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A Review Of The Approaches Employed In The Management Of Malnutrition In Nigeria

Osunu T. P[1], Apiyanteide F[1], Nwose EU[2]

[1]Public & Community Health Department, Novena University Ogume, Delta State, Nigeria

[2]School of Health & Medical Science, University of Southern Queensland, Australia

Abstract

Malnutrition (undernutrition) remains a major public health challenge in Nigeria, that has been fueled and sustained by insecurity, a dwindling economy in addition to the impact of climate change. This review seeks to discuss the various approaches in the management of undernutrition among children in the country with the view of providing up to date information and best practices on the subject. A review of databases like Google Schoolar, PubMed and Global repository like the World Health Organization (WHO) and United Nations Office for the Coordination of Humanitarian Affairs (OCHA) was done to obtain information on the subject. The key outcome sought in the review were methods used by government, implementing partners (Community Based Organizations, Non-Governmental Organizations, and the United Nations), mothers/caregivers and researchers on the various approaches utilized for the management of undernutrition in Nigeria. The result showed that there are basically five approaches for the management of undernutrition in Nigeria. These include the Infant and Young Child Feeding (IYCF) approach that targets optimum nutritional practices from birth to two years and beyond, Community Management of Acute Malnutrition which consist of community mobilization, outpatient care for the management of Severe Acute Malnutrition (SAM) without complications using the Ready to Use Therapeutic Food (RUTF), the in-patient care carried out in stabilization centres using RUTF, Formula 75 (F75) and Formula 100 (F100) depending on the condition of the child, and the Supplementary Feeding Program for the Management of Moderate Acute Malnutrition (MAM) using Ready to Use Supplementary Food (RUSF) and Micronutrient powder in addition to counselling which targets children aged 6 -59months. The next approach is the food-based approach which targets children alone and involves the use of locally available food (Tom Brown) and fruits to prevent /treat moderate malnutrition, and the food-based approach for mothers (Porridge Mum) which involves food demonstrations and provision of quality food to pregnant and lactating mothers and their babies usually in humanitarian conditions and lastly the nutrition sensitive agriculture approach which involves the implementation of agriculture programs that puts “nutrition first” and involves the fortification of agricultural products and building the capacity of local farmers on best agricultural practices that are climate smart and ensure high yields of crops with high nutritional value to address the nutritional needs of the entire households and community. Factors reported to contribute to the sustained cases of malnutrition in Nigeria include poverty, insecurity, misuse and management of nutrition commodities, lack of knowledge amongst mothers and caregivers on the various approaches of managing undernutrition. There is an urgent need to come up with innovations and implements strategies that timely detects and wholistically address malnutrition in Nigeria in order to actualize zero hunger in the country by 2030 (SDG 2).

Key Words: Malnutrition, Community Management of Acute Malnutrition, Food-based approach, mothers, caregivers, health workers, zero hunger.

Introduction

The term nutrition refers to the totality of the processes involved from intake to utilization of food substances by living organisms. This involves ingestion, digestion, absorption, transportation, metabolism and utilization of nutrients found in food that is required for proper growth and development of the individual. Adequate nutrition is vital for healthy growth and development during childhood (Abel *et al.,* 2019) and according to the World Health Organization (WHO, 2009), malnutrition could occur whenever there is an imbalance of nutrients and/or energy in the body. There are several forms of malnutrition which can be broadly grouped into two categories - undernutrition and overnutrition (Kim *et al*., 2019). Undernutrition which is commoner among children in low- and middle-income countries like Nigeria manifests as wasting or low weight for height (acute malnutrition), stunting or low height for age (chronic malnutrition), underweight or low weight for age, mineral, and vitamin deficiencies (WHO, 2009). On the other hand, overnutrition could be expressed as overweight, and obesity which are often implicated in non-communicable diseases (NCDs) such as diabetes mellitus, hypertension, and some forms of cancer (WHO, 2009).

WHO (2009) opined that malnutrition is one of the greatest threats to the world's public health that is associated with high morbidity and mortality among vulnerable and marginalized populations. Its toil among such population includes discrimination and a poverty cycle following consistent out of pocket payments for the management of various diseases due to the immunocompromised state of children with malnutrition (WHO, 2009). Evidence from the Maternal and Child Undernutrition Study Group, revealed that more than one-third of child deaths are attributed to malnutrition and about 178 million children globally are stunted because of not having adequate food with vitamins and minerals, as well as the needed calories (Black *et al.*, 2008).

Globally, the WHO (2021) noted that in 2020, an estimated 149 million children under the age of 5years were stunted, 45 million were wasted and about 45% of deaths among children under the age of 5 years are linked to undernutrition. In Sub-Sahara Africa, the prevalence of stunting was estimated at 36% which is greater than the global prevalence of 21.3% in 2019 (FAO, IFAD, UNICEF, WFP, & WHO, 2020). In Nigeria, (UNICEF, 2015) stated that Nigeria has the second highest burden of stunting among children in the world, with a national prevalence of 32 percent of children under five who are currently stunted and an estimated 2 million children with severe acute malnutrition (SAM) while only 20% of them are currently reached with treatment which is a major gap in the eradication of malnutrition in the country.

The high burden of malnutrition in Nigeria and other low and middle income countries with similar pattern is worrisome and various factors have been identified to be associated with the condition and this include the political and economic depreciation, the low level of education and sanitation practices, the effects of seasons and climate change, high cost of food production and cost of food stuffs, cultural and religious practices that mitigates against proper nutrition, poor breast-feeding habits and practices, the high prevalence of infectious diseases, the limited number of nutrition and health programs that will address this condition and multi-dimesional poverty affecting several households (Morris *et al.*,2008). The immediate causes of child malnutrition also manifest themselves at the individual, household and family levels, and they include poor dietary intake and presence of

disease conditions such as diarrhea and measles. A child with inadequate dietary intake is more susceptible to diseases, experiences poor appetite, with inhibition of the processes for effective absorption of nutrients in food, with resultant low energy levels of the child (Abel *et al.,* 2019). Other causes of malnutrition include underlying factors such as inadequate access to food, poor maternal and childcare, poor health services, and an unhealthy environment which are influenced by economic, political, and sociocultural conditions at the regional, national and global context that ultimately affects the availability of resources and these are the basic causes of malnutrition that have been poor in most nations with high burden of undernutrition (Saloojee, 2007).

The impact of undernutrition has been assessed in several studies and according to Gladstone *et al.* (2014) children that are malnourished face serious health and physical consequences such as delayed physical growth and motor development, lower intellectual quotient (IQ), higher risk of behavioral problems, deficient social skills, and high susceptibility to infectious diseases. Child malnutrition may also lead to higher levels of chronic illnesses in adult life which may have intergenerational effects, as experienced by malnourished females who are more likely to give birth to low-weight babies that ultimately becomes malnourished and the cycle continuous (Abel *et al.,* 2019).

Malnutrition must be addressed in children as the manifestations and symptoms begin to appear in the first 2 years of life which coincides with the mental development and growth periods in children. A period that they are easily prone to developing protein energy malnutrition (PEM) at ages 6 to 24months of age (De and Chattopadhyay, 2019). This period is considered a window period when mothers and caregivers should ensure adequate nutrition of their child or children to avoid acute or chronic malnutrition and its associated harmful impacts (Walton, 2011). A malnutrition cycle exists in populations experiencing chronic undernutrition and during this period, the nutritional requirements are not met in pregnant women. Infants born to these mothers are of low birth weight, and are unable to reach their full growth potential, and may therefore be stunted, susceptible to infections, and experience early mortality (Walton, 2011).

It is important to timely identify, prevent and treat cases of malnutrition to avoid its sequalae and this has been a challenge in Nigeria. Even though several approaches have been employed in the management of malnutrition across the country for many decades, there is still a dearth of information and knowledge on existing methods employed by stakeholders in the management of malnutrition. This review critically gives an in-depth description of the various methods employed in the management of malnutrition in Nigeria with the goal of promoting best practices needed to address the problem in the country.

Review of Related Literatures

Malnutrition

Malnutrition remains a significant contributor to morbidity and mortality among children worldwide despite global efforts made to achieve adequate nutrition and zero hunger (WHO, 2021). Abainya (2012) defined malnutrition as the insufficient, excessive, or imbalanced consumption of nutrients which results in an imbalance in the body system. Pollard & Booth (2019) reported that malnutrition is responsible for more than half of all the

deaths among children around the world including deaths caused by diarrhea, pneumonia, malaria, and measles. This is because poor nourishment leaves children with a weakened immune system that makes them vulnerable to infectious diseases (Gladstone *et al.*, 2014). The World Health Organization estimated that malnutrition was associated with over 50% of all childhood deaths in developing countries (WHO, 2021). In Nigeria, Adesuyi, *et al.* (2021) reported that the prevalence of stunting was 37.8%, underweight was 20.3% while 9.6% of children were wasted.

Causes of Malnutrition

Inadequate dietary intake and disease conditions are the two immediate causes of malnutrition, for which growth faltering in children is a marker. This outcome thus refers to physiological processes, influenced by both diet and illness. The diet-infection cycle is well known, inadequate nutrient intake results in a lowering of immunity which has adverse consequences on children. Among affected children, there is increased vulnerability, incidence, severity, and duration of illness with often worse outcomes. At the same time, disease processes increase nutrient requirements and exacerbate the loss of nutrients, and/or are associated with a loss of appetite, cycling back to further lower nutrient intake (Abel *et al.*, 2019). This diet-infection cycle reflects some of the most important relationships which account for the high morbidity and mortality that characterize many poor communities in low- and middle-income countries.

UNICEF Framework for the Causes of Malnutrition

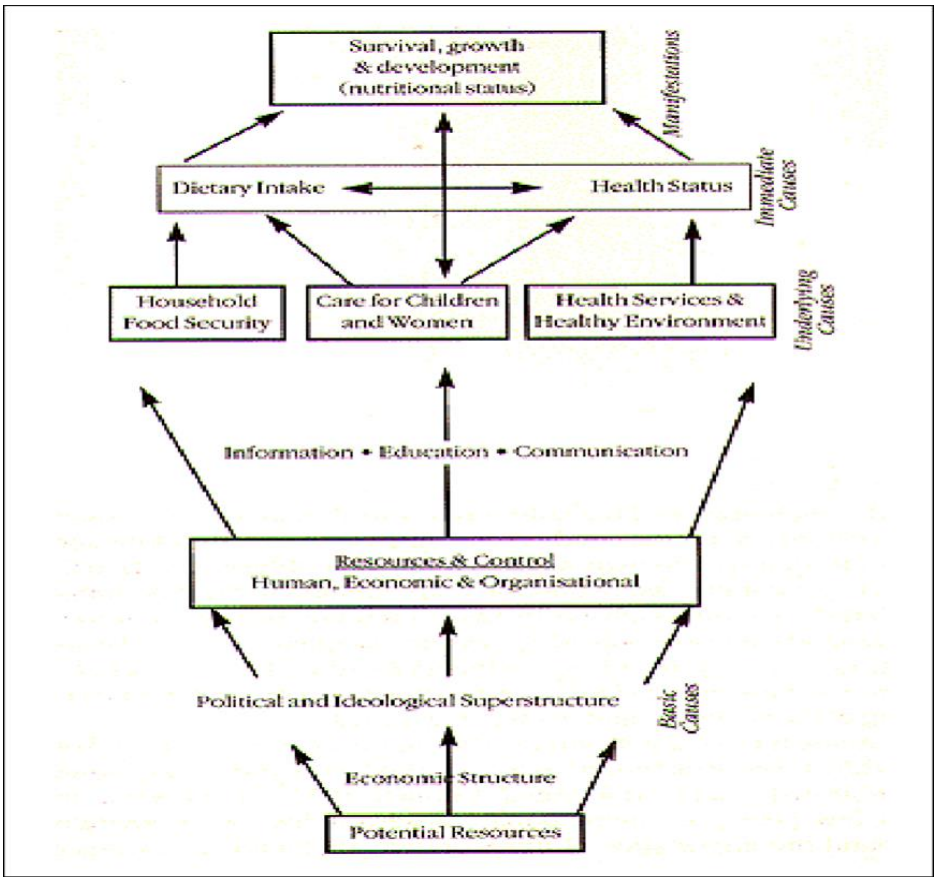

Figure 2: UNICEF Framework for the causes of malnutrition

The UNICEF framework for malnutrition divided the causes of malnutrition into three – immediate, underlying and basic causes of malnutrition and this framework has been very instrumental in understanding the etiology of malnutrition and its application to the field since its design. The causes are discussed below.

Immediate Causes of Malnutrition

The two immediate causes of malnutrition are inadequate dietary intake and illness. Dietary intake is affected by food availability and access to the households. Illnesses such as diarrhea, measles, and respiratory tract infections result to malnutrition following the various processes that inhibit intake or results to exit of nutrients from the body. This is influenced by access to healthcare services such as immunization, maternal and child healthcare and the presence of a healthy environment including the availability of clean water, sanitation and hygiene among households (Michelle, 2022).

Underlying Causes of Malnutrition

Underlying causes of malnutrition include household inadequate access to food, inadequate maternal and childcare, insufficient health services and an unhealthy environment. These factors are linked to the immediate and basic causes of malnutrition and addressing them in a holistic manner is important towards addressing undernutrition among children.

Basic causes of malnutrition

This consists of political, ideological, and economic factors that influence the presence of the underlying factors. These factors operate more at the national or sub-national levels and during favourable conditions, there are often interventions like industrialized agriculture that promote food security that result to a decline in the cases of malnutrition. This also supports a stable economy and country that fosters mass agricultural production and availability of a variety of quality food at any point in time which also results to a decline in cases of malnutrition (Michelle, 2022).

Types of Malnutrition

Clinically, malnutrition or Protein Energy Malnutrition (PEM) can occur in the form of kwashiorkor, marasmus, marasmic-kwashiokor and micronutrient deficiency. These are described herein.

Kwashiorkor

This is a form of PEM due to insufficient intake of protein in the presence of adequate calorie intake (Pham *et al.*, 2021). This condition often affects infants and children and is marked by severe protein deficiency which is often prominent during weaning up to the age of 5 years (Benjamin & Lappin, 2023). Children with kwashiorkor are characterized by bilateral pitting pedal edema, a protruded abdomen due to enlarged liver with fatty infiltrates, and an enlarged head relative to the body size.

Etiologically, the exact cause of kwashiorkor is not well delineated. Although children with kwashiorkor are known to commonly consume cassava, maize and rice on a frequent basis. Some research linked the disease to aflatoxins, lack of antioxidants micronutrients such as vitamin C, Beta-carotene, lycopene and other carotenoids (Pham *et al.,* 2021). Despite this evidence, some of these factors have not been identified in some circumstances and conditions of malnutrition among children in some parts of the world. Conditions that have been persistently observed among malnourished children are recent weaning, current infections such as measles, poverty, death of parent and poor environment (Grellecy & Golden, 2018).

Kwashiorkor is usually common during famines and insecurity and the prevalence across the globe varies with higher prevalence in South-East Asia, Sub-Sahara Africa, and Central America (FitzPatrick *et al.,* 2018).

Management of this condition involves an interdisciplinary team that are working in a Community-based Management of Acute Malnutrition (CMAM) Centre that provides out-patient therapeutic feeding program for those without complication using RUTF and in patient therapeutic feeding program (Stabilization Centres) for SAM with complications using F75, F100, RUTF and medications for underlying illness. During management of malnutrition, it is important to identify and provide care to the immediate condition causing protein or calorie deprivation (Ndzo *et al.,* 2018).

Marasmus

This is a form of PEM that is mainly due to deficiency in nutrients and energy due to insufficient intake. The condition is often seen with infections such as diarrhea, measles, HIV and TB (Ndzo *et al.,* 2018). It is also common during natural or man-made conditions like drought and war respectively. Poor access to water, sanitation and hygiene, poor parent education has all been associated with marasmus. Marasmus always occurs because of negative energy balance characterized by insufficient intake, increase loss of ingested calories during diarrhea and vomiting high energy expenditure or a combination of these measles (Ndzo *et al.,* 2018).

Children with marasmus are often lethargic due to an adaptation mechanism to the energy deficiency state. They lose weight and experience slow growth. Evidence revealed that there is usually electrolyte derangement with some elements such as Zinc, Magnesium and Selenium remarkably low and the introduction of these micronutrients often results in improvement in the health of the child.

Marasmus has a multi-factorial etiology which is not the same among children and across the globe. The condition could occur because of inappropriate weaning practices by a young inexperienced mother, underlying or precipitating infections such as diarrhea and measles and the effects of war which results in non-availability of food rich in nutrients for good nutritional status of children.

Timely management of children with marasmus is key towards the prevention of neurological and other sequalae that can result to long-term deficits (Ndzo *et al.,* 2018). On clinical presentation, children with marasmus have a shrunken wasted appearance which is classic for the condition. They could present with anaemia, dehydration

with shrunken eyes and thirst for water, hypothermia and hypovolemic shock among other manifestations in the body systems.

Following a positive appetite test, children with marasmus are managed with RUTF in Out-patient therapeutic centre in the absence of complications and in the presence of complication, they are managed in an in-patient or stabilization centres and underlying medical conditions like diarrhea, respiratory tract infection and malaria are treated accordingly.

Marasmic-Kwashiokor

The combined signs and symptoms of marasmus and kwashiorkor are known as marasmic kwashiorkor. Children with this form of PEM exhibits features of both conditions and management should be done promptly following CMAM guidelines.

Micronutrient Deficiency

Micronutrient deficiency, otherwise known as hidden hunger, is a form of malnutrition that occurs when essential vitamins and/or minerals are not present in adequate amounts in the diet. This condition is a serious public health concern in most developing countries of the globe where it's devastating effects is felt among vulnerable populations such as pregnant and lactating women and children under the age of five (WFP, 2005). According to Stevens *et al.* (2022) an estimated 372 million preschool-aged children are deficient in at least one of three micronutrients (iron, zinc, and/or vitamin A). In Nigeria the Federal Ministry of Health (2013) noted that iodine, iron, and vitamin A deficiency are common forms of micronutrient deficiency that have persisted for years despite several efforts, and it currently remains a public health issue which led to the development of the National Guideline on Micronutrient Deficiency Control in Nigeria to guide the effective implementation of programs aimed at addressing this problem. Bryce *et al.* (2003) opined that if left unchecked, micronutrient deficiencies can lead to irreversible physical consequences, and this is why they are considered a major public health issue that deserves national and international attention. A review of the three common micronutrient deficiency in Nigeria is provided below.

Iodine Deficiency

Iodine is essential for the normal growth and development of the human body and is required for the production of thyroid hormones, which are necessary for normal brain development (WHO, 2007). Insufficient intake of iodine in the diet causes a myriad of health problems collectively known as Iodine Deficiency Disorders (IDD). The health consequences of IDD include mental retardation, goiter, growth retardation, and increased neonatal and post-natal mortality. Lack of iodine at conception causes maternal hypothyroidism, which has dramatic consequences for the fetus, including severe and irreversible brain damage. It is estimated that 2 billion people, or 30.6 percent of the global population, have insufficient iodine intake, including 59.7 million school-aged children in Africa (UNICEF 2007; de Benoist *et al.*, 2007). Data from the 2001–2003 NFCNS revealed that a total of 27.5

percent of children suffered various degrees of iodine deficiency, while 46.5 percent had more than adequate levels. Deficiency of iodine was reported in 10.6 percent of children under five in the medium (semi-urban) sector, 10.6 percent in the urban sector, and 15.5 percent in the rural sector. More than adequate and possible excessive intakes of iodine were seen in 42 percent of children under five in the rural sector, 49 percent in the urban sector, and 51 percent in the medium sector (Maziya-Dixon, 2004). Among mothers, Iodine deficiency by agroecological zones was 11.6 percent in the dry savannah, 15.2 percent in the humid forest, and 19.0 percent in the moist savannah. The percentage of those with mild deficiency ranged from 16.8 to 21.6 percent across zones. Iodine deficiencies among mothers were 10 percent in the urban sector, 13.7 percent in the medium sector, and 21 percent in the rural sector. The high prevalence of iodine deficiency in Nigeria clearly demonstrates that this micronutrient deficiency in the country is worrisome and calls for immediate action such as fortification of salts used by all households in the country (Kuku-Shittu *et al.,* 2016).

Iron Deficiency

Iron is critical for cognitive and motor development in childhood and physical activity in all humans. Nutritional iron deficiency is a major health problem in many developing countries, often coexisting with iodine deficiency in the same populations. Iron Deficiency Anemia (IDA) is indeed the most prevalent and widespread nutritional disorder in the world today, affecting populations in both developed and developing countries. Insufficient iron intake can lead to increased maternal mortality, compromised development of motor skills and learning capacity, lethargy, and reduced immunity to diseases. It is estimated that more than 2 billion people worldwide are at risk of iron deficiency anemia, with the prevalence around 40–60 percent in pregnant women, 20–40 percent in women of childbearing age, and about 10 percent in school-aged children and adult men (UNICEF, 1992). In a Southwestern Nigeria study, Maziya-Dixon *et al.* (2004) in their survey showed that almost 20 percent of children were iron deficient. Several factors such as age, gender, and socioeconomic status of an individuals have been linked with iron deficiency among various populations. This could be from insufficient iron intake, decreased absorption of iron, or haemorrhage (blood loss). Iron-deficiency anemia is most often from blood loss among older persons and could be due to low dietary intake for children, increased systemic requirements for iron during pregnancy, and decreased iron absorption in celiac disease (Khan, 2018; Warner & Kamran, 2023). Management of this form of micronutrient deficiency is based on addressing the underlying cause(s) of the condition.

Vitamin A Deficiency

Vitamin A is a fat-soluble vitamin, essential for vision in dim light; cellular, bone, and tooth growth; formation and maintenance of healthy skin, hair, and mucous membranes; reproduction; and immunity boosting. Vitamin A is so important in embryological development that without it, the fertilized egg cannot develop into a fetus (Brody, 2007). Its deficiency results in night blindness or impaired adaptation to the dark; lowered immunity to infections such as measles, diarrhea, chicken pox, and respiratory infections; anemia; poor growth; slowed bone development; blindness; and death. All these have disastrous effects on the healthy growth and intellectual performance of a child. Globally, one in three preschool-aged children and one in six pregnant women are vitamin

A deficient due to inadequate dietary intake (WHO, 2009). Nigeria is considered one of the WHO's Category 1 countries with the highest risk of vitamin-A deficiency (Humphrey *et al.,* 1992) where the condition contributes to 25 percent of infant, child, and maternal mortality due to reduced immunity to acute respiratory infection, measles, malaria, and diarrhea and higher risk of developing PEM (WHO, 2009).

The micronutrient deficiencies indicators reveal that at the national level, 4.7 percent of children under five had serum retinol concentration (< 10 µg/dl) and were suffering from severe vitamin A deficiency (clinical deficiency); 24.8 percent suffered from marginal deficiency (serum retinol concentration < 20µg/dl) and were vitamin-A deficient, and 71.5 percent of children were normal. If those who were marginally deficient are combined with those who were clinically deficient, 29.5 percent of children under five were suffering from vitamin-A deficiency (Maziya-Dixon *et al.,* 2006). In pregnant women, vitamin-A deficiency contributes to intra-uterine malnutrition, which leads to low birth weight or stillbirths, especially when found in combination with zinc deficiency. Furthermore, scientific evidence showed that adding vitamin A or beta-carotene to the diets of pregnant women lowers their risk of death from pregnancy by as much as 40 percent. Mothers with serum retinol concentration (< 30 µg/dl) were considered at risk of vitamin A deficiency and constituted 13.1 percent of the national population (Kuku-Shittu *et al*., 2016). Sources of vitamin A could be from plants or animals and examples of plant sources are oranges, pawpaw, sweet potatoes, carrots, and tomatoes while example of animal source is the liver. These foods need to be consumed in the right proportion to prevent micronutrient deficiency (Kuku-Shittu *et al.,* 2016).

Assessment of the Nutritional Status of Children

This refers to one's state of health as depicted by the quality of nutrient intake and the body's ability to utilize them for metabolic needs (Amosu *et al.,* 2011). Nutritional status indicates the health of an individual in terms of what they consume or better still one's current state of health after the body has made use of the food they take. The evidence of the effect of our dietary intake is visible in the human body and how the body systems work.

In children under five, nutritional status reflects the child's overall health (GSS, 2011). It is also an accepted indicator of the nutritional well-being and health of their community. It is not surprising most studies seek to assess the nutritional status of children under five.

Akorede *et al.* (2013) in their recommendation on solving the problem of malnutrition suggested that periodically, nutritional assessments should be conducted to help track the progress being made to solve the malnutrition problem. Thus, there is a need to assess the nutritional status of communities.

Assessment of one's nutritional status tries to give an interpretation of what the body lacks, has in the right amounts, or has in excess. It helps in the identification of people with nutritional deficiencies and the type of deficiencies they have. Nutritional status can be determined by either one of the following methods or a combination of them. According to (Maqbool *et al.,* 2008) every nutritional assessment requires one or more of these for better interpretations since no single method provides an adequate assessment of nutritional status. They include anthropometry, biochemical analysis, clinical assessment, and dietary assessment. The gold standard for assessing the nutritional status of a population is by combining all four methods (Wasantwisut *et al.,* 2007).

Assessment of the nutritional status of children can be done through dietary assessment, biochemical analysis, clinical examination and anthropometry. These are discussed below.

Dietary Assessment

This involves a measure of dietary intake and one's feeding ability. It can be used to measure both nutrient and food intake. Dietary assessment involves different methods. It includes individual dietary assessments, food frequency questionnaires, household survey methods, and a simple food list. It is an essential component of nutritional assessment because it provides information about the amount, and quality of food consumed and also the eating patterns and behaviours of the family (Maqbool *et al.,* 2008). In nutritional assessments of children, it gives an idea of the child's intake over a specified period. It is most of the time used as a reflection of the child's diet.

Biochemical Assessment

Biochemical assessment is used in the assessment of the nutrients in the body. It involves the collection of laboratory samples to assess nutritional status. Samples such as blood and urine are taken from the individual. These tests are done to assess the level of biological markers in the body. These markers are used to determine the levels of nutrients the body contains (Maqbool *et al.*, 2008).

Clinical Assessment

Signs of malnutrition may be seen on the body of the individual. These signs can be seen by close observation. Maqbool *et al.* (2008) noted that clinical assessment involves the close examination of one's physical body such as skin, hair, and teeth. This is done to find evidence of specific nutritional deficiencies. Clinical assessment serves as a valuable aid in detecting nutritional deficiency since it requires little expertise. Key investigation done during this period is to identify whether the child has oedema or not and classify the oedema into severity such as plus one (+) to plus three (+++) to show the severity of the oedema which indicates presence of kwashiorkor in a child.

Anthropometric Assessment

Anthropometry can be described as a useful tool for monitoring growth and nutritional assessment which has been used for a long time as a diagnostic tool for grading malnutrition. He further describes it as a simple tool for the nutritional assessment of individuals because of its objectivity and relatively low technology required in its usage (Duggan, 2010). Anthropometric measurements are the most widely used indicators for nutritional status in a community. It can be used to determine the prevalence of malnutrition in a survey population. It is also used to assess growth and development, especially in young children.

Anthropometry involves taking body measurements such as weight, height, and mid-upper arm circumference and comparing them to the WHO 2006 growth standards. These body measures are used to formulate indicators that

give some information on the nutritional status of the child. There are three main indicators used in assessing the nutritional status of children by anthropometry which are height-for-age, weight-for-height, and weight–for–age. Based on this, the outcomes for screening children 6 – 59 months is represented with the table below.

Table 1: Outcomes of screening children aged 6 – 59 months for malnutrition

Severe Acute Malnutrition	Moderate Acute Malnutrition	Normal
• MUAC < 11.5 cm (red) • WFH < -3 Z scores • Bilateral pitting oedema	• MUAC > 11.5cm and < 12.5cm (Yellow) • WFH > -3 and < -2 Z scores • No oedema present	• MUAC > 12.5CM (Green) • WFH > - 2 Z Scores • No oedema

Weight -for -Height

This measures the child's weight versus their height. A child with a low weight for their height is referred to as being wasted. This is a measure of acute malnutrition (malnutrition of a short period) that is a recent nutrition deficiency (Prentice *et al.,* 2008). This indicator shows significant changes associated with the availability of food or disease prevalence (GSS, 2011).

Weight -for -Age

This assesses the weight of the child for his age and is a measure of long and short-term malnutrition (Prentice *et al.,* 2008). A child with a low weight-for-age is referred to as underweight (GSS, 2011).

Height -for-Age

It measures linear growth. Faltering in linear growth is detected as low height for age and is referred to as stunting. It reflects chronic malnutrition over a long period) which results from prolonged inadequate nutrient intake (GSS, 2011). Stunting is the greatest problem of the three indicators and can also result in being underweight. Thirty-one (31%) of children in low and middle-income countries are stunted (Prentice *et al.,* 2008). Even in Ghana, stunting has been the greatest problem, twenty-eight (28%) of the children under-five are reportedly stunted (GSS *et al.,* 2009).

Strategies for the Management of Malnutrition in Nigeria

In Nigeria, various approaches have been implemented in the management of malnutrition across the country. Key approaches ultilised include Infant and Young Child Feeding, Community Management of Acute Malnutrition (CMAM), Food-based approach for children, food-based approach for pregnant and lactating mothers and nutrition sensitive agriculture approach. These are discussed herein.

Infant and Young Child Feeding

In 2002, the World Health Organization and UNICEF adopted the Global Strategy for Infant and Young Child Feeding (IYCF) (WHO/UNICEF, 2003). The strategy was developed to revitalise the world's attention towards the impact of feeding practices on the nutritional status, growth and development, health, and survival of infants and young children across the globe. WHO and UNICEF's recommended optimal infant feeding and set out the Global Strategy needed to actualize this goal which are outlined as follows:

Early Initiation of Breast Feeding

Early initiation of breastfeeding, within one hour after birth is a recommendation by the WHO which is required to protect newborn from contracting infections and reduces infant mortality. The practice promotes bonding between the mother and baby and has been shown to have a positive impact on duration of exclusive breastfeeding. Once mother's initiate breastfeeding within an hour after birth, breast milk production is stimulated, and this enhances the breast-feeding experience between the mother and the baby. The yellow or golden first milk produced in the first days, also called colostrum, is an important source of nutrition that boost the child's immunity against infectious diseases (Victora *et al.*,2016). Programs aimed at eradicating malnutrition should therefore build the capacity of mothers/caregivers on the benefits of early initiation of breast feeding including the bonding it fosters between the baby and the mother or caregiver.

Exclusive Breastfeeding

Exclusive breastfeeding for 6 months has been shown to have several benefits for the infant, mother, and the family. Key benefits noted are the fact that exclusive breast feeding provides protection against gastrointestinal infections, especially in developing nations with poor water, sanitation and hygiene practices (Victora *et al.*,2016). Thus, the risk of mortality from diarrhoea and other infectious diseases among infants who are exclusively breast fed when compared to those that are partially breastfed or not breastfed at all is lower. Breast milk is an important source of energy and nutrients to children aged 6–23 months and this implies that children are breast feed exclusively for six months with continued breastfeeding for two years and beyond in addition to appropriate complementary feeding. At 6 and 12 months, breast feeding provides at least half of the child's energy and from 12 – 24months, it provides one-third of the energy requirement of the child. Breast milk is also a critical source of energy and nutrients, and it is found to reduce mortality from malnutrition (WHO, 2023).

Children and adolescents who were breastfed as babies are less likely to be overweight or obese. They perform better on intelligence tests and have higher school attendance which is often linked with higher academic achievement and income during adult life. Improving child development and reducing health costs results in economic gains for individual families as well as at the national level (Victora *et al.*, 2016). Longer durations of breastfeeding also contribute to the health and well-being of mothers by reducing the risk of ovarian and breast cancer, provide lactational amenorrhea needed for pregnancy spacing when exclusive breastfeeding for six months is practice. Mothers and families need to be supported for their children to be optimally breastfed and

actions that help protect, promote, and support breastfeeding are well captured in various policies and guidelines. Among these are the International Labour Organization "Maternity Protection Convention 183" and "Recommendation No. 191", which complements "Convention No. 183" by suggesting a longer duration of leave and higher benefits, international code of marketing of breast milk substitutes and the subsequent relevant World Health Assembly resolutions, Baby friendly hospital initiative that clearly outlines the strict implementation of the "Ten Steps to Successful Breastfeeding" (Victora *et al.,* 2016).

Complementary Feeding

Around the age of 6 months, an infant's need for energy and nutrients starts to exceed what is provided by breast milk, and complementary foods are necessary to meet those needs which they are developmentally prepared to consume and ultilise such meals (WHO, 2021). Growth faltering may ensure when children are not adequately nourished, and this could occur as a result of poor understanding of the principles towards successful complementary feeding (Deborah *et al.,* 2023). Victoria *et al.* (2016) outlined the guiding principles for appropriate complementary feeding and they include:

- Continue frequent, on-demand breastfeeding until 2 years of age or beyond.
- Practice responsive feeding (for example, feed infants directly and assist older children. Feed slowly and patiently, encourage them to eat but do not force them, talk to the child, and maintain eye contact).
- Practice good hygiene and proper food handling.
- Start at 6 months with small amounts of food and increase gradually as the child gets older.
- Gradually increase food consistency and variety
- Increase the number of times that the child is fed: 2–3 meals per day for infants 6–8 months of age and 3–4 meals per day for infants 9–23 months of age, with 1–2 additional snacks as required.
- Use fortified complementary foods or vitamin-mineral supplements as needed; and during illness, increase fluid intake including more breastfeeding, and offer soft, favourite foods.

Community-based Management of Acute Malnutrition (CMAM)

The CMAM is a globally recognized approach/model in the management of malnutrition among children aged 6 – 59months. This approach is a shift from the previously facility-based treatment for children with wasting. The current framework focuses mostly on a community approach where caregivers and family members are empowered to timely identify and take action to end malnutrition at the community level. The overall goal of CMAM is to reduce childhood morbidity and mortality and this is achieved through key principles that the approached is based upon (Federal Ministry of Health, 2010).

The principles of CMAM include:

i. **Improve access and coverage on management of malnutrition**: This involves the operationalization of programs including community mobilization to reach out to a large number of children with wasting and timely take actions needed to prevent or treat cases of malnutrition. To actualize this, community members are actively engaged with regular conduct of outreach sessions to identify and treat malnutrition at designated centres in the community.

ii. **Timeliness**: CMAM ensures the timely identification and treatment of children with wasting (MAM & SAM) before complications arise. Through this means, most (90%) of children with severe acute malnutrition can be managed at home (Federal Ministry of Health, 2010).

iii. **Appropriate care**: This involves the provision of appropriate medical and nutrition care to children with malnutrition that have been identified in the community. The care provides should be acceptable and tailored to the need of the child.

iv. **Care for as long as it is needed**: This involves the continuous provision of medical and nutrition care and services such as health education of the caregivers as long as the child remains malnourished. Usually, a weekly or bi-weekly visiting schedule is done for routine visits and monitoring of treatment progress and the status of the child whether he/she is no longer malnourished.

Components of CMAM

CMAM is divided into four major components which include community mobilization, out-patient therapeutic care (OTP), in-patient care and supplementary feeding program (SFP) (Federal Ministry of Health, 2010). These are discussed below.

Community Mobilization: This deals with a mix of activities that are designed to foster community participation in the eradication of malnutrition. These activities aim to timely detect and refer children with wasting to locations or health facilities where the children will be given right nutrition and medical care.

Out-patient care: This is also known as out-patient therapeutic care (OTP) which involves the provision of treatment to children aged 6 – 59months without any medical complications. Following the identification of SAM in a child, the child is enrolled into the program, appetite test is conducted and thereafter the child is placed on RUTF on a daily basis until the child actualize the target weight, nutrition and health status.

Supplementary Feeding Program: This program aims to timely detect and treat children with MAM using RUSF basically. This service is provided at a supplementary feeding centre which are often limited in number across Nigeria. Timely detection of MAM and providing the needed care is key towards reducing the burden of

SAM and its sequalae in every community and this should therefore be given the needed priority especially in high-risk communities across the country.

In-patient care: This is also known as Stabilization Centre (SC) care which involves admitting and providing medical and nutrition care to a child with SAM and complications based on clearly defined criteria for admission. Basically, children during this level of care are managed with F_{75}, F_{100} and RUTF in addition to appropriate medical treatment of underlying medical condition(s) the child has. This level of care should be carried out under medical supervision (UNICEF, 2018).

Nutrition Formulas/Feeds for Management of Acute Malnutrition in CMAM

The F-75 is a therapeutic milk diet for children with SAM which has carbohydrates, vegetable fat, vitamins and minerals. The formula is a liquid therapeutic diet with an energy density of approximately 75kcal/100 ml (UNICEF, 2018). This formula has 75 Kcal energy and 0.9 gm protein per 100 ml and should be administered to children during the stabilisation phase of management of SAM under medical supervision. This formula is intended to stabilize the metabolism of the child and support the rehydration process among children with SAM (UNICEF, 2018).

F-100 also known as the "catch-up" formula is a high energy dense feed with added fats, and protein which provides a large amount of nutrients to a child with SAM. The formula contains 100 kcals of energy per 100 ml and provides 100 kcal and 2.9 g protein per sachet when administered. It is used to promote weight gain of the child with SAM and during the rehabilitation phase for management of SAM, after appetite test has been done and confirmed to be positive (Federal Ministry of Health, 2010).

Ready-to-Use Therapeutic Food (RUTF)

RUTF is a readily available paste that is made up of powdered milk, peanuts, butter, vegetable oil, sugar, and several critical vitamins and minerals needed to improve health and save the lives of children with malnutrition. One sachet of RUTF is equivalent to 500 calories and a variety of micronutrients with high nutritional value that promotes fast weight gain among malnourished children. The formula is usually very appealing to taste, digest easily with a shelf life of two years (UNICEF, 2022).

Ready-to-Use Supplementary Food (RUSF)

RUSF is a food supplement designed for supplementary nutrition programs aimed to treat children with moderate acute malnutrition (MAM) who are 6 months old and above for a period of 2-3 months. The recommended dose for this product is one sachet per day which provides an estimated 535kcal of energy. This feed is to be eaten directly from the package with no dilution, mixing or cooking. It should be given in combination with breast milk and never to be considered as a replacement for breast milk (UNICEF, 2018).

Food-based Approach

The most practical and long-lasting strategy for eradicating malnutrition and micronutrient insufficiency is the food-based approach which involves the use of locally available and affordable food with fruits and vegetable as source of the daily meals of a child. Akorede *et al.* (2013) observed that Nigerians do not eat adequate fruits and vegetables that meets the daily nutritional needs, and this is aggravated by the yearly and seasonal shifts in the availability of fresh fruits and vegetables (Awoyemi *et al.,* 2012). A reduction in the prices of fruits and vegetables, increased awareness and good household income will boost the consumption of these fruits and vegetables needed for healthy growth and development (Ochieng *et al.*, 2018; Conti *et al.*, 2021). Miller *et al.* (2013) posited that vegetables have low production costs and when appropriate meals are consumed with this vegetable, under nutrition will be addressed.

Food-based Approach for Children

The benefits of the food-based approach for the eradication of malnutrition among children is well established (Conti *et al.*, 2021). This approach is known to be sustainable, cost effective, culturally acceptable, promotes self-reliance and community participation towards ending hunger and undernutrition, environmentally friendly, generates income for the family, promotes alliances between the government, consumer groups, the food industry, and other relevant stakeholders towards the achievement of zero hunger by 2030 through the provision of a balanced diet (Conti *et al.*, 2021; Blackstone *et al.*, 2018). In Nigeria, a five-star diet is recommended for children from 6months of age to 2years and beyond. Such diet consists of diet that is rich in essential macro and micronutrients needed for energy, metabolism and growth and development of the child. A typical example of such diet for children in Nigeria is “Tom Brown” which has shown potential to address moderate wasting in Nigeria (USAID Advancing Nutrition, 2023).

Tom Brown is an attractive yummy, and a healthy porridge made from a combination of roasted vitamin A maize, soya beans, millet, and groundnut flour. It is a great meal for complementary feeding of children who are aged 6 months and above. This rich complimentary food offers important nutrients like carbohydrates, fibre, protein, fat and oil, iron, and vitamins that are needed for proper growth and development of children. Various forms of Tom-Brown exist but a typical one is based on a mixture of the flour made from roasted maize, groundnut, soyabeans, and millet with appropriate proportion of water added to the flour to make the yummy paste as shown below.

Components	**Measure**	**Food Class**
Maize	1kg	Carbohydrate, Protein, Vit B. and Minerals (Mg, P, Cu)
Groundnut	½ kg	Fat, Carbohydrate, Mineral (Mg, P)
Soyabeans	½ kg	Protein, Fat & Oil, Water
Millet	½ kg	Carbohydrate, Fibre, Protein, Fat, Minerals (Mg, P, Fe2+)
Water	As desired but ensure the porridge is not watery.	

Food-based approach for Pregnant and Lactating Mothers

Another food-based approach for the management of malnutrition is the Porridge Mum approach designed and first implemented by Action Against Hunger together with other food and cash distribution programming. This program was not designed specifically to address moderate malnutrition among children, but rather designed to support pregnant and lactating women (PLW) or caregivers with children under the age of two during humanitarian emergency in North East Nigeria. Usually, a group of women like ten constitute the Porridge Mum group who receive electronic cash and/or voucher transfers to purchase foods needed to prepare nutritious recipes for themselves and children under the age of two years. Women gather at a communal cooking site where they learn how to make the recipes through cooking demonstrations championed by the nutrition officer/manager, and they receive monthly health and nutrition education sessions to promote healthy lifestyles including proper nutrition, improved water, sanitation and hygiene. Despite not being designed as an approach for the management of malnutrition, the Porridge Mum groups have made positive impact on the nutritional status of children enrolled in the program. As a result, there is interest in using the approach to manage moderate wasting in areas where other services, such as targeted supplementary feeding programs (TSFP), are not available (USAID Advancing Nutrition, 2023).

Nutrition Sensitive Agriculture

The term Nutrition-sensitive agriculture refers to a food-based approach towards agricultural development and practice that puts nutritionally rich foods and dietary diversity at the heart of overcoming undernutrition, overnutrition and micronutrient deficiencies. This approach promotes the fact that agriculture need to be nutrition-sensitive by putting quality food stuff and nutrition at the fore, rather than the traditional method which do not give adequate attention to the need to plant, harvest and consume quality food stuff that is always adequate and readily available in the year. Despite agriculture being the source of most food consumed by several homes, a lot of individuals and households who are into agriculture seldom consume enough food or benefit from a healthy diet (Njoro, 2021).

Njoro (2021) noted that the primary objective of investing in nutrition-sensitive agriculture and food systems is to ensure that acceptable, diverse, nutritious and safe foods, adequate to meet the dietary needs of people of all ages, are available and affordable at all times. This implies the practice of agriculture that introduces innovations that enable year-round access to a variety of nutritious food – either by making sure producers have the resources to produce the right foods for a healthy diet, or by equipping markets to sell a variety of nutritious foods at affordable prices (Njoro, 2021). Nutrition sensitive agriculture supports the prevention of food loss and waste by reducing food-borne pathogens through good hygiene practices and improving technology and innovations along the value chain. This can be achieved through capacity building of individuals and families on what and how to produce, purchase, prepare and consume healthy foods for improved health and wellbeing of the entire household and communities (Njoro, 2021).

Factors Associated with High Prevalence of Undernutrition despite ongoing Interventions

Malnutrition is caused by multiple and interrelated factors which have hitherto limited the effectiveness and impact of several interventions aimed at eradicating malnutrition in the country. According to Iram & Butt (2006), food issues are just one aspect of the multiple factors that lead to malnutrition and a multi-facetted approach will be needed to successful solve the problem of malnutrition in Nigeria and other countries with this problem. The factors associated with sustained malnutrition in Nigeria and other countries are discussed below.

Poverty

Poverty is a major contributor to malnutrition in most low- and middle-income countries like Nigeria. According to Akombi-Inyang (2021), a consequence of poverty is the lack of access to nutritious and safe food, which often results in poor nutrition and ultimately undernutrition among children. Malnutrition also results to household poverty which results to persistent poverty and chain of malnutrition among communities.

Prior to the emergence of COVID-19, approximately 40% Nigerians were living under extreme poverty but during post-COVID-19, there was a continued rise in the cost of items, and this further plunged the nation into poverty. Recent assessment of poverty also known as multi-dimensional poverty which assesses both financial and other forms of poverty places Nigeria at 47% (98 million people) Nigerians living in multidimensional poverty. Key elements in the measurement of multidimensional poverty include poor health, lack of education, inadequate living standards, disempowerment, poor quality of work and the threat of violence. The economic status of a household or caregiver has been identified as one of the key determinants of a child's nutritional status. It is also an indicator of access to an adequate and nutritious food supply, use of health services, and availability of improved water, sanitation and hygiene which are prime determinants of child nutrition. Smith *et al.*, (2005) stated that household economic status significantly affects access to food. It is also an indicator to the possession and utilization of childcare resources on a sustainable basis. In addition, it allows a more diversified diet and effective childcare among households that are economically well to do when compared to poor households. Yimer (2000) also showed that the higher the level of the economic status of the household, the lower the level of child stunting. This is because an increase in the household income leads to improved access to quality food, health care, improved water and sanitation systems, and access to information which are closely associated with the nutritional status of a child.

Cultural Factors

Cultural factors that are enshrined in some communities have been associated with high prevalence of malnutrition in Nigeria. In an Ethiopian study, Bantamen *et al.* (2014) revealed that inappropriate child-care and feeding practice that are common among some communities were strongly associated with malnutrition. This is clearly demonstrated by the fact that education of women on best care given practices is known to improve nutritional practices and outcomes among children in Nigeria (Oyekale & Oyekale, 2005). Furthermore, cultures

that promote large family sizes have been associated with high prevalence of malnutrition. Large family sizes may adversely affect the nutritional status of children through reduced availability of adequate and nutritious food that is needed by all members of the family for proper growth and development (Kalu & Etim, 2018). The practice of large family size in some parts of Nigeria is strongly linked with high burden of malnutrition and this may persist despite several ongoing interventions that are focused on the eradication of malnutrition in Nigeria.

Mismanagement of RUTF

Mismanagement of resources used for community management of acute malnutrition such as RUTF and sale of food items for targeted supplementary feeding programs by individuals enrolled for this program have been noted to contribute to the sustained cases of malnutrition amongst communities in Northern Nigeria. Experienced shows that rather than give malnourished children the ration of RUTF needed for their nutritional rehabilitation, some caregivers due to poverty and poor knowledge of the impact of undernutrition on the development of the child tend to sell such items or re-distribute them for general family consumption. The outcome of such practice is the sustained malnutrition seen in several communities in Northern Nigeria despite the ongoing humanitarian and government interventions needed to address malnutrition in the country.

Poor Coverage of CMAM Activities

Community-based management of acute malnutrition (CMAM), a proven intervention for treating SAM, has been launched in 11 northern states of Nigeria, but the treatment is estimated to cover only 15-25% of the national burden of SAM each year. This poor coverage within states and across the nation could be associated with the sustained high prevalence of undernutrition in the country.

Insecurity

Nigeria is currently experiencing a myriad of security challenges which have contributed to economic retardation and poor health outcomes in the nation. Currently, the insecurity cuts across Boko Haram Insurgency in the Northeast, armed militancy, kidnapping, cattle rustling, and illegal mining. These activities have adversely affected farming which inturn has made households unable to provide the necessary food needed for proper growth and development.

Parental Factors

Nyaruhucha *et al.* (2006) in their study on assessment of the nutritional status of children under-five in Tanzania revealed that factors such as maternal educational status, age, and marital status significantly contribute to undernutrition among children. Akorede et al. (2013) in their Nigeria study also noted that the educational attainment of mothers seriously influences the nutritional status of children, and this can persist if mothers' education continues to remain low in the country. Iram & Butt (2006) in a similar study carried out in Pakistan noted that maternal age and education are associated with the nutritional status of a child. They observed that

mothers with high level of education have children with good nutritional status while those with poor education backgrounds tend to be associated with higher prevalence of malnutrition. According to Chaudhury (1983), children whose parents are educated up to the tertiary level are more likely to have a nutritious diet irrespective of income level due to their increased level of knowledge on basic child nutrition. Contrary to this, Nikoi, (2011) found that in Ghana, parental high educational status and maternal occupation have no relation with child nutritional status. Rather, women who work outside their homes are less likely to breastfeed their babies consistently and exclusively and this could lead to high prevalence of malnutrition among children. This situation is often worse when women are more likely to practice early weaning due to work and other related factors (Kalu & Etim, 2018). With respect to the age of the mother, younger mothers (less than 18years) are more likely to have undernourished children due to their inexperience and inability to take good care of the child (Akorede *et al.*, 2013; Nyaruhucha *et al.,* 2006).

Child factors

The age of a child is an important factor in nutrition, especially after six months. This is the stage where the child is introduced to complementary food and is later weaned off breast milk. The inability of a child to adjust to intake of solid foods could prevent the child from meeting their nutrient needs during this stage and this can lead to malnutrition (Macharia *et al.,* 2005). In addition, the exposure of the child to infection may lead to reduced dietary intake, poor health, and eventually malnutrition. According to Prentice *et al.* (2008), infections lower the child's resistance to diseases and act hand-in-hand with malnutrition to promote high morbidity with subsequent increased prevalence of malnutrition despite ongoing efforts to address the condition across Nigeria and other parts of the globe.

Household Food Insecurity

Food insecurity occurs when the ability to acquire safe, and nutritionally adequate food is limited or uncertain (Oquntin, 2010). It has been observed that, in most developing countries, the dietary practice in populations experiencing food insecurity tends to meet their energy requirements but does not provide sufficient food with adequate nutrients to support health and prevent infection. Hence, it can be inferred that undernutrition is strongly associated with food insecurity (Babatunde *et al.,* 2007; Awoyemi *et al.,* 2012). Factors such as poor academic performance, physical and mental ill-health, psycho-social problems, and anaemia related to iron deficiency are consequences of food insecurity in children (Kalu & Etim, 2018). This implies that with sustained food insecurity in a country, there will be undernutrition, and this brings to fore the need to address malnutrition using a multi-sectoral approach that ensures nutrition services are delivered with food security interventions, health, water, sanitation and hygiene and other components that have proven to be effective in addressing malnutrition.

CONCLUSION

Malnutrition (undernutrition) is a major challenge in Nigeria that needs a multi-facetted approach for its eradication. This review has clearly demonstrated the various approaches employed in the management of malnutrition in Nigeria. This includes the Infant and Young Child Feeding, CMAM, Food-based approach for children (using Tom-brown) and Food-based approach for pregnant and lactating mothers (using the Porridge Mum approach where cash transfer and nutrition education are conducted) to support mothers and caregivers and indirectly address MAM and lastly the nutrition sensitive agriculture approach where quality food and diet is at the heart of every agricultural practices have all been shown to be helpful in addressing under nutrition in Nigeria. Several factors have been implicated for the continued high prevalence of acute and chronic malnutrition in Nigeria despite ongoing interventions. Poor educational status of parents, household poverty, food insecurity, adverse cultural practices on nutrition and a lack of awareness on these strategies, and health care practices that are beneficial have been identified to contribute to the high burden of malnutrition in the country. This calls for immediate public health actions that are timely and effective in resolving this challenge among children. It is hoped that addressing the immediate causes, underlying causes and basic causes of malnutrition based on the highlighted strategies will change the narrative in the country.

Based on the current distortions in global logistic supply chain and the need to improve nutrition and health outcomes in the country, there is need for programs to focus on Maternal, Infant and Young Child Nutrition as well as the food-based approaches in addressing undernutrition in Nigeria. Appropriate stakeholder engagement and local manufacturing of RUTF and RUSF can improve nutritional interventions and outcomes in the country.

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