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Child Malnutrition in Nigeria: Evidence from Kwara State

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABBREVIATIONS AND ACRONYMS

EBF	exclusive breast feeding
FAO	Food and Agriculture Organization of the United Nations
FMOH	Federal Ministry of Health
FUNAAB	Federal University of Agriculture, Abeokuta
IFPRI	International Food Policy Research Institute
IMR	infant mortality rate
IYCF	infant and young child feeding
KAP	knowledge attitude and practice
LBW	low birth weight
LGA	local government area
MDG	Millennium Development Goals
MICS	Multiple Indicator Cluster Survey
NDHS	Nigeria Demographic and Health Survey
NFCNS	Nigeria Food Consumption and Nutrition Survey
NGO	non-governmental organization
NID	National Immunization Days
UNICEF	United Nations Children Fund
WASH	water quality and supply, sanitation and hygiene
WHO	World Health Organization

I. INTRODUCTION

Food security is defined as "a situation that exists when all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food that meets their dietary needs and food preferences for an active and healthy life" (FAO 2002). This definition implies that food insecurity reflects uncertain access to sufficient appropriate foods (Barrett 2002) and encompasses three main concepts: availability, access, and utilization.

First, "availability" in the macro sense refers to the efforts by governments to ensure that sufficient quantities of food are available for people within a certain geographic region. As a result of slow growth in the agricultural sector and rapid increases in population, Nigeria has evolved from being self-sufficient in food production to being heavily dependent on food imports. This dependence on imports makes Nigeria vulnerable to fluctuating prices in the world market. The spike in world food prices in 2007 and 2008 caused inflation to rise from 5.4 percent in 2007 to 9.7 percent in 2008, and the share of income spent on food within the same period increased from 45 percent to 80 percent (NISER 2008). Consequently, poor agricultural output and widespread poverty resulted in extensive and persistent food insecurity, with some case studies suggesting that as many as 70 percent of Nigerians are food insecure (Orewa and Iyangbe 2009; Obayelu 2010).

The second component of food security, access, refers to the ability of households to obtain food in the marketplace or from other sources. The major constraints facing the agricultural sector, including food price fluctuations due to overexposure to world markets, imply that food access may be compromised for the poorest Nigerians. While imports may bridge the gap in food supply in a macro sense, financially disadvantaged Nigerians may not have adequate economic access to quality food. In 2011, about 71 percent of total household expenditure was spent on food, with households in the northeast and northwest regions spending the highest proportions (64 percent and 73 percent, respectively). In addition, the diet of most Nigerians mostly consists of staple foods but few animal proteins like meat and fish. While cereals and tubers are consumed every day, animal proteins are consumed on average about four times a week. This varies by region, however, with animal proteins only consumed an average of two days per week in the northwest (Kuku-Shittu 2013).

The third component of food security is utilization, which refers to the proper usage of food, including processing, storage, consumption, and digestion. Utilization is often measured via anthropometric variables that indicate malnutrition levels. Many studies have confirmed significant variations in the level of malnutrition across rural and urban settings, geopolitical zones, and agro-ecologies in Nigeria (NPC/ORC Macro 2004; Maziya-Dixon et al. 2004; NDHS 2008; NPC/ICF Macro 2009; NDHS 2013). All these data sources confirm that child undernutrition is high and that Nigeria is far from the targets recommended for achievement by 2015. Studies have revealed that hunger and malnutrition continue to be pervasive in Nigeria (Maziya-Dixon et al. 2004; NPC/ICF Macro 2009); they tend to be primarily concentrated in rural agricultural areas and more acute among the landless, pastoralists, smallholders, and hired agricultural workers (Southgate et al. 2007; AU/NEPAD 2007).

African children make up one-quarter of the estimated 148 million underweight children globally. Although underweight prevalence has decreased slightly in Africa (from 29 percent to 26 percent over the past 17 years), the absolute number of underweight children has increased by 8 million, meaning that the rate of decline has not kept pace with population growth (Black et al. 2008). More than one-third of children under five in Africa are stunted—that is, having low height for their age (World Health Statistics 2009). In Nigeria, available data from the 2001–2003 Food Consumption and Nutrition Survey show that 42 percent of children under five were stunted, 25 percent underweight, and 9 percent wasted (Maziya-Dixon et al. 2004). The data suggest high levels of protein-energy malnutrition, which is usually accompanied by poor micronutrient status. Data from the 2013 Nigeria Demographic Health Survey (NDHS) corroborated the findings of the Nigeria Food Consumption and Nutrition Survey (NFCNS) of 2001–2003, suggesting that no improvement had occurred in the anthropometric indicators of children under 5 over a 10-year period. The 2013 NDHS found that more than two out of every five children were stunted, which reflects the cumulative effect of chronic malnutrition, with significantly higher proportion of stunted males (43 percent) than females (38 percent); 45 percent of children in rural areas were stunted versus 31 percent in urban areas.

Micronutrients are vital components of good nutrition, and their deficiency in the human diet is responsible for many health problems. Vitamin A, iron, iodine, zinc, and folate are currently the most widely studied micronutrients. Large numbers of people globally are micronutrient deficient, and this deficiency remains a threat in many African countries. Both vitamin and mineral deficiency afflict one-third of the population in Africa south of the Sahara, affecting minds, bodies, energies, and the economic prospects of nations. More than 20 percent of children under five years of age suffer from vitamin A deficiency in 37 countries throughout the region (Mason & Beda-Andourou et al. 2005). The prevalence of anemia is higher than 40 percent in many African countries. Thirteen countries currently have iodine deficiency rate of over 50 percent in school-aged children (UNICEF 2009). The micronutrient deficiency indicators in Nigeria reveal that 28 percent of children under five were suffering from iron deficiency anemia (IDA), 29.5 percent from vitamin A deficiency (VAD), and 29.6 percent from iodine deficiency (Maziya-Dixon et al. 2004). Also the 2004 *Vitamins and Minerals Deficiency Damage Assessment Report for Nigeria* reported that an estimated 11,000 young Nigerian women die every year in pregnancy and child birth due to severe iron deficiency anemia (FMOH/MI/UNICEF 2004). High prevalence of IDA, VAD, and iodine deficiency disorders (IDD) are not exclusively found in Nigeria; indeed the conditions afflict about 30 percent of the world's population (WHO/UNICEF/UNU 1998; WHO 2001). As in Nigeria these deficiencies often coexist in children especially in developing countries (Zimmermann et al. 2003). IDA interferes with the thyroidal metabolism of iodine and it has been reported that it may, in fact, reduce the efficacy of iodine prophylaxis (Zimmermann et al. 2000).

The study discussed in this paper was conducted to provide a closer understanding of malnutrition in Nigeria as a major public health challenge, with a particular focus on Kwara state, in the west of the North Central geopolitical zone. The objectives of the study are to:

- Conduct an in-depth desk review of malnutrition and its determinants among vulnerable groups in the Nigerian context, with special emphasis on micronutrient deficiencies by region.
- Identify the current state of policies to reduce malnutrition in Nigeria.
- Examine trends in determinants of malnutrition among the rural poor in Kwara State.
- Understand the food consumption patterns of the rural poor in Kwara State.
- Identity the nutrition status of vulnerable groups in Kwara State.
- Assess the diversity of diets consumed by individual household members in Kwara State.
- Investigate respondents' knowledge and awareness of micronutrients, fortification, and biofortification.

In the next section, an in-depth and comprehensive review of the current state of vulnerable groups in Nigeria with regard to malnutrition and micronutrient deficiencies is presented. We provide a brief overview of current efforts being made to tackle these deficiencies. An overview of the nutrition literature and Kwara State, where the study was conducted, is presented in the fourth section, while the data and methods used to pick the sample and analyze the data are presented in the fifth section. Contextual socioeconomic, environmental, and nutritional information about the sample are presented in the sixth and seventh sections of this report. Major nutrition outcomes of vulnerable groups are presented in Section 8. The report concludes with a summary and recommendations in Section 9.

2. LITERATURE REVIEW

2.1 Childhood Nutrition and Malnutrition in Nigeria

According to the Food and Agriculture Organization of the United Nations (FAO 2013), more than 14 percent of the population in developing countries were undernourished in the period between 2011 and 2013. Malnutrition includes both nutrient deficiencies and excesses and is defined by the World Food Programme as "a state in which the physical function of an individual is impaired to the point where he or she can no longer maintain adequate bodily performance processes such as growth, pregnancy, lactation, physical work, and resistance to and recovering from disease" (2005). It results in disability, morbidity, and mortality, especially among infants and young children (Pelletier 1994). Malnutrition often begins at conception, and child malnutrition is linked to poverty, low levels of education, and poor access to health services, including reproductive health and family planning (IFPRI 2014). Undernutrition is mostly associated with developing countries like Nigeria (DHS 2013).

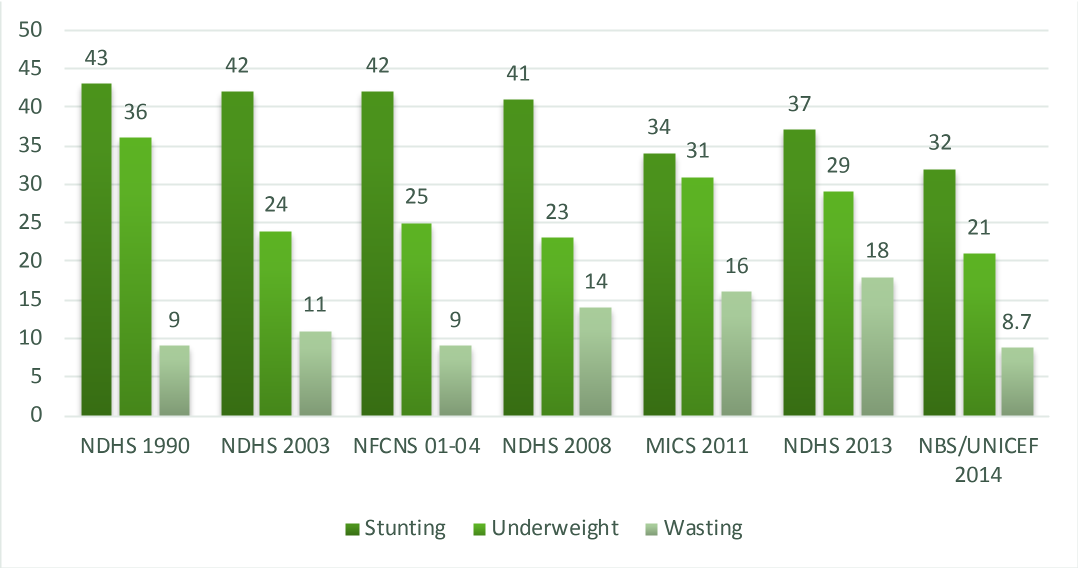
Two main types of malnutrition have been identified in Nigerian children: (1) protein-energy malnutrition and (2) micronutrient malnutrition. Protein-energy malnutrition among preschool children is a major public health problem across the country. "Stunting" is typically defined as low height-for-age, but, more specifically, it is a deficit of linear growth and failure to reach genetic potential that reflects long-term and cumulative effects of inadequate dietary intake and poor health conditions (ACC/SCN 2000). Low weight-for-age is called "underweight" while "wasting" is severe underweight or substantial weight loss that is usually a consequence of acute food shortage or disease. (The NCHS/CDC/WHO International Growth Reference reports data on these levels in a set of published indices, which served as a reference for this study.)

National and regional statistics on anthropometric indicators in Nigeria have been consistently dire. In 1983–1984, the National Health and Nutrition Survey (HANS) conducted by the Federal Ministry of Health estimated the prevalence of wasting to be around 20 percent (FGN 1983–1984). A 1986 Demographic and Health Survey (DHS) of children ages 6–36 months in Ondo State (southwestern Nigeria) found the prevalence of wasting to be 6.8 percent, underweight 28.1 percent, and stunting 32.4 percent. In February 1990, an anthropometric survey of preschool children (2–5 years old) in seven states found underweight prevalence ranging from 15 percent in Akure (Ondo State) to 52 percent in Kaduna (Kaduna State) while stunting prevalence ranged from 14 percent in Iyero-Ekiti (Ondo State) to 46 percent in Kaduna. In addition, the 1990 DHS survey conducted by the Federal Office of Statistics estimated the prevalence of wasting at 9 percent, underweight at 36 percent, and stunting at 43 percent among preschool children. These figures are lower than the figures published in 1994 by UNICEF-Nigeria from a 1992 survey conducted among women and children in 10 states; the UNICEF report showed the prevalence of wasting among women and children at 10.1 percent, underweight 28.3 percent, and stunting 52.3 percent. There was a decrease in prevalence of stunting in the 2003 NDHS with 11 percent of children wasted, 24 percent underweight, and 42 percent of children stunted (NDHS 2003). By 2008 prevalence of underweight had decreased to 23 percent and stunting had dropped to 41 percent but wasting increased to 14 percent (NDHS 2008).

Similar trends were reported by the 2001–2003 NFCNS: 9 percent wasting, 25 percent underweight, and 42 percent stunting, with significant variations across rural and urban areas, geopolitical zones, and agro-ecological zones (Maziya-Dixon et al. 2004). The study showed that prevalence of stunting was lowest in the southeast at 16 percent; it reached 18 percent in the south and 55 percent in the northwest. Among the states, stunting was highest among children in Kebbi (61 percent). The 2003 NDHS showed that rural children (43 percent stunted) were disadvantaged compared to urban children (29 percent stunted). Children living in the Northwest geopolitical zone stood out as being particularly disadvantaged at 55 percent compared to 43 percent in the Northeast zone, 31 percent in North Central, 25 percent in the Southwest, 21 percent in the South-South, and 20 percent in the Southeast. Among the three broad agro-ecological zones used in the 2001–2003 NFCNS, the stunting rate was 58 percent in the dry savannah, 46 percent in the moist savannah, and 27 percent in the humid forest zone. Similar patterns were reported for underweight and wasting. Additional studies have also shown that malnutrition is more pronounced in the rural areas and rural children are more disadvantaged than urban children in Nigeria (UNICEF 1998; MICS 2011; NDHS 2003, 2008, 2013).

There was a decrease in prevalence of malnutrition in the 2011 reports of the Multiple Indicator Cluster Survey (MICS) in Nigeria with 34 percent of children under five stunted, 31 percent underweight, and 16 percent wasted, while about 15 percent of children had low birth (at less than 2,500 grams at birth) (MICS 2011). It is evident from the 2013 NDHS that the proportion of children who are stunted has been decreasing over the years. However, the extent of wasting has worsened, indicating a more recent nutritional deficiency among children in the country. Prevalence of stunting decreased to 37 percent, with a higher concentration among rural children (43 percent) than urban (26 percent). However, the proportion of children underweight (29 percent) and wasting (18 percent) increased (NDHS 2013). Similarly, the 2014 *National Nutrition and Health Survey Report* by the National Bureau of Statistics and UNICEF shows that children's nutritional status modestly improved since 2013, according to the 2013 NDHS report, with 32 percent of children under five stunted, 21 percent underweight, and 9 percent wasted. The trend in the nutritional status of children under five from 1990 to 2014 is displayed in Figure 2.1. It is is based on the child growth standards adopted by the World Health Organization (WHO) in 2006.

Figure 2.1—Trends in nutritional status of children under five in Nigeria, 1990–2014



Note: NDHS Nigeria Demographic and Health Survey; NFCNS = Nigeria Food Consumption and Nutrition Survey; MICS = Multiple Indicator Cluster Survey.

Source: NDHS 2013; NBS/UNICEF 2014.

A similar study on child nutrition in northern Nigeria assessed the nutritional status of children under five and women 15–49 years old in eight northern states (UNICEF 2012). More than 40 percent of children under five suffered from stunting across northern Nigeria. In addition, 17 percent of adolescent girls were pregnant in the surveyed areas and found to be more malnourished than older women. It was concluded that undernutrition is a major development concern.

Comparing data from these different studies, it is clear that malnutrition of children under five has been a consistent problem in Nigeria over time, with too little improvement recorded since the beginning of health reform in Nigeria. The report computed from the NDHS on nutritional status in northern Nigeria revealed that household economic status has a positive effect on child nutrition. Additional important factors in nutritional status include maternal education; the quality of healthcare facilities for women and children (which is particularly poor in the northern states); immunization levels; and women's incomes, livelihoods, and overall empowerment (Ajieroh 2009; Murphy 2013). Malnutrition contributed to 53 percent of deaths among children under five in Nigeria, and levels of wasting and stunting are still very high (UNICEF 2007).

2.2 Micronutrient Malnutrition

Micronutrient deficiency or "hidden hunger" occurs when essential vitamins and/or minerals are not present in adequate amounts in the diet; it is a serious public health concern in most developing countries that has devastating effects on vulnerable groups, including pregnant and lactating women and children under five (WFP 2005). According to WHO, one in three people in developing nations are affected by deficiencies in micronutrients; in Nigeria, those deficiencies are primarily in iodine, iron, and vitamin A. If left unchecked, micronutrient deficiencies can lead to irreversible physical consequences, which is why they are considered a major health issue deserving international attention. Micronutrient malnutrition is responsible for a significant share of infant mortality (Bryce et al. 2003).

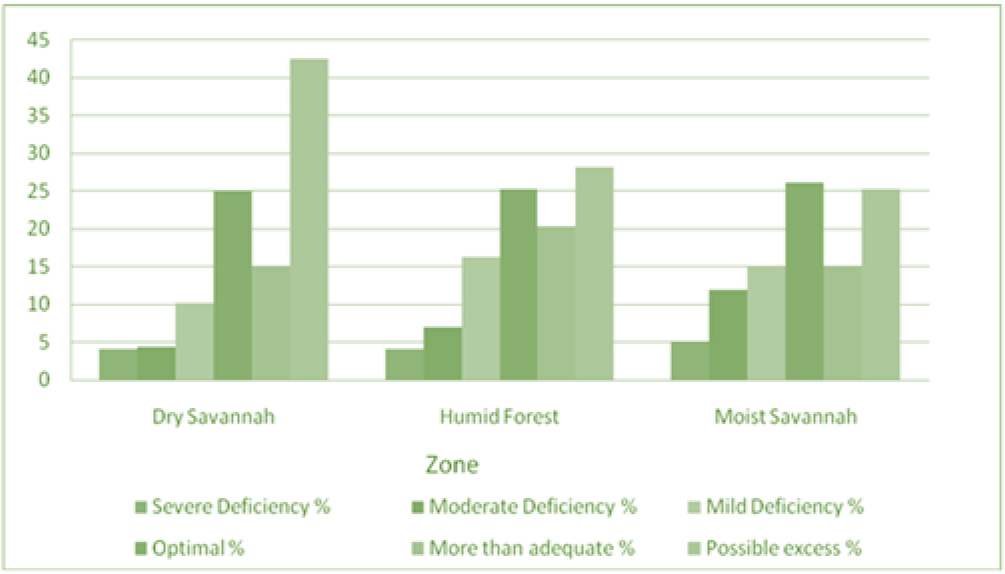
IODINE DEFICIENCY

Iodine is essential for the normal growth and development of the human body. It is required for the production of thyroid hormones, which are necessary for normal brain development (WHO/UNICEF/ICCIDD 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, goiters, 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 (Maziya-Dixon 2004). The deficiency was severe in 4.2 percent, moderate in 8.7 percent, and mild in 14.6 percent of children. Only 26 percent of children had optimal levels of iodine. However, it is noteworthy that 16.6 percent of children had more than adequate levels, while 29.8 percent had a possible excess intake of iodine and ran the risk of adverse health consequences. More than 20 percent of the total population suffered from goiter, the abnormal enlargement of the thyroid gland, which is the most severe form of iodine deficiency. Endemic iodine deficiency reduces the IQ by 3.5 percent, permanently affecting intellectual development. 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.

Iodine deficiency in mothers by agro-ecological zones (Figure 2.2) 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. A more than adequate intake was seen in 16.6 percent of the mothers in the rural sector, 20.3 in the urban sector, and 20.6 percent in the medium sector. Those with possible excess iodine intake were observed in the rural (14.6 percent), urban (24.4 percent), and medium sectors (25.9 percent).

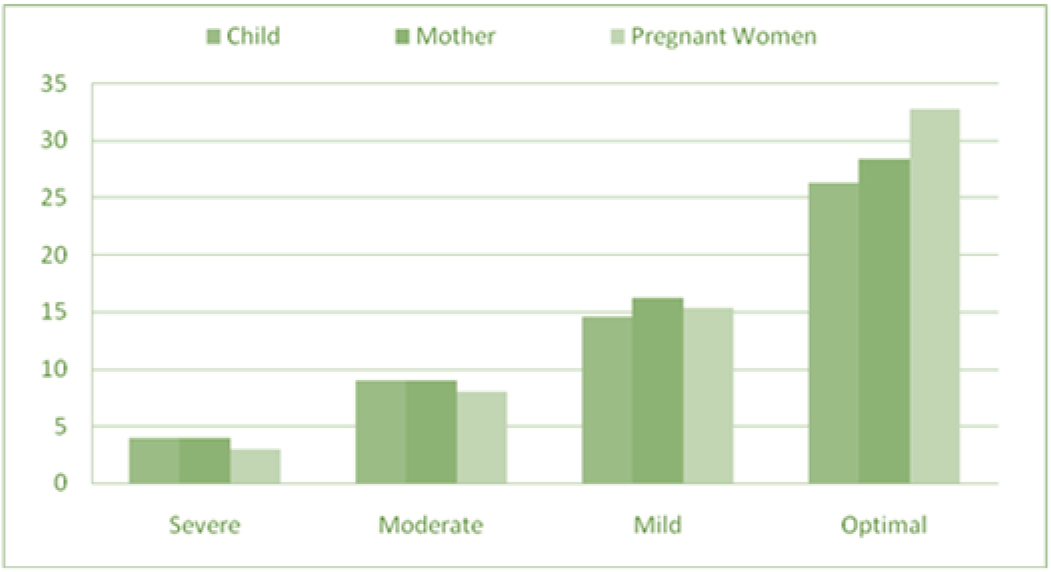
Figure 2.2—Iodine status of children under five in Nigeria, by agro-ecological zone



Source: Maziya-Dixon et al. 2004.

In pregnant women, deficiency rates were 8 percent for the dry savannah, 11.3 percent for the humid forest, and 15 percent for the moist savannah. Although the deficiency level was low, over one-fifth of pregnant women in all zones had a possible excess iodine intake: 22.3 percent in the dry savannah, 22.4 percent in the moist savannah, and 25.8 percent in the humid forest. There were more pregnant women with adequate iodine status in the dry savannah (34.7 percent), compared to those in the moist savannah (28.4 percent) and humid forest (27.4 percent). Across the zones, the percentages of pregnant women with adequate iodine nutrition ranged from 27.4 to 34.9 percent. Among pregnant women, iodine deficiency was reported as 9 percent (urban), 10 percent (medium), and 14 percent (rural). Excess intake was reported in 37 percent of pregnant women in the rural sector, 41 percent urban, and 45 percent medium. Goiter prevalence of 40.2 percent was reported among school-aged children in southwestern Nigeria (Sanusi & Ekerette, 2013), further confirming IDD as a public health problem in Nigeria.

Figure 2.3—Severity of iodine deficiency status of children, mothers, and pregnant women in Nigeria



Source: Maziya-Dixon et al. 2004.

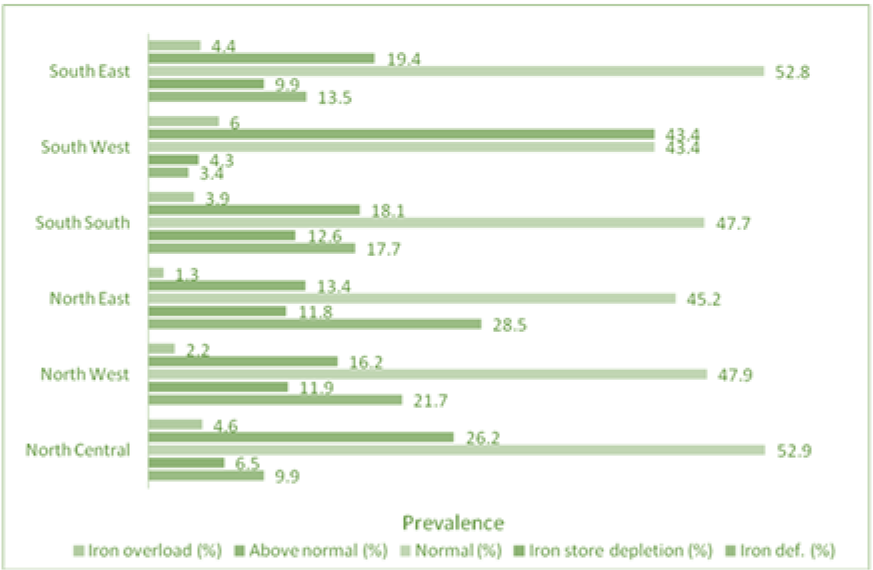
IRON DEFICIENCY

Iron is critical for cognitive and motor development in childhood and for 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. This disease reduces the work capacity of an individual when affected, and subsequently the entire population at large, resulting in serious economic consequences that inhibit national development (Davidson 2011a; Davidson 2011b).

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 small study in southwestern Nigeria (Adelekan & Adeodu 1998), it was reported that both iron deficiency and infections were equally important etiological factors in the anemia recorded in mothers and their children. This study observed that iron deficiency was more prevalent in the southwest areas of the country when compared with data from other parts of the country. Some contributory factors identified included consumption of cereal-based diets, which are low in bioavailable iron, worm infestation, frequent pregnancies, and hemoglobinopathies (inherited blood disorders).

The iron profile from the Maziya-Dixon et al. (2004) survey showed that almost 20 percent of children were iron deficient and another 8 percent had depleted iron stores. With more than 25 percent of children under five iron-deficient, it is critical that the global community pay attention to adequate dietary intake of iron. This profile is not the same in the three agro-ecological zones. Figure 2.4 shows the distribution of iron deficiency anemia in children under five by geopolitical zone. Anemia affects 25 percent of women of reproductive age in Nigeria, and as many as 61 percent in some regions. If no action is taken, about 6,570 maternal deaths will occur annually—roughly 18 women every day (Akinyele et al. 2002).

Figure 2.4—Nutritional iron status of children under five in Nigeria, by geopolitical zone



Source: Maziya-Dixon et al. 2004.

When data were disaggregated by sector, the results showed that the proportion of children with varying degrees of iron deficiency was 24.4 percent for the rural sector, 27.9 percent in the medium sector, and 33.1 percent for the urban sector. Iron deficiency (serum ferritin concentration < 10 µg/ml) was high in urban areas (22.6 percent), followed by the medium and rural areas (17.8 percent and 13.5 percent, respectively). Children under five with depleted iron store (serum ferritin concentration < 20 µg/ml) were similar in the different sectors: 10.9 percent in rural areas, 10.5 percent in urban areas, and 10.2 percent in the medium areas. The percentages of children with normal iron status (serum ferritin concentration 20–100 µg/ml) did not vary much by sector: 47.8 percent in rural areas, 48.7 percent in urban areas, and 49.4 percent in medium areas.

The distribution by sector of children under five who had a serum ferritin concentration above the normal range showed that 18.2 percent were in the urban areas, 22.7 percent in medium areas, and 27.8 percent were in rural areas. The level of iron deficiency may have been due to poor dietary sources of iron, or sources in which the iron is in a form that is not available for absorption. Vegetables are a major source of iron subject to chelation by oxalates, phytates, and other anti-nutrients, making it unavailable for absorption by the body. Other nutrients enhance iron absorption—particularly vitamin C. Animal sources of iron are most desirable.

Smaller studies further confirm the severity of iron deficiency in Nigeria. A study conducted in Enugu (southeastern Nigeria) reported iron deficiency anemia in 34.3 percent of the surveyed children under five (Ekwochi et al. 2014). A similar study conducted among pregnant women in Sokoto State (northwestern Nigeria) reported a high prevalence of anemia (21.3 percent) and iron deficiency anemia (13.5 percent) among pregnant women (Erhabor et al. 2013).

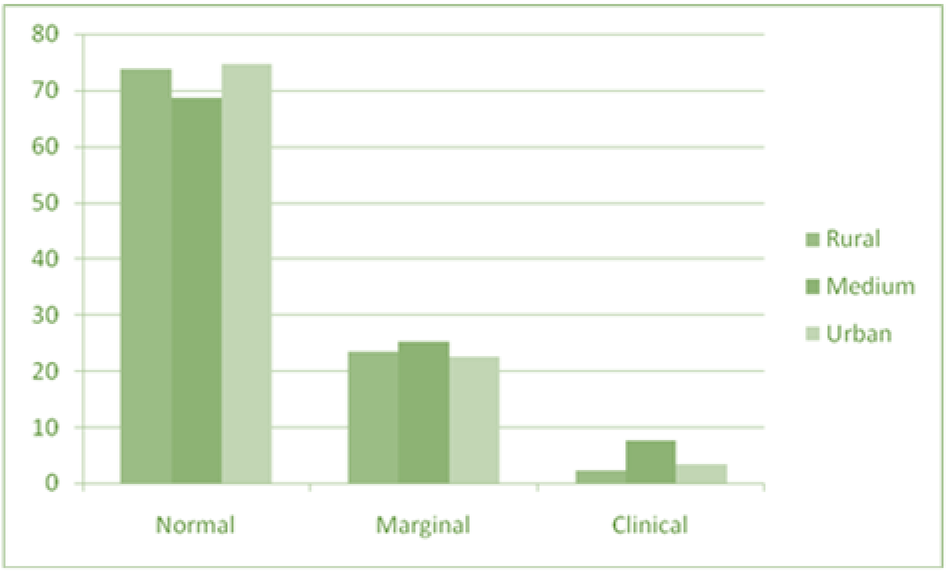
VITAMIN A DEFICIENCY

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. The main health consequence of a diet that is chronically insufficient in vitamin A is a failure to meet physiologic needs, including healthy tissue growth, normal metabolism, and resistance to infection (WHO 2009). Globally, one in three preschool-aged children and one in six pregnant women are vitamin-A deficient due to inadequate dietary intake (UNICEF 2013). Nigeria is considered one of the WHO's Category 1 countries with the highest risk of vitamin-A deficiency (Humphrey et al. 1992). Vitamin-A deficiency contributes to 25 percent of infant, child, and maternal mortality in Nigeria because of reduced resistance to protein-energy malnutrition, acute respiratory infection, measles, malaria, and diarrhea (WHO 2009; UNICEF 2013).

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, MI 2014).

Figure 2.5 presents information on the distribution of vitamin-A status by sector (median denotes communities that could not be classified as urban or rural based on population size definition). The figure demonstrates that VAD is more dominant in the rural sector. The distribution of the marginally deficient was 22.5 percent for the urban sector, 23.4 percent for the rural, and 25.1 percent for the medium. The clinical deficiencies were 7.5 percent in the medium sector while the urban (3.4 percent) and rural (2.2 percent) sectors were much lower. In Figure 2.6, the same information is presented by geopolitical zone. Disparities witnessed were due mainly to dietary patterns that influence sources of vitamin A.

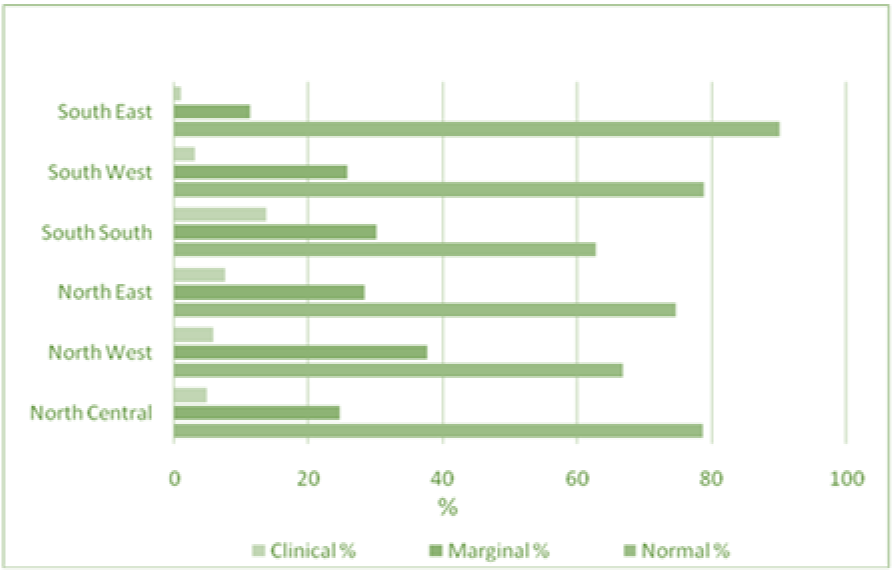
Figure 2.5—Vitamin A status of children under five in Nigeria



Source: Maziya-Dixon et al. 2004.

There were, however, significant zonal differences in the prevalence rates, which offers insight into the location of the children suffering from VAD. Among the three agro-ecological zones, the dry savannah zone had the highest VAD prevalence (30 percent), which is also higher than the national average. This zone consists of states in the far northern, drier part of the country. It is characterized by a crop-growing period that could be as short as 30 days per year. The principal food crops in the zone are cereals and legumes. Low intake of vitamin A-rich foods and their precursors, such as carrots, orange-fleshed sweet potatoes, and dark-green leafy vegetables, might be one reason for such a high prevalence of VAD. It is significant to point out that palm oil, which is rich in vitamin-A, is not cultivated or consumed regularly in this zone, which could be a contributory factor in the observed high VAD prevalence in the zone. Other zones also had high prevalence of VAD with 24 percent observed in the moist savannah and 29.9 percent in the humid forest. Also significantly, more children with severe deficiency (serum retinol < 0.35 µmol/L) were found in the humid forest (7.1 percent) than in the dry (3.1 percent) and moist savannah (2.4 percent) zones.

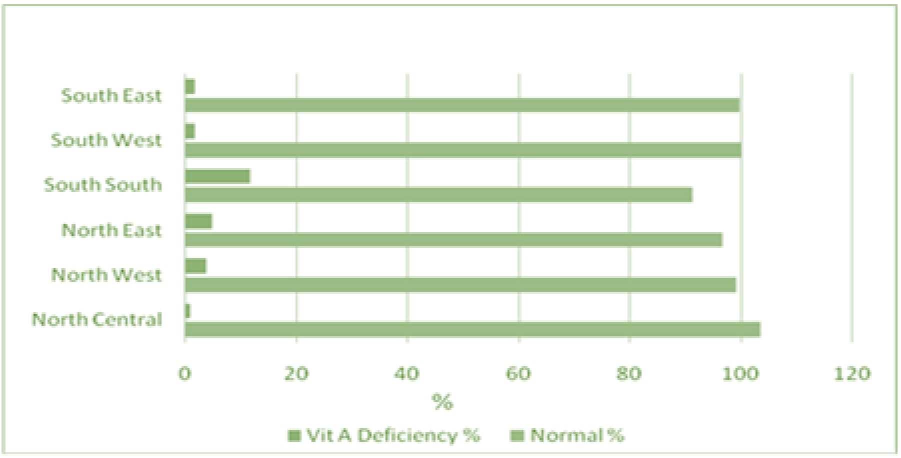
Figure 2.6—Vitamin-A status of children under five in Nigeria, by geopolitical zone



Source: Maziya-Dixon et al. 2004.

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. At the AEZ level, there was a decrease in the percentage of mothers at risk of vitamin A deficiency from arid to humid climates, with 19.6 percent at risk in the dry savannah to 14.5 percent in the moist savannah to 8.8 percent in the humid forest. More mothers were at risk of vitamin-A deficiency in the medium sector (30.7 percent) sector than in the rural (11.2 percent) and urban (10 percent) sectors. Mothers with serum retinol concentration lower than 20 micrograms were considered vitamin A deficient. From the population of mothers considered at risk for vitamin-A deficiency, only 4.1 percent were actually found to be deficient. These findings were disaggregated by geopolitical zone (Figure 2.7).

Figure 2.7—Maternal vitamin-A status in Nigeria, by geopolitical zone



Source: Maziya-Dixon et al. 2004.

There is evidence to show that dietary sources of pro-vitamin A—including oranges, pawpaw, orange-flesh sweet potatoes (newly introduced), carrots, and tomatoes, among others— are available in rural areas but could be better promoted for consumption among rural dwellers, who do not generally have access to animal sources of vitamin A, including bush meat and assorted animal livers.

There is some evidence from Figures 2.6 and 2.7 of higher than expected vitamin-A deficiency rates in south of Nigeria. There are a few possible explanations for the discrepancy between the reported vitamin-A intake and the high prevalence of vitamin-A deficiency. The humid forest zone (comprised of states in the south) is characterized by the high production and regular consumption of palm oil, which is high in pro-vitamin A. The food preparation methods commonly employed, however, remove a significant percentage of pro-vitamin A from palm oil and other important dietary sources of the vitamin. Similarly, beta-carotene is destroyed during processing, especially palm oil, which means it is not consumed in sufficient quantities to have an effect on the vitamin-A status of children. Most of the sauces, pottages, and soups consumed in the southern part of Nigeria are prepared using palm oil (a practice more common in the humid forest than in the other zones); nevertheless, the prevalence of severe vitamin-A deficiency remains high—to the level of being classified a public health problem—in this region. For example, in a study that relates the vitamin-A status of pregnant Nigerian women to their dietary habits, only 45.5 percent of the women had normal plasma retinol concentration levels (> 0.70 µmol/L) (Ajose et al. 2004). Although 80 percent of the subjects consumed red palm oil daily, approximately 64 percent of them would heat the oil until it was smoking for at least 10 minutes—thereby destroying the carotenoids—before adding it to the stew during cooking. Green vegetables were also boiled in hot water before adding to sauce (Rodriguez-Amaya 1997; 1999).

The bioconversion of beta-carotene to vitamin A in the blood in another factor that could possibly explain the discrepancy between the reported vitamin A intake and the high prevalence of vitamin A deficiency. It has long been established that after an oral dose of beta-carotene, its metabolite retinol as well as intact beta-carotene appear in the circulation. It is also known that the conversion of beta-carotene into vitamin A takes place mostly in the intestine. The beta-carotene equivalent to vitamin A is defined as the ratio of the amount of beta-carotene given in an oral dose to the amount of vitamin A derived from the oral dose. Previously, it was assumed that 6 micrograms of beta-carotene in all plant foods provided the same vitamin A activity as 1 microgram of preformed retinol. However, recent data reveal that the amount of beta-carotene required from plant foods to provide 1 microgram of preformed retinols is much greater than 6 micrograms and is also highly variable among foods, ranging from 8 micrograms to as many as 40–45 (de Pee et al. 1998; West et al. 2002). This may further explain why VAD is common among children who consume diets previously thought to meet or nearly meet their vitamin-A requirements (Miller et al. 2002).

Additionally, there is a negative effect of infection, including malaria, on plasma vitamin-A levels and therefore prevalence of vitamin-A deficiency. It has been suggested that one significant contributory factor to poor vitamin-A status in many developing countries is the widespread presence of infections, which can suppress levels of vitamin A in plasma as well as mobilization of vitamin A stores in the liver (IVACG 1997).

2.3 Food Consumption and Micronutrient Intake Studies in Nigeria

There are relatively few studies that address food consumption, nutrient intake, and nutrient status of Nigerians. Even fewer studies address current vitamin-A, iodine, and iron status of children under five. Most of the studies available are regional, rather than national, in scope and the number of subjects surveyed is usually limited. In addition, a majority of the studies deal with specific aspects of these micronutrient deficiencies in specific populations and in different geographical locations of the country. Even fewer studies have examined food intake and related this to blood levels of the nutrients in the same subjects.

Food consumption and nutritional status of Nigerians have long been the subject of scientific investigation. The earliest comprehensive reports on this were indeed during the colonial era. Prominent among these were the seminal reports of Nicol of the Colonial Medical Service published in the 1940s and 1950s (1949, 1952, 1956, 1959a, and 1959b), which attempted to determine the energy and protein requirements of peasants in different parts of Nigeria. Old as these reports are, they provide valuable insights into the state of food intake and nutritional status of the different groups in Nigeria at that time. They evaluated the food intake and nutritional status of these groups with special reference to the effects of deficiencies in vitamin A, B2, B-complex, and animal protein (Nicol 1949, 1952).

Significantly, the studies reported levels of vitamin A intake to be as high as 5,174 International Units (IU) in some districts (Bida) and between 625 and 713 IU in Kontagora and Zuru. The very high intake of red palm oil by the peasants in Bida was said to account for the superior levels of Vitamin A nutritional status of children 4 to 6 and 10 to 12 years old. The study compared the state of nutrition of children from smallholder farming households from different parts of the country with that of children of educated parents living in urban areas. The results showed that intake by children ages 4 to 6 in farming households ranged from 1,270 IU to 3,300 IU (45 to 125 percent Recommended Daily Amount (RDA)) while intake by 10 to 12-year-olds ranged from 1,970 IU to 7,300 IU (79 to 162 percent RDA). In evaluating the food and nutrient intakes in these studies, iron and iodine intakes were not the focus. Consequently, intakes of these micronutrients were only tangentially reported. Indeed none of the studies provided data on iodine intake. The report on Nigerian children recorded daily intake of iron to range from 10 milligrams (mgs) among 4 to 6 year olds to 29 mg among 10 to 12 year olds in the farming households studied.

In 1970, a report on the national nutrition survey conducted between 1965 and 1966 was circulated among the nutrition community in Nigeria (National Institutes of Health 1967). The report documented the consumption of large quantities of vegetables and other pro-vitamin–A rich foods, but no quantitative data were provided for iron and vitamin-A consumption. The results showed that children in southern Nigeria exhibited severe growth retardation for age, which is associated with low intake of protein and essential vitamins. There is no record of any other food consumption and nutrition survey that covered the whole country since the 1967 report. Instead, such surveys that were conducted focused on regions and groups in the country. One of the earlier regional reports, by Nnanyelugo (1980), described a 1976 study on preschool children in urban and rural areas of Cross River, a state in the southern region of Nigeria. The survey obtained detailed individual food intakes from 27 preschool children over a 48-hour period. The results showed intake of retinol and iron to be adequate (98–132 percent of RDA for retinol and 135–230 percent of RDA for iron) for all the age cohorts between 1 and 5 years. According to the report of an expert consultation on human vitamin and mineral requirements conducted by FAO and WHO in 2002, the recommended nutrient intakes (Table 2.1) for retinol (RE) for children is 40microgram of retinol (µgRE)/day while that of iron ranges from 176–480 µg for one-year-olds and 184–337 µg for 2–3-year-olds. Retinol intake of older children (4 to 5 years) ranged from 187–708 µg (mean 393 µg). Intake of iron ranged from 5.6–19.0 mg (mean 9.5 mg) for one-year-olds and between 0.9–19.8 mg (mean 13.2 mg) for children ages 2–3 years. Iron intake of older children (4 to 5 years) ranged from 8.5–27.2 mg (mean 16.8 mg).

A 1983 study in northern Nigeria similarly weighed food intake of 150 children ages 36 to 60 months in the urban areas of Zaria, Kano, Katsina, and Jos, all located in the dry savannah zone (Addo 1984). The results showed adequate intake of iron and vitamin A, as assessed based on the RDA published in 1967 (WHO). Intake ranged from 3,674.3 IU (1,102 µg) among two-year-old children to 5,000.1 IU (1,500 µg) among the five-year-olds while the intake of iron ranged from 3.8mg among two-year-olds to 6.3mg among the five-year-olds. The mean intake for all age groups combined provided 148 percent of RDA for vitamin A and between 54 and 90 percent of RDA for iron. A similar study was conducted on the food consumption of households in eight villages around the Kainji Lake in the moist savannah zone (Adekolu-John et al. 1985). The study measured both food production by households and daily dietary recall on individuals within the households. Intake data were collected for 282 individuals including children 0–5 years (n=60), lactating women (n=16), and one pregnant woman. The results show vitamin-A intake levels that far exceeded RDA for children (170 percent) and lactating women (167 percent) and iron intake that exceeded RDA for children (192 percent) and adult women (380 percent).The authors attributed the generally superior nutrient intake to the availability and consumption of animal products and grains in the extensive fertile plains of this region.

Additional regional surveys of food and nutrient intake emanated from the dry savannah zone in subsequent years, including those on different groups in the northern-most part of the country. In a 1987 study of peasants living in a semi-arid zone of Borno State, 82 adults were surveyed for dietary intake using a combination of 24-hour dietary recall and weighed intake over seven days (Oguntona et al. 1987a). The study found that, on average, daily consumption of foods rich in iron and vitamin A was significant: 136 g for dairy products; 110 g for meat, fish, and poultry; and 495 g for green leafy vegetables. The study measured seasonal nutrient intake over a six-month period (July–December) and revealed significant variation in micronutrient intakes. Mean intake of iron and vitamin A by adult peasants ranged from 3 mg and 201.2 µg at the beginning of the rainy season (July) to 8.7 mg and 368 µg once harvests are in (December). The mean intake of iron and vitamin A was calculated to be 5.4 mg and 277 µg per day, respectively. Borno State lies in the far northeastern corner of Nigeria in the interface between the Sudan and Sahel savannah zones. Most of the peasants inhabiting this area are farmers and herdsmen, so the diet is primarily based on cereals and dairy. These two food items are usually plentiful by December.

Adolescents and the elderly in Borno were also subjects of food and nutrient intake studies (Oguntona et al. 1987b; Oguntona et al., 1988). Each subject (n=425) completed five dietary records of three consecutive days (that is, 15 total records per subject) between January 1983 and December 1984. The results showed that rural adolescents had vitamin-A and iron intake in excess of RDA at 112 percent and 161 percent for males and 117 percent and 134 percent for females, respectively. Urban adolescents had significantly lower intake of these vitamins and minerals compared with their rural cohorts.

Again, as with the peasants in Borno, the major sources of dietary vitamin A were meat and dairy products. The elderly, estimated to be about 2 percent of the population in Borno in 1987, were studied to assess the adequacy of their nutrient intake when compared with FAO/WHO recommendations. Mean intake of iron was significantly different for males and females. While the males had adequate intakes of 129 percent of RDA for the urban cohort and 97 percent for the rural cohort, female elderly had intakes that ranged from 36 percent of RDA for the urban cohort to 49 percent for the rural cohort. Mean intake of vitamin A by all cohorts within the group was 830 µg per day. For rural and urban, male and female elderly, intake of vitamin A was found to exceed RDA. A similar observation was made for calcium intake, and the authors of the study attributed these to the high consumption of dairy products typical of indigenous Kanuri people in the survey area.

Table 2.1—Recommended levels of daily intake of key minerals and vitamins for the population of Nigeria, by age, sex, and pregnancy or lactation status

Age	Vitamin A (µg RE/day)	Iron (mg/day)	Iodine (µg/day)	Zinc (mg/day)	Calcium (mg/day)
Infants					
0–6 months	375	–	30	2.8	300
7–11 months	400	9.0	15	4.1	400
Children					
1–3 years	400	6	75	4.1	500
4–6 years	450	6	110	5.1	600
7–9 years	500	9	100	5.6	700
10–18 years (male)	600	17	135	9.7	1,300
10–18 years female	600	30	135	9.7	1,300
Males	600	–	–	–	–
Females	600	–	–	–	–
Adults					
Males, 19–65 years	600	14	–	7.0	1,000
Females, 19–45 years (pre-menopausal)	500	29	–	4.9	1,000
Females, 50–65 (menopausal)	500	11	–	4.9	1,300
Pregnant and Lactating Women					
Pregnancy	800	–	200	10.0	1,200
Lactation	850	48	200	9.5	1,000
Older Adults (65+ years)					
Males	600	14	130	7.0	–
Females	600	11	110	4.9	–

Source: FAO/WHO (Food and Agriculture Organization of the United Nations and World Health Organization). 2002. Report of a Joint FAO/WHO Expert Consultation. Bangkok: WHO.

The 24-hour dietary recall method was used to obtain details of the food consumption and nutrient intake of a sample of the Kanuri people (Oguntona et al. 1989). The subjects numbered 289, consisting of 110 adolescents aged 13 to 19 years and 188 adults (men and women) aged 20 to 65 years. The results show that not only was the energy intake of adolescents adequate but their intake of iron and vitamin A were in excess of RDA—at 109 percent for vitamin A and 65 percent for iron in boys and 113 percent of vitamin A and 40 percent of iron in girls. Intake of vitamin A by adults also exceeded RDA in both men (108 percent) and women (120 percent); iron intake by adults also exceeded RDA for men (220 percent) but not for women (71 percent).

A baseline survey conducted in three states—Akwa Ibom, Cross Rivers, and Rivers—in 1993 found mean dietary iron intakes in females in Cross Rivers (Ikang) to be 18.1 mg constituting about 64 percent of RDA, while the intake of children under five was 8.2 mg (82 percent RDA) (Akinyele et al. 1993). In Akwa Ibom (Uta Ewa), the intake was 8 mg for women (28.5 percent RDA) while the value for children under five was 6 mg (60 percent RDA).

The difficulties inherent in conducting scientific studies with pregnant women are well known. It is not surprising therefore that few studies address the food and nutrient intake of pregnant women in Nigeria. The challenges are even more complicated if the pregnant woman is an adolescent. A recent study in southwestern Nigeria, however, assessed the food and nutrient intake of 101 pregnant adolescent Nigerians during their third trimester, using the three-dimensional weighed intake technique to obtain information on food intake (Oguntona and Akinyele 2002). The adolescents were grouped according to ages in two groups: those under 17 and those older than 17. Iron intake ranged from 9.7–10.9 mg for rural adolescents to 11.8–12.8 mg for the urban adolescents. Not a single subject studied met the RDA of 30 mg per day. However, except for three subjects, all the adolescents had vitamin-A intakes in excess of RDA (258–345 percent), suggesting that this nutrient is abundant in the food supply. On the basis of these results, the authors suggested that vitamin A may not constitute a critical nutrient in the survey area. It is interesting to note that the intake of vitamin A among the subjects comes essentially from the conversion of carotenoid from dark leafy vegetables.

Similar conclusions could be reached from the results of another survey conducted in southwestern Nigeria (Okafor & Oloyo 2004). The study was a survey of nutrient intake and workload of pregnant women in the Yewa South Local Government Area (LGA) of Ogun State. The 24-hour dietary recall procedure was used to obtain information on food and drink consumed by 40 pregnant women between 17 and 43 years old. The mean intake of vitamin A for all subjects was 942 µg, which is 157 percent of RDA, and that of iron was 25.7 mg, which is 86 percent of RDA. Vitamin-A intake ranged from 118 percent RDA among women farmers to 203 percent RDA among full-time housewives. An even more recent study in Lau LGA of Taraba State (southwestern Nigeria), however, reported low intakes of iron and vitamin A among adolescents (Anita et al. 2014). These observed differences are presumably due to the sample size and method used to assess nutrient intake. The study showed that most of the family members depended on carbohydrates (corn, pounded yam, *fufu*, rice, and *tuwo* from *garri* (dumplings from cassava)), which are the major crops in the area; few respondents have access to plant and animal protein. The results also indicated that only 11 percent of mothers surveyed fed their children three times per day, so most children were under fed.

In Nigeria and other developing countries, food intake and nutritional status has been largely affected by rapid urbanization, which causes food habits of urban dwellers to change. A major characteristic of this change is the increase in the consumption of "street foods." Some studies have addressed this issue and estimated the contribution of street foods to daily consumption of nutrients (including micronutrients) by different categories of urban dwellers. One such study by Oguntona et al. (1998) in southwestern Nigeria, found that all of the subjects (126 university students) had adequate intake of iron, ranging from 8.8 mg for females to 10.2 for males (85–89 percent, respectively).The study also found that all the subjects had intake of vitamin A in excess of RDA, with the percent supplied by street foods at 80 percent for male students and 68 percent for their female counterparts.

At least two other similar studies in the southwestern part of the country have been reported: one assessing women traders, the other looking at office workers in an urban center. The study of market women found that all subjects had iron and vitamin A intakes above RDA levels for their respective age groups (Oguntona & Tella 1999). Significantly, in all subjects, the amount of vitamin A obtained daily from street foods alone exceeded RDA for their respective ages. Data obtained from the study of urban office workers followed a similar pattern: of the 133 government and corporate employees assessed, street foods indeed contributed more than 100 percent RDA of vitamin-A for male subjects and 94 percent RDA for female subjects (Oguntona and Jaiyesimi 1998).

2.4 Studies on Blood Concentrations of Vitamin A and Iron

In 1996, the World Health Organization provided criteria for assessing the prevalence of sub-clinical vitamin-A deficiency using plasma retinol concentrations (< 0.7 µmol/l). Using these standards, many studies have been conducted in Nigeria to determine vitamin-A status in newborns, children, and pregnant women (Uzoechina and Okoro 1994; Adelekan et al. 1997; Adelekan et al. 2003; Oso et al. 2003; Ene-Obong et al. 2003). Tables 2.2 and 2.3 present summaries of studies reporting dietary intake of vitamin A in Nigeria.

In an attempt to fully assess the vitamin-A status of newborns, Adelekan and coauthors at Obafemi Awolowo University in southwestern Nigeria collected blood samples from 205 subjects (2003). They measured not only plasma retinol but also concentrations of plasma carotenoids and acute phase proteins because of their potential value as indicators of vitamin-A nutrition levels or inflammatory status. In addition they measured body weight, gestational age, and prematurity because of possible associations that these variables have with plasma concentrations of retinol. Their results show that overall, newborns with low body weights had significantly lower mean plasma retinol concentrations than those with normal weights (0.46–0.59 µmol/L) respectively. Babies born both premature and with significantly low birthweight (< 2.5 kilograms) also low mean plasma retinol concentrations than those of normal gestational age and weight (0.45 versus 0.59 µmol/L, respectively).

Table 2.2—Summary of studies reporting dietary intake of vitamin A in Nigeria

Age group	Retinol (µg/d)	Mean intake (µg/d)	Percent RDA	Data Collection Procedure	Population Sector	Reference
1 yr.	176-480	–	–	48-hr recall	Urban & rural	Nicol (1959a)
2-3 yrs.	184-337	230	–	48-hr recall	Urban & rural	Nicol (1959a)
4-5 yrs.	181-708	393	–	48-hr recall	Urban & rural	Nicol (1959a)
1-5 yrs.	–	–	98–132	48-hr recall	Urban & rural	Nicol (1959a)
3-5 yrs.	–	–	148	Weighed intake	Urban	Nicol (1959b)
5 yrs.	5,000 IU	–	–	Weighed intake	-	Nicol (1959b)
0-5 yrs.	–	–	170	24-hr recall	Rural	Nnanyelugo (1980)
Lactating women	–	–	167	24-hr recall	Rural	Nnanyelugo (1980)
Peasants male	207-368	277	–	24-hr recall & weighed in-take	Rural	Addo (1984)
Adolescents	–	–	96-117	Dietary records	Urban & rural	WHO (1967)
Adolescents	–	860	–	24-hr recall	Urban & rural	Ijarotimi (2004)
Children 2-5yrs	734	–	183	Weighed intake	Rural	Okoroigwe & Okeke (2009)
Adolescents	6,296-9,135	7,716	–	Weighed intake	Urban	Anyika et al (2009)
Adolescents		730	152	24-hr recall	Rural	Onabanjo & Balogun (2014)
Adolescent males	–	–	109	24-hr recall	Urban	WHO (1967)
Adolescent females	–	–	113	24-hr recall	Urban	WHO (1967)
Nursing mothers (15-49 yrs)	–	288	–	24-hr recall	Rural	Fabunmi et al., 2013

Source: Authors' compilation

Table 2.3—Summary of studies reporting dietary intake of iron in Nigeria

Age group	Mean intake (mg/d)	Percent RDA	Data Collection Pro-cedure	Population Sector	Reference
1 yr.	9.5	135	48-hr recall	Preschool children in urban & rural southern Nigeria	Nnanyelugo 1980
2–3 yrs.	13.2	189	48-hr recall	Preschool children in urban & rural southern Nigeria	Nnanyelugo 1980
4–5 yrs.	16.1	230	48-hr recall	Preschool children in urban & rural southern Nigeria	Nnanyelugo 1980
2 yrs.	3.8	54.3	24-hr recall and weighed intake	Urban children in northern Nigeria	Addo 1983
3 yrs.	4.1	58.6	–	Urban children in northern Nigeria	Addo 1983
4 yrs.	7.2	102.9	–	Urban children in northern Nigeria	Addo 1983
Lactating women	38.2		24-hr recall	Kainji Lake area	Adekolu-John et al. 1985
Peasants male	6.0	66	24-hr & weighed intake	Northeastern Nigeria	Oguntona et al. 1987
Peasants female	5.0	17.9	24-hr & weighed intake	Northeastern Nigeria	Oguntona et al. 1987
Adolescent males	8.8	81.8	24-hr recall	Urban southwestern Nigeria	Oguntona et al. 1998
Adolescent females	10.2	83.9	24-hr recall	Urban southwestern Nigeria	Oguntona et al. 1998
Market Women	12.4	115.2	–	Urban southwestern Nigeria	Oguntona & Tella 1999
Adolescent males	21.8		24-hr recall	Urban southwestern Nigeria	Ijarotimi 2004
Adolescent females	17.9		24-hr recall	Urban southwestern Nigeria	Ijarotimi 2004
Children 2–5 yrs	8.2	93.3	Weighed intake	Rural southwestern Nigeria	Okoroigwe & Okeke 2009
Nursing women	48.0	267	24-hr recall	Rural southwestern Nigeria	Fabunmi et al. 2013
Adolescent males	8.8	52	24-hr recall	Rural southwestern Nigeria	Onabanjo & Balogun 2014
Adolescent females	7.8	26	24-hr recall	Rural southwestern Nigeria	Onabanjo & Balogun 2014

Source: Authors' compilation

In a study of 250 eastern Nigerian preschool children, serum retinol values were used to determine the children's vitamin A status (Uzoechina & Okoro 1994). Using WHO standards, the authors concluded that VAD prevalence was 25.4 percent. Overall roughly one in ten of the children (9.2 percent) had deficiency levels (< 10 µg/dl), and 16.4 percent had low levels (< 20 µg/dl). A significantly higher proportion of boys than girls—11.9 versus 6.8 percent—had deficiency levels. Also a significant percentage of the children ages 3–5 suffered from night blindness (3.7 percent). In 1997, the results of a similar study conducted in southwestern Nigeria demonstrated the prevalence of malnutrition and vitamin-A deficiency in

Nigerian preschool children subsisting on high intakes of carotenes foods, such as sweet potatoes, orange fruits, and plant leaves (Adelekan et al. 1997). The subjects—204 preschool children (3–57 months) recruited from two rural communities in Osun State—were assessed using anthropometry, frequency of consumption of locally available pro-vitamin A rich foods (green leafy vegetables, carrots), and concentration of plasma retinol. The results indicated widespread malnutrition among the subjects despite the fact that dietary intake of vitamin A appeared to be adequate, although the source of vitamin A was predominantly from green leafy vegetables. Overall VAD prevalence was determined from plasma retinol to be 11.3 percent.

Similar conclusions were reached from another study conducted in the same region around the same time (Oso et al. 2003). The vitamin A status and dietary intakes of carotenoid-rich foods were determined in 213 children ages 6–72 months. The study reported a rather high prevalence of vitamin-A deficiency despite calculated high intake of foods containing carotenoids. Among the subjects, 26.8 percent had serum retinol levels below10 µg/dl, while 47.9 percent had levels between 10–19 µg/dl. A particularly significant finding from this study was that the highest VAD prevalence was recorded among subjects that are ages 6–12 months most of whom were still receiving breast milk. A possible explanation may be that the beta-carotene in the food consumed is destroyed during processing, rendering it less bioavailable, or that it is not consumed in sufficient quantities to have an effect on the vitamin A status of the children.

Not many studies have addressed the vitamin-A and iron status of adolescents in Nigeria, especially through an assessment of blood levels of the micronutrients. A report published in 2003 describes a study of food intake and plasma concentration of vitamin A in 600 adolescents attending secondary schools in Nsukka (Enugu State). The results show that even though the intake of vitamin A was more than adequate (126–137 percent RDA), 40 percent of the male and 32 percent of the female subjects had plasma concentrations less than 20 µg/dL (Ene-Obong et al. 2003). In 2014, another study assessed the iron status of adolescents attending secondary school in Ogun State (Onabanjo & Balogun). In this study, multiple iron status indicators (haemoglobin, serum ferritin, and transferrin receptor) and inflammation markers (C-reactive protein) were measured. The study reported that the prevalence of iron depletion (serum ferritin <12.0 µg/L) and iron deficiency (Hb = 13.0 g/dL in boys and Hb = 12.0 g/dL in girls plus serum ferritin <12 µg/L) in the adolescent were 7.9 percent and 15.0 percent, respectively. The prevalence of anemia was high (24.4 percent) with iron-deficiency anemia the most prevalent at 71 percent. In both boys and girls, ferritin correlated positively with body mass index, waist circumference, and waist-to-hip ratio. The study concluded by acknowledging the high prevalence of iron deficiency and poor nutritional status among Nigerian adolescents.

There are fewer studies in Nigeria on the vitamin-A status of pregnant women using blood concentration of the vitamin as a criterion. This understandably is partly due to difficulties in receiving ethical clearance and patient consent. One clinic-based study determined the vitamin-A status of 200 pregnant women ages 15–43 years (mean 27.2 years) by measurement of retinol concentration in plasma (Ajose et al. 2004). The study also looked at the relationship between vitamin-A status, dietary habits, and morbidity pattern. Vitamin-A deficiency (plasma retinol concentration < 0.35 µmol/L) was found in 17.5 percent of the subjects while 37 percent had borderline levels (plasma retinol concentration of 0.35–0.70 µmol/L). Almost half (45.5 percent) of the subjects, however, had normal vitamin-A status (plasma retinol concentration > 0.7 µmol/L). The authors documented some dietary and food preparation practices—including overheating of red palm oil and blanching of green vegetables—that could have negatively impacted the vitamin-A content of their diets.

Perhaps the most comprehensive national survey of food consumption and nutritional status of Nigerians was conducted in 2001. The overall goal of the survey was to assess the prevalence and spread of micronutrient deficiencies and determine the nutritional status and nutrient intakes of the rural and urban populations in Nigeria (Maziya-Dixon et al. 2006). One of the objectives was to assess the micronutrient (iron, zinc, iodine, vitamin A and vitamin E) status of children under five, mothers, and pregnant women from food intake and biochemical indices. For vitamin A, a total of 6,480 households with eligible mother/child pairs were sampled for determination of serum retinol concentration by high-performance liquid chromatography (HPLC). The results showed that 29.5 percent of children under five across the country were vitamin-A deficient (serum retinol < 0.70 µmol/L). There were significant zonal differences in the prevalence rates, however, with 31.3 percent in the dry savannah zone, 24 percent in the moist savannah, and 29.9 percent in the humid forest ($p < 0.01$). Also significantly more children with severe deficiency (serum retinol < 0.35 µmol/L) were found in humid forest (7.1 percent) than in the dry savannah (3.1 percent) and moist savannah (2.4 percent). The prevalence of VAD in the subjects was similar in the rural (25.6 percent) and urban (25.9 percent) areas but significantly ($p < 0.05$) higher (32.6 percent) in the medium (semi-urban) sector.

Nationwide, mothers with serum retinol concentrations < 30 µg/L that are also considered to be at risk of vitamin-A deficiency were 13.1 percent. Among the mothers, agro-ecological zone differences in prevalence rates were significant with 19.6 percent in the dry savannah, 14.5 in moist savannah, and 8.8 percent in the humid forest. However, only 4.1 percent of the mothers who were at risk were actually found to be vitamin-A deficient. The cutoff point for being at risk of VAD—serum retinol concentration < 30 µg/L—is the same for mothers and pregnant women. Nationwide, pregnant women considered to be at risk of VAD were 19.2 percent and those that were actually deficient (serum retinol concentration < 20 µg/L) constituted only 8.8 percent. Significant zonal differences were also observed in the prevalence of pregnant women at risk of VAD, being 34.3 percent in the dry savannah, 28.3 percent in moist savannah, and 21.6 percent in the humid forest.

Table 2.4—Summary of vitamin-A status of children and women in Nigeria using blood vitamin A concentration

Population group	Adequate Vitamin A (blood), %	Marginal Vitamin A deficiency (VAD), %	Severe VAD, %	Marginal &Severe VAD,%	References
1. Neonates	-	-	18.0	72	Adelekan et al. 2003
2. < 5 yrs old	71.5	24.8	4.7	29.5	Maziya-Dixon et al. 2006
	-	16.4	9.2	25.4	Uzoechina & Okoro 1994
	-	-	-	11.3	Adelekan et al. 1997
	-	47.9	26.8	-	Oso et al. 2003
3. Adolescents	-	-	-	32-40	Ene-Obong et al. 2003
4. Mothers	-	13.1	-	-	Maziya-Dixon et al. 2006
5. Pregnant women	45.5	37.0	17.5	-	Ajose et al. 2004
	-	19.3	-	-	Maziya-Dixon et al. 2006

Source: Authors' compilation

The same national survey of food consumption and nutritional status of Nigerians assessed the status of iron deficiency of children, pregnant women, and mothers using the serum ferritin level (SF) (Maziya-Dixon et al. 2004). SF levels below 12 ng/ml are highly specific for iron deficiency and indicate exhaustion of iron store in adults. In children, benchmark for iron deficiency is 10 ng/ml. For children under five, at the national level, 27.5 percent were at different stages of iron deficiency and 19.4 percent had an SF level of less than 10ng/ml. Disaggregating by AEZ, the proportion of children with varying degrees of iron deficiency was 42.2 percent in the dry savannah while prevalence of iron deficiency was 31.5 percent, less than in moist savannah but higher than in humid forest; 10.7 percent had iron store depletion.

Later analysis of data from the NFCNS by Akinyele (2009) found that in the northwest zone, 21.7 percent of under-fives were iron deficient and 11.9 percent had iron store depletion, the differences presumably being due to the reorganization of data from AEZ to State category. Approximately 24.3 percent of mothers and 35.3 percent of pregnant women were at different stages of iron deficiency, with 12.7 percent of mothers and 19.9 percent of pregnant women already with iron store depletion (SF level <12 ng/ml) indicating iron deficiency. In the dry savannah, 33.2 percent of mothers and 43.1 percent of pregnant women were at different stages of iron deficiency.

A survey that tested for nutritional factors associated with anemia in 146 pregnant women, who attended two prenatal clinics in Gombe (northern Nigeria) found that based on a hemoglobin value of <105 g/L, 32 percent of women were classified as anemic (Vanderjagt et al. 2007). The major contributing factor to anemia was iron deficiency based on the SF level. Conclusions from this study were that the most common cause of anemia in the pregnant women in northern Nigeria was iron deficiency, and the elevated concentrations of homocysteine were most likely due to both their marginal folate and vitamin B12 status. Malaria was also present in fifteen women (9.4 percent). The common diet in the northern region is heavily reliant on grains, such as millet and sorghum, which contain large quantities of phytates known to interfere with the bio-utilization of iron, zinc, calcium, and other trace minerals. The requirements of iron during pregnancy are high, and it was difficult to meet these requirements through diet alone.

The IDD problem is concentrated in the middle belt and southeast regions of Nigeria (Ojule et al. 1998). This has been associated with the high consumption of cassava products in the southern parts of the country. Data generated from the 2001–2003 national nutrition survey provide some detailed information on the prevalence and spread of iodine deficiency (Maziya-Dixon et al. 2004). Nationally, some 30.7 percent of mothers were found to have varying degrees of iodine deficiency; it was severe in approximately 4.2 percent of mothers, moderate in 8.8 percent, and mild in 17.8 percent. Mothers in the moist savannah had the highest prevalence (19 percent) followed by those in humid forest (15.2 percent) and the dry savannah zone (11.6 percent).

In response to the high prevalence of iodine deficiency, the government embraced the strategy of salt iodization in the 1990s. Through a unique partnership between government agencies, academia, the private sector, and civil society, the country succeeded in establishing a salt iodization program and was granted a universal salt iodization (USI) certification by the WHO. USI has been mandatory since 1993, and Nigeria is among the countries that have succeeded in achieving and sustaining high levels of coverage, from less than 40 percent in 1993 to 95 percent or higher (1998–2004) (GAIN 2014). Nigeria was designated as USI compliant in 2008. However, salt and iodine deficiency disorder is still a problem. This was attributed to the fact that iodized salt is often sold in open receptacles although attempts are being made to require packing of quantities that are 50 mg or higher. In Nigeria, there has been a massive concerted effort by the federal government through the National Food and Drug Administration and Control (NAFDAC) to ensure cheap availability and consumption of adequately iodized salt. As of 2005, it was estimated that 98 percent of households in the country had access to iodized salt (Akunyili 2005). Efforts to sustain and build on this success are being maintained through several strategies like social marketing and continuous monitoring at the different levels. The result of the 2010 survey reveals that iodine levels of household salts in Nigeria has improved and the urinary iodine level data shows that Nigeria is not in eminent danger of IDD. According to the MICS (2011), most households (80 percent) consumed adequately iodized salt that contained 15 parts per million (ppm), while about 13 percent households consumed salt with an iodine content of less than 15 ppm. In all, about 93 percent of households in Nigeria used iodized salt, with the northwest region having the lower iodized salt consumption level, at 63 percent (MICS 2011).

2.5 Infant and Child Feeding Patterns in Nigeria

BREASTFEEDING

Another important aspect of child nutrition is breastfeeding. Breastfeeding practices and introduction of complementary foods are important determinants of the nutritional status of children, particularly those under age two. Exclusive breastfeeding during the first six months of life—a recommendation by WHO and UNICEF—provides children with the essential nutrients needed for growth and reduces the risk of infant mortality from diarrheal disease, which is responsible for 17 percent of the main causes of child deaths in the Africa (Kramer and Kakuma 2011; UNICEF 2008).

A recent estimate showed that worldwide only 35 percent of children between birth and their fifth month are breastfed exclusively (WHO 2010). Based on WHO global data on infant and young child feeding in 2003, 22.3 percent of children in Nigeria were exclusively breastfed for fewer than four months while 17.2 percent were exclusively breastfed for fewer than six months. From these figures, Nigeria could be designated as a "low-rate breastfeeding country" in Africa. The situation has not improved much since 2003. According to the 2008 Nigerian Demographic and Health Survey (NDHS), 17 percent of children were exclusively breastfed for fewer than four months while 13 percent were exclusively breastfed for under six months. The median exclusive breastfeeding period in southwest Nigeria was seven months in 2003; by 2008, it had dropped to only six months. Within the same period, early initiation of breastfeeding among women in the region was 12.7 percent in 2003, but increased to 35.5 percent by 2008 (NPC & ICF Macro 2009). All these figures are far below the 90 percent level recommended by the WHO (Jones et al. 2003). Nigeria has the highest rural mortality rate for children under five: 242.7 per 1,000 among selected countries in Africa south of the Sahara (Anyamele 2009).

The 2011 Multiple Indicator Cluster Survey (MICS) revealed that about 15 percent of children under six months were exclusively breastfed, a level considerably lower than recommended. The 2013 NDHS reported an increase to 17.2 percent in the exclusive breastfeeding rate. Analysis from the NLSMS put the percentage at 14 percent (Kuku-Shittu et al. 2013). A much higher exclusive breastfeeding rate of 25.2 percent was reported by the NFB/UNICEF study (NFB/UNICEF 2014). The study also provides evidence that children from families in the wealthier quintiles are more likely to be exclusively breastfed for the first six months than those in the poorer quintiles.

The prevalence of a low level of breastfeeding for children under five is highest among rural small-scale farmer households because many lactating women are too undernourished to provide adequate milk for their offspring; as a result they tend to supplement breast milk with cereal food products. Despite the high initiation prevalence, there was a low prevalence of exclusive breastfeeding, as shown by data from the 2013 NDHS. Rural and urban differentials have also been documented in the practice of exclusive breastfeeding as the practice was reportedly higher (41 percent) in the urban areas compared with 38 percent in the rural areas (NPC and ICF Macro 2009).

There are numerous reports of studies on breastfeeding and other child feeding practices in various parts of Nigeria, and although the samples and methods in these studies are not directly comparable, the results are generally consistent. Most of the studies available have been regional rather than national. Almost all rural Nigerian mothers and the majority of urban mothers breastfeed their babies for at least the first few months of life. Despite widespread prevalence in Nigeria, breastfeeding is not as effective as it could be in promoting good child nutrition and health because of suboptimal breastfeeding practices. The UNICEF (Nigeria) Participatory Information Collection Survey of 1994 indicated that 97.4 percent of mothers were breastfeeding their babies during the first month of life (UNICEF 1994). Only a very small proportion of mothers put the baby to the breast within the first hour after birth, as is recommended, while most studies report that the majority initiate breastfeeding within the first 24 hours (Fagbule & Adedoyin 1987; Ojofeitimi 1981; Omololu 1982, MICS 2011) or 48 hours (Omotola & Akinyele 1985). The NDHS provides a somewhat different picture, however, with 34 percent of women reporting initiation of breastfeeding immediately after delivery and 24 percent within 24 hours.

The traditional practice among Yoruba women (the major ethnic group in southwestern Nigeria) has been to provide prelacteal feeds of water or an herbal infusion known as *agbo* (Mebrahtu & Bentley 1989; Omotola and Akinyele 1985). In the major urban center of Ibadan, the majority of women discarded colostrums for the first 24 hours, citing reasons such as hospital advice or an absence of milk in the breast. Omotola and Akinyele (1985) concluded that this practice of discarding colostrums was not based on underlying cultural belief. But the majority of mothers (66 percent) in Ilorin, Kwara State, said colostrums should be eaten, one-third opposed this practice because the colostrum is dirty and yellow in color (Fagbule & Adedoyin 1987). Few of the urban Igbo mothers (the major ethnic group in southeastern Nigeria) gave breast milk as the first feed after birth, with water given most commonly. The rural Igbo mothers were more likely to start with breast milk or a commercial glucose beverage, water, or a local preparation (Uwaegbute & Nnanyelugo 1987). A major factor affecting the feeding of colostrums to babies by mothers in this part of the country is that Igbos traditionally rejected colostrums and prefer to give water feeds instead (Kings and Ashworth 1987). In the northern region, more than 40 percent of mothers reported giving colostrums and about one-third began breastfeeding immediately (Atinmo et al. 1992). Both the Hausa and the Fulani (the major ethnic groups in the northern region) reportedly hold strong views of colostrums as dirty, unhygienic, and potentially harmful. Compared to other regions of the country, the southwest has a much lower proportion of mothers who begin breastfeeding immediately after birth (Atinmo et al. 1992).

There are very little data on frequency of breastfeeding, perhaps because most mothers breastfeed on demand (Omotola & Akinyele 1985; Fagbule & Adedoyin 1987). Among Igbo mothers, it was found that urban women were more likely (26 percent) than rural women (9 percent) to feed according to a time schedule (Uwaegbute & Nnanyelugo 1987). A study of children ages 6–30 months in a village in Kwara State demonstrated that the average feeding time was 30 minutes and the average number of feedings was six per twelve-hour period. The mean volume of breast milk consumed in twelve hours was about 300 ml for healthy children; it tended to be higher during diarrheal illness and convalescence (Dicken et al. 1990).

Breastfeeding practices, including initiation and duration, are influenced by multiple interwoven factors that include health, psychosocial, cultural, political, and economic factors (Cripe 2008; Schmied and Barclay 1999). Among these factors, decisions regarding initiation and duration of breastfeeding in low-income countries are influenced by education, employment, place of delivery, family pressure, and cultural values (World Health Organization 2010; Gartner et al. 2005; Ogunlesi 2010; Otoo et al. 2009). In Nigeria, while breastfeeding initiation is increasing, the duration and practice of exclusive breastfeeding remains low (Ogunlesi 2010). The early introduction of complementary feeding, based on erroneous assumptions, affects breastfeeding initiation and sustainability (World Health Organization 2010). Among the Yoruba people, a common belief around infant feeding is that exclusive breastfeeding is beneficial to both infants and mothers, but complementary feeding is essential for babies to adapt to other meals with ease (Ojofeitimi et al. 2000; Lawoyin et al. 2001; Tella et al. 2008). Besides normative expectations, personal experiences and networks of support have influence on the forms and quality of breastfeeding practices. Largely, these factors exert pressure on breastfeeding mothers thereby making their experience pleasurable or painful within time and space (Cripe 2008; Baumslag and Michels 1995; Blum 1999).The results of a similar study conducted in southwestern Nigeria were published in 2010. The study (Agunbiade & Ogunlewe 2010) investigates breastfeeding practices and experiences of nursing mothers and the roles of grandmothers, as well as the work-related constraints affecting nurses in providing quality support for breastfeeding mothers in southwestern Nigeria. The respondents consisted of 200 breastfeeding mothers, nurses, and grandmothers recruited from two rural communities in Osun State, southwestern Nigeria. The survey showed the major constraints to exclusive breastfeeding to be: the perception that babies continued to be hungry after breastfeeding (29 percent); maternal health problems (26 percent); fear of babies becoming addicted to breast milk (26 percent); pressure from mother-in-law (25 percent); pain in the breasts (25 percent); and the need to return to work (24 percent). In addition, the qualitative findings showed that significant others played dual roles on breastfeeding practices. The desire to practice exclusive breastfeeding was often compromised shortly after child delivery. Factors such as poor feeding, inadequate support from husband, and conflicting positions from the significant others were dominant constraints..

COMPLEMENTARY FEEDING

Complementary feeding begins when breast milk alone is no longer sufficient to meet the nutritional requirements of infants, and therefore other foods and liquids are fed along with breast milk. The World Health Organization recommends introduction of complementary foods, in addition to human milk, at six months of age (2002). In Nigeria, the recommendation is that breastfeeding should be continued along with the introduction of complementary foods at six months (FMH/DCD/PA 2005).

Complementary foods are also often introduced early in Nigeria, with 23 percent of children under age six months and 38 percent of children between four and five months old consuming solid or semi-solid foods in addition to breast milk. Supplementing breast milk before age six months is unnecessary and discouraged because of the likelihood of contamination, which may result in the risk of diarrheal diseases. After six months, breast milk should be complemented by other solid or mushy food to provide adequate nutrition to the child (PAHO 2002).

The first food other than milk and liquids given to an infant in Nigeria is a thin gruel made from maize, sorghum, or millet, commonly known as "pap." Pap was the most common complementary food to be introduced by all income and education categories of mothers in an Ilorin sample, although higher income and education was associated with a greater tendency to add milk to the pap. In a survey of ethnic differences in weaning foods, it was found that the majority of Hausa (96 percent), Yoruba (90 percent), and Igbo (83 percent) mothers start with pap, and 100 percent in all groups mentioned pap when asked to name a good weaning food. Complementary infants' foods among the Yoruba are somewhat different from those used by other two major ethnic groups in Nigeria. Beans and bean products are the first solid foods given to infants next to pap by the urban poor of Ibadan (Akinyele and Omotola 1987). Foods such as *moin-moin*, *akara*, and bean pottage are commonly consumed (Omotola 1984). A common problem associated with most complementary food in Nigeria is inadequate sufficient proteins, vitamins, and minerals. A traditional complementary food used by the Kanuri, Hausa, and Fulani in northern Nigeria is known as *kunu* and is usually made from a cereal (sorghum, rice, or wheat) combined with groundnut or *tsamya* (a sour fruit). About half of the mothers interviewed in Maiduguri mixed this cereal pap with formula, and about a quarter combined formulas with commercial cereals (Igun 1982). The Hausas of northern Nigeria also give a type of dough made from guinea corn, millet, or rice (called *tuwo*) with different vegetable soups to infants as the next solid food after introduction to pap. Beans and bean products are rarely used because they are believed to cause flatulence. Mashed yam and rice were the next important infant foods. Among the Igbos of eastern Nigeria, next supplement to maize gruel are mashed yams, rice, beans, plantains, and cassava *fufu* or *garri* (Kazimi & Kazimi 1979). Like the Hausas, the Igbos also consume vegetable soups along with the modified adult foods. Beans and bean dishes are similarly prominent as important foods for infant weaning. Other foods given to children in the first year include rice, beans, tubers, and other cereals, including commercial preparations (Aina et al. 1992; Anyanwu & Enwonwu 1985; Igun 1982; Omotola & Akinyele 1985; Orwell et al. 1984; Uwaegbute & Nnanyelugo 1987; Uwaegbute 1991).

2.6 Impact of Improved Water, Sanitation, and Hygiene (WASH) Practices on Nutrition Outcomes

Most mortality of children under five in Nigeria results from diseases that in one way or another are related to poor housing conditions, unsafe water supply, inadequate sanitary facilities, and/or unhygienic behavior. Contaminated drinking water and unsanitary means of excreta disposal are closely associated with diarrheal diseases. Malnutrition in children is mainly caused by inadequate dietary intake and infectious diseases (Noreen Mucha 2014). Unsafe drinking water, inadequate water for food and personal hygiene, and insufficient access to sanitation are partly responsible for up to 88 percent of deaths from infectious diseases, such as repeated diarrhea in children globally (WHO 2009). In many developing countries, project intervention to improve water, sanitation, and hygiene (WASH) and reduce infectious diseases has been part of developmental process. Research is frequently being conducted to evaluate the impact WASH interventions have on nutritional outcomes of children.

Probably the foremost WASH intervention evaluation in Nigeria was conducted on the Imo State Drinking Water Supply and Sanitation Project in 1982 (Blum et al. 1990). The evaluation studied the project's impact on diarrhea and guinea worm disease as health indicators. They reported a link between some water-associated behavior and a lower risk of diarrhea in the intervention villages. In addition, the prevalence of wasting among children under three decreased significantly over time, except in the control villages. In a similar study conducted by Ahmed et al. (1994) in low land rural Bangladesh on an intervention to improve hygiene practices and reduce childhood diarrhea, children up to 8 months composed the control site because of their high vulnerability to diarrhea morbidity and malnutrition (related to unhygienic practices) at their developmental stage. Higher cleanliness scores, better growth status, and lower diarrhea morbidity were recorded at the intervention villages compared to those of the control villages. A few more studies have reported data on WASH in Nigeria. The 2011 MICS reported about six in every ten households in Nigeria were using an improved source of drinking water with 73 percent in urban areas and 51 percent in rural areas. There were similar disparities with the sanitation indicator: only 26 percent of household members in rural areas used an improved sanitation facility versus 41 percent in urban areas. The 2014 FBS/UNICEF reported that 52 percent of households in Nigeria had access to an improved source of drinking water; tube wells or boreholes were the most common sources of improved drinking water (34 percent), and only 37 percent of households in Nigeria have access to improved sanitation facilities. Water and sanitation figures reported by the 2013 NDHS are similar to the 2014 FBS/UNICEF, with 49 percent of households in rural areas having access to safe water compared to 76 percent in urban areas. Only 25 percent of rural households have access to improved sanitation compared to 37 percent in urban areas (NDHS 2013).

Dangour et al. (2013) also conducted a meta-analysis of some studies (carried out in ten low-to-middle-income countries) from cluster-randomized controlled trials. The authors concluded that WASH interventions have some impact on the duration and amount of growth in children under five. Although the majority of evidence was based on relatively short-term studies with some methodology shortcomings, some research has found a 36 percent median reduction in diarrhea as a result of good WASH practices (Jamison & Mosley 1991); this would have a positive impact on nutritional outcome of any population. More studies are needed on the relationship between WASH practices and nutritional outcomes among vulnerable populations, and more awareness should be raised on the importance of hand washing through WASH education.

3. MEASURES TO PREVENT AND CONTROL MICRONUTRIENT MALNUTRITION IN NIGERIA

In many developing countries, strategies for reducing the prevalence of micronutrient deficiencies in vulnerable populations include food fortification, dietary diversification, and supplementation. Among these three strategies, food fortification is acknowledged to be the most cost-effective, accessible, and direct intervention to increase micronutrient intake without changing dietary and cultural habits across various sociocultural groups and levels of income.

3.1 Control Strategies for Vitamin A Deficiency in Nigeria

In Nigeria, initiatives to control and reduce micronutrient deficiency disorders goes back to 1990. In 2002, the government adopted a new strategy: fortification of staple foods with vitamin A so that children will naturally consume vitamin A in their food. The Ministry of Industry (Standards Organization of Nigeria) published mandatory standards for vitamin A fortification in vegetable oil, sugar, and flour in 2002. By 2004, 55 percent of vegetable oil, 70 percent of sugar, and 100 percent of wheat flour on the market were fortified with vitamin A. Wheat flour is also being fortified with iron to improve general physical and mental health.

In recognition of the effectiveness of food fortification to control vitamin A deficiency, a national Vitamin A Food Fortification Consultative Group was formed in 1996 with representatives of key stakeholders as members. A subcommittee of this group was charged with establishing mandatory minimum levels to be added to the three staple foods. At the end of extensive consultation, fortification levels were agreed as follows:

Flour	30,000 IU of vitamin A/kg
Sugar	25,000 IU of vitamin A/kg
Edible vegetable oil	20,000 IU of vitamin A/kg

The implementation of the fortification exercise was launched in the flour and vegetable oil industries in September 2002 (Akunyili 2005).

As a short-to-medium-term strategy for combating vitamin A deficiency, supplementation has been mostly the strategy of choice in many developing countries because of its demonstrated efficacy. In a recent Cochrane Review, including 43 randomized trials representing 215,633 children, it was shown that giving vitamin A capsules to children between six months and five years old can reduce overall risk of death by 24 percent. The authors concluded that vitamin A supplementation is effective in reducing all-cause mortality; they therefore recommended universal supplementation for children under five in areas at risk of vitamin A deficiency (Imdad et al. 2010).

In Nigeria, vitamin A supplementation has primarily been promoted through the Primary Health Care System, which is the primary level of healthcare delivery in the country. The National Immunization Days (NID) have also been used for effective coverage since NID targets the population of children under five. Since 2000, the vitamin A supplementation program has also piggy-backed on the national campaign against polio. It was hoped that 39 million children aged 6 to 60 months would, by the end of the year 2000, have received high potency doses of vitamin A with their polio vaccinations to achieve coverage near 90 percent of the target. Data indicate only 23 percent vitamin A coverage from 1998 to 2000 (UNICEF 2001), jumping to 79 percent in 2000 (UNICEF 2002) and 70 percent in 2004 (UNICEF 2005). Regrettably significant zonal differences exist in the reported coverage with vitamin A supplementation in the country. Data from the Multiple Indicator Cluster Survey (FGN/UNICEF 1999) indicated that the zones with the most serious prevalence of VAD had the lowest coverage of vitamin A supplementation. While coverage was as high as 47 percent in the humid forest zone of southeast, it was only

16 percent in the northeast and 10 percent in the northwest. These northern areas are within the dry savannah zone where vitamin A deficiencies are the highest (31.3 percent).

In an attempt to improve on this coverage level, vitamin A supplementation efforts have now been incorporated into the new Maternal, Newborn and Child Health Week Program. This program, launched by the federal government, is a simple "one-off" approach to deliver a combination of core preventive and curative health services that allow mother and child to thrive and develop through the existing health system. Its objective is to achieve the highest possible coverage of children and pregnant women by the delivery of an integrated package of "high-impact, cost-effective preventive services" to improve maternal, newborn, and child health in conjunction with routine services at health facilities. The program includes five key intervention packages, namely immunization, nutrition, health education, birth registration, and care for pregnant women. The nutrition package includes vitamin A supplementation, deworming, and nutrition status screening for severe acute malnutrition. Over the past few years many states have been celebrating Maternal, Newborn and Child Health Weeks, and there are indications that this program has great potential to improve coverage of vitamin A supplementation. As an example, Akwa Ibom State implemented the Maternal, Newborn and Child Health Week in 2010 in all 31 local government areas (LGA). During the exercise, no LGA recorded less than 40 percent coverage, with eight reporting 100 percent vitamin A supplementation coverage for children 12–59 months. Overall, the state recorded 82.1 percent vitamin A supplementation coverage for children 6–59 months.

This reported high level of coverage perhaps masks individual, household, community, and regional disparities in vitamin A capsule uptake. The Vitamin A supplementation program in Nigeria recently was evaluated for equity in terms of socioeconomic and geographic coverage using the country's most current representative data (Aremu et al. 2010; NPC/ORC Macro 2009). The study applied regression analysis on 19,555 children living within 888 communities in the six geopolitical zones of the country. The results revealed variability in vitamin A supplementation uptake among children, which is attributable to several characteristics at individual, household, and community levels. At the individual level, maternal occupation was shown to be associated with vitamin A capsule uptake. At the household level, wealth status was the only characteristic significantly associated with vitamin A uptake. Equally significant is the fact that at the community level, neighborhood socioeconomic disadvantage and geographic location were the characteristics used to determine receipt of vitamin A supplementation.

3.2 Biofortification

One potential solution to micronutrient deficiency is biofortification, the process of breeding and delivering staple food crops with higher micronutrient content (Qaim 2007; Bouis et al. 2011; Saltzman et al. 2013). Biofortification could prove to be a cost-effective and sustainable strategy for alleviating micronutrient deficiency in rural areas of developing countries, where the majority of poor households' diets consist of staple foods and where access to food supplements and commercially marketed fortified foods is limited. Since 2003, breeders across the Consultative Group on International Agricultural Research (CGIAR) have been working under the HarvestPlus program to develop varieties of seven staple crops (cassava, maize, sweet potato, beans, pearl millet, rice, and wheat) that contain significant levels of bioavailable, critical micronutrients. The micronutrients of focus are vitamin A, iron, and zinc, which are—apart from iodine, which can be fairly easily addressed by the iodization of table salt—recognized by the international nutrition community as most limiting in diets (Black et al. 2013). Interventions are planned or underway to adapt and multiply planting materials of these varieties and deliver them to rural households in Asia (Bangladesh, India, and Pakistan); Africa (Mozambique, Nigeria, Rwanda, Uganda, and Zambia); and Latin America and the Caribbean (Bolivia, Brazil, Colombia, Haiti, Honduras, Guatemala, Nicaragua, and Panama). Existing evidence suggests that biofortification is an efficacious and cost-effective strategy for alleviating micronutrient deficiency in rural areas of developing countries.

HarvestPlus has led biofortification projects in Africa since the 1990s, when a critical need arose to increase the level of micronutrients in major African staple foods. In Nigeria in 2011, HarvestPlus developed and introduced the first biofortified cassava and maize rich in Vitamin A, through the National Root Crops Research Institute (NRCRI) and the International Institute for Tropical Agriculture (IITA). Cassava being a staple widely consumed by the resource-poor in the community offers a great potential as a vehicle for biofortification with vitamin A. NRCRI and IITA recently introduced three new varieties of cassava that are richer in Vitamin A than similarly biofortified varieties introduced three years ago. HarvestPlus and the Cassava Transformation Agenda of the Nigerian Federal Ministry of Agriculture and Rural Development provided financial support. These cassava varieties are 25 percent richer in beta-carotene than the first set of vitamin A cassava varieties released in 2011, which are being grown by more than 250,000 Nigerian farmers. The newer improved varieties are expected to gradually replace the earlier ones. In addition to their higher beta-carotene content, the vitamin A cassava varieties boast of improved pest-and disease-resistant traits and are high yielding. Biofortified cassava and maize were estimated to each provide up to 25 percent of daily vitamin A requirements as opposed to the conventional varieties that provide virtually none. More recently, three vitamin A cassava varieties were released and developed to provide up to 40 percent of the vitamin A daily recommendation for children under five.

In 2013, 654 hectares of vitamin A cassava stems developed by HarvestPlus were multiplied in 272 villages; private sector engagement in multiplication meaningfully increased from 5 percent in 2012 to 32 percent in 2013 across target and spillover states, including Akwa-Ibom, Benue, Imo, and Oyo. The number of households targeted has increased from fewer than 3,000 to more than 100,000 across the country. Post-harvest and nutritional benefits include development of 15 products (ten commercial and five household), a recipe book for training, and as a guide for investors as well as the establishment of ten model villages and five model restaurants identified and linked to the vitamin A *garri* and *fufu* market. In Akwa Ibom State, one commercial *garri* and *flour* factory, which produces 50 tons of fresh roots per day, was built in support of HarvestPlus by the state government. The shelf-life of vitamin A products has improved with the increase in demand for *garri* and *fufu,* which are now becoming attractive to investors. The awareness of vitamin A cassava has increased tremendously with more than 30 million Nigerians now aware of vitamin A cassava through the use of messages aired in major languages including English, Ibo, Pidgin, Hausa, and Yoruba.

3.3 School Feeding

School feeding is simply the provision of food to school-children (State of School Feeding Worldwide 2013). It is also an organized program to reduce micronutrient malnutrition while supporting education, health, and agriculture community development (WFP 2007). Different countries have different objectives for school feeding programs based on their own goals. However, to achieve multiple benefits, the program design must correspond to its objectives. Thus, programs are classified based on their modalities, including in-school feeding, where foods are given to children in the school, or take-home rations, where parents are given food because their children attend school (State of School Feeding Worldwide 2013).

School feeding programs have been an integral part of child welfare in developed countries like the United Kingdom and Brazil as far back as 1906 and 1955 respectively (WFP 2012). Nigeria, like most developing countries, practices in-school feeding programs that provide children with breakfast, lunch, or a combination of the two.

To improve the nutritional status of school children, the federal government launched the Home-Grown School Feeding and Health Program in September 2005 in Abuja, under the coordination of the Ministry of Education. The aim of the program was to provide a nutritionally adequate meal during the school day. The pilot phase (Sept 2005–July 2006) involved 12 states and the federal capital territory in the six geopolitical zones (UNICEF 2006). The multisectoral program had the following objectives: (1) to alleviate short-term hunger; (2) to increase attendance, retention, and completion of basic schooling; (3) to reduce gender inequalities in education; and (4) to improve health and nutritional status of students (Yunusa 2012).

In addition to the above objectives, the school feeding program can have multiplier effects on other sectors if properly implemented. For instance, it can create markets for poor farmers as has been the case in Brazil, where the second largest school feeding program in the world has provided a stable market to family farmers in the country (Emilie et al. 2013). Countries where school feeding programs are being implemented have recorded increased attendance and enrollment rates in addition to a positive effect on nutritional status among school children (Akanbi & Alayande 2011). Unfortunately, most Nigerian states could not sustain the program, probably due to the cross-sectoral responsibilities in program delivery. Only Osun State is still implementing the Home-Grown School Feeding and Health Program with state government funding. The state currently provides, on average, one meal a day for 129,318 children in kindergarten through primary 2 classes in all 1,352 of its public schools; benefits of the program have been observed in children's education, health, and nutrition, as well as community and agriculture development. A major challenge to scaling up the program is funding.

Falade et al. (2012) conducted a survey of daily food intake by the school children in Osun State and reported that the children were given food like rice as breakfast, *garri* (a cassava product) and groundnut as lunch, and *eba* (another cassava meal) or *amala* (yam flour meal) with okra soup as supper. They therefore suggested that food should be complemented with more legumes and animal proteins in order to achieve the objective of improved health and nutritional status for students.

3.4 Regulatory Requirements on Food Labeling and Fortification

The Declaration on Child Survival, Protection, and Development at the World Summit for Children in 1990 initiated the Universal Salt Iodization (USI) program around the world. In 1993, the government of Nigeria launched the program, which mandated salt manufacturers to fortify table salt with iodine. According to UNICEF (2014), iodized salt consumption in Nigeria was 80 percent in 2011; it was the first country in Africa to get international recognition for achieving USI. Following this success, in

September 2002, the Nigerian government mandated other staples to be fortified with essential micronutrients (Sablah et al. 2013). The policy required addition of vitamin A to wheat flour, maize meal, vegetable oil, and sugar, as well as the addition of iron, zinc, folic acid, B vitamins, niacin, thiamine, and riboflavin to wheat flour (Figure 3.1).

Table 3.1—Mandatorily fortified food items with levels of fortification required

Food	Micronutrient	Levels
Sugar	Vitamin A	25,000 IU/kg
Wheat/maize flour	Vitamin A	30,000 IU/kg
	Iron	40.7 mg/kg
Vegetable oil	Vitamin A	20,000 IU/kg
Margarine and butter	Vitamin A	26,000–33,000 IU/kg
Salt	Iodine (in the form of Sodium Iodate or Potassium Iodate)	50 ppm in factory or port of entry; 30 ppm at retail outlets and household

Source: NAFDAC, 2005, Food Fortification with Vitamin A Regulations.

A survey conducted in October 2003 by NAFDAC indicated that sampled flour and vegetable oils showed only 5 percent compliance with mandatory vitamin A levels. A more recent study showed only slightly higher levels of compliance with mandatory micronutrient fortification standards in selected processed foods (Table 3.2). The NAFDAC Food Fortification with Vitamin A regulations addressed the following areas: prohibition of sales of the specified fortified foods, which include an "eye logo" for easy identification; proper packaging; advertising materials; and permits granted by NAFDAC before airing. However, there are two major challenges facing the country with regards to vitamin A food fortification: continued importation of nonfortified edible vegetable oil and sugar. Cottage industries involved in making maize flour and edible vegetable oil, which do no not have the capacity to fortify their products. According to the Food Fortification Initiative (FFI), Nigeria is one of the 81 countries that have passed legislation to mandate the fortification of staple cereals.

Table 3.2—Levels of compliance with fortification standards at retail level

Food type	Micronutrient	Micronutrient content: Minimum acceptable	Micronutrient content: Median in market samples	Percentage of samples meeting or exceeding standard
Vegetable oil	Vitamin A	10,000	1,100	24.2
Sugar	Vitamin A	12,500	4,500	26.2
Cereal flours (wheat, semolina, maize)	Vitamin A	15,000	7,100	10.2
	Iron	34.6	27.4	37.8

Source: Adapted from Ogunmoyela et al. (2013). In Robinson et al. 2014.

The coordination of mandatory fortification rests with the National Fortification Alliance, which comprises the private sector manufacturers, industry associations, and public agencies. Some of the organizations involved in the National Fortification Alliance—including GAIN, UNICEF, and Helen Keller International among others—have been rendering institutional and technical supports to National Agency for Food and Drug Administration and Control (NAFDAC) and other regulatory agencies to strengthen their capacity and that of the food industry to effectively regulate food manufacturing companies' compliance and improve consumers' knowledge of food fortification (Robinson & Nyagaya 2014). Their activities include revising legal standards on premix formulations to follow international best practice; providing training workshops to regulatory agencies and the industry and equipping them with testing technology; promoting mutual understanding among public and private sector employees; and supporting the restructuring of NAFDAC to place greater emphasis on food regulation and promote professionalization (Robinson et al. 2014).

NAFDAC is the regulatory authority of the federal government of Nigeria; it was established to regulate and control manufacturing, importation, exportation, advertisement, distribution, sale, and use of food and other regulated products, such as drug, cosmetics, medical devices, chemicals, detergents and packaged water. NAFDAC applies the food additive standards of the Codex Alimentarius Commission, the European Union, and the Food and Drug Administration (FDA) in its assessment of food safety. As the lead agency for food safety and quality, NAFDAC has a specific food additive regulation on fortification as specified in the federal government of Nigeria's Act 19 of 1993, as amended.

One of the main aims of regulating the level of fortificants in processed food is to preserve the nutrient balance and safety of the food for the consumers (WHO 2006). Regulatory agencies have the responsibility of ensuring that reasonable amounts of micronutrients are added to food products and that these additives are listed on the product label and mentioned during product advertisement. NAFDAC has also stipulated minimum food labeling requirements, which are: labels should be informative, clear, and accurate in English (and other language); product's brand name should be boldly written; name and address of the manufacturer, packer, distributor, importer, exporter, or vendor should be provided; NAFDAC Registration Number should be included; batch number, manufacturing date, and expiration or "best before" date should be listed; ingredients list in metric weight in case of solids, semi-solids, and aerosols and metric volume in case of liquids; food additives and colors must be declared on the label (see www.nafdac.gov.ng).

Nigeria has not yet reached the required level of food fortification due to low levels of compliance (Robinson and Nyagaya 2014). There is still need for a robust regulatory system that covers both large and small food manufacturers in order to achieve the required level of micronutrients in food products.

4. CASE STUDY OF NUTRITION IN KWARA STATE, NIGERIA

4.1 Study Area

Kwara State is located in the north central geopolitical zone of Nigeria on the western border of Nigeria with Benin. With a total of 16 local government areas (LGAs), it had a total population of about 2.7 million in 2006 (Figure 4.1). Males accounted for 57 percent of this population (1.55 million) (NPC 2008). The state is predominantly rural, with more than 80 percent of the population living in rural areas. Almost 90 percent of the population are farmers, and 50 percent of them are women (NBS 2012). Kwara State has abundant natural resources and good climatic conditions suitable for agriculture.

Figure 4.1—Map of Kwara Sate showing the 16 local government areas

Source: Map of Kwara State "Royal Times of Nigeria Newspaper" Last updated April 3, 2014 Retrieved from http://royaltimes.net/police-navy-clash-omu-aran-kwara (accessed July 20, 2016).

The state shares boundaries with six other states—Ekiti, Kogi, Niger, Ondo, Osun, and Oyo—resulting in its rich ethnic diversity. However, there are four main ethnic groups: Bariba, Fulani, Nupe, and Yoruba. There are also seven main languages spoken, including Ebira and Nupe, but Yoruba is the most widely spoken language. Kwara State is divided into four zones by the Kwara State Agricultural Development Project (KWADP) based on agro-ecological characteristics and cultural practices, among other criteria.

Kwara State is one of the ten poorest states in Nigeria (UNICEF 2007) with more than 70 percent of the population estimated to be living on less than a dollar a day (NBS 2005; Alaye-Ogan 2008). In 2007, 27.9 percent of the population was food-deprived, 19.1 percent were stunted, and 12.2 percent of children were underweight. Kwara State was chosen for this study because this high prevalence of undernutrition and poverty. In addition, no recent studies have analyzed the determinants of malnutrition among children under five within farming households in the state. More importantly, the state also has a wide ethnic diversity and is midway between the dry cereal-based food systems of northern Nigeria and the wet root-based food systems of the southern and western parts of the country, thus combining a rich variety of dietary practices.

Agricultural production is predominantly conducted by peasant farmers at small-scale, characterized with rudimentary farming practices and limited use of mechanization, technology inputs, improved seeds, fertilizer, and agrochemicals. The typical cropping systems in the state are maize-based, yam-based, cassava-based, sweet potato-based, and rice-based in areas located along the Niger River, the major river in the state. Mixed cropping, shifting cultivation, and crop rotation are the predominant methods of cropping, and the major crops cultivated include cassava, cowpeas, groundnut, melon, maize, okra, pepper, rice, sorghum, yam, and some leafy vegetables (KWADP 1996).

Highest household expenditures in Kwara state are made on food commodities, such as vegetables (excluding pulses) (20.3 percent), tubers and plantain (19.6 percent), rice (11.8 percent), beans and peas (9.5 percent), oil fats and oil-rich nuts (8.4 percent) and maize (3.9 percent) (NBS 2012). According to Omotesho and Muhammed (2010), the most commonly consumed food items were yam, rice, and maize with per-household weekly consumption of 21.3 kg, 5.8 kg, and 5.1 kg, respectively. In the study, cowpeas, meat, and fish were also consumed but in smaller quantities of 2.6 kg, 1.1 kg, and 1.0 kg weekly, respectively. These statistics suggest that smaller quantities of proteins are consumed per household than starches and cereals. (The issue of diversity of diets is thoroughly investigated in Section 7.) The authors also reported that 65.5 percent of the population living in rural areas were food insecure.

4.2 Studies on Prevalence of Malnutrition in Kwara State

There are very few studies on the nutritional status of children and women in Kwara State. One of the earliest was a cross-sectional nutritional survey conducted among children in medically isolated villages in 1987 (Ehigie 1987). The results showed that children had mid-upper-arm circumference below the fiftieth percentile of the Harvard standard. Also, children in urban areas had better anthropometric indices compared to their rural counterparts. This study therefore revealed that children in the medically isolated villages were not only at risk of protein-energy malnutrition but suffered from multiple infections.

The report of a similar study among children under five of farming households in Kwara State found prevalence of stunting, underweight, and wasting to be 23.6 percent, 22.0 percent, and 14.2 percent respectively (Babatunde et al. 2011). These figures are comparable to the national averages for Nigeria. Descriptive analysis of the data indicates that children from richer households were less malnourished than those from poorer households. This underscores the importance of household income in child nutritional status. Similar conclusions could be reached from the results of another survey conducted to assess the prevalence of malnutrition among settled pastoral Fulani children in southwest Nigeria (Ekpo et al. 2008). Respondents from Kwara, Ogun, and Oyo States in southwestern Nigeria participated in the study, which found that 38.7 percent were stunted, 38.7 percent underweight, and 13.6 percent wasted when compared to the reference NCHS/WHO standard. Their results showed that overall 37.8 percent of the children surveyed were found to be malnourished, with boys more malnourished than girls, using WHO malnutrition classification systems.

The figures for Kwara in the NDHS using standardized monitoring and assessment of relief and transitions (SMART) conducted by the National Bureau of Statistics and UNICEF put the prevalence of stunting, underweight, and wasting at 34.5 percent, 17.9 percent of the children, and 6.4 percent respectively (NBS/UNICEF 2014). A total of 453 children under five from Kwara were included in this cross-sectional household survey. The observed figures in this survey are consistent with other similar surveys in the state. The more recent anthropometric indices for malnourished children under five in Kwara State presented in Table 4.1 reveal that stunting, underweight, and wasting remain key issues.

Table 4.1—Nutritional status of children under five years of age in Kwara State, Nigeria

Source	Weight for Age (underweight)		Height for Age (stunted)		Weight for Height (wasted)	
	percent below		percent below		percent below	
	-2SD	-3SD	-2SD	-3SD	-2SD	-3SD
2011 Multiple Indicator Cluster Survey (MICS)	21.5	6.5	29.5	15.1	11.5	3.9
2013 Nigerian Demographic and Health Survey (NDHS)	13.8	3.3	27.1	10.1	6.5	1.4

Source: Compiled by authors.

The most recent study comparing the child nutritional status across ethnic groups in Kwara State was conducted by Ebomoyi (2012), who made comparisons across the Fulani, Hausa, and Yoruba children living in rural areas. At age one, Fulani and Yoruba children exceeded 100 percent of National Center for Health Statistics (NCHS) standard for height. At ages 4, 11, 13, and 15 years, statistically significant differences were observed between the heights of Hausa and Yoruba children (p<0.05). Although Hausa subjects were lighter than the US National Center for Health Statistics (NCHS) data, significant differences were observed in eight age groups between the weight of Hausa and Yoruba children (P<05). Beyond age of three, the Hausa male children had triceps skin-fold thicknesses that were less than those of the Yoruba and the NCHS standard. The body mass index or Quetelet's index (weight/height2) identified 62.2 percent, 50.4 percent, and 68.6 percent of the Fulani, Hausa, and Yoruba children to be malnourished. In addition, 13 percent of the children consuming cassava as a staple food had inadequate protein intake in their diets. The fraction of dietary energy derived from cassava was negatively correlated with protein intake, protein-energy ratio, and dietary diversity—meaning that those individuals who consumed cassava as a staple did not compensate for the very low protein-energy ration of cassava by including sufficient amounts of protein-rich foods, such as legumes and fish in the diet. Height-for-age z-scores for stunting were directly associated with protein intake and negatively associated with cassava consumption using regression modeling that controlled for energy and zinc intake.

5. DATA AND METHODOLOGY

5.1 Survey Sampling Procedure

The household survey in Kwara state was carried out in November 2014. The sample consisted of 414 households that were chosen by a multi-stage targeted sampling technique. The first stage involved the selection of the five LGAs that constitute the villages where vitamin A cassava stems were recently introduced. (As noted in Section 3, vitamin A cassava was introduced into four target states in Nigeria by HarvestPlus and then more recently into several spillover states, which include Kwara state.) Although vitamin A cassava is not yet well established in the state, tracking it in Kwara provided an opportunity to have a baseline on awareness and adoption, after which subsequent studies could be developed to track growth in these indicators.

Table 5.1—Eligible and listed households by village and local government

Main Ethnic Group	Village	Local Government	Eligible Households	Households Listed
Nupe	Chewurum	Edu	33	51
Nupe	Edogi-Dukun	Edu	120	514
Nupe	Gagara	Edu	12	18
Nupe	Gbadegun	Edu	23	37
Nupe	Wariku	Edu	27	45
Yoruba	Aare-Opin	Ekiti	5	41
Yoruba	Aafin-Oro	Irepodun	6	7
Yoruba	Eleyin	Isin	37	63
Yoruba	Ekan	Oke-Oro	120	436
Yoruba	Erinmope	Oke-Oro	31	63
		Total	**414**	**1,275**

Source: Authors.

In the second stage, ten villages were selected (Table 5.1)—five from the Nupe-speaking area in Edu LGA and five from the Yoruba-speaking areas in the other four LGAs (Ekiti, Irepodun, Isin, and Oke-Oro). In selecting eligible households for this survey, censuses were conducted in all the selected villages, and households that had mothers or caregivers with eligible children (that is, those under five years of age) were selected. A total of 1,275 households were listed in all the villages out of which 294 were eligible from nine villages based on the selection criteria. A systematic random sampling procedure was employed in selecting 120 eligible households in one of the larger Nupe villages (Edogi-Dukun), which had a total number of 514 households and was too large for a census, given the very high number of eligible households. A total of 215 households in the Nupe areas and 199 households in the Yoruba villages were surveyed, bringing the total households surveyed to 414.

It is also important to note that due to the very multiethnic nature of Kwara State, there were several other ethnic groupings living within the predominantly Nupe or predominantly Yoruba villages. For instance, most Nupe villages also included a Hausa/Fulani settlement very close to the village. Hence we were able to include several other ethnic groupings in the study (Table 5.2). See Appendix 1 for the full list of ethnic groups represented in the survey.

Table 5.2—Number of households by main ethnic group, by village and local government area

Local Government Area	Village	Yoruba	Nupe	Hausa/ Fulani	Others	Total
Edu	Chewurum	0	25	7	1	33
	Edogi Dukun	0	119	1	0	120
	Wariku	0	20	2	6	28
	Gagara	0	12	0	0	12
	Gbadagu	0	22	0	0	22
Isin	Eleyin	9	2	4	22	37
Irepodun	Aafin- Oro	2	0	2	2	6
Oke-Oro	Ekan	117	0	0	3	120
	Erinmope	30	0	0	1	31
Ekiti	Aare- Opin	5	0	0	0	5
	Total	**163**	**200**	**16**	**35**	**414**

Source: Authors.

Figure 5.1—Map of surveyed villages and distance from the capital, Ilorin

The questionnaires for the survey were administered through computer-assisted personal interview (CAPI) technology using CSPro software. The questionnaire consisted of two modules: (1) a household roster administered to the head of household or most knowledgeable member, which contained demographic information for all household members, household socioeconomic information, agricultural production, household food and nutrition security, and water and sanitation sections; and (2) a module which was administered to the main groups of interest of the survey—the mothers and caregivers of children under five. Information such as child and maternal health, child care, food and nutrition security, sanitation practices, and anthropometric measurement was sought on the last child under five years of age within monogamous households where the mother or caregiver had more than one child under five. For polygamous households, interviews were only conducted for the last child under five from each mother or caregiver. The final sample size for the second section was 478 pairs of mother/caregiver and child.

5.2 Data Collection and Analysis Procedures

Weight and length or height measurements were taken on children ages 0 to 59 months within the sample. Weight and height measurements were also taken for their mothers or caregivers. Children's age was assessed based on their birth date from their child health hospital record or birth certificate. Ages of the women were calculated using self-reporting. Anthropometric indicators of length/height-for-age, weight-for-age, and weight-for-length/height were determined for the children ages 0 to 59 months using WHO growth standards (2008). Measurers were specially trained in conducting anthropometry using standardized procedure. Pre-test anthropometry measurements of children and women in a community were conducted as part of the training to ensure accuracy in measurement. Weight was measured using a Seca electronic scale (minimum 50g) and height was measured using stadiometers (minimum 1 cm) recommended by UNICEF and WHO (www.childinfo.org).

Weighing instruments were calibrated before taking measurements, using standard weights. Standard WHO protocol for measuring height and weight of children and women were used.

In a well-nourished population, there is a reference distribution of height and weight for children under age five. Undernourishment in a population can be gauged by comparing children to a reference population. Each of the three nutritional status indicators can be expressed in standard deviation units (z-scores) from the median of the reference population. Z - scores are calculated based on the distribution of the reference population, including both the mean and the standard deviation (SD); thus, they reflect the reference distribution. The reference population used in this report is based on the 2008 WHO growth standards. Anthropometric data were analyzed using WHO Anthro software (Version 3.1.0). The distribution graphs were computed from the WHO Anthro software, and they show how the nutritional status of the children sampled deviates from the normal distribution curve of the reference population. The classifications of the nutritional indices expressed in z-scores are as follows: <= -1SD as mild, <= -2SD as moderate, and <= -3SD as severe.

6. SOCIOECONOMIC CONTEXT OF HOUSEHOLDS

6.1 Social Characteristics of Household Members

The sample consisted of 414 heads of household and 484 spouses. Overall, there were 1,057 children born to these households (Appendix 2). However, in this section emphasis will be placed primarily on the 478 children ages 0 to 59 months and their caregivers, who are the primary focus of this study. Table 6.1 presents information on the age distribution of these children; with an overall mean of 25 months. Most of the caregivers were biological mothers of the children (94 percent) while the outstanding 6 percent were extended family members (Table 6.2, Panel 1).

Table 6.1—Age distribution of eligible children sampled

Child age (months)	Frequency	Percent
0-6	57	11.9
7-12	62	13.0
13-23	119	24.9
24-35	113	23.6
36-47	76	15.9
48-59	51	10.7
Total	**478**	**100.0**

Source: Authors.

The majority of household heads and caregivers were married, mostly to each other, as 95 percent of the caregivers were wives of the household heads and mothers of the children in the study. A large majority of household heads were men (91 percent) (Table 6.3). The female household heads were mostly widows or unmarried single parents. While the caregivers who were biological mothers tended to be younger (mean age of 31 years), caregivers who were extended family members were older (Table 6.2, Panel 4). The household heads were also older than the caregivers on average (mean age 42 years).

The overall level of education of household members in this sample was generally poor. Of the 414 household heads, 53 percent (222 people) had a primary school education or less. There were however differences by tribe: 65 percent of the Yoruba household heads had a secondary school education and higher, compared to only 27 percent of the Nupe household heads (Table 6.3, Panel 3). Even fewer caregivers (primarily women) had a basic education: only about 30 percent had attended secondary school. Once again, there were differences by ethnic group, following the same pattern as the household heads. Of the 248 Nupe caregivers in the sample, 90 percent of them had a primary school education or less. In contrast, 65 percent of the Yoruba sample (175 caregivers) had at least a secondary school education (Table 6.2, Panel 3).

Table 6.2—Caregiver characteristics, by ethnic group

	Yoruba n (percent)	Nupe n (percent)	Hausa/Fulani n (percent)	Others n (percent)	Total n (percent)
Panel 1: Relationship of Caregiver to Child					
Stepparent	0 (0.0)	1 (0.4)	0 (0.0)	0 (0.0)	1 (0.2)
Grandparent	14 (8.0)	6 (2.4)	1 (7.1)	3 (7.5)	24 (5.0)
Uncle/aunt	1 (0.6)	0 (0.0)	0 (0.0)	1 (2.5)	2 (0.4)
Niece/nephew	1 (0.6)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.2)
Other relative	1 (0.6)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.2)
Biological mother	158 (90.2)	241 (97.2)	13 (92.9)	36 (90.0)	448 (94.0)
Total	**175 (100.0)**	**248 (100.0)**	**14 (100.0)**	**40 (100.0)**	**477 (100.0)**
Panel 2: Marital Status of Caregivers					
Never married	3 (1.7)	3 (1.2)	0 (0.0)	1 (2.5)	7 (1.5)
Married	159 (90.9)	244 (98.4)	14 (100.0)	37 (92.5)	454 (95.2)
Divorced	2 (1.1)	0 (0.0)	0 (0.0)	0 (0.0)	2 (0.4)
Widowed	10 (5.7)	1 (0.4)	0 (0.0)	1 (2.5)	12 (2.5)
Separated	1 (0.6)	0 (0.0)	0 (0.0)	1 (2.5)	2 (0.4)
Total	**175 (100.0)**	**248 (100.0)**	**14 (100.0)**	**40 (100.0)**	**477 (100.0)**
Panel 3: Education Level of Caregivers					
No education	11 (6.3)	191 (77.0)	13 (92.9)	26 (65.0)	241 (50.5)
Some primary	8 (4.6)	14 (5.6)	0 (0.0)	2 (5.0)	24 (5.0)
Primary	28 (16.0)	19 (7.7)	1 (7.1)	7 (17.5)	55 (11.5)
Some secondary	14 (8.0)	2 (0.8)	0 (0.0)	2 (5.0)	18 (3.8)
Secondary	91 (52.0)	6 (2.4)	0 (0.0)	2 (5.0)	99 (20.8)
Some tech/professional	15 (8.6)	3 (1.2)	0 (0.0)	1 (2.5)	19 (4.0)
Tech/professional/pol	7 (4.0)	2 (0.8)	0 (0.0)	0 (0.0)	9 (1.9)
University	1 (0.5)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.2)
Koranic school	0 (0.0)	11 (4.5)	0 (0.0)	0 (0.0)	11 (2.3)
Total	**175 (100.0)**	**248 (100.0)**	**14 (100.0)**	**40 (100.0)**	**477 (100.0)**
Panel 4: Mean Age of Caregivers, years					
Stepparent	0	35	0	0	35
Grandparent	55	48	58	57	53
Uncle/aunt	43	0	0	60	52
Niece/nephew	30	0	0	0	30
Other relative	54	0	0	0	54
Biological mother	33	30	31	27	31

Source: Authors.

Table 6.3—Household head characteristics, by ethnic group

	Yoruba	Nupe	Hausa/Fulani	Others	Total
Panel 1: Gender of Household Heads					
Male	130 (79.7)	198 (99.0)	16 (100.0)	33 (94.3)	377 (91.1)
Female	33 (20.2)	2 (1.0)	0 (0.0)	2 (5.7)	37 (8.9)
Total	**163 (100.0)**	**200 (100.0)**	**16 (100.0)**	**35 (100.0)**	**414 (100.0)**
Panel 2: Mean Age of Household Heads					
Head	43	39	37	43	42
Panel 3: Education Level of Household Heads					
No education	15 (9.2)	62 (31.0)	11 (68.7)	15 (42.9)	103 (24.9)
Some primary	5 (3.1)	18 (9.0)	0 (0.0)	2 (5.7)	25 (6.0)
Primary	24 (14.7)	31 (15.5)	1 (6.2)	5 (14.3)	61 (14.7)
Some secondary	13 (8.0)	7 (3.5)	1 (6.2)	3 (8.6)	24 (5.8)
Secondary	71 (43.6)	30 (15.0)	1 (6.2)	6 (17.1)	108 (26.1)
Some tech/professional	15 (9.2)	10 (5.0)	0 (0.0)	1 (2.9)	26 (6.3)
Tech/professional/pol	12 (7.4)	11 (5.5)	0 (0.0)	0 (0.0)	23 (5.6)
University	8 (4.9)	3 (1.5)	0 (0.0)	0 (0.0)	11 (2.7)
Koranic school/makaranta	0 (0.0)	28 (14.0)	2 (12.5)	3 (8.6)	33 (8.0)
Total	**163 (100.0)**	**200 (100.0)**	**16 (100.0)**	**35 (100.0)**	**414 (100.0)**
Panel 4: Marital Status of Household Heads					
Never married	2 (1.2)	2 (1.0)	1 (6.2)	0 (0.0)	5 (1.2)
Married	144 (88.3)	197 (98.5)	15 (93.7)	34 (97.1)	390 (94.2)
Divorced	2 (1.2)	0 (0.0)	0 (0.0)	0 (0.0)	2 (0.5)
Widowed	14 (8.6)	1 (0.5)	0 (0.0)	1 (2.9)	16 (3.9)
Separated	1 (0.6)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.2)
Total	**163 (100.0)**	**200 (100)**	**16 (100.0)**	**35 (100.0)**	**414 (100.0)**

Source: Authors.

Table 6.4—Number of wives per household, by ethnic group

Number of wives	Yoruba	Nupe	Hausa/Fulani	Other	Total
Household with only one wife	125 (76.7)	108 (54.0)	10 (62.5)	29 (82.9)	272 (65.7)
Household with two wives	3 (1.8)	85 (42.5)	4 (25.0	3 (8.6)	95 (22.9)
Household with three wives	0 (0.0)	5 (2.5)	1 (6.2)	0 (0.0)	6 (1.4)
Household with four wives	0 (0.0)	1 (0.5)	0 (0.0)	0 (0.0)	1 (0.2)
Household with no wives	35 (21.5)	1 (0.5)	1 (6.2)	3 (8.6)	40 (9.7)
Total	163 (100.0)	200 (100.0)	16 (100.0)	35 (100.0)	414 (100.0)

Source: Authors.

The average overall household size was 6.3 people. In general, the mean household size (both total and by ethnic group) in this study was greater than the national mean (5.2) and the Kwara State mean (4.2) (NBS 2012). The Yoruba sample had a mean of 4.6, the Nupe was 7.6, the Hausa/Fulani was 6.5, and other ethnic groups combined had a mean household size of 6.0 individuals. These large household size figures were due to polygamous nature of many of the households surveyed (Table 6.4). While most households were monogamous, 27 percent of married households included two or more wives. Nupe households accounted for 90 percent of the 101 polygamous households.

6.2 Economic Characteristics of Households

LIVELIHOODS

Of the 414 households surveyed, almost 60 percent of the household heads were farmers. Other notable work activities included small businesses, commerce; working in the civil service or with non-governmental organizations, tailoring, and artisanship. There were 484 spouses in these households (due to polygamy). About 54 percent of these spouses were engaged in small business while another 14 percent were engaged in domestic activities, meaning that they were full-time housewives.

Table 6.5—Primary activities of household head and spouse(s)

Primary Activity	Head	First Spouse	Second Spouse	Third Spouse	Fourth Spouse	Total
Farming	243	42	11	1	0	297
Herding	3	1	0	0	0	4
Fishing	3	0	0	0	0	3
Small business/commerce	44	199	60	3	1	307
Domestic activities	2	48	17	4	0	71
Tailor/artisan	44	48	4	0	0	96
Civil servant/NGO worker	44	7	0	0	0	51
Others	31	29	9	0	0	69
Total	414	374	101	8	1	898

Source: Authors.

ASSETS

Land

While most Nigerian farmers have generally been described as subsistence farmers whose parcels are fewer than five acres on average, this was not true of the study sample, particularly the Nupe ethnic group sample. Only about 34 percent of all farmers in the sample cultivated under five acres of land. Farming is serious business for the Nupe people, and they have access to vast areas of land; they were the only ethnic group to report cultivating more than 20 hectares of land (34 households). While a lot of the land under cultivation was owned by the households in the survey, renting land for farming purposes was also quite common; larger parcels of land were typically owned and smaller parcels (mostly those fewer than five acres) were rented.

Table 6.6—Size of farmers' land parcels, by ethnic group

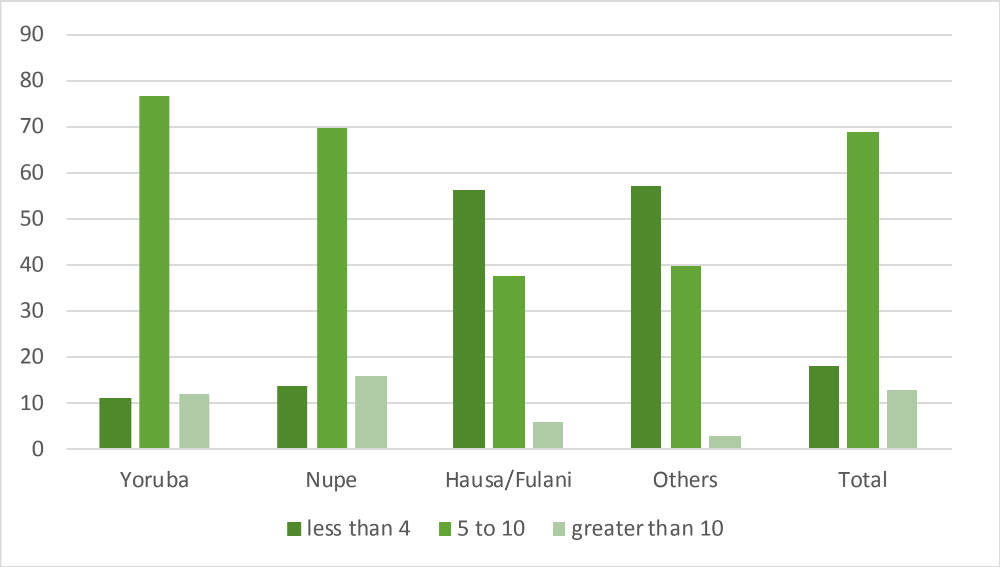
	Yoruba	Nupe	Hausa/Fulani	Others	Total
Panel 1:Total land under cultivation					
Less than 5 acres	49 (30.1)	30 (15.0)	3 (18.7)	10 (28.6)	92 (22.2)
Between 5 and 20 acres	31 (19.0)	133 (66.5)	10 (62.5)	20 (57.1)	194 (46.9)
Greater than 20 acres	1 (0.6)	33 (16.5)	0 (0.0)	0 (0.0)	34 (8.2)
Missing	82 (50.3)	4 (2.0)	3 (18.7)	5 (14.3)	94 (22.7)
Total	**163 (100.0)**	**200 (100.0)**	**16 (100.0)**	**35 (100.0)**	**414 (100.0)**
Panel 2: Owned land under cultivation					
Less than 5 acres	66 (40.5)	43 (21.5)	9 (56.2)	24 (68.6)	142 (34.3)
Between 5 and 20 acres	27 (16.6)	121 (60.5)	4 (25.0)	6 (17.1)	158 (38.2)
Greater than 20 acres	1 (0.6)	33 (16.5)	0 (0.0)	0 (0.0)	34 (8.2)
Missing	69 (42.3)	3 (1.5)	3 (18.7)	5 (14.3)	80 (19.3)
Total	**163 (100.0)**	**200 (100.0)**	**16 (100.0)**	**35 (100.0)**	**414 (100.0)**
Panel 3: Rented land under cultivation					
Less than 5 acres	78 (47.8)	189 (94.5)	8 (50.0)	20 (57.1)	295 (71.3)
Between 5 and 20 acres	5 (3.1)	8 (4.0)	6 (37.5)	14 (40.0)	33 (8.0)
Missing	80 (49.1)	3 (1.5)	2 (12.5)	1 (2.9)	86 (20.8)
Total	**163 (100.0)**	**200 (100.0)**	**16 (100.0)**	**35 (100.0)**	**414 (100.0)**

Source: Authors

Household assets

Table 6.7 presents the list of household assets owned by household members. Assets for entertainment were quite common as a majority owned radios (85 percent), televisions (67 percent), and video players (64 percent). About 97 percent of households in the sample had at least one person with a mobile phone. Assets that they owned the fewest of include a computer and access to the internet (even via their phones).

Figure 6.1—Percentage of sample owning categorized household assets, by ethnic group



Source: Authors.

The number of assets owned are grouped into categories in Figure 6.1 and disaggregated by ethnic group. While Yoruba and Nupe asset ownership trends are similar, the Hausa-Fulani in particular owned very few assets, similar to the other minority ethnic groups.

Table 6.7—Ownership of household assets

Household Asset	Frequency	Percent
Radio	351	84.8
Television	278	67.1
Land telephone	0	0.0
Refrigerator	94	22.7
Video player	264	63.8
Sewing machine	61	14.7
Clock	318	76.8
Generator	103	24.9
Computer	2	0.5
Internet facility	33	8.0
Fan	283	68.4
Air conditioner	1	0.2
Blender/mixer/food processor	14	3.4
Food grinder	49	11.8
A wrist watch	277	66.9
Mobile telephone	401	96.9
Bicycle	152	36.7
Motorcycle or scooter	300	72.5
Car or truck	65	15.7

Source: Authors.

Livestock

With the sample consisting predominantly of rural based farming households, most households owned livestock both for sale and for household consumption. These animals are counted as assets and could provide a safety net for the household if necessary. Table 6.8 shows the types of livestock owned, quantities, and mean (among owners, not among the total population surveyed). There were cultural differences in terms of livestock ownership preferences. For instance, most of the cattle in the sample were owned by the Nupe people as well as the Hausa/Fulani ethnic group. The Fulani in particular are famous for their cattle-rearing skills and are more likely to measure wealth in number of cattle owned than by any other asset. Despite the small number of households in the sample, this is obvious from a comparison of Figure 6.1 and Table 6.8: The Fulani own few household assets, but many cows. In contrast, all the pigs were owned by Yoruba households. The Nupe and the Hausa / Fulani people cannot raise pigs due to cultural and religious reasons. Goats and chickens were raised by all ethnic groups.

Table 6.8—Ownership of livestock, by ethnic group

	Yoruba		Nupe		Hausa/Fulani		Others		Total	
Livestock	Total	Mean	Total	Mean	Total	Mean	Total	Mean	Total	Mean
Cattle	0		294	11.8	102	8.5	4	1.3	400	0.1
Goats	277	3.8	854	6.3	46	5.1	39	4.3	1,216	0.5
Sheep	17	3.4	156	6	14	3.5	12	6	199	0.1
Chickens	1,412	11.7	2,090	12.7	198	14.1	387	13.8	4,087	0.8
Pigs	46	5.1	0	0	0	0	12	4	58	0.03
Camels	0	0	11	5.5	0	0	0	0	11	0.01
Ducks / geese	3	3	159	4.5	11	2.7	3	3	176	0.1
Fish	500	500	50	50	23	23	0	0	573	2.0

Source: Authors.

Farm assets

Another category of assets owned by the farmers were farming implements or tools, which were mainly rudimentary because of the manual nature of agriculture in rural Nigeria (Table 6.9). All the mechanized tools were owned by the Nupe, who tended to make more investments in farming than other ethnic groups made.

Table 6.9—Ownership of farm tools, by ethnic group

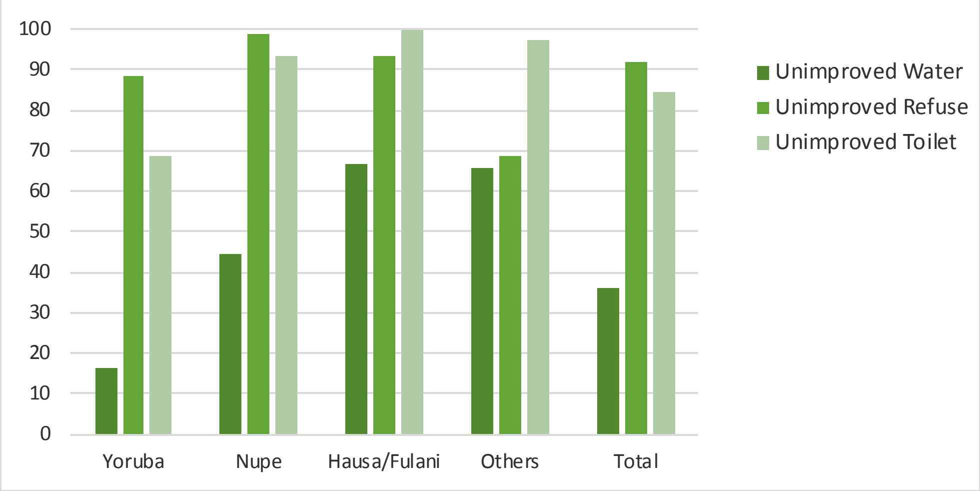
	Yoruba		Nupe		Hausa/Fulani		Others		Total	
	Total	Mean	Total	Mean	Total	Mean	Total	Mean	Total	Mean
Panel 1: Manual Tools										
Wheelbarrow	22	0.13	33	0.17	4	0.25	2	0.05	61	0.15
Cutlass	425	2.61	585	2.93	48	3.00	115	3.28	1,173	2.83
Hoe	331	2.03	967	4.84	57	3.56	130	3.71	1,485	3.59
Watering can	7	0.04	61	0.31	3	0.18	3	0.08	74	0.18
Irrigation pump	0	0	28	0.14	2	0.13	1	0.03	31	0.07
Sprayer	33	0.20	177	0.89	7	0.44	19	0.54	236	0.57
Fishing net	0	0	136	0.68	28	1.75	2	0.06	166	0.40
Canoe	0	0	20	0.10	7	0.44	0	0	27	0.07
Other animal drawn equipment	0	0	10	0.05	0	0	0	0	10	0.02
Panel 2: Mechanized Tools										
Tractor	0	0	25	0.13	0	0	0	0	25	0.06
Plough / ridger	0	0.19	37	0.19	0	0	0	0	37	0.09
Harvester	0	0.06	11	0.06	0	0	0	0	11	0.03
Planter	0	0.05	9	0.05	0	0	0	0	9	0.02
Thresher / sheller	0	0.20	39	0.20	0	0	0	0	39	0.09
Trailer	0	0.07	14	0.07	0	0	0	0	14	0.03
Milling machine	2	0.01	27	0.14	0	0	0	0	29	0.07
Pickup	1	0.01	7	0.04	0	0	0	0	8	0.02
Boat	0	0	18	0.09	2	0.13	1	0.03	21	0.05

Source: Authors.

6.3 Living Conditions

As detailed in the literature review, sanitation is a key element in ensuring positive nutritional outcomes, particularly in children. Unfortunately, the level of access to proper sanitation in the sample was very poor, in line with findings from national data (Kuku-Shittu 2013). Figure 6.2 provides the proportion of households using unimproved water,[1] refuse disposal,[2] and toilet facilities.[3] Many of the households had regular access to decent water sources, although only eight had running water in their homes. Others were able to access a public tap/stand, a borehole, or a protected well. Despite the decent access to water, toilet and refuse disposal facilities were inadequate with 84 percent of households using poor toilet facilities—in fact, 79 percent were using an open field for toilet. In addition, 92 percent of households dumped their refuse in unauthorized heaps (Figure 6.2). There were also differences by ethnic group here, with more Yoruba households having a lower proportion of households using poor water and toilet facilities than the other ethnicities.

Figure 6.2—Percentage of sample utilizing unimproved sanitation facilities, by ethnic group



Source: Authors.

Despite the rural nature of the villages, most of the houses were built with relatively modern materials: 95 percent with metal sheet or zinc roofing, 82 percent with cement, and another 82 percent with floors crafted from cement or other modern materials (including tiles and carpets). In addition, Kwara has a very impressive rural electrification scheme, with 83 percent of households connected to the national grid. Electricity was also well-distributed among all the surveyed local governments with almost all villages connected to electricity. Out of the ten villages visited, only one—Chewurum, a village right on the bank of the Niger River with a population of 51 households—was not connected to the national grid.

7. NUTRITIONAL CONTEXT OF HOUSEHOLDS

7.1 Macronutrient Consumption

DIETARY DIVERSITY

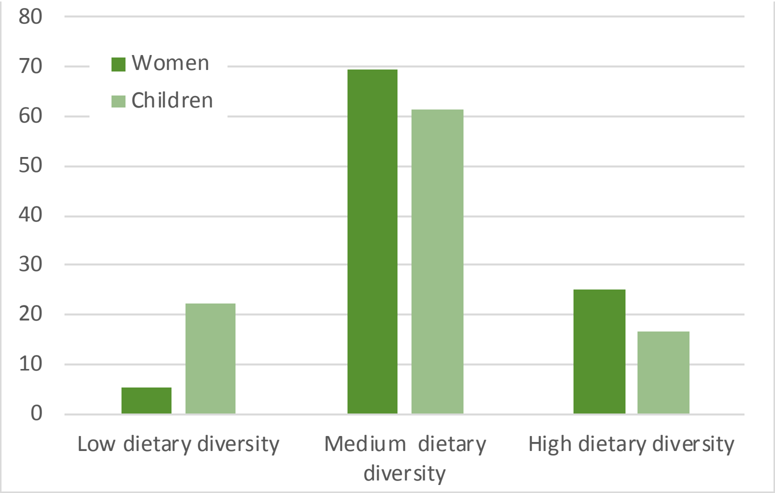
Dietary diversity refers to the consumption of a wide variety of foods across nutritionally distinct food groups (Kennedy et al. 2010). Households were asked about what they consumed the previous day (for breakfast, lunch, dinner, and snacks), and the meals' main ingredients were allocated into distinct food groups. The Individual Dietary Diversity Score (IDDS) is meant to reflect the nutritional quality of the diet (FAO 2011). In this section, we provide the dietary diversity scores for two groups of household members: the primary caregiver of a child under five—a wife in more than 90 percent of cases, and the youngest children under five in the household. While there are no absolute rules on how to quantify and organize dietary diversity information for adult individual, we follow a framework used by FAO in categorizing dietary diversity into low, medium, and high categories based on the number of food groups consumed (2011). On the other hand, the guidelines for accessing dietary quality of infant and young child contained in Marías et al. (2014) was adapted in calculating dietary diversity of children 6-59 months.

This categorization is displayed in Figure 7.1 and Tables 7.1 to 7.2 below. Figure 7.1 provides an overview of the dietary diversity situation of caregivers and children in the household. About 23 percent of the children surveyed are catego-

[1] Unimproved water sources include open bodies of water or those with risk of contamination, such as an unprotected spring.
[2] Defined as disposal within the compound or refuse dumped in an unauthorized refuse heap or near a water source.
[3] Use of uncovered toilet sources, including water bodies and open fields that hasten spread of diseases.

rized in the low dietary diversity group, while the proportion of women with low dietary diversity are less than 6 percent. Tables 7.1 and 7.2 provide more disaggregated and detailed information about the diversity of diets for these identified household groups; they also provide an explanation for the disproportionate representation of children in the low dietary diversity group.

Figure 7.1—Percentage of household members in different dietary diversity groups



Source: Authors.

In Appendix 3, we provide detailed information on the foods actually consumed by households in these categories. The tubers consumed were mostly yam and cassava, while rice and maize (in the form of maize porridge locally known as pap or ogi) were the dominant cereals. The primary vegetables consumed were okra and some leafy vegetables in addition to tomatoes and peppers used to make stews. Fruits were barely consumed, as the survey took place in November when most fruits were not in season. The most popular legumes were beans and groundnuts (in the form of a groundnut cake locally named *kulikuli*). While meat and fish were widely consumed, they were typically eaten in small portion that were not of very high quality. (The latter was derived from observation and anecdotal evidence.) In addition, *ponmo* (cow skin) was only explicitly identified by 23 households, but, once again, based on observation and anecdotal evidence, a large number of households consumed ponmo as meat and insisted that it was meat. Unfortunately, however, ponmo contains empty calories and has limited nutritional value. Oils and fats were widely consumed because they were used to cook the stews and vegetable sauces that accompanied the tubers and cereals. Examination of the various foods eaten within each food group shows that diets are actually not as diverse as they should be as there is the tendency to eat only certain foods. This may be due to religion or culture as well as a lack of awareness, accessibility, affordability, and availability.

CAREGIVER DIETARY DIVERSITY

The Women Dietary Diversity Score (WDDS) reflects the probability of micronutrient adequacy within a given diet, and the nine food groups included in the score are therefore tailored toward this purpose Table 7.1a presents the WDDS for all the caregivers listed in the sample, while food groups included in the WDDS is presented in Appendix 4a.

Table 7.1a provides information on the dietary diversity status of women by food group. From the table, it is clear that most caregivers have medium to high dietary diversity, but there are a few important food groups that are rarely consumed. Especially, organ meat, eggs and milk products were barely consumed by caregivers in the lowest and medium dietary diversity groups. However, starchy staples such as cereals, white roots, and tubers are widely consumed by all women across the dietary diversity groups. In Table 7.1b, the membership of the dietary diversity groups is broken down by ethnic group. The table shows that the proportion of women in the low dietary diversity categories is small, there are more Yoruba women in this category than women from other ethnic groups.

Table 7.1a—Caregivers categorized by dietary diversity according to consumption of different food groups, percentage of group that consumed food from food group

	Lowest Dietary Diversity Frequency	Medium Dietary Diversity Frequency	High Dietary Diversity Frequency
Starchy staple	100.0 (26)	99.7 (331)	100.0 (120)
Dark green leafy vegetables	7.7 (2)	21.4 (71)	60.0 (72)
Vitamin A rich fruits and vegetables	65.4 (17)	99.7 (331)	100.0 (120)
Other fruits and vegetables	23.1 (6)	73.2 (243)	99.2 (119)
Organ meat	0.0 (0)	0.3 (1)	10.0 (12)
Meat and fish	23.1 (6)	95.5 (317)	96.7 (116)
Eggs	3.8 (1)	3.0 (10)	24.2 (29)
Legumes, nuts, and seeds	19.2 (5)	67.2 (223)	85.0 (102)
Milk and milk products	11.5 (3)	5.4 (18)	51.7 (62)
Observations	*26*	*332*	*120*

Source: Authors.

Notes: Lowest dietary diversity = three food groups or fewer; medium dietary diversity = four or five food groups; and high dietary diversity = six or more food groups. Figures in parenthesis are counts of caregivers.

Table 7.1b—Caregiver dietary diversity by ethnic group, percentage of total in dietary diversity group

Categories	Yoruba	Nupe	Hausa/ Fulani	Others	*Observa-tions*
Lowest Dietary Diversity	61.5 (16)	34.6 (9)	0.00 (0)	3.9 (1)	*5.4 (26)*
Medium Dietary Diversity	32.3 (107)	58.9 (195)	1.5 (5)	7.24 (24)	*69.5 (332)*
High Dietary Diversity	43.3 (52)	36.7 (44)	7.47 (9)	12.5 (15)	*25.1 (120)*
Total	36.7 (175)	52.0 (248)	2.9 (14)	8.4 (40)	*100.0 (478)*

Source: Authors.

Notes: Lowest dietary diversity = three food groups or fewer; medium dietary diversity = four or five food groups; and high dietary diversity = six or more food groups. Figures in parenthesis are counts of caregivers.

CHILDREN DIETARY DIVERSITY

Table 7.2a provides information on the dietary diversity status of young children (6-59 months) by food group, and the proportion that consumed food from food group by age of child. Food groups included in the children dietary diversity score (CDDS) is presented in Appendix 4b. The data reveal that a large proportion of women do not breastfeed their children exclusively (see Table 8.6 for proportion of mothers that practices exclusive breastfeeding), validating the information from the literature review. Of the 67 infants below six months, 44.8 percent of them were fed cereals (pap) the previous day. For children ages 7 to 12 months, the number increased to 78.9 percent. It appears that the most popular supplementary food is pap, which also confirms the findings from the literature review. In addition, very few of these children took eggs, milk, or fruits. There appears to be very little diversity in the composition of supplementary foods fed to children in the sample.

Table 7.2a—Consumption of different food groups by children under five years of age, percentage that consumed food from food group by categories of dietary diversity and by age of child

	Dietary Diversity Group			Age Group		
	Lowest Dietary Diversity	Medium Dietary Diversity	High Dietary Diversity	0 to 6 months	7 to 12 months	13 to 59 months
Grains, roots and tubers	79.3 (69)	98.5 (258)	100.0 (70)	44.8 (30)	78.9 (41)	97.2 (349)
Legumes and nuts	12.6 (11)	87.8 (230)	100.0 (70)	16.42 (11)	44.2 (23)	80.5 (289)
Dairy products	32.8 (32)	15.3 (40)	80.0 (56)	34.3 (23)	44.2 (23)	27.0 (97)
Flesh foods	9.2 (8)	90.0 (236)	98.6 (69)	13.4 (9)	38.5 (20)	81.6 (293)
Eggs	0.0 (0)	2.7 (7)	41.4 (29)	4.5 (3)	5.8 (3)	8.6 (31)
Vitamin A fruits and vegetables	25.3 (22)	98.9 (259)	100.0 (70)	19.4 (13)	44.2 (23)	91.6 (329)
Other fruits and vegetables	12.6 (11)	77.9 (204)	98.6 (69)	13.4 (9)	38.5 (20)	73.3 (263)
Observations	*20.8 (87)*	*62.5 (262)*	*17.0 (70)*	*14.0 (67)*	*10.9 (52)*	*75.1 (359)*

Source: Authors.

Notes: Lowest dietary diversity = three food groups or fewer; medium dietary diversity = four or five food groups; and high dietary diversity = six or more food groups Figures in parenthesis are counts of children.

In terms of dietary diversity by ethnic group, 34 percent of the children belonged to the lowest dietary diversity or medium dietary diversity group, and the proportions per ethnic group were generally similar. This may be explained by the fact that many of the children were infants consuming complementary foods, but it also highlights the complete lack of diversity in the foods being fed to these children in their formative years (Table 7.2b).

Table 7.2b—Make-up of children's dietary diversity categories by ethnic group, percent of members in category

Dietary diversity category	Yoruba	Nupe	Hausa/ Fulani	Others	*Observa- tions*
Lowest Dietary Diversity	41.4	42.5	3.5	13.4	*87*
Medium Dietary Diversity	35.3	56.1	1.9	6.5	*262*
High Dietary Diversity	38.6	45.7	7.1	8.6	*70*
Total	37.1	51.5	3.2	8.2	*419*

Source: Authors.

Notes: Lowest dietary diversity = three food groups or fewer; medium dietary diversity = four or five food groups; and high dietary diversity = six or more food groups. Figures in parenthesis are counts of children.

CONSUMPTION OF MEAT AND ANIMAL PRODUCTS

In order to get more details on sources of meat consumption, the authors identified the animal assets owned by households and assessed how these animal assets contributed to human nutrition. See Table 7.3.

Table 7.3—Ownership and frequency of consumption of livestock and livestock products, frequency

Type of Livestock or Livestock product	Own						Frequency of consumption, for those who own				
	Yes										
	Yoruba	Nupe	Hausa/ Fulani	Other	Total	No	Do not con- sume	Daily	Weekly	Monthly	Occa- sionally
Milk cow/bull	0	25	12	3	40	324	29	–	1	1	9
Cow milk product	–	–	–	–	–	–	23	4	6	2	5
Goats	71	135	9	9	224	140	66	–	2	5	151
Goat product	–	–	–	–	–	–	220	–	–	–	4
Sheep	5	26	4	2	37	327	13	–	–	–	24
Sheep product	–	–	–	–	–	–	35	–	–	1	1
Chickens	121	165	14	28	328	35	27	_	10	57	234
Chicken product	–	–	–	–	–	–	138	3	32	60	95
Pigs	9	0	0	3	12	351	8	–	–	–	4
Camels	0	2	0	0	2	361	–	–	–	–	–
Ducks/geese	1	35	4	1	41	322	20		3	7	2
Duck/geese product	–	–	–	–	–	–	20	–	1	4	16
Fish	1	1	1	0	3	360	–	1	1	–	1

Source: Authors.

While a large percentage of households own small animals (see Table 6.8), a much smaller sample consume them with any level of regularity. For instance, 79 percent of the sample owned chickens (328 households), but only 71 percent consumed their chickens occasionally (234 households) and even fewer consumed chicken eggs occasionally (92 households). From interactions with the respondents, we were able to deduce several reasons for this low level of consumption of owned animals: (1) many households view these animals as assets and therefore as sources of income (and not of nutrition); and (2) awareness of proper animal husbandry practices is lacking, with many respondents complaining of poor livestock growth, poor production of secondary products, and high mortality rates.

7.2 Micronutrient Consumption

KNOWLEDGE AND AWARENESS OF MICRONUTRIENTS AND FORTIFICATION

While the high level of micronutrient malnutrition in Nigeria has been established within this report, what became more apparent through the authors' interactions with the respondents was a lack of understanding of the nutritional benefits of many food items. Many of the foods consumed by the respondents were nutritious in composition, and there was some understanding of the need to pair carbohydrates with proteins and vegetables. However, there did not appear to be any understanding of micronutrients or the role they performed. When questions were asked about the function of micronutrients—for instance, how foods rich in vitamin A contribute to improved eyesight—most respondents did not know.

Respondents were also asked about their knowledge of food fortification, and less than 20 percent of the sample (72 households) were aware of the concept. The households that were aware were then asked how they would recognize these foods. Most of them (62 households) relied on the logo or what was written on the packaging to recognize these brands. The outstanding households had only heard about these products, but could not recognize them.

Many of the households in the sample actually did consume fortified food, however, this was simply due to accessibility and affordability rather than any deliberate attempt to make nutritious choices. The lack of understanding of basic nutrition in addition to the widespread unawareness of government policy—particularly with regards to policy on food fortification—have important implications for nutrition education and food labelling policies, which will be further explored in the section on conclusions and recommendations.

Biofortification is an expanding measure being undertaken to fight malnutrition through agriculture. While HarvestPlus, which has been involved in developing biofortified crops in Nigeria, has primarily focused in four states, the organization recently began to distribute biofortified cassava in Kwara State (see section 3.2). While awareness is still low, we found that the farmers that had embraced it were very enthusiastic about the new brand of cassava. They were passing it on to other farmers and quite interested in expanding acreage. In discussions with the farmers, they stated their main concern was about market acceptance and finding markets for yellow cassava and its derivatives (for example, *garri*).

Because of the emphasis of the new federal nutrition initiative on micronutrient powders, respondents were also asked if they were familiar with these powders. Nearly 100 percent of respondents (97 percent) were not aware and had never heard of micronutrient powders. Respondents were then asked about consumption of Moringa as a proxy, to gauge their openness to micronutrient powders. Moringa (*Moringaceae*) is a plant native to the tropics with high nutritional value and an impressive range of medicinal uses (Anwar et al. 2007). Moringa is often dried and added as a sprinkle to food, or used in soups, like a micronutrient powder would be if distributed. About 23 percent of the sample (100 households) consumed Moringa, but only 23 households consumed Moringa in powdered form.

CONSUMPTION OF FORTIFIED PRODUCTS

There has been a law in place since 2002 mandating the fortification of certain essential staples. This policy would be constrained by two factors: (1) how well the industry is adhering to fortification standards and (2) how widely the major products are consumed. In rural Kwara State, the study found that national brands that are likely to be fortified are very widely distributed. There is access through regular market days to essential staples and provisions. Table 7.5 lists the top brands of major commodities that are mandated by law to be fortified with essential micronutrients, as detailed in Section 3 of this report.

For groundnut oil, while the packaged brands are widely consumed, there are two other major alternatives favored locally. First is *ororo kuli*, which is consumed by a very large number of households particularly among the Nupe people. It is extracted from groundnuts during the process of making groundnut cake. Another source of oil, though not as widely consumed, is oil from cow milk, locally known as *Mai shanu*. This is more popular among the Fulani people.

Table 7.4—Awareness and use of iodized salt, by ethnic group

	Awareness of iodized salt		Consumption of iodized salt			
Ethnic group	**Yes**	**No**	**Yes**	**No**	**Do not know**	***Observations***
Yoruba	49.7	50.3	98.2	1.2	0.6	*163*
Nupe	38.5	61.5	49.5	23.5	27.0	*200*
Hausa/Fulani	40.0	60.0	40.0	53.3	6.7	*15*
Others	25.7	74.3	77.1	20.0	2.9	*35*
Total	41.9	58.1	70.7	15.5	13.8	*413*

Source: Authors.

Among other non-staple items, brand names were often preferred. While it was not always possible to know the brand of salt utilized (as people often just bought a cup of salt in the market), most respondents did consume iodized salt, even though they were not aware of it (Table 7.4) The Mr. Chef brand of iodized salt was widely available and hence widely consumed. Although flour does not show up as a significant diet staple, it is used to make breads, pastries (including meat-pies with sausage), and local snacks like puffpuff (fried flour dough), all of which are quite popular and filling. For margarrine, respondents also favored well-known brand names like Blue Band and Simas, but they had a local alternative in the form of shea butter. Sugar was consumed mainly as a sweetener for *pap* and tea, but very often in small quantities.

As seen in Table 7.5, most of the brands were fortified with a variety of vitamins as mandated by law and consumed by a decent number of households. However, as earlier noted, this was due more to availability rather than knowledge or deliberate nutrition choices.

Table 7.5—Number of households consuming fortified commodities[4]

Commodity	Main brand names	Number of house-holds consuming	Fortified (y/n)	Included micronutrients
Vegetable oil				
	Ororo Kuli[5]	259	No	
	Kings	105	Yes	Vitamins A and E
	Gino	110	Yes	Vitamins A and E
	Turkey	30	No	
Sugar				
	Dangote	246	Yes	Vitamin A
	St. Louis	67	No	
Margarrine				
	Blue band	191	Yes	Vitamins A, D, and E
	Simas	54	Yes	Vitamins A and D
	Shea butter	51	no	
Flour				
	Dangote	104	Yes	Vitamin A
	Honeywell	49	Yes	Vitamin A
	Golden Penny	44	Yes	Vitamin A

Source: Authors.

Study households faced challenges in accessing branded food items. There were no supermarkets in any of the villages visited, and the villagers had to rely on the local market, which did not operate fully every day, but, rather, during designated market days. On market days, people from neighboring villages would come with farm produce and other wares to sell. We visited some of these markets on days when they were open and found a wide variety of locally grown produce in addition to quite a few of the popular national brands, including those featured in Table 7.5. The list of market days by village is presented in Table 7.6, in addition to the regularity of market days.

Table 7.6—Market locations and market day intervals

Village	Market Location	Market day intervals
Chewurum	Edogi (Mondays), Lafiagi (Fridays)	7
Edogi-Dukun	Edogi (Mondays), Lafiagi (Fridays)	7
Gagara	Gbugbu (Wednesdays), Lafiagi (Fridays)	7
Gbadegun	Gbugbu (Wednesdays), Lafiagi (Fridays)	7
Wariku	Gbugbu (Wednesdays), Lafiagi (Fridays)	7
Aare-Opin	Isare-Opin, Omuo-aran	5
Aafin-Oro	Isare-Opin, Omuo-aran	5
Eleyin	Omuo-Aran	5
Ekan	Ekan, Omuo-aran	5
Erinmope	Ekan, Omuo-aran	5

Source: Authors.

[4] Households often use more than one of these commodities, so they were able to pick multiple options.
[5] *Ororo kuli* is locally made groundnut oil, extracted from the process of making groundnut cake (locally known as *kulikuli*). This is a major cottage industry among the Nupe people and *ororo kuli* is widely consumed and sold in that area.

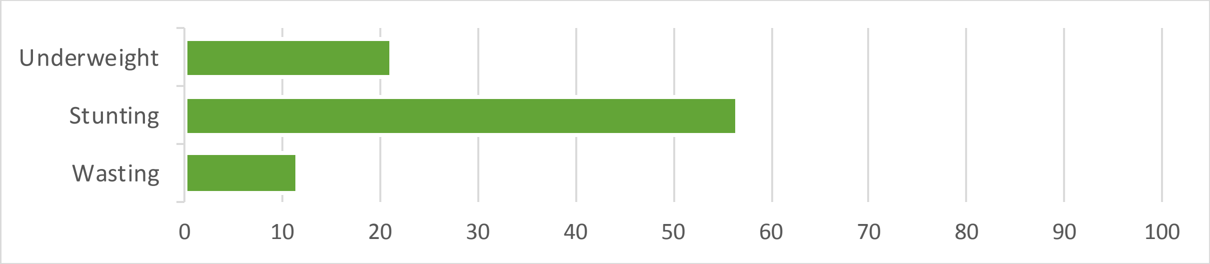
8. RESULTS

The previous sections have provided contextual information on the socioeconomic, environmental, and nutritional situation for the study sample. All these factors interact to produce the nutritional outcomes that we report in this section.

8.1 Nutritional Outcomes for Children

As shown in Figure 8.1, stunting remains by far the most common nutritional disorder affecting nearly three out of five children. For all children, the prevalence of stunting (below -2 SD height-for-age z-scores) was 56.5 percent. Severe stunting (below -3SD height-for-age Z-scores) was found in 33.6 percent of children under five, wasting was 11.4 percent, and severe wasting 6.0 percent. Underweight was found in 21.1 percent and severe underweight in 11.1 percent (Figure 8.2). The distribution of weight-for-height z-scores is shown in Figure 8.3 while Figures 8.4 and 8.5 show the distribution of the height-for-age z-scores and weight-for-age z-scores, respectively.

Figure 8.1—Prevalence of malnutrition among children aged 0 to 59 months, percentage



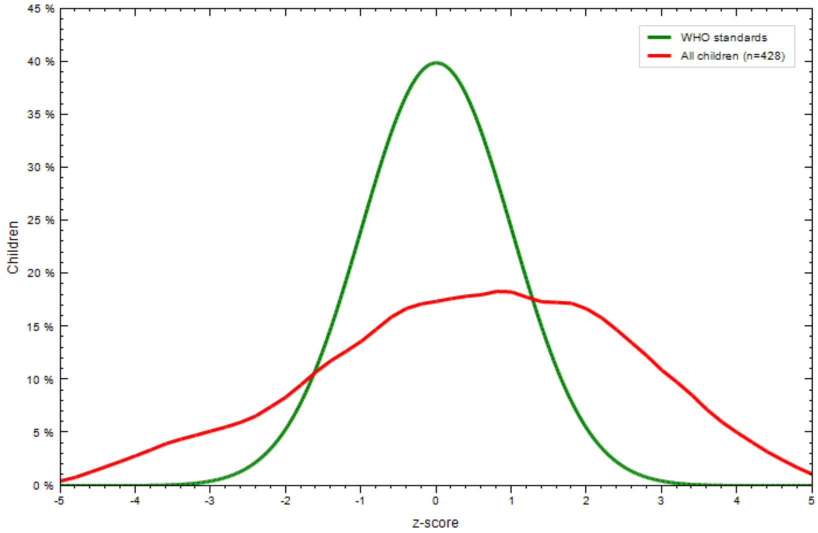
Source: Authors.

Figure 8.2—Prevalence of malnutrition (mild, moderate, and severe) in children aged 0 to 59 months

Source: Authors.

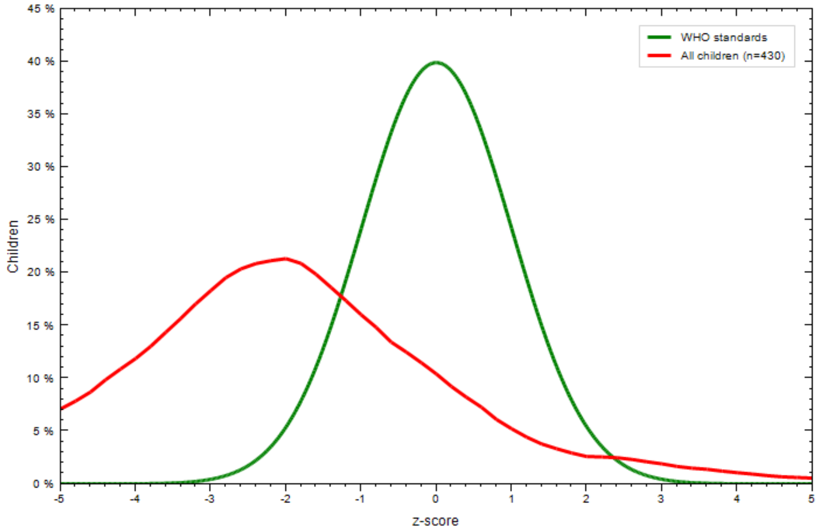
The distribution graphs below (Figures 8.3 to 8.5) were computed from the WHO Anthro software and show the deviation of the nutritional status of the children sampled compared to the normal distribution curve of the reference population (that is, the WHO standard).

Figure 8.3—Distribution of weight-for-height z-scores (wasting) in children aged 0 to 59 months



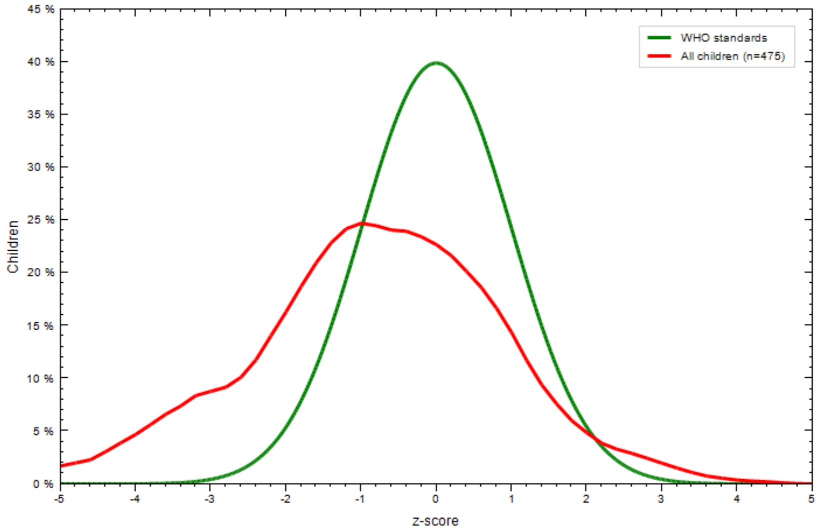
Source: Authors.

Figure 8.4—Distribution of height-for-age z-scores (stunting) in children aged 0 to 59 months



Source: Authors.

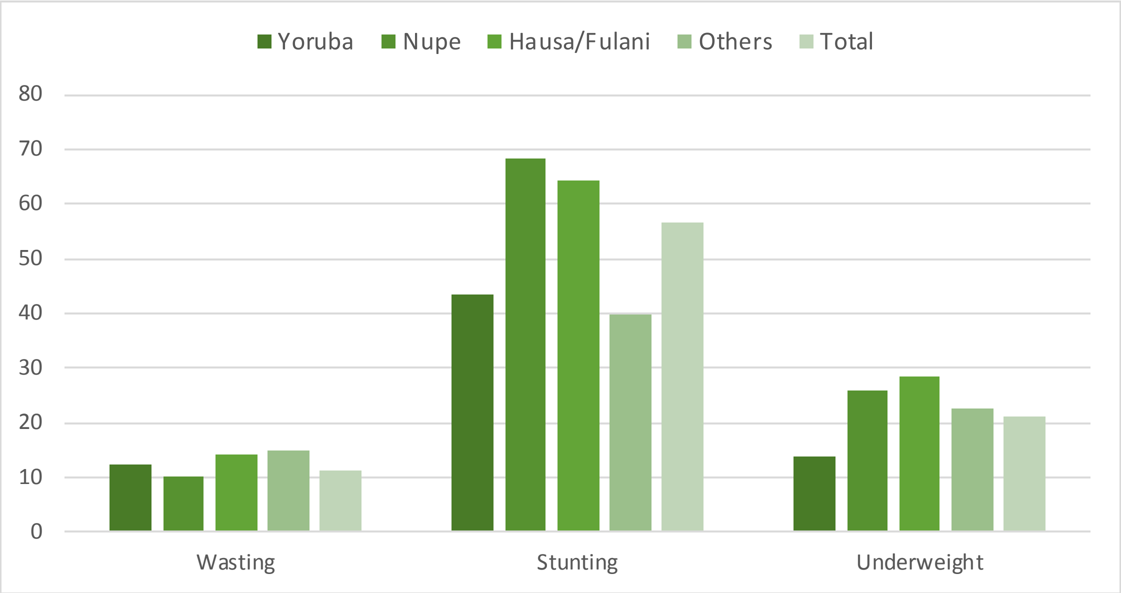
Figure 8.5—Distribution of weight-for-age z-scores (underweight) in children aged 0 to 59 months



Source: Authors.

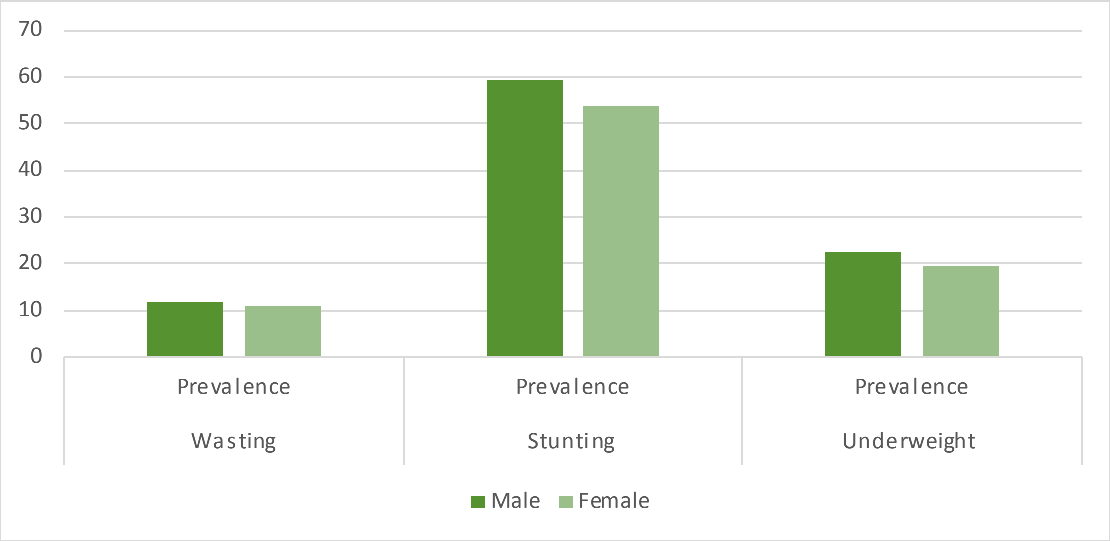
Child stunting is more prevalent among the Nupe ethnic group (68.3 percent) as well as Hausa/Fulani (64.3 percent) when compared with Yoruba (43.4 percent) and other ethnic groups (Figure 8.6). A similar pattern emerged for the prevalence of a child being underweight, whereas for wasting this pattern was less prevalent, affecting less than 15 percent of children. Disaggregating the data by gender revealed that female children had the lowest prevalence of all the forms of malnutrition, as shown in Figure 8.7. The distribution of weight-for-height, height-for-age, and weight-for-age z-scores by gender are shown in Figures 8.8, 8.9, and 8.1, respectively.

Figure 8.6—Prevalence of malnutrition in children aged 0 to 59 months, by major ethnic group



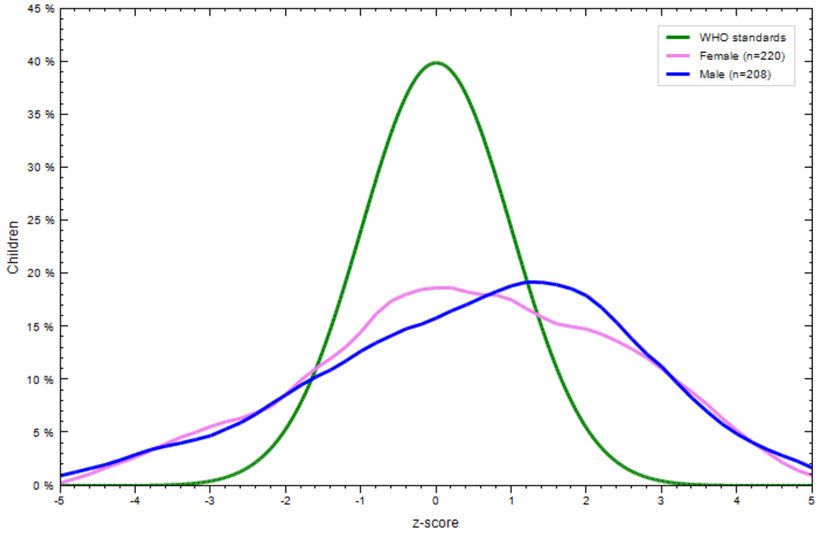
Source: Authors.

Figure 8.7—Prevalence of malnutrition in children aged 0 to 59 months, by gender



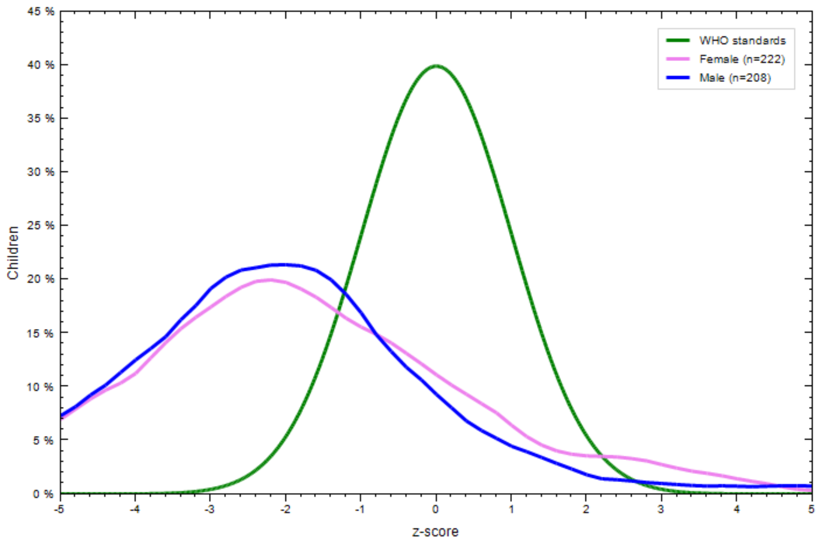
Source: Authors.

Figure 8.8—Distribution of weight-for–height z-scores (wasting) in children aged 0 to 59 months, by gender



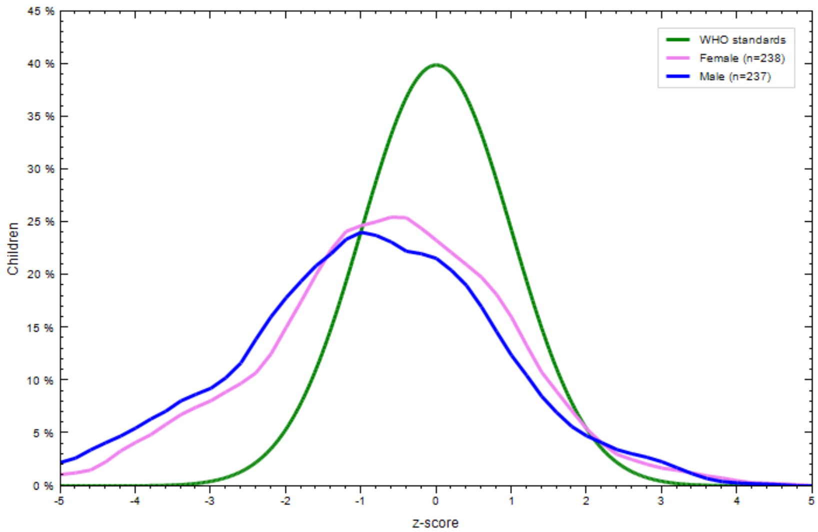
Source: Authors.

Figure 8.9—Distribution of height-for–age z-scores (stunting) in children aged 0 to 59 months, by gender



Source: Authors.

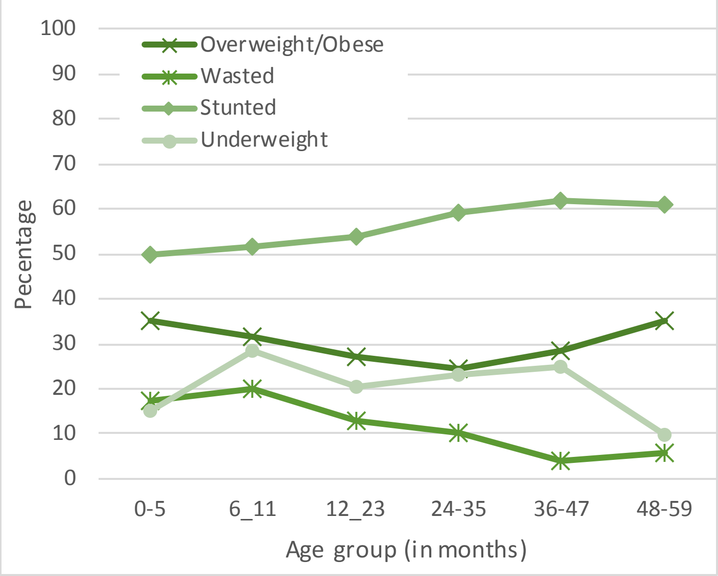
Figure 8.10—Distribution of weight-for–age z-scores (underweight) in children aged 0 to 59 months, by gender



Source: Authors.

From Figure 8.11, we see that the prevalence of stunting increased with age from 51 percent in children ages 0 to 11 months to 62 percent in those ages 36 to 47 months. For overweight children, the prevalence falls for younger children and increases for children over 36 months. There is a general downward trend for wasting and underweight. Appendix 5 provides a full breakdown of the prevalence of malnutrition by age of surveyed children.

Figure 8.11—Distribution of malnutrition in children aged 0 to 59 months, by age groups



Source: Authors.

In Table 8.1, correlation between maternal education and different indicators of child malnutrition is examined. The clearest pattern of relationship is seen with stunting, as it has the highest sample size thus providing adequate variation. The prevalence of stunting was highest in the children of mothers with the lowest level of education, and this percentage decreased as the level of education of the mother increased. Prevalence of wasting was highest among the mothers with some primary school education after which there was a consistent decreasing pattern of wasting observed with increasing education. However, no consistent pattern was seen in the prevalence of underweight when comparisons were made with the levels of maternal education. A weak negative relationship exists between maternal education and prevalence of wasting, overweight, stunting, and underweight among the children. A significant relationship was found between the level of maternal education and stunting—meaning that mothers with higher levels of education tend to have less issue with stunting among the children as compared to wasting and underweight (Table 8.1).

Table 8.1—Maternal education and prevalence of malnutrition among children aged 0 to 59 months

Maternal Education	Overweight / Obese (percent above +2SD)	Wasted (percent below -2SD)	Stunted (percent below -2SD)	Underweight (percent below -2SD)
No education	55.2	54.7	55.4	64.4
Some primary	3.7	5.7	6.3	4.9
Primary	11.9	9.4	11.5	8.9
Some secondary	3.7	1.9	3.7	4.9
Koranic school	4.5	0.0	2.6	1.0
Secondary & above	20.9	28.3	20.4	15.8
Observations	*134*	*53*	*269*	*101*
Spearman's rho	-0.0695	-0.2028	-0.1236	-0.1342
Prob>t	0.4249	0.1453	0.0428	0.1808

Source: Authors.

In terms of household size, the prevalence of stunting, underweight, and overweight was highest in households with seven or more members (Table 8.2). However, the prevalence of wasting was highest in the households with less than three members. There was a consistent increasing pattern in the prevalence of stunting, overweight and underweight with increasing number of household members, with the reverse seen in the prevalence of wasting.

The prevalence of low birth weight babies (that is, newborns with birth weights less than 2.5 kg) is examined in Table 8.3. Very few children were low birth weight babies (34 children). Most low birth weight babies were female (67 percent), and they were predominantly born to mothers with no education (58 percent). Women with higher levels of education had much fewer babies with low birth weights when compared to women with no education, although the progression was inconsistent.

Table 8.2—Prevalence of malnutrition by household size, percentage

Household Size	Height-for-Age		Weight-for-Height		Weight-for-Age			
	<-3SD (severe)	<-2SD (stunting)	<-3SD (severe)	<-2SD (wasting)	<-3SD (severe)	<-2SD (underweight)	⩾+2SD (overweight)	*# of children*
< 4 members	26.5	19.3	1.2	11.1	4.8	4.8	11.1	*83*
4 to 6	33.7	20.7	6.1	5.6	10.3	11.3	11.7	*204*
⩾ 7	43.7	19.5	8.1	2.7	14.7	25.1	15.6	*191*
Total	34.6	19.8	5.2	6.5	9.9	13.7	12.8	*478*

Source: Authors.

Table 8.3—Prevalence of low birth weight by gender and mother's education

Characteristics	Percent of children with low birth weight	*# of children*
Gender		
Male	32.3	*11*
Female	67.6	*23*
Total	100.0	*34*
Maternal Education		
No education	58.8	*20*
Primary education	8.8	*3*
Secondary education	23.5	*8*
Higher education	8.8	*3*
Total	100.0	*34*

Source: Authors.

The majority of children who suffered from any of the indicators of malnutrition had been exposed to poor toilet facilities with a prevalence greater than 80 percent in all cases (Table 8.4). While there is no clear correlation between malnutrition indicators and measures of sanitation in this study (Appendix 6), more rigorous analysis will be done in future work to identify the pathways through which sanitation and malnutrition interact.

Table 8.4—Water, sanitation, and hygiene conditions and prevalence of malnutrition among children aged 0 to 59 months

	Unimproved water supply	Unimproved toilet	Total
Wasting (percent below -2SD)	22 (43.1)	44 (86.3)	51
Stunting (percent below -2SD)	97 (40.1)	211 (87.2)	242
Underweight (percent below -2SD)	45 (47.9)	82 (87.2)	94
Any malnourished	113 (40.21)	245 (87.2)	281

Source: Authors.
Note: Any malnourished children are reported to suffer from at least one of stunting, wasting, or underweight.

8.2 Nutritional Status of Women of Reproductive Age

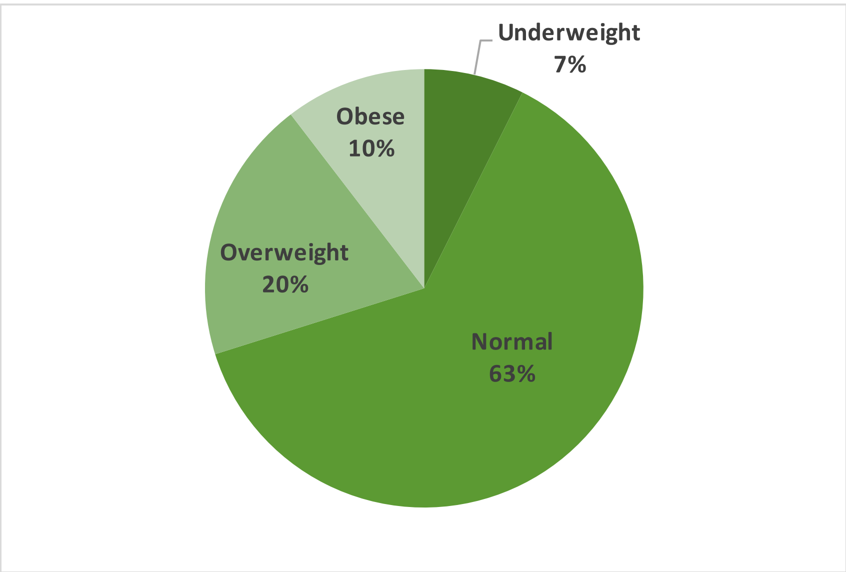
Body mass index (BMI)—calculated as body weight in kg divided by height in meters squared—was calculated from the measured weights and heights from 432 non-pregnant women. The BMI has been considered to be the most appropriate and simple indicator by which weight-for-height in women of childbearing age can be related to health outcomes. The mean BMI of the population was 23.7 ± 4.49kg/m2. The different classes of BMI are shown in Table 8.5 and Figure 8.12. The total prevalence of chronic energy deficiency (underweight) among women was 7.4 percent, and the total prevalence of obesity was 10.4 percent.

Table 8.5—Percentage distribution of BMI of women, by ethnic group

	Underweight (BMI < 18.5 kg/m^2)	Normal (18.5–24.99)	Overweight (25.0–29.9)	Obese BMI (≥30 kg/m^2)
Total	**7.4**	**62.6**	**19.5**	**10.4**
Yoruba	6.2	52.8	22.4	18.6
Nupe	7.9	67.0	18.9	6.2
Hausa/Fulani	0.0	77.8	22.2	0.0
Others	11.8	76.5	8.8	2.9
Observations	*32*	*271*	*84*	*45*

Source: Authors.

Figure 8.12—Percentage distribution of BMI in adult women



Source: Authors.

8.3 Indicators of Morbidity and Infant and Young Child Feeding Practices

Table 8.7 shows the indicators of infant morbidity and infant and young child feeding practices; most of the infant feeding indicators were poor, including exclusive breastfeeding and early initiation of breastfeeding across all the ethnic groups. The proportion of children who had ever been breastfed at a certain point in their lives was also low and not significantly different among ethnic groups. Early initiation of breastfeeding was, however, low with significant differences across the ethnic groups. This indicator defines the number of infants or children who were put to the breast within one hour of birth. The exclusive breastfeeding indicator shows the percentage of infants 0–6 months who are currently being exclusively breastfed—that is, who are receiving only breast milk and no water, other liquids, or solids. (Drops or syrups of vitamins, mineral supplements, or medicines are allowed.) This indicator provides a measure of the degree to which women have adopted behaviors consistent with the WHO recommendation that infants should be fed breast milk exclusively from birth to about six months.

As seen in the table, the prevalence of exclusive breastfeeding is 24.8 percent for the combined ethnic groups. There is a statistically significant difference in the mean exclusive breastfeeding between the different ethnic groups, however. The prevalence of exclusive breastfeeding was highest among the Yoruba (75.4 percent) followed by other minority ethnic groups (32.5 percent), Hausa/Fulani (28.6 percent), and Nupe (23.0 percent). This indicator is very low, and it is evident from the data that more than two-thirds of the women gave water to their children, which contradicts the WHO definition of exclusive breastfeeding. The prevalence of continued breastfeeding at 12 months and at 24 months measures the percentage of children 12–16 and 20–23 months, respectively, who are breastfed. This therefore is a measure of the breastfeeding duration. The prevalence of continued breastfeeding was 21.3 percent and 3.8 percent for children 12–16 months and 20–23 months respectively. This implies that a greater number of women stop breastfeeding before two years.

Table 8.6—Indicators of morbidity and infant and young child feeding practices, by ethnic group, percentage

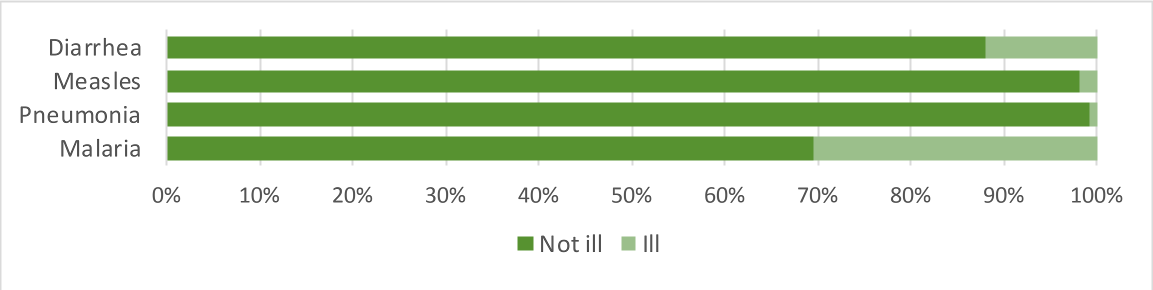
Indicator	Yoruba	Nupe	Hausa/ Fulani	Others	Combined
Ever breastfed (0 to 23 months)	32.0	56.0	3.0	9.0	99.6
Early Initiation of breastfeeding (0 to 23 months)	47.4	23.0	28.6	32.5	32.9
Exclusively breastfed (0 to 6 months)	75.4	12.7	2.5	9.3	24.8
Reason for noncompliance with exclusive breastfeeding					
Nature of work	84.9	6.1	3.0	6.1	7.9
Shortage of breast milk	62.5	29.2	0.0	8.3	5.7
Mother's health	41.7	25.0	8.3	25.0	2.9
Child's health	37.5	62.5	0.0	0.0	1.9
Tradition	14.8	75.3	3.2	6.7	67.9
Age <6 months	72.7	9.1	0.0	18.2	2.6
Other specify	73.9	15.2	0.0	10.9	11.0
Continued breastfeeding at 12 months	18.2	16.4	20.0	31.6	18.4
Continued breastfeeding at 24 months	1.8	5.5	0.0	10.5	4.8
Introduction of solids, semi-solids, or soft food (6 to 8 months)	55.4	12.9	7.1	37.5	30.4
Reported prevalence of diarrhea within the last two weeks					11.9
Continued feeding during diarrhea (0 to 23 months)					43.9
Increased feeding during diarrhea 0 to 23 months)					7.0
Increased drinking during diarrhea (0 to 23 months)					28.1
Use of Oral Rehydration Solution during diarrhea (0 to 23 months)	40.0	52.2	100.0	66.7	54.6
Reported prevalence of malaria within the last two weeks	36.0	25.4	35.7	37.5	30.5
Reported prevalence of pneumonia within the last two weeks	1.1	0.8	0.0	0.0	0.8
Reported prevalence of measles within the last two weeks	2.9	1.6	0.0	0.0	1.9

Source: Authors.

8.4 Child Health

Every year more than 10 million children in low- and middle-income countries die before they reach their fifth birthdays. Most die because they do not have access to effective interventions that could combat common and preventable childhood illnesses. Mothers of children under five were asked to provide information on illness profiles, methods of prevention, and treatment of common diseases they use with their children. The observed results showed that 11 percent of all respondents' children had been ill during the two-week period preceding the survey date. Malaria was the most prevalent, as it affected 30.5 percent of the children based on how often the child had been sick with different illnesses. Malaria is one of the most severe public health problems and a leading cause of disease and death in many developing countries, with a large burden on children. It is the commonest reason for hospitalization among children and a leading contributor to the widespread problem of anemia. This was followed by diarrhea, measles, and pneumonia with 11.9 percent, 1.9 percent, and 0.8 percent, respectively (Figure 8.13).

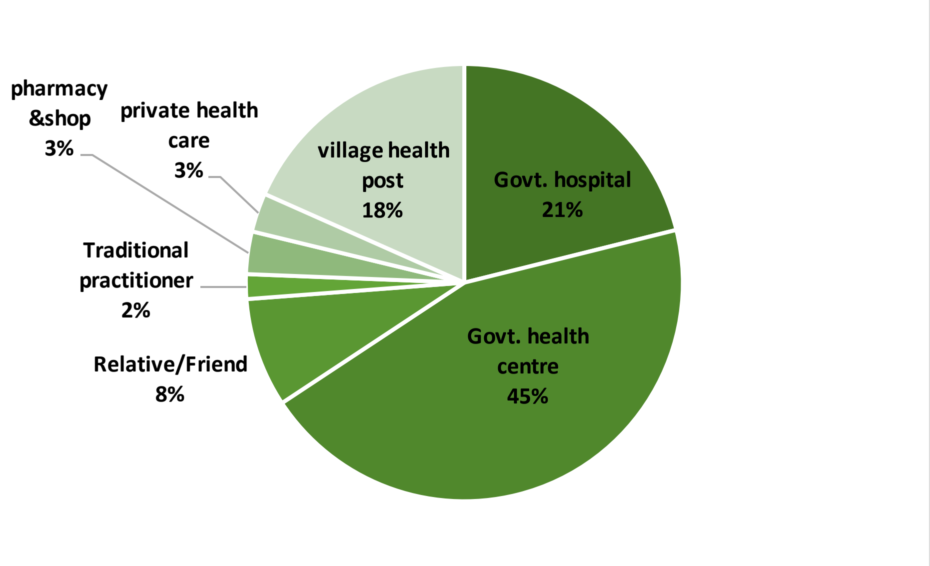
Figure 8.13—Illness profile over the past two weeks of children aged 0 to 59 months, by illness



Source: Authors.

Health-seeking behavior and locations for health-seeking clearly vary for the same individuals or communities when faced with different illnesses. In evaluating childcare practices, the place of treatment of a sick child, which is part of home health practices, is indicative of the quality of care given to the child. Households make different choices based on several factors (including social, cultural, and economic) when seeking treatment for their sick children. Use of government health centers (44 percent) like the primary health centers (PHC) and government hospitals (21 percent) ranked first and second respectively in the options (Figure 8.14). Other places where mothers seek treatment include: village health workers (13 percent), relatives and friends (8 percent), and government health posts (6 percent). These decisions vary among ethnic groups.

Figure 8.14—Percentage distribution of treatment locations by mothers



Source: Authors

In developing countries, diarrhea is the main cause of infant death. The cause of diarrhea is usually a bacterial or viral infection, which leads to dehydration that can result in death. Diarrhea has a potent negative impact on nutrition as a result of increasing nutritional requirements while at the same time reducing intake and aggravating losses. The importance of correct case management cannot be overemphasized. As shown in Figure 8.17, the most popular method used in the treatment of diarrhea was antibiotic tablet or capsule (22 percent) followed by the use of Oral Rehydration Solution (15 percent). Across the ethnic groups, Oral Rehydration Solution was used by 65 percent of respondents among the Nupe and only 14 percent among the Yoruba and Hausa/Fulani ethnic groups.

Table 8.7—Treatment of diarrhea in children, by ethnic group, percent using treatment

Treatment for Diarrhea	Yoruba	Nupe	Hausa/Fulani	Others	*Observations*
Oral Rehydration Solution	14	65	14	7	*29*
Salt sugar solution	0	100	0	0	*11*
Antibiotic tablet/capsule	12	71	10	7	*41*
Antimotility (Imodium, Lomitil)	29	46	14	11	*28*
Zinc (mix mag) tablet/capsule	14	72	14	0	*7*
Other non-antibiotic tablet/capsule or syrup	8	67	8	17	*12*
Unknown tablet/capsule	0	72	17	11	*18*
Injection	7	77	8	8	*13*
Antibiotic injection	11	67	11	11	*9*
Non-antibiotic injection	0	100	0	0	*1*
Unknown injection	0	100	0	0	*2*
Home remedy/herbal medicine	17	61	5	17	*18*

Source: Authors.

8.5 Immunization Coverage

Infant immunization is considered essential for improving infant and child survival. In all, the percentage of children who had ever received any immunization against diseases was high at 89.3 percent. Across ethnic groups, more children in the Yoruba ethnic group were ever vaccinated (97.1 percent) followed by the Nupe (89.5 percent), Hausa/Fulani (85.7 percent), and 55 percent for the other ethnic groups (Figure 8.18). Vaccination coverage was highest for BCG (tuberculosis) (69.2 percent) and lowest for Vitamin A (34.3 percent). The other vaccination coverages were 86.2 percent for polio, 58.6 percent for DPT (diphtheria, pertussis (whooping cough), and tetanus), and 51.9 percent for Hepatitis B. There was marked ethnic variation in the immunization coverage (Tables 8.8a and 8.8b).

Table 8.8a—Total immunization coverage of children aged 0 to 59 months, percent

Child Immunization	Yes	No	Do not know
Received any vaccination against diseases	89.3	8.6	2.1
Received a BCG (tuberculosis) vaccination	68.2	23.0	8.8
Received a polio vaccine	86.2	11.7	2.1
Received a DPT (diphtheria, pertussis (whooping cough), and tetanus) vaccination injection	58.6	32.0	9.4
Received a Hepatitis B vaccination injection	51.9	32.4	15.7
Received a measles or an MMR (measles, mumps, and rubella (German measles)) injection	49.4	39.5	11.1
Received a yellow fever vaccination	43.9	43.9	12.1
Received Vitamin A dose within the last 6 months	34.3	46.0	19.7

Source: Authors.

Table 8.8b—Immunization coverage of children aged 0 to 59 months, by ethnic groups, percent

	Yoruba			Nupe			Hausa/Fulani			Others		
Child Immunization	Yes	No	Do not know	Yes	No	Do not know	Yes	No	Do not know	Yes	No	Do not know
Received any vaccination against diseases	97.1	2.3	0.6	89.5	7.3	3.2	85.7	14.3	0.0	55.0	42.5	2.5
Received a BCG (tuberculosis) vaccination	91.4	4.0	4.6	57.7	30.2	12.1	28.6	50.0	21.4	45.0	52.5	2.5
Received a polio vaccine	94.3	3.4	2.3	85.9	12.1	2.0	85.7	14.3	0.0	52.5	45.0	2.5
Received a DPT (diphtheria, pertussis (whooping cough), and tetanus) vaccination injection	84.6	8.6	6.9	44.4	43.6	12.1	42.9	42.9	14.3	40.0	57.5	2.5
Received a Hepatitis B vaccination injection	68.0	13.7	18.3	44.4	39.9	15.7	28.6	57.1	14.3	37.5	57.5	5.0
Received a measles or an MMR (measles, mumps, and rubella (German measles)) injection	68.0	18.9	13.1	39.1	50.8	10.1	35.7	57.1	7.1	35.0	55.0	10.0
Received a yellow fever vaccination	69.1	17.7	13.1	28.6	58.9	12.5	28.6	64.3	7.1	32.5	60.0	7.5
Received Vitamin A dose within the last 6 months	38.3	37.1	24.6	35.1	47.6	17.3	28.6	71.4	0.0	15.0	65.0	20.0

Source: Authors.

9. SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

The level of malnutrition among children under five in Nigeria is higher than it should be. In the present report, available studies at the national, regional, state, and local levels have been reviewed and the following facts have been established:

- The prevalence of malnutrition—measured by stunting, wasting, and underweight—is unacceptably high.
- While there are no current national data on micronutrient malnutrition, data from the last food consumption study and smaller localized surveys also show worrisome levels of micronutrient malnutrition.
- Nigerian women do not breastfeed exclusively for the WHO recommended length of time (six months) either due to cultural or health reasons (for example, they do not produce enough milk).
- There is a lack of diversity in the composition of complementary foods given to preschool children; they are mostly fed corn-based gruel (*pap*).
- Adults also consume monotonous diets due to culture and lack of nutrition education.
- WASH practices are very poor, particularly in rural areas.

These findings among several others were strongly validated by analyzing data from a rural sample in Kwara State.

Poverty and a lack of awareness seem to be at the heart of the problem of childhood malnutrition in Nigeria. Until the socioeconomic status of the vast majority of Nigerians improves significantly, malnutrition will continue to pose a serious threat to the growth and development of Nigerian children and the future of national development. Significant variations exist in the level of child and maternal malnutrition across rural/urban settings, geopolitical zones, and agro-ecological bands in Nigeria. Malnutrition rates are higher among rural households who depend more on agriculture than on other sectors for their livelihoods. A range of socioeconomic, demographic, and public health related factors work together to influence maternal and child nutrition outcomes among rural and urban dwellers across the geopolitical zones and agro-ecological zones in Nigeria.

The authors make the following recommendations based on the findings of the study:

- There is an urgent need for a national food consumption and nutrition survey, with processes and resources put in place to conduct one regularly.
- Similarly, it is necessary to regularly collect localized data on dietary habits of Nigerians by cultural groupings. Food is cultural, and interventions can only work when using the right food vehicles which can only be identified by appropriate diet studies.
- Nutrition education, starting from even primary school is critical to teach households to engage in proper dietary practices for all household members, but most especially children in the formative stage of their lives. In particular the need to encourage the regular consumption of fruits, vegetables, animal proteins, eggs, and milk cannot be overemphasized.
- There is also a need to develop food dictionaries and food composition tables that specifically capture the foods consumed by different ethnicities and people groups. It is important to know what is consumed, what these foods are composed of, and in what quantities in order to make appropriate policy decisions, particularly on how to encourage certain value chains, or design interventions to plug nutrition gaps for vulnerable people groups.
- The government needs to exert deliberate efforts to ensure compliance with food fortification standards.
- The government and its partners need to engage in better advertising, labelling, and packaging of fortified foods so that even poorly educated households like those in this sample would be able to recognize these foods in order to be able to make informed nutrition choices.

In conclusion, Nigeria has the resources to produce well-nourished, healthy, and productive children if these resources are properly deployed. It is important that health and nutrition be made a high priority in order to get desired health and nutrition outcomes from vulnerable groups.

APPENDIXES

Appendix 1. Full List of Ethnic Groups in the Study by Village

Village	Yoruba	Nupe	Hausa	Tiv	Bassa	Fulani	Zuru	Taba-rumaw	Gara	Gbagi	Oghuma	Total
Chewurum	-	25	7	-	-	-	-	1	-	-	-	33
Edogi Dukun	-	119	1	-	-	-	-	-	-	-	-	120
Wariku	-	20	1	-	-	1	6	-	-	-	-	28
Gagara	-	12	-	-	-	-	-	-	-	-	-	12
Gbadegu	-	22	-	-	-	-	-	-	-	-	-	22
Eleyin	9	2	1	8	10	3	-	-	1	2	1	37
Aafin- Oro	2	-	1	-	1	1	1	-	-	-	-	6
Ekan	117	-	-	2	1	-	-	-	-	-	-	120
Erinmope	30	-	-	-	1	-	-	-	-	-	-	31
Aare Opin	5	-	-	-	-	-	-	-	-	-	-	5
Total	163	200	11	10	13	5	7	1	1	2	1	414

Source: Authors.

Appendix 2. Total Household Members by Ethnic Group

	Yoruba	Nupe	Hausa	Fulani	Other	Total
Head	163	200	11	5	35	414
First spouse/wife	127	201	10	4	32	374
Second spouse/wife	4	88	4	-	5	101
Third spouse/wife	-	7	1	-	-	8
Fourth spouse/wife	-	1	-	-	-	1
Son/daughter	263	668	40	8	78	1,057
Son/daughter-in-law	5	-	-	-	3	8
Grandchild	12	4	-	-	1	17
Parent/parent-In-Law	1	-	-	-	-	1
Niece/nephew	2	1	-	-	2	5
Other relative	1	-	-	-	-	1
Adopted/foster	1	-	-	-	1	2
Total	579	1,170	66	17	157	1,989

Source: Authors.

Appendix 3. Consumption Frequency of Foods by Study Households, by Food Group

Food group	Food Type	Consumption frequency
Tubers	cassava (*amala*)	85
	cassava (*eba*)	24
	cassava (*fufu*)	15
	cassava (*garri*)	48
	Irish potato	11
	sweet potato	18
	yam	71
	yam (*akara ojojo*)	3
	yam (*amala*)	116
	yam (pounded yam)	72
	Tuwo (cassava & sorghum)	36
Cereals	bread	67
	maize	38
	maize (pap, *akamu*, *ogi*)	125
	sorghum	4
	sorghum (pap, *akamu*, *ogi*)	4
	millet (*fura*)	3
	rice (fried)	3
	rice (*jollof*)	25
	rice (*tuwo*)	64
	rice (white)	255
	maize (*tuwo*)	6
	donkuwa (maize, groundnut, sugar)	18
	eko	16
	wheat (*amala*)	8
	wheat (noodles)	6
	wheat (semovita)	18
	wheat (spaghetti)	20
Vegetables	cucumber	1
	okra	182
	vegetable (amaranthus)	67
	vegetable (*ewedu*/corchorus)	53
	vegetable (others)	2
	vegetable (*ugwu* leaf)	8
	stew	245
	zobo	1
Fruits	apple	2
	banana	23
	coconut	2
	mango	2
	orange	27
	papaya (ripe)	9
	guava	1
	plantain	23
	watermelon	9
	bambara	1

Food Group	Food Type	Consumption frequency
Legumes, nuts, & seeds	beans	207
	beans (*akara*)	39
	beans (*gbegiri* soup)	26
	beans (*moinmoin*)	33
	melon (*egunsi*)	24
	groundnut	20
	groundnut cake (*kulikuli*)	40
	kolanut	16
	soybeans	5
	ekuru	12
	kunu	16
Meat, fish, and eggs	egg	33
	chicken	7
	fish (dried)	19
	fish (fresh)	273
	flesh meat	202
	frog (*konko*)	1
	game meat (bush meat)	6
	organ meat	9
	pomo (cow skin)	23
	snail	2
Milk and milk products	cheese (*wara*)	24
	milk (*nunu*)	3
	milk powder	24
	yogurt	5
Sweets	biscuit	8
	candies	13
	pastry	7
	sugar	89
	sugar cane	7
Oils and fats	groundnut oil	6
	palm oil	152
	vegetable oil	86
Spices, condiments, and beverages	chocolate drinks	8
	condiments (Maggi)	1
	malt drinks	19
	soda drinks	24
	tea	48

Source: Authors.

Appendix 4. Food Groups Included in the Dietary Diversity Scores

FOOD GROUPS INCLUDED IN THE WOMEN'S DIETARY DIVERSITY SCORE

Food Group	Notes
Starchy staple	Combination of cereals, white roots, and tubers.
Dark leafy vegetables	
Other source of vitamin A	Combination of vitamin A rich vegetables, tubers, and vitamin A rich fruit.
Other fruits and vegetables	Combination of other fruit and other vegetables.
Organ meat	
Meat and fish	Combination of meat and fish.
Eggs	
Legumes, nuts, and seeds	
Milk products	

Source: FAO 2011.

FOOD GROUPS INCLUDED IN THE CHILDREN DIETARY DIVERSITY SCORE

Food Group	Notes
Grains, roots and tubers	Porridge, bread, rice, noodles or other foods made from grains. White potatoes, white yams, cassava or any other foods made from roots
Legumes and nuts	Any foods made from beans, peas, lentils, nuts or seeds
Dairy products	Infant formula. Milk, such as tinned, powdered or fresh animal milk. Yogurt or drinking yogurt. Cheese or other dairy products
Flesh foods	Liver, kidney, heart or other organ meats. Any meat, such as beef, pork, lamb, goat, chicken or Duck. Fresh or dried fish, shellfish or seafood. Grubs, snails or insects
Eggs	Eggs
Vitamin A fruits and vegetables	Pumpkin, carrots, squash or sweet potatoes that are yellow or orange inside. Any dark green vegetables. Ripe mangoes (fresh or dried [not green]), ripe papayas (fresh or dried), musk melon. Foods made with red palm oil, red palm nut or red palm nut pulp sauce
Other fruits and vegetables	Any other fruits or vegetables

Source: Marías et al. 2014.

Appendix 5. Anthropometric Status of Children Aged 0 to 59 months, by Age Groups

Variable	0–11 months n (percent)	12–23 months n (percent)	24–35 months n (percent)	36–47 months n (percent)	48–59 months n (percent)	Total n (percent)
WHZ (Wasting)						
Normal	72 (72.0)	102 (77.3)	79 (73.8)	62 (83.8)	46 (90.2)	361 (77.8)
Mild	9 (9.0)	13 (9.8)	17 (15.9)	9 (12.2)	2 (3.9)	50 (10.8)
Moderate	6 (6.0)	10 (7.6)	3 (2.8)	3 (4.0)	3 (5.9)	25 (5.4)
Severe	13 (13.0)	7 (5.3)	8 (7.5)	0 (0.0)	0 (0.0)	28 (6.0)
Total	100 (100.0)	132 (100.0)	107 (100.0)	74 (100.0)	51 (100.0)	464 (100.0)
HAZ (Stunting)						
Normal	37 (35.6)	36 (27.3)	25 (22.1)	13 (17.1)	10 (19.6)	121 (25.4)
Mild	14 (13.5)	25 (18.9)	21 (18.6)	16 (21.0)	10 (19.6)	86 (18.1)
Moderate	17 (16.3)	23 (17.4)	31 (27.4)	13 (17.1)	11 (21.6)	95 (20.0)
Severe	36 (34.6)	48 (36.4)	36 (31.9)	34 (44.7)	20 (39.2)	174 (36.5)
Total	104 (100.0)	132 (100.0)	113 (100.0)	76 (100.0)	51 (100.0)	476 (100.0)
WAZ (Underweight)						
Normal	58 (54.7)	75 (56.8)	61 (54.0)	40 (52.6)	32 (62.7)	266 (55.6)
Mild	24 (22.6)	30 (22.7)	26 (23.0)	17 (22.4)	14 (27.4)	111 (23.2)
Moderate	10 (9.4)	6 (4.5)	15 (13.3)	14 (18.4)	3 (5.9)	48 (10.0)
Severe	14 (13.2)	21 (15.9)	11 (9.7)	5 (6.6)	2(3.9)	53 (11.1)
Total	106 (100.0)	132 (100.0)	113 (100.0)	76 (100.0)	51 (100.0)	478 (100.0)

Source: Authors.

Appendix 6. Water, Sanitation, and Hygiene and Prevalence of Malnutrition among Children under Five

	Wasting (n & percent WHZ below -2SD)	Stunting (n & percent HAZ below -2SD)	Underweight (n & percent WAZ below -2SD)	Overweight/Obese (n & percent WHZ above +2SD)
Source of Drinking Water				
Unimproved source of drinking water	22 (43.1)	97 (40.1)	45 (47.9)	54 (43.5)
Improved source of drinking water	29 (56.9)	145 (59.9)	49 (52.1)	70 (56.4)
Total	51 (100.0)	242 (100.0)	94 (100.0)	124 (100.0)
Spearman's rho	0.0478	-0.0920	-0.0699	0.0287
Prob> t	0.7342	0.1324	0.4874	0.7418
Toilet Facilities				
Unimproved toilet facilities	44 (86.3)	211 (87.2)	82 (87.2)	98 (79.0)
Improved toilet facilities	7 (13.7)	31 (12.8)	12 (12.8)	26 (21.0)
Total	51 (100.0)	242 (100.0)	94 (100.0)	124 (100.0)
Spearman's rho	-0.0779	-0.0810	-0.1920	0.0842
Prob> t	0.5791	0.1856	0.0544	0.3332
Disposal of Child Stools				
Child used toilet/latrine	1 (2.0)	10(4.1)	4 (4.3)	7 (5.6)
Put/rinsed into toilet or latrine	3 (5.9)	22 (9.1)	9 (9.6)	8 (6.4)
Put/rinsed into drain or ditch	1 (2.0)	6 (2.5)	2 (2.1)	1 (0.8)
Thrown into garbage	13 (25.5)	52 (21.5)	24 (25.5)	33 (26.6)
Buried	7 (13.7)	48 (19.8)	15 (16.0)	25 (20.2)
Left in the open	23 (45.1)	95 (39.3)	37 (39.4)	45 (36.3)
Don't know	3 (5.9)	8 (3.3)	3 (3.2)	5 (4.0)
Others	0 (0.0)	1 (0.4)	0 (0.0)	0 (0.0)
Total	51 (100.0)	242 (100.0)	94 (100.0)	124 (100.0)
Spearman's rho	-0.0354	0.0345	-0.0011	-0.0572
Prob> t	0.8014	0.5728	0.9916	0.5117

Source: Authors.

REFERENCES

Addo, A. A. 1984. "Assessment of Nutritional Status of Urban Pre-school Children in Northern Nigeria." *Nigerian Journal of Nutrition Science* 4 (2): 131–141.

Adekolu-John, E. O., Omolulu, A, & E. O. Olunsaya. 1985. "Food Production and Food Consumption of the People of Kainji Lake Area of Nigeria." *Nigerian Journal of Nutrition Science* 6 (1): 15–27.

Adelekan, D. A., Adeodu, O. O., & Thurnham, D. I. 1997. "Comparative Effects of Malaria and Malnutrition on Plasma Concentrations of Antioxidant Micronutrients in Children." *Annals of Tropical Paediatrics* 17 (3): 223–227.

Adelekan, D. A., Northrop-Clewes, C. A., Owa, J. A., Oyedeji, A. O., Owoeye, A. A., & Thurnham, D. I. 2003. "Use of Biomarkers of Sub-clinical Infection, Nutrition and Neonatal Maturity to Interpret Plasma Retinol in Nigerian Neonates." *British Journal of Nutrition* 90 (02): 353–361.

African Union/New Partnerships for African Development (NEPAD). 2007. *Framework for African Food Security.* Retrieved from www.microlinks.org/sites/microlinks/files/group/resource/files/CAE999~1.PDF.

Agunbiade, O. M., & Ogunleye, O. V. 2010. "Constraints to Exclusive Breastfeeding Practice among Breastfeeding Mothers in Southwest Nigeria: Implications for Scaling Up." *International Breastfeeding Journal* 7 (5): 1–10.

Ahmed, N. U., Zeitlin, M. F., Beiser, A. S., Super, C. M., Gershoff, S. N., & Ahmed, M. A. 1994. "Assessment of the Impact of a Hygiene Intervention on Environmental Sanitation, Childhood Diarrhoea, and the Growth of Children in Rural Bangladesh." *Food Nutrition Bulletin* 15: 40–52.

Aina, T. A., Zeitlin, M. F., Setiloane, K., & Armstrong, H. 1992. "Phase I Survey Results: Positive Deviance in Nutrition Research Project, Lagos State, Nigeria." *Draft Report to UNICEF*.

Ajieroh, V. 2009. "A Quantitative Analysis of Determinants of Child and Maternal Malnutrition in Nigeria." *Nigeria Strategy Support Program (NSSP) Background Paper 10.* International Food Policy Research Institute: Washington, DC.

Ajose, O. A., Adelekan, D. A., & Ajewole, E. O. 2004. "Vitamin A Status of Pregnant Nigerian Women: Relationship to Dietary Habits and Morbidity." *Nutrition and Health* 17 (4): 325–333.

Akinyele, I. O. 2009. "Ensuring Food and Nutrition Security in Rural Nigeria: An Assessment of the Challenges, Information Needs, and Analytical Capacity." *Nigeria Strategy Support Program (NSSP) Background Paper No. NSSA 007.* International Food Policy Research Institute: Washington, DC.

Akinyele, I. O., B. Maziya-Dixon, O. A. Ajayi, F.T. Aminu, E. B. Oguntona, B. D. Omotola, L. Adams, R. A. Sanusi. 2002. "Profile: Nutrition for National Development in Nigeria: A Call for Action. Advocacy Tool Developed on the Consequences of Malnutrition in Nigeria." FGN/USAID.

Akinyele, I. O., Sanusi, R., and A. Hart. 1993. "UNDP/IFAD Assisted Artisanal Fisheries, Development Project: Baseline Survey on Health, Sanitation and Nutrition (in Akwa Ibom, Cross River and Rivers State)."

Akinyele, O. O. & B. D. Omotola. 1987. Nutrient Composition of Traditional Weaning Foods in Ibadan. Proceedings of Food Composition Workshop, University of Ibadan.

Akunyili, D. N. 2005. "Food Fortification with Vitamin A and Iron for Child Survival." Paper presented at the 2005 Nigeria Nutrition Networking Meeting, Gombe State.

Alaye-Ogan, E. O. 2008. *Rural Poverty among Women in Nigeria: A Case Study of Abuja Satellite Communities of Nigeria.* Doctoral Dissertation. St. Clements University. Turks and Caicos Islands, British West Indies.

Anita, D. A., Flora, K., Bhadmus, B. A. & Kwetishe, D. T. 2014. "Mother Education and Nutrient Intake of Children Ages 2–7 Years in Lau Local Government Area of Taraba State." *Journal of Science and Multidisciplinary Research* 6 (1): 111–118.

Anyamele, O. D. 2009. Urban and Rural Differences across Countries in Child Mortality in Sub-Saharan Africa. *Journal of Health Care for the Poor and Underserved* 20 (4A): 90–98.

Anyanwu, R. C. & C. O. Enwonwu. 1985. "Impact of Urbanization and Socio-economic Status on Infant Feeding Practices in Lagos, Nigeria. *Food and Nutrition Bulletin* 7 (1): 33–37.

Aremu, O., Lawoko, S. & Dulal, K. 2010. "Childhood Vitamin A Capsule Supplementation Coverage in Nigeria: A Multilevel Analysis of Geographic and Socioeconomic Inequities." *Scientific World Journal* 10: 1901–1914.

Babatunde, R. O., Olagunju, F. I., Fakayode, S. B., & Sola-Ojo, F. E. 2011. "Prevalence and Determinants of Malnutrition among Under Five Children of Farming Households in Kwara State, Nigeria." *Journal of Agricultural Science* 3 (3): 173.

Barrett, C. B. 2002. "Food Security and Food Assistance Programs." *Handbook of Agricultural Economics* 2: 2103–2190.

Baumslag, N., & Michels, D. L. 1995. *Milk, Money, and Madness: The Culture and Politics of Breastfeeding*. Westport: Bergin & Garvey.

Black, R. E., Allen, L. H., Bhutta, Z. A., Caulfield, L. E., De Onis, M., Ezzati, M., Mathers, C., & Rivera, J. 2008. Maternal and Child Undernutrition Study Group. "Maternal and Child Undernutrition: Global and Regional Exposures and Health Consequences." *The Lancet* 371 (9608): 243–260.

Blum, D., Emeh, R. N., Huttly, S. R., Dosunmu-Ogunbi, O., Okeke, N., Ajala, M., Okoro J. I., Akujobi, C., Kirkwood, B. R., & Feachem, R. G. 1990. "The Imo State (Nigeria) Drinking Water Supply and Sanitation Project: 1. Description of the Project, Evaluation Methods, and Impact on Intervening Variables." *Transactions of the Royal Society of Tropical Medicine and Hygiene* 84 (2): 309–315.

Blum, L. M. 1999. At the Breast: Ideologies of Breastfeeding and Motherhood in the Contemporary United States. Beacon Press.

Bouis, H. E., Hotz, C., McClafferty, B., Meenakshi, J. V., & Pfeiffer, W. H. 2011. "Biofortification: A New Tool to Reduce Micronutrient Malnutrition*." Food & Nutrition Bulletin* 32 (Supplement 1): 31S–40S.

Brody T. 2007. Vitamin A Deficiency Encyclopedia of Medicine. Retrieved from www.findarticles.com/p/articl-mig2601/is0014/ai_2601001456.

Bryce, J., el Arifeen, S., Pariyo, G., Lanata, C. F., Gwatkin, D., & Habicht, J. P. 2003. Reducing Child Mortality: Can Public Health Deliver? *The Lancet* 362 (9378): 159–164.

Cohen, R. 1967. *The Kanuri of Borno*. Holt, Rhinehart & Winston: New York.

Cripe, E. T. 2008. "Supporting Breastfeeding: Nursing Mothers' Resistance to and Accommodation of Medical and Social Discourses." In Zoller, H. M., & Dutta, M. J. (Eds.), *Emerging Perspective in Health Communication: Meaning, Culture and Power.* New York: Routledge.

Dangour, A. D., Watson, L., Cumming, O., Boisson, S., Che, Y., Velleman, Y., Cavill, S., Allen, E., & Uauy, R. 2013. Interventions to Improve Water Quality and Supply, Sanitation and Hygiene Practices, and their Effects on the Nutritional Status of Children. *The Cochrane Library*.

De Benoist B., McLean E., Andersson M., & Rogers L. 2008. "Iodine Deficiency in 2007: Global Progress Made since 2003." *Food and Nutrition Bulletin* 29 (3): 195–202.

De Pee, S., West, C. E., Permaesih, D., Martuti, S., & Hautvast, J. G. 1998. Orange Fruit is More Effective than are Dark-Green, Leafy Vegetables in Increasing Serum Concentrations of Retinol and Beta-Carotene in Schoolchildren in Indonesia. *The American Journal of Clinical Nutrition* 68 (5): 1058–1067.

Dickin, K. L., Brown, K. H., Fagbule, D., Adedoyin, M., Gittelsohn, J., Esrey, S. A., & Oni, G. A. 1990. "Effect of Diarrhoea on Dietary Intake by Infants and Young Children in Rural Villages of Kwara State, Nigeria. *European Journal of Clinical Nutrition* 44 (4): 307–317.

Ebomoyi, E., Wickremasinghe, A. R, & Cherry, F. F. 1991. Anthropometric Indicators of Children's Nutrition in Two Nigerian Communities. *Journal of Biosocial Science* 23: 33–38.

Ekwochi, U., Osuorah, D. I. C., Odetunde, O. I., Egbonu, I., & Ezechukwu, C. C. 2014. Prevalence of Iron Deficiency Anaemia in Anaemic under Five Children in Enugu South East Nigeria. *Nigerian Journal of Paediatrics* 41 (2): 129–132.

Ene-Obong, H. N., Odoh, I. F., & Ikwuagwu, O. E. 2003. Plasma Vitamin A and C Status of In-School Adolescents and Associated Factors in Enugu State, Nigeria. *Journal of Health, Population and Nutrition* 18–25.

Erhabor, O., Isah, A., Isaac, I. Z., & Udomah, F. P. 2013. Iron Deficiency Anaemia among Antenatal Women in Sokoto, Nigeria. *British Journal of Medical and Health Sciences* 1 (4): 47, 57.

Fabunmi, T. M., Onabanjo, O. O., Oguntona, E. B., Keshinro, O. O., Onabanjo, J. A., Obanla, O. O., & Oyawoye, O. O. 2013. "Nutrient Intakes and Nutritional Status of Mothers and their Under-Five Children in a Rural Community of Oyo State, Nigeria." *International Journal of Child Health and Nutrition* 2 (1): 39–49.

Fagbule, D., & Adedoyin, M. A. 1987. "Knowledge, Beliefs and Attitudes towards Breastfeeding in Ilorin." *West African Journal Medicine* 6 (2): 88–89.

Falade, O. S., Otemuyiwa, I., Oluwasola, O., Oladipo, W., & Adewusi, S. A. 2012. "School Feeding Programme in Nigeria: The Nutritional Status of Pupils in a Public Primary School in Ile-Ife, Osun State, Nigeria." *Food and Nutrition Sciences* 3: 596.

Federal Government of Nigeria/UNICEF. 1999. Report of the Multiple Indicator Cluster Survey (MICS), United Nations Children's Fund, Lagos, Nigeria.

Federal Ministry of Health (FMOH)/M.I/UNICEF. 2004. Vitamin and Mineral Deficiency Damage Assessment Report Nigeria.

Federal Office of Statistics (FOS) [Nigeria] & IRD/Macro International Inc. IRD. 1992.

Food and Agriculture Organization of the United Nations (FAO) & WHO. 2002. *Report of a Joint FAO/WHO Expert Consultation Bangkok*, *Thailand*.

Food and Agriculture Organization of the United Nations (FAO), IFAD & WFP. 2013. *The State of Food Insecurity in the World 2013. The Multiple Dimensions of Food Security.* Italy, Rome: FAO.

Food and Agriculture Organization of the United Nations (FAO). 2002. *The State of Food Insecurity in the World 2001*. Italy, Rome: FAO.

Food and Agriculture Organization of the United Nations (FAO). 2011. *Guidelines for Measuring Household and Individual Dietary Diversity.* Retrieved from www.fao.org/fileadmin/user_upload/wa_workshop/docs/FAO-guidelines-dietary-diversity2011.pdf

Gabriele A., & Schettino F. 2008. Child Malnutrition and Mortality in Developing Countries: Evidence from a Cross-Country Analysis. *Analyses of Social Issues and Public Policy* 8 (1): 53–81.

Gartner, L. M., Morton, J., Lawrence, R. A., Naylor, A. J., O'Hare, D., Schanler, R. J., & Eidelman, A. I. 2005. Breastfeeding and the Use of Human Milk. *Pediatrics* 115 (2): 496–506.

Global Alliance for Improved Nutrition (GAIN), (2014). Nigeria Food Fortification. Retrieved from www.gainhealth.org/knowledge-centre/project/nigeria-large-scale-food-fortification/.

Humphrey, J. H., Agoestina, T., Wu, L., Usman, A., Nurachim, M., Subardja, D., Hidayat, S., Tielsch, J., West, K.P., & Sommer, A. 1996. Impact of Neonatal Vitamin A Supplementation on Infant Morbidity and Mortality. *The Journal of Pediatrics* 128 (4): 489–496.

International Food Policy Research Institute. 2014. Global Nutrition Report 2014: Actions and Accountability to Accelerate the World's Progress on Nutrition. Washington, DC.

Imdad, A., Herzer, K., Mayo-Wilson, E., Yakoob, M. Y., & Bhutta, Z. A. 2010. Vitamin A Supplementation for Preventing Morbidity and Mortality in Children from 6 Months to 5 Years of Age. *Cochrane Database of Systematic Reviews* 12.

IVACG. 1997. *Vitamin A and Malaria. Report of the XVIII Meeting*. Cairo and Washington, DC: IVACG 22–23.

Jamison, D. T., & Mosley, W. H. 1991. Disease Control Priorities in Developing Countries: Health Policy Responses to Epidemiological Change. *American Journal of Public Health* 81 (1): 15–22.

Jones, G., Steketee, R. W., Black, R. E., Bhutta, Z. A., Morris, S. S., & Bellagio Child Survival Study Group. 2003. "How Many Child Deaths Can We Prevent this Year?" *The Lancet* 362 (9377): 65–71.

Kazimi, L. J., & Kazimi, H. R. 1979. Infant Feeding Practices of the Igbo, Nigeria. *Ecology of Food and Nutrition* 8 (2): 111–116.

Kennedy, G. L., Pedro, M. R., Seghieri, C., Nantel, G., & Brouwer, I. 2007. Dietary Diversity Score is a Useful Indicator of Micronutrient Intake in Non-Breast-Feeding Filipino Children. *Journal of Nutrition* 137 (2): 472–477.

Kramer, M. S., & Kakuma, R. 2012. Optimal Duration of Exclusive Breastfeeding. *The Cochrane Library*.

Kuku, O., Mathiassen, A., Wadhwa, A., Myles, L., & Ajibola, A. 2013. *Comprehensive Food Security and Vulnerability Analysis: Nigeria*. IFPRI Discussion Paper (No. 1275). International Food Policy Research Institute (IFPRI).

Lawoyin, T. O., Olawuyi, J. F., & Onadeko, M. O. 2001. Factors Associated with Exclusive Breastfeeding in Ibadan, Nigeria. *Journal of Human Lactation* 17 (4): 321–325.

Marías, Y.F., Glasauer, P. and Macias, Y.F., 2014. *Guidelines for assessing nutrition-related knowledge, attitudes and practices.* Food and Agriculture Organization of the United Nations (FAO).

Mason, J., Rivers, J., & Helwig, C. 2005. “Recent Trends in Malnutrition in Developing Regions: Vitamin A Deficiency, Anemia, Iodine Deficiency.” *Recent Trends in Malnutrition in Developing Regions 26* (1): 57.

Maziya-Dixon, B. B., Akinyele, I. O., Sanusi, R. A., Oguntona, T. E., Nokoe, S. K., & Harris, E. W. 2006. “Vitamin A Deficiency is Prevalent in Children less than 5 Years of Age in Nigeria. *Journal of Nutrition* 136 (8): 2255–2261.

Maziya-Dixon, B., Akinyele, I. O., Oguntona, E. B., Nokoe, S., Sanusi, R. A., & Harris, E. 2004. Nigerian Food Consumption and Nutrition Survey 2001–2003, Summary. *International Institute of Tropical Agriculture (IITA)*, Ibadan, Nigeria.

Mebrahtu, S. B. 1989. “Maternal Perceptions of Child Nutrition and Body Image: An Ethnographic Study of Three Nigerian Villages, Kwara State.” Presented at the American Anthropological Association 88th Annual Meeting, November 15–19. Washington, DC.

Micronutrient Initiative (MI). (2014). Micronutrient Initiative. Retrieved from www.micronutrient.org/english/View.asp?x=596.

Miller, M., Humphrey, J., Johnson, E., Marinda, E., Brookmeyer, R., & Katz, J. 2002. “Why Do Children become Vitamin A Deficient?” *Journal of Nutrition* 132 (9): 2867S–2880S.

Multiple Indicator Cluster Survey (MICS). 1999. UNICEF, Nigeria.

Multiple Indicators Clusters Survey (MICS). 2011. Multiple Indicators Clusters Survey. *Monitoring the Situation of Children and Women*. UNICEF/NBS/UNFPA.

Murphy, L. 2013. Nutritional Status in Northern Nigeria, Prevalence and Determinants: a Review of Evidence.

National Bureau of Statistics (NBS). 2011. *Nigeria Multiple Indicator Cluster Survey*. Abuja. NBS.

National Bureau of Statistics (NBS). 2012. Consumption Patterns in Nigeria 2009/10. *National Bureau of Statistics. Nigeria*.

National Bureau of Statistics (NBS)/UNICEF. 2014. Summary Findings of National Nutrition and Health Survey. *National Bureau of Statistics and United Nation Children’s Fund, Nigeria.*

National Population Commission (NCP). 2000. *Nigeria Demographic and Health survey 1999*. National Population Commission and ORC/Macro: Calverton, MD.

National Population Commission (NPC). 2008. Kwara State: Population Distribution by Age, Sex and Literacy Status (State and Local Government Area). Abuja: NPC.

National Population Commission NPC/ORC. 2004. Nigeria Demographic and Health Survey 2003. Calverton, Maryland: National Population Commission and ORC Macro.

National Population Commission/ICF Macro. 2009. *Nigeria Demographic and Health Survey 2008*. Preliminary Report. Calverton, Maryland: National Population Commission and ICF Macro.

Nicol, B. M. 1949. Nutrition of Nigerian Peasant Farmers, with Special Reference to the Effects of Vitamin A and Riboflavin Deficiency. *British Journal of Nutrition* 3 (01): 25–43.

Nicol, B. M. 1952. “The Nutrition of Nigerian Peasants, with Special Reference to the Effects of Deficiencies of the Vitamin B Complex, Vitamin A and Animal Protein.” *British Journal of Nutrition* 6 (01): 34–55.

Nicol, B. M. 1956. The Nutrition of Nigerian Children, with Particular Reference to their Energy Requirements. *British Journal of Nutrition* 10 (03): 181–197.

Nicol, B. M. 1959a. The Calorie Requirements of Nigerian Peasant Farmers. *British Journal of Nutrition* 13 (03): 293–306.

Nicol, B. M. 1959b. The Protein Requirements of Nigerian Peasant Farmers. *British Journal of Nutrition* 13 (03): 307–320.

Nigeria Demographic and Health Survey (NDHS). 2008. *Nigeria Demographic and Health Survey.*

Nigeria Demographic and Health Survey (NDHS). 2013. *Nigeria Demographic and Health Survey.*

Nigeria Demographic and Health Survey (NDHS). 1990. Columbia, Maryland: FOS and IRD.

Nigeria Demographic and Health Survey (NDHS). 2003. Calverton, Maryland: National Population Commission and ORC Macro.

Nigeria Demographic and Health Surveys (NDHS). 2000. National Population Commission (NPC) & ORC Macro.

National Institutes of Health (U.S.) Nutrition Section. 1967. Nigeria nutrition survey February through April 1965): a report of the Nutrition Section, Office of International Research, National Institutes of Health. Bethesda, Md.: U. S. Dept. of Health, Education, and Welfare, Public Health Service.

Nigerian Institute for Social and Economic Research (NISER). 2008. *The Global Food Crisis: Impact and Policy Implications in Nigeria.* Ibadan, Nigeria.

Nnanyelugo, D. O. 1980 “Nutritional Status of Preschool Children in the Cross River State of Nigeria.” *Nigeria Journal of Nutrition Science* (1): 20–26.

Noreen Mucha, M. P. A. 2014. Preventing Moderate Acute Malnutrition (MAM) Through Nutrition-Sensitive Interventions.

Obayelu, A. E. 2010. “Classifications of Households into Food Security Status in the North Central Nigeria: An Application of Rasch Measurement Model.” *Journal of Agricultural and Biological Sciences* 5 (3): 26-41.

Ogunlesi, T. A. 2010. "Maternal Socio-demographic Factors Influencing the Initiation and Exclusivity of Breastfeeding in a Nigerian Semi-Urban Setting." *Maternal and Child Health Journal* 14 (3): 459–465.

Oguntona, C. R. B., & Jaiyesimi, O. O. 1998. "Contribution of Street Foods to Food and Nutrient Intake or Urban Workers in Abeokuta." *The Indian Journal of Nutrition and Dietetics* 35: 262–267.

Oguntona, C. R., & Akinyele, I. O. 2002. Food and Nutrient Intakes by Pregnant Nigerian Adolescents during the Third Trimester. *Nutrition* 18 (7): 673–679.

Oguntona, C. R., Razaq, M. A., & Akintola, T. T. 1998. Pattern of Dietary Intake and Consumption of Street Foods among Nigerian Students. *Nutrition and Health* 12 (4): 247–256.

Oguntona, C.R. B. & T. O. Tella. 1999. "Street Foods and Dietary Intake of Nigerian Urban Market Women." *International Journal of Food Sciences and Nutrition* 50 (6): 383–390.

Oguntona, T. E., Oguntona, C. R., & William, L. 1988. Food and Nutrient Intake of the Elderly in Borno, Nigeria. *Nutrition Research* 8 (10): 1099 –1108.

Oguntona, T., Bernstein, C. R., & Williams, L. 1987. "Dietary (Nutrient) Intakes of Nigerian Peasants Living in a Semi-Arid Zone." *Ethiopian Journal of Health Development* 2 (1): 27–35.

Oguntona, T., Oguntona, C. R. B., & Williams, L. 1989. "Survey of Food and Nutrient Intake of the Kanuri of Borno, Nigeria." *Savanna: A Journal of the Environmental and Social Sciences* 10 (2): 86–91.

Ojofeitimi, E. O., Esimai, O. A., Owolabi, O. O., Olaobaju, O. F., & Olanuga, T. O. 2000. "Breastfeeding Practices in Urban and Rural Health Centres: Impact of Baby-Friendly Hospital Initiative in Ile-Ife, Nigeria." *Nutrition and Health* 14 (2): 119–125.

Ojule, A. C., Abbiyesuku, F. M., & Osotimehin, B. O. 1997. "Endemic Goitre Prevalence in Ifedapo Local Government Area of Oyo State, Nigeria." *African Journal of Medicine and Medical Sciences* 27 (1–2): 77–80.

Okafor, J. C. & R. A. Oloyo. 2004. "A Survey of Nutrient Intake and Workload of Pregnant Women in Yewa South Local Government Area of Ogun State, Nigeria." *West Africa Journal of Food and Nutrition* 7 (1): 65–78.

Olusanya, J. O. 2010. "Assessment of the Food Habits and School Feeding Programme of Pupils in a Rural Community in Odogbolu Local Government Area of Ogun State, Nigeria." *Pakistan Nutrition Journal* 9 (2): 198–204.

Omolulu, A. 1982. "Breast-feeding Practice and Breast Milk Intake in Rural Nigeria." *Human Nutrition. Applied Nutrition* 36 (6): 445–451.

Omotesho, O. A., & Muhammad-Lawal, A. 2010. "Optimal Food Plan for Rural Households' Food Security in Kwara State, Nigeria: The Goal Programming Approach." *Journal of Agricultural Biotechnology and Sustainable Development* 2 (1): 7–14.

Omotola B.D, & Akinyele. 1985. "Infant Feeding Practices of Urban Low-Income Group in Ibadan." *Nutrition Reports International* 31 (4): 837–848.

Omotola, B. D. 1984. "Dietary Pattern and Nutrition Status of Children from the Low-Income Group of Ibadan." *M. Phil. Thesis. University of Ibadan*, Ibadan.

Onabanjo, O. O., & Balogun, O. L. 2014. "Anthropometric and Iron Status of Adolescents From Selected Secondary Schools in Ogun State, Nigeria." *ICAN: Infant, Child, and Adolescent Nutrition* 6 (2): 109–118.

Orewa, S. I., & Iyanbe, C. 2009. "Household Food Insecurity in Nigeria: An Assessment of the Present Status of Protein–Energy Malnutrition among Rural and Low-Income Urban Households." *Journal of Applied Sciences Research* 5 (10): 1615–1621.

Orwell, S., Clayton, D., & Dugdale, A. E. 1984. "Infant Feeding in Nigeria." *Ecology of Food and Nutrition* 15 (2): 129–141.

Oso, O. O., Abiodun, P. O., Omotade, O. O., & Oyewole, D. 2003. "Vitamin A Status and Nutritional Intake of Carotenoids of Preschool Children in Ijaye Orile Community in Nigeria." *Journal of Tropical Pediatrics* 49 (1): 42–47.

Otoo, G. E., Lartey, A. A., & Pérez-Escamilla, R. 2009. "Perceived Incentives and Barriers to Exclusive Breastfeeding among Periurban Ghanaian Women." *Journal of Human Lactation* 25 (1): 34–41.

Pelletier, D. L. 1994. "The Potentiating Effects of Malnutrition on Child Mortality: Epidemiologic Evidence and Policy Implications." *Nutrition Reviews* 52 (12): 409–415.

Qaim, M., Stein, A. J., & Meenakshi, J. V. 2007. "Economics of Biofortification." *Agricultural Economics* 37 (1): 119–133.

Robinson, E., & Nyagaya, M. 2014. "Ensuring that Food Fortification Will Reach the Poor in Tanzania." *DS Policy Issue* 72.

Rodriguez-Amaya, D. B. 1997. Carotenoids and Food Preparation: The Retention of Provitamin A Carotenoids in Prepared, Processed and Stored Foods. John Snow Incorporated/OMNI Project.

Rodriguez-Amaya, D. B. 1999. Changes in Carotenoids during Processing and Storage of Foods. *Archivos latinoamericanos de nutrición*, 49 (3): 38–41.

Sablah, M., Grant, F., & Fiedler, J. L. 2013. Food Fortification in Africa. *Sight and Life, Ed*, *27*.

Saltzman, A., Birol, E., Bouis, H. E., Boy, E., De Moura, F. F., Islam, Y., & Pfeiffer, W. H. 2013. Biofortification: Progress toward a More Nourishing Future. *Global Food Security* 2 (1): 9–17.

Sanusi, R. A., & Ekerette, N. N. 2013. "Nutrition and Goiter Status of Primary School Children in Ibadan, Nigeria." *African Journal of Biomedical Research* 12 (1): 37–41.

Schmied, V., & Barclay, L. 1999. "Connection and Pleasure, Disruption and Distress: Women's Experience of Breastfeeding." *Journal of Human Lactation* 15 (4): 325–334.

Sidaner, E., Balaban, D., & Burlandy, L. 2013. "The Brazilian School Feeding Programme: An Example of an Integrated Programme in Support of Food and Nutrition Security." *Public Health Nutrition* 16 (06): 989–994.

Southgate, D., D. Graham, & L. Tweeten. 2007. *The World Food Economy*. Blackwell: Oxford.

Talabi, A. E., Emiola, L., & Ogunsakin, E. A. 2003. "Urban-Rural and Ethnic Trends in Body Composition and Fitness of Kwara State Primary School Children (Nigeria)." In *African Symposium: An On-Line African Educational Research Journal* 3 (1).

Tella A, Falaye A, Aremu O, Tella A. 2008. "Hospital-Based Assessment of Breast-Feeding Behavior and Practices among Nursing Mothers in Nigeria and Ghana. *Pakistan Journal of Nutrition* 7 (1): 165–171.

UNICEF. 1992. National Strategies for Overcoming Micronutrient Malnutrition: Nutrition Paper of the Month. New York.

UNICEF. 2001. The State of the World's Children 2000. New York.

UNICEF. 2002. The State of the World's Children 2003: United Nations System Standing Committee on Nutrition. Fifth Report on the World's Nutrition Situation.

UNICEF. 2005. The State of the World's Children 2006: Excluded and Invisible.

UNICEF. 2006. Information Fact Sheet on Nutrition.

UNICEF. 2007. *Global Study on Child Poverty and Disparities 2007-2008 Guide.* Global Policy Section, Division of Policy and Planning. New York.

UNICEF. 2007. "Iodine Deficiency: A Continuing Threat to Development. How Seven Countries in Eastern snd Southern Africa are Meeting this Threat." Nairobi: UNICEF, ESARO, 1-20.

UNICEF. 2008. The State of Africa's Children, 2008: Child Survival.

UNICEF. 2009. The State of the World's Children 2009: Maternal and Newborn Health.

UNICEF. 2012. The State of the World's Children 2012: Children in an Urban World. Working Papers, eSocialSciences.

UNICEF/Federal Government of Nigeria. 1994. Nutritional Status of Women and Children. Participatory Information Collection Study. Lagos, Nigeria.

UNICEF/Food Fortification Initiative. 2014. "Monitoring of Flour Fortification: The Case of South Africa." New York. Retrieved from www.ffinetwork.org/monitor/Documents/SouthAfricaCS.pdf.

United Nations Administrative Committee on Coordination/Sub-Committee on Nutrition (ACC/SCN). 2000. *Fourth Report on the World Nutrition Situation: Nutrition throughout the Life Cycle. ACC/SCN in collaboration with IFPRI*. Geneva. Retrieved from www.unscn.org/layout/modules/resources/files/rwns4.pdf.

Uwaegbute, A. C., & Nnanyelugo, D. O. 1987. "Differences in the Infant-Feeding Practices in Urban and Rural Nigeria." *Journal of Nutrition Education* 19 (2): 83–89.

Uzoechina, O. N., & Okoro, B. A. 1994. "Serum Vitamin A Levels of Preschool Children in a Nigerian Rural Community." *Annals of Tropical Paediatrics* 14 (2): 157–161.

VanderJagt, D. J., Brock, H. S., Melah, G. S., El-Nafaty, A. U., Crossey, M. J., & Glew, R. H. 2007. "Nutritional Factors Associated with Anaemia in Pregnant Women in Northern Nigeria." *Journal of Health, Population, and Nutrition* 25 (1): 75.

West, C. E., Eilander, A., & van Lieshout, M. 2002. "Consequences of Revised Estimates of Carotenoid Bioefficacy for Dietary Control of Vitamin A Deficiency in Developing Countries." *The Journal of Nutrition* 132 (9): 2920S–2926S.

World Food Programme. 2000. *Food and Nutrition Handbook.* Rome: World Food Programme.

World Food Programme. 2005. *Food and Nutrition Handbook.* Rome.

World Food Programme. 2007. *Food and Nutrition Handbook.* Rome.

World Food Programme. 2012. *Food and Nutrition Handbook*. Rome.

World Food Programme. 2013. State of School Feeding Worldwide 2013. Rome.

World Health Organization (Ed.). 2009. Global Health Risks: Mortality and Burden of Disease Attributable to Selected Major Risks.

World Health Organization (WHO). 1967. "Requirements of Vitamin A, Thiamine, Riboflavin and Niacin." *WHO Technical Report Series No 522. WHO.* Geneva.

World Health Organization (WHO). 2001. "Vitamin A Deficiency and Iodine Deficiency Disorders Prevalence Estimates for the Global Burden of Disease. *Micronutrient Deficiency Information System (MDIS).* Geneva.

World Health Organization (WHO). 2009. "Global Prevalence of Vitamin A Deficiency in Populations at Risk 1995–2005." *WHO Global Database on Vitamin A Deficiency*. Geneva.

World Health Organization (WHO)/UNICEF/ICCIDD. 2007. Assessment of Iodine Deficiency Disorders and Monitoring Their Elimination: A Guide for Programme Managers. Geneva.

World Health Organization (WHO)/UNICEF/UNU. 1998. IDA: Prevention, Assessment and Control. Report of A Joint WHO/UNICEF/UNU Consultation. Geneva:1–9.

World Health Organization. 1996. "Indicators for Assessing Vitamin A Deficiency and Their Application in Monitoring and Evaluating Intervention Programmes." Geneva.

World Health Organization. 2002. The World Health Report 2002: Reducing Risks, Promoting Healthy Life: Geneva.

World Health Organization. 2006. Guidelines on Food Fortification with Micronutrients. Geneva.

Yunusa, I., Gumel, A. M., Adegbusi, K., & Adegbusi, S. 2012. "School Feeding Program in Nigeria: A Vehicle for Nourishment of Pupils." In *The African Symposium: An Online Journal of African Educational Research Network* 12 (2): 104–110.

Zimmermann, M. B., Zeder, C., Chaouki, N., Saad, A., Torresani, T., & Hurrell, R. F. 2003. "Dual Fortification of Salt with Iodine and Microencapsulated Iron: A Randomized, Double-Blind, Controlled Trial in Moroccan Schoolchildren." *The American Journal of Clinical Nutrition* 77 (2): 425–432.

Zimmermann, M., Adou, P., Torresani, T., Zeder, C., & Hurrell, R. 2000. "Persistence of Goiter Despite Oral Iodine Supplementation in Goitrous Children With Iron Deficiency Anemia in Cote d'Ivoire." *The American Journal of Clinical Nutrition*, 71 (1): 88–93.

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