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Food Security among Households in Northern Nigeria: Descriptive Analysis

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B.A., Ithaca College, 2010

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An abstract of

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Abstract

Food Security among Households in Northern Nigeria: Descriptive Analysis

By: Melissa Reichwage

In Nigeria, the most populous country in Africa with a population of 140 million, about 50 million people suffer from extreme hunger. Food insecurity and malnutrition have profound implications for health and development, and present major obstacles to attaining the Millennium Development Goals. Reducing poverty and hunger remain a key challenge in the country. Northern Nigeria, where the prevalence and demographics of food security have not been adequately quantified, may be better categorized as facing problems (drought, climate change, food unavailability, etc.) similar to those in Niger, rather than in Southern Nigeria. The research objective is to determine the status of household food security in Northern Nigeria, using the Living Standards Measurement Study – Integrated Survey on Agriculture (LSMS-ISA), to expand on current knowledge and literature. Furthermore, this analysis hopes to aid in informing further research, policy, and programming in the region. Household hunger analysis of this data categorized 99.5% of households as having little to no hunger within the past 7 days, with 0.2% of households having moderate hunger and 0.2% having severe hunger. With 13.6% of households were unable to meet their food provisioning needs for at least one month of the year, there is a clear issue of seasonal hunger in Northern Nigeria. Using expenditure data, the dietary diversity available to household in Northern Nigeria ranged from 1 to 12 food groups, with a mean of 6.93 foods (SD=2.03). Households in the study population were especially lacking fruits and dairy from their diets, likely to resulting in health and nutritional issues. The limitations of measuring food security in the LSMS-ISA dataset are discussed.

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Chapter 1: Introduction

Introduction and Rationale

Nigeria is the most populous country in Africa and the seventh largest country in the world, with a population of over 160 million (U.S. Census Bureau, 2012). Despite economic growth, largely fueled by revenues from oil and other natural resources, Nigeria remains one of the poorest countries globally, with over 100 million people living on less than $1 per day. According to the 2008 demographic and health survey (DHS), nearly one in four children is underweight in Nigeria. Half of all child deaths are a result of malnutrition (Adamu, 2012). Malnutrition has been a key health challenge for Nigeria, particularly in the northern region of the country. Forty-one percent of children in Nigeria are stunted, according to the 2008 DHS (Adamu, 2012). However, this figure is particularly alarming in the north with 53 percent of children stunted in the north west region and 49 percent in the north east, compared with only 22 percent in the south east.

Nigeria is an agrarian country with about 70 percent of the population engaged in agriculture production (Ugwu, 2011). Despite the rapidly growing oil industry in Nigeria, agriculture still accounts for 40 percent of the GDP (Ugwu, 2011). The major agricultural commodities, by production quantity, are (in order) cassava, yams, maize, sorghum, vegetables, rice, citrus fruit, taro, groundnuts, and sweet potatoes (FAO, 2011). Agricultural productivity is showing signs of recovery, after decades of decline, but it is happening too slowly to meet the demands of a rapidly growing urban population (IFPRI, 2011). Constraints to increasing agricultural productivity in Nigeria include poor agricultural policies, low fertilizer use, low access to agricultural credit, land tenure insecurity, land degradation, poverty and gender issues, low and unstable investment in research, poor market access and market efficiency, drought, pests and

diseases, post-harvest losses, and high input costs (Dayo, 2009). High and volatile food prices in recent years continue to pose increased risk of food insecurity (Okuneye, 2001). Processing, transportation infrastructure, and marketing pose additional challenges for food security in Nigeria (IFPRI, 2011).

Compared to Niger and other nations in the Sahel, Nigeria lacks international attention despite suffering from major food insecurity. Northern Nigeria may be better categorized as facing problems (drought, climate change, food unavailability, etc.) similar to those in Niger, rather than in Southern Nigeria (Simister, 2006). Rainfall in the Sahel region has fallen by about 30 percent since the 1970s. Nigeria is the key food producer in the Sahelian region but volatile food prices, poor dietary diversity, government policies, food losses due to poor storage facilities, drought, and other issues continue to threaten food security (IRIN, 2012). Research suggests that the Sahara desert is spreading south, causing many Northern Nigerian farmers to struggle.

The north east and north west zones of Nigeria have greater “food poverty”, absolute poverty, relative poverty, and people living on less than a dollar per day than any of the other zones (NBS, 2010). The northern climate is arid compared with the equatorial and tropical climate in the southern regions of Nigeria. While the south has a combination of central hills, plateaus, and mountains the northern terrain is mostly plains (CIA, 2012). Other key differences between the north and south include history, politics, culture, customs, and religion. With more than 150 million people, at least 250 different ethnic groups, and nearly proportional Christian and Muslim populations, Nigeria’s diversity is palpable (Campbell, 2011). The south has much better socioeconomic indicators than the north (Campbell, 2011). Northern Nigeria has some of the world’s worst health and economic statistics (Campbell, 2011). Its economy is in decline because of lack of investment in agriculture and infrastructure, such as access to education (Campbell,

2011). The north has long feared domination by the more advanced south, and distrust remains widespread (Campbell, 2011). Additionally, Nigeria faces growing unrest across the nation, but especially in the northeastern region of the country, with escalating violence and tensions between religious groups spurred on by the shadow sect book Haram (Webb Girard et al, 2012).

Food security has not been adequately and critically analyzed in Northern Nigeria. Better data collection, analysis, and research on food security contribute to achieving the Millennium Development Goals (particularly goal #1, eradication of extreme poverty and hunger). Food insecurity and malnutrition have profound implications for health and development, and present major obstacles to attaining the Millennium Development Goals. Recently the Nigeria Millennium Development Goal Report 2010 reported that reducing poverty and hunger remain a key developmental challenge in the country (Omuemu, 2012). Understanding smallholder farmers in the developing world – how much they earn, what they eat, as well as broader questions about the role food security plays in health outcomes – is crucial to designing sustainable strategies to reduce hunger, poverty, and illness.

Problem Statement

Poverty and food security have profound implications for health and welfare. In Northern Nigeria the prevalence and demographics of food security have not been adequately quantified. The current set of household and farm surveys conducted by the National Bureau of Statistics (NBS) cover a wide range of sectors. However, none of these surveys were conducted as a panel. Longitudinal surveys, which includes panel surveys, gather data over a period of time, which allows researchers to analyze changes in the population in an attempt to describe or explain them.

Data have been collected by the World Bank Living Standards Measurement Study Integrated Survey on Agriculture (LSMS-ISA) but have not yet been thoroughly analyzed. The LSMS-ISA project was developed after the recognition that existing agricultural data in the region suffers from inconsistent investment, institutional and sectoral isolation, and methodological weakness. The multi-topic coverage of the LSMS-ISA surveys is designed to improve the understanding of the links between agriculture, household socioeconomic status, and non-farm income activities. These data need to be analyzed to better understand the population and inform policy and approaches to improve food security in Northern Nigeria.

Purpose Statement

The research objective is to determine the status of household food security in Northern Nigeria. The purpose of analyzing household food security in Northern Nigeria is to expand on current knowledge and literature. This analysis hopes to aid in informing further research, policy, and programming in the region. Furthermore, this study assess the feasibility of applying common measures of food security to the LSMS-ISA data from the World Bank.

Significance Statement

The study of food security in Northern Nigeria is necessary to fill the gap in current literature and to provide greater evidence-base for decision-making and policy-making. The analysis below is a first step to better understand the characteristics of food secure and insecure households, and whether the LSMS-ISA provides adequate data to measure hunger. The descriptive analysis aims to promote further discussion and analysis of households experiences of food security and related household characteristics. Additionally, this research can contribute to making evidence-based policy and programming decisions and informed targeting of limited resources. Prabhu

Pingali, Deputy Director of Agriculture Development at Bill & Melinda Gates Foundation, stated "the LSMS-ISA project has the potential to transform our understanding of agricultural development in Africa, while empowering African governments to make better decisions on behalf of the rural poor" (World Bank, 2012).

Chapter 2: Literature Review

Introduction

This literature review will first discuss the background, consequences, and causes of food security. Next, different methods measurements of food security are discussed. After an overview of the Living Standards Measurement Study – Integrated Surveys on Agriculture (LSMS-ISA) is given, along with the applicability of using the food security indicators on the LSMS-ISA dataset, food security studies in Nigeria are examined. Finally, the gaps in the literature are discussed.

Millions of people suffer from a range of health problems with a common root cause: food insecurity. What is now being discussed as food security or insecurity, was the phenomenon loosely labeled hunger in the 1980s (Campbell, 1991). The World Food Summit of 1996 defines food security as "when all people at all times have access to sufficient, safe, nutritious food to maintain a healthy and active life" (World Food Summit, 1996). The three dimensions of food security are food availability, food accessibility, and food utilization. At the household level, food security implies sufficient access to food over time, and is not affected by any shocks or risks affecting food production (Akinyele, 2009). Malnutrition refers to all deviations from adequate nutrition, including undernutrition and overnutrition relative to need (Shetty, 2003). Malnutrition arises from deficiencies of specific nutrients or from diets based on wrong types or proportions of food. Undernutrition is the outcome of insufficient food caused primarily by an inadequate intake of dietary or food energy, whether or not any specific nutrient deficiency is present. Undernutrition is defined as dietary energy intake below the minimum requirement level needed to maintain the balance between actual energy intake and acceptable levels of energy expenditure (Shetty, 2003).

Nearly 870 million people are estimated to have been chronically undernourished in 2010-2012, according to FAO measurements (percentage of inadequate energy) (FAO, 2012). This represents 12.5% of the global population, mostly people living in developing countries, where the prevalence of undernourishment is now estimated at 14.9% of the population (FAO, 2012). Areas prone to deadly outbreaks of malnutrition often overlap in areas of conflict, but nutritional emergencies are just as likely to occur as seasonal phenomenon in stable regions (FAO, 2012). While the most severe food insecurity is typically associated with disasters such as drought, floods, war, or earthquakes, most food insecurity is not associated with catastrophes (Barrett, 2012). Only 8% of hunger-related deaths worldwide in 2004 were caused by humanitarian emergencies, with the other 92% associated with chronic or reoccurring hunger and malnutrition (Barrett, 2012). For example, agricultural households are routinely exposed to seasonal hunger, the period when a family's food stocks run out before new harvests are available - with climatic shocks, shifting weather patterns, political upheavals, and instability in global markets, food insecurity can quickly worsen. There is a clear seasonality to food insecurity in many regions. The "hunger season" is when food supplies are exhausted in between harvest. Families tend to adopt coping methods to get themselves through the season, such as reducing their food intake quantity.

Food insecurity and malnutrition have profound implications for health and development. In September 2000, world leaders adopted the United Nations Millennium Declaration, committing to a new global partnership to reduce extreme poverty and other issues by 2015 – that are collectively known as the Millennium Development Goals (United Nations, 2012)). The first of the eight Millennium Development Goals is to "eradicate extreme poverty and hunger" through three targets: 1) Halve, between 1990 and 2015, the proportion of people whose income is less than $1.25 a day; 2) Achieve full and productive employment and decent work for all, including

women and young people; 3) Halve, between 1990 and 2015, the proportion of people who suffer from hunger (United Nations, 2012).

Considerable differences exist among regions and individual countries in their progress to reach the poverty and hunger MDG (FAO, 2012). Furthermore progress on the three targets of MDG #1 also varies:

- *Progress towards target 1: Halve, between 1990 and 2015, the proportion of people whose income is less than $1.25 a day.*

According to the Millennium Development Goals Report (United Nations, 2012), extreme poverty has fallen in every region of the world. Despite significant progress, poverty remains widespread in sub-Saharan Africa and in Southern Asia. The poverty rate in sub-Saharan Africa fell by almost 5%, to less than 48% between 2005 and 2008 – the largest decrease ever in sub-Saharan Africa since international poverty rates began to be estimated.

- *Progress towards target 2: Achieve full and productive employment and decent work for all, including women and young people*

Recent estimates produced by the International Labour Organsation (ILO) found a reduction of workers in the world living below the $1.25 a day poverty line from 26.4% in 2000 to 14.8% in 2011. This is largely due to rapid economic growth and reduction in extreme poverty among workers in Eastern Asia. Working poverty is decreasing, yet progress has slowed since 2008.

- *Progress towards target 3: Halve, between 1990 and 2015, the proportion of people who suffer from hunger*

Progress towards relieving food deprivation has slowed or stalled (United Nations, 2012). Nearly one in five children under age five in the developing world are underweight (United Nations, 2012). Progress towards reducing the proportion of children under age five who are

underweight is insufficient to reach the global target by 2015 (United Nations, 2012). The prevalence of hunger remains unsatisfactorily high in sub-Saharan Africa and in Southern Asia; despite reductions in income poverty, there have been no improvements in undernourishment rates in Eastern Asia since 2000 (United Nations, 2012). Africa is not on track to meet its MDG hunger targets (Omuemu, 2012).

Food insecurity and malnutrition have profound implications for health and development, and present major obstacles to attaining the Millennium Development Goals. The Nigeria Millennium Development Goal Report 2010 reported that reducing poverty and hunger remain a key developmental challenge in the country (UNDP, 2010). The improvement in economic growth in Nigeria over the past half a decade has not resulted in the desired reduction in poverty (UNDP, 2010). The prevalence of underweight children under age five years of age has fallen from 35.7% in 1990, to 28.7% between 2011 and 2003, and to 23.1 percent by 2008 (UNDP, 2010). If this progress is sustained, Nigeria is on track to halve the proportion of underweight children under age five by 2015 (UNDP, 2010). The impacts of climate change on agriculture pose risk to reaching the poverty and hunger MDG targets (UNDP, 2010). Crop failures, decreases in agricultural productivity, and incomes will hurt the poor, threaten food security, and slow progress towards eradicating poverty and hunger (UNDP, 2010).

Consequences of Food Insecurity

Food insecurity overwhelmingly affects nearly a billion people (FAO, 2012). There are a number of negative consequences as a result of food insecurity (Mason, 2002). Hunger, or undernutrition, results from the insufficient intake of macro- and micro-nutrients (FAO, 2012). Malnutrition results in some 3.5 million deaths per year (FAO, 2012). Both general (protein and energy) and micronutrient deficiencies are associated with significant defects in cell-mediated

and humoral immunity, depressed cytokine production, lowered specific antibody production and decreased phagocyte function (Gillespie, 2005).

Food intake is important for more than dietary energy; inadequate diets have serious consequences beyond hunger, growth failure, and thinness (Mason, 2002). The features of "hunger" that drive the concern for combating it include health, suffering, behavior, and economic effects. Inadequate intake predict or cause undesirable outcomes in health and biological development, behavior, and productivity. Most nutritional deficiencies interfere with the complex metabolic processes necessary for healthy functioning. The immune system is probably most compromised by nutrient deficiencies and it is very possible that cognitive function is similarly vulnerable (Mason, 2002).

It is hypothesized that food insecurity can impair parents' capacity to provide optimal feeding to their children through a variety of mechanisms. A study among urban Kenya women utilized qualitative analysis of interview and focus group discussion transcripts to assess whether food insecurity was associated with beliefs and attitudes towards exclusive breastfeeding (Webb Girard et al, 2010). Webb Girard, et al (2010) documented that maternal experience of hunger contributes to perceived milk insufficiency, anxiety about infant hunger, and a perception that access to adequate food is necessary for successful breastfeeding. Furthermore, a study of 1343 infants in Matlab, Bangladhesh found that better household food security was associated with poor infant feeding practices during 3-6 months of age but was associated with better infant feeding practices during 6-9 and 9-12 months of age (Saha et al, 2008). Lastly, Dewey et al (2008), in a systematic review of educational interventions to improve complementary feeding of infants 6-24 months identified food security status as a key modifying effect. While nutrition

education and counseling can be an effective strategy to improve mothers' complementary feeding practices, effectiveness was highest in food secure contexts.

Food insecurity not only affects physical growth and health of children but also their intellectual development, school attendance, and academic performance (Belachew et al, 2011). Evidence from a study of adolescents in Ethiopia found that significantly more (33.0%) food insecure adolescents were absent from school compared with their food secure peers (Belachew et al, 2011). The authors concluded that adolescent and household food insecurity are positively associated with school absenteeism and a lower educational attainment (Belachew et al, 2011).

Research also suggests that mental disorders are associated with food insecurity. Common mental disorders are a major contributor to the global burden of disease (Hadley et al, 2008). A study by Sorsdahl et al (2009) administered surveys of 4186 South African adults. The researchers found that, after controlling for conventional socioeconomic and sociodemographic variables, food insufficiency was associated with having a 12-month and mental disorder (Sorsdahl et al, 2009). As part of an ongoing cohort study, the Gilgel Gibe Growth and Development Study (GGGDS) in Ethiopia administered household surveys to assess anxiety and depression and post-traumatic stress symptoms (Hadley et al, 2008). The study found that among 902 adult participants, food insecurity, stressful life events and symptoms of common mental disorders were highly prevalent (Hadley et al, 2008). Furthermore, in multivariate models adjusting for potential confounders, food insecurity and stressful life events were independently associated with high symptoms of depression, anxiety, and post-traumatic stress (Hadley et al, 2008). These findings indicate that the negative effects of food insecurity extend beyond nutritional outcomes (Hadley et al, 2008). While these studies have found food insecurity and mental illness associated, the current literature regarding the impacts of food

insecurity on mental health in developing countries is limited – few studies have examined these issues directly, and serious methodological flaws are present in many of the existing studies (Weaver et al, 2009).

Food insecurity often results in increased risk-taking. Among women in Botswana and Swaziland, food insecurity (not having enough food to eat over the previous 12 months) was found to be an important risk factor for increased sexual risk-taking including inconsistent condom use, sex exchange, and other measures of risky sex (Weiser et al, 2007).

HIV/AIDS and food and nutrition insecurity are entwined in a vicious cycle, with food insecurity heightening susceptibility to HIV exposure and infection, and HIV/AIDS in turn heightening vulnerability to food insecurity (Gillespie et al, 2005). The HIV/AIDS pandemic is a global crisis is severely challenging food and nutrition security (Gillespie et al, 2005). A major response to cope with food insecurity is required from the agriculture sector, as the need to secure and provision food for populations affected by HIV/AIDS is rapidly increasing (Loevinsohn et al, 2003). There is a growing evidence-base about the crucial role nutritional status plays – both in terms of susceptibility to HIV infection and transmission and in terms of the quality of life and lifespan of HIV-positive individuals (Loevinsohn et al, 2003).

Food insecurity and malnutrition may accelerate the spread of HIV, both by increasing people's exposure to the virus and by increasing the risk of infection following exposure (Gillespie et al, 2005). Observation studies have reported an association between communities suffering poor food security and HIV transmission (Rollins, 2007). Poverty and food insecurity may place people in situations of heightened risk of exposure to the virus (Gillespie et al, 2005). However, little is known about the specific mechanism by which food insecurity influences risk-taking behavior and consequent vulnerability to HIV transmission (Rollins, 2007). Food-insecure people may be

less able to access information about HIV/AIDS or less able to act in accordance with their knowledge on how to minimize risk to HIV exposure (Gillespie et al, 2005). They may have to separate from their families or even forced into transactional sex in order to earn a livelihood (Gillespie et al, 2005). Miller et al (2011) found that food insecurity led to increased sexual vulnerability among women. Women were often compelled to engage in transactional sex or remain in an abusive relationship because of their reliance on men to provide food for themselves and their children (Miller et al, 2011). Furthermore, the study found that four major themes emerged from the interview data: the relationship between food insecurity and transactional sex for women; the impact of a husband's death from HIV on worsening food insecurity among women and children; the impact of food insecurity on control over condom use; and the relationship between food insecurity and staying in violent relationships (Miller et al, 2011). Among other risky behaviors, other observational studies suggest that food insecurity is associated with increased HIV transmission risk behaviors and decreased access to HIV treatment and care (Anema, 2009). Among individuals receiving antiretroviral therapy (ART), food insecurity is associated with decreased ART adherence, reduced baseline CD4 count, incomplete virologic suppression, and decreased chance of survival (Anema, 2009). Few other studies have rigorously investigated the direct impact of food insecurity on the adoption of risky behaviors (Gillespie et al, 2005).

Food security, along with poor health, may lead to increased malnutrition rates which can lead to increased HIV transmission efficiency by weakening immunity and comprising gut and genital mucosal integrity (Gillespie et al, 2005). Malnutrition among pregnant and lactating may increase vertical transmission rates from mother to infant, which can occur during pregnancy, during delivery, or postnatally through breastfeeding (Gillespie et al, 2005). Mother to infant is a major factor in the transmission of HIV infection (Gillespie et al, 2005). Inadequate nutritional

status may increase the risk of vertical HIV transmission because micronutrient deficiencies impair immune responses, weaken epithelial integrity and are associated with accelerated HIV disease progression (Gillespie et al, 2005). Many studies also suggest that improved maternal micronutrient status may reduce vertical transmission of HIV by "enhancing systemic immune function in the mother or fetus, reducing the rate of clinical, immunological, or viral progression in the mother, reducing the viral load or the risk of viral shedding in genital secretions or breast milk, reducing the risk of low birth weight, or maintaining the integrity of the child's gastrointestinal track" (Gillespie et al, 2005).

In addition to issues relating to being undernourished or malnourished, food insecurity is associated with non-communicable diseases like cardiovascular disease, chronic respiratory disease, diabetes and cancer, which together cause two out of three deaths in the world (80% of those in developing countries) (Nugent, 2011). High prevalence rates of overweight are also found in low-income countries (FAO, 2012). Even in very poor populations facing hunger and traditional food insecurity, there is evidence of high blood pressure, diabetes and other diet-related non-communicable diseases (Nugent, 2011). A study of low income U.S. children, among 3 to 10 year olds, the interaction of food insecurity and maternal stressors was significantly linked to the probability of being overweight (Gundersen et al, 2008). Another study found that food security remained a significant predictor of overweight status among women, after adjustment for potentially confounding demographic and lifestyle variables (Townsend et al, 2001). The nutrition transition refers to the current phenomenon of diets increasingly containing more energy-dense, semi-processed foods, and becoming higher in saturated fats, sugars, and cholesterol (FAO, 2012). The reason for this issue is that being overweight is necessarily a matter of over consumption, but by eating food that is not nutritious.

Finally, food security has immense implications for national and global security. Food insecurity can be attributed to human causes such as war and environmental degradation. However, war is also a consequence of food insecurity. Water and food security will face major challenges as a result of climate change (Allouche, 2010). Food security is directly affected by the effects of climate change, resulting in serious consequences, particularly for more vulnerable groups (Alpas and Kiymaz, 2011). Poor households are particularly vulnerable because they are less able to cope with environmental scarcity and the social crises they cause (Homer-Dixon, 1994). Climate change undermines human security in the present, and will continue to do so in the future, by reducing access to, and the quality of natural resources (such as food) that are necessary to sustain livelihoods (Barnett et al, 2007).

As the majority of the poor in the world are dependent on agriculture, the severity of climate change effects may lead to greater food system risk and societal and political risks (Alpas and Kiymaz, 2011). The majority of poor people in Nigeria depend on climate-sensitive natural resources for incomes, employment, and livelihood (UNDP, 2010). Food price volatility and climate change is expected to bring social disturbances and terrorism in the short to long term (Alpas and Kiymaz, 2011). Many conflicts related to food security have already taken place around the world. Escalating food prices trigger protests and riots in vulnerable populations (Adam, 2008). Sir John Holmes, Undersecretary General for Humanitarian Affairs and the UN's Emergency Relief Coordinator, stated that the security of the food crisis should not be underestimated as food riots are already being reported across the globe (Adam, 2008). In 2008, the rising cost of scarcity of food was blamed for variety in a number of locations, including violent protests in Ivory Coast, and deadly riots in Cameroon and Haiti (Adam, 2008). The risk of destabilization is likely to increase as a result of climate change (Barnett et al, 2007).

Causes of Food Insecurity

Using child malnutrition as a proxy (along with descriptive controls of non-food determinants of malnutrition), Smith et al (2000) found little correlation between national food availabilities and food insecurity. The causes of food insecurity go beyond food availability and are intertwined with various variables, many of which deal with the food access pillar of food security. In the ten studies summarized below, food insecurity in Nigeria has been found to be associated with age of household heads in both directions, female-headed households, per capita non-food expenditure, educational status, income, dependency ratio, household size (Omonoma et al (2007) and Oluyole (2001)). Research applied across Nigeria and a variety of non-country specific contexts has found similar results. In developing regions, rural children are almost twice as likely to be underweight than children in urban households (United Nations, 2012). Poor children are almost three times as likely as underweight as are children in the wealthiest 20 percent of households (United Nations, 2012).

While risk factors for food insecurity are more easily analyzed, the causal reasons for food insecurity are complex. Environmental, historical, economic, and political factors also play a major role in determining the food security of an area (Gardner, 2012). Poor agricultural production, linked with policies, has constrained food security in Nigeria. Agricultural productivity issues include poor agricultural pricing policies, low fertilizer use, limited access to inputs, low access to agricultural credit, low and unstable investment in agricultural research, poor funding and coordination of agricultural extension, land tenure system and land degradation, drought, and poor market access and market efficiency (Dayo, 2009 and Okuneye, 2011). Other recent works by has revealed other constraints of agricultural productivity in Nigeria to include; poor conceptualization and inefficient implementation of programs; early cessation of rainfall after several interruptions during the season which causes significant crop

losses and reduced yields; poor rural roads and attendant high transportation cost; the increasing unattractiveness of the agricultural and rural sector to the youths who prefer “white collar” jobs in cities; the continued dependence on subsistence farming; the cultural structure of communal living and inter dependence which causes unwholesome burden to the working populace; the HIV/AIDS pandemic which is depleting the working population; ethnic and communal conflicts; farmers investing funds in unproductive areas like offsetting debts, building more houses, marrying more wives; disregard of farmers needs and desires by government in the formulation of agricultural policies; farmers educational low profile; the devastating effect of avian influenza (bird flu) on poultry industry which led to a drastic fall in demand for poultry products and prompted a decline in the production of maize; and bad governance been at the fulcrum of all (Jerome, 2012).

Economic policies, particularly in the agricultural sector, play a central role in determining the food security of a nation because they help dictate adequate supply and accessibility of food, as well as citizens’ ability to obtain food (Gardner, 2012). Nigeria’s policies surrounding agriculture in national development have changed considerably throughout history (Ugwu and Kanu, 2011). The affected policies and strategies used to address food security issues have equally changed over time (Ugwu and Kanu, 2011). The rising cost of food prices in Nigeria have roots in policies and programs of past governments (Okuneye, 2001). The 1960 to 1969 era was a period of minimum government intervention in Nigeria (Ugwu and Kanu, 2011). The later phase from 1970 to 1985 was a period of maximum government in the agricultural sector (Ugwu and Kanu, 2011) Since the Structural Adjustment Program (SAP) was introduced in Nigeria in 1986, the nation has experienced a gross neglect of the food production sector (Okuneye, 2001). Despite the objectives of SAP and the key policies implemented as a result of these objectives, the agricultural sector did not register significant overall growth (Ogwu and Kanu, 2011). New

millennium agricultural policies were implemented in May 1999 (Ogwu and Kanu, 2011). Despite agricultural growth of 6.8% between 2002 and 2006, food security remains a major concern due to the subsistence nature of Nigeria's agriculture (Ogwu and Kanu, 2011).

A substantial factor behind policy reforms' inability to truly address food security lies in poor planning and implementation on the part of political actors (Gardner, 2012). Interest groups and political lobbying and lack of initiative or implementation of effective policies hinder food security further (Gardner, 2012). Furthermore, insecurity of investment is another common factor responsible for the ineffectiveness of policies and regulations (Ogwu and Kanu, 2011).

Another area of key policy concern regarding food security, is foreign assistance. Some experts argue that declining aid has limited agricultural growth (Morrision et al, 2004). However, others believe that the volume of official development assistance (ODA) is a cause of the problem (Morrision et al, 2004). Little evidence exists regarding the advantages and effectiveness of the different aid instruments and mechanisms for agricultural development (Morrision et al, 2004). The nature of assistance to agriculture has changed substantially over the past 40 years, making it difficult to definitively judge impact (Morrision et al, 2004). There is a need to better understand financing flows in the agriculture sector (FAO, 2009).

Measurements of Food Security

Hunger and malnutrition are difficult to define in exact, measurable terms, and is difficult to estimate, especially for large groups of people (Mason, 2002). It is important to measure hunger accurately. Data on hunger can be used to make statements for political advocacy about the numbers of "hungry" or how this this number is changing. Such statements are often seen as ill-defined and only having a public relations meaning, yet these estimates need to be meaningful (even if not completely accurate). To accomplish this, global and regional estimates must be

built from data that are comparable across countries and available for many countries and for most years. Another use of measuring hunger is for analyzing policies and programs, to evaluate what works or does not and to indicate what new or adjusted policies are necessary (Mason, 2002).

Measurement matters for at least three primary reasons (Barrett, 2010). First, each measure captures and neglects different aspects of food security, thereby influencing prioritization of food security interventions subtly. Second, observational data reports on the past but an ideal food security indicator would reflect the forward-looking time series of probabilities of satisfying the access criteria. However, there has been little success in developing forecasting indicators. Third, national-level measure inherently only address national-scale food availability shortfalls. There is need for the development of cross-nationally comparable, longitudinal monitoring and analysis at the household and individual level (Barrett, 2010).

The three pillars of food security – availability, access, and utilization – are inherently hierarchical, with availability necessary but not sufficient to guarantee access, which is necessary but not sufficient for effective utilization (Barrett, 2010). Access is reflects the demand side of food security, as manifest in uneven inter- and intra-household food distribution and in the sociocultural limits on what foods are consistent with prevailing tastes and values within a community. Food access is closely tied to poverty, and to social, economic, and political disenfranchisement. Access is an inherently multidimensional concept, making measurement of access more difficult than measures for assessing availability. Utilization reflects whether individuals and households make good use of the food to which they have access – for example, whether their health status is such that they are able to absorb and metabolize essential

nutrients. In practice, analysts use proxy measures for different aspects of food security (Barrett, 2010).

Despite advancements in household food insecurity measurement, there has been little attention in the literature to the best method for determining the content of culturally appropriate food insecurity measures or the extent to which measures can be applied across cultures (Coates, 2006). There is literature to support that household food insecurity is a culturally unique experience and that a thorough ethnographic process is necessary to ground the scale in locally relevant experience (Coates, 2006). Yet many studies have merely adapted the U.S.D.A. Household Food Security Survey Measure without considering whether it validly reflects the food insecurity experience of households in other countries (Coates, 2006).

Estimates of hunger, undernourishment, and food security are subject to error and their interpretation presents difficulties, even if the estimates are accurate (Mason, 2002). There is no absolute measure (or "gold standard") for measuring food security and hunger, but these methods assess various aspects of hunger and dimensions of its effects on health, suffering, behavior, and economics (Mason, 2002). There are five methods used for assessing the extent of hunger, undernourishment, and food security, with different applications and advantages in terms of use for advocacy, policy analysis and decision-making, and research (Mason, 2002 and FAO, 2005). Some comparative features of the five methods and specific indicators are summarized in the following sections. The five methods used to measure varying aspects of hunger and malnutrition are described in the following papers (Mason, 2002):

1) "FAO methodology for estimating the prevalence of undernourishment" by Naiken (2003)

2) “The use of household expenditure surveys for the assessment of food insecurity” by Smith (2003)
3) “Individual food intake survey methods” by Ferro-Luzzi (2003)
4) “Measures of nutritional status from anthropometric survey data” by Shetty (2003)
5) “Qualitative measures of food insecurity and hunger” by Kennedy (2003)

Quantity of food does not measure the extent of diet quality. Furthermore, the cheapest foods typically have the poorest quality (Mason, 2002). None of these measures, directly assesses micronutrient deficiencies. Micronutrient deficiencies are observed to be extremely widespread, probably more so than malnutrition as assessed by inadequacy of energy intake or anthropometry (Mason, 2002). Micronutrient deficiencies have profound effects economically as well as impacts on health and behavior (Mason, 2002). Micronutrient deficiencies are directly measured by diagnosing clinical signs, which may not be sensitive or specific for some deficiencies and only tend to detect later stages of deficiency (Seal and Prudhon, 2007). This is done on an individual-level and that information is sued to give a population estimate of micronutrient deficiencies (Seal and Prudhon, 2007). Indirect assessment involves the estimation of nutrient intakes a population level and extrapolates the risk of deficiency and the likely prevalence of micronutrient deficiencies (Seal and Prudhon, 2007). The national availability of micronutrients can be estimated from the same input data as for dietary energy in the FAO Food Balance Sheets (Mason, 2002). However, this requires extensive application of food composition values to the range of food commodities consumed (Mason, 2002). Household surveys that provide data on food energy availability may also provide estimates of micronutrient deficiencies (Mason, 2002).

One of the most crucial points regarding the alternative methods of measuring hunger and malnutrition, is that the methods should be seen as complementary, not competing, approaches to capturing various aspects of a multidimensional concept (Osmani, 2002).

FAO Method

The most commonly cited food insecurity indicator is "undernourishment" estimates generated by FAO (Barrett, 2010). FAO uses this indicator to document global and national food security status. It is also importantly used to track progress on the first Millennium Development Goal related to hunger.

The FAO measure of food deprivation, the prevalence of undernourishment, is based on a comparison of usual food consumption expressed in terms of dietary energy (kcal) with certain energy requirement norms (Naiken, 2003). By focusing on dietary energy intake, the FAO measure attempts to capture those whose food consumption is insufficient for body weight maintenance and work performance. These figures are derived from national-level food balance sheets and assumptions about intra-national distribution of food (Barrett, 2010). There are alternative measures such as generating simulation models based on prices and national accounts and production equations (Barrett, 2010). The approach of using food availability information, income distribution and energy requirement for estimating the global prevalence of food deprivation has been applied in other studies, including the USDA annual assessment of food security in developing countries (2000), and by Senauer and Sur (2001). The surplus/shortfall measure, described in more detail below, is similar to the FAO method as well.

A central question is whether adequacy of dietary food energy intake and changes in this can actually be measured (Mason, 2002). Three of the methods outlined previously focus on this as their central concern: the FAO method, household income and expenditure surveys, and

individual food intake surveys (Mason, 2002). The FAO methodology is concerned with the correlation between energy intake and need but has adopted a “cutoff” approach (Mason, 2002). The issue is that until food availability is restricted, intake will tend to meet requirement, and taking account of this must be at the individual level, for which, there are virtually no data (Mason, 2002).

Undernourishment is measured by classifying households based on whether or not there are sufficient kcal available in the household typically using the daily per capita calorie intake of 2470 kcal (Ibrahim et al, 2009). The amount of available calories available data are derived from food balance sheets complied every year by FAO based on the production and trade of food commodities data (Naiken, 2003). Using these data and other information on seed rates, waste coefficients, stock changes, types of utilization (feed, food, etc.), a supply/utilization account is prepared for each commodity in weight terms. The food component refers to the total amount of the commodity available for human consumption during the year. Then, the total mean represented by the per calorie available is obtained by aggregating the food component of all commodities after conversion into energy values (Naiken, 2003). The estimated total household calorie availability is divided by the adjusted household size in adult equivalent, in order to estimate the per capita calorie intake (Ibrahim et al, 2009). Households who’s daily energy availability falls below that minimum energy requirement are regarded as “undernourished” (UN Stats). The estimate of the proportion of individuals with insufficient energy consumption is defined within a probability distribution framework, as it is not practical to determine energy consumption of individuals (UN Stats).

The prevalence of undernourishment is calculated using three input measures (Naiken, 2003):

$$\bar{x} = 2414 \ kcal/person/day$$
$$CV(x) = 0.29 \ and$$
$$r_L = 1885 \ kcal/person/day$$

The first step is to derive the two parameters of the log-normal distribution:

$$\sigma = [\log_e (CV^2(x) + 1)]^{0.5} = [\log_e (0.29^2 + 1)]^{0.5} = 0.2842$$

$$\mu = \log_e \bar{x} - \sigma^2/2 = \log_e 2414 - 0.2842^2/2 = 7.7487$$

The next step, is to construct the standard normal deviate corresponding to the cutoff point:

$$Z = (\log_e r_L - \mu)/\sigma = (7.5417 - 7.7487)/0.2842 = -0.7284$$

Lastly, the proportion of the population below the cutoff point is calculated:

$$\Phi(Z) = \Phi(-0.7284) = 0.2332$$

In the sample equations above, if x=2414 kcal/person/day, CV(x)=0.29, and r_L=1885 kcal/person/day then the prevalence of undernourishment is estimated to be 23.32%. The number of undernourished can be obtained from multiplying F(Z) by the total population of the country (Naiken, 2003).

Trends in undernourishment are mainly driven by: 1) changes in energy availability as measured by country food balance sheets; 2) changes in the variance of the distribution of dietary energy consumption in the population, induced by changes in both the distribution of dietary energy

consumption due to income levels, and the distribution of dietary energy requirements based on weight for attained heights by sex and age; and 3) changes in the minimum level of dietary energy consumption. A major problem with this measure concerns the use of energy requirement norms and energy consumption for individuals (UN Stats). Even after taking into account the leading factors such as age, sex, body weight and activity, differences exist in the energy requirement of individuals. The FAO method also assumes a low energy expenditure which may not be appropriate for countries where subsistence agriculture is a primary livelihood, resulting in an underestimated prevalence.

Another common issue with the FAO method is that those at risk of hunger often go through differing periods of dietary energy needs, there may be periods where they are adequately nourished – for example, after harvests or when wages are obtained – followed by periods of deprivation (Mason, 2002). Food supply estimates, such as Months of Adequate Household Food Provisioning (MAHFP), typically use a reference period of one year (Mason, 2002). Insufficient food for one day is too short a time period to be counted into an estimate of hunger, as individuals may be sick, traveling or fasting (Mason, 2002). Yet, other dimensions of hunger (e.g. health and economic) do not respond from low intake just for one day if it rebounds the next day (Mason, 2002). Transient hunger should be assessed by other methods, notably the qualitative measures (Mason, 2002).

Household Income and Expenditure Surveys

Income is another determinant of food intake, which is a major factor in determining height in growing children and body weight (Mason, 2002). An important facet of the method is that food data collected in household expenditure surveys reflect the quantity of food “acquired” by a household rather than that “consumed” by its members such as data collected in household

food consumption or individual dietary intake surveys (Smith, 2003). The four main strengths of household expenditure surveys are: 1) they are a source of multiple, policy-relevant and valid measures (household food energy deficiency, dietary diversity, and percent of expenditures on food, a measure of vulnerability to food deprivation); 2) They allow multilevel monitoring and targeting; 3) they allow causal analysis for identifying actions to reduce food insecurity; 4) Given that food security manifests itself at household and individual levels and that data on expenditure are collected directly from households themselves, they are more likely to be reliable than those derived from data collected at more aggregate levels (Smith, 2007). The main weaknesses of household expenditure surveys for the purpose of measuring food insecurity are: 1) they are not undertaken on a regular basis in all developing countries; 2) data collection and computational costs in terms of time, financial resources and technical skill required are quiet high; 3) data are not collected on the access to food by individuals within households; and 4) although reasonably reliable estimates of food insecurity can be obtained, estimates may be biased owning to various systematic, non-sampling errors (Smith, 2003). Another drawback of using the household income and expenditure surveys to estimate micronutrient intake, is that certain non-staple foods, especially snacks that are consumed in smaller quantities and may provide higher concentrations of micronutrients, tend to be missed in surveys, leading to an underestimate level of micronutrients (Mason, 2002).

Accurately estimating the amount of food people eat is costly in terms of time and money (Smith and Subandoro, 2007). In larger populations, it has been necessary to rely on less accurate, indirect techniques based on the availability of food and the national level (Smith and Subandoro, 2007). Household expenditure is not a direct measure of food insecurity, however a relative high share of income spent on food is often linked to poor households (De Cock, 2012). Determining expenditure is fundamental in identifying the consumption patterns of the poor

(NBS, 2012). Expenditure on food depends on many other parameters including change in food prices and location (De Cock, 2012). Household expenditure aggregates is commonly expressed in terms of per capita expenditure or the household expenditure divided by the household size (NBS, 2012). Basic food security analyses are possible through the use of an appropriate strategy for calculating quantities of food acquired by households, given time constraints, financial constraints, and the nature of the population's diet (Smith and Subandoro, 2007).

Food Intake Surveys / Food Frequency

The degree of flexibility afforded by individual dietary survey methods, the availability of effective validation and standardization procedures, and the nature of the information obtained are attributes that are unique to this method (Ferro-Luzzi, 2003). Another unique feature is that its error structure is much better understood than for any other method used for assessing food security. This is the only method that can reveal intra-household distribution of food. Individual dietary survey methods are a robust approach for assessing food security. However, costs and other considerations, such as logistics, the degree of collaboration required from subjects and cultural constraints, make its use difficult. The primary weakness of the method is under-reporting. It also raises interpretation issues, as the assessment of energy and nutrient adequacy or inadequacy may only be obtained on a probabilistic level, making it impossible to identify specific individuals with inadequate intake. However, it is likely to provide sufficient grounds for policy and decision-making purposes (Ferro-Luzzi, 2003).

Household Dietary Diversity

Household dietary diversity is the number of different food groups consumed over a given reference period (Bilinsky, 2006). The Household Dietary Diversity Scale (HDDS) usesconsumption data. HDDS is a strong food access indicator for the following reasons:

- A more varied diet is a valid outcome in its own right (Hoddinott, J. & Yohannes, Y., 2002)
- A more varied diet is associated with a number of improved outcomes in areas such as birthweight, child anthropometric status, improved hemogloblin concentrations, reduced incidence of hypertension, reduced risk of mortality from cardiovascular disease and cancer (Hoddinott, J. & Yohannes, Y., 2002)

Dietary diversity has long been recognized by nutritionists as a key element of a good diet (Ruel, 2002). It is not surprising that eating a large variety of food within major food groups is recommended in most dietary guidelines since it is associated with a number of improved health outcomes (Ajani, 2010). The rationale for measuring and addressing dietary diversity in developing countries stems from a concern related to nutrient deficiency and the recognition of the importance of increasing food and food group variety to ensure adequate nutrition (Ruel, 2002).

In spite of the importance of dietary diversity, there is still lack of consensus about what it really is and what it really reflects (Ruel, 2002). There is lack of uniformity in methods to measure dietary diversity and also in approaches to validate indicators. Dietary diversity typically uses a reference period of 1 to 15 days. This makes comparisons between studies difficult to interpret. Furthermore, the selection of food and good groupings, the consideration of portion size and frequency of intake, and the selection of scoring systems and cutoff points will ensure the validity and reliability of the dietary diversity indicator (Ruel, 2002).

In light of the need to build consensus on household food access impact indicators, the Household Dietary Diversity Scale (HDDS) was developed through USAID's Food and Nutritional Technical Assistance Project (FANTA). The HDDS is a proxy measure of the socio-economic level

of the household versus the individual dietary diversity score (IDDS) which is a proxy measure of the nutritional quality of an individual's diet (Bilinsky, 2006). The differences in the list of food groups used to construct the HDDS and IDDS reflect these different objectives (Bilinsky, 2006).

One unique strength of the HDDS method is that the results can be validated using the doubly labeled water method which measures energy expenditure (FAO, 2005). Large-scale individual dietary intake surveys may not be the best way to monitor trends of food security across time because of costs and logistical difficulties (FAO, 2005). Hence, HDDS is a useful validation tool for other food security measurement approaches that are routinely used (FAO, 2005).

Sometime studies have shown than fat and carbohydrate intakes are under-reported to a greater extent than protein (FAO, 2005) while fish and other non-staple foods consumed in small quantities may be missed in surveys (FAO, 2005). Another limitation of HDDS can result from survey methods, as foods consumed outside the home that were not prepared in the home should not be included in HDDS (Ballard et al, 2011). This may result in an underestimation of the dietary diversity of households (Ballard et al, 2011). Underreporting is common in dietary assessment surveys, a potentially significant source of error (FAO, 2005). One should be cautious about drawing conclusions about micronutrient intake and deficiency from the HDDS (Mason, 2002).

Headey and Ecker (2013) conclude that dietary diversity indicators are the best performing class of indicators: they are powerful predicators of economic status and malnutrition (both stunting and wasting), sensitive to shocks, and relatively inexpensive to measure.

Anthropometry

Anthropometry is the use of human body measurements for the purpose of obtaining information about nutritional status (FAO, 2005). Anthropometry is used to assess and predict

performance, health and survival of individuals and reflect the economic and social well-being of populations. Advantages of the anthropometry method include simple, safe, and non-invasive techniques; inexpensive; relatively unskilled personnel can perform measurement procedures; suitable for large sample sizes; able to be used to quantify the degree of undernutrition or overnutrition and provide a continuum of assessment from under-to overnutrition (Shetty, 2003).

However, the anthropology method also has its weaknesses. Anthropometry techniques are prone to measurement and other types of error, both systematic and random. Other disadvantages include the inability to distinguish the effect of specific nutrient deficiencies, the inability to pinpoint the principal causality of undernutrition, the relative higher costs and organization required to obtain representative and quality data to estimate numbers of undernourished, and the relative insensitivity to detect changes in nutritional status following inadequacy of food over short periods of time (Shetty, 2003). There is some debate as to whether undernutrition is an adequate measure of food insecurity as poor anthropometric results, particularly stunting, reflects a past history of undernutrition rather than a current problem (FAO, 2005). Anthropometric indicators are status indicators and therefore do not indicate changes in the nutritional status of populations (FAO, 2005). Additionally, acceptable anthropometric results are not necessarily indicative of adequate food security as risk levels may be high (FAO, 2005). The relationship between anthropometric and dietary energy inadequacy is not symmetric (Mason, 2002). Anthropometry concerns more than just dietary energy, but also encompasses other elements of food, such as micronutrients and protein (Osmani, 2002). Even in the presence of adequate food supply, food intake can be low due to sickness affecting appetite (Mason, 2002). Anthropometry tries to measure the prevalence of malnutrition defined as impairment of physical and cognitive functions resulting from

inadequate nourishment (Osmani, 2002). While nourishment of cells depend crucially on food, anthropometry can be said to measure of food deprivation (Osmani, 2002). However, the other four methods measure deprivation at the "intake level", whereas anthropometry measures deprivation at the "cellular level", the level at which the food is actually absorbed by the body (Osmani, 2002).

Anthropometry can be used to measure wasting (acute malnutrition), stunting (chronic malnutrition), and underweight (acute and/or chronic). Wasting for example is useful for screening children at risk and is useful when exact ages are difficult to determine (Cogill, 2003). Wasting is measured using weight-for-height or weight-for-length. Wasting is the result of a weight falling considerably below the weight expected of a child of the same length or height. Wasting indicates current or acute malnutrition as a result of failure to gain weight or weight loss. Causes include inadequate food intake, incorrect feeding practices, diseases, infection, or a combination of factors. Wasting in children can change rapidly and shows marked seasonal patterns associated with changes in food availability or disease prevalence to which it is very sensitive (Cogill, 2003). Weight-for-height/length is expressed using Z scores (standard deviations from the reference median). The WHO Reference Standards are used as a comparison (Cogill, 2003). These references standards are the most commonly used and recommended for international use by the World Health Organization (WHO, 2006).

Qualitative Measures of Food Security

Academics and practitioners have recently gained momentum in their search for cost-effective and scientifically valid measures of household food insecurity, moving away from indicators such as income and consumption and moving toward more direct measures that are intended to capture the household's reported experience (Coates, 2006). The current generation of

indicators analyzes respondents experiences through responses to validated survey items that are transformed into a scale . These advancements have the potential to close the concept-to-measurement gaps that plague attempts to understand and quantify the “access” dimension of household food insecurity (Coates, 2006).

The qualitative method is concerned with people’s perceptions surrounding food deprivation, of which energy inadequacy is just one aspect (Osmani, 2002). Interviewers ask questions around an alteration in food type consumption, the physical sensation of hunger or weight loss, the experience of running out of food without money to obtain more, and the perception that food consumed was of inadequate quality or quantity (FAO, 2005). Due to the highly context-specific and linguistically dependent nature of qualitative methods it may never be feasible to develop a universal measure to capture the levels of severity in food insecurity across diverse regions and peoples (FAO, 2005). Any qualitative evaluation of people’s perception of deprivation is influenced by their relative position in society (Osmani, 2002). In cases where energy intake is adequate and people do not feel the pangs of hunger, they may still suffer from an acute sense of food deprivation if what they eat is of inferior quality and quantity relative to the average standard in their society (Osmani, 2002). Still, the qualitative method measures important aspects of food security (Osmani, 2002).

Household Hunger Scale (HHS)

The household hunger scale (HHS) is a household food deprivation scale for cross-cultural use, adapted from the United States household food security survey model for use in developing country context, as well as from the Household Food Insecurity Access Scale (HFIAS) for cross-cultural use (Ballard et al, 2011). This differentiates the HHS from most indicators of household food insecurity, because the HHS was intentionally developed and validated for cross-cultural

use (Deitchler et al, 2011). This means that HHS results from one food insecure context can be directly and meaningfully compared to HHS results from another food insecure context (Deitchler et al, 2011). The approach used by the HHS is based on the concept that the experience of household food deprivation causes behaviors that can be captured through a survey and summarized in a scale (Ballard et al, 2011). This approach, sometimes referred to as an "experimental" or "perception-based" methods of collecting data, was first popularized in the mid-1990s, when the United States Department of Agriculture (USDA) adopted the approach for regular measurement of household food insecurity in the United States (Ballard et al, 2011). Since then, the approach has been more extensively adopted by other food insecurity measurement tools, including the HFIAS (Ballard et al, 2011).

The HHS is most appropriate to use in areas of substantial food insecurity (Ballard et al, 2011). The HHS focuses on the food quantity dimension of food access and does not measure dietary quality (Ballard et al, 2011). It is a household level indicator (Ballard et al, 2011). The HHS questions are directed to the person in the household who is most involved with the food preparation and meals (Ballard et al, 2011).

USDA Household Food Security Scale

The U.S. Department of Agriculture (USDA) Household Food Security Scale measures the degree of severity of food insecurity experienced by a household in a single numerical values (USDA, 2000). The scale fundamentally uses a scale which depends on the number of increasingly severe indications of food security that the household has experienced, as indicated by affirmative responses to the increasingly severe sequence of survey questions (USDA, 2000). There are a number of limitations in the USDA indicator. The measure reflects the household's situation over the 12 months before the interview, failing to capture present levels of food

security (USDA, 2000). The scale is reliable for describing the status of a population, but has not been proven reliable for assessing the status of an individual household (USDA, 2000). The main limitation of this indicator, in relation to the applicability with the LSMS-ISA or other study in Nigeria, is that the USDA food security measure has been developed for households in the United States only (USDA, 2000). The USDA Household Food Security Scale was not used to analyze the LSMS-ISA data in this study.

The Household Food Insecurity Access Scale

HFIAS was developed by USAID's Food and Nutrition Technical Assistance Project (FANTA) (Coates, 2007). The HFIAS is an adaption of the approach used to estimate the prevalence of food insecurity in the U.S. annually (Coates, 2007). The method is based on the concept that the experience of food insecurity (access) causes predictable reactions and responses that can be capture and quantified through a scale and summarized in a scale (Coates, 2007). FANTA identified a set of nine questions that have been used in several countries and appear to distinguish the food secure from the insecure households across different cultural contexts (Coates, 2007). With a recall period of 30 days, each respondent is asked a list of questions – first an occurrence question, that is whether the condition happened at all in the past four weeks (yes or no) (Coates, 2007). If the respondent answers "yes" to an occurrence question, a frequency-of-occurrence question is asked to determine whether the condition happened rarely (once or twice), sometimes (three to ten times), or often (more than ten times) in the past 30 days (Coates, 2007).

Freedom From Hunger Measuring Food Security Scale

An example of an indicator with of limited evidence-base is the Freedom from Hunger (FFH) Measuring Food Security scale does not have sufficient literature to support its strength in

measuring food security. The indicator was adapted from the USDA Household Food Security Survey Module, which originally served as a measure food security levels in migrant populations in the United States. The seventeen question FFH indicator uses a 17-question, 10-15 minute, survey to measure "access" to food. While FFH has conducted research to determine whether the indicator can act as a reliable proxy measure of daily expenditure, it has not been found to be reliable (FFH).

Other Measures

The Months of Adequate Household Food Provisioning (MAHFP) indicator was developed by FANTA in 2010. It is a relatively new measure, and does not fit nicely into one of the five categories above.

Months of Adequate Household Food Provisioning

As a household manages its resources over the course of a year, the ability to meet its food may vary due to a number of factors, such as inadequate crop production by the households due to poor soil or shortage of labor, loss or decrease in income sources such as employment, social obligations or natural disaster (Bilinsky, 2010). Over time, the Months of Adequate Household Food Provisioning for Measurement of Household Food Access (MAHFP) indicator can capture changes in households' inability to address vulnerability in such a way as to ensure that food is available above a minimum level all year round (Bilinsky, 2010). The USAID Office of Food for Peace (FFP) identified the need to build consensus on household food access impact indicators, hence MAHFP was developed (Bilinsky, 2010). The MAHFP is a proxy measures of household food access (Bilinsky, 2010). As MAHFP is a recently developed indicator of food security, literature assessing the accuracy and utility of the indicator.

The Surplus/Shortfall Indicator

The surplus/shortfall measure at the aggregate level, the extent to which households are below or above the food security line (Okwoche and Asogwa, 2012). The surplus/shortfall measure is defined as:

$$p = \frac{1}{M}\sum_{j-1}^{m} Gj$$

Where Gj = (Xj – I), I is the deficiency or surplus faced by household j, Xj is the average daily calorie available to the jth household, while M is the number of households that are food secure (for surplus index) or food insecure (for shortfall index) (Okwoche and Asogwa, 2012). It is unclear where this information is derived from – whether balance sheets, income/expenditure data, qualitative indices – based on the current literature. A number of studies of food security in Nigeria used a "surplus/shortfall" index and described the equation in the methodology but not the source of this information, impacts which measurement method category it belongs under. This method has not been rigorously evaluated by experts in order to ascertain its strengths and weaknesses.

LSMS-ISA

Recognizing the agricultural data in Africa suffers from inconsistent investment, institutional and sectoral isolation, and methodological weaknesses, the LSMS-ISA project collaborates with national statistic offices to design and implement systems of multi-topic, national representative panel household surveys with a strong focus on agriculture (World Bank, 2012). The study is underway in seven countries: Nigeria, Malawi, Niger, Ethiopia, Tanzania, Uganda and Malawi

(World Bank, 2012). The frequency of data collection is determined on a country-by-country basis, depending on data demand and funding (World Bank, 2012).

The Living Standards Measurement Study – Integrated Surveys on Agriculture (LSMS-ISA) General Household Survey (GHS-Panel) was funded by the Bill and Melinda Gates Foundation, implemented by the World Bank, and fielded by the Nigeria National Bureau of Statistics (NBS) in 2010-2011. The GHS survey is a cross-sectional survey of 22,000 households carried out annually throughout Nigeria. The panel component applies to 5,000 households of the GHS collection (World Bank, 2012). The household sample size for both the north east and north west zones is 1,690 (north east zone = 797 and north west zone = 893).

The first wave of the GHS was carried out in two visits to the Panel households (post-planting visit in August-October 2010 and post-harvest visit in February-April 2011) and one visit to the full cross-section (in parallel with the post-harvest visit to the panel). The survey covered a wide range of socio-economic topics which were collected via three different questionnaires administered to the household and the community. These are the Household Questionnaire, the Agricultural Questionnaire, and the Community Questionnaire (World Bank, 2012). Due to the scope of this study and limited resources available, this analysis only focused on the Post-Harvest Household Questionnaire which can be found at the World Bank site at: http://siteresources.worldbank.org/INTSURAGRI/Resources/7420178-1294154315467/GHS_PANEL_HOUSEHOLD_POST_HARVEST_FINAL.pdf

It is important to note the timing of the surveys, 93.7% of interviews were completed in March 2011, with 3.1% in April 2011, 2.7% in February 2011, and the remaining in January, May, June, August, September, October, and December 2011.

The household questionnaire collected detailed socioeconomic information, including consumption expenditures, and other dimensions of well-being such as education, health, non-farm employment, and income. The agriculture questionnaire collected information on smallholder farming, such as estimation of land areas, labor and non-labor input use and expenditures, and production figures for main crops. The community questionnaire collected a wide range of information on community characteristics, including physical infrastructure, access to public services, economic activities, organization and governance, and local retail prices information for essential goods and services.

The sample is designed to be representative of Nigeria on a national and zonal level. The sample size of the GHS-Panel was not designed for state-level estimates, which is why state-level data were not analyzed. The sample is a two-stage probability sample. The first stage used Enumeration Areas (EAs) as Primary Sampling Units (PSUs). The second stage was the selection of households (World Bank, 2012).

Data were collected by teams consisting of a supervisor, between 2 to 4 interviewers and a data entry operator (World Bank, 2012). The number of teams varied from state to state, based on the sample size or number of EAs selected (World Bank, 2012). The teams moved in a “roving manner” and data collection lasted 20-30 days for each of the post-planting and post-harvest visits (World Bank, 2012).

The survey implementers used a concurrent data entry approach. The fieldwork and data entry were managed by each team assigned to the state. Immediately after the data were collected in the field by the interviewers, the questionnaires were collected, checked, and documented by the supervisor, then passed to the data entry operator. After questionnaires were entered, the data entry operator generated an error report which reported issues including out of range

values and other data inconsistencies. The supervisor then checked the reports, determined what should be corrected, and then decided if the field team needed to revisit the household. CSPro software was used for the data entry (World Bank, 2012).

Four specific indicators were used the analysis of the LSMS-ISA Household Post-Harvest Nigeria dataset (2010-2011): Expenditure; Household Hunger Scale (HHS); Months of Adequate Household Food Provisioning (MAHFP); and Household Dietary Diversity Scale (HDDS). The measurements of food security which were applied to the LSMS-ISA data are described in greater detail above in the literature review, as well as in the methods section. There are a number of commonly used indicators which were not or could not be applied to the data in this analysis which could have been useful for assessing food security in Northern Nigeria including the Household Food Insecurity Access Scale (HFIAS), Surplus/Shortfall index, and anthropometry indicators, such as wasting.

The LSMS-ISA project aims to foster innovation and efficiency in statistical research on agriculture, poverty, and food security in the region. Due to the large-scale and wide-scope of topics covered, LSMS-ISA presents an incredible opportunity to this. There are few other surveys of this size, and possibly no other surveys which delve this deeply into agricultural issues. The analysis presented here barely skims the surface of the analysis possibilities of the LSMS-ISA. It is feasible to study a wide array of topics such as social networks, access to infrastructure, farming practices, livestock, land holding, to migration. There are currently very few publications which use the LSMS-ISA data. However, greater analysis of the LSMS-ISA datasets could have profound implications for decision-making, policy, and interventions.

Scope of the Problem in Nigeria

There have been a number of studies which have used the various methods mentioned above to analyze food security in Nigeria specifically. Given, the complexities of measuring food security mentioned above, the various methods of quantifying food security and the results of these studies must be critically analyzed. The table below summarizes (in reverse chronological order) studies which have analyzed the prevalence of food insecurity in Nigeria.

Table #1: Food Security in Nigeria Literature Review Summary Table

Study	Location	Sample Size	Food Security Indicator	HH Food Security
Omuemu, V., Otasowie, E., & Onyiriuka, U. (2012).	Egor LGA, Edo State, south south Nigeria	416 households	Household Food Insecurity Access Scale (HFIAS)	38.2% food secure, 7.9% mildly food insecure, 12.8% moderately food insecure, and 41.1% severely food insecure
Obayelu, E. (2012, May).	Kwara and Kogi states, north central Nigeria	396 households	Adapted US Department of Agriculture (USDA) Household Food Security Survey	In rural areas: 15.6% food secure in Kogi State, 11.1% in Kwara State In urban areas: 20.7% food secure in Kogi State, 17.1% in Kwara State
Ibeanu, V., Onuoha, N., Ezeugwu, E., & Ayogu, R. (2010, May 2).	Eha-Alumona and Opi-Uno in Nsukka, Enugu State, south east Nigeria	200 households	Household food security/insecurity based on availability of preserved foods after preservation of post-harvest surpluses	64% food secure vs. 36% food insecure
Ibrahim, H., Uba-Eze N.R., Oyewole S.O., & Onuk E.G.	Gwagwalada Area Council, Federal Capital Territory Nigeria	120 households	Adapted Freedom From Hunger (FFH) food security scale	70% food secure or moderately food secure vs. 30% food

(2009).				insecure
Ibrahim, H., Bello M., & Ibrahim H. (2009).	Nasarawa State, north central Nigeria	180 households	Undernourished (based on recommended daily per capita calorie intake of 2470 kcal)	58.9% undernourished
Lawal, A., Omotesho, A., & Ibrahim, H. (2008).	Giwa area, north central Nigeria	87 households	FAO undernourished measure and surplus/shortfall index	66% adequately nourished vs. 34% undernourished
Babatunde, R.O., Omotesho, O.A., & Sholotan, O.S. (2007).	Kwara State, north central Nigeria	94 households	FAO undernourished measure (based on recommended daily per capita calorie intake of 2470 kcal) and shortfall/surplus index	62% undernourished, 27.2% adequately nourished
Omonoma, B.T. & Agoi, G.A. (2007).	Kosofe local government area of Lagos State, north west Nigeria	165 households	Expenditure index (per capita monthly food expenditure falls above/below to two-third of the mean per capita food expenditure)	49% above expenditure index
Ajani, S.R., Adebukola, B.C., & Oyindamola, Y.B. (2006).	LGAs of Lagos and Ibadan, north west Nigeria	482 households	USDA 18-Question Household Food Security Questionnaire Module	25.9% food secure vs. 41.3% "food insecure without hunger"
Oluyole, K. (2001).	Ondo and Kwara states of Nigeria	200 cocoa farming households	FAO nourishment index and surplus/shortfall index	44.0% of households adequately nourished, 56.0% of households undernourished

The sample sizes in these ten studies range from 87 to 416 households. Four studies focus on households in urban areas (Ajani et al (2006), Omonoma et al (2007), Ibrahim et al (2009), Omuemu et al (2009)), one study analyzes food security in both urban and rural households (Lawal et al (2008)), and the remaining six studies focus on rural areas (Obayelu (2012), Obayelu (2012), Ibeanu et al (2010), Ibrahim (2009), Babatunde et al (2007), Ajani et al (2006)). Informants in all the studies were head of households or the household member in charge of

purchase and preparation of meals. The studies analyze food security using different indicators and therefore define food insecurity categories differently, with some studies using dichotomous categories (food secure and food insecure) and other studies dividing the categories further (such as mild, moderate, and severe food insecurity).

The Omuemu et al (2012) study focused on food security in an urban community in Egor Local Government Area (LGA) in Edo State in Southern Nigeria. The cross-sectional, descriptive study used a multi-stage sampling method. The interviewer-administered questionnaire included the Household Food Insecurity Access Scale (HFIAS) for a measurement of food access security (Omuemu et al, 2012). 416 households were studied, with 38.2 percent categorized as food secure, 7.9 percent mildly food insecure, 12.8 percent moderately food insecure, and 41.1 percent were severely food insecure security (Omuemu et al, 2012). Multiple regression analysis showed that higher educational status [adjusted OR = 2.68 (95% CI = 1.26 to 4.38), P = 0.004] and higher household income [adjusted OR = 10.89 (95% CI = 3.36 to 81.50), P = 0.0001] were significantly associated with food security.

Obayelu (2012) analyzed the socioeconomic and demographic characteristics of household heads and classified them by food security status in Kwara and Kogi states of north central Nigeria. Household level data came from a cross-sectional survey (November 2006 – February 2007) with a multi-stage sampling procedure (Obayelu, 2012). An 18-item household food security questionnaire, adapted from the USDA household food security survey was administered with 3 items that ask about experiences of the entire household, 7 items asking about experiences and behaviors of the adults as a group or individually, and 8 items which as about experiences and conditions of children in the household as a group (Obayelu, 2012). Differences exist between households' food security status in the rural and urban areas of two

states analyzed (Obayelu, 2012). In rural areas, Kogi State was 15.6% classified as food secure vs. 11.1% in Kwara state (Obayelu, 2012). In urban areas, 20.7% of household heads were food secure in Kogi State compared to 17.1% in Kwara state (Obayelu, 2012). Children in both states were found to be more food insecure than adults (Obayelu, 2012).

Ibeanu et al (2010) sought to determine whether there was a relationship between preservation of post-harvest surpluses and food security at the rural household level in Eha-Alumona and Opi-Uno in Nsukka, Enugu State of the south east region of Nigeria. These two rural communities both have farming as their main occupation (Ibeanu et al, 2010). Interviews and questionnaires were used to gather information on socio-economic characteristics, foods preserved and methods of preservation, problems encountered, and the effect of preservation on food security and descriptive statistics were used to analyze the data (Ibeanu et al, 2010). Sixty-four percent of households were determined to be food secure, based on preservation of post-harvest surpluses) versus 36 percent which did not have enough food because of spoilage and rodent/insect attack (Ibeanu et al, 2010). Additionally, the authors found that 17 percent of the households in the population depended completely on family food production (Ibeanu et al, 2010). One hundred percent of households stored palm oil in bottles or jars, 90 percent of households preserved foods by sun-drying (mostly cereal, legumes, vegetables, and roots/tubers), and 87.5 percent of households smoked meat and/or fish. About 62 percent of households consumed their preserved foods, 19 percent sold their preserved foods, and 19.4 percent did a combination of selling and consuming (Ibeanu et al, 2010).

Ibrahim et al (2009) designed a study to assess the state of food security among urban households in Gwagwalada Area Council of the Federal Capital Territory of Nigeria. Data were analyzed using simple descriptive statistics and a food security scale adapted from Freedom

From Hunger's (FFH) scale. FFH's scale incorporates 17 items that account for a maximum scale score of 9 points. The Ibrahim et al (2009) study incudes only 12 questions, which are used to categorize household food security status into 3 groups (food secure, moderate food secure, non-food secure). The authors found that 70 percent of urban households in the study area are food secure or moderately food secure, while 30 percent are food insecure (Ibrahim et al, 2009).

The main objective of the Ibrahim et al (2009) study was to determine the food security of farming households, as well as an optimal farm plan to guide for resource allocation (such as land, labor, fertilizer, seed, and insecticides) by farmers to enhance their food security status in Nasarawa State in the north central zone (Ibrahim et al, 2009). For data analysis, the FAO method for measuring percent undernourished (based on recommended daily per capita calorie intake of 2470 kcal) was used (Ibrahim et al, 2009). Through this method, the researchers found that 58.9 percent of households were undernourished (Ibrahim et al, 2009).

Lawal et al (2008) studied the extent of food security and determinants in the arid and semi-arid Giwa area of the north central zone of Nigeria. The FAO food security index was used to determine percent undernourished (Lawal et al, 2008). The analysis revealed that the majority of households in the study are adequately nourished, compared with 34.48 percent undernourished (Lawal et al, 2008).

Babatunde et al (2007) examined the socio-economic characteristics and determinants of the food security status of rural farming households in Kwara State of Nigeria, in the north central zone. Based on the FAO undernourished measure, the study found that 64 percent of households were undernourished (Babatunde et al, 2007). Using the Shortfall/Surplus index, authors found that food insecure households fell short of the recommended calorie intake by 38 percent (Babatunde et al, 2007).

Omonomo et al (2007) presented the food security situation among urban households in the Kosofe local government area of Lagos State, Nigeria. Primary data were collected using a structured questionnaire from 165 randomly selected households in 7 communities (Omonomo et al, 2007). In this study, a food secure household was defined by those whose per capita monthly food expenditure falls above or is equal to two-thirds of the mean per capita food expenditure (Omonomo et al, 2007). The authors found 49 percent of households to be above the expenditure index study area (Omonomo et al, 2007).

Ajani et al (2006) designed a study to assess the food security status of households in selected local government areas in two large Nigeria cities (Lagos and Ibadan). The cross-sectional, descriptive study aimed to analyze the food security status of urban households headed or managed by teachers employed in secondary and primary, public and private schools (Ajani et al, 2006). The data were collected using an interviewer-administered USDA 18-Question Household Food Security Questionnaire Module (HHFSS) (Ajani et al, 2006). The results show that the prevalence of food security in the study population was 25.9 percent (41.3 percent "food insecure without hunger"), with Lagos households having significantly higher food security than Ibadan households (28 percent vs. 23.7 percent) (Ajani et al, 2006).

The study by Oluwole examined the food security status of cocoa farming households in Ondo and Kwara states in Southwestern Nigeria (2011). The FAO Index for nourishment and surplus/shortfall index were used to for measurement (Oluwole, 2011). The author found that only 44 percent of households were able to meet the recommended calorie intake of 2450 kilocalories per capita per day using FAO methods (Oluwole, 2011).

Summary of Current Problem and Study Relevance

As described in the measurements section, food security measurement is very complex. No study is able to perfectly measure food security in any population. The current body of literature on food security in Nigeria is limited for a number of reasons. The current body of literature on household food security in Nigeria focus specifically on certain regional areas which tend to be relatively small (such as a state or zone) and does not give a full-view of the food security situation in Nigeria. Furthermore, much of the literature is limited by only food security indices which have not been verified for cross-cultural use such as the HFIAS or USDA measure, as well as recall bias and response bias (for income and food security indicators). Additionally, questionable survey methods, such as using outdated or adapted food security indices (as in the Obayelu et al (2012) and Ibrahim et al (2009) studies) also weaken the literature.

The literature on food security in Nigeria is modest, in particular in the Northern region. No articles in the literature review specifically focused on the north east or north west zones of Nigeria. As stated above, the northern region of Nigeria has different characteristics than the south, including but not limited to climate, culture, religion, terrain, etc.

The literature which exists on food security in Nigeria is limited, especially for the Northern Nigeria, and many studies use measures of food security which, as described above, have a variety of limitations, as well as strengths. Hence, the purpose of this study, analyzing household food security in Northern Nigeria, is to expand on current knowledge and literature. The analysis below is a first step to better understand the food security households. Furthermore, this analysis hopes to promote further discussion and aid in informing further research, policy, and programming in the region, particularly surrounding survey and measurement methods.

Chapter 3: Methods

Introduction

A secondary analysis of a subset of the LSMS-ISA primary dataset for Nigeria was completed to determine the status of food security in Northern Nigeria (the north east and north west zones only). Four specific indicators were used the analysis of the LSMS-ISA Household Post-Harvest Nigeria dataset (2010-2011): Expenditure; Household Hunger; Months of Adequate Household Food Provisioning (MAHFP); and Household Dietary Diversity. The measurements of food security which were applied to the LSMS-ISA data are described in greater detail below.

Population and Sample

LSMS-ISA data, collected between 2010 and 2011, were analyzed from 1,690 households for Northern Nigeria and 5,000 households in all of Nigeria.

In this study a household was defined as a social unit consisting of one or more persons who use joint accommodation and food. A household is a group of persons who typically live in the same household unit ("live under the same roof"), who are or are not related and who eat together ("eat from the same pot") (NBS, 2011). Household members are anyone who meets the following criteria:

- A household member is present at the moment of interview, if that is the place where he/she spent at least six months of the previous twelve months. The household head should be listed as a member even if they did not spend six of the previous twelve months at the household.
- Person absent at the moment of the interview, if he/she is absent less than six months during the previous twelve months.

- Guests or other persons who live in the households longer than six months during the previous twelve months.
- Guests or other persons who live in the households longer than six months during the previous twelve months.
- Newborn babies, irrespective of duration of stay in the household.
- Students who are absent longer than six months but are supported by household members.

When discussing Northern Nigeria, this study means the north east and north west zones of Nigeria. Does not include federal capital territory, north central, south east, south south, or south west zones. All states of the north east and north west zones are used in the analysis including Adamawa, Bauchi, Borno, Gombe, Jigawa, Kaduna, Kano, Katsina, Kebbi, Sokoto, Taraba, Yobe, and Zamfara.

Procedures

All data were analyzed using IBM SPSS Statistics 20, after converting the original files from STATA format. Only data from the 2010-2011 LSMS-ISA Post-Harvest Household cross-sectional survey were used. Multiple datasets from the LSMS-ISA Post-Harvest Household dataset (2010-2011) were merged including section A (basic information questionnaire including zone), section 12 (household food security questionnaire), annual spreadsheet (tabulated expenditure), section 1 (household roster), section 4B (health), and section 10B (food consumption).

The following indices (some adapted due to differences in questionnaire design and indicators, explained below) were used to analyze the data:

Expenditure

Expenditure refers to all goods and services for the use of the household. It also includes all monetary transactions, such as donations and savings. The consumption aggregates were computed by LSMS-ISA from the expenditure sections of the questionnaire for general food and non-food expenditures. The datasets used to compute the aggregate data include: sect8_harvestw1 (housing expenditure); sect2a_harvestw1 and sect2b_harvestw2 (education); sect10a_harvestw1 (meals away from home expenditure); sect10b_harvestw1 (food consumption expenditure); sect11a_harvestw1, sect11b_harvestw1, sect11c_harvestw1, sect11d_harvestw1, and sect11e_harvestw1 (non-food expenditure).

All expenditure data were converted to USD by multiplying by 0.00630318, the exchange rate on March 18, 2013 of 1 Nigerian Naira to 0.00630318 US Dollars. The original data were in Nigerian Naira. Means and standard deviations were calculated using SPSS. To compute the percentage of non-food and food expenditure on total expenditure, the means of non-food and food expenditure were divided by the total amount of expenditure.

Household Hunger

The Household Hunger Scale (HHS) recommended by the FANTA project was adapted to fit the LSMS-ISA. In addition to analyzing hunger through the analysis of three hunger terciles (little to no hunger, moderate hunger, severe hunger), the frequency was computed for each of the three HHS questions. The HHS analyzes three questions to qualitatively assess hunger:

In the past [time period], was there ever no food to eat of any kind in your house because of lack of resources to get food?

a. How often did this happen in the past [time period]?

2. In the past [time period], did you or any household member go to sleep at night hungry because there was not enough food?
    a. How often did this happen in the past [time period]?
3. In the past [time period], did you or any household member go a whole day without eating anything at all because there was not enough food?
    a. How often did this happen in the past [time period]?

(Ballard, 2011).

The HHS typically uses a 30 day recall period (Ballard et al, 2011). However, the LSMS-ISA questionnaire uses a recall period of 7 days. The LSMS-ISA responses were recoded so that:

HHS Categories	LSMS-ISA Categories	Coded
Rarely (0-2 times in past 30 days)	Never to Rarely (0 days in past 7 days)	0
Sometimes (3-10 times in past 30 days)	Sometimes (1 days in past 7 days)	1
Often (more than 10 times in the past 30 days)	Often (1+ days in past 7 days)	2

To tabulate the categorical Household Hunger Scale indicator, the values for the responses are summed for each household, then a categorical indicator is created for the summed values (Ballard, 2011):

0-1 = little to no hunger in the household

2-3 = moderate hunger in the household

4-6 = severe hunger in the household

Months of Adequate Household Food Provisioning for Measurement of Household Food Access (MAHFP)

MAHFP asks: “Were there months, in the past 12 months, in which you did not have enough food to meet your family’s needs? If yes, which months?”

To calculate the MAHFP Indicator for each household: Twelve months minus the total number of months out of the previous 12 months that the household was unable to meet their food needs. Values for each month (represented by A through L) are either "0" or "1." If a household is food secure all months of the year, the MAHFP per household = 12. If the household is unable to meet its food needs every month, the MAHFP per household = 0.

MAHFP per Household = (12) – Sum (A + B + C + D + E + F + G + H + I + J + K + L)

Next, an average for all the households in the sample is calculated (Bilinsky, 2010). The denominator includes all households interviewed, even those who did not experience any months of inadequate household food provisioning (Bilinsky, 2010).

Average MAHFP = Sum of the MAHFP for all households in the sample / total number of households (Bilinsky, 2010).

Household Dietary Diversity

Household dietary diversity is the number of different food groups consumed over a given reference period (Bilinsky, 2006). To reflect a quality diet, the number of different food groups consumed is calculated, not the number of different foods (Bilinsky, 2006). The following set of 12 food groups is used to calculate the HDDS (Bilinsky, 2006):

1) Cereals
2) Roots and tubers
3) Vegetables
4) Fruits
5) Meats, poultry, offal
6) Eggs

7) Fish and seafood

8) Pulses/legumes/nuts

9) Milk and milk products

10) Oil/fats

11) Sugar/honey

12) Miscellaneous

The USAID Food and Nutrition Technical Assistance Project (FANTA), recommends using intake data to calculate HDDS. However, in this study household dietary diversity was calculated from the food expenditure section (Section 10B) of the LSMS-ISA. While the food groups were not represented exactly the same as in the LSMS-ISA (for example eggs were not separate from chicken, and chicken products were not part of the meat category), the data were recoded to match the categories suggested for use by the HDDS indicator.

Information on household food consumption should be collected using the previous 24-hours as a reference period (Bilinsky, 2006). The LSMS-ISA uses a 7-day recall period. Longer reference periods result in less accurate information due to imperfect recall (Bilinsky, 2006). However, in settings where household food consumption is not very diverse, recall capability is typically longer (Bilinsky, 2006). This may create a number of biases which are mentioned in the discussion section.

The tabulation of the HDDS was calculated using IBM SPSS Statistics 20. The value of this variable ranges from 0 to 12. The values for each food group (represented by letters A through L) will either be “0” for no or “1” for yes. The HDDS equals the total number of food groups consumed by members of the household, therefore the sum was calculated by adding A through L (A + B + C + D + E + F + G + H + I + J + K + L). Second, the mean HDDS indicator was calculated

for the sample population by dividing the sum (HDDS) by the total number of households (Bilinsky, 2006).

Limitations and Delimitations

The GHS-Panel Survey data are subject to measurement problems. The LSMS-ISA project integrated new technology, such as GPS technology to map households and measure agricultural plot areas, into all aspects of data collection. The project also supports the development and use of Computer Assisted Personal Interview (CAPI) platforms to replace paper questionnaires with electronic interviewing, for the purpose of improving the quality and timeliness of collected data. One limitation of a panel of sample households is that they suffer from attrition over time as some households move, split or cease to exist.

There were a number of limitations as a result of the LSMS-ISA design. In addition to being required to adjust the recommended measurements of food security to work with the LSMS-ISA, there were a number of indicators were not able to be used. Four specific indicators were used the analysis of the LSMS-ISA Household Post-Harvest Nigeria dataset (2010-2011): Expenditure; Household Hunger; Months of Adequate Household Food Provisioning (MAHFP); and Household Dietary Diversity. However, it was not possible to simply apply anthropometric methods or the Household Food Insecurity Access Scale (HFIAS) to this data. The author attempted to calculate wasting and was unable to do so due to the lack of exact ages of children under five. Another example of limitations of the LSMS-ISA is that the survey did not ask the necessary questions to calculate Household Food Insecurity Access Scale (HFIAS) (Coates et al, 2007). While the LSMS-ISA provides ample opportunity for interesting analysis, it has a number of shortcomings that do not allow for a full analysis of food security. While agriculture is the main focus of the LSMS-ISA

project, food security is clearly an important component but was not adequately addressed in the questionnaire and survey design.

Due the specific adaptations necessary to apply the indicators to the LSMS-ISA data, a number of limitations and delimitations arise, in particular with the HHS and HDDS reference periods. Contacting the World Bank LSMS-ISA project in an attempt to garner a better understanding of the survey design of the food security portion of the Nigeria dataset did not yield results. The design and choices to use certain reference periods or omit certain questions was simply brushed off as being a complicated process, without justification for the decisions made.

The HHS uses a 30 day recall period. However, the LSMS-ISA questionnaire uses a recall period of 7 days. This had to be adjusted for in the analysis as explained in the methods section. Longer recall periods pose a risk of measurement bias due to the issues with accurate recall period over an extended period of time, yet a shorter recall period may not capture the full extent of the deprivation experience, since fluctuations of food accessibility are common within a month (Ballard et al, 2011).

The LSMS-ISA uses a 7-day recall period, instead of the 24 hour recall period typically used to calculate the Household Dietary Diversity Score (HDDS). Longer reference periods result in less accurate information due to imperfect recall. However, in settings where household food consumption is not very diverse, recall capability is typically longer. If the survey was taken within seven days of a special occasion such as a funeral or feast, or if most household members were absent, data may be inaccurate resulting in an erroneous HDDS (Ballard et al, 2011).

The LSMS-ISA recorded HDDS response questions as “yes” or “no”, but rather as “yes” or “missing value” which does not allow for missing values to be properly calculated and separated from those who answered “no” to not having eaten a certain food. This may result in a greater

number of households having eaten less diverse diets, when in actuality some of them may not have responded to the survey question.

These indicators do not capture social-cultural issues surrounding food security. For example, the indicators used do not describe intra-household food allocation which could perhaps capture whether food was allocated based on the age or sex of the person.

Chapter 4: Results

Introduction

The results of this data analysis provide a recent (2010-2011), though somewhat limited, picture of food security in Northern Nigerian households. The results are presented below through the use of four different food security indicators: expenditure; Household Hunger Scale (HHS); Months of Adequate Household Food Provisioning (MAHFP); and Household Dietary Diversity Scale (HDDS). A descriptive analysis of the population for Northern Nigeria and Nigeria as a whole is firstly presented in the findings.

Population Description

In the north east and north west zones of Nigeria, the population is 51.4% are male vs. 48.6% female, compared to 49.9% male and 50.1% female in all of Nigeria. The large majority (92.2%) of individuals in the north identified as Islamic with 7.7% reporting as Christian. In Nigeria as a whole, 61.7% of people reported their religion as Islam and 37.9% reported Christianity. Rural households comprise 81.8% of households vs. 18.2% of households located in urban areas in the north, whereas in all of Nigeria rural households make up 68.3% of the population and urban households 31.7%. The average household size in Northern Nigeria is 6.89 people (SD = 3.42). The average household size in all of Nigeria is smaller at 5.78 people (SD= 3.16%). The household size ranges from 1 to 31 persons. The average age (in completed years) of people in Northern Nigeria is 20.36 (SD=18.58) with a range of 0 to 120 (n=11,406). The average age in all of Nigeria is a little higher at 23.9 (SD=26.92). Ages greater than 120 were thrown out.

Table #2: Individual level demographic percentages (sex, marital status, religion) in LSMS-ISA Post-Harvest in Northern Nigeria vs. all of Nigeria(2010-2011)

Sex of Individuals in Households	N. Nigeria	Nigeria
Male	51.4%	49.9%

Female	48.6%	50.1%
Marital Status of Individuals in Households	**N. Nigeria**	**Nigeria**
Married (monogamous)	20.9%	22.9%
Married (polygamous)	13.0%	9.3%
Informal Union	0.1%	0.2%
Divorced	0.2%	0.3%
Separated	0.2%	0.5%
Widowed	1.6%	3.3%
Never Married	63.9%	63.6%
Religion of Individuals in Households	**N. Nigeria**	**Nigeria**
Christianity	7.7%	37.9%
Islam	92.2%	61.7%
Traditional	0.1%	0.5%

Table #3: Household level demographic percentages (sector, household size, expenditure) in LSMS-ISA Post-Harvest in Northern Nigeria vs. all of Nigeria(2010-2011)

Sector	**N. Nigeria**	**Nigeria**
Rural	81.8%	68.3%
Urban	18.2%	31.7%
Household Size	**N. Nigeria**	**Nigeria**
1-3 persons	15.4%	24.7%
4-6 persons	33.2%	38.6%
7-10 persons	35.5%	28.35%
11-15 persons	14.5%	7.6%
16-20 persons	1.0%	0.5%
21-25 persons	0.2%	0.2%
>26 persons	0.1%	0%
Expenditure per year (USD)	**N. Nigeria**	**Nigeria**
$0-500	3.1%	2.8%
$501-1000	12.2%	11.8%
$1001-2000	34.8%	32.2%
$2001-3000	26.2%	23.8%
$3001-4000	11.9%	12.4%
$4001-5000	4.8%	6.9%
$5001-7500	4.2%	6.5%
$7501-10000	1.7%	2.1%
>$10001	1.1%	1.5%

Household Expenditure

In Northern Nigeria, the mean annual consumption expenditure is USD $2446.47 (SD=2047.41). The mean for non-food expenditure per year is $567.71 (SD=1090.61), compared with $1869.76 (SD=1354.43) for food expenditure per year. This equates to households living on a mean of $6.73 per day or a per capita expenditure mean of $1.22 per day (SD=1.61). The maximum daily per capita expenditure is $36.13. In Northern Nigeria, the mean household expenditure spent on food as a percentage of total expenditure is 76.42%. The mean household expenditure spent on non-food items a percentage of total consumption expenditure is 23.57%.

In all of Nigeria, the mean annual consumption expenditure is $2682.09 (SD=2226.36). The mean for non-food expenditure is $856.22 (SD=1339.82) and the mean for food expenditure is 1825.87 (SD=1348.70). This equates to households living on a mean of $7.34 per day or a per capita expenditure mean of $1.21. In all of Nigeria, the mean household expenditure spent on food as a percentage of total expenditure is 76.43%. The mean household expenditure spent on non-food items as a percentage of total expenditure is 23.57%.

Household Hunger

Household hunger analysis of this data categorized 99.5% of households as having little to no hunger, with 0.2% of households having moderate hunger and 0.2% having severe hunger in Northern Nigeria. In Nigeria as a whole, 96.8% of households have little to no hunger, 2.1% of moderate hunger, and 1.0% have severe hunger. Meaning that households in the “little to no hunger” tercile had no food to eat of any kind in their house, had to go sleep at night hungry, or went a whole day without eating anything 0 to 1 time in the past 7 days. For households with

moderate hunger, this occurred 2 to 3 times in the past 7 days, and for households with severe hunger this happened 4 to 7 times in the past 7 days.

Tables #4-7: Household Hunger in LSMS-ISA Post-Harvest in Northern Nigeria vs. all of Nigeria (2010-2011).

HHS Terciles	Percent (Northern Nigeria)	Percent (All Nigeria)
Little to no hunger	99.5%	96.8%
Moderate hunger	0.2%	2.1%
Severe hunger	0.2%	1.0%

Analysis looked more closely at the three individual HHS questions from LSMS-ISA which were asked to households in the study population in Northern Nigeria.

1) In the past 7 days, was there ever no food to eat of any kind in your house because of lack of resources to get food? How often did this happen in the past 7 days?

Days	# of Households (North)	Percent (North)	# of households (All Nigeria)	Percent (All Nigeria)
0	1654	99.2%	4560	96.7%
1	2	.1%	66	1.4%
2	6	.4%	57	1.2%
3	2	.1%	21	0.4%
4	1	.1%	8	0.2%
5	0	0%	0	0%
6	0	0%	1	0%
7	2	.1%	3	0.1%

2) In the past 7 days, did you or any household member go to sleep at night hungry because there was not enough food? How often did this happen in the past 7 days?

Days	# of Households (North)	Percent (North)	# of households (All Nigeria)	Percent (All Nigeria)
0	1651	97.1%	4571	97.0%
1	2	0.1%	79	1.7%
2	9	0.5%	37	0.8%
3	3	0.2%	16	0.3%

4	1	.1%	5	0.1%
5	0	0%	2	0%
6	0	0%	0	0%
7	0	0%	1	0%

3) In the past 7 days, did you or any household member go a whole day without eating anything at all because there was not enough food? How often did this happen in the past 7 days?

Days	# of Households (North)	Percent (North)	# of households (All Nigeria)	Percent (All Nigeria)
0	1652	99.2%	4653	98.7%
1	1	0.1%	23	0.5%
2	10	0.6%	26	0.5%
3	3	0.2%	8	0.2%
4	0	0%	2	0%
5	0	0%	0	0%
6	0	0%	1	0%
7	0	0%	1	0%

Months of Adequate Household Food Provisioning for Measurement of Household Food Access (MAHFP)

In both Northern Nigeria and all of Nigeria, the number of months of adequate household food provisioning ranged from 6 months to 12 months. No households reported more than 6 months without adequate household food provisions. However, 13.6% of households in Northern Nigeria were unable to meet their food provisioning needs for at least one month of the year, compared to 3.3% in Nigeria as a whole. The mean MAHFP for Northern Nigeria is 11.76 (SD = 0.73) compared with 11.92 (SD = 0.48) in all of Nigeria.

In Northern Nigeria, August (n=151) and July (n=93) were the months when households reported not having adequate household food most frequently. Followed by September (n=38), February (n=25), June (n=24), March (n=21). For 2010 specifically, in Northern Nigeria, August

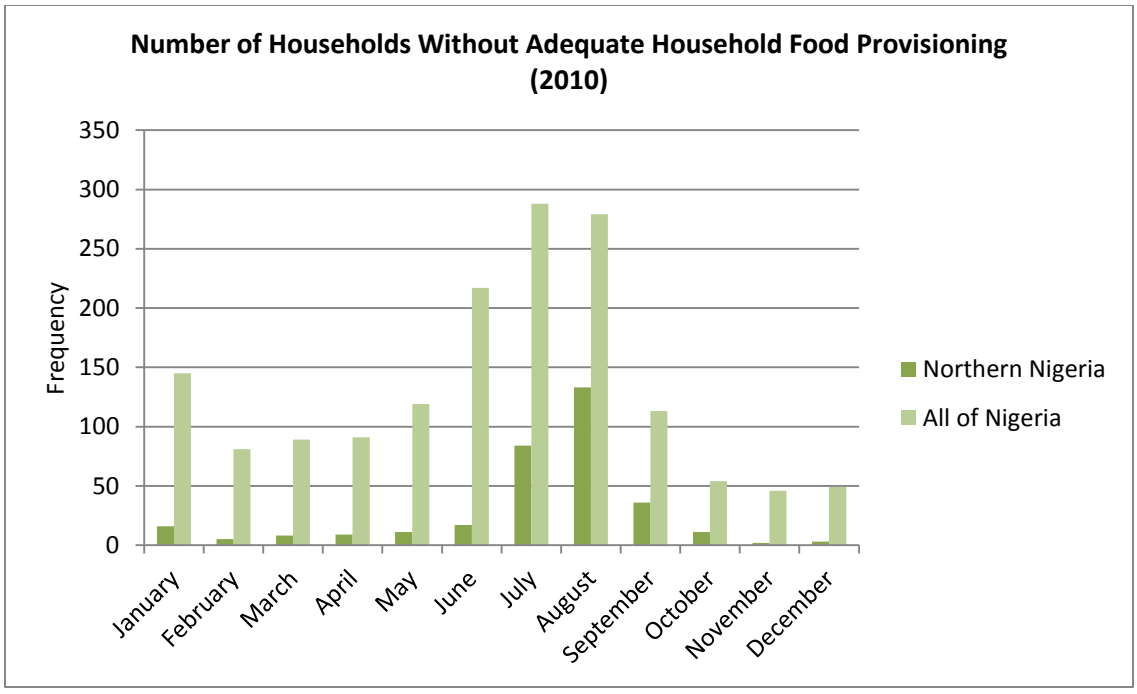
(n=133) and July (n=84) were the months when households reported not having adequate household food most frequently. For 2011 specifically, in Northern Nigeria, February (n=20) and January (n=16) were the months when households reported not having adequate household food most frequently.

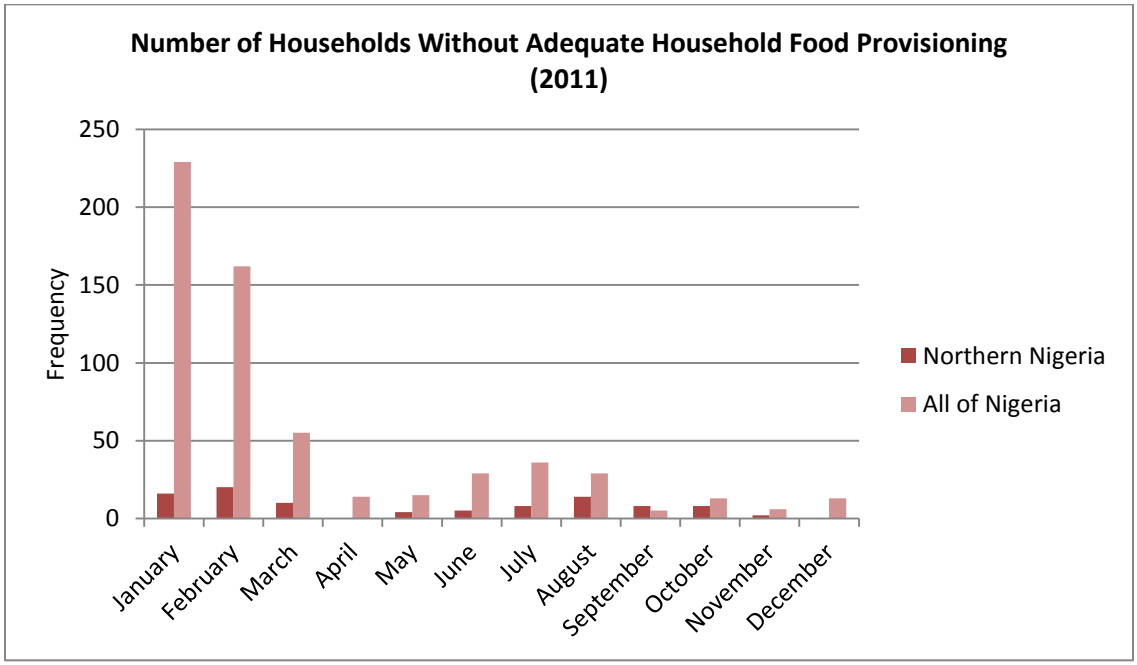
In all of Nigeria, January (n=374), July (n=324), and August (n=308) were the months when households reported not having adequate household food most frequently. Followed by June (n=246), February (n=243), March (n=144). For 2010 specifically, in all of Nigeria, July (n=288) and August (n=279) were the months when households reported not having adequate household food most frequently. For 2011 specifically, in all of Nigeria, January (n=229) and February (n=162) were the months when households reported not having adequate household food most frequently.

Table #8: Months of Adequate Household Food Provisioning Percentages in LSMS-ISA Post-Harvest in Northern Nigeria vs. all of Nigeria (2010-2011)

Months	Percentage (Northern Nigeria)	Percentage (All Nigeria)
0-5	0.0%	0.1%
6	0.4%	0.1%
7	0.2%	0.2%
8	0.3%	0.3%
9	1.0%	0.4%
10	4.9%	1.3%
11	6.8%	1.0%
12	86.4%	96.7%

Figures #1-3: Frequency of months where respondents did not have enough food to meet family's needs in LSMS-ISA Post-Harvest in Northern Nigeria vs. all of Nigeria (2010-2011)


Number of Households Without Adequate Household Food Provisioning (2010)
Frequency
350
300
250
200
150
100
50
0
January
February
March
April
May
June
July
August
September
October
November
December
Northern Nigeria
All of Nigeria


Number of Households Without Adequate Household Food Provisioning (2011)
Frequency
250
200
150
100
50
0
January
February
March
April
May
June
July
August
September
October
November
December
Northern Nigeria
All of Nigeria

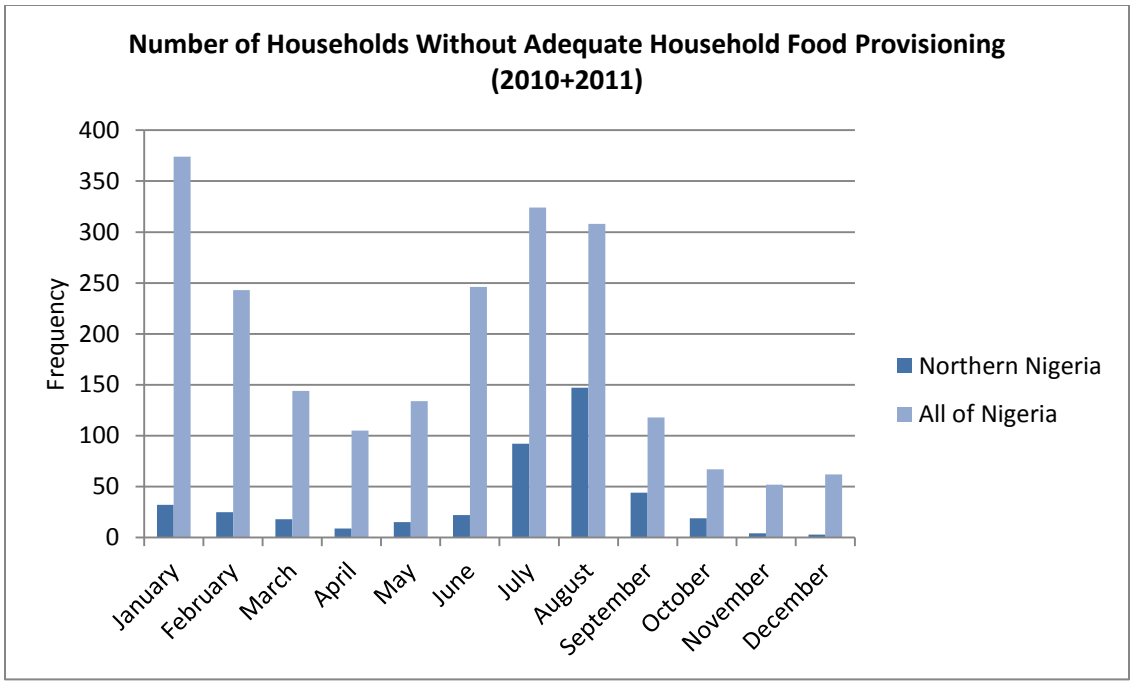


Table #9: Frequency of months where respondents did not have enough food to meet household needs in LSMS-ISA Post-Harvest in Northern Nigeria (2010-2011)

	Number of Households Without Adequate Food (2010)	Number of Households Without Adequate Food (2011)	Number of Households Without Adequate Food (2010+2011)
January	16	2	18
February	5	20	25
March	11	10	21
April	6	0	6
May	12	4	16
June	19	5	24
July	85	8	93
August	137	14	151
September	30	8	38
October	9	8	17
November	2	2	4
December	3	0	3

Table #10: Frequency of months where respondents did not have enough food to meet household needs in LSMS-ISA Post-Harvest in Nigeria (2010-2011)

	Number of Households Without Adequate Food (2010)	Number of Households Without Adequate Food (2011)	Number of Households Without Adequate Food (2010+2011)
January	145	229	374
February	81	162	243
March	89	55	144
April	91	14	105
May	119	15	134
June	217	29	246
July	288	36	324
August	279	29	308
September	113	5	118
October	54	13	67
November	46	6	52
December	49	13	62

Household Dietary Diversity

In Northern Nigeria, household dietary diversity using expenditure data ranged from 1 to 12 food groups with a mean of 6.93 (SD=2.03) food groups (n=1,677 households). The mean number of food groups for all of Nigeria was slightly higher at 7.75 (SD=2.15: n= 4825 households). In comparison to all of Nigeria, the northern region ate less mean good groups, meaning they have less diversity in their diets.

Households in Nigeria reported expenditure on similar food groups to households in the northern region. However, some stark differences exist. 96.40% of Northern Nigerians reported expenditure on eggs, yet only 10.10% of the full Nigerian sample. The only other food groups which Northern Nigerians reported in greater percentage were cereals (99.60% vs. 97.70%); meat, poultry and offal (65.70% to 61.50%); and sugar and honey (63.90% vs. 51.50%). A smaller percentage of Northern Nigerians had consumed vegetables (94.20% vs. 95.80%); oils and fats

(92.80% vs. 93.70%); pulses, legumes, and nuts (74.40% vs. 79.40%; coffee, tea, condiments, and misc. (55.80% vs. 62.70%); roots & tubers (45.90% vs. 77.10%); fish & seafood (43.50% vs. 77.10%); milk products (28.10% vs. 35.90%); and fruits (25.30% vs. 37.70%).

Table #11: Percentage of Households that Consumed Each Food Group in Past 7 Days in LSMS-ISA Post-Harvest, Nigeria vs. Northern Nigeria (2010-2011)

	Percentage of Households Consumed in Past 7 Days	
Food Groups	**Northern Nigeria**	**All of Nigeria**
Cereals	99.60%	97.70%
Eggs	96.40%	10.10%
Vegetables	94.20%	95.80%
Oils & fats	92.80%	93.70%
Pulses, legumes, & nuts	74.40%	79.40%
Meat, poultry, & offal	65.70%	61.50%
Sugar & honey	63.90%	51.50%
Coffee, tea, condiments, & misc.	55.80%	62.70%
Roots & tubers	45.90%	77.10%
Fish & seafood	43.50%	72.70%
Milk & milk products	28.10%	35.90%
Fruits	25.30%	37.70%

Figure #4: Percentage of Households that Consumed Each Food Group in Past 7 Days in LSMS-ISA Post-Harvest, Nigeria vs. Northern Nigeria (2010-2011)

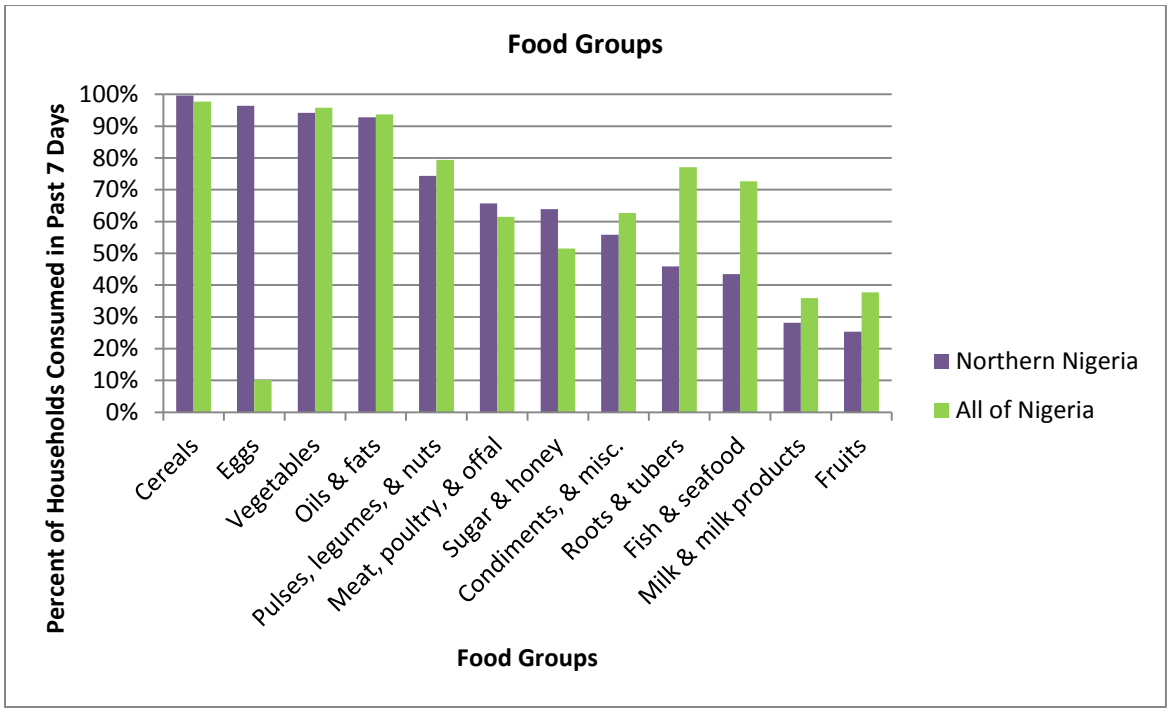
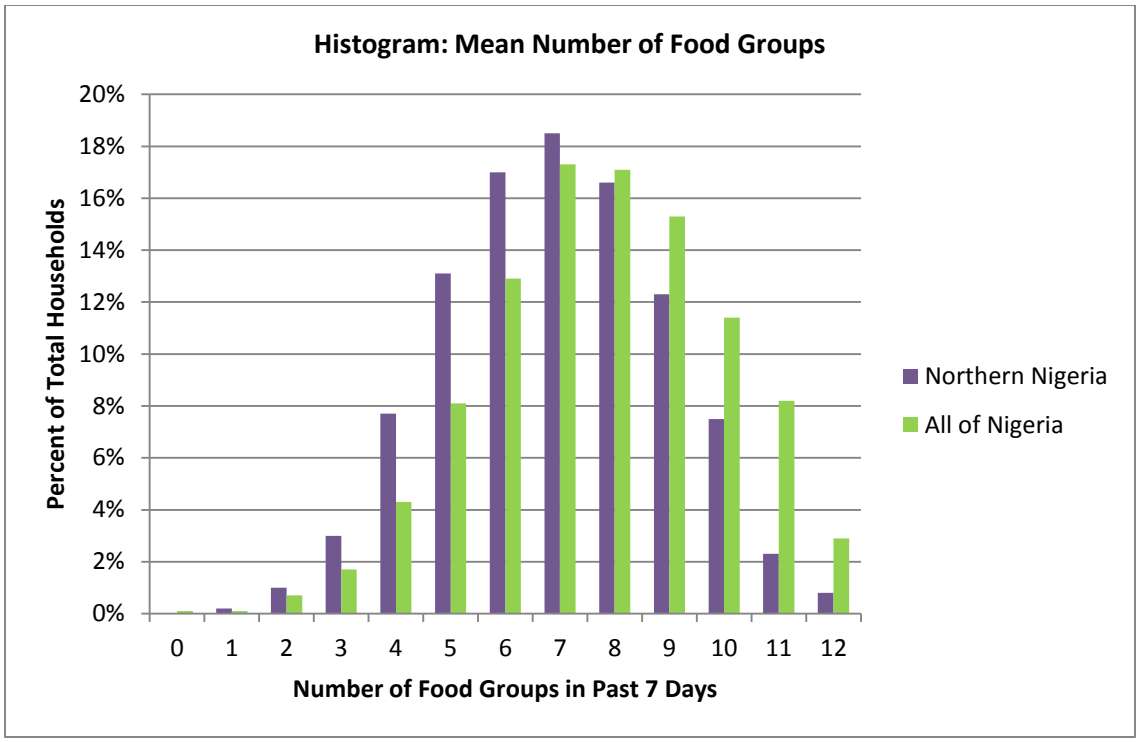


Table #12: Dietary Diversity Terciles in LSMS-ISA Post-Harvest in Northern Nigeria vs. all of Nigeria (2010-2011)

	Percentage of Households	
Dietary Diversity Terciles	**Northern Nigeria**	**All of Nigeria**
Low (1-4 food groups)	11.90%	6.80%
Medium (5-8 food groups)	65.10%	55.40%
High (9-12 food groups)	23.00%	37.80%

In comparison to the entire dataset of 4,825 households across all geographic areas of Nigeria, the northern region (n=1677) had less diversity in their diets, as indicated by the histograms below.

Figures #5-6: Mean Number of Food Groups in LSMS-ISA Post-Harvest in Northern Nigeria vs. all of Nigeria (2010-2011)


Histogram: Mean Number of Food Groups
Percent of Total Households
20%
18%
16%
14%
12%
10%
8%
6%
4%
2%
0%
0
1
2
3
4
5
6
7
8
9
10
11
12
Number of Food Groups in Past 7 Days
Northern Nigeria
All of Nigeria

Chapter 5: Discussion

Introduction

This study used data from the Living Standards Measurement Study – Integrated Survey on Agriculture (LSMS-ISA) Nigeria Panel Post-Harvest Household (2010-2011) dataset to determine the status of household food security in Northern Nigeria and to expand on current knowledge and literature. Overall, the analysis found varying levels of household food security in the study population, which is, on average, living in poverty (below $2 per day).

Summary of Results

In Northern Nigeria, households live on a mean of $6.73 per day or a per capita expenditure mean of $1.22 per day (SD=1.61). In Northern Nigeria, the mean household expenditure spent on food as a percentage of total expenditure is 76.42% and the mean household expenditure spent on non-food items a percentage of total consumption expenditure is 23.57%. In all of Nigeria, households live on a mean of $7.34 per day or a per capita expenditure mean of $1.21. In all of Nigeria, the mean household expenditure spent on food as a percentage of total expenditure is 76.43% and the mean household expenditure spent on non-food items as a percentage of total expenditure is 23.57%.

Household hunger analysis of this data categorized 99.5% of households as having little to no hunger, with 0.2% of households having moderate hunger and 0.2% having severe hunger in Northern Nigeria. In Nigeria as a whole, 96.8% of households have little to no hunger, 2.1% of moderate hunger, and 1.0% have severe hunger.

In both Northern Nigeria and all of Nigeria, the number of months of adequate household food provisioning ranged from 6 months to 12 months. No households reported more than 6 months

without adequate household food provisions. However, 13.6% of households in Northern Nigeria were unable to meet their food provisioning needs for at least one month of the year, compared to 3.3% in Nigeria as a whole. The mean MAHFP for Northern Nigeria is 11.76 (SD = 0.73) compared with 11.92 (SD = 0.48) in all of Nigeria. In Northern Nigeria, August (n=151) and July (n=93) were the months when households reported not having adequate household food most frequently. In all of Nigeria, January (n=374), July (n=324), and August (n=308) were the months when households reported not having adequate household food most frequently.

Household dietary diversity ranged from 1 to 12 food groups. A mean number of food groups of 6.93 (SD=2.03) was derived from the LSMS-ISA data involving 1,677 households, in Northern Nigeria. The mean number of food groups for all of Nigeria was slightly higher at 7.75 (SD=2.15), derived from the LSMS-ISA data involving 4825 households.

Expenditure

The expenditure in both Nigeria and Northern Nigeria is very low, with the average individual living in poverty on under 2 dollars per day. The per capita expenditure mean is $1.22 per day in the north and $1.21 per day in Nigeria, putting these households at extreme risk for food insecurity. The expenditure results are similar to survey data from the National Bureau of Statistics in Nigeria (2011). The application of the dollar per day in the computation of poverty measure was computed for Nigeria for 2011 (NBS, 2012). When annualized, it a poverty incidence of 62.8% was found (NBS, 2012). The relative poverty measure estimates poverty to be 71.5% and the absolute poverty measure in Nigeria in 2011 to be 61.9% (NBS, 2012).

Expenditure on food as a percentage of total expenditure is a strong indicator of food security as well (according to Omonoma et al (2007), Oluyole (2001), and Smith (2007)). In Northern Nigeria, the mean household expenditure spent on food as a percentage of total expenditure is

76.42%. The mean household expenditure spent on non-food items a percentage of total consumption expenditure is 23.57%. In all of Nigeria, the mean household expenditure spent on food as a percentage of total expenditure is 76.43%. The mean household expenditure spent on non-food items as a percentage of total expenditure is 23.57%. This highlights that the households may be spending the large majority of their money on food and have very little flexible income to cope with adverse events and costs such as medical bills. Other explanations, for the large percentage of expenditure spent on food, may be that food expenditure are overestimated or that other expenses are underestimated and/or not predictable. For the LSMS-ISA data, it is likely to be an underestimation of household dietary diversity as a result of the 7 day recall period, making it more difficult for households to remember their consumption.

The Nigeria National Bureau of Statistics analyzed expenditure shares for nine categories in two time periods: 2003/2004 and 2009/2010 (NBS, 2012). Results from 2009/2010 shows that food expenditure outweighed non-food expenditure, but not as large of a majority of expenditure spent on food (NBS, 2012). In a similar yet different context, food security was measured from expenditure patterns in Harare, Zimbabwe (Tawodzera et al, 2012). In this study, food also constituted the single largest expenditure but was not given as a percentage of total expenditure (Tawodzera et al, 2012).

Household Hunger

Due to the nature of the three questions asked, HHS is most appropriate to use in areas of substantial food insecurity (Ballard et al, 2011). The HHS focuses on the food quantity dimension of food access and does not measure dietary quality (Ballard et al, 2011). As described in the methods and limitations sections, the three HHS questions were asked with a 7 day recall

period, instead of the recommended 30 day recall period, likely resulting in an underestimation of hunger.

Based on the household hunger analysis, Nigeria as a whole has worse food insecurity than the north east and north west zones. While, the percentages of households being categorized as having little to no hunger, moderate hunger, and severe hunger may not sound like there is much hunger in the population these are still concerning levels of hunger. As this means that in Northern Nigeria 99.5% of households had no food to eat of any kind in their house, had to go sleep at night hungry, or went a whole day without eating anything 0 to 1 time in the past 7 days. For households with moderate hunger, this occurred 2 to 3 times in the past 7 days, and for households with severe hunger this happened 4 to 7 times in the past 7 days. These categories could be adjusted for, resulting in different estimates of hunger. However, because over 95% of households reported 0 days in the past 7 days of having no food to eat of any kind in their house, having to go sleep at night hungry, or going a whole day without eating in each category, it is unlikely adjusting the categories would have much of an effect on the results. It is impossible to ascertain what these frequencies would have been had a 30 day recall period been used, but there likely would have been greater levels of hunger.

The HHS indicator guide was published as recently as 2011, after the adapted HFIAS was validated for cross cultural use. Thus far, few literature has documented use of HHS to measure food security. Onuemu et al (2012) found greater amounts of household food insecurity using HFIAS in the south south zone of Nigeria (with 41.1% severely food insecure, 12.8% moderately food insecure, and 7.9% mildly food insecure). A study by Regassa (2012) among smallholder farmers in Southern Ethiopia, is one such study which has employed HHS (Regassa, 2012). The results revealed that about 54.1% of the households are food insecure and 28.8% fall in the mild

to severe level of household food insecurity tercile (Regassa, 2012). The limited literature measuring HHS in similar contexts does not match the household hunger analysis in this paper (with 99.5% of households being categorized as having little to no hunger, with 0.2% of households having moderate hunger and 0.2% having severe hunger). This is likely the result of underestimation as a result of adapting the HHS to a 7 day recall period instead of the recommended 30 day recall period. It is also possible that the timing of the survey affected the results. The surveys may have been administered during a period of low food insecurity. As discussed earlier, seasonality has a large impact on food security measurements.

Months of Adequate Household Food Provisioning for Measurement of Household Food Access (MAHFP)

The MAHFP results highlight the issue of seasonal hunger in Nigeria. It is notable that 13.6% of households in Northern Nigeria and 3.3% in Nigeria as a whole were unable to meet their food provisioning needs for at least one month of the year. This seasonal food shortage is a yearly cycle for many rural households (Damisa et al, 2011). These households barely produce enough food to meet their needs, yet sell much of their farm produce at harvest time, specifically between October to December to pay back loans and meet other household needs, such as school fees (Damisa et al, 2011). Farming households in Northern Nigeria usually experience incidence of hunger two to three months after harvest (Damisa et al, 2011). According to Damisa et al (2011), food shortage experienced by the households becomes harsh by January/February and the shortage becomes severe around March/June. Other sources suggest that for crop farmers the hunger season comes to the Sahel every year between June and September, and for livestock farmers between April and June (Action Against Hunger, 2012).

The results of the MAHFP for showed that in Northern Nigeria, August (n=151) and July (n=93) were the months when households reported not having adequate household food most

frequently. In all of Nigeria, January (n=374), July (n=324), and August (n=308) were the months when households reported not having adequate household food most frequently. While it is similar this does not align exactly with the general hunger season as suggested by the literature (Damisa et al (2011) and Action Against Hunger (2012)). This may be an indication that there were other adverse events during this period which impacted food production and household food security. One such occurrence might be the flooding and drought in some parts of Northern Nigeria in 2011, making hunger season more pronounced (Damisa et al, 2011). Many of the usual coping strategies adopted by households, such as eating less diverse foods, are inadequate as a result of the weather and climatic conditions (Damisa et al, 2011).

The households in Northern Nigeria did not report as high of levels of inadequate food provisioning for January-March in comparison with the whole Nigeria study population. While it is possible that Northern Nigerians are better prepared to cope with food shortages during January-March, relative to the rest of the country, this is more likely a result of differences in weather during this time periods.

In the discussion of MAHFP, it is important to note when the interviews in the LSMS-ISA post-harvest household (2010-2011) dataset were conducted. 93.7% of interviews were completed in March 2011, with 3.1% in April 2011, 2.7% in February 2011, and the remaining in January, May, June, August, September, October, and December 2011. The date of the interview may influence responses to the MAHFP questions due to recall bias. It is likely that households will have a more difficult time remembering food provisions during the months the furthest past. In addition to the climatic shocks mentioned above, the timing of the interviews may explain why food insecurity does not appear to be as high during Northern Nigeria's typical severe hunger season in March and June (Damisa et al, 2011).

A study of Southern Africa found that on average urban food insecure households go without adequate food for four months of the year (Frayne et al, 2010). In a study of households in Harare, Zimbabwe, MAHFP shows that about 92% of households in the survey experienced some months of inadequate food provisioning during the past year (Tawodzera et al, 2012). The months of greatest inadequacy were from June to October (Tawodzera et al, 2012). It is important to note that urban cycle of MAHFP is not identical to rural (Frayne et al, 2010). For example, a second improvement in urban food security occurs in what are often lean months in rural areas – from September to December (Frayne et al, 2010). Increases in spending on food toward the end-of-year holiday season and the payment of annual bonuses for those in employment may help explain this anomaly (Frayne et al, 2010). Likewise, the end-of-the-year is when many return home to rural areas for their annual holiday, reducing the number of mouths to feed in urban households (Frayne et al, 2010).

Household Dietary Diversity

While the HDDS indicator recommends collecting household food consumption information using the previous 24-hours as a reference period (Bilinsky, 2006). The LSMS-ISA uses a 7-day recall period. Longer reference periods result in less accurate information due to imperfect recall (Bilinsky, 2006). However, in settings where household food consumption is not very diverse, recall capability is typically longer (Bilinsky, 2006). As dietary diversity was not extremely varied, the study population is likely to have a decent recall capability. Although, using a 7 day recall period may have also led to an overestimation of HDDS because respondents may typically consume an increased number of food groups in a 7 day period than they would in a 24-hour period. Additionally, overestimation of HDDS may have been over or underestimated if respondents were unable to recall their consumption patterns in the past 7 days.

Another major difference between the FANTA guides for calculating HDDS and the method used here on LSMS-ISA is that FANTA recommends using consumption surveys to calculate HDDS. However, in this study household dietary diversity was calculated from the food expenditure section (Section 10B) of the LSMS-ISA. This was a result of the way the survey was designed and the different food groups that were used. For example, the LSMS-ISA lumped eggs into poultry products. However, eggs and poultry should be analyzed as different food groups. Eggs and poultry have a different associated social strata, as many poor families are still able to obtain eggs, a nutritionally beneficial food, yet not the meat from chickens. Using different food group categories create a number of biases and can lead to both underestimates or overestimates of dietary diversity.

A mean number of food groups available in the household per expenditure data of 6.93 was found in Northern Nigeria. The mean number of food groups available in the household per expenditure data for all of Nigeria was slightly higher at 7.75. In comparison to all of Nigeria, the northern region had less diversity in their diets, according to the mean number of food groups available in the household. The mean number of food groups available in the household is comparable with other studies from sub-Saharan Africa. A study of rural households in Limpopo Province, South Africa found a mean HDDS of 4.57 (SD = 6.83), in other words, Northern Nigeria had greater household dietary diversity (De Cock, 2012). Another study from urban areas of Southern Africa found a HDDS score of 8 (Frayne et al, 2010). Frayne et al (2010) also found that the dominant food type eaten are starch staples (96%), with less than half of the study population reporting eating any form of animal protein. In Harare, Zimbabwe, households were found to have poor dietary diversity where as many as two thirds of the households had eaten from five or fewer of the 12 food groups in the 24 hours prior to the survey (Tawodzera et al, 2012). The most commonly consumed food group eaten by households was cereals (99%)

whereas very few households ate eggs (9%), roots or tubers (12%), milk products (12%), or fruits (15%) (Tawodzera et al, 2012). The Tawodzera et al (2012) study found very similar results of HDDS to the LSMS-ISA analysis here.

The entirety of Nigeria reported expenditure on similar food groups to the northern region. However, some stark differences exist. 96.40% of Northern Nigerians reported expenditure on eggs, yet only 10.10% of Nigerians. Perhaps eggs are more available, accessible, and/or affordable for the northern Nigeria population.

Households in the north were especially lacking fruits and dairy from their diets, as only 25.3% of households reported consuming fruit in the past 7 days and only 28.1% of households reported consuming milk products in the past 7 days. Not surprising, cereals were consumed by 99.60% of northern households, as the staple grains of Northern Nigeria are a main source of calories in their diet. This is likely to result in nutritional and health issues and a cadre of other issues summarized in the consequences section of the literature review. Dietary diversity has long been recognized by nutritionists as a key element of a good diet (Ruel, 2002). Eating a large variety of food within major food groups is recommended in most dietary guidelines since it is associated with a number of improved health outcomes (Ajani, 2010). Nutritional problems are common in poor populations as their diets are predominately based on starchy staple foods, such as cassava or rice, and these foods are often low in micronutrients, and high in phytate and dietary fiber which inhibits the absorption of micronutrients (Ajani, 2010).

Chapter 6: Recommendations

A strong consorted effort toward Millennium Development Goal #1 is need to eradicate hunger and poverty. Despite clear evidence of the disastrous consequences of nutritional deprivation, nutritional health and food security remain a low priority (United Nations, 2012). It is time for nutrition to be placed higher on the development agenda (United Nations, 2012). Through strong national leadership with the support of robust international partnerships, rapid progress in reducing levels of hunger and undernutrition is attainable. To catalyze progress towards MDG #1, the focus must be on implementing the current evidence-based approaches, rather than the development of novel innovations and new technologies. Success depends on linking clear policies with an effective delivery of interventions which can be quickly taken to scale.

Food security and poverty alleviation initiatives should be pro-poor and cover the most vulnerable areas of Nigeria. In order to have a large impact on food insecurity, multi-disciplinary approaches need to be developed to look at nutrition, family planning, agriculture, and economic development. In instances of extreme wide-spread poverty, food aid may be necessary. At multiple levels and from multiple angles, Nigeria should seek to increase the availability, accessibility, and affordability to nutritious foods.

Poverty reduction through a number of economic development strategies should be a priority of the Nigeria government to improve malnutrition and undernutrition rates, as income is associated with food security status (according to Ibrahim et al (2009), Babatunde et al (2008), Twaodzera et al (2012), and other studies). Economic growth must be accompanied by purposeful and decisive public action, in order to accelerate hunger reduction (FAO, 2012). Economic growth is most effective in reducing poverty and hunger when it increases employment and income-earning opportunities that the bottom of the pyramid can partake in

(FAO, 2012). Economic growth takes time to reach the poor, and may not always reach the poorest of the poor. Therefore, social protection is vital for eliminating hunger as rapidly as possible (FAO, 2012).

Deliberate policies are needed to foster gainful employment and provide opportunities to empower people (UNDP, 2010). An intensification of poverty programs and approaches (UNDP, 2010). Policies at all governmental levels should attempt to enhance the productivity of enterprises (particularly in the agriculture sector and for small and medium size enterprises), and to ensure a good business environment including infrastructure and sustainable access to finances. The National Directorate of Employment, the National Poverty Eradication Program, the Small and Medium Enterprises Development Agency, and other development schemes must be well coordinated and financed to promote poverty reduction (UNDP, 2010).

While economic growth is key for progress in improving people's nutrition, the links also go in the other direction as well – nutritious diets are vital for achieving people's full physical and cognitive potential and health, thus contributing to economic growth (FAO, 2012). Improved childhood nutrition and access to education can improve cognitive development and increase levels of income – with benefits both at the individual and societal levels (FAO, 2012).

Furthermore, farming must be made a business opportunity in Nigeria. There should be a reduction of dependence on aid. Programming and policies should aim to make Nigerian farmers more competitive, to increase income and generate job growth. Existing projects to increase agribusiness competitiveness should be scaled up.

Improving food security can contribute to essential nutrition actions such as a number of simple, cost-effective measures to reduce undernutrition in the critical "window-of-opportunity" – the first 1,000 days of life – are already available (United Nations, 2012). Improved maternal

nutrition and care, breastfeeding within one hour of birth, exclusive breastfeeding for the first six months of life, and timely, adequate, safe and appropriate complementary feeding and micronutrient intake in the following 18 months (United Nations, 2012). Urgent, accelerated, and concerted actions are needed to deliver and scale-up such interventions (United Nations, 2012). As stated in the consequences of food security, food insecurity is associated with beliefs and attitudes towards exclusive breastfeeding (Webb Girard et al, 2010) and a modifier of educational interventions to improve complementary feeding of infants 6-24 months (Dewey et al, 2008).

Family planning education and access should be encouraged, as large households tend to have greater food insecurity (Lawal (2008) and Twaodzera et al (2012)). Women and younger headed households should be targeted for interventions to improve food security as these are risk groups for food insecurity (Babatunde, 2007). Education should be promoted as low education of household heads is associated with food insecurity (Babatunde, 2007). Food security strategies in Northern Nigeria should be designed and implemented to address and focus on identified determinants which contribute to the Millennium Development Goal of eradicating hunger.

Roughly one-third of food produced for human consumption is lost or wasted globally (FAO, 2011). In Sub-Saharan Africa the per capita food loss is 120-170 kg/year (FAO, 2011). In developing countries, more than 40% of food losses occur at post harvest and processing levels. Poor storage facilities and lack of infrastructure cause postharvest food losses. Fresh products like fruits, vegetables, meat and fish can quickly spoil in hot climates due to a lack of infrastructure for transportation, storage, cooling, and markets (FAO, 2011). Improving food storage to prevent spoilage should be addressed to reduce the seasonal variations in hunger

evident by the MAHFP indicator. Government and private sector investment in infrastructure and transportation, particularly roads, energy, and markets, is needed (FAO, 2011). Knowledge and capacity of food chain operators should be developed. Furthermore, there is need for developing contract farming linkages between processors and farmers through an enabling environment which stimulates the private sector to invest in the food industry and to work more closely with farmers to address supply issues. Additionally, to minimize waste, market systems must be improved, as they are often small, overcrowded, unsanitary and lacking cooling equipment (FAO, 2012).

Nigeria should take action at multiple levels, to increase availability and stability to diverse adequate food. Initiatives to increase yields should focus on adding value to different points along the value chain. This can be done through improved farm and crop processing technology and strengthening farming business and industries, including those that provide access to quality inputs such as seed and fertilizer. The expansion of the agriculture industry should use sustainable practices. Many agriculture practices have negative impacts when practiced without regard for the environment. Practitioners should encourage agricultural practices, such as rotating crops, which minimally disturb the environment. Agriculture, much of which involves deforestation, is not only a culprit of climate change, but also a victim.

Climate change, one of the most formidable challenges to ever face the global food production system, should be prevented against and prepared for. Climate change can have dramatic impacts on agricultural productivity, farm incomes, and food security. If temperatures continue to rise, there will be immense damage to food systems, without sufficient investments in adaptation. New crop varieties that are resistant to heat, drought, and other climatic changes should be developed and made available to the most vulnerable. There should be increased

research on existing crops, such as banana and cassava, which may be more resistant to climate change. Climate change will have major impacts on the availability of water for growing food and crops. Nigeria should implement an effective system for 'water accounting' – the measurement of water supplies, transfers, and transactions in order to inform decisions about how to manage water resources. At the household level, farmers should change their crop patterns, such as by planting deep-rooted crops, to reduce their water use and optimize irrigation. There is a need for greater understanding of the nature, scope, and location of climate change on food security. A greater frequency of droughts and floods needs to be planned for. Issues of weather vagaries and climate change cannot be ignored if agricultural development and sustainability is to hold. Nigeria should adopt a new combined weather and crop forecasting system as used in many advanced economics (Jerome, 2012). This allows for the most current climate and weather forecasting models and crop/atmosphere interactions to be represented in a realistic manner (Jerome, 2012). No single institution alone can address all aspects of the climate change and food security challenge. Diverse partnerships are needed to bring the world's experts together to overcome the surmounting crisis.

Households should be educated on the nutritional implication of food items which are missing from their diet (such as fish, soy, and fruit to increase micronutrient intake) (Ibrahim, 2009). However, knowledge is inadequate if households do not have access to these foods or the means to produce these foods. There needs to be simultaneous actions to increase the accessibility, affordability, and availability of key food groups. Initiatives to encourage food and/or crop diversification should be encouraged to reduce malnutrition and undernutrition, including value chain development of key food groups. Additionally, it has been found that people with more income have greater dietary diversity (FAO, 2012). Measures to achieve greater dietary diversity and adequate intake of micronutritients may include the use of

targeted supplementation for the poorest until the cost of a diversified diet becomes affordable (FAO, 2012).

Despite long-standing efforts to improve the food security situation of populations globally, food deprivation and its physical consequences remain a continuing problem around the world (Ballard et al, 2011). Arguably, one of the first steps to effectively address food insecurity is to design and implement reliable methods for measuring it (Ballard et al, 2011). Measurement drives diagnosis and response (Barrett, 2010). Without reliable measurement techniques, it is not possible to appropriately target interventions, monitoring and evaluate programs and policies, or improve the effectiveness of these efforts in the future (Ballard et al, 2011).

Lack of data are both a cause and symptom of the low prioritization of food security. Opportunities to improve the measurement of food security should be seized. The efforts should include a global network of sites using a standardized core survey protocol for regular, repeated household- and individual-level monitoring (Barrett, 2010). This would allow for tracking multiple food security indicators with targetable individual, household, and community characteristics across the globe (Barrett, 2010). It would also enable rigorous monitoring and evaluation of various policy and project interventions (Barrett, 2010). Furthermore, action must be taken to better understand the predictive accuracy of different indicators in forecasting future food security states (Barrett, 2010). This would allow researchers to more cost-effectively concentrate data collection on measures of which targetable actions will most reliably be success (Barrett, 2010). The food security research community must move beyond a static, snapshot measure to dynamic mobile ones, especially with respect to critical behavioral thresholds (Barrett, 2010). Research should look at developing measures based on longitudinal

data that capture the risk of food insecurity that respondents routinely report in qualitative measures (Barrett, 2010).

The Living Standards Measurement Study – Integrated Survey on Agriculture (LSMS-ISA) is one step to increasing data on agriculture and related data. Due to privacy and ethical concerns the households GPS locations are not provided. Therefore, it is not possible to use the survey results for GIS mapping of households. Still, there is a lack of data surrounding climate, weather, water, expenditure, and food security available for research and program planning. There is a need for improved of data, data availability, and data analysis.

As evident in the methods and limitations sections, a number of adjustments had to be made when analyzing the LSMS-ISA data as it did not fit the standard indicators as recommended by USAID's Food and Nutrition Technical Assistance III Project (FANTA). For example, by using 7 day recall periods instead of the recommend 30 day recall period, results were significantly altered. Additionally, a number of key survey questions were not asked by the LSMS-ISA. For example, it was not possible to calculate Household Food Insecurity Access Scale for Measurement of Food Access (HFIAS) using the LSMS-ISA because the survey did not ask all nine questions necessary. The HFIAS would have been useful to assess the prevalence of household food insecurity (access component) and to detect changes in the food insecurity situation of the population over time. Additionally, there were differences between the post-harvest and pre-planting datasets making comparison between the two time periods difficult. The World Bank could strengthen the food security sections of its surveys for future use, by consulting with food security measurement specialists and designing the surveys in a way that allow researchers to more accurately measure and describe food security. The way ahead is to shift towards trend assessment based on patterns of related food security indicators that capture different dimensions of hunger.

Therefore, the LSMS-ISA should include questions which will provide data for researchers to analyze multiple food security indicators and provide a more accurate measure and fuller picture of the situation. The World Bank and national partners should continue to implement the LSMS-ISA in sub-Saharan Africa, recording panel data pre-planting and post-harvest to help mitigate the seasonality issues of measurement.

Better policies and programs and necessary resources do not appear simply because data are available (Mason, 2002). There needs to be intent to make changes, but the methods and data need to be available for appropriate analysis and interpretation to make more convincing arguments for explicit action (Mason, 2002).

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