowa, 2012).

Mix feeding: The combination of breast milk and breast milk alternatives (i.e., commercial infant formula).

Malnutrition: A condition where an IYC lacks proper nutrition that occurs when there is surplus, inadequacies, or imbalances in a child's consumption of food (WHO, 2016).

Assumptions

I assumed that the majority of nursing mothers and caregivers who possess some high level of education and receive adequate information concerning the benefits of EBF and CF would adopt this feeding techniques. During pregnancy and throughout the early stages when nursing mothers are nurturing their children, they are faced with conflicting opinions about infant feeding. This contradictory information can significantly influence the choices these nursing mothers make regarding feeding practices. Therefore, adequate information will improve the adoption of feeding practice, thus guaranteeing the better nutritional status of IYC, especially for primipara women who are more vulnerable and are faced with conflicting opinions about infant feeding practices due to their inexperience.

Scope and Delimitations

The scope of this research was neonates (IYC between 0 to 24 months of age in Northwest Nigeria), their feeding practices, and their overall health status. A key delimitation in this study was the use of IYCF practices in the evaluation of the nutritional status of IYC in Northwest Nigeria. Feeding practices were chosen primarily because of the significance and value of good nutrition and appropriate feeding practices to neonates, IYC. It was also chosen because it is a good indicator in the measurement of IYC nutritional status. I did not consider diseases such as compromised digestion and intestinal malabsorption or chronic diseases that result in either partial or complete loss of appetite (e.g., cancer, AIDS). The fundamental concepts supporting this research were self-efficacy, self-consistency, and self-actualization.

Limitations

The limitations of this research are effects that the researcher has no control over, and they affect the overview of the findings by placing restraints on the methodology and conclusions (Baltimore County Public Schools, 2017). The identifiable limitations of this research were the possibility of data integrity. Like all secondary data, I lacked control over the quality of the data even though there is some level of guarantee from official institutions and government bodies. Another limitation of the study was that I was not privy to information in the data collection process. Recall bias, particularly on vital information and misreporting of information by subjects and researchers during the data collection process, may distort the collated data resulting in analysis and interpretation errors to some degree. Therefore, the findings of this research were interpreted with care, bearing in mind these limitations.

Significance

UNICEF (2015b) maintained that in Nigeria, 37% of infants and young children, or 6 million children, were stunted; these groups of children suffer from chronic malnourishment or low height for age, and a little over 50% of these cases are severe. According to UNICEF, another additional 18% of IYC suffered from wasting; this group of individuals suffers from acute malnourishment or low weight for height, and 50% of them are severe. About 29% of infants and young children also suffered from underweight, either acute and chronic malnourishment, or low weight for age, with approximately 50% of these being severe (UNICEF, 2015b). By disaggregating various geopolitical zones, it is observed cute malnutrition is highest in the Northwest region of the country, with 10.2% of infants and young children being affected, closely followed by the Northeast region, which has 9.5%; the lowest rates are in the Southern region as well as the North Central states that records about 4.5% (National Bureau of Statistics, Federal Government of Nigeria, 2014).

In this study, I investigated the IYCF practices and nutritional status of IYC below 2 years in Northwest Nigeria. Based on the current number of infants who are malnourished, malnutrition is a disease of public health importance. Hence, the results of this study may be used to evaluate the current programs on the ground and design of interventions that will help mothers adopt recommended feeding practices. Available data on stunting, wasting, and underweight are all beyond the trigger point for public health intervention activation. Therefore, identifying current practices will lead to the implementation of recommended interventions that will steer a reduction of incidence of malnutrition in that region.

Summary

Initiating BF within the first the 60 minutes postnatally and continued EBF for 6 months is imperative; the introduction of CF while still breastfeeding for about 2 years are the recommendations of the WHO (2003) and UNICEF (2005). Researchers have demonstrated considerably low infant morbidity and mortality rate with the practice of BF, initiated within 60 minutes after delivery (Cai, Wardlaw, & Brown, 2012). IYCF practices are determining factors of the nutritional status of IYC, which affects IYC morbidity and mortality (Diallo, Bell, Moutquin, & Garant, 2009). Among the various feeding practices, BF is fundamental in the survival, wellbeing, growth, and development of IYC (Diallo et al., 2009). Optimal CF that is necessary for the wellbeing of these infants is influenced by a combination of factors that include what the IYC is fed, how, when, and where this feeding is carried out (Engle, Bentley, & Pelto, 2000; Pelto, Levitt, & Thairu, 2003). This research will help scientists better understand numerous limitations that can affect EBF and CF during the postnatal phase, and it will help to recommend and promote essential interventions designed to overcome these feeding practices, subsequently enhancing the general health and wellbeing of the IYC.

Chapter 2: Literature Review

A review and synthesis of literature relevant to the development of the conceptual framework guiding this research is presented in this chapter. This quantitative study aimed to explore and describe feeding practices as they relate to the nutritional status of IYC not older than 2 years in Northwest Nigeria. To achieve the study objective, an extensive review of the scholarly evidence was required to explore all the aspects of BF and CF of IYC. Nutrition plays a role in the first year of life of an infant in guaranteeing a healthy foundation, thus preventing the onset of diseases such as upper respiratory tract infection, diarrhea, asthma, and obesity; these conditions are known to be responsive to prevention if optimal IFPs are embarked on early in life (Duijts, Jaddoe, Hofman, & Moll, 2010; Quigley, Kelly, & Sacker, 2007).

One of the fundamental public health strategies adopted in the improvement of IYC morbidity and mortality is EBF, which is also beneficial to nursing mothers/caregivers (American Academy of Pediatrics, 2005; Piñeiro-Albero et al., 2013; U.S. Breastfeeding Committee, 2014). Attaining developmental milestone of IYC and improving their nutritional status, health, and wellbeing are the positive aspects of EBF. The American Academy of Pediatrics (2005) and the WHO (2003) maintained that EBF possesses health benefits for IYC and nursing mothers.

The introduction of CF should commence around 6 months, while still breastfeeding; however, CF introduction to IYC in sub-Saharan African is often of low nutritional quality because they are predominately cereal-legume-based known to have few nutrients and energy concentration. They are comprised of certain inhibitors such as phytic acid, which limits the absorption of micronutrients such as iron and zinc (Gibson et al, 1998). This malabsorption is worse for IYC who were not given breastmilk, either as a result of ill-health, death of mother, or mother not desirous of breastfeeding; these IYC who are fed mainly cereal-legume diet will be deficient of certain micronutrients such as calcium, zinc, and iron (Dewey, 2003; Dewey, Cohen, & Rollins, 2004). To solve the problem of micronutrient deficiency, it is recommended that CF be comprised of native foodstuffs made up of the family diet. When necessary, food fortification is done to increase the energy and micronutrient densities (Dewey & Brown, 2003; WHO, 2002a).

Literature Search Strategy

An extensive online search was carried out to determine current literature on feeding practices and nutritional status of infants 0 to 24 months of age in Northwest Nigeria. Because IFPs is a broad topic, it was important to use filters for keywords. The primary databases used were PubMed, CINAHL Plus, ProQuest, MEDLINE, WHO, and UNICEF. All of the information was accessed electronically some through Walden University Library website while other information was obtained via the organization's concerned website. Only studies documented in the English language were used. I streamlined all searches by the selection of filters that accepted only pertinent journals by keywords and date of publication. Peer-reviewed journals and official government agencies records were used. The search terms were as followed: *nutritional status of children, infant morbidity, and mortality due to malnutrition, infant malnutrition*, and *maternal and child undernutrition*.

Literature articles adopted for this study met the following requirements:

1. Journal publication dates ranged from 2010 to 2016 (with the exception of a few pertinent articles).
2. Peer-reviewed journals and materials from governmental agencies as well as international nongovernmental organizations.
3. Journal articles that met the target population.

Theoretical Foundation

The choice of nursing mothers to breastfeed their children is solely an individual decision; thus, the goal determines the commencement and length of the BF period, and all these factors are dependent on the mother's social group and available social support scheme (Sheehan et al., 2013). In child feeding decision making, Sheehan et al. (2013) studied the adoption of certain behavioral theories such as the theory of maternal role attainment (MRA), the theory of reasoned action (TRA), and TPB as foundations for accepting the decision-making process of the feeding of infants. Several scholars maintained that the decision-making concept could shape theory-centered interventions whose intention is to motivate the initiation of BF as well as prolong the length of the BF period (Sheehan et al., 2013).

The TPB recommends that execution of a particular behavior will depend entirely on the degree of a person's behavioral intent (Sheehan et al., 2013); this kind of intent as it concerns the BF of infants involves attitudes and subjective norms or perceptions of other people's attitudes towards this kind of behavior (Lawton et al., 2012). Lawton et al. (2012) concluded that there is a correlation between intent to BF and a rise in the rates of BF among South Asian caregivers; therefore, intentions led to greater rates of BF. These intents were mainly as a result of emotional and moral principles (Lawton et al., 2012). Previous researchers had highlighted that BF intents, negative attitude, and poor knowledge are likely to influence feeding practices, creating obstacles to the uptake of optimal BF (Mbada et al., 2013).

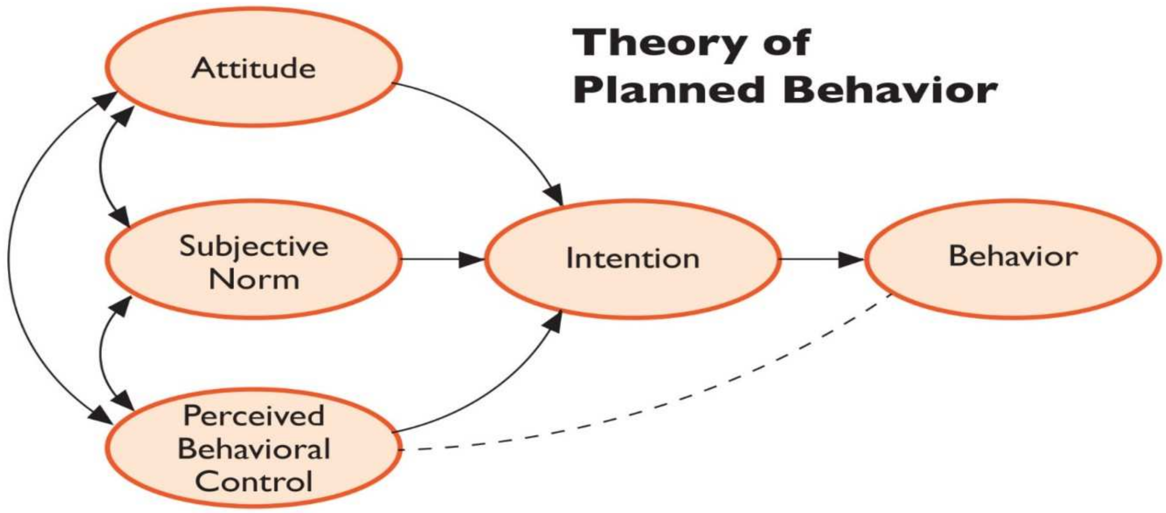

Figure 3: The theory of planned behavior.

Note: From "The Theory of Planned Behavior in Entrepreneurship Research: What We Know and Future Directions," by J. Lortie, & G. Castogiovanni, *International Entrepreneurship and Management Journal*, 2015, 11(4), (p. 937). TPB links beliefs and behavior. This concept was developed to predict an individual's intention to engage in a behavior at a specific time and place, including perceived behavioral control.

The TBF is a widely adopted theoretical approach in the field of health psychology that has been applied to comprehend health behaviors that lead to the development of appropriate interventions (Ajzen, 1991). The major determining factor of behavior in TPB is intention, which is further predicted by three key constructs: (a) attitudes, (b) subjective norms, and (c) perceived behavioral control. IYCF choices are affected by an array of social, cultural, psychological, individual, and clinical features, such as age, culture, level of education, and personality variables (Bai, Wunderlich, &

Fly, 2011; Lawton et al., 2012; Scott, Landers, Hughes, & Binns, 2001; Sheehan, Schmied, & Barclay, 2010).

TPB is guarded by three principal classifications of opinions: (a) beliefs as regards the influence of a particular behavior, (b) beliefs regarding anticipations of others, and (c) beliefs regarding the existence of elements that have the tendency to stimulate or deter an actual behavior (Giles, Connor, McClenahan, & Mallet, 2010). Ajzen (1991) argued that an attitude towards a particular behavior is influenced by a person's beliefs about the expected results or characteristics of carrying out that behavior (behavioral beliefs). The objective in performing a chosen behavior is predicated upon the opinions of a person in carrying out a particular behavior (Ajzen, 1991). This scenario is more evident in nursing mothers or caregivers who are of the opinion that the act of BF of a child is challenging considering that BF is performed uninterruptedly round the clock all day; these group of caregivers is unlikely to BF, and this will stimulate the adoption of infant formula postnatally.

Cultural norms and personal characteristics impact BF behaviors in postpartum women (Bai et al., 2011; Dyson, Green, Renfrew, McMillan, & Woolridge, 2010). Mitra, Khoury, Carothers, and Foretich (2003) noted that one of the most important predicting factors of BF intent among the lower class in the southern region of North America is self-efficacy, seeming social support (Mitra et al., 2003), and attitudes. In addition, an earlier experience in IYC BF influenced BF practices (Kloeblen-Tarver, Thompson, & Miner, 2002).

With the successful application of the TPB model in the prediction of maternal feeding behaviors, this framework can be adopted in investigating CF practices.

Horodynski et al. (2007) argued that TPB framework could be adopted in examining the knowledge and attitudes as regards introducing solid foods in the perspective of CF introduced not earlier than 4–6 months. Caregivers recognized and accepted infant feeding recommendations, but IYC features like sleeping patterns and satiety hampered their intents to delaying the introduction of CF (Horodynski et al., 2007).

The more positive attitude an individual develops towards a particular behavioral act, the more that individual believes others desire them to perform that behavioral act; thus, there is a high tendency for them to want to engage in that behavioral act. Ajzen (1988) maintained that TPB is helpful in predicting human behaviors; therefore, declaring an individual’s intention to carry out a behavior someone else is responsible for will increase the individual’s likelihood to perform that behavior. I used the TPB as its theoretical foundation, while integrating demographic factors, as determining predictors of caregivers’ intentions and behaviors, linked with BF initiation and age-appropriate CF introduction. From a TPB stance, it was hypothesized that certain maternal demographic variables such as age, norms, household income, and educational level, are contributing factors in predicting intent and behaviors that are correlated to initiation of BF, the practice of EBF, and CF introduction about 6 months.

Numerous studies have acknowledged that family and friends are fundamental in influencing age-appropriate CF practices (Alder et al., 2004; Crocetti, Dudas, & Krugman, 2004; Horodynski et al., 2007; Olson, Horodynski, Brophy-Herb, & Iwanski, 2010). Group norms are also responsible for predicting behavioral intentions (Johnston & White, 2003). Normative effects of family and friends have been demonstrated by numerous researches as the main determining factor of CF practices (Alder et al., 2004; Crocetti et al., 2004; Horodynski et al., 2007; Olson et al., 2010).

The second phase of a developmental and nutritional milestone for IYC begins with the introduction of complementary feeding, in an exclusively breastfed child or in IYC who were fed appropriately with infant formula or a mixture of breastmilk and formula (National Health and Medical Research Council, Commonwealth of Australia 2012). Hamilton, Daniels, White, Murray, and Walsh (2011) in their study maintained that attitudes, normative influences, and individual characteristics where the three cardinal points in decision making as regards to complementary feeding; their study concluded that introducing CF (solids and or semi-solid) in the 6th month is vital, because this belief is shared by caregiver peers, therefore it is the primary modifiable predictors of intention in the introduction of complementary feeding. The adoption of the TPB framework provides a foundation to clearly understand CF practices and the importance of its application that will assist developing strategies for the uptake of this IFP.

TPB helps scholars understand the reasons why caregivers are not enthusiastic about practicing EBF; this will help in the development of appropriate campaign approaches to improve the uptake of EBF (Bai et al., 2011). Fundamentally, the essential principle of TPB is that there is a link between an individual’s beliefs with the behavior the individual exhibits coupled with the individual’s intent to perform that behavior**,** and this is further facilitated if the individual has a positive attitude towards that behavior. Thome, Alder, and Alfons (2006) maintained that studies have shown that attitude of caregivers toward intention to breastfeeding or the timing of complementary feeding introduction can be measured through these beliefs; this is so because the intent to breastfeed influences both the initiation of breastfeeding, its duration and also the practice of EBF, these aims and objectives will all cascade into plans which influences the introduction of formulae and complementary foods (Newby et al., 2014).

Infant Feeding Practices

Two main biological factors affecting infant growth are nutrition and hormones (Bogin, 1999). The advancement of infant feeding has come a long way; historically, infant feeding has evolved from wet nursing to the feeding bottle and then the use of infant formula. Before this evolution, wet nursing was commonly practiced as a substitute to the natural mother's breast milk in situations where nursing mothers are unable to breastfeed due to ill-health or death (Stevens, Patrick, & Pickler, 2009). With innovations emerging in pediatrics and the way the society perceives wet nursing, as well as the development of baby bottle and the use of animal milk, all these have paved the way for formulas comprising nutrients in concentrations comparable to human milk, all progressively cumulated to substituting artificial infant feeding for wet nursing (Stevens et al., 2009).

Batal, Boulghourjian, and Akkik (2010) noted that approximately 18.1% of caregivers commence the practice of EBF for their baby within 60 minutes postpartum, and 55.9% of caregivers commence EBF within the several hours postpartum in Lebanon. Even though a little over 70% of caregivers commenced EBF, over 40% of these nursing mothers discontinued this practice before 6 months of age of the baby. Hanif (2011) noted that the prevalence of nursing mothers who breastfed within 60 minutes postpartum was 65.5% (95% CI: 64.3–66.8), and the prevalence of EBF among caregivers was 37.1% (95% CI: 34.0–0.2) in Pakistan.

Issaka et al. (2015), after analyzing secondary data of demographic and health surveys carried out in Ghana, Nigeria, Sierra Leone, and Liberia, they concluded that suboptimal CF practices is disadvantageous to the growth, health, and wellbeing of infants 0–2 years of age. The researchers further noted that suboptimal CF practices were the leading cause of infant malnutrition, which contributed to stunting (38%) and underweight (28%) in infants less than 5 years of old in those West African nations (Issaka et al., 2015).

A total of 12 623 IYC between the ages of 6–23 months from four Sub Saharan African countries where involved in the data analysis, while four CF indicators were tested against these factors; individual, family and community, adopting multiple regression and multivariate analyses statistical methods; these statistical methods both confirmed that the absence of postpartum contact with healthcare personnel, maternal level of education and geographical location were the principal determining factors responsible for delayed introduction of CF in all the countries analyzed (Issaka et al., 2015). The researchers also concluded that to achieve a major reduction in IYC morbidity and mortality, these West African countries will have to channel their energy to improve CF practices (Issaka et al., 2015).

Factors Influencing Infant Feeding Behavior

The duration of breastfeeding of children is usually determined by nursing mothers. A 6-month exclusive breastfeeding period, which should be followed immediately by appropriate complementary feeding, is recommended by WHO and

UNICEF (WHO, 2017a), unfortunately, these recommendations are not usually adhered to by most nursing mothers who live in northern Nigeria (Chetty, Carter, Bland, & Newell, 2014; Mwendo et al., 2014). Universally, there have been various strategies developed that support breastfeeding as a norm and the optimization of maternal and child health nutrition as defined by UNICEF and WHO (UNICEF/WHO, 1990; WHO, 1981). The global figure for annual infant mortality attributed to nonexistence of exclusive breastfeeding is approximately 1.3 million, additionally another 600,000 deaths are recorded due to non-continuity of breastfeeding with appropriate complementary family diet (World Health Organization, 2003).

Wallace and Chason (2007) argued that deciding on and selecting the most appropriate infant feeding practice is method is primarily the personal decision of the nursing mother. In line with the conclusions of Clifford and McIntyre (2008) on the positive impact of the involvement of the family unit and the social support system in influencing the nursing mother's infant feeding practice. Arora, McJunkin, Wehrer, and Kuhn (2000) reviewed various elements whose capabilities can influence the feeding decision of the caregiver concerning infant feeding and also those elements that would encourage bottle-feeding caregivers to adopt breastfeeding.

A total of 245 caregivers were involved in the research, where various questions such as infant feeding choice timing, decision-making factors, breastfeeding information sources, variety of infant feeding practices, and concerns connected to infant feeding (Arora et al., 2000). The researcher noted that the caregiver's conjecture of the spouse's preference was the fundamental determining factor for the non-adoption of BF practices (Arora et al., 2000). The study outcomes demonstrated that 80% of the surveyed nursing mothers identified assistance from spouse, maternal grandmother, and close relatives (90.9%) as features capable of encouraging breastfeeding (Arora et al., 2000).

Factors that influence child growth

With the use of data from approximately 9,000 children who were fed with breast milk from five countries (United States, India, Ghana, Norway, Oman and Brazil), the WHO published its growth Standards which is the most up to date global reference parameter of child growth, as regards anthropometric measurement by age and gender (WHO, 2006). The weight of a child is a good determining factor for any short term condition while the child's height offers comprehensive long term information about nutritional status and general wellbeing (de Onis & Branca, 2016). Growth potentials are achieved when other aspects that negatively influence growth and development of individuals are removed. Children are known to experience rapid growth much early in their life but exhibit a near plateau at 2 year of age, starting from a year old (WHO, 2009). The growth pattern of children can be allocated into three categories infancy phase which spans from birth to 2 or 3 years, childhood phase is between preschool age up until puberty while adolescence phase starts with puberty (Gokhale & Kirschner, 2003; Wei & Gregory, 2009).

Research has illustrated that all through infancy, the growth of IYC is typically driven by nutritional intake and intrauterine conditions (Lejarraga, 2012). The childhood stage, which is the second phase in the postpartum calendar, spans from preschool all the way to puberty; this phase is also characterized by growth though a linear fashion. Generally, a girl child is inclined to experience more rapid growth compared to the boy child, this happens up until four years of age when both gender growth rate is at the same level, which is approximately 5‒6 cm per annum until puberty (Gokhale & Kirschner, 2003; Rogol, Roemmich, & Clark, 2002; Wei & Gregory, 2009).

In a report documented by Food and Agriculture Organization estimates that between 2014 and 2016, approximately 795 million persons world over are undernourished (Food and Agriculture Organization, International Fund for Agricultural Development, & World Food Programme, 2015). While appropriate nutrition is necessary for adequate linear, neurological, and cognitive growth, undernutrition on the other hand is a consequences of inadequate food or the consumption of food not containing ingredients required for growth and wellbeing of the individual (Maleta, 2006). The effects of undernutrition can be measured using three main parameters: stunting, wasting, and underweight. According to WHO (2006), wasting is weight-for-height (WHZ) below -2SD in a given population. This is a process where muscle and fatty tissues waste away as a result of the disease condition. While underweight is in any situation where weight-for-age (WAZ) falls below -2SD. In this situation, weighing less than the normal amount for one's age, height, and built could be termed as underweight. Stunting is length or height-for-age (L/HAZ) below -2SD, which can also be defined as the possession of a short stature for age; this is one of the best parameters of measuring chronic undernutrition in children. Eze, Oguonu, Ojinnaka, and Ibe (2017) noted that numerous research findings agreed that the nutritional status of a child was one of the vital indicators of measuring the level of development, physically and mentally as well as the qualities of these developments in young children.

Roberts and Stein (2017) in their aim to analysis the linear growth effects of nutritional interventions in IYC 2 years and older, the researcher evaluated the effectiveness of numerous vitamins nutrients and foods, boosting growth in IYC. A systematic review of 69 articles demonstration that zinc, vitamin A, several micro-nutrients, and protein significantly affect linear growth of IYC positively, while iron, calcium, iodine, and food-based interventions were insignificant in their effect on growth (Roberts & Stein, 2017). The researchers concluded that zinc, vitamin A, several micro-nutrients, and protein interventions provided to the IYC after the age of 2 is capable of positively affecting linear growth, essentially in regions where IYC populations have grappled with growth failure (Roberts & Stein, 2017).

Benefits of Exclusive Breastfeeding

Breastfeeding has come to be known as the most important public health strategy in issues pertaining to IYC survival and morbidity ratio reduction; this is because breastmilk contains water, fat, proteins, carbohydrates, minerals, vitamins, some hormones, enzymes, growth factors, essential fatty acids, and immunological factors, which are all responsible for optimal growth and development of IYC (American Academy of Pediatrics, 2005; Piñeiro-Albero et al., 2013; USBFC, 2014). EBF from birth up until 6 months, which is immediately followed by the introduction of CF while still breastfeeding until 2 years is known to reduce the incidence of allergy, childhood obesity, and the onset later in life of type II diabetes, hypertension, and hypercholesterolemia (Godfrey & Lawrence, 2010). Al-Binali (2012) maintained that the incidences of otitis media, gastroenteritis, respiratory diseases, sudden infant death syndrome (SIDS), and necrotizing enterocolitis (NEC) are lower in exclusively breastfed IYC. There is improved mother-infant bonding when EBF is practiced, and these exclusively breastfed IYC have also demonstrated improved cognitive ability when neurodevelopmental assessed (Rempel & Moore, 2012). EBF practice has shown to be directly responsible in reducing occurrences or severity of bacterial infections such as meningitis, diarrheal disease, and neonatal sepsis; lymphoma, leukemia, Hodgkin's disease, and asthma are also reduced (Kramer & Kakuma, 2012).

Basrowi, Sulistomo, Adi, and Vandenplas (2015) argued that the working environment of the caregiver was a determining factor for the practice of EBF, this was demonstrated in a cross-sectional research study carried out in five workplace environments. Data elicited from 186 participants showed 52% of the caregivers' age ranged 20–46 years of age, 75.3% of the participants' educational levels were high, 12.9% of the subjects had 2 or more children, and 36.0% had their own homes (Basrowi et al., 2015). The prevalence of EBF in the first 6 months postnatal was 32.3%, the researcher also noted that a suitable devoted BF center was accessible for 21.5% of the caregivers, but only 7.5% of the participants are in touch with a BF support program (Basrowi et al., 2015). Despite the small study sampling size, which is the study limitation because of its ability to decrease the statistical power, the authors concluded that dedicating a BF center increases the adoption and practice of EBF by nearly 3 times. Therefore, the awareness and understanding of the BF support program caused a dramatic increase in the practice of EBF by nearly 6 times; educational levels of caregivers also demonstrated similar tendency: The higher the educational levels, the higher the percentage of EBF uptake (Basrowi et al., 2015).

Benefits of Timely Introduction of Complementary Feeding

CF era in IYCF practices is the phase of life when foods which comprises of solids, semi-solids, soft foods, or liquid milks are feed to IYC from 6 months of age, while still breastfeeding (Monte & Giugliani, 2004). Any additional food fed to IYC other than breast milk in this period is termed CF (Monte & Giugliani, 2004). Malnutrition in infants, which manifest in the era of semi-solids and solid foods introduction, has been accredited to inappropriate CF practices, and it is the direct cause of a little over one-third IYC mortality in Nigeria (Udoh & Amodu, 2016). Abeshu et al. (2016) concluded that breastfeeding along can only guarantee optimal nutritional needs for the first 6 months, beyond that time if CF is not introduced there will be a shortfall in the total sum of energy and micronutrients essential for most favorable growth and development of the IYC. Complementary foods fill the gap between the aggregate nutritional requirements of the IYC and the amounts offered by breastmilk, making this phase of feeding indispensable (WHO, 2000). In developing countries, many IYC demonstrate characteristics of faltering rate in weight and height for age, which are the direct consequences of malnutrition and also ill-timed and or inappropriate complementary feeding (Scrimshaw & Underwood, 1979).

An appropriate complementary feeding should consist of diets with plenty of energy, nutrients, and vitamins, without any form of contaminants, palatable to IYC in an adequate amount, having little or no spice or salt, easily prepared from family diets, that are usually inexpensive, affordable by many families and also available locally (WHO, 2000). Scrimshaw and Underwood (1979) maintained that it is imperative for CF introduction to be properly timed; this singular act guarantees adequate growth and development and a decrease in morbidity and mortality of IYC. The quantification of an appropriate CF adopting the WHO IYCF indicators are introducing CF timely, the introduction of minimum food variety and food regularity; only IYC who satisfy the stated standards can be considered receiving appropriate complementary foods (Kassa, Meshesha, Haji, & Ebrahim, 2016).

Yohannes, Ejamo, Thangavel, and Yohannis (2018) in a cross-sectional community-based study, where 543 women who had children aged 6–23 months were sampled, data collected were analyzed applying bivariate logistic regression to ascertain crude association and multivariate logistic regression to model predictors. The researcher noted that the percentage of timely introduction of CF was 34.3% at 95% CI: (30.31, 38.29), educational levels above high school of study participants, spouses and nursing mothers postnatal care appointments (AOR = 1.94 at 95% CI: 1.19, 3.16) were established as independent predictors for timely introduction of CF practice in this study (Yohannes et al., 2018). The researchers concluded that timely CF practice was increased with higher educational levels; therefore, furnishing caregivers with adequate IYCF practices information is recommended to guarantee an increase in appropriate CF practices uptake knowing how critical CF is in early childhood development (Yohannes et al., 2018).

Breastfeeding from a Public Health Viewpoint

Alipui (2012) noted that the benefits of breastfeeding rather than formula feeding go further than the caring bond that exists between the caregiver and infant; it has been demonstrated that regular breastfeeding can stimulate lactational amenorrhoea, which is a kind of natural contraceptive adopted in birth spacing and or family planning. BF positively influences the health of the nursing mother, her child, and the general wellbeing of the entire population (Alipui, 2012). BF has been shown to be cost-effective, offering financial advantages for caregiver, families, communities, and the wider society of poor socioeconomic status (Center of Advancing Health, 2014; Gartner et al., 2005).

Studies have demonstrated that about 13 billion United States dollars could possibly be saved in terms of morbidity cost, if 90% of IYC in North America were breastfed, this will reduce the volume of biodegradable and non-biodegradable materials from infant formula and bottles pile up which is a treat to the environment (Bomer-Norton, 2013). Bearing these in mind, the practice of breastfeeding can stimulate the prioritizing of the global health agenda as it links 7 of the 8 Millennium Developmental Goals (MDGs) (Wilson, 2017). These MDGs established by the United Nations focuses on the improvement of maternal health, IYC mortality reduction, eliminating hunger, guaranteeing environmental sustainability, and the promotion of gender equality, education, and empowerment, are all important facets of breastfeeding campaign (Wilson, 2017).

Brown (2017) conducted a narrative evaluation to synthesize subjects in relevant literature using PubMed, Science Direct and Web of Science, to determine hurdles to BF at the societal rather than at the level of the individual caregiver, were economic influences, health policy and service issues were all recognized. BF had more hurdles at the societal level compared to the individual level, and these effects are usually outside the control of the caregivers; therefore, BF is a public health problem that demands substantial investment at a societal level (Brown, 2017).

Barriers of Exclusive Breastfeeding and Significances of Not Breastfeeding Infants

Workplace barriers are among one of the various factors which contribute to discontinuation of breastfeeding practices; this is more pervasive in workplaces where there are no provisions for nursing mothers and caregivers to bring their children (Ajibade, Okunlade, Makinde, Amoo, & Adeyemo, 2013; Velpuri, 2004). Agunbiade and Ogunleye (2012) argued that conflicting positions on feeding practices, as well as having a spouse who offered little or no support, are also known to influence infant feeding behaviors. For nursing mother who often has to be outdoors with their babies sometimes are uncomfortable to breastfeed outside their homes, and this feeling of embarrassment prompts discontinuation of breastfeeding practices. Physical and medical problems such as illness and even nipple soreness are several hurdles to BF continuity (Ahluwalia, Morrow, & Hsia, 2005; Bentley, Dee, & Jensen, 2003; Brownell, Hutton, Hartman, & Dabrow, 2002; Khoury, Moazzem, Jarjoura, Carothers, & Hinton, 2005; Kimbro, 2006).

According to Rojjanasrirat and Sousa (2010) and Wiener and Wiener (2011), low educational status, younger maternal age, and low socioeconomic status are known to hinder the practice of EBF. Marital status was another barrier to the practice of EBF, single motherhood was associated with lower breastfeeding prevalence, and they rarely adopt EBF practice (Rojjanasrirat, & Sousa, 2010; Wiener & Wiener, 2011). The significances of not breastfeeding are not on the grounds of breastmilk initiation shortly after delivery; rather, it is on the practice of EBF and its duration. Several studies have concluded that the infant morbidity risk reduces when a young child is breastfed because antibodies from the nursing mother or caregiver is passed to the young child through breastmilk (American Academy of Pediatrics, 2005; WHO, 2007). IYC, who are not fed with breastmilk are susceptible to microorganisms, such as viruses, bacteria, and protozoa infestations because there are no antibodies for their protection (Stuebe, 2009).

Fjeld et al. (2008), whose study aimed at collecting baseline information on IYCF practices, attitudes, and knowledge in Zambia for adopting qualitative research methods, noted various barriers to the practice of EBF. The perception of insufficient milk flow by nursing mother, the fear of illness or death and thus unable to breastfeed, conventional method of mixed feeding, perception of ‘bad milk,’ and poor knowledge of breastfeeding advantages were identified as barriers to the practice of EBF (Fjeld et al., 2008). The researchers concluded that traditional birth attendants (TBAs) are the closest and most essential healthcare workers who can transmit the knowledge of EBF to nursing mothers for them to make informed infant feeding decision (Fjeld et al., 2008).

Ergenekon-Ozelci, Elmaci, Ertem, and Saka, (2006**)** explored the BF beliefs and practices of caregivers who migrated their villages forcefully to reside in shantytowns of Diyarbakir in Turkey using qualitative research methods. The researchers noted that caregivers, in general, were more optimist towards BF, but perceived colostrum in a negative way, none of the research participants practiced EBF, 9.9% of the caregivers initiated BF within 60 minutes postpartum, and 40% of the caregivers introduced CF before 4 months of age (Ergenekon-Ozelci et al., 2006). In all of these, caregivers’ educational level appeared to be a major determining factor that influenced the introduction of colostrum to neonates (Ergenekon-Ozelci et al., 2006).

Ergenekon-Ozelci et al. (2006) also noted that caregivers with little or no education believe that colostrum is inappropriate and should not be given to neonates and also that an expectant mother’s breast-milk is not healthy for infants, and exposure to sunlight attenuates breast-milk quality. The researchers concluded that cultural beliefs significantly influenced BF practices, and these practices have the potentials of harming neonates; therefore it is recommended that a comprehensive health training programs will be beneficial in addressing these cultural erroneous beliefs and practices in a culturally tactful manner (Ergenekon-Ozelci et al., 2006).

Table 1

Summary of Differences Between Milk: Comparing Breast Milk vs. Cow Milk and Infant Formula Composition

	Human Milk	Animal Milk	Formula
Bacterial Contamination	None	Likely	Likely when mixed
Anti-infective Factors	Present	Not Present	Not Present
Growth Factors	Present	Not Present	Not Present
Protein	Correct easy to digest	Too much difficulty to digest	Partly corrected
Fat	Enough essential fatty acids lipase to digest	Lacks essential fatty acids no lipase	Lacks essential fatty acids no lipase
Iron	Small amount well absorbed	Small amount not well absorbed	Extra added not well absorbed
Vitamins	Enough	Not enough A and C	Vitamins added
Water	Enough	Extra needed	May need extra
Hormones	Present	Not Present	Not Present

Note. Reprinted from *Breastfeeding* [PowerPoint presentation, Slide #15], by A. Haleem (2016). Retrieved from https://www.slideshare.net/azadhaleem/breast-feeding-64546851

The National Breastfeeding Policy in Nigeria

In the cause of protecting the wellbeing of nursing mothers and IYC, International Labor Organization enacted the Maternity Protection Convention, which guarantees a minimum period of about 98 days of paid maternity leave (Worugji & Etuk, 2005). The Convention on the Elimination of All Forms of Discrimination Against Women (ECDAW) also guarantees among other things the right for women to acquire education, the right to information, the right for the acquisition of all necessities of life, and right to improve self-worth, which favors the right for mother to breastfeed the child (Worugji & Etuk, 2005). Since this IFP improves the self-worth of nursing mothers, the right to breastfeed should be guaranteed and supported by their relatives, societies, employers, and the nation (Worugji & Etuk, 2005).

According to UNICEF (2016b), Nigeria is progressing toward the adoption of EBF in a rather slow pace, the country has increased its EBF rates from 12% to only 25% after 10 years. National policy on IYCF in Nigeria states that the federal government through relevant agencies concerned will ensure the advancement, protection, and support of EBF and appropriate CF from 6 months of age to guarantee a reduction in the morbidity and mortality rate of IYC, the optimal intellectual and physical development of IYC, and the overall wellbeing of the family and society at large (FMOH, Department of Family Health, 2000).

In the practice of infant feeding, the policy further stated that caregivers should breastfeed infants exclusively postnatally till 6 months, and only then should appropriate CF be introduced while IYC is still breastfed for about 2 years or beyond (FMOH, Department of Family Health, 2000). A nursing mother should exercise their right to breastfeed at their place of employment without being discriminated against or be exposed to any form of risk (FMOH, Department of Family Health, 2000).

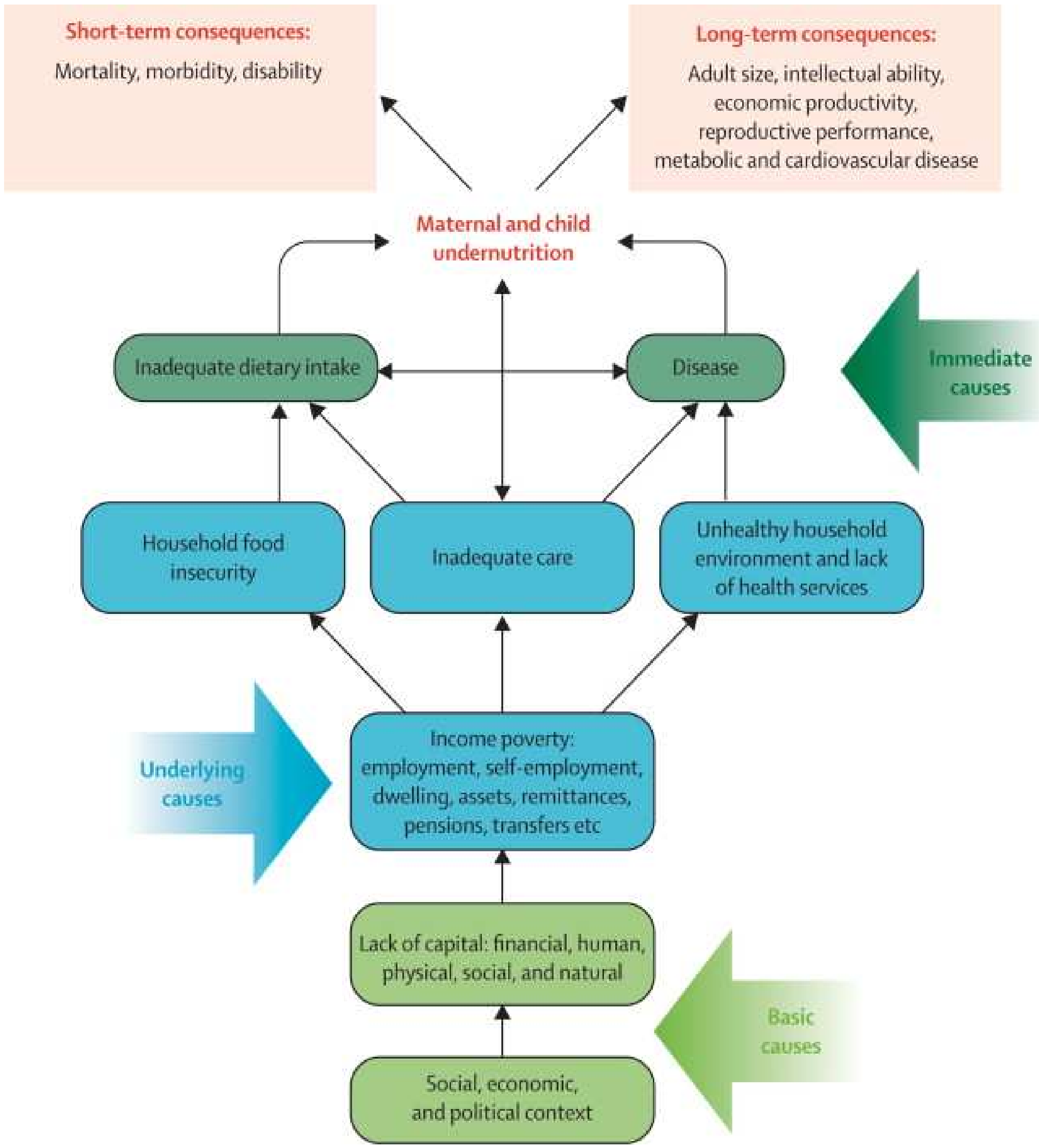

Figure 4: Conceptual framework of under-nutrition.

Note: Reprinted from *Improving Child Nutrition: The Achievable Imperative for Global Progress* (p. 4), by United Nations Children's Fund, 2013. This framework shows malnutrition occurs when dietary intake is inadequate, and health is unsatisfactory, being the two immediate causes of malnutrition.

Diversity of Infant Feeding Methods

The moment a woman attains puberty and goes through the process of conception and pregnancy, the female body undergoes dramatic postnatal growth, which culminates into lactation. Breastfeeding has a physiological and hormonal connection to cyesis, where the female breast is primed by estrogen and progesterone, which are responsible for the rapid increase of the ductal and alveolar systems all through gestation in expectation of lactation period (Biervliet, Maguiness, Hay, Killick, & Atkin, 2001). It is uncommon for women to experience physiologically-induced lactation failures; therefore the big question remains, "why do caregivers choose other forms of breastmilk substitutes other than breastmilk?" Marchione (1980) maintained that traditional caregivers were always happy to breastfeed their babies, and this model feeding method was practiced up until there were was an explosion in the advertising of infant formula by multi-national companies; only then was there a drastic decline in the practice of breastfeeding which is significantly detrimental to the health of IYC. Arnold (1989) argued that the act of breastfeeding is predetermined and designed by cultural influences and must be transformed and understood in the aspect of a person's assessment of the experiences entrenched in a multifaceted family, social, and cultural interconnection.

The world we live in today is culturally diverse; it is only normal for theses societies to be respected for their cultural dissimilarities (Leininger, 1988; Mays, 1986). Race, ethnicity, socioeconomic status, maternal age, and parent's level of education are some of the factors that influence infant feeding method (Barlow, 1984; Bertelsen & Auerbach, 1987; Stahlberg, 1985; Sugarman, 1989; Susser, Watson, & Hopper, 1985). Additionally, the feeding characteristics of the nursing mother, which is hereditary, IYC responses toward the caregiver, and the family history of the nursing mother are all responsible for diversity of infant feeding methods (Lawrence, 1985; Thornton, 1984; Weichert, 1975) maintained that the problems intrinsic in BF in several cultures and societies is the fact that the female mammary gland principally symbolizes sexuality. Therefore some nursing mother will always be reluctant to breastfeed their infants for fear of unfounded myth that breastfeeding would increase the chances of their breast sagging (Rinker, Veneracion, & Walsh, 2008).

Ogunba (2010) noted that diversification in CF of IYC is imperative in achieving the desired essential nutrients necessary for ideal growth and development. Consumption of various variety of foods by IYC is an important strategy that guarantees intake of nourishment needed for the maintenance of life; therefore, availability of assorted foods is encouraged (Ogunba, 2010). Developing countries whose populations are poor lack diversification in CF of IYC, and foods given to IYC are primarily starchy staples, occasionally seasonal fruits and vegetables, but most times, there is little or no animal products to meet their protein requirements (Arimond & Ruel, 2004). It is essential for IYC to consume a variety food which is improved and fortified because IYC not older than 24 months of age are known to grow and develop rapidly in this age bracket and also susceptible to illnesses; scientific studies have shown that feeding practices are deplorable in most developing nations (Ogunba, 2010).

Dietary diversity in IYC is correlated with enhanced nutritional status (Arimond, & Ruel, 2002). In developing nations, nutritionally imbalanced foods (Lutter, & Rivera, 2003), absence of dietary diversity (Onyango, 2003), and family structure and their socioeconomic status (Bronte-Tinkew & DeJong, 2004) are all contributing factors to poor nutritional status of IYC. The health, physical growth, and cognitive development of IYC can be assessed by the quality of food they consume (Crepinsek, Burstein, & Abt Associates, 2004), thus recommending a diversity in IYC food is imperative to guarantee that nutritional requirements are achieved and sustained (Ogunba, 2010).

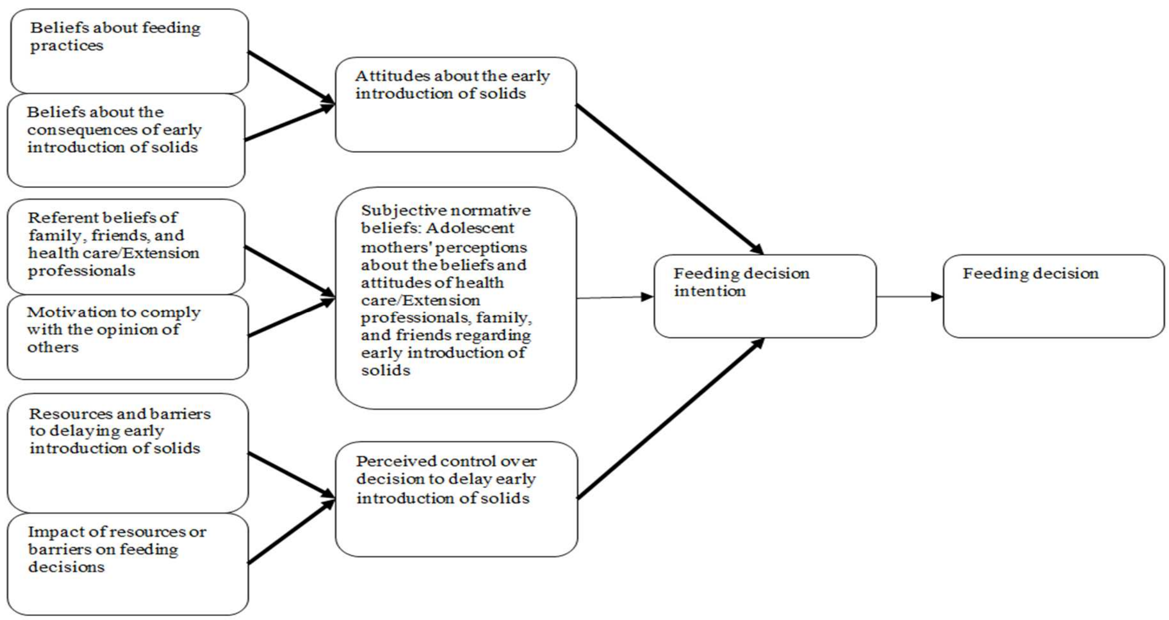

Figure 5: Conceptual model for infant feeding practices.

Note: Reprinted from "The Voice of Low-Income Adolescent Mothers on Infant Feeding" by M. A. Horodynski & K. J. Mills, 2014, *Journal of Extension, 52*(6), p. n6. Theory of planned behaviors relative to infant feeding decisions: Antecedents impacting behavioral beliefs, referent beliefs, and control beliefs.

Recommended Nutrient Intake by Infants and Young Children (IYC)

Complementary diets characterized by low energy density is capable of limiting consumption; usually the required average energy density of IYC is 4.2 KJ (1 kcal)/g or more, which is dependent on meal frequency. It is important for a complementary diet to have good appearance and aroma when presented and a mixed variety of textures, all in an attempt to be palatable to IYC (Michaelsen, 2000). The energy required from complementary diets is dependent on the energy got from breastmilk and the individual IYC energy requirement, this makes it challenging to assess the average energy requirement from CF alone (Michaelsen, 2000). However, the WHO/UNICEF report on CF in emerging nations tried to estimate this energy requirement.

Table 2

Age-Specific Estimates of Energy in MJ (kcal) Day Required from Complementary Foods in Industrialized and Developing Countries, Assuming an Average Breast-Milk Intake

Group	Developed Countries		Developing Countries	
(Months)	Brest Milk	Complementary Foods	Brest Milk	Complementary Foods
0-2	2.1(490)	0.0(0)	1.8(437)	0.0(0)
3-5	2.3(548)	0.0(2)	2.0(474)	0.3(76)
6-8	2.0(486)	0.8(196)	1.7(413)	1.1(269)
9-11	1.6(375)	1.9(455)	1.6(379)	1.9(415)
12-23	1.3(313)	3.3(779)	1.5(346)	3.1(746)

Note. Reprinted from *Feeding and Nutrition of Infants and Young Children: Guidelines for the WHO European Region, With Emphasis on the Former Soviet Countries* (p. 50), by K. F. Michaelsen, 2000. The table illustrates differences between the energy needs of IYC and energy from a breast-milk intake based on available data from developing countries, where infants often have a low body weight

Table 3

Minimum Energy Density in KJ (kcal)/g of Complementary Foods by Number of Meals per Day, Breast Milk Intake, and Age Group

Age	Average Breast-Milk Intake			No Breast-Milk Range		
(months)	2 meals	3 meals	4 meals	2 meals	3 meals	4 meals
6-8	3.8(09)	2.5(0.6)	1.6(0.4)	7.1(1.7)	4.6(1.1)	3.8(0.9)
9-11	5.0(1.2)	3.4(0.8)	2.5(0.6)	7.5(1.8)	5.0(1.2)	2.8(0.9)
12-23	6.3(1.5)	4.2(1.0)	2.9(0.7)	8.4(2.0)	5.4(1.3)	4.2(1.0)

Note. Reprinted from *Feeding and Nutrition of Infants and Young Children: Guidelines for the WHO European Region, With Emphasis on the Former Soviet Countries* (p. 53), by K. F. Michaelsen, 2000. This table shows the energy densities needed to satisfy energy requirements assuming an average breast-milk intake.

In conditions of low intake where energy consumption falls far short of the energy requirement of IYC, they will experience some decline in their physical activities and or a decline in growth rate; if the shortfall lingers, the development of protein-energy malnutrition is very likely (Michaelsen, 2000). There is also a high possibility of protein metabolization for energy in the event of low energy consumption, subsequently resulting in protein deficit (Michaelsen, 2000). Protein is a nutrient used as energy sources (calories), which are made up of building blocks called amino acids; they are the vital part of all living organisms, mainly as structural constituents of body tissues that are required for growth and maintaining good health (Shiel, 2018c).

In situations where there is the high consumption of energy that exceeds more than is required by the body, this results in fat deposit and subsequent weight gain; however this fat deposit is an integral part of normal infant growth, which would decline at about 6 years of age (Michaelsen, 2000). Evidence-based studies have demonstrated that there is no association between weight gain due to fat deposition and obesity in adulthood (Heird, 1991; Rolland-Cachera et al., 1987). The definite aggregate of food needed by IYC is determined by the energy density of that particular food presented (WHO, 2009). Breastmilk contains approximately 0.7 kcal per ml, while complementary diets, though varying depending on food variety, contain appropriately between 0.6 and 1.0 kcal per ml. It is expected that CF will possess greater energy density than breastmilk, at least 0.8 kcal per gram (WHO, 2009)**.** In achieving 1.0 kcal per gram in a complementary diet, the food must be thick in texture, containing fats and oils, which are requirements for most energy-rich diets (WHO, 2009).

It has been demonstrated that IYC have an energy intake per kilogram body weight as seen in Tables 1 and 2, this is approximately 2–3 times that of grown-ups; considering that IYC need to consume large amounts of energy to meet their energy requirements, the principal determining factor of energy intake is energy density in CF, thus excessively low energy density consumption might result in energy shortfall, subsequently resulting in nutritional stunting (Michaelsen, 2000). Complementary food containing low fat will naturally produce low energy density diets, therefore to achieve the appropriate amount of energy density, the IYC must ingest a large quantity of food which most times is not feasible to achieve (Bier et al., 1999; Koletzko, 1999). Over ingestion of energy-dense complementary diets may predispose the IYC to gain excessive weight; this is responsible for the high risk of obesity in IYC (Baird, et al., 2005; Monteiro, & Victora, 2005; Ong & Loos, 2006). Studies have demonstrated that fat content in complementary foods is a significant determining factor of energy density, and it is always necessary for fat content to always be above 25% of energy intake, which may compensate for periods of poor appetite or repeated infections (Agostoni et al., 2008).

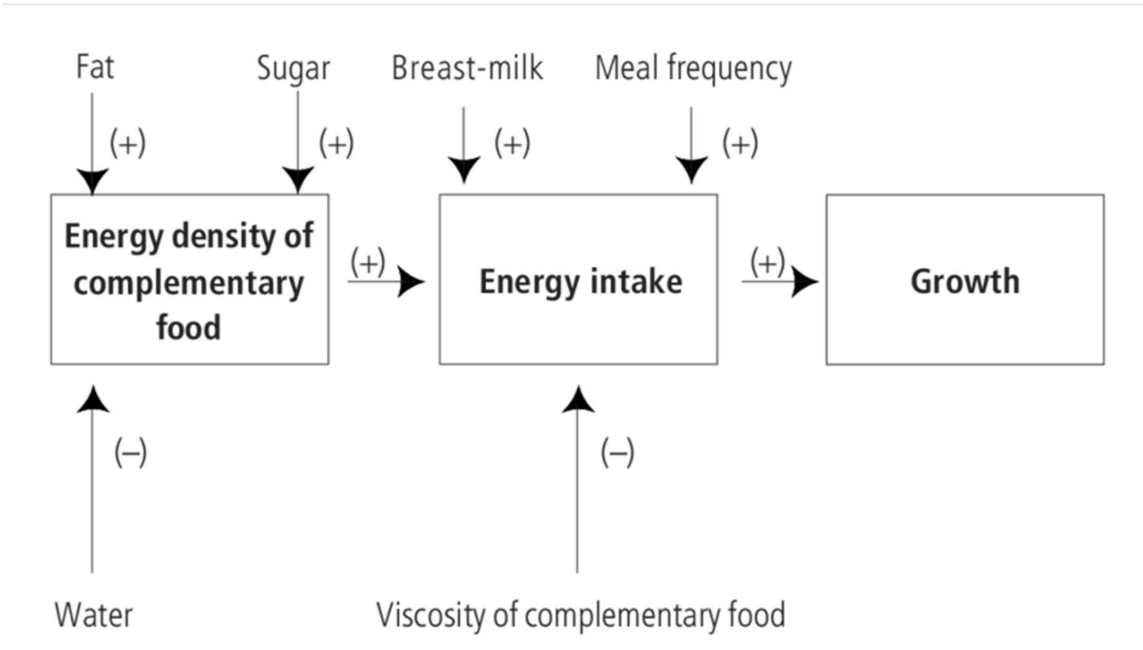

Figure 6. Factors affecting energy density of CF and energy intake by IYC.

Note: Reprinted from *Feeding and Nutrition of Infants and Young Children: Guidelines for the WHO European Region, With Emphasis on the Former Soviet Countries* (p. 52), by K. F. Michaelsen, 2000. This figure illustrates several ways in which the energy density of a complementary food can be increased; the addition of fat or sugar shows an increase in the energy density without increasing the viscosity of the food.

The Influence of Socioeconomic and Demographic Factors

There is no doubt that various efforts have been made by the government and some non-governmental organizations in the promotion of satisfactory nutritional improvements such as modifications in feeding behaviors, which is intended to positively impact the mortality rates over a period of time (Ezechukwu, Egbuonu, Ugochukwu, &

Chukwuka, 2004). Appropriate complementary feeding frequency should be increased as the IYC is growing in age (WHO, 2001). Various feeding practices carried out by caregivers is essentially dependent on caregivers' knowledge, attitude, a socio-cultural tradition that influences them (Ezechukwu et al., 2014). Isingoma, Samuel, Edward, and Maina (2017) examined the effect of socio-demographic characteristics of households vis-à-vis the nutritional status, morbidity ratio of IYC, and also the correlation of socio-demographic factors with IYC complementary feeding.

Socio-demographic factors has a direct influence on timing of complementary foods introduction, meal frequency, and the nutritional diversity of complementary feeding; socio-demographic factors also exacerbated the configuration of diseases among IYC in Uganda (Isingoma et al., 2017). Scholars argued that maternal education and age of caregivers were principal socio-demographic indicators that influenced the adoption and practice of complementary feeding in IYC in Uganda (Isingoma et al., 2017). Therefore, providing counseling facilities to caregivers is imperative in the promotion of complementary feeding practices (Isingoma et al., 2017).

Summary and Conclusion

The chapter provides comprehensive background information on EBF and CF vis-à-vis the nutritional status of IYC in Northwest Nigeria. Malnutrition prevention among IYC is imperative, and it is a vital public health strategy that guarantees the survival of IYC not older than 2 years in developing countries. This research study objective is aimed at examining the relationship between EBF, appropriate CF, and the nutritional status of IYC. Studies have demonstrated that IYC, who were fed with breastmilk exclusively and later introduced to appropriate CF, had adequate growth, health, and developed to their full potential (WHO, 2009).

The theoretical foundation of this research study was based on TPB. The study demonstrated that caregivers choice to BF was exclusively a personal decision; factors like the social group and available social support scheme are most times what caregivers rely on in decision making (Sheehan et al., 2013). TPB has been extensively applied in BF studies; the theory outlines the way a particular behavior is followed by a behavioral intention, describing how the implementation of a particular behavior is entirely dependent on the degree of a person's behavioral intent (Sheehan et al., 2013)**.** A review of relevant literature illustrated that BF intention is a strong predictor of BF initiation and continuation, while several studies have concluded that introduction of CF in the 6th month is vital, and it is the primary modifiable predictors of intention in the introduction of CF (Hamilton et al., 2011). Therefore, the central foundation of TPB is that the immediate antecedent of a behavior is the individual's intention to carry out the behavior (Ajzen, 2002, p. 107).

Several studies have also established that all through infancy, the growth of IYC is determined by nutritional intake and intrauterine conditions (Lejarraga, 2012). Genetic factors, nutritional factors, and socio-economic and environmental conditions are a few factors known to directly influence the growth and development of IYC (National Research Council, 2004). The scope of this study is on the effect of nutritional factors in the survival, development, and growth of IYC in Northwest Nigeria. The study noted that exclusively breastfed IYC who were introduced to appropriate CF at 6 month of age, while still BF were known to suffer less incidences of childhood related illnesses

(Godfrey & Lawrence, 2010), these feeding pattern is one the most effective public health strategy in the reduction of IYC morbidity and mortality (American Academy of Pediatrics, 2005; Piñeiro-Albero et al., 2013).

Chapter 3 of this study comprises of the synopsis of the research objective, suitable methodology for achieving those objectives methods that will be adopted for the research study. Vital information on secondary data to be collected will be provided and analyzed with multiple linear regression, which was adopted as predictive analysis to delineate the correlation between two or more independent variables and one continuous dependent variable. Chapter 3 will also comprise vital information on the methods and reasons behind the choice of survey tools.

Chapter 3: Research Method

In Nigeria, a Nigerian child dying is about 30 times more likely before 5 years of age compared to their counterparts in developed countries (UNICEF, 2001). In Nigeria, there is a higher prevalence of malnutrition and other diseases responsible for IYC mortality in the northern part of the country compared to the south (UNICEF, 2001). Jason, Nieburg, and Marks (1984) maintained that a distinguishing factor from developing nations and developed economies is their infant mortality ratios. Monte and Giugliani (2004) noted that adequate CF of a breastfed infant is essential for optimum growth and development of the child. Policies and programs targeted at infant mortality and morbidity reduction should consider feeding practices and timing as well, as mortality and morbidity causes in the selection of most effective and sustainable interventions. The purpose of this study was to identify correlations between current feeding practices of infants not older than 2 years of age in Northwest Nigeria and their nutritional status with the intent of identifying gaps in the recommended IYCF practices in Nigeria

Dewey, Cohen, Brown, and Rivera (2001) noted that premature introduction of complementary diets raises morbidity and mortality chances of an infant. This occurs primarily due to the reduction of the consumption of protective elements such as immunoglobulins, lysozyme, and lactoperoxidase found in breastmilk that prevent and restrict different external organisms (Dewey et al., 2001). Breastmilk provides protection to young children from various infections, while complementary diets could be the origin of contaminants for children (Dewey et al., 2001). Also, introducing complementary foods too early truncates BF period, thereby restricting uptake of essential nutrients such as zinc and iron found in breast milk and resulting in deficiencies of these nutrients (Bell, Keen, & Lönnerdal, 1897; Oski & Landaw, 1980; Zeitlin & Ahmed, 1995). Delayed introduction of complementary diets is detrimental to the achievement of developmental milestones for infants, because, from 6 months of age, breastmilk alone becomes insufficient, resulting in micronutrient deficiency and malnutrition (Dewey, 2003; WHO & UNICEF, 1998).

Methodological Issues

Huffman, Zehner, and Victora (2001) maintained that assessing the effect of BF on IYC's morbidity and mortality must take into account all of the BF patterns that are practiced. The timing of breastmilk initiation depends on how quickly BF is initiated postnatal, and it is known as timely initiation when BF commences within the first 30 minutes to 1 hour (Huffman et al., 2001). EBF is the absence of other foods and liquids, including water, for a period of 6 months. With partial BF, the child is given breastmilk as well as other forms of food. Huffman et al. argued that EBF or partial BF research can be conducted either by 24-hour recall, a recall of foods/liquid consumed in the previous 1 to 2 weeks or recall of whatever the baby has ever consumed. The primary methodological concern in researching the effects of BF on the death of neonates is the need for comparing clusters in such a way that there is segmenting; sets of elements are divided into subsets (Jason et al., 1984).

Habicht, Davanzo, and Butz (1986) argued that at every point of data collection, comparing clusters are affected by various categories of biases; these include self-selection bias, reverse causality, and confounding. These biases are also present when evaluating the effect of BF throughout infancy and the effects of solid /semisolid foods on young children when introduced.

Research Design and Rationale

I used a quantitative cross-sectional design that was comprised of two stages of cluster sampling to identify patterns of association between EBF for the first 6 months and nutritional status of the infant. I also aimed to establish the correlation between age-appropriate CF from 6 to 24 months of age and nutritional status of the infant. EBF was determined by BF initiation within the first hour postnatal and continually feeding infant solely breastmilk until the infant is 6-month-old. CF was determined by the introduction of semisolid and solid foods from the 6th month. The nutritional status of IYC was determined by weight for infant age (underweight), height for infant age (stunting), and weight for infant height (wasting). Demographic covariates of age, education, parity, and house-hold income and cultural norms were controlled for and or adjusted.

I used secondary data from the National Bureau of Statistics and United Nations Children’s Fund (2017), which contains the 2017 multiple indicator cluster survey results to understand the correlation between EBF for the first 6 months and the nutritional status of the young child in Northwestern Nigeria. There is a need for more studies to understand the relationship between age-appropriate CF from 6 to 24 months of age and the nutritional status of IYC in Northwestern Nigeria. Secondary data from the National Bureau of Statistics, Federal Government of Nigeria (2014) was adopted in trying to understand how appropriate IYC feeding practices could be used to categorize determining factors that dictate the health outcomes of IYC. Because of the advantages of its ability to test hypotheses through deductive reasoning and statistical analysis, a quantitative approach method was the most appropriate for this research (Teddlie & Tashakkori, 2009).

The use of secondary data was pertinent in the generalization of the research findings from this project, which will add to the understanding of disparities interconnected with EBF, CF, and nutritional status of IYC. Johnston (2017) noted that researchers regularly adopted secondary data analysis in the study of an entire population, due to the increased magnitude on which outcomes can be generalized. Secondary data increases sample size, population representativeness, and the number of observations; comprehensive generalizations are achieved by the contribution of all these factors (Frankfort-Nachmias & Nachmias, 2008). To acquire the primary dataset, a written request was made to the NNHS. My contact at the NNHS provided the SAS raw data files, codebook, and operator's manual for reference. With the research questions in mind, the codebook variables were scrutinized to ensure these questions could be addressed after data analysis. The raw data were not accessed until institutional review board, and committee approvals were received.

Description of Research Variables

The research variables for this study were derived from the feeding practices and nutritional status of infants 0–24 months of age in Northwest Nigeria. The independent variables were demographic covariates of age, educational level, parity, house-hold income, and cultural norms. The dependent variable was the nutritional status of infants. EBF for 6 months: This is period of life is no longer than 6 months from birth, and infants are fed entirely on breastmilk (no solid or liquid of any sort) from the nursing mother or caregiver (UNICEF, 2015b). The research covariates or control variables were defined as maternal age (i.e., the nursing mother's age in years at the time of delivery), maternal educational level (i.e., the highest educational level completed by the nursing mother), maternal parity (i.e., the frequency at which a woman has been pregnant, and she carries it to a viable gestational age regardless of the outcome), maternal income (i.e., the gross earnings or income generated by a nursing mother), maternal marital status (i.e., the nursing mother's state regarding whether she is single, married, separated, divorced, or widowed), and nutritional status (i.e., the state of the human body that is a direct result from intake of foods in response to nutritional requirements).

Sampling Methods and Study Population

UNICEF and NNHS have jointly conducted several nutritional surveys regularly, such as MICS. A cross sectional survey adopting Standardized Monitoring and Assessment of Relief and Transitions (SMART) methods was introduced to help to continually track achievements made by providing estimates of the number of lives saved inside the scheme's time frame (NNHS, 2014). A survey of the nutritional and health status of IYC below the age of 5 and women in their reproductive ages (15–49 years) was carried out in all states of the country (NNHS, 2014). Data collection involved 25,210 households; 20,060 IYC below the age of 5 and 23,688 women of reproductive age and data on IYC feeding practices were collated adopting a day recall period from 8,935 IYC aged 0–23 months of age (NNHS, 2014).

Galaxy Tab 4 7.0 was used in field data collection, and gathered data were sent electronically to a central server via 3G Internet connectivity via Form-Hub (Open Data Kit) and instantly analyzed for relevant information. Collected data were analyzed using STATA version 14.0, while emergency nutrition assessment for SMART application was adopted to evaluate anthropometric measurements quality (National Bureau of Statistics, Federal Government of Nigeria, 2014).

Power Analysis

The process of preparing to conduct this research, the calculation of power analysis was carried out to estimate an appropriate sample size that was needed to reject the null hypothesis at a set significance level if the alternative hypothesis turns out to be true. Alpha, power, and effect size were the parameters adopted. The alpha level was adopted in the likelihood where the null hypothesis is rejected, and in a situation where the null hypothesis is true, this is usually standardized at 0.05, signifying a 5% probability null hypothesis will be rejected when it is actually true (Department of Psychology, Softpedia, 2014).

Using G*Power sample size calculating software for multiple linear regression, with an alpha level of 0.05, with 80% power and effect size of 0.02, where the probability of $Y = 1$ and $X = 1$, the required sample size was 395. Also, to be adopted will be independent *t*-test to demonstrate the statistical difference between the mean of the dependent variable and that of the independent variable.

Operationalization of Variables

This covers demographic information for the exposure (independent variables), namely; age, parity, education, marital status, and socioeconomic status. Others are EBF, mixed feeding, and CF. The outcome (dependent) variables will be identified from the secondary data set; the nutritional status of the child will fit into any of the four categories, which include normal, underweight, stunting, and wasting. Measurement of the exposure variable will be nominal for most of the determinants, as there are categorical variables. Only the age is measured on the ratio scale, and the mean age can be determined. For the outcome variables, all would be nominal. Coding for the variables according to WHO IYC growth standards and identification of severe acute malnutrition in IYC (normal, underweight, stunting, and wasting) are done to enable comparison where necessary.

Statistical Analysis Plans

SPSS package will be adopted in performing this quantitative analysis study mainly due to the acceptability, compatibility and robustness of the software in its collation and analysis of variables. Data transformation will be carried out using the SPSS software; such as categorical variables which are normal, underweight, stunting, and wasting which will be appropriate for required multiple linear regression. Some levels of analysis will reflect the features of the individual caregiver that include caregiver's age, educational level, socio-economic status, and the different feeding practices. Because the exposure variables are mostly nominal scale, the descriptive statistics was carried out primarily for summary and analysis of the demographic data.

The R-squared is a statistical measure, which demonstrates the close-fitting of research data in the regression line, therefore the addition of an independent variable, the model effect the dependent variable by the production of *R* squared and *R* squared change. The standard error estimates the accuracy of predictor variables and the F value will determine the statistical models fitted to a data set by comparison to enable better identification of models that best fits the population, the statistical significance is determined when $p < 0.05$, and the study beta coefficient is a comparison of the effect of each specific exposure variable such as education, marital status, and socioeconomic status has on the outcome variable which is nutritional status. Only age will be transformed into the age group and will have both frequencies and mean ages as descriptive statistics. The outcome variables are normal weight, underweight, stunting, and wasting. Cross-tabulations will be done for each of the exposure characteristics and each of the outcome variables.

Multiple linear regression was adopted as predictive analysis to describe the correlation between two or more independent variables and one continuous dependent variable. Multiple linear regression analysis was the most suitable statistical technique for the study hypotheses because beyond analyzing the association between two or more independent variables and one continuous dependent variable; it also determines which had the greatest effect on the dependent variable.

From the cross-tabulations, a Chi-square tests will be done to determine the strength of association for each of the exposure characteristics and the outcome variables mentioned. Each of the outcome variable is designed to respond to each research question. In order to determine the main determinants of the observed outcomes, multiple linear regression will clarify the association between a continuous dependent factor and several independent factors; this is because categorical variables are appropriate for multiple linear regression (Creswell, 2009). Scatter plots demonstrate the degree to which a variable is influenced by another; the extent of this correlation between two variables is shown.

Confounding Variables

Confounding variables are the unwanted independent variables that have influence on the outcome variables, even though the researcher has no interest in these variables, and the researcher has no control of these variables, notwithstanding the overall effect on the outcome variable. Controlling for the confounding variable effect, caregiver and IYC features were evaluated to demonstrate their influences on the dependent variable. These comprise of gender of IYC, infant size at birth, infant immunization history, caregiver's body mass index (BMI), caregiver's religion, and caregiver's ethnicity.

Ethical Considerations

Not all research involves eliciting and collation of data from study participants, sometimes a huge amount of data has already been being collected through various research survey activities, which can be analyzed to answer important research questions and also produce hypotheses (Tripathy, 2013). Even though there were no identified potential risks, other ethical issues like protecting study participants from harm and ensuring anonymity at all times were achieved through obtaining research approval and storage of coded data in password-protected computer (Creswell, 2012; Lodico, Spaulding, & Voegtle, 2010).

Threats to Validity

A number of factors and situations is capable of threatening the validity of a research study, thus influencing the quality and outcome of the final results (Aschengrau & Seage, 2014; Creswell, 2014). Therefore, it is important for an empirical study to have validity (Aschengrau & Seage, 2014; Creswell, 2014). The validity of a scientific study is usually assessed based on two vital techniques: (a) external validity and (b) internal validity (Aschengrau & Seage, 2014; Creswell, 2014). Internal validity aids investigators in determining cause and effect correlation between variables, while external validity establishes the degree to which generalization of research outcome of the population of interest is carried out (Creswell, 2009, p. 162). External validity can be said to be the estimation of the truth of research outcomes that are generalizable (Trochim, 2006). Thus, threats to the validity of scientific research must be considered all through the research and implementation design phases of the study (Aschengrau & Seage, 2014; Creswell, 2014).

With this insight, population validity is more credible when the study population has high representation; therefore, the more confident we are to generalize the research outcome of the population**.** In this secondary research study, the methodology adopted in the collection of data is capable of threatening the validity of the research study; response rate or participants' misunderstanding of particular survey questions re also capable of threatening the validity of the research (Smith et al., 2011). Therefore, determining the mode, a survey question is formulated to help determine if the questions give room for vague answers, thereby reducing data validity (Smith et al., 2011). Investigators using secondary data sets should bear in mind that the information collated in the secondary data set may not have been intended for research purposes, thus lacking some level of research accuracies (Smith et al., 2011).

Missing Data

In public health research study, the occurrence of missing data or values is prevalent, and these missing data are capable of having significant effect on the overall study outcome. Therefore, using a suitable technique in the handling of settings with missing data in the course of implementing secondary analyses is imperative for the reduction of bias and reaching a valid outcome (Langkamp, Lehman, & Lemeshow, 2010). These can be achieved by carrying out subsequent analysis to guarantee that missing data do not vary methodically from data adopted in the research; this is possible by ensuring that the right imputation method is applied and the study research questions re-analyzed, where it is required to confirm that the result is not so different because of the omitted observations with missing data.

Summary

To determine the relationship between the feeding practices of IYC and their nutritional status, I chose to use multiple linear regression; this will clarify the association between a continuous dependent factor and several independent factors. An independent *t*-test to show the statistical difference between the mean of the dependent variable and that of the independent variable and the multiple linear regression comprised the primary statistical analysis methods. The entire data analysis was conducted with SPSS; the statistical calculation was carried out at a 95% confident interval. This research explored the secondary data set of multi-indicator cluster survey (MICS) (National Bureau of Statistics & UNICEF, 2017) obtained from the National Bureau of Statistics (NBS). The data analysis results are presented in Chapter 4, while the discussion of the results is provided in Chapter 5.

Chapter 4: Findings

In this chapter, I present the research sample and the results of the statistical analysis carried out to answer the research questions and test hypotheses from a cross sectional secondary data study. The purpose of this quantitative study was to identify a correlation between current feeding practices of infants not older than 2 years in Northwest Nigeria and their nutritional status with the intent of identifying gaps in the recommended IYCF practices in Nigeria.

This chapter is structured into various sections that comprise the data collection method, descriptive analysis, preliminary analysis, and the primary analysis. The descriptive analysis segment is comprised of the descriptive statistics of the variables. The preliminary analysis segment shows the *R*-squared statistical measure, which determines the close-fitting of research data in the regression line. The standard error estimated the correctness of predictor variables, while the *F* value determined the statistical models fitted to a data set by comparison to enable better identification of models that best fits the population. The statistical significance was determined when $p < .05$, and the study beta coefficient was a comparison of the effect of how each exposure variable (i.e., education, marital status, and SES) has on the outcome variable (nutritional status).

Age was transformed into the age group and had both frequencies and mean ages as descriptive statistics. Pearson's Chi-square test was carried out to ascertain if the observed frequency of a nominal variables (gender, place of residence, educational level, and wealth quintile) group was significantly different from the known frequency in the population. Independent *t*-test was adopted to demonstrate the statistical difference between the mean of the dependent variable and that of the independent variables. The primary analysis segment shows the analyses conducted to address each research question; multiple linear regressions were adopted as predictive analysis to describe the correlation between two or more independent variables and one continuous dependent variable. The alpha level for the study was set at $\alpha = 0.05$. Any findings with *p*-values of less than 0.05 were presented as nonsignificant. Measurement of the exposure variable was nominal for most of the determinants as there are categorical variables.

Research Questions and Hypotheses

RQ1: *Is there a correlation between EBF for the first 6 months of an infant's life and nutritional status of the infant in Northwestern Nigeria?*

$H_1$1: EBF in the first 6 months of infant's life correlates with nutritional status of the infant in Northwestern Nigeria after controlling for poverty level, educational level, age, and norms.

$H_0$1: EBF in the first 6 months of an infant's life, does not correlate with the nutritional status of the baby in Northwestern Nigeria after controlling for poverty level, educational level, age, and norms.

RQ2: *Is there a correlation between age-appropriate CF from 6 to 24 months of age and nutritional status of the infant in Northwestern Nigeria?*

$H_1$2: Age-appropriate CF from 6 to 24 months of age is correlated to the nutritional status of the infant after controlling for poverty levels, educational levels, age, and norms.

$H_0$2: Age-appropriate CF from 6 to 24 months of age is not correlated to the nutritional status of the infant after controlling for poverty levels, educational levels, age, and norms.

Data Collection

I used the MICS5, secondary data collected in 2017 by NBS and UNICEF, which was the most recent survey carried out. The universal MICS program was started by UNICEF in the early 90s as a household survey plan that aims at supporting nations in collecting and analyzing globally comparable data whose indicators are related to children and women. MICS surveys were focused on measuring fundamental indicators that allowed data to be generated by various countries pertinent to their programs and policy formulation and the effective monitoring of the progress achieved in the set Sustainable Development Goals (SDGs; NBS & UNICEF, 2017). The survey sampled 9,376 women 15–49 years of age, with an 95.6% overall response rate and 9,519 children under 5 years of age with an overall response rate of 98.1% in the Northwest geopolitical zone; the total household number sampled in the Northwest geopolitical zone was 7,680, with a 99.6% overall response rate (NBS & UNICEF, 2017).

Results

Before the analysis began, the distribution of each item was examined. For categorical variables, the number of responses at each level was checked to make sure all variables could be analyzed. For variables with a level that had less than 10% of the sample, responses were recoded so that the group sizes were more equivalent. The alpha level for the study was set at $\alpha = .05$. Any findings with *p*-values less than .05 were presented as nonsignificant.

Preliminary Analysis: Research Question 1

Variables

Independent variable: EBF measured as a categorical (nominal) variable, with 0 = no, 1 = yes.

Dependent variables: Nutritional status all measured as continuous (scale) variables.

- Underweight - Weight for Age (WFA *z*-score)
- Stunting - Height for Age (HFA *z*-score)
- Wasting - Weight for Height (WFH *z*-score)

Cofounding variables:

- Child's age (months)
- Child's gender
- Poverty level measured as wealth quintile (nominal variable): 1 = poorest to 5 = richest
- Mother's educational level (nominal): 1 = none to 5 = higher
- Mother's age (nominal): 1 = 15–19, 2 = 20–24, 3 = 25–29, 4 = 30–34, 5 = 35–39, 6 = 40–44 and 7 = 45–49
- Place of residence (nominal): 1 = urban, 2 = rural

Descriptive statistics

Underweight. After data cleaning, the total number of young infants not older than 6 months of age was 898. The frequencies and percentages for exclusive BF, male gender, place of residence, wealth index quintile, maternal age, and maternal education all are demonstrated in Table 4. A large population of infants (77.8%) did not have exclusive BF, and almost all of the infants (86.6%) were underweight. A small population of infants was exclusively breastfed (22.2%), and also a small number of these infants (13.4%) were underweight. More than three-quarters of the infants sampled lived in the rural area (80.9%), and 87.0% of them were underweight. The participants' sampled showed 32.5% of them fell among the poorest in the wealth index quintile, and in this category, 44.8% of the infants were underweight. A quarter of the population (8.3%) were the richest, and 3.3% of this population was underweight. Maternal age was somewhat evenly distributed with the age group of 20–24 representing the second-largest population (22.2%); equally, 22.2% of these children were underweight. The age group 25–29, represented the largest population (27.8%), 23.8% of infants in this age group were underweight. The age group of 45–49, representing the smallest population (2.6%), 2.5% of infants in this group were underweight. Maternal level of education showed non-formal education representing almost half of the entire population sampled (47.0%); in this category, 44.8% of the infants were underweight. Primary education was 13.1%, and 9.6% of the infants in this category were underweight. Secondary/secondary-technical had the smallest population (4.1%), and 1.7% of infants in that category were underweight. The WHO (2006) maintained that wasting is weight-for-height (WHZ) below -2 standard deviations of the WHO Child Growth Standards median in a given population; underweight is weight-for-age (WAZ) falls below -2 standard deviations of the WHO Child Growth Standards median, and stunting is length- or height-for-age (L/HAZ) below -2 standard deviations of the WHO Child Growth Standards median.

Table 4

Frequencies and Percentages of Study Variables of Exclusive Breastfeeding, Gender, Place of Residence, Mother's Age, Wealth, and Education by underweight categories (N= 898)

		Underweight [WAZ < -2.00]			
		No		Yes	
		N	%	N	%
Exclusive breastfeeding	No	513	77.8	207	86.6
	Yes	146	22.2	32	13.4
Male gender	No	347	52.7	108	45.2
	Yes	312	47.3	131	54.8
Urban residence	No	533	80.9	208	87.0
	Yes	126	19.1	31	13.0
Wealth index quintile	Poorest	214	32.5	107	44.8
	Second	214	32.5	72	30.1
	Middle	107	16.2	33	13.8
	Fourth	69	10.5	19	7.9
	Richest	55	8.3	8	3.3
Mother's age [age groups]	15–19	66	10.0	38	15.9
	20–24	146	22.2	53	22.2
	25–29	183	27.8	57	23.8
	30–34	127	19.3	43	18.0
	35–39	84	12.7	27	11.3
	40–44	36	5.5	15	6.3
	45–49	17	2.6	6	2.5
Mother's education	None	158	24.0	89	37.2
	Non-formal	310	47.0	107	44.8
	Primary	86	13.1	23	9.6
	Secondary/ Secondary-technical	78	11.8	16	6.7
	Higher	27	4.1	4	1.7

Table 5

Pearson Chi-Square Tests of Young Infants Below 6 Months

		Underweight [WAZ < -2.00]
Exclusive breastfeeding	Chi-square	8.48
	df	1
	Sig.	0.00*
Male gender	Chi-square	3.91
	df	1
	Sig.	0.05*
Urban residence	Chi-square	4.60
	df	1
	Sig.	0.03*
Wealth index quintile	Chi-square	15.77
	df	4
	Sig.	0.00*
Mother's age [age groups]	Chi-square	6.91
	df	6
	Sig.	0.33
Mother's education	Chi-square	20.52
	df	4
	Sig.	0.00*

Note: * The Chi-square statistic is significant at the .05 level.

Pearson's Chi-square value presented in Table 5 showed the percentage of young infants below 6 months of age. The relationship between exclusive breastfeeding and underweight was significant X^2 (1, N = 898) = 8.48, $p > .01$. The association between male gender and underweight was statistically significant X^2 (1, N = 898) = 3.91, $p > .05$. The association between urban residence and underweight was also statistically significant X^2 (1, N = 898) = 4.60, $p > .03$. The relationship between wealth index quintile and underweight was significant X^2 (4, N = 898) = 15.77, $p > .01$. The association between mother's age and underweight was not statistically significant X^2 (6, *N*= 898) = 6.91, $p > .33$. The relationship between mother's education and underweight was significant X^2 (4, *N* = 898) = 20.52, $p > .01$.

I conducted independent samples *t*-test to compare the means of the weight for age *z*-score (Underweight) for infants under 6 months of age who had exclusive breastfeeding and those who did not have exclusive breastfeeding. The mean for infants who had EBF was -.88, and infants without EBF was -1.23. The assumption of homogeneity of variance was assessed by the Levene Test, $F = 5.48$, $p = .02$; this indicated a significant violation of the equal variance assumption. The test was statistically significant; hence, the null hypothesis was rejected, which suggest that there is a difference between the means of infants who had EBF and infants who did not enjoy EBF (M = -.88, *SD* = 1.21), *t*(3.30). The 95% CI for the difference between sample means, M1 − M2, had a lower bound of 0.14 and an upper bound of 0.55 as shown in Table 6.

Table 6

T-Test of the Weight for Age Z-Score (Underweight) for Infants Under 6 Months of Age

	Exclusive breastfeeding	*N*	Mean	*SD*	*SEM*
Weight for age *z*-score WHO	Yes	178	-0.88	1.21	0.09
	No	720	-1.23	1.43	0.05

	t	*df*	*p* value	Mean Difference	*SE* Difference	95% LL	95% UL
Equal variances assumed	2.99	896	0.00	0.35	0.12	0.12	0.58
Equal variances not assumed	3.30	310.98	0.00	0.35	0.11	0.14	0.56

Note: For Levene's Test for equality of variances, $F = 5.482$, and $p = 0.019$

Stunting. After data cleaning, the total number of young infants not older than 6 months of age was 898. The frequencies and percentages for exclusive breastfeeding, male gender, place of residence, wealth index quintile, maternal age, and maternal education are all demonstrated in Table 5. A large population of infants (78.3%) did not have EBF, and almost all of the infants (86.6%) were stunted. A small population of young infants were exclusively breastfed (21.7%), and also a small number of these infants (15%) were stunted. More than three-quarter of the infants sampled live in the rural area (79.5%), and 90.1% of them were stunted. The participants sampled showed 30.7% of them fell among the poorest in the wealth index quintile, and in this category, 48.6% of the infants were stunted, while 9.2% of the population were the richest, and 1.5% of that population were stunted. Maternal age was somewhat evenly distributed with the age group of 20–24 representing the second-largest population (21.6%), and equally (23.7%) of the IYC in that population were stunted. Age group 25–29 represented the largest population (28.7%) had (21.7%) stunted infants. Age group of 45–49 representing the smallest population (1.6%) had (5.1%) stunted infants. Maternal level of education showed non-formal education representing almost half of the entire population sampled (45.6%), and in this category (48.6%) of the infants were stunted. Primary education (13%) showed (9.9%) of the infants in this category were stunted. Secondary/ Secondary-technical had the smallest population (4.7%), and (.4%) infants in that category were stunted as demonstrated in Table 7.

Table 7

Frequencies and Percentages of Study Variables by Stunting Categories

		Stunting [HAZ < -2.00]			
		No		Yes	
		N	%	N	%
Exclusive breastfeeding	No	505	78.3	215	85.0
	Yes	140	21.7	38	15.0
Male gender	No	344	53.3	111	43.9
	Yes	301	46.7	142	56.1
Urban residence	No	513	79.5	228	90.1
	Yes	132	20.5	25	9.9
Wealth index quintile	Poorest	198	30.7	123	48.6
	Second	205	31.8	81	32.0
	Middle	110	17.1	30	11.9
	Fourth	72	11.2	16	6.3
	Richest	60	9.3	3	1.2
Mother's age [age groups]	15–19	66	10.2	38	15.0
	20–24	139	21.6	60	23.7
	25–29	185	28.7	55	21.7
	30–34	130	20.2	40	15.8
	35–39	81	12.6	30	11.9
	40–44	34	5.3	17	6.7
	45–49	10	1.6	13	5.1
Mother's education	None	157	24.3	90	35.6
	Non-formal	294	45.6	123	48.6
	Primary	84	13.0	25	9.9
	Secondary/ Secondary-technical	80	12.4	14	5.5
	Higher	30	4.7	1	0.4

Table 8

Pearson Chi-Square Tests: Percentage of Young Infants below 6 Months of Age (EBF)

		Stunting [HAZ < -2.00]
Exclusive breastfeeding	Chi-square	5.11
	df	1
	Sig.	0.02*
Male gender	Chi-square	6.51
	df	1
	Sig.	0.01*
Urban residence	Chi-square	14.11
	df	1
	Sig.	0.00*
Wealth index quintile	Chi-square	40.88
	df	4
	Sig.	0.00*
Mother's age [age groups]	Chi-square	18.95
	df	6
	Sig.	0.00*
Mother's education	Chi-square	27.90
	df	4
	Sig.	0.00*

Note: * The Chi-square statistic is significant at the .05 level.

Pearson's Chi-square value presented in Table 8 showed the percentage of young infants below 6 months of age. The relationship between EBF and stunting was significant X^2 (1, N= 898) = 5.11, p >. 02. The association between male gender and stunting was statistically significant X^2 (1, N= 898) = 6.51, p >.01. The association between urban residence and stunting was also statistically significant X^2 (1, N= 898) = 14.11, p >.01. The relationship between wealth index quintile and stunting was significant X^2 (4, N= 898) = 40.88, p >.01. The association between mother's age and stunting was statistically significant X^2 (6, N= 898) = 18.95, *p* >.01. The relationship between mother's education and stunting was significant X^2 (4, N= 898) = 27.90, *p* >. 01.

I conducted independent samples *t*-test to compare the means of the Height for Age *z*-score (Stunting) for infants under 6 months of age who had exclusive breastfeeding and those who did not have exclusive breastfeeding. The mean for infants who had EBF was -.86, and infants without EBF is -1.11. The assumption of homogeneity of variance was assessed by the Levene test, *F* =3.17, *p* = .06; this indicated no significant violation of the equal variance assumption. The test was not statistically significant; hence, we fail to reject the null hypothesis, which suggests that there is no difference between the means of infants who had EBF and infants who did not enjoy EBF: (M = −.86, SD = 1.58), *t*(1.80). The 95% CI for the difference between sample means, M1 − M2, had a lower bound of .02 and an upper bound of .54 as shown in Table 9.

Table 9

T-Test: Height for Age Z-Score (Stunting) for Infants under 6 Months of Age (EBF)

	Exclusive Breastfeeding	*N*	Mean	*SD*	*SEM*
Height for age *z*-score WHO	Yes	178	-0.86	1.58	0.12
	No	720	-1.11	1.74	0.06

	T	*df*	*p* value	Mean difference	SE Difference	95% LL	95% UL
Equal variances assumed	1.80	896	0.07	0.26	0.14	-0.02	0.54
Equal variances not assumed	1.91	292.47	0.06	0.26	0.14	-0.01	0.52

Note: For Levene's Test for equality of variances, *F* = 3.172 and *p* = 0.075

Wasting. After data cleaning, the total number of young infants not older than 6 months of age was 898. The frequencies and percentages for exclusive breastfeeding, male gender, place of residence, wealth index quintile, maternal age, and maternal education are all demonstrated in Table 8. A large population of infants (79.7%) did not have EBF, and almost all of the infants (83.8%) suffered wasting. A small population of young infants were exclusively breastfed (20.3%) and also a small number these infants (16.2%) suffered wasting. More than three-quarter of the infants sampled live in the rural area (82.8%), and 80.2% of them suffered wasting. The participants sampled showed 34.8% of them fell among the poorest in the wealth index quintile, and in this category (42.3%) of the infants suffered wasting. A quarter of the population (7.0%) was the richest and (7.2%) of this population suffered wasting. Maternal age was somewhat evenly distributed with the age group of 20–24 representing the second-largest population (22.6%), and equally (18.9%) of these children suffered wasting. Age group 25-29 represented the largest population (26.0%) had (31.5%) of the population suffered wasting. Age group of 45–49 representing the smallest population (2.5%) had (2.7%) of the population suffered wasting. Maternal level of education showed non-formal education representing almost half of the entire population sampled (46.1%), and in this category (48.6%) of the infants suffered wasting. Primary education was (12.2%), and (11.7%) of the infants in this category suffered wasting. Secondary/ Secondary-technical had the smallest population (3.6%) and (2.7%) of infants in that category suffered wasting as demonstrated in Table 10

Table 10

Frequencies and Percentages of Study Variables by Wasting Categories

		Wasting [WHZ < -2.00]			
		No		Yes	
		N	%	N	%
Exclusive breastfeeding	No	627	79.7	93	83.8
	Yes	160	20.3	18	16.2
Male gender	No	398	50.6	57	51.4
	Yes	389	49.4	54	48.6
Urban residence	No	652	82.8	89	80.2
	Yes	135	17.2	22	19.8
Wealth index quintile	Poorest	274	34.8	47	42.3
	Second	257	32.7	29	26.1
	Middle	121	15.4	19	17.1
	Fourth	80	10.2	8	7.2
	Richest	55	7.0	8	7.2
Mother's age [age groups]	15–19	92	11.7	12	10.8
	20–24	178	22.6	21	18.9
	25–29	205	26.0	35	31.5
	30–34	152	19.3	18	16.2
	35–39	93	11.8	18	16.2
	40–44	47	6.0	4	3.6
	45–49	20	2.5	3	2.7
Mother's education	None	214	27.2	33	29.7
	Non-formal	363	46.1	54	48.6
	Primary	96	12.2	13	11.7
	Secondary/ Secondary-technical	86	10.9	8	7.2
	Higher	28	3.6	3	2.7

The Pearson Chi-square value seen in Table 11 showed the percentage of young infants below 6 months of age. The relationship between EBF and wasting was not significant X^2 (1, N = 898) = 1.04, p > .31. The association between male gender and wasting was not statistically significant X^2 (1, N = 898) = .02, p > .88. The association between urban residence and wasting was also not statistically significant X^2 (1, N = 898) = .48, p > .49. The relationship between wealth index quintile and wasting was not significant X^2 (4, N = 898) = 3.91, p > .42. The association between mother's age and wasting was not statistically significant X^2 (6, N = 898) = 4.75, p > .58. The relationship between mother's education and wasting was not significant X^2 (4, N = 898) = 1.87, p > .0.76.

Table 11

Pearson Chi-Square Tests of Young Infants below 6 Months of Age (EBF)

		Wasting [WHZ < -2.00]
Exclusive breastfeeding	Chi-square	1.04
	df	1
	Sig.	0.31
Male gender	Chi-square	0.02
	df	1
	Sig.	0.88
Urban residence	Chi-square	0.48
	df	1
	Sig.	0.49
Wealth index quintile	Chi-square	3.91
	df	4
	Sig.	0.42
Mother's age [age groups]	Chi-square	4.75
	df	6
	Sig.	0.58
Mother's education	Chi-square	1.87
	df	4
	Sig.	0.76

Note: * The Chi-square statistic is significant at the .05 level.

I conducted an independent samples *t*-test to compare the mean weight for height *z*-score (Wasting) for infants under 6 months of age who had EBF and those who did not have EBF. The mean for infants who had EBF was -.23 and infants without EBF was -.45. The assumption of homogeneity of variance was assessed by the Levene test, $F = .48$, $p = .49$; this indicated no significant violation of the equal variance assumption. The test was not statistically significant; hence, we failed to reject the null hypothesis, which suggests that there is no difference between the means of infants who had EBF and infants who did not enjoy EBF. ($M = -.23$, $SD = 1.38$), $t(1.84)$. The 95% CI for the difference between sample means, M1−M2, had a lower bound of .02 and an upper bound of .45 as shown below in Table 12.

Table 12

T-Test: Weight for Height Z-Score (Wasting) for Infants under 6 Months of Age (EBF)

	Exclusive Breastfeeding	*N*	Mean	*SD*	*SEM*
Weight for height *z*-score WHO	Yes	178	-0.23	1.39	0.10
	No	720	-0.45	1.44	0.05

	t	*df*	*p* value	Mean difference	SE Difference	95% LL	95% UL
Equal variances assumed	1.84	896	0.07	0.22	0.12	-0.02	0.45
Equal variances not assumed	1.89	280.30	0.06	0.22	0.12	-0.01	0.45

Note: For Levene's Test for equality of variances, $F = 0.48$, $p = 0.49$.

Relationships between demographic variables and dependent variables

Child's age (months). According to Salkind (2000) argued that the correlation coefficient (r) must be located between -1 (sound negative correlation) and +1 (sound positive correlation). Salkind went further to note that in the interpretation of correlation coefficient; .0‒.2 (insubstantial or no correlation), .2‒.4 (weak correlation), .4‒.6 (moderate correlation), .6‒.8 (strong correlation), and .8‒1.0 (very strong correlation). Pearson's r correlation coefficient was applied to determine the association between the demographic variables and the dependent variable. Pearson's correlation coefficient of child's age (months) vs. nutritional anthropometry scores, which are weight for age (WFA), height for age (HFA), and weight for height (WFH) and are all continuous scale variables with a normal linear relationship.

$$r = \frac{\sum z_x \cdot z_y}{n-1} = \frac{\sum\left(\frac{x-\overline{x}}{s_x}\right)\left(\frac{y-\overline{y}}{s_y}\right)}{n-1}$$

Results of the Pearson correlation coefficient indicated that there was a significant negative association between infant's age and nutritional anthropometry scores (Underweight) WFA [($r = -.13$) $p < .05$ (2-tailed), $N = 898$]. Pearson correlation coefficient indicated a statistical significant negative correlation of infant's age and nutritional anthropometry scores (Stunting) HFA [($r = -.10$) $p < .05$ (2-tailed), $N = 898$]. Pearson correlation coefficient of (Wasting) WFH [($r = (-.01)$ $p < .73$ (2-tailed), $N = 898$] establishes a non-statistically significant negative correlation of infant's age and nutritional anthropometry scores (Wasting) WFH; since the correlation is not statistically significant, it means it just occurred by chance in the population.

Wealth quintile. Oneway ANOVA tests of wealth quintiles and child weight for age (WFA), height for age (HFA), and weight for height (WFH) scores were conducted to compare means of two or more samples. For the Levene Test, which is a test for homogeneity of variances, there are non-significant results, which means we can assume there is homogeneity of variances. WFA *z*-score oneway ANOVA demonstrates $F(4, 893) = 8.97$, $p = .00$, showed statistically significant differences between the four groups. There was a statistically significant association ($p = .00$) between the WFA of the infants and the apparent wealth quintiles (Poorest, Second, Middle, Fourth, Richest) at the $p < .05$ level of significance, as shown in Table 13. Post hoc test adopting Bonferroni of multiple comparisons showed non-significant differences at the 0.05 level between Poorest and Second at ($p = .11$), Second and Middle ($p = 1.00$), Middle and Fourth ($p = 1.00$), and Fourth and Richest ($p = 0.19$). So there is no statistical significance between scores in any of the four groups, as soon in Table 14.

HFA *z*-score oneway ANOVA demonstrates F (4, 893) = 14.25, $p = .00$, showed statistically significant differences between the four groups. There was a statistically significant association ($p = .00$) between the HFA of the infants and the apparent wealth quintiles (Poorest, Second, Middle, Fourth, Richest) at the $p < 0.05$ level of significance, as shown in Table 13. The post hoc test adopting Bonferroni of multiple comparisons (see Table 15) showed non-significant differences at the .05 level between Poorest and Second at ($p = 0.32$), Second and Middle ($p = 0.97$), Middle and Fourth ($p = 1.00$), while only between the Fourth and Richest group ($p = 0.044$) was there a statistical significant difference.

WFH *z*-score oneway ANOVA demonstrates F (4, 893) = 1.19, $p = 0.32$, showed non-statistically significant differences between the four groups. Because there is no statistical significance difference between the groups, Post Hoc Test was not interpreted, as shown in Table 13.

Table 13

Oneway ANOVA Tests of Wealth Quintiles and Child Weight for Age, Height for Age, and Weight for Height Scores

	Sum of Squares	*df*	Mean Square	*F*	*p* value
WFA *z*-score					
Between Groups	67.45	4	16.86	8.97	0.00
Within Groups	1,679.77	893	1.88		
Total	1,747.22	897			
HFA *z*-score					
Between Groups	156.91	4	39.23	14.25	0.00
Within Groups	2,458.62	893	2.75		
Total	2,615.53	897			
WFH *z*- score					
Between Groups	9.68	4	2.42	1.19	0.32
Within Groups	1,820.20	893	2.04		
Total	1,829.87	897			

Table 14

WFA = Weight for Age Z-Score. Post Hoc Tests by the Bonferroni Method for Wealth Quintiles vs. Child Weight for Age Scores

I	J	Mean Difference (I-J)	*SE*	*p* value	95% *CI*	
					LL	*UL*
Poorest	Second	-0.28	0.11	0.11	-0.60	0.03
	Middle	-0.31	0.14	0.26	-0.70	0.08
	Fourth	-0.52*	0.17	0.02	-0.98	-0.06
	Richest	-1.05*	0.19	0.00	-1.58	-0.52
Second	Middle	-0.03	0.14	1.00	-0.43	0.37
	Fourth	-0.24	0.17	1.00	-0.71	0.24
	Richest	-0.77*	0.19	0.00	-1.30	-0.23
Middle	Fourth	-0.21	0.19	1.00	-0.73	0.32
	Richest	-0.74*	0.21	0.00	-1.33	-0.15
Fourth	Richest	-0.53	0.23	0.19	-1.17	0.11

Note: * The mean difference is significant at the 0.05 level.

Table 15

Post Hoc Tests by the Bonferroni Method for Wealth Quintiles vs. Child Height for Age Scores

I	J	Mean Difference (I-J)	*SE*	*p* value	95% *CI*	
					LL	*UL*
Poorest	Second	-0.29	0.14	0.32	-0.67	0.09
	Middle	-0.57*	0.17	0.01	-1.05	-0.10
	Fourth	-0.78*	0.20	0.00	-1.35	-0.22
	Richest	-1.57*	0.23	0.00	-2.21	-0.92

Table 15 continued

I	J	Mean Difference (I-J)	*SE*	*p* value	95% *CI*	
Second	Middle	-0.28	0.17	0.97	-0.77	0.20
	Fourth	-0.49	0.20	0.14	-1.06	0.08
	Richest	-1.28*	0.23	0.00	-1.93	-0.63
Middle	Fourth	-0.21	0.22	1.00	-0.85	0.43
	Richest	-0.99*	0.25	0.00	-1.70	-0.28
Fourth	Richest	-0.78*	0.27	0.04	-1.55	-0.01

Note: * The mean difference is significant at the 0.05 level.

Mother's age. Oneway ANOVA tests of maternal age categories, and child weight for age (WFA), height for age (HFA), and weight for height (WFH) scores. WFA *z*-score oneway ANOVA demonstrates $F\ (6, 891) = 1.56$, $p = .16$, showed non-statistically significant differences between the four groups. Because there is no statistical significance difference between the groups. Post Hoc Test was not interpreted, as shown in Table 16.

HFA *z*-score oneway ANOVA demonstrates $F(6, 891) = 2.66$, $p = .02$ showed statistically significant differences between the four groups. There was a statistically significant association ($p = .02$) between the HFA of the infants and the Mother's age (15−19, 20−24, 25−29, 30−34, 35−39, 40−44 and 45−49) at the $p < 0.05$ level of significance, as shown in Table 16. Post hoc test adopting Bonferroni of multiple comparisons showed non-significant differences at the 0.05 level between 15−19 and 20−24 at (p =.68), 20−24 and 25−29 ($p = 1.00$), 25−29 and 30−34 ($p = 1.00$), 30−34 and

35–39 (p = 1.00), 35–39 and 40–44(p = 1.00), and 40–44 and 45–49 (p = 1.00) as demonstrated in Table 17.

Table 16 shows WFA *z*-score oneway ANOVA demonstrates $F(6, 891) = 1.03$, $p = .40$, showed non-statistically significant differences between the four groups. Because there is no statistical significance difference between the groups, Post Hoc Test was not interpreted.

Table 16

Oneway ANOVA Tests of Maternal Age Categories and Child Weight for Age, Height for Age, and Weight for Height Scores

	Sum of Squares	*df*	Mean Square	*F*	*p* value
WFA *z*-score					
Between Groups	18.12	6	3.02	1.56	0.16
Within Groups	1,729.11	891	1.94		
Total	1,747.22	897			
HFA *z*-score					
Between Groups	46.01	6	7.67	2.66	0.02
Within Groups	2,569.52	891	2.88		
Total	2,615.53	897			
WFH *z*-score					
Between Groups	12.61	6	2.10	1.03	0.40
Within Groups	1,817.26	891	2.04		
Total	1,829.87	897			

Table 17

Post Hoc Tests by the Bonferroni Method for Maternal Age Groups vs. Child Height for Age Scores

I	J	Mean Difference (I-J)	*SE*	*p* value	95% *CI*	
					LL	*UL*
15–19	20–24	-0.44	0.21	0.68	-1.07	0.19
	25–29	-0.64*	0.20	0.03	-1.24	-0.03
	30–34	-0.34	0.21	1.00	-0.99	0.30
	35–39	-0.69	0.23	0.06	-1.39	0.02
	40–44	-0.45	0.29	1.00	-1.34	0.43
	45–49	0.15	0.39	1.00	-1.04	1.35
20–24	25–29	-0.20	0.16	1.00	-0.69	0.30
	30–34	0.10	0.18	1.00	-0.44	0.64
	35–39	-0.25	0.20	1.00	-0.86	0.36
	40–44	-0.01	0.27	1.00	-0.82	0.80
	45–49	0.60	0.37	1.00	-0.54	1.74
25–29	30–34	0.29	0.17	1.00	-0.23	0.81
	35–39	-0.05	0.20	1.00	-0.65	0.54
	40–44	0.19	0.26	1.00	-0.61	0.98
	45–49	0.79	0.37	0.70	-0.34	1.92
30–34	35–39	-0.35	0.21	1.00	-0.98	0.28
	40–44	-0.11	0.27	1.00	-0.94	0.71
	45–49	0.50	0.38	1.00	-0.65	1.65
35–39	40–44	0.24	0.29	1.00	-0.64	1.12
	45–49	0.84	0.39	0.64	-0.34	2.03
40–44	45–49	0.61	0.43	1.00	-0.70	1.90

Note: * The mean difference is significant at the .05 level.

Mother's educational level. Oneway ANOVA tests of maternal educational level and child weight for age (WFA), height for age (HFA), and weight for height (WFH) scores. Table 18 showed WFA *z*-score oneway ANOVA, which revealed $F(4, 893) = 9.32$, $p = .00$, showed statistically significant differences between the four educational level groups. There was a statistically significant association (p =.00) between the WFA of the infants and the Mother's educational level (None, Non-formal, Primary, Secondary/ Secondary-technical, and Higher) at the $p < .05$ level of significance. Post hoc test adopting Bonferroni of multiple comparisons showed significant differences at the .05 level between None and Non-formal at ($p = .03$), non-statistical difference between Non-formal and Primary ($p = 1.00$), Primary and Secondary/ Secondary-technical ($p = 1.00$), Secondary/ Secondary-technical and Higher ($p = 1.00$), as shown in Table 19.

HFA *z*-score oneway ANOVA revealed F (4, 893) = 11.04, $p = .00$ showed statistically significant differences between the four educational level groups. There was a statistically significant relationship ($p = .00$) between the HFA of the infants and the Mother's educational level (None, Non-formal, Primary, Secondary/ Secondary-technical, and Higher) at the $p < .05$ level of significance, as seen in Table 18. Post hoc test adopting Bonferroni of multiple comparisons showed significant differences at the .05 level between None and Non-formal at (p =.03), non-statistical difference between Non-formal and Primary ($p = 1.00$), Primary and Secondary/ Secondary-technical (p=.32), Secondary/ Secondary-technical and Higher ($p = 1.00$), as shown in Table 20.

The WFH *z*-score oneway ANOVA demonstrated F (4, 893) = .17, $p = .95$, showed non-statistically significant differences between the four educational level groups (see Table 18). Because there is no statistical significance difference between the groups, Post Hoc Test was not interpreted.

Table 18

Oneway ANOVA Tests of Maternal Educational Level and Child Weight for Age, Height for Age, and Weight for Height Scores

	Sum of Squares	*df*	Mean Square	*F*	*p* value
WFA *z*-score					
Between Groups	70.04	4	17.51	9.32	0.00
Within Groups	1,677.18	893	1.88		
Total	1,747.22	897			
HFA *z*-score					
Between Groups	123.25	4	30.81	11.04	0.00
Within Groups	2,492.28	893	2.79		
Total	2,615.53	897			
WFH *z*-score					
Between Groups	1.41	4	0.35	0.17	0.95
Within Groups	1,828.47	893	2.05		
Total	1,829.87	897			

Table 19

Post Hoc Tests by the Bonferroni Method for Maternal Education Levels vs. Child Weight for Age Scores

I	J	Mean Difference (I-J)	*SE*	Sig.	95% *CI*	
					LL	UL
None	Non-formal	-0.32*	0.11	0.03	-0.63	-0.01
	Primary	-0.52*	0.16	0.01	-0.96	-0.07
	Secondary/ Secondary-technical	-0.79*	0.17	0.00	-1.25	-0.32
	Higher	-1.13*	0.26	0.00	-1.86	-0.39
Non-formal	Primary	-0.19	0.15	1.00	-0.61	0.22
	Secondary/ Secondary-technical	-0.46*	0.16	0.03	-0.90	-0.02
	Higher	-0.81*	0.26	0.02	-1.52	-0.09
Primary	Secondary/ Secondary-technical	-0.27	0.19	1.00	-0.81	0.27
	Higher	-0.61	0.28	0.28	-1.40	0.17
Secondary/ Secondary-technical	Higher	-0.34	0.28	1.00	-1.14	0.46

Note: * The mean difference is significant at the 0.05 level.

Table 20

Post Hoc Tests by the Bonferroni Method for Maternal Education Levels vs. Child Height for Age Scores

I	J	Mean Difference (I-J)	*SE*	Sig.	95% *CI*	
					Lower Bound	Upper Bound
None	Non-formal	-0.39*	0.13	0.03	-0.77	-0.02
	Primary	-0.61*	0.19	0.01	-1.16	-0.07
	Secondary/ Secondary-technical	-1.12*	0.20	0.00	-1.69	-0.55
	Higher	-1.39*	0.32	0.00	-2.29	-0.50
Non-formal	Primary	-0.22	0.18	1.00	-0.73	0.29
	Secondary/ Secondary-technical	-0.73*	0.19	0.00	-1.26	-0.19
	Higher	-1.00*	0.31	0.01	-1.88	-0.13
Primary	Secondary/ Secondary-technical	-0.51	0.24	0.32	-1.17	0.16
	Higher	-0.78	0.34	0.22	-1.74	0.18
Secondary/ Secondary-technical	Higher	-0.28	0.35	1.00	-1.25	0.70

Note: * The mean difference is significant at the .05 level.

Place of residence. Independent samples *t*-test was conducted to compare the means of the weight for age *z*-score (Underweight) by place of residence for infants under 6 months of age. The mean for infants who resided in the urban area was -.84, and infants who resided in the rural area is -1.23. The assumption of homogeneity of variance was assessed by the Levene Test, F =.07, p = .80; this indicated no significant violation of the equal variance assumption. The test was not statistically significant hence we fail to reject the null hypothesis, which suggests that there is no difference between the means of infants who resided in the urban area and infants who reside in the rural area (M = −.84, *SD* = 1.37), *t*(3.14). The 95% CI for the difference between sample means, M1 − M2 had a lower bound of .14 and an upper bound of .62, as shown in Table 21.

To determine Height for Age (stunting) by place of residence, independent samples *t*-test was conducted to compare the means of the Height for Age (stunting) of infants under 6 months of age who resided in the urban and rural area. The mean for infants who resided in the urban area was -.45, and infants who resided in the rural area was -1.19. The assumption of homogeneity of variance was assessed by the Levene Test, F =.00, p = .98; this indicated no significant violation of the equal variance assumption. The test was not statistically significant hence we fail to reject the null hypothesis; this suggests that there is no difference between the means of infants who resided in the urban area and infants who reside in the rural area (M = -.45, *SD* = 1.65), *t*(1.65). The 95% CI for the difference between sample means, M1 − M2, had a lower bound of .45 and an upper bound of 1.03, as shown in Table 22.

To determine Weight for Height (wasting) by place of residence, independent samples *t*-test was conducted to compare the means of the Weight for Height (wasting) of infants under 6 months of age who resided in the urban and rural area. The mean for infants who resided in the urban area was -.62, and infants who resided in the rural areas was -.34. The assumption of homogeneity of variance was assessed by the Levene Test, F =.69, p = .41; this indicated no significant violation of the equal variance assumption. The test was not statistically significant hence we fail to reject the null hypothesis, which suggests that there is no difference between the means of infants who resided in the urban area and infants who reside in the rural area (*M* = -.62, *SD* = 1.32), *t*(-2.07). The 95% CI for the difference between sample means, M1 − M2, had a lower bound of -.51 and an upper bound of -.01, as shown in Table 23.

Table 21

T-Test: Weight for Age Z-Score (Underweight) by Place of Residence for Infants Under 6 Months

	Place of residence	*N*	Mean	*SD*	*SEM*
Weight for age *z*-score	Urban	157	-0.84	1.37	0.11
	Rural	741	-1.226	1.392	0.051

	t	*df*	*p* value	Mean difference	*SE* Difference	95% *LL*	95% *UL*
Equal variances assumed	3.14	896	0.00	0.38	0.12	0.14	0.62
Equal variances not assumed	3.17	229.23	0.00	0.383	0.12	0.15	0.62

Note: For Levene's Test for equality of variances, *F* = 0.07, *p* = 0.80

Table 22

T-Test: Height for Age (Stunting) by Place of Residence

	Place of residence	N	Mean	SD	SEM		
Height for age z-score	Urban	157	−0.448	1.654	0.132		
	Rural	741	−1.193	1.691	0.062		
	T	df	p value	Mean difference	SE Difference	95% LL	95% UL
Equal variances assumed	5.04	896	0.00	0.75	0.15	0.46	1.04
Equal variances not assumed	5.11	230.40	0.00	0.75	0.15	0.46	1.33

Note: For Levene's Test for equality of variances, $F = 0.00$, $p = 0.98$.

Table 23

T-Test: Weight for Height (Wasting) by Place of Residence

	Place of Residence	N	Mean	SD	SEM		
Weight for height z- score	Urban	157	-0.62	1.32	0.11		
	Rural	741	-0.36	1.45	0.05		
	t	df	p value	Mean difference	SE Difference	95% LL	95% UL
Equal variances assumed	-2.07	896	0.04	-0.26	0.13	-0.51	-0.01
Equal variances not assumed	-2.19	241.70	0.03	-0.26	0.12	-0.49	-0.03

Note: For Levene's Test for equality of variances, $F = -0.69$, $p = 0.41$.

Preliminary Analysis: Research Question 2

Variables

Is there a correlation between age-appropriate complementary feeding (CF) from 6 to 24 months of age and nutritional status of the infant in Northwestern Nigeria?

- *$H_0$2*: Age-appropriate CF from 6 to 24 months of age is not correlated with the nutritional status of the child after controlling for poverty level, mother's educational level, and mother's age.
- *$H_1$2*: Age-appropriate CF from 6 to 24 months of age is correlated with the nutritional status of the child after controlling for poverty level, mother's educational level, and mother's age.
- *Independent variable*: CF measured as a categorical (nominal) variable, with 0 = no and 1 = yes.

Dependent variables: Nutritional status all measured as continuous (scale) variables

– Underweight - Weight for Age (WFA *z*-score)

– Stunting - Height for Age (HFA *z*-score)

– Wasting - Weight for Height (WFH *z*-score)

Cofounding variables:

– Poverty level measured as wealth quintile (nominal variable): 1 = *poorest* to 5 = *richest*

– Mother's educational level (nominal): 1 = *none* to 5 = *higher*

– Mother's age (nominal): 1 = *15–19* to 7 = *45–49*

– Place of residence (nominal): 1 = *urban*, 2 = *rural*

Descriptive statistics

Underweight. After data cleaning, the total number of young infants 6–24 months of age was 2,963. The frequencies and percentages for CF, male gender, place of residence, wealth index quintile, maternal age, and maternal education all are demonstrated in Table 24. A large population of infants (92.2%) had age-appropriate CF, and almost all of the infants (91.0%) were underweight. A small population of young infants did not have age- appropriate complementary feeding (7.8%), and also a small number of these infants (9.0%) were underweight. About three-quarter of the infants sampled live in the rural area (76.2%), and 85.6% of them were underweight. The participants sampled showed 28.3% of them fell among the poorest in the wealth index quintile, and in this category (41.0%) of the infants were underweight. A quarter of the population (13.0%) were the richest and (5.0%) of this population was underweight. Maternal age was somewhat evenly distributed with the age group of 20–24 representing the second-largest population (24.0%), and equally (20.1%) of these children were underweight. Age group 25–29 represented the largest population (24.9%); 25.6% of this population of IYC were underweight. Age group of 45–49 representing the smallest population (2.6%) 4.3% of these IYC were underweight. Maternal level of education showed non-formal education representing almost half of the entire population sampled (42.4%), and in this category (49.6%) of the infants were underweight. Primary education (11.9%) and (9.5%) of the infants in this category were underweight. Secondary/ secondary-technical had the smallest population (4.8%), and (1.2%) infants in that category were underweight. WHO (2006), maintained that wasting is weight-for-height (WHZ) below -2 standard deviations of the WHO Child Growth Standards median in a given population, underweight is weight-for-age (WAZ) falls below -2 standard deviations of the WHO Child Growth Standards median, and stunting is length- or height-for-age (L/HAZ) below -2 standard deviations of the WHO Child Growth Standards median.

Frequencies and percentages of study variables of CF, Gender, Place of Residence, Mother's Age, Wealth, and Education (*N*= 2,963) are presented in Table 24.

Table 24

Frequencies and Percentages of Study Variables by Underweight Categories

		Underweight [WAZ < -2.00]			
		No		Yes	
		N	%	N	%
Complementary feeding	No	121	7.8	127	9.0
	Yes	1,435	92.2	1,280	91.0
Male gender	No	852	54.8	648	46.1
	Yes	704	45.2	759	53.9
Urban residence	No	1,186	76.2	1,205	85.6
	Yes	370	23.8	202	14.4
Wealth index quintile	Poorest	441	28.3	577	41.0
	Second	446	28.7	457	32.5
	Middle	288	18.5	218	15.5
	Fourth	179	11.5	85	6.0
	Richest	202	13.0	70	5.0
Mother's age [age groups]	15–19	133	8.5	132	9.4
	20–24	373	24.0	283	20.1
	25–29	387	24.9	360	25.6
	30–34	294	18.9	254	18.1
	35–39	204	13.1	201	14.3
	40–44	124	8.0	116	8.2
	45–49	41	2.6	61	4.3
Mother's education	None	389	25.0	449	31.9
	Non-formal	660	42.4	698	49.6
	Primary	185	11.9	134	9.5
	Secondary/ Secondary-technical	248	15.9	109	7.7
	Higher	74	4.8	17	1.2

Table 25

Pearson Chi-Square Tests: Percentage of Young Infants 6–24 Months of Age (CF)

		Underweight [WAZ < -2.00]
Complementary feeding	Chi-square	1.51
	df	1
	Sig.	0.22
Male gender	Chi-square	22.38
	df	1
	Sig.	0.00*
Urban residence	Chi-square	42.11
	df	1
	Sig.	0.00*
Wealth index quintile	Chi-square	118.32
	df	4
	Sig.	0.00*
Mother's age [age groups]	Chi-square	12.10
	df	6
	Sig.	0.043*
Mother's education	Chi-square	96.09
	df	4
	Sig.	0.00*

Note: * The Chi-square statistic is significant at the .05 level.

The Pearson Chi-square values in Table 25 showed the percentage of IYC between 6–24 months of age. The relationship between CF and underweight was not statistically significant X^2 (1, N= 2,963) = 1.51, p >.22. The association between male gender and underweight was statistically significant X^2 (1, N= 2,963) = 22.38, p > .01. The association between urban residence and underweight was also statistically significant X^2 (1, N= 2,963) = 42.11, p >.01. The relationship between wealth index quintile and underweight was significant X^2 (4, N= 2,963) = 118.32, p >.01. The association between mother's age and underweight was statistically significant X^2 (6, N=

2,963) = 12.99, *p* >.04. The relationship between mother's education and underweight was significant X^2 (4, *N*= 2,963) = 96.09, *p* >. 01.

Table 26

T-Test: Weight for Age Z-Score (Underweight) for Infants 6–24 Months (CF)

	Complementary Feeding			*N*	Mean	*SD*	*SEM*
Weight for age *z*-score WHO	Yes			2,715	-1.92	1.31	0.03
	No			248	-2.07	1.26	0.08
	t	*df*	*p* value	Mean difference	*SE* Difference	95% *LL*	95% *UL*
Equal variances assumed	1.76	2,961	0.08	0.15	0.09	-0.02	0.32
Equal variances not assumed	1.82	298.07	0.07	0.15	0.08	-0.01	0.32

Note: For Levene's test for equality of variances, *F* = 0.173, *p* = 0.677

An independent samples *t*-test was conducted to compare the means of the weight for age *z*-score (Underweight) for infants 6–24 months of age who had complementary feeding and those who did not have complementary feeding. The mean for infants who had age-appropriate CF was -1.92, and infants without age-appropriate CF was -2.07. The assumption of homogeneity of variance was assessed by the Levene Test, *F* =0.173, *p* = .68; this indicated no significant violation of the equal variance assumption. The test was not statistically significant; hence, we fail to reject the null hypothesis, which suggests that there is no difference between the means of infants who had age-appropriate CF and infants who did not have age-appropriate CF. (M = -1.92, *SD* = 1.31), *t*(1.76). The 95% CI for the difference between sample means, M1 − M2, had a lower bound of .02 and an upper bound of -.03, as shown in Table 26.

Stunting. To determine Height for age HAZ of young infants 6-24 months of age (CF).

Table 27

Frequencies and Percentages of Study Variables by Stunting Categories (N= 2,963)

		Stunting [HAZ < -2.00]			
		No		Yes	
		N	%	N	%
Complementary feeding	No	110	8.1	138	8.6
	Yes	1,241	91.9	1,474	91.4
Male gender	No	766	56.7	734	45.5
	Yes	585	43.3	878	54.5
Urban residence	No	1,021	75.6	1,370	85.0
	Yes	330	24.4	242	15.0
Wealth index quintile	Poorest	376	27.8	642	39.8
	Second	379	28.1	524	32.5
	Middle	243	18.0	263	16.3
	Fourth	159	11.8	105	6.5
	Richest	194	14.4	78	4.8
Mother’s age [age groups]	15–19	110	8.1	155	9.6
	20–24	301	22.3	355	22.0
	25–29	363	26.9	384	23.8
	30–34	255	18.9	293	18.2
	35–39	186	13.8	219	13.6
	40–44	104	7.7	136	8.4
	45–49	32	2.4	70	4.3
Mother’s education	None	349	25.8	489	30.3
	Non-formal	552	40.9	806	50.0
	Primary	149	11.0	170	10.5
	Secondary/ Secondary-technical	229	17.0	128	7.9
	Higher	72	5.3	19	1.2

After data cleaning, the total number of young infants 6–24 months of age was 2,963. The frequencies and percentages for CF, male gender, place of residence, wealth index quintile, maternal age, and maternal education all are demonstrated in Table 27. A large population of infants (91.9%) had age-appropriate CF, and almost all of the infants (91.4%) were stunted. A small population of young infants did not have CF (8.1%), and also a small number of these infants (8.6%) were stunted. More than three-quarter of the infants sampled live in the rural area (75.6%), and 85.0% of them were stunted. The participants sampled showed 27.8% of them fell among the poorest in the wealth index quintile and in this category (39.8%) of the infants were stunted. About a quarter of the population (14.4%) was the richest, and (4.8%) of this population was stunted. Maternal age was somewhat evenly distributed with the age group of 20–24 representing the second-largest population (22.3%), and equally (22.0%) of these children were stunted. Age group 25–29, which represents the largest population (26.9%), had (23.8%) stunted infants. Age group of 45–49 representing the smallest population (2.4%) had (4.3%) stunted infants. Maternal level of education showed non-formal education representing almost half of the entire population sampled (40.9%), and in this category (50.0%) of the infants were stunted. Primary education was (11.0%), and (10.5%) of the infants in this category were stunted. Secondary/ Secondary-technical had the smallest population (5.3%), and 1.2% of infants in that category were stunted.

Table 28

Pearson Chi-Square Tests: Percentage of Young Infants 6–24 Months

		Stunting [HAZ < -2.00]
Complementary feeding	Chi-square	0.17
	df	1
	Sig.	0.68
Male gender	Chi-square	36.66
	df	1
	Sig.	0.00*
Urban residence	Chi-square	41.81
	df	1
	Sig.	0.00*
Wealth index quintile	Chi-square	132.13
	df	4
	Sig.	0.00*
Mother's age [age groups]	Chi-square	13.54
	df	6
	Sig.	0.04*
Mother's education	Chi-square	109.58
	df	4
	Sig.	0.00*

Note: * The Chi-square statistic is significant at the .05 level.

Pearson Chi-square value seen in Table 28 above showed the percentage of young infants 6–24 months of age. The relationship between age-appropriate CF and stunting was not significant X^2 (1, N = 2,963) = .17, p > .68. The association between male gender and stunting was statistically significant X^2 (1, N = 2,963) = 36.66, p > .01. The association between urban residence and stunting was also statistically significant X^2 (1, N = 2,963) =. 41.81, p > .01. The relationship between wealth index quintile and stunting was significant X^2 (4, N = 2,963) = 132.13, p > .01. The association between mother's age and stunting was statistically significant X^2 (6, N = 2,963) = 13.54, p > .04. The relationship between mother's education and stunting was not significant X^2 (4, N = 2,963) = 109.58, p >. 01.

Table 28

T-Test: Height for Age Z-Score (Stunting)

	Complementary feeding	*N*	Mean	*SD*	*SEM*		
Height for age *z*-score WHO	Yes	2,715	-2.12	1.62	0.03		
	No	248	-2.14	1.60	0.10		
	t	*df*	*p* value	Mean difference	SE Difference	95% LL	95% UL
Equal variances assumed	0.17	2,961	0.87	0.02	0.11	-0.19	0.23
Equal variances not assumed	0.17	295.69	0.87	0.02	0.11	-0.19	0.23

Note: For Levene's Test for equality of variances, F = .00, p = .99

Independent samples *t*-test was conducted to compare the means of the Height for Age *z*-score (Stunting) for infants 6–24 months of age who had complementary feeding and those who did not have complementary feeding. The mean for infants who had age-appropriate CF was -2.12 and infants without age-appropriate CF was -2.14. The assumption of homogeneity of variance was assessed by the Levene Test, F =.00, p = .99; this indicated no significant violation of the equal variance assumption. The test was not statistically significant; hence, I failed to reject the null hypothesis, which suggests that there is no difference between the means of infants who had age-appropriate CF and infants who did not have age-appropriate CF: (M = -2.12, SD = 1.62), t(.17). The 95% CI for the difference between sample means, M1 − M2, had a lower bound of .19 and an upper bound of .23, as shown above in Table 29.

Wasting. After data cleaning, the total number of IYC between 6–24 months of age was 2,963. The frequencies and percentages for complementary feeding, male gender, place of residence, wealth index quintile, maternal age, and maternal education all are demonstrated below in Table 30. A large population of infants (91.7%) had age-appropriate CF, and almost all of the infants (91.3%) suffered wasting. A small population of young infants did not have CF (8.3%), and also a small number of these infants (8.7%) suffered wasting. More than three-quarter of the infants sampled live in the rural area (80.3%), and 82.1% of them suffered wasting. The participants sampled showed that 32.8% of them fell among the poorest in the wealth index quintile and in this category (40.3%) of the infants suffered wasting. Almost a quarter of the population (9.9%) were the richest, and (6.6%) of this population suffered wasting. Maternal age was somewhat evenly distributed with the age group of 20–24 representing the second-largest population (22.6%), and equally (20.3%) of these children suffered wasting. Age group 25–29 represented the largest population (25.2%) that had (25.1%) wasted infants. Age group of 45–49 representing the smallest population was (3.4%), and 3.5% of IYC in this population suffered wasting. Maternal level of education showed non-formal education representing almost half of the entire population sampled (45.0%), and in this category, 48.8% of the infants suffered wasting. Primary education was 11.2%, and 9.2% of the infants in this category suffered wasting. Secondary/secondary-technical had the smallest population (3.3%), and 2.1% of IYC in that category suffered wasting.

Table 29

Frequencies and Percentages of Study Variables by Wasting Categories

		Wasting [WHZ < -2.00]			
		No		Yes	
		N	%	N	%
Complementary feeding	No	194	8.3	54	8.7
	Yes	2,148	91.7	567	91.3
Male gender	No	1,229	52.5	271	43.6
	Yes	1,113	47.5	350	56.4
Urban residence	No	1,881	80.3	510	82.1
	Yes	461	19.7	111	17.9
Wealth index quintile	Poorest	768	32.8	250	40.3
	Second	713	30.4	190	30.6
	Middle	419	17.9	87	14.0
	Fourth	211	9.0	53	8.5
	Richest	231	9.9	41	6.6
Mother's age [age groups]	15–19	217	9.3	48	7.7
	20–24	530	22.6	126	20.3
	25–29	591	25.2	156	25.1
	30–34	432	18.4	116	18.7
	35–39	313	13.4	92	14.8
	40–44	179	7.6	61	9.8
	45–49	80	3.4	22	3.5
Mother's education	None	654	27.9	184	29.6
	Non-formal	1,055	45.0	303	48.8
	Primary	262	11.2	57	9.2
	Secondary/ Secondary-technical	293	12.5	64	10.3
	Higher	78	3.3	13	2.1

The Pearson Chi-square value seen in Table 31 showed the percentage of young infants 6–24 months of age. The relationship between age-appropriate CF and wasting was not significant X^2 (1, N = 2,963) =. 11, p > .74. The association between male gender and wasting was statistically significant X^2 (1, N = 2,963) = 15.34, p > .01. The association between urban residence and wasting was not statistically significant X^2 (1, $N = 2{,}963) = 1.03$, $p > .31$. The relationship between wealth index quintile and wasting was significant X^2 (4, $N = 2{,}963) = 18.11$, $p > .01$. The association between mother's age and wasting was also not statistically significant X^2 (6, $N = 2{,}963) = 6.18$, $p > .40$. The relationship between mother's education and wasting was not significant X^2 (4, $N = 2{,}963) = 8.27$, $p >. 08$.

Table 30

Pearson Chi-Square Tests: Young Infants Between 6–24 Months of Age (CF)

		Wasting [WHZ < -2.00]
Complementary feeding	Chi-square	0.11
	df	1
	Sig.	0.74
Male gender	Chi-square	15.34
	df	1
	Sig.	0.00*
Urban residence	Chi-square	1.03
	df	1
	Sig.	0.31
Wealth index quintile	Chi-square	18.11
	df	4
	Sig.	0.00*
Mother's age [age groups]	Chi-square	6.18
	df	6
	Sig.	0.40
Mother's education	Chi-square	8.27
	df	4
	Sig.	0.08

Note: * The Chi-square statistic is significant at the .05 level.

Relationships between Demographic Variables and Dependent Variables

Child's age (months)

Pearson's correlation coefficient of child's age vs. nutritional anthropometry scores

$$r = \frac{\sum z_x \cdot z_y}{n-1} = \frac{\sum \left(\frac{x - \overline{x}}{s_x} \right) \left(\frac{y - \overline{y}}{s_y} \right)}{n-1}$$

Results of the Pearson correlation coefficient indicated that there was a significant negative association between infant's age and nutritional anthropometry scores (Underweight) WFA [($r = -.11$) $p < .01$ (2-tailed), $N = 2,963$]. The Pearson correlation coefficient indicated a statistical significant negative correlation between infant's age and nutritional anthropometry scores (Stunting) HFA [($r = -.26$) $p < .01$ (2-tailed), $N = 2,963$]. The Pearson correlation coefficient of (Wasting) WFH [($r = (-.00)$ $p < .83$ (2-tailed), $N = 2,963$] establishes a statistically non-significant negative correlation of infant's age and nutritional anthropometry scores (Wasting) Since the correlation is not statistically significant, it means it just occurred by chance in the population.

Wealth quintile. Oneway ANOVA tests of wealth quintiles and child weight for age (WFA), height for age (HFA), and weight for height (WFH) scores were conducted to compare means of two or more samples. WFA *z*-score oneway ANOVA demonstrates $F(4, 2,958) = 36.66$, $p = .00$, showed statistically significant differences between the four groups. There was a statistically significant association ($p = .00$) between the WFA of the infants and the apparent wealth quintiles (Poorest, Second, Middle, Fourth, Richest) at the $p < 0.05$ level of significance, as seen below in Table 32. Post hoc test adopting Bonferroni of multiple comparisons showed significant differences at the 0.05 level between Poorest and Second at (*p* = .00), Second and Middle (*p* =.04). While Middle and Fourth (*p* =.42) and Fourth and Richest (*p* = .06) had no statistical significance between scores in any of the four groups, as seen in Table 33.

Table 31

Oneway ANOVA Tests of Wealth Quintiles and Child Weight for Age, Height for Age, and Weight for height Scores

	Sum of Squares	*df*	Mean Square	*F*	*p* value
WFA *z*-score					
Between Groups	237.95	4	59.49	36.66	0.00
Within Groups	4,799.87	2,958	1.62		
Total	5,037.81	2,962			
HFA *z*-score					
Between Groups	367.13	4	91.78	36.83	0.00
Within Groups	7,370.72	2,958	2.49		
Total	7,737.85	2,962			
WFH *z*-score					
Between Groups	62.93	4	15.73	11.08	0.00
Within Groups	4,198.12	2,958	1.41		
Total	4,261.05	2,962			

Table 32

Post Hoc Tests by the Bonferroni Method for Wealth Quintiles vs. Child Weight for Age Scores

I	J	Mean Difference (I-J)	*SE*	*p* value	95% *CI*	
					LL	*UL*
Poorest	Second	-0.22*	0.06	0.00	-0.38	-0.06
	Middle	-0.43*	0.07	0.00	-0.62	-0.23
	Fourth	-0.63*	0.09	0.00	-0.87	-0.38
	Richest	-0.93*	0.09	0.00	-1.17	-0.68
Second	Middle	-0.21*	0.07	0.04	-0.40	-0.01
	Fourth	-0.40*	0.09	0.00	-0.65	-0.15
	Richest	-0.71*	0.09	0.00	-0.95	-0.46
Middle	Fourth	-0.19	0.097	0.42	-0.47	0.08
	Richest	-0.50*	0.096	0.00	-0.77	-0.23
Fourth	Richest	-0.30	0.11	0.06	-0.61	0.01

Note: * The mean difference is significant at the .05 level.

HFA *z*-score oneway ANOVA demonstrated $F(4, 2{,}958) = 36.83$, $p = 0.00$, showing statistically significant differences between the four groups. There was a statistically significant association ($p = .00$) between the HFA of the infants and the apparent wealth quintiles (Poorest, Second, Middle, Fourth, Richest) at $p < .05$ level of significance, as shown in Table 32. Post hoc test adopting Bonferroni of multiple comparisons showed non-significant differences at the .05 level between Poorest and Second at (p=1.00). Second and Middle (p =0.03), Middle and Fourth (p =.01) both where statistical significance. Fourth and Richest (*p* =0.08) was not statistically significant, as demonstrated in Table 34.

Table 33

Post Hoc Tests by the Bonferroni Method for Wealth Quintiles vs. Child Height for Age Scores

I	J	Mean Difference (I-J)	*SE*	*p* value	95% *CI*	
					LL	*UL*
Poorest	Second	-0.11	0.07	1.00	-0.31	0.10
	Middle	-0.36*	0.09	0.00	-0.61	-0.12
	Fourth	-0.76*	0.11	0.00	-1.07	-0.45
	Richest	-1.13*	0.11	0.00	-1.43	-0.82
Second	Middle	-0.26*	0.09	0.03	-0.51	-0.01
	Fourth	-0.66*	0.11	0.00	-0.97	-0.35
	Richest	-1.02*	0.11	0.00	-1.33	-0.71
Middle	Fourth	-0.40*	0.12	0.01	-0.74	-0.06
	Richest	-0.76*	0.12	0.00	-1.10	-0.43
Fourth	Richest	-0.36	0.14	0.08	-0.75	0.02

Note: * The mean difference is significant at the 0.05 level.

WFH z-score oneway ANOVA demonstrates F (4, 2,958) = 11.08, $p = .00$, showed statistically significant differences between the four groups. There was a statistically significant association ($p = .00$) between the WFH of the infants and the apparent wealth quintiles (Poorest, Second, Middle, Fourth, Richest) at the $p < .05$ level of significance as shown in Table 32. Post hoc test adopting Bonferroni of multiple comparisons showed significant differences at the .05 level between Poorest and Second at (p = .00). Second and Middle (p = 1.00), Middle and Fourth (p = .00), and Fourth and Richest (p = 1.00) groups were all not statistically significant, as illustrated in Table 35.

Table 34

Post Hoc Tests by the Bonferroni Method for Wealth Quintiles vs. Child Weight for Height Scores

I	J	Mean Difference (I-J)	*SE*	*p* value	95% *CI*	
					LL	*UL*
Poorest	Second	-0.22*	0.06	0.00	-0.38	-0.07
	Middle	-0.32*	0.07	0.00	-0.50	-0.14
	Fourth	-0.27*	0.08	0.01	-0.50	-0.04
	Richest	-0.42*	0.08	0.00	-0.65	-0.20
Second	Middle	-0.10	0.07	1.00	-0.28	0.09
	Fourth	-0.05	0.08	1.00	-0.28	0.19
	Richest	-0.20	0.08	0.15	-0.43	0.03
Middle	Fourth	0.05	0.09	1.00	-0.204	0.30
	Richest	-0.10	0.09	1.00	-0.36	0.15
Fourth	Richest	-0.15	0.10	1.00	-0.44	0.14

Mother's age. The oneway ANOVA tests of maternal age categories and child weight for age (WFA), height for age (HFA), and weight for height (WFH) scores are shown in Table 36. The WFA *z*-score oneway ANOVA of F (6, 2,956) = 1.80, p = .10 showed non-statistically significant differences between the four groups. Because there is no statistical significance difference between the groups, Post Hoc Test was not interpreted.

Table 35

Oneway ANOVA Tests of Maternal Age and Child Weight for Age

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	18.35	6	3.06	1.80	0.10
Within Groups	5,019.47	2,956	1.70		
Total	5,037.81	2,962			

The HFA *z*-score oneway ANOVA demonstrated F (6, 2,956) = 1.61, p = .14, which showed non-statistically significant differences between the four groups. Because there is no statistical significance difference between the groups, Post Hoc Test was not interpreted, as shown in Table 37.

Table 36

Oneway ANOVA Tests of Maternal Age and Child Height for Age

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	25.21	6	4.20	1.61	0.14
Within Groups	7,712.64	2,956	2.61		
Total	7,737.85	2,962			

WFH *z*-score oneway ANOVA demonstrated F (6, 2,956) = 1.42, p = .20, showing non-statistically significant differences between the four groups. Because there is no statistical significance difference between the groups, Post Hoc Test was not interpreted as demonstrated in Table 38.

Table 37

Oneway ANOVA Tests of Maternal Age and Child Weight for Height

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	12.251	6	2.04	1.42	0.20
Within Groups	4,248.80	2,956	1.44		
Total	4,261.05	2,962			

*Mother's educational level***.** In Table 39, the WFA *z*-score oneway ANOVA revealed $F(4, 2958) = 29.27$, $p = .00$, showing statistically significant differences between the four educational level groups. There was a statistically significant association ($p = .00$) between the WFA of the infants and the Mother's educational level (None, Non-formal, Primary, Secondary/ Secondary-technical, and Higher) at the $p < .05$ level of significance. Post hoc test adopting Bonferroni of multiple comparisons showed significant differences at the .05 level between None and Non-formal at ($p =.03$), statistically non-significant difference between Non-formal and Primary ($p =1.00$), also Primary and Secondary/ Secondary-technical ($p =1.00$) also has a statistically non-significant difference. Secondary/ Secondary-technical and Higher ($p =1.00$) is equally not statistically significant, as demonstrated in Table 40.

Table 38

Oneway ANOVA Tests of Mother's Educational Level and Child Weight for Height

	Sum of Squares	*df*	Mean Square	*F*	Sig.
Between Groups	191.78	4	47.95	29.27	0.00
Within Groups	4,846.03	2,958	1.64		
Total	5,037.81	2,962			

Table 39

Post Hoc Tests by the Bonferroni Method for Maternal Age vs. Child Weight for Age Scores

I	J	Mean Difference (I-J)	*SE*	Sig.	95% *CI*	
					LL	*UL*
None	Non-formal	-0.32*	0.11	0.03	-0.12	0.19
	Primary	-0.52*	0.16	0.01	-0.52	-0.05
	Secondary/ Secondary-technical	-0.79*	0.17	0.00	-0.82	-0.37
	Higher	-1.13*	0.26	0.00	-1.32	-0.53
					-0.19	0.13
Non-formal	Primary	-0.19	0.15	1.00	-0.54	-0.09
	Secondary/ Secondary-technical	-0.46*	0.16	0.03	-0.84	-0.42
	Higher	-0.81*	0.26	0.02	-1.35	-0.57
					0.05	0.52
Primary	Secondary/ Secondary-technical	-0.27	0.19	1.00	0.09	0.54
	Higher	-0.61	0.28	0.28	-0.59	-0.04
					-1.07	-0.22
Secondary/ Secondary-technical	Higher	-0.34	0.28	1.00	0.37	0.82
					0.42	0.84
					0.04	0.59
					-0.75	0.09
					0.53	1.32
					0.57	1.35
					0.22	1.07
					-0.09	0.75

Note: * The mean difference is significant at the 0.05 level.

The HFA *z*-score oneway ANOVA revealed $F(4, 2{,}958) = 31.71$, $p = .00$, showing statistically significant differences between the four educational level groups. There was a statistically significant relationship ($p = .00$) between the HFA of the infants and the Mother's educational level (None, Non-formal, Primary, Secondary/ Secondary-technical, and Higher) at the $p < .05$ level of significance, as shown in Table 41. Post hoc test adopting Bonferroni of multiple comparisons showed non-significant differences at the 0.05 level between None and Non-formal at ($p = 1.00$), significant difference between Non-formal and Primary ($p = .02$), Primary and Secondary/ Secondary-technical ($p = .00$) also has significant difference, while Secondary/ Secondary-technical and Higher ($p = .24$) showed non-significant differences as seen in Table 42.

Table 40

Oneway ANOVA Tests of Mother's Educational Level and Child Height for Age

	Sum of Squares	*df*	Mean Square	*F*	Sig.
Between Groups	318.18	4	79.54	31.71	0.00
Within Groups	7,419.67	2,958	2.51		
Total	7,737.85	2,962			

Table 41

Post Hoc Tests by the Bonferroni Method for Mother's Educational Level vs. Child Height for Age Scores

I	J	Mean Difference (I-J)	*SE*	Sig.	95% *CI*	
					LL	*UL*
None	Non-formal	0.10	0.07	1.00	-0.10	0.30
	Primary	-0.21	0.10	0.48	-0.50	0.09
	Secondary/ Secondary-technical	-0.74*	0.10	0.00	-1.03	-0.46
	Higher	-1.16*	0.18	0.00	-1.66	-0.67
		-0.10	0.07	1.00	-0.30	0.09
Non-formal	Primary	-0.31*	0.10	0.02	-0.59	-0.03
	Secondary/ Secondary-technical	-0.85*	0.09	0.00	-1.11	-0.58
	Higher	-1.26*	0.17	0.00	-1.75	-0.78
		0.20	0.10	0.48	-0.09	0.50
Primary	Secondary/ Secondary-technical	0.30*	0.10	0.02	0.031	0.59
	Higher	-0.54*	0.12	0.00	-0.88	-0.20
		-0.96*	0.19	0.00	-1.49	-0.43
Secondary/ Secondary-technical	Higher	0.74*	0.10	0.00	0.46	1.03
					0.58	1.11
					0.20	0.88
					-0.94	0.10
					0.67	1.62
					0.78	1.75
					0.43	1.49
					-0.10	0.94

Note: * The mean difference is significant at the 0.05 level.

In Table 43, the WFH *z*-score oneway ANOVA demonstrates $F(4, 2{,}958) = 6.46$, $p = .00$, showing statistically significant differences between the four educational level groups. There was a statistically significant relationship ($p = .00$) between the WFH of the infants and the Mother's educational level (None, Non-formal, Primary, Secondary/ Secondary-technical, and Higher) at the $p < .05$ level of significance. Post hoc test adopting Bonferroni of multiple comparisons showed non-significant differences at the 0.05 level between None and Non-formal at (p =1.00), the non-significant difference between Non-formal and Primary (p =.08), Primary and Secondary/ Secondary-technical (p =1.00) and Secondary/ Secondary-technical and Higher (p =1.00).

Table 42

Weight for Height Z-Score WHO

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	36.89	4	9.22	6.46	0.00
Within Groups	4,224.16	2,958	1.43		
Total	4,261.05	2,962			

Place of residence. Independent samples *t*-test was conducted to compare the means of the weight for age *z*-score (Underweight) by place of residence for infants 6–24 months of age. The mean for infants who resided in the urban area was -1.57, and infants who resided in the rural area were -2.02. The assumption of homogeneity of variance was assessed by the Levene test, F =.01, p = .92; this indicated no significant violation of the equal variance assumption. The test was statistically not significant; hence, I failed to reject the null hypothesis, which suggests that there is no difference between the means of infants who resided in the urban area and infants who resided in the rural area (M = −1.57, SD = 1.29), t(7.34). The 95% CI for the difference between sample means, M1 − M2, had a lower bound of .32 and an upper bound of .56, as illustrated in Table 44.

Table 43

T-Test: Weight for Age Z-Score (Underweight) by Place of Residence for Infants 6–24 Months

	Place of Residence		*N*	Mean	*SD*	*SEM*		
Weight for age *z*-score re	Urban		572	−1.574	1.294	0.054		
	Rural		2,391	−2.015	1.292	0.026		
	t	*df*	*p* value	Mean difference	*SE* Difference		95% *LL*	95% *UL*
Equal variances assumed	7.34	2,961	0.00	0.44	0.06		0.32	0.56
Equal variances not assumed	7.33	864.14	0.00	0.44	0.06		0.32	0.56

Note: For Levene's Test for equality of variances, $F = 0.011$, $p = 0.916$

In determining Height for age (stunting) by place of residence, an independent sample *t*-test was conducted to compare the means of the Height for age (stunting) of infants 6–24 months of age who resided either in the urban or rural area. The mean for infants who resided in the urban area was -1.63, and infants who resided in the rural area were -2.24. The assumption of homogeneity of variance was assessed by the Levene test, F =.08, p =. 78; this indicated no significant violation of the equal variance assumption. The test was statistically not significant; hence, I failed to reject the null hypothesis, which suggests that there is no difference between the means of infants who resided in the urban area and infants who resided in the rural area (*M* = -1.63, *SD* = 1.62), *t*(8.04). The 95% CI for the difference between sample means, M1 − M2, had a lower bound of .45 and an upper bound of .74, as seen in Table 45.

Table 44

T-Test: Height for Age (Stunting) by Place of Residence for Infants 6–24 Months

	Place of Residence		*N*	Mean	*SD*	*SEM*		
Height for age *z*-score re	Urban		572	-1.64	1.63	0.07		
	Rural		2,391	-2.24	1.59	0.03		
	t	*df*	*p* value	Mean difference		*SE* Difference	95% *LL*	95% *UL*
Equal variances assumed	8.04	2,961	0.00	0.75		0.07	0.45	0.74
Equal variances not assumed	7.94	852.26	0.00	0.75		0.08	0.45	0.75

Note: For Levene's Test for equality of variances, *F* = 0.08, *p* = 0.78

In establishing the Weight for Height (Wasting) by place of residence, independent samples *t*-test was conducted to compare the means of the weight for height (Wasting) of infants 6–24 months of age who resided either in the urban or rural area. The mean for infants who resided in the urban area was -.99, and infants who resided in the rural area were 1.13. The assumption of homogeneity of variance was assessed by the Levene test, *F* =3.67, *p* = .06. This indicated no significant violation of the equal variance assumption. The test was statistically not significant; hence, I failed to reject the null hypothesis, which suggests that there is no difference between the means of infants who resided in the urban area and infants who resided in the rural area (*M* = -.99, *SD* = 1.26), t(2.56). The 95% CI for the difference between sample means, M1 − M2, had a lower bound of .03 and an upper bound of .26, as shown in Table 45.

Table 45

T-Test: Weight for Height (Wasting) by Place of Residence for Infants 6–24 Months

	Place of residence		*N*	Mean	*SD*	*SEM*		
Height for age *z*-score	Urban		572	-0.985	1.256	0.053		
	Rural		2,391	-1.128	1.184	0.024		
	t	*df*	*p* value	Mean difference		*SE* Difference	95% *LL*	95% *UL*
Equal variances assumed	2.56	2,961	0.00	0.14		0.06	0.03	0.25
Equal variances not assumed	2.47	830.94	0.00	0.14		0.06	0.03	0.26

Note: For Levene's Test for equality of variances, $F = 3.67$, $p = 0.06$

Primary Analysis: Question 1

The preliminary analysis reported, weight for age *z*-score (Underweight) for infants under 6 months of age who had EBF and those who did not have EBF. The mean for infants with EBF was -0.88, and infants without EBF was -1.22. The *p*-value was .02, where the significance level is .05; this indicated EBF was a predicting factor for underweight. Determining the association between EBF in the first 6 months of infant's life and the height for age *z*-score (Stunting), the mean for infants who had EBF was -0.86, and infants without EBF was -1.11, the *p*-value was .08, where the level of significance is .05. This indicates that EBF was not a predicting factor for Stunting. Similarly, determining the correlation between EBF in the first 6 months of an infant's life and the weight for height *z*-score (wasting). The mean for infants who had EBF was

-.23, and infants without EBF was -.44. The significance value was .49, where the level of significance is .05, which also indicated that EBF is a poor predicting factor for wasting. As shown in Table 44, a multiple linear regression was conducted to predict the overall effect of various variables on the nutrition status (underweight) of infants under 6 months of age.

Multiple linear regression predicting weight for age (underweight)

Predicted weight for age *z*-score (underweight), the linear regression equation is

$$WAZ = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \beta_5 x_5 + \beta_6 x_6 + \beta_7 x_7 + \beta_8 x_8 + \beta_9 x_9 + \beta_{10} x_{10} + \beta_{11} x_{11} + \beta_{12} x_{12} + \beta_{13} x_{13} + \beta_{14} x_{14} + \beta_{15} x_{15} + \beta_{16} x_{16} + \beta_{17} x_{17} + \beta_{18} x_{18}$$

The overall regression model was significant, $F(18, 879) = 4.29$, $p < .05$, adj. $R^2 = .06$, taking the predictor analysis as a group, they predict underweight in infants under 6 months of age. The Coefficient table demonstrates that Child's age (in months) (p = .00), Wealth index quintile [Second] (p =.04), Wealth index quintile [Richest] (p = . 02), Mother's age [20–24] (p = .05), Mother's education [Non-formal] (p = .01), Mother's education [Primary] (p = .01), Mother's education [Secondary/ Secondary-technical] (p = .01) and Mother's education [Higher] (p = .04) are all the predictors that are statistically significant, which means these variables accounts unique amount of variance in the dependent variable. Thus, they are all offering a unique contribution to the weight for age (underweight) of infant under 6 months of age. Exclusive breastfeeding (p = .09), Wealth index quintile [Middle] (p = .12), Wealth index quintile [Fourth] (p = .08), Mother's age [30–34] (p = .13), Mother's age [40–44] (p = .14), Male gender (p = .06), and Urban residence (p = .90) are predictors that are not statistically significant; thus, they do not offer an unique contribution to the weight for age (underweight) of the infant under 6 months of age, as demonstrated below in Table 47.

Table 46

Linear Regression Model of WFA (EBF)

	B	*SE*	β	*t*	*p value*
(Constant)	-1.53	0.18		-8.35	0.00
Exclusive breastfeeding	0.20	0.12	0.06	1.70	0.09
Child's age (in months)	-0.12	0.03	-0.12	-3.72	0.00
Wealth index quintile [Second]	0.24	0.11	0.08	2.10	0.04
Wealth index quintile [Middle]	0.22	0.14	0.06	1.55	0.12
Wealth index quintile [Fourth]	0.33	0.19	0.07	1.75	0.08
Wealth index quintile [Richest]	0.63	0.27	0.11	2.32	0.02
Mother's age [20–24]	0.32	0.16	0.10	1.93	0.05
Mother's age [25–29]	0.33	0.16	0.11	2.07	0.04
Mother's age [30–34]	0.26	0.17	0.07	1.51	0.13
Mother's age [35–39]	0.30	0.19	0.07	1.57	0.12
Mother's age [40–44]	0.34	0.23	0.06	1.47	0.14
Mother's age [45–49]	0.08	0.31	0.01	0.24	0.81
Mother's education [Non-formal]	0.28	0.11	0.10	2.57	0.01
Mother's education [Primary]	0.43	0.16	0.10	2.67	0.01
Mother's education [Secondary/ Secondary-technical]	0.49	0.20	0.11	2.46	0.01
Mother's education [Higher]	0.64	0.31	0.08	2.02	0.04
Male gender	-0.17	0.09	-0.06	-1.89	0.06
Urban residence	-0.02	0.15	-0.01	-0.13	0.90
R	0.28				
***R*²**	0.08				
Adj. *R*²	0.06				

Predicted height for age z-score. The linear regression equation is:

$$\textbf{HAZ} = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \beta_5 x_5 + \beta_6 x_6 + \beta_7 x_7 + \beta_8 x_8 + \beta_9 x_9 + \beta_{10} x_{10} + \beta_{11} x_{11} + \beta_{12} x_{12} + \beta_{13} x_{13} + \beta_{14} x_{14} + \beta_{15} x_{15} + \beta_{16} x_{16} + \beta_{17} x_{17} + \beta_{18} x_{18}$$

The overall regression model was significant, $F(18, 879) = 5.379$, $p < .05$, adj. $R^2 = .08$, taking the predictor analysis as a group, they predict stunting in infants under 6 months of age.

The coefficient table demonstrates that Child's age (in months) (p =.00), Wealth index quintile [Second] (p =.05), Wealth index quintile [Richest] (p =. 01), Mother's age [25‒29] (p =. 02), Mother's age [35‒39] (p =. 01), Mother's education [Non-formal] (p = 0. 01), Mother's education [Primary] (p = . 03), Mother's education [Secondary/ Secondary-technical] (p = . 03), and Male gender (p = . 01) were all the predictors that are statistically significant, which means these variables accounts unique amount of variance in the dependent variable. Thus, they are all offering a unique contribution to the height for age (stunting) of the infant under 6 months of age. Exclusive breastfeeding (p = .06), Mother's age [20‒24] (p = .90), Mother's age [30‒34] (p = .23), Mother's age [40‒44] (p = 0.15), and Mother's age [45‒49] (p = .77); Mother's education [Higher] (p = .25), and Urban Residence (p = .29) are predictors that are not statistically significant; thus, they do not offer a contribution to the height for age (stunting) of infants under 6 months of age.

Predicted weight for height z-score. The linear regression equation is:

$$\text{HAZ} = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \beta_5 x_5 + \beta_6 x_6 + \beta_7 x_7 + \beta_8 x_8 + \beta_9 x_9 + \beta_{10} x_{10} + \beta_{11} x_{11} + \beta_{12} x_{12} + \beta_{13} x_{13} + \beta_{14} x_{14} + \beta_{15} x_{15} + \beta_{16} x_{16} + \beta_{17} x_{17} + \beta_{18} x_{18}$$

The overall regression model was not significant, $F(18, 879) = 1.06$, $p < .05$, adj. $R^2 = .01$, taking the predictor analysis as a group, the model does not predict wasting in infants under 6 months of age.

Primary Analysis: Research Question 2

Multiple Linear regression predicting weight for age (underweight).

Predicted weight for age z-score (underweight) in infants 6–24 months of age.

The overall regression model was significant, $F(18, 2{,}944) = 14.29$, $p < .05$, adj. $R^2 = .08$, taking the predictor analysis as a group, they predict underweight in infants between 6–24 months of age. The Coefficient table demonstrates that complementary feeding (p = . 01), Child's Age (in months) (p = .00), Wealth index quintile [Second] (p = .00), Wealth index quintile [Middle] (p = .00), Wealth index quintile [Richest] (p = .00), Mother's education [Secondary/ Secondary-technical] (p = 0. 01) and Mother's education [Higher] (p = .00) and male gender (.00) are all the predictors that are statistically significant, which means these variables account for unique amount of variance in the dependent variable. Thus they are all offering a unique contribution to the weight for age (underweight) of the infant. Mother's age [20–24] (p = .23), Mother's age [25–29] (p = .59), Mother's age [30–34] (p=0.96), Mother's age [30–34] (p = .96), Mother's age [45–49] (p = .56), Mother's education [Non-formal] (p = .54), and Urban residence (p = .40) are predictors that are not statistically significant, thus do not offer an unique contribution to the weight for age (underweight) of the infant 6–24 months of age, as seen below in Table 48.

Table 47

Linear Regression Model of WFA (CF)

Model	Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients β	*t*	*p*
(Constant)	-1.90	0.13		-15.14	0.00
Complementary feeding	0.24	0.09	0.05	2.82	0.01
Child's age (in months)	-0.03	0.01	-0.13	-6.84	0.00
Wealth index quintile [Second]	0.21	0.06	0.07	3.65	0.00
Wealth index quintile [Middle]	0.33	0.07	0.09	4.62	0.00
Wealth index quintile [Fourth]	0.46	0.10	0.10	4.55	0.00
Wealth index quintile [Richest]	0.63	0.12	0.14	5.12	0.00
Mother's age [20–24]	0.11	0.09	0.04	1.20	0.23
Mother's age [25–29]	0.05	0.09	0.02	0.54	0.59
Mother's age [30–34]	0.00	0.10	0.00	0.03	0.98
Mother's age [35–39]	-0.04	0.10	-0.01	-0.42	0.67
Mother's age [40–44]	0.05	0.11	0.01	0.44	0.66
Mother's age [45–49]	-0.09	0.15	-0.01	-0.59	0.56
Mother's education [Non-formal]	-0.03	0.06	-0.01	-0.61	0.541
Mother's education [Primary]	0.16	0.08	0.04	1.92	0.06
Mother's education [Secondary/ Secondary-technical]	0.25	0.10	0.06	2.64	0.01
Mother's education [Higher]	0.51	0.16	0.07	3.11	0.00
Male gender	-0.25	0.05	-0.10	-5.40	0.00
Urban residence	0.06	0.08	0.02	0.84	0.40

R = 0.28
$\boldsymbol{R^2}$ = 0.08
Adj. $\boldsymbol{R^2}$ = 0.08

Predicted height for age z-score (stunting). The ANOVA table (test using α = .05). The overall regression model was significant, $F(18, 2{,}944) = 28.42$, $p < .05$, adj. R^2

= .14, taking the predictor analysis as a group, the model predicts stunting in infants 6–24 months of age.

The coefficient table demonstrates that complementary feeding (p =. 00), Child's Age (in months) (p = .00), Wealth index quintile [Middle] (p = .00), Wealth index quintile [Fourth] (p = .00), Wealth index quintile [Richest] (p = . 00), Mother's education [Higher] (p = .00) and male gender (p = .00) are all the predictors that are statistically significant, which means these variables accounts for unique amount of variance in the dependent variable. Thus, they are all offering a unique contribution to the height for age (stunting) of the infant between 6 to 24 months of age. Mother's age [20–24] (p = .29), Mother's age [25–29] (p = .09), Mother's age [30–34] (p = .52), Mother's age [35–39] (p = .72), Mother's age [45–49] (p = 0.79), Mother's education [Non-formal] (p = .13), Mother's education [Primary] (p = .50), and Urban residence (p = .21) are predictors that are statistically not significant, thus do not offer an unique contribution to the height for age (stunting) height for age (stunting) of the infant between 6 to 24 months of age.

Predicted weight for height z-score (wasting). The ANOVA table (test using $\alpha = .05$). The overall regression model was significant, $F(18, 2{,}944) = 3.74$, $p < .05$, adj. $R^2 = .02$, taking the predictor analysis as a group, the model predicts wasting in infants 6–24 months of age.

The coefficient table showed the Wealth index quintile [Second] (p = .00), Wealth index quintile [Middle] (p = .00), Wealth index quintile [Fourth] (p = . 03), Wealth index quintile [Richest] (p = .01), Mother's education [Primary] (p = . 00), and male gender (p = .00) are all the predictors that are statistically significant, which means these variables accounted for unique amount of variance in the dependent variable. Thus, they are all offering a unique contribution to the weight for height (wasting) of the infant between 6 to 24 months of age. CF (*p* = .92), Child's Age (in months) (*p* = .77), Mother's age [20–24] (*p* = .49), Mother's age [25–29] (*p* = .43), Mother's age [30–34] (*p* = .61), Mother's age [35–39] (*p* = .39), Mother's age [45–49] (*p* = .56), Mother's education [Non-formal] (*p* = .75), Mother's education [Secondary/ Secondary-technical] (*p* = .21), Mother's education [Higher] (*p* = .08), and Urban residence (*p* = .96) are predictors that are not statistically significant; thus, they do not offer an unique contribution to the weight for height (wasting) of the infant between 6 to 24 months of age.

Summary

The descriptive statistics of each of the study variables have been presented in this chapter. The bivariate relationships between study variables were reviewed in the preliminary analysis section. The hypothesis of the two research questions was examined using regression models. $H_0$1: EBF in the first 6 months of infant's life does not correlate with the nutritional status of the baby in Northwestern Nigeria after controlling for poverty level, educational level, age, and place of residence. $H_1$1: EBF in the first 6 months of an infant's life correlates with the nutritional status of the infant in Northwestern Nigeria after controlling for poverty level, educational level, age, and place of residence. Independent samples of a *t*-test were conducted to compare the means of the weight for age *z*-score (underweight). The *p*-value was .02, where the level of significance is .05. The test was statistically significant; hence, the null hypothesis is rejected. Thus, the alternative hypothesis was accepted. This means EBF in the first 6 months of an infant's life is associated with the nutritional status (underweight) of the young infant. In conducting an independent *t*-test to compare the means of height for age (stunting), it was noted that the outcome was not statistically significant; hence, the null hypothesis is accepted. This means that EBF in the first 6 months of the life of an infant does not correlate with nutritional status (stunting) of the baby. In conducting an independent samples *t*-test to compare the mean weight for height *z*-score (wasting), it was demonstrated that the test was again not statistically significant; hence, the null hypothesis was accepted, which means EBF in the first 6 months of the life of an infant does not correlate with nutritional status (wasting) of the baby.

In research question 2, where $H_0 2$: Age-appropriate CF from 6 to 24 months of age, is not correlated with the nutritional status of the child after controlling for poverty level, mother's educational level, or mother's age. $H_1 2$: Age-appropriate CF from 6 to 24 months of age, is correlated with the nutritional status of the child after controlling for poverty level, mother's educational level, and mother's age. Independent samples *t*-test was conducted; the test was not statistically significant; hence, the null hypothesis is accepted, which means that age-appropriate CF from 6 to 24 months of age is not correlated with the nutritional status (underweight). Conducting an independent samples *t*-test to compare mean of the height for age and the mean of weight for height. The test was statistically non-significant in both tests carried out; hence, the null hypothesis is accepted. This means age-appropriate CF from 6 to 24 months of age is not correlated with the nutritional status of the children in the study population.

Linear regression models were adopted to predict weight for age *z*-score (underweight) overall regression model was significant; dealing with the predictor analysis as a group, they were capable of predicting underweight in infants under 6 months of age. Linear regression models predicted weight for age *z*-score (underweight) in infants 6–24 months of age. In this case, the overall regression model was significant, making it a good model for the prediction of underweight in infants 6–24 months in the study population. Chapter 5 of this dissertation will be focused on discussion. The study interpretations, study limitations, recommendations for future research, and implication of the research on social change will be emphasized in Chapter 5.

Chapter 5: Discussion, Conclusion, and Recommendation

The purpose of this study was to identify a correlation between current feeding practices of infants not older than 2 years of age in Northwest Nigeria and their nutritional status, with the intent of identifying gaps in the recommended IYCF practices in Nigeria. This study objective was aimed at examining the relationship between EBF, appropriate CF, and the nutritional status of IYC. IYC, who were fed with breast milk exclusively and later introduced to appropriate complementary feeding, had adequate growth health, and they developed to their full potential (WHO, 2009). A quantitative cross-sectional design was applied to establish the association between feeding practices and nutritional status of infants 0–24 months of age in Northwest Nigeria.

In this chapter, I will discuss the synopsis of the problems, the study purpose, the main findings of this study, and previous literature that has already laid a premise. I will also establish the association between feeding practices and nutritional status of infants who are less than 2 years of age.

Summary and Interpretation of Key Findings

EBF has been recommended by both WHO and UNICEF as the exclusive BF of infants for the first 6 months of life. This practice is the most cost-effective technique in the reduction of infant morbidities, such as obesity, hypertension, gastrointestinal infections, and mortality (Bai, Middlestadt, Joanne Peng, & Fly, 2009). Motee and Jeewon (2014) argued that blood pressures and serum LDL concentration in the body is significantly reduced in exclusively breastfed children, while others scholars found no evidence to support that BF offered some sort of protective support against the onset of heart diseases. Thus, more research is required in this area to establish the relationship between BF and the possibility of developing cardiovascular diseases (Motee & Jeewon, 2014).

At some point in the life of the infant, breast milk alone becomes insufficient. Therefore, CF should be introduced, which typically begins from 6^{th} months of life while still breastfeeding until 2 years of age. This is a critical growth phase in which infants are highly susceptible to nutritional deficiencies and ailments (WHO, 2009a). The determining factors of the growth of an infant are genetic capabilities and ethnic influences (Johnson & Blasco, 1997). Nutrition is the most important factor, as it allows physical growth, the development of the brain, and overall wellbeing of the individual (Hamdani, 2015).

In answering the research questions, two models were adopted in this study. The Pearson Chi-square tests (X^2) was carried out to determine the strength of association for each of the exposure characteristic and the dependent variable. The model showed the percentage of young infants below 6 months of age while at the same time comparing the relationship between EBF and underweight; this model was significant X^2 (1, N = 898) = 8.48, $p > .01$. The relationship between EBF and stunting was significant X^2 (1, N= 898) = 5.11, $p > .02$; the relationship between EBF and wasting was not significant X^2 (1, N = 898) = 1.04, $p > .30$. In examining the percentage of young infants 6–24 months of age, it was observed that the relationship between CF and underweight was not statistically significant X^2 (1, N = 2,963) = 1.51, $p > .22$; the relationship between appropriate CF and stunting was not significant X^2 (1, N = 2,963) = .17, $p > .68$. The relationship between age-appropriate CF and wasting was also not significant X^2 (1, N = 2,963) =. 11, $p > .74$.

Multiple linear regression that modeled the association between several independent factors was used to test the effects of these independent variables on infant nutritional status. Infant nutritional status was measured by normal weight, underweight, stunting, and wasting. Infants under 6 months of age who had EBF and those who did not have EBF were tested. The coefficient of determination (R^2) indicated that the changes in underweight associated with EBF were 8.1%. The overall regression model was significant, $F(18, 879) = 4.29$, $p < .05$, adj. $R^2 = .06$. Taking the predictor analysis as a group, they predicted underweight in infants under 6 months of age. A possible explanation to this research finding is that exclusively breastfeeding an infant between 0 and 6 months of age provided some protective effect up to about 8.1% against the onset of underweight in young infants.

Examining appropriate CF, the coefficient of determination (R^2) indicated that the changes in underweight associated with appropriate CF were 8.0%. The overall regression model was significant, $F(18, 2{,}944) = 14.29$, $p < .05$, adj. $R^2 = 0.08$; taking the predictor analysis as a group, the model predicted underweight in infants 6–24 months of age. This research finding means that appropriate CF provided some protective effect of about 8.0% against the onset of underweight in infants 6–24 months of age. In examining stunting in young infants, the coefficient of determination (R^2) indicated that the changes in stunting associated with EBF were 9.9%. The overall regression model was significant, $F(18, 879) = 5.379$, $p < .05$, adj. $R^2 = .08$, taking the predictor analysis as a group, the model predicted stunting in infants under 6 months of age. This indicated that EBF was a good predictor with a 9.9% protective effect against stunting in young infants less than 6 months of age. For CF, the coefficient of determination (R^2) indicated that the changes in stunting associated with CF was 14.8%; the overall regression model was significant, $F(18, 2{,}944) = 28.42$, $p < .05$, adj. $R^2 = .14$, taking the predictor analysis as a group, the model predicted that CF had about 14.8% protective effect against stunting in infants 6–24 months of age.

For the association between EBF and wasting, the coefficient of determination (R^2) indicated that the changes in wasting associated with EBF were 2.1%, The overall regression model was not a statistically significant predictor of wasting $F(18, 879) = 1.06$, $p < .05$, adj. $R^2 = .01$; taking the predictor analysis as a group, the model did not predict wasting in infants under 6 months of age. This means that EBF cannot protect against the occurrence of wasting in IYC of this age category. Although for IYC who had appropriate CF, the coefficient of determination (R^2) indicated that the changes in wasting associated with EBF were 2.2%, the overall regression model was a statistically significant predictor of wasting $F(18, 2{,}944) = 3.74$, $p < .05$, adj. $R^2 = .02$. Taking the predictor analysis as a group, the model predicted that appropriate CF had about 2.2% protective effect against wasting in infants who had appropriate CF between 6 to 24 months of age.

In relation to the TPB, integrating demographic factors were determining predictors of a caregiver's intentions and behaviors linked with BF initiation and age-appropriate CF introduction. From a TPB standpoint, it was hypothesized that certain maternal demographic variables (i.e., age, norms, household income, and educational level) are contributing factors in predicting intent and behaviors that are associated with the initiation of BF, the practice of EBF, and CF introduction in IYC. In child feeding decision making, Sheehan et al. (2013) studied the adoption of several behavioral theories such as TPB, which was designed as a foundation for accepting the decision-making process of the feeding of infants.

The choice of nursing mothers to BF their children is solely an individual decision; thus, determining the commencement and length of the BF period and all these factors are dependent on a mother's social group and available social support scheme (Sheehan et al., 2013). I found that there was a statistically significant relationship between a mother's education and an infant being underweight, which means that the higher the educational level of the mother, the lesser the chances of the onset of underweight in infants under 6 months of age. The relationship between wealth index quintile and underweight was also statistically significant, which also means that the higher the socioeconomic status of the mother, the lesser the chances of the onset of underweight in infants under 6 months of age. This study supports the finding of other researchers. Hasan, Soares Magalhaes, Williams, and Mamun (2016) argued that caregivers with a higher educational status had higher tendencies to adopt better infant care practice when compared to uneducated caregivers; caregivers with higher educational levels had infants who were not at risk of suffering from stunting, underweight, and wasting. Owoaje, Onifade, and Desmennu (2014) maintained that a caregiver's educational level, when below secondary level, and when family monthly income is below $20 were linked with undernutrition.

Horodynski et al. (2007) argued that the TPB framework could be adopted in examining the knowledge and attitudes as regards introducing solid foods from the perspective of complementary feeding introduced not earlier than 4-6 months. The knowledge required for the introduction of solid and semi-solid foods: that is, the information and understanding of the importance of age-appropriate complementary feeding, are all demonstrated in caregivers who have higher levels of education and also caregivers with higher wealth quintile. This study shows that the relationship between wealth index quintile and underweight was significant, and the relationship between mother's education and underweight was also significant. This study supports the findings of other researches, whose studies have shown that with increasing levels of maternal educational attainment, there is a higher likelihood for the caregiver to have the capability to access, process, and comprehend simple postnatal health information to make informed health decisions. For instance, caregivers of higher educational status are unlikely to accept unorthodox practices in child healthcare (Karlsen et al., 2011).

Limitations of the Study

The identifiable limitations to this research were the possibility of data integrity like every secondary data. The researcher lacked control over the quality of the data, even though there was some level of guarantees from official institutions and government bodies, but this is sometimes not always the situation. The use of secondary data in this research study design introduced potential misclassification and reporting biases in the data collection and recording. These biases could have occurred when vital information concerning infants' weight height and age and also infant feeding practices were elicited from caregivers in the absence of the infant's mother. These misclassification and reporting errors are capable of affecting the overall outcome of the study. Due to the nature of the questions and delivery of the data collection tool, recall bias could be observed in data collected from the target population surveyed. Infant feeding practices like breastfeeding initiation and timing of complementary diet introduction could have suffered some error in accuracy or completeness due to participants' inability to recall certain events; consequently, this recall error would significantly affect the research findings. This secondary data used were not originally collated to address the research questions or to test the various hypotheses. One of my research variables "norms" was not available for analysis, so to make up for that missing variable, other variables were added. The addition of a new variable in replacement should be anticipated in secondary dataset analysis. This is because findings are iterative processes rather than linear, which will not produce any significant effect on the overall research findings.

Despite the mentioned study limitations, the proposed research questions and the secondary dataset were certainly a good fit; this minimized the research errors and increased the study validity. It can be demonstrated that outcomes essentially measured what was intended to be measured, showing an association between the variables and the observed results. The secondary dataset had a sample size representative of the desired study population; thus, there can be generalizability of the findings and conclusions of this study to a greater population or other comparable circumstances in a broader context. There is consistency of the measurements; the research instruments will yield the same outcomes when carried out under the same conditions each time they are adopted. This study reproducibility showed reliability of research; therefore, results can be applied in the area of clinical practice.

Implications for Positive Social Change

These research findings have extensive implications for social change. Even though it has been demonstrated in various research literature that breastfeeding guarantees critical nutrient provision and protective effects for young infants, in West

Africa, the practice of EBF is still very low, because BF infants are still given water and other liquids (Dop, 2002). This study can be adopted in the development and improvement of the existing intervention techniques, which are intended to improve the uptake of EBF and appropriate CF among nursing mothers and caregivers. This study has identified that nursing mothers and caregivers of lower socioeconomic status and those with little or no educational background had infants with poor nutritional status. Therefore, social mobilization of these categories of women will go a long way to bridge the gap and, at some point, improve the nutritional outcome of these young infants because vital information is passed onto these women. The knowledge gained in this study can be used in the reinforcement of EBF and appropriate CF guidelines and policies for caregivers, and this will lead to positive social change. These study findings will also be thought provoking to policymakers on the need to enforce the already existing policies, which mandate government and the private sector to provide basic workplace accommodation and time for nursing mothers. The extension of paid maternity leave from 3 months to 6 months will also stimulate positive social change. The family paid leave, flexibility in working hours, and private space to express and breastfeed will sustain the practice of EBF and guarantee healthier infants.

Conclusion

This study established multiplicity risk factors of nutritional status affecting young infants not older than 2 years. After data analysis, I found a relationship between EBF and the onset of underweight in infants less than 6 months of age, where it was demonstrated that EBF practice offered some strong protective effect. Mature milk is produced around Week 3 postpartum, and more than 80% of this milk produced at this time is comprised of water, which is usually delivered at the beginning of the breastfeeding process, which essentially is required to keep the young infant hydrated (WHO, 2014). So, caregivers who give water or any kind of liquid to their infants only succeed in filling the stomach of these infants with water, coupled with the additional water that is delivered at the beginning of the feeding process. This routine of giving water may cause the infant to drink less breast milk or even discontinue breastfeeding much earlier, resulting in underweight.

The relationship between age-appropriate CF and onset of underweight, as shown in this study, demonstrates that the practice of age-appropriate CF also offered some strong protective effect. The timing of this feeding pattern is important because the introduction of this practice too early or too late in the life of the IYC is counterproductive when assessing the nutritional status of the infant. These study findings are consistent with Ahmad, Madanijah, Dwiriani, and Kolopaking, (2018), who concluded that infants 6–23 months of age with a high prevalence of underweight were known to have experienced suboptimal CF practices; therefore, the need to improve CF practices for a better nutritional status outcome is important. Poor nutritional status of infants has become a public health problem of concern in Northwest Nigeria; the occurrence of growth faltering is highly prevalent where there is inadequacy of CF in terms of the quality, quantity, and frequency of diets.

Recommendations

EBF has been demonstrated as an effective feeding technique that provides young infants less than 6 months old with nutrient-enriched, healthy food from birth, and appropriate CF has also demonstrated to have numerous health benefits. It is recommended that interventional mapping, which is aimed at improving the nutritional status of infants, be focused. It is important to educate pregnant women during antenatal clinics, underscoring the health benefits of EBF and age-appropriate CF practices. These nutritionally tailored interventional initiatives should aim at targeting poorer households and caregivers with lower levels of education to improve the uptake of EBF and age-appropriate CF practices. Numerous developmental initiatives should be established by the government at the local levels, focusing on women empowerment in the rural communities, aimed at creating sustainable employment, and in return, improve the household income of these rural women. With the improvement in household income, age-appropriate CF practices that involve the introduction of family diets will be comprised of dietary diverse nutrient-rich foods. There is also a need to educate nursing mothers to commit to adequate care of their infants' dietary needs without discriminating or giving priority to a particular gender. In the future, more analytical cross-sectional studies incorporating principles and models of behavioral change are required to be carried in Northwest Nigeria. This will be done to determine if nursing mothers who attended antenatal clinics reared infants who had better nutritional status with respect to the uptake of the practices of EBF and appropriate CF by ascertaining if nutritional knowledge acquired is actually translated to practice.

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