FOOD SECURITY STATUS AND AWARENESS OF SUSTAINABLE DEVELOPMENT GOAL-2 AMONG HOUSEHOLDS IN ABUJA MUNICIPAL AREA COUNCIL

BY

NJOKU, SYLVALINE CHISOM
REG. NO.: 20184142608

A THESIS SUBMITTED TO THE POSTGRADUATE SCHOOL, DEPARTMENT OF PUBLIC HEALTH TECHNOLOGY SCHOOL OF HEALTH TECHNOLOGY, FEDERAL UNIVERSITY OF TECHNOLOGY, OWERRI

JULY, 2023

FOOD SECURITY STATUS AND AWARENESS OF SUSTAINABLE DEVELOPMENT GOAL-2 AMONG HOUSEHOLDS IN ABUJA MUNICIPAL AREA COUNCIL

BY

NJOKU, SYLVALINE CHISOM
REG. NO.: 20184142608

A THESIS SUBMITTED TO THE POSTGRADUATE SCHOOL, DEPARTMENT OF PUBLIC HEALTH TECHNOLOGY SCHOOL OF HEALTH TECHNOLOGY, FEDERAL UNIVERSITY OF TECHNOLOGY, OWERRI

IN PARTIAL FUFILMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTERS OF PUBLIC HEALTH (MPH EPIDEMIOLOGY & BIOSTATISTICS) DEGREE

SUPERVISOR: DR. J. C. NWAOKORO

JULY, 2023

CERTIFICATION

This thesis study on FOOD SECURITY STATUS AND AWARENESS OF SUSTAINABLE DEVELOPMENT GOAL-2 AMONG HOUSEHOLDS IN ABUJA MUNICIPAL AREA COUNCIL, written by **Njoku, Sylvaline Chisom (Reg. No: 20184142608)** has been certified as meeting the requirements for a Master's Degree Thesis in Public Health, in Postgraduate school, Federal University of Technology, Owerri, Imo state, Nigeria.

Dr. J.C. Nwaokoro (Principal Supervisor)	16/6/2023 **Date**
Dr. (Mrs.) U.W. Dozie (Co-Supervisor)	16/6/2023 **Date**
Dr. U.M. Chukwuocha (Head of Department)	07/09/23 **Date**
Prof. P.U. Agbasi (Dean, School of Health Technology)	07/09/2023 **Date**
Prof B.O Esonu (Dean, Postgraduate School)	**Date**
Prof. Regina Idu Ejemot-Nwadiaro (External Examiner)	16-06-2023 **Date**

DEDICATION

This research thesis is dedicated to all lovers of knowledge and research, especially in the field of Public Health Nutrition.

ACKNOWLEDGEMENTS

I heartily express my immense gratitude to God Almighty for his ever merciful and unwavering love. I cannot thank God enough, his mercies and ever sufficient grace brought me this far. To him be all the glory.

I appreciate in a very special way, my research supervisors, Dr. J. C. Nwaokoro and Dr. (Mrs.) U. W. Dozie for their support, guidance, encouragement, constructive criticisms and advice and corrections made towards the success of this work. I also thank Mrs. J. C. Obi and Miss Akam N. V. who validated my questionnaire.

Special gratitude goes to my HOD, Dr. Uche M. Chukwuocha, the Post Graduate coordinator, Dr. (Mrs.) Ugonma W. Dozie all my lecturers in the Department of Public Health and the Dean of Post graduate Studies, FUTO, Dr. C. C. Eze, for their academic guidance and tutorship in making me better academically and otherwise. I also thank my Reader, Prof. (Mrs.) S.N.O. Ibe, who proofread my work and made necessary inputs and corrections.

I also acknowledge my colleagues in the department of Public health, my friends and all others who made impact during this study. Not forgetting to mention, Dr. Ifeanyi Irokwe, for his input in making sure this work was a success. In a very special way, I acknowledge my parents, Mr. & Mrs. Celestine C. Njoku, whose love for education has brought me this far. Also, importantly, I thank my husband, Mr. Emmanuel I. Anyanwu, for his encouragements, motivation and unflinching support towards the success of this work. Thanks to the rest of my family, siblings, friends, colleagues, and well wishers. To the University of Washington, Department of Global Health E-learning, all authors of published works especially my lecturers who were cited in this work, I appreciate you all.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

OPERATIONAL DEFINITION OF TERMS

AMAC: Abuja Municipal Area Council

Dietary diversity is defined as the number of different foods or food groups eaten over a reference time period, irrespective of the consumption frequency.

Domestic Head of Household: This refers to the person in charge of the domestic activities in the house, including going to the market, cooking and taking care of the children.

Food frequency: is defined as the frequency (in terms of days of consumption over a reference period) that a definite food item or food group is taken at each home (household) (WFP, 2008).

Food group: is defined as a combination of food items with related caloric and nutrient content.

Food security: food security as operationalised in this study exists when households do have adequate physical food for consumption, and have the social or economic access to satisfactory food for a healthy life at all times.

Food accessibility: is a measure of the ability to obtain/secure food. This is determined by affordability of food and money spent on food.

Food availability: is associated with the produced food's physical quantities; food processed, stored, exchanged and distributed. It has to do with "Sufficient food".

Food system stability: deals with the phrase "at all times" in the food security definition by FAO (1996; 2008a). It deals with the importance of reducing the risk of negative effects on the other three dimensions: food accessibility, food availability or food utilization. It is the temporal determinant as used in this study which defines the ability to access and utilize adequate levels of nutritious food over time.

Food utilization: entails to the consumption of food and how essential nutrients are acquired from consumed food by a person. It covers the diet's nutritional value, in addition to access to potable water; its composition, preparation methods and safety of food.

Household (HH): is a group of people living together and maintaining unique eating arrangement.

Hunger: is regarded as a severe stage of food insecurity, rather than as a distinct or disconnected condition from the more common experience of food insecurity.

Goal: The object of a person's ambition or effort; an aim or desired result.

Sustainability: the ability to be maintained at a certain rate or level.

Sustainable development goal: the Sustainable Development Goals are the blueprint to achieve a better and more sustainable future for all. They address the global challenges we face, including poverty, inequality, climate change, environmental degradation, peace and justice.

ABSTRACT

With the recent covid-19 pandemic, hunger and malnutrition have increased worldwide, with sub–Saharan Africa being the most affected. This study was carried out to determine the food security status and awareness of sustainable Development Goal - 2 among households in Abuja Municipal Area Council, an urban area in the Federal Capital Territory of Nigeria. Using a descriptive cross-sectional study design, four hundred and twenty-one (421) households were randomly selected from the various wards in Abuja Municipal Area Council, Abuja. Structured questionnaire and Household Food Insecurity Access Scale (HFIAS) as well as the Food Consumption Score (FCS) were the tools used in gathering the information needed for the study. Respondents from the sampled households were domestic heads of households, multistage sampling technique was used and data collected were subjected to descriptive statistics and Chisquare using SPSS statistics version 23. From the results gotten, food security status among households in Abuja Municipal Area Council is poor (37%) as most of the households were food insecure (63%). Also, there was poor awareness of SDG-2 as seen among respondents (57%), only 43% of the respondents have heard about SDG-2. There was also significant association of sociodemographic characteristics of respondents and food security in the study area ($P \leq 0.05$). Food security was highest in respondents who were satisfied with their monthly income 17 (85%), followed by those who had a family size of two 33 (65%) and least among those who had no occupation 1(3%). Moreso, the most food insecure were those who had no occupation 33 (97%). However, food security was also higher among the able bodied 138(43%) male respondents 89(47%) who were Islam 93(41%) and were within the age bracket of 32 – 41 years 67(46%) and were also married 101(49%). Food security was also higher among most of them who achieved tertiary as their highest level of education 38(51%) and are public/civil servant 47(52%). The food consumption score of the participants was shown to be 21 (poor), 33 (borderline) and 36 (acceptable) for the < 3 days, 3-4 days and 5days and above respectively. As household coping strategies against food insecurity, majority of the participants occasionally eat once a day 294(70%), followed by allowing children to eat first 220(52%), with the least being reducing the number of meals eaten in one day 149(35%). However, most of them never sold their assets 183 (43%) nor engaged in illegal income activities (theft, smuggling, prostitution) as a coping strategy 325(77%). The study emphasized that stakeholders should promote nutrition training and socio-economic status, especially for domestic heads of households, in order to improve household nutrition-related knowledge, thereby enhancing the food security of the households. It also recommends that family planning methods should be used more by couples so as to maintain small family sizes, hence promoting more food secure households.

Keywords: Food Security, Domestic Head of Household, Food Consumption Score (FCS), Household Food Insecurity Access Scale (HFIAS)

CHAPTER ONE

INTRODUCTION

1.1 Background to the study

In 2019, it was revealed that close to 690 million (8.9% percent world population) people are estimated to be undernourished globally. This showed that the number of hungry people continued to rise steadily since 2014 and projected to increase to about 841.4 (9.8 percent) million where Africa will have 51.5% (433.2 million) share, the highest number in undernourished people globally by 2030 (FAO *et. al*. 2020). Nigeria being the largest country in Africa was ranked 103rd out of a total of 121 countries in the 2022 Global Hunger Index, with a score of 27.3 which indicates serious hunger and 163rd out of a total of 191 countries in the 2021 United Nations Development Programme (UNDP) Human Development Index, with a score of 0.535 which indicates low human development classification (GHI, 2022; UNDP, 2022)

World Bank (2012) estimates the population of Nigerian to be above 160 million people, the largest in Africa almost accounting for 47% of West Africa's total population. As the population increases, the country's demand for food increases while the ability to produce food diminishes because pressure from the growing population in form of desertification, climate change and erosion are also impacting on the already diminishing resources and further threatening food production. According to the United States Department of Agriculture (USDA) Economic Research Service, Nigeria has a population of 19.9 million people who are food insecure, which is greater than the population of seven West African

countries altogether (Nechifor *et al*., 2021). A nation of weak and sick people cannot be productive. Therefore, provision of adequate food is required at all times for its teeming population. This has reflected in the attention given by governments to ensure that every human being has adequate food needed for sustenance.

The United Nations (UN) in September 2015 at its General Assembly adopted the resolution of the agenda for sustainable development and the resolution birthed 17 goals referred to as Sustainable Development Goals (SDGs) (UN, 2017a). The SDG Goal 2 (SDG 2) as one of the food security goals, was set to address the importance of food security and nutrition within the wider agenda, and calls member States to *"end hunger, achieve food security and improve nutrition, and promote sustainable agriculture"* by

2030. The SDG 2 has five principal targets and three implementing mechanisms (Otekunrin *et al.* 2019a; IITA, 2017; UN, 2017b;). The FAO definition of food security which evolved after the 1996 World Food Summit states that "*food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life"* (FAO, 1996). X-raying the definition reveals the multi-dimensional nature of the food security concept.

Food security is an immensely discussed issue in our society and many scholars have studied the factors leading to food security with their direct and indirect impacts on food security (Berhanu and Wolde, 2019; Martin-Shields and Stojetz, 2019; Musemwa *et. al*.,

2015). Studies have shown that various drivers lead to food insecurity, such as: conflict, climate change, and economic development. As many scholars analysed, these drivers often co-exist and influence each other and just now, the COVID-19 pandemic has increased food insecurity in many

places around the world, due to the effect of sanitary measures and their socioeconomic consequences (Laborde *et. al*., 2020; von Braun *et. al*., 2020). It is therefore against this background that this research is geared towards assessing food security and awareness of Sustainable Development Goal 2 in urban households of Abuja, the capital of Nigeria. Therefore, the following research questions were thus formulated to guide the study;

i.What is the level of food security among households in Abuja Municipal Area Council (AMAC)?

ii.What is the level of awareness of the respondents on food security and SDG-2 among households in Abuja Municipal Area Council (AMAC)?

iii.What are the sociodemographic characteristics of respondents associated with food security among households in Abuja Municipal Area Council (AMAC)?

iv.What are the household coping strategies used against food insecurity among households in Abuja Municipal Area Council (AMAC)?

1.2 Statement of Problem

The goal of the United Nations sustainable development goal – 2 is to achieve zero hunger across all populations of the world, including Nigeria, by 2030. (UN, 2023)

However, this goal has not been met as statistics show that there has been a rising prevalence of hunger and food insecurity across countries and regions globally, with the recent covid-19 pandemic which has caused this prevalence to increase the more (UN, 2023).

A study carried in Nigeria by Cadre Harmonisé (CH) listed the FCT among the 21 states affected by food and nutrition insecurity, in which 14.5 million people require urgent

assistance (Omorogbe, 2022). Abuja Municipal Area Council (AMAC), being one of the area councils in Nigeria's federal Capital Territory (FCT) is faced with enormous challenges resulting in the prevalence of hunger and food insecurity in the country. These challenges include high level of poverty, severe pre-and post-harvest losses due to ravaging pests and diseases, unemployment, social exclusion, corruption, banditry, kidnapping, conflicts, and terrorism (Otekunrin *et. al*., 2019a; Otekunrin *et. al*., 2020a;

Behera *et al*., 2019). Nairametrics (2021) also reveals that Northern Nigeria, including Abuja Municipal Area Council (AMAC) and 22 other conflict areas have been identified as hunger sensitive zones due to Covid-19 and conflict.

With less than a decade to the deadline of the United Nations SDG 2 target, it is therefore important to assess food security status to identify populations with particularly severe conditions (Magan˜a-Lemus *et al*., 2016).

1.3. Objectives of the Study

1.3.1 General Objective

The general objective of this study is to determine the food security status and awareness of Sustainable Development Goal-2 among households in Abuja Municipal Area Council

(AMAC).

1.3.2 Specific Objectives

i.To determine the level of food security among households in Abuja Municipal Area Council (AMAC).

ii.To assess the level of awareness of the domestic heads of households on food security and Sustainable Development Goal-2 among households in Abuja Municipal Area Council (AMAC).

iii.To determine the sociodemographic characteristics of respondents associated with food security among households in Abuja Municipal Area Council (AMAC).

iv.To determine the household coping strategies used against food insecurity among households in Abuja Municipal Area Council (AMAC).

1.5 Research Hypothesis

i.There is no significant association between socio-demographic characeristics of the respondents and food security among households in Abuja Municipal Area Council (AMAC).

ii. There is no significant level of awareness of the respondents on food security and SDG-2 among households in Abuja Municipal Area Council (AMAC).

iii. There are no household coping strategies used against food insecurity among households in Abuja Municipal Area Council (AMAC).

1.6 Significance of the Study

This study uses a more intensive approach for food security assessment which includes identifying the sociodemographic factors associated with food insecurity, level of awareness of the respondents in the study area towards food insecurity, coping strategies employed by these respondents in fighting

food insecurity, and also adapting the FANTA-HFIAS (2007) version 3 and Food Consumption Score (FCS) approach for the analysis of food insecurity status in the study area.

Results gotten at the end of this research will help to close the gap in knowledge on the food security situation of Abuja Municipal Area Council of the Federal Capital Territory of Nigeria.

The information gained from this study could be useful for government and non- government organizations, Ministry of Agriculture and policymakers for planning targeted intervention activities towards achieving Sustainable Development Goal (SDG)

2.

Also, the information gathered from the research will serve as a relevant literature for future researchers on food security.

1.7 Scope of the Study

The study was carried out among adult respondents (≥18 years) residing in Abuja Municipal Area Council, Federal Capital Territory, Abuja. Questionnaire was used in the collection of relevant information relating to the socio-demographic characteristics of the respondents as well their level of awareness on food security and food security status among households in the study area. Furthermore, the various coping strategies adopted by the respondents against food insecurity were ascertained.

CHAPTER TWO

LITERATURE REVIEW

2.1 CONCEPTUAL FRAMEWORKS

2.1.1 Concept of Food Security

According to FAO (1996), food security exists when all people at all times have physical, social and economic access to sufficient, safe and nutritious food which meets their dietary needs and food preferences for an active and healthy life. This definition implies that food security goes beyond availability of food items. It requires that people should have ready access to food. Thus, food production does not necessarily guarantee food security if people that need it do not possess the economic power to access it in their locality. According to the Food and Agricultural Organization (FAO), food security involves four aspects otherwise called four dimensions. These dimensions arise from the definition of food security and are accompanied by a set of indicators. These dimensions are Availability, Access, Utilization, and Stability.

1. **Availability:** World food programme defines food availability as 'the amount of food that is present in a country or area through all forms of domestic production, imports, food stocks and Food aid' (FAO/WFP, 2009)

2. **Access:** Access as a dimension of food security relates to the ability of households to purchase food and transport it. This concept was first presented by Amartya Sen in the

early 1980's. It is defined as 'a household's ability to acquire adequate amount of food regularly through a combination of purchases, barter, borrowings, food assistance or gifts (FAO/WFP, 2009). This dimension is a logistical one. A simple illustration of this is where food is abundant in one part of a country but unavailable in another part due to lack of information or transportation or households do not have the economic empowerment to purchase food.

3. **Utilization:** Food utilization borders on households being able to consume foods that provide their required nutritional standards.

4. **Stability:** Stability characterizes the situation where there is adequate food to satisfy the needs of the people in the country at all times.

2.2 Distribution of Food Insecurity in Nigeria

Figure 1 shows the prevalence of severe food insecurity in Nigeria between 2014 and 2019, which increased with population growth. As it can be seen from Figure 1, demand for food increased by 0.9% throughout the 2014–2019 period. Figure 2, presents the

Food Insecurity Experience Scale's (FIES) regional prevalence of food insecurity in Nigeria, with Borno excluded in the estimate of the study. It demonstrates that food insecurity is more prevalent in southern Nigeria. Figure 3 presents the Famine Early

Warning System Network's (FEWS NET) current food security outcome, which countered the FIES analysis. The FEWS outlook demonstrates that outside of the north, in much of the

rest of the country, the agricultural season is progressing favourably with average and above-average harvests. Therefore, households in these areas will have access to food and income and will remain in minimal acute food insecurity. Inside the north and areas affected by crisis and conflicts between farmers and pastoralists among other unrest are facing greater difficulty in accessing food and income and will be stressed, famine or require emergencies, Figure 4 illustrates that the incidence of moderate and severe food insecurity as per the FIES analysis rose in 2020. As shown in Figure 1, the prevalence of acute food insecurity in Nigeria between 2014 and 2019 has increased with a share of population growth. For instance, there is a strong relation between severe demand for food and a percentage of population by 0.9% throughout the

2014–2019 period. The implications for future trends of population growth could offer Nigeria a huge demographic benefit in food production and significant growth in national markets. However, ignoring these opportunities will be challenging the food sustainability target in Nigeria.

As shown in Figure 2, FIES illustrates that the regional comparison of the prevalence of elements of food insecurity in Nigeria between the north and the south is contained in all of the FIES' 8 constituent questions. On a regional scale level, food insecurity is more prevalent in southern Nigeria for all of the 8 FIES questions. For instance, 84% are worried about food availability, 83% suffer health issues due to insufficient food, 83% have few foods, 71% skipped meals, 75% ate less, 60% ran out of food, 58% are hungry when asked, and 8% witnessed the whole day without food in the south East. SouthSouth and Southwest have been

relatively more food secured than the South East. On the one hand, the NorthWest region is more food secure than the rest of the regions in Nigeria, according to FIES analysis.

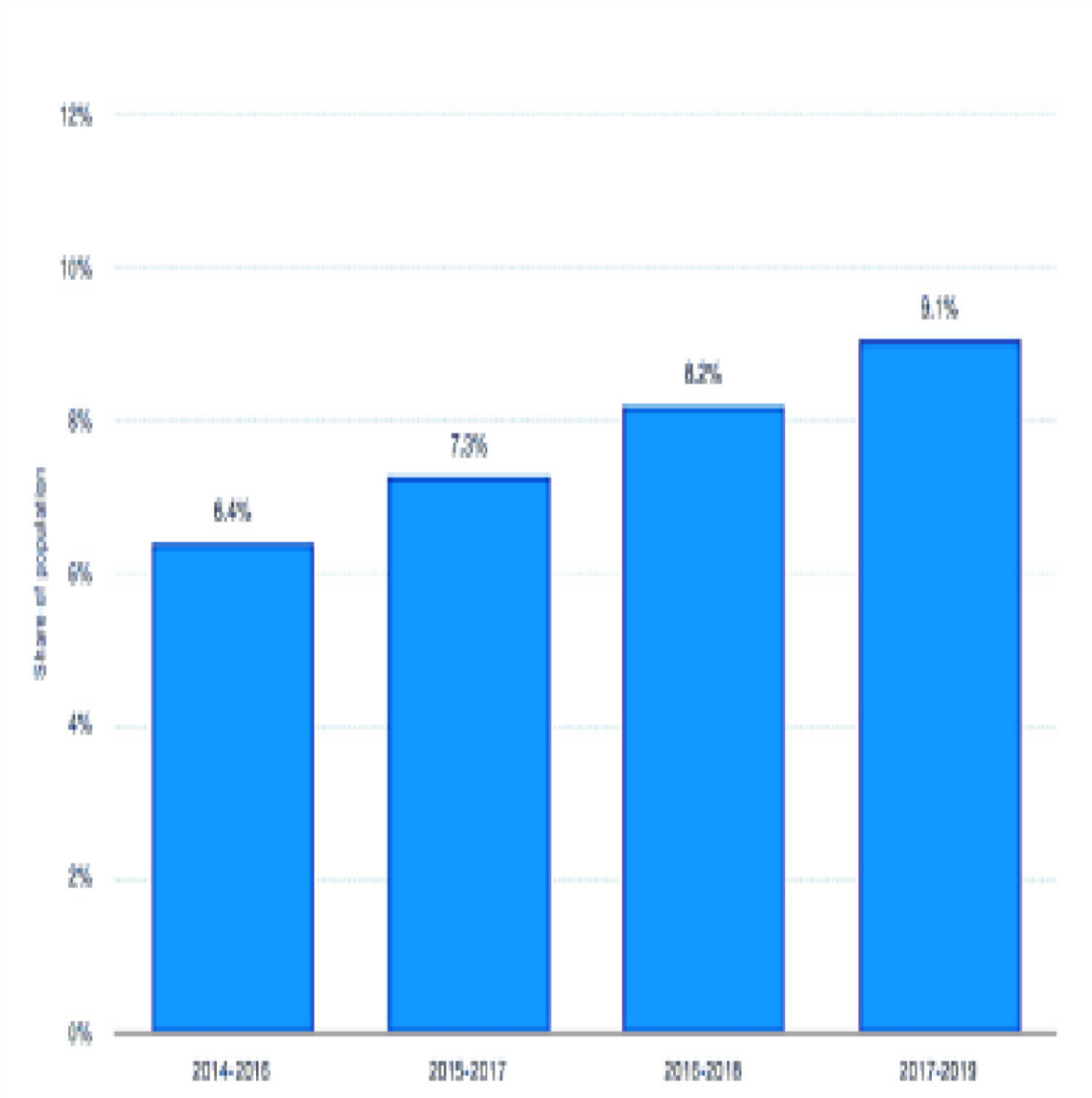

Figure 1. Prevalence of severe food insecurity in Nigeria: Source: FAO (2021).

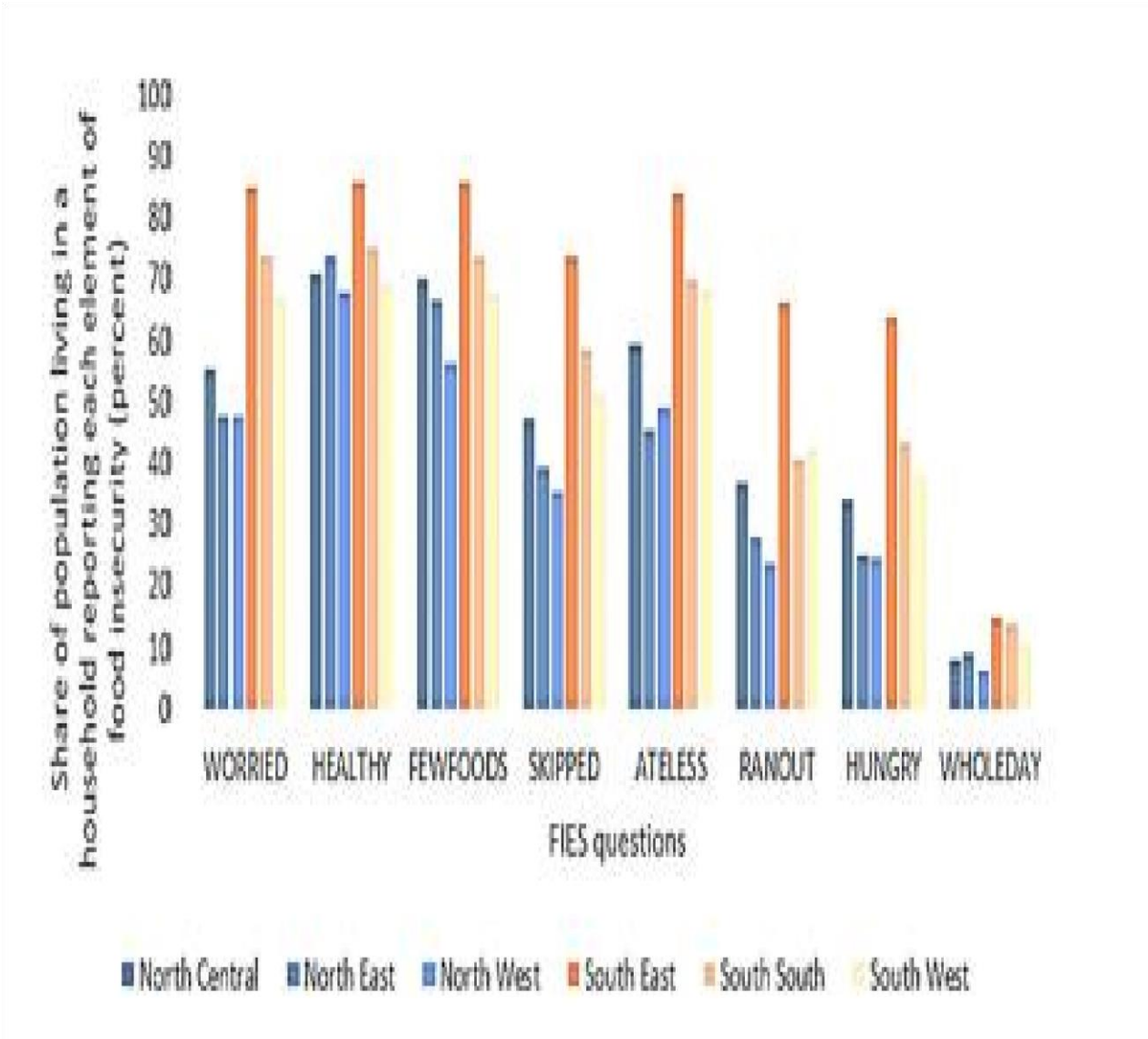

Figure 2. FIES regional prevalence of food insecurity in Nigeria with Borno excluded in the estimate (FIES, 2021)

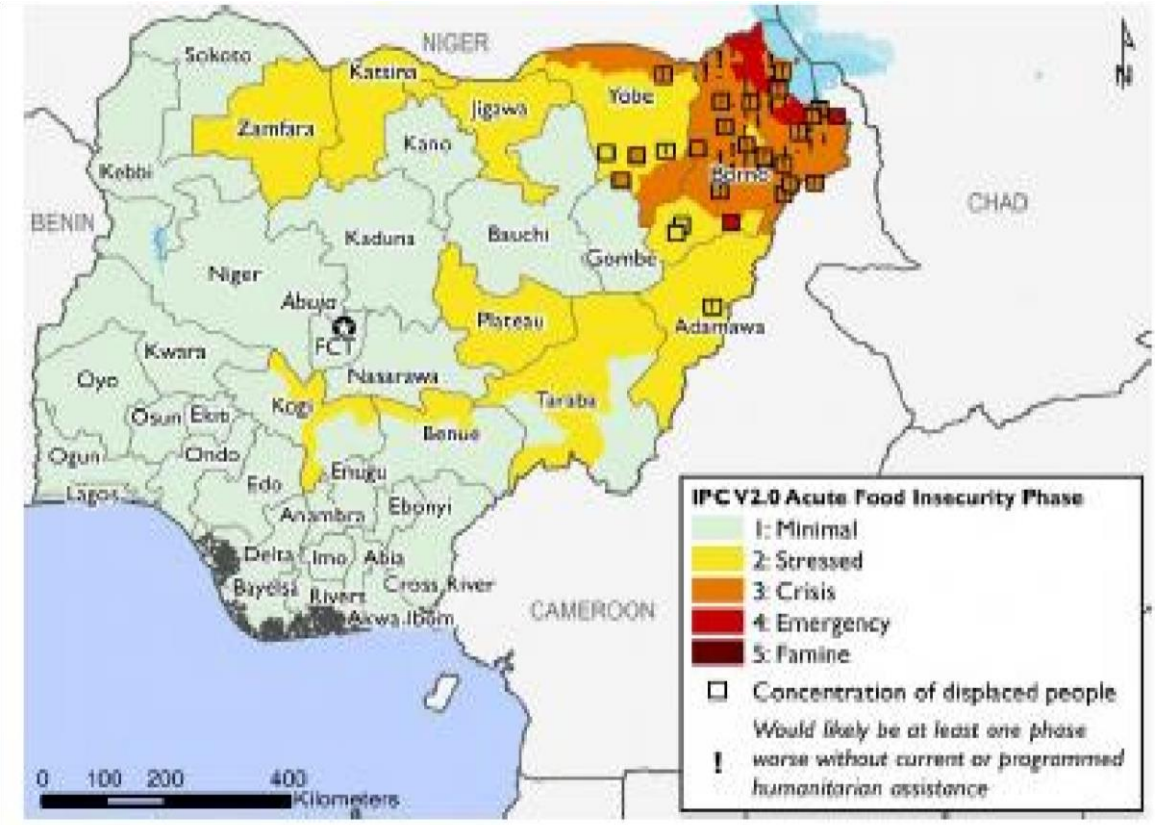

Figure 3. Food security outcomes across Nigeria as at June 2018 (FEWS, 2021)

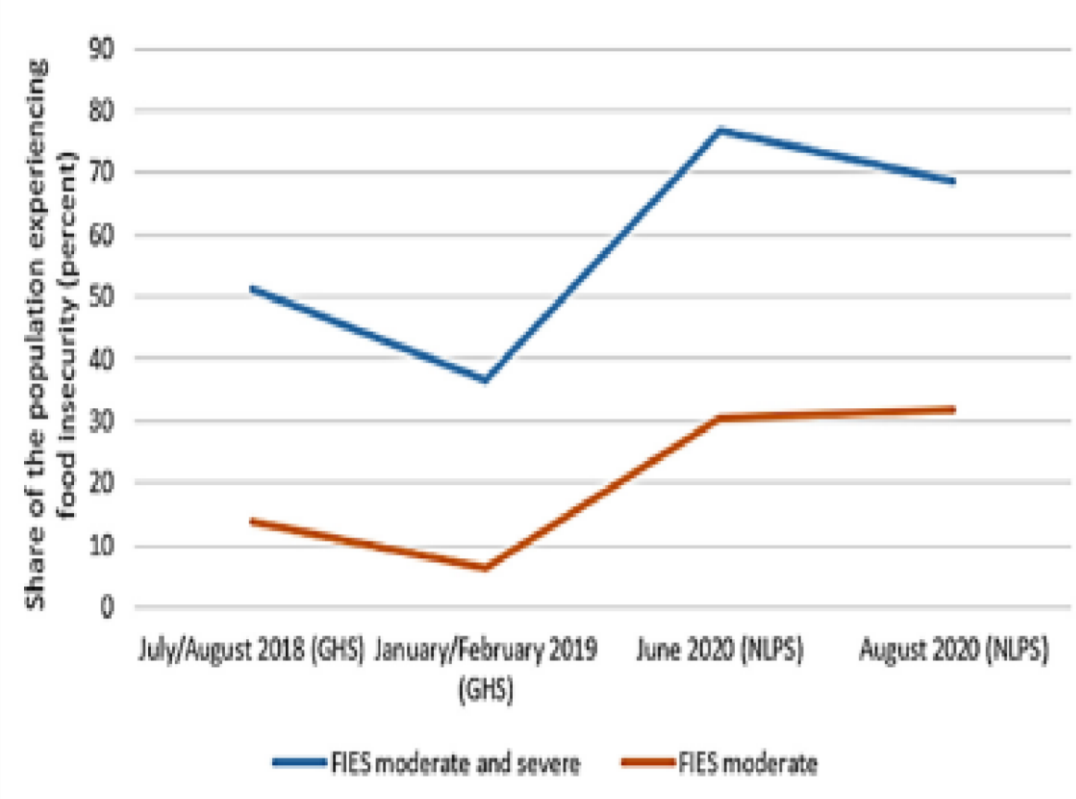

Figure 4. Incidence of moderate and severe food insecurity as per the FIES analysis in 2020. General Households Survey (GHS) National: Longitudinal Phone Survey (NLPS, 2021).

As shown in Figure 3, Phase 1 shows that most households outside of the northeast have access to food and income as a result of average and above-average agricultural harvests, and

they are experiencing only minimal acute food insecurity. Phase 2: Areas most affected by farmer-pastoralist conflict will face more significant challenges in obtaining basic requirements and will be stressed. Food emergency is required in most areas of Borno, northern Adamawa, and eastern Yobe in Phases 3 and 4, due to the prevailing crisis and inability to get humanitarian assistance. As shown in Figure 4, The incidence of moderate and severe food insecurity as per the FIES analysis in 2020 had risen from

38% to 78% and 69% while moderate food insecurity from 7% to 31% and 32% between January 2019 and August 2020.

2.2.1 Food Insecurity and Underdevelopment Features of Nigeria

Nigeria, according to World Data Lab has an estimated population of 205,323,520 persons and has 102,407,327 people living in extreme poverty (50% of the total population) (World Data Lab, 2020). Nigeria is unarguably the most populous nation in Africa and ranked number 7 globally with an estimated growth rate of 2.43 percent per annum and a high dependency ratio of 88 percent. According to Worldometer, Nigeria's population is equivalent to 2.64% of the total world population and it is projected to reach 401million by 2050. (NPC/NBC, 2018; Otekunrin *et. al*., 2019a; Worldometer, 2020; World Data Lab, 2020).

In 2014, Nigeria, the 10th largest crude oil producer in the world, achieved a status of a middle-income country. In spite of Nigeria's oil wealth, 50% of Nigerians total population live in extreme poverty within poverty threshold of $1.90 per day (World Data Lab, 2020). Food insecurity in Nigeria is currently at alarming rate calling for urgent and immediate intervention. *Figure* 2 shows that Nigeria's ranking in Global Food Security Index (GFSI)

has continued to increase since 2013 (ranked 86 among 107 countries with 33/100 score) and reached a disturbing rank of 94 (with 48.4/100 score) among 113 countries behind Ethiopia, Niger and Cameroon in 2019 GFSI overall

ranking table (the closer to 100 score the better) (EIU, 2019).

Moreover, Nigeria overtook India which was previously regarded as the country with the highest number of people living in extreme poverty globally but in May 2018, Nigeria overtook India to become the world poverty capital with the highest number of populations living in extreme poverty reaching 86.9 million. It is quite alarming that the poverty situation in Nigeria is increasing. As of 6 May 2020, 102.4 million Nigerians live in extreme poverty implying that an additional 15.5 million Nigerians have plunged into poverty in 24 months (World Data Lab, 2020). The acute food insecurity in Nigeria is occasioned by chronic and hidden hunger, extreme poverty, corruption, conflict events

(insurgency in the North East) and unfavourable climate change. In the 2019 Global Hunger Index (GHI) score, Nigeria has a GHI score of 27.9, which falls in the *serious* category. These data reflected that Nigeria (through these indicators) is not yet on track in attaining the SDG 2 target of ending all forms of hunger, achieve food security and improved nutrition, and promote sustainable agriculture by 2030. Proportion of undernourished increased from 9.3% in 2000 to 13.4% while a slight decrease was reported in stunting from 39.7% in 2000 to 37% in 2019. Meanwhile, the only indicator that showed remarkable progress was the child mortality rate, which declined from

18.6% in 2000 to 10% in 2019 (von Grebmer *et al.* 2019). Nigeria also had a rather low Africa's Sustainable Development Goals Index (SDGI) rank and score (ranked 43rd among

52 countries in Africa with 47.03/100 score) slightly behind Sudan (ranked 42nd with 47.38/100 score) and Comoros (ranked 41st with 47.5/100 score) in Africa (Otekunrin *et al.* 2019c).

Nigeria is blessed with abundant land suitable for agriculture (75 percent) but unfortunately; only 40 percent is used for agricultural purposes. A vast majority of the rural household population still engages in subsistence farming which can barely feed their immediate families. Lack of infrastructural facilities such as good roads has heightened rural poverty disconnecting rural farmers from needed inputs and markets for their produce (FAOSTAT, 2019; Otekunrin and Sawicka, 2019).

Chronic and seasonal food insecurity persist in every part of Nigeria, escalated by frequent high food prices, impact of conflict related to insurgency (especially in the Northeast), armed banditry, communal, pastoralist/farmer crisis, kidnapping, cattle rustling, and climate change (FEWS NET, 2020). Among the six geopolitical zones in Nigeria, Northeast, North-Central and South-South are the three zones mostly affected by conflict events. Figure 3 shows that the reoccurring conflict events are terrorism in the Northeast (73%), land or resource access in the North-Central (55%) and cultism/criminality in the South-South (36%) (NBS/World Bank, 2018; Otekunrin *et al.*, 2019a). According to the International Office of Migration (IOM) assessment in October 2018, over 1.8 million persons were displaced across Borno, Yobe and Adamawa states with Borno state remaining the epicentre of *Boko Haram* conflict hosting over 1.4 million Internally Displaced Persons (IDPs) (FEWS NET, 2019). Global Rights (an international non-governmental organisation) report revealed that 3,188 persons, including 2,707 civilians and 481 security operatives, were reportedly killed in 2019

(FEWS NET, 2020). IOM-DTM assessment, conducted between August and October 2019, reported that over 2 million people were displaced in Adamawa, Bauchi, Borno, Gombe, Taraba and Yobe states in the northeast while in January 2020, ACLED reported 507 fatalities throughout Nigeria (FEWS NET, 2020). Agriculture, a major source of livelihood for people in these areas, and other income-generating activities were disrupted leading to reduced household income and limited access to food (USAID, 2017).

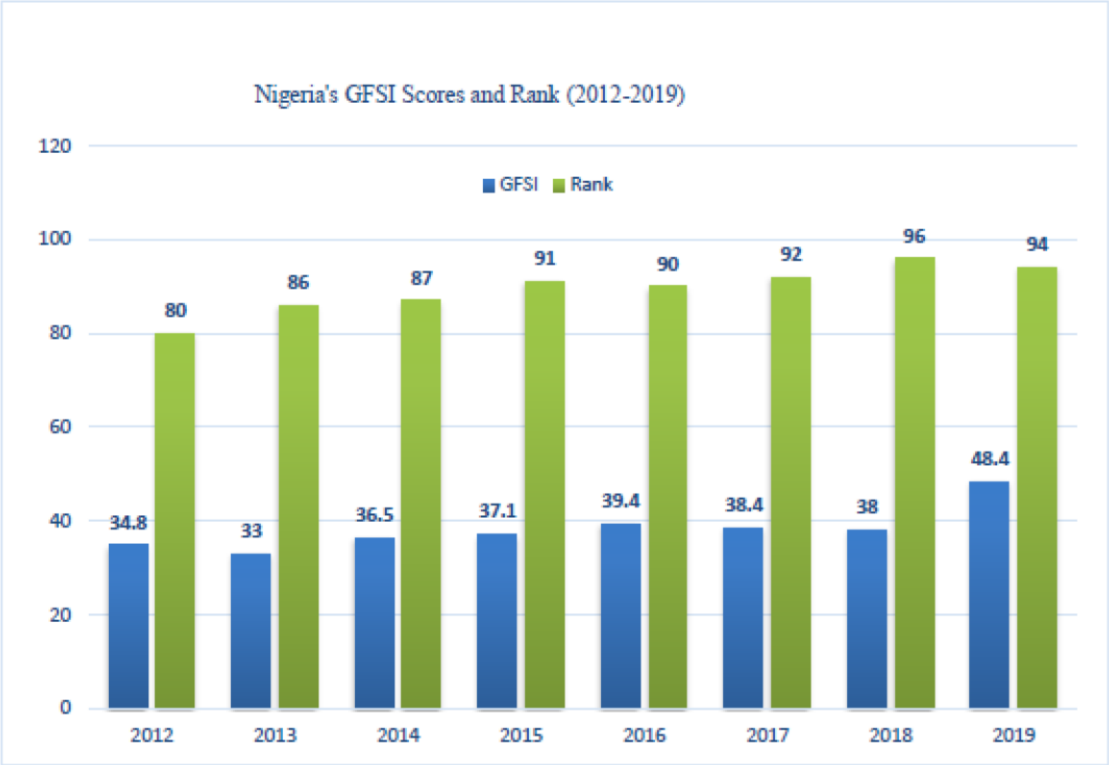

Figure 5: Nigeria's Global Food Security Index and Rank (2012-2019)

Source: Authors' graph using EIU 2012-2019 data

The projected food security outcomes (June-September 2020) in the country is displayed in figure 5. According to FEWS NET (2019), intense insurgent attacks in the northeast Nigeria have led to increased displacement of persons with attendant food needs. Also, many households are negatively impacted by farmer/herder conflict in central and northern states of Zamfara, Katsina, Kaduna, Taraba, Plateau, Benue, Nasarawa and Adamawa. The conflict did not allow the households to engage in normal livelihood activities including farming with no access to market and income opportunities (FEWS NET, 2019; 2020).

2.2.2 Link between Food Security and Development

National development can be described as a sustained improvement in the standard of living in the country as depicted economically, by sustained growth in per capita income. Economic development is brought about by sustained economic growth, which is characterized by high efficiency and productivity of resources invested in production (Ayinde, 2019). It is a fact widely acclaimed that no country can achieve economic development without agricultural development. This is achieved through achieving food security and sustainability in the provision of abundance crop and livestock (food accessibility, food affordability, food utilization and food quality), to meet local consumption, raw materials for the processing industries, national reserves and export (Ayinde, 2019).

Food insecurity and its derivatives are used as economic development indicators because of the positive linear correlation that exists between the two (Otekunrin *et al.* 2019a); this informs its prominent mention in the SDGs. Examples of food security-related indicators of development include but not limited to:

a) Prevalence of stunting and wasting of under-age children.

b) Under-five years' children mortality rate.

c) Infant mortality rate

d) Maternal mortality rate

e) Proportion of total water resources used

For Nigeria to develop, food security growth must be sustained. An increase in production activities in the industrial, mining, metallurgy sub-sector, especially if it promotes export (like the case of Nigeria been a net exporter of urea) must, without doubt, put food on the table of average Nigeria. No economy can thrive sustainably without improving the human capital component of the economy (Awoyemi *et. al.*, 2015; Ayinde, 2019). Food insecurity negatively affects human physical, social, emotional, and cognitive development throughout the life course and is a major social and environmental disruptor with serious repercussions for planetary health (i.e., the health of human civilization and the state of the natural systems on which it depends). Food security is related to all of the United Nations SDGs. Improved food security governance based on sound, sustainable and equitable agricultural is essential for countries to meet the SDGs (Perez-Escamilla, 2017b).

Food and nutrition security embraces meeting energy, protein and nutrient needs for healthy life. Figure 6 shows very clearly, the pictorial representation of the link between food security, human capital development and national development.

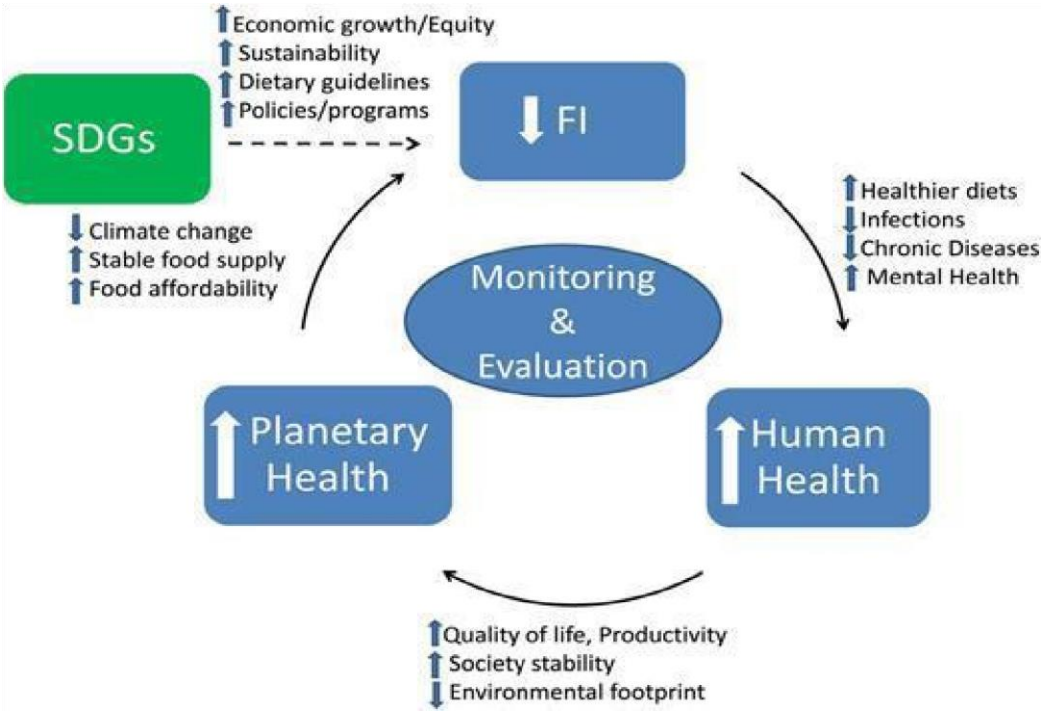

Figure 6: Precursors food insecurity (FI), human capital development and national development (SDGs). **Source**: Built from SDGs; UN Sustainable Development Goals Data. Perez-Escamilia (2017b).

2.2.3 Major Causes of Food Insecurity in Nigeria

Scholars have studied different drivers that influence food security. Amongst them, three drivers stand out: environmental and climate change, the economic situation of the population, and political and social unrest or war (Oyinloye *et. al*., 2018). To answer the research question, analysing these three most examined factors impacting food security are important and are reviewed in this chapter.

2.2.3.1 Climate Change as a Driver of Food Insecurity

Climate change has turned into a global issue and has worsened in recent times. It is now considered a climate crisis and threatens the agricultural production due to higher and more inconsistent temperatures as well as the variation in rainfall patterns and extreme events, such as droughts and floods, occurring more often (Ogbo *et. al*., 2013). With this change, researchers decided to study the relationship between climate change and food security. Studies were done concerning one single country, several countries, or simply regions. Most of the research has been conducted through surveys, direct observation, and weather data. They often used a modeling approach, because they often predicted future scenarios (Berhanu and Wolde, 2019). Researchers agree upon several impacts that climate change already has or will have on food security: on the cultivation and crop yields, as well as on biodiversity.

Climate change affects the first aspect of the food supply chain most. Food production starts with crop growth and cultivation. These are strongly affected by climate variability and therefore especially the agricultural sector is hit by climate change (Wossen and Berger, 2015). In Iran for example Karimi *et al*. (2018) have with the help of crop modeling looked

towards the possible impacts, the decline of water resources and precipitation, warmer temperature, and higher CO_2 emissions will have on crop growth and food production. Their findings were similar to the majority of research: food production depends on a steady climate and enough clean water resources.

Another effect climate change has on the beginning of the food supply chain is in the fishery sector. According to Muringai *et. al*., (2020) droughts, that are happening due to climate variability are the biggest problem in that sector. Water temperature is increasing, and the level of oxygen is decreasing which leads to a change of fish habitats. The fish might then be contaminated with bacteria, might reproduce less, or get wiped out completely. Droughts can also lead to desertification and lakes disappearance, on which small-scale fishers depend.

Climate change also forces people to leave their homes, which makes them vulnerable to food insecurity. Internally displaced persons (IDPs) are often forced to leave because of climate change and conflict; two of the three drivers reviewed here. McGregor (1994) addressed the nexus of climate change, forced migration, and food insecurity because already in 1994 there have been many involuntary population displacements due to climate change. Food is one of the most vital needs in displacement camps, where a lot of the IDPs have to live in for many years. They have limited access to it and because they mostly depend on aid that is not always given and most likely they are not able to consume the amount and diversity needed. Thus, they increase food insecurity in a country (McGregor, 1994; Mooney, 2005).

As has been shown, climate change affects food security in various ways. It mostly affects people's livelihoods through food production, people live food insecure because there is less food available or the available food does not have enough nutrients. This leads to people not

being able to access food. Most researchers focused on climate change and its impact on future food security or how it evolves and less on how climate change led to food insecurity. Therefore, it is worth it to explore how climate change has led to food insecurity in Nigeria.

2.2.3.2 Economic Development as a Driver of Food Insecurity

Previous literature suggests that the economy influences food security. Economic growth is one of the biggest variables to measure the economy and can be closely connected to food security. Studies by several scholars provide proof that the better the economic growth is, the more people are likely to be food secure (Warr, 2014). Hence a weak economy or an economic crisis can lead to food insecurity in a country (Musemwa,

2015; FAO *et al*, 2019). Most research has been conducted in developing countries in Africa because especially developing countries might have thriving economic growth, but at the same time are vulnerable to an economic crisis, because they are often lowincome countries, countries in conflict and the countries that are hit most by climate change. All this increases the vulnerability of a population (FAO, 2019).

For the food security status of a household, the economic situation of the individual is significant as well. Many researchers analysed unemployment as a factor leading to food insecurity. It is one of the most explored factors in the field of economic development and food security. Being unemployed puts people into poverty and poor people usually depend on the market to obtain food. They spend a higher percentage of their income on food and consequently suffer more likely from food insecurity (Etana and Tolossa, 2017). A lot of other literature argues that unemployment, in particular long-term unemployment, does not only

result in people spending less money on food but also causes people to change their diet. Evidence showed that they bought cheaper and less healthy food, which in turn impacted the quality of the daily calorie intake. Other studies also found that consumption patterns change when one gets unemployed (Leichenko and Silva, 2014). Therefore, unemployment can lead to food insecurity on the individual

level.

Food prices are another indicator leading to food insecurity (Smith *et. al.*, 2017). Global food price drops or rises hit especially countries with an uneven trade balance.

When a country depends on exporting agricultural goods or minerals, they are more vulnerable to global price volatility (FAO, 2019). As mentioned above, most scholars argue that often developing countries are affected by economic crisis. However, all countries can be affected by a sudden global economic shock. Especially the 2008 financial crisis and the recession that followed have negatively impacted several countries in the Global North. Davis and Geiger (2017) analysed the demand for food aid in Europe after 2008. They argue that the need for more food aid represents higher food insecurity. They found a rise in food aid and therefore more food insecurity after 2008. Griffith *et al*. (2013) have, on the other hand, examined the food expenditure of people in the UK and concluded that after 2008 there was a significant change in what people bought. Further studies have also shown identical results in studies covering developing countries (Huang *et al,* 2016). The economic situation people are in affects their state of food security. Hereby it does not matter whether a country is in the Global North or Global South, an economic crisis can hit every country.

2.2.3.3 Violent Conflict as a Driver of Food Insecurity

The FAO (2017) has asserted that conflict-affected countries have on average higher rates of food insecure people than countries not affected by conflict. Violent conflicts can have short-term effects on people's nutritional status. This in turn can have longlasting impacts on their livelihoods. There are several ways where violent conflict affects food security. However, at first, it has to be mentioned that the effect conflict has on food security depends on what kind of conflict it is, considering that 'measuring and categorizing conflict is not straightforward' (Martin-Shields and Stojetz, 2019). Studies show that the outcome depends on the type of conflict.

Available literature shows that conflict often occurs in rural areas, areas that have a lot of agriculture (FAO, 2017). Consequently, violent conflict can especially impact agricultural production. On the one hand, food production can decrease. Cultivation is interrupted, where people depend on agriculture. Often fields were ruined by bombs, or it was simply unsafe to work on them (Baumann and Kuemmerle, 2016). Other times farmers abandoned their lands because farmers or workers were killed, people were forced to leave, fled voluntarily, or were involved in the fighting. This can lead to a labour shortage and therefore fewer people harvesting which then can lead to crop yield loss and food insecurity (Eklund, *et al.*: 2016; Adelaja *et al*., 2019). On the other hand, agricultural productivity can increase and have a positive impact on the food security situation in conflict areas. Agriculture can be an important income source for the militants. Jaafar and Woerz (2016) analysed the agricultural productivity of the Islamic State in their controlled area until 2016. Their findings were that it is an important source of domestic food security.

Whereas the scholars above agreed that conflict impacts food security, Adelaja and George (2019) came to different findings. Their focus was also on food production. However, they could not clearly support the argument that conflict has an impact on food security at all. They collected data from household surveys and the Armed Conflict Location & Event Data Project (ACLED). When analysing the data, they found that the amount of land that can be harvested does not decrease when the number of attacks goes up. Although at the same time they did find that a higher intensity of the conflict harms the output of agriculture (Adelaja and George, 2019). Food access to households and individual food consumption has also been researched by people. A reduced production can lead to a decline in food availability which can cause a reduction in market access to buyers.

An example of long-term impacts of food insecurity due to a conflict are studies that focused on the long-term effect of children that were exposed to conflict at an early age (Martin-Shields and Stojetz, 2019; George *et al*., 2020). The researchers often used the difference-in-differences approach. They analysed one region where conflict occurred and one where there was no conflict and compared the results. Bundervoet *et. al*., (2007), for example, studied the impact of the civil war in Burundi on children's nutritional status over time. They use data from household surveys in civil war affected and nonaffected areas. According to their study, children that were born in regions that at the time of birth experienced violence and had no access to food, due to the disruption of the agricultural production, had lower height-for-age z-score (HAZ) and were therefore not developing the same way as other children. Minoiu and Shemya-kina (2014), as well as Arcand *et al*., (2015), based their research on Bundervoet *et al*., (2007) and did similar studies in Côte d'Ivoire and Angola. With the same approach, their

findings are similar: Children who were exposed to these conflicts while born or in their early childhood had a lower HAZ than others. Lastly, other scholars focused on the impact on IDPs. As above mentioned, conflict can lead to people fleeing and as noted, they are especially vulnerable to food insecurity. The outcomes are the same as when there are IDPs due to climate change. However, these scholars show that not only climate change can lead to internal displacement, also conflict can be a reason (Tusiime *et al*., 2013). As demonstrated, violent conflict can impact food security directly and indirectly. Direct impacts are mostly on the national level and indirect impacts mainly on the individual level. For example, as the prior section of economic development on food security shows, unemployment, and reduced household expenditure can impact the household and individual level, this can happen due to interference into markets and food chains (FAO, 2017). Therefore, although not every scholar supports this, it can be said that conflict can have an impact on all different levels of food security.

2.2.4 Food Security and Nutrition Measures

Measuring food security is a highly diverse field of action and requires a careful selection of the indicators and techniques employed during assessment. Indicators and sets of indicators might work well in a setting but might not be appropriate for another. Food security surveys can, as all surveys, be subject to errors due to biased/malinterpreted questions and biased/mal-interpreted answers (in a participants' experience, despite good training, enumerators misunderstood a question and ended up affecting the whole result of the survey). On the other hand, objective measures such as anthropometrics or more detailed assessments of diet components remain less used and can be much more complex (FAO, IFAD, IMF, OECD, UNCTAD, *et al*., 2011). The full range of food insecurity

and hunger cannot be captured by any single indicator. Instead, a household's level of food insecurity or hunger must be determined by obtaining information on a variety of specific conditions, experiences, and behaviours that serve as indicators of the varying degrees of severity (FAO, 2014). The choice of methods and indicators should be driven by the aim of the measurements (targeting, monitoring, evaluation, etc.) and by the audience to which the measurements are directed (analysts, researchers, community leaders, policy makers, etc).

Following FAO (2003), five general types of methods/Indicators were identified. The first indicator can be labelled undernourishment, a measure commonly identified with the Food and Agriculture Organization of the United Nations (FAO). This FAO method begins with an estimate of the per capita dietary food energy supply, derived from aggregate food supply data. Assumptions regarding the distribution of this supply across households are made based on the income or consumption distribution, or other available data. A second group of indicators, which can be termed food intake, measures the amount of food consumed at the individual or household level. Indicators at the individual level can be obtained directly by measuring actual food intake through several techniques. Food intake surveys, however, are relatively rare, given its cost considerations. Instead, food consumption is usually measured indirectly through household surveys. Household surveys in general, and multipurpose household surveys, are aimed at assessing living standards, not just food security. Although they are time-, resource and skill-intensive, they are now regularly implemented in many countries. Household level data can be used to construct several measures of food insecurity, including food energy deficiency and poor diet quality and diversity.

The third approach to the assessment of dietary deficiencies is to measure food utilization through nutritional status. Anthropometric measures of children under age five are regularly collected in random sample surveys in many countries. Anthropometric measures, as outcome measures, are well suited for monitoring and evaluating interventions, and can be collected with socioeconomic information to analyze the determinants of malnutrition. Anthropometric attainment, however, is a nonspecific indicator, because it is the result not only of food intake, but also of factors such as sanitation, health and childcare practices. Since nutritional status is an individual-level indicator, it has distinct advantages. For example, it does not mask food insecurity in seemingly food secure households when intra-household allocation rules result in unequal distribution of food resources. This is a problem for both objective and subjective measures, where, for example, one household member responds (e.g., the head) perhaps on basis his/her response on his/her own situation. However, as nutritional status is only available for young children, it has limited power in describing food security for the broad population.

Fourth, food availability is of little use if households or individuals do not have enough financial or productive resources to acquire food. The fourth group of indicators revolves around the concept of access to food and can be proxy by wealth status, measured by total consumption, expenditures or income. Access-to-food indicators, and income, have served as the main food security indicator in many countries. The link between access and a given wealth proxy breaksdown when local markets are not functioning, as in the case of war or disaster (FAO, 2003). Finally, the last approach revolves around the concept that even if households are not currently undernourished, they may be at risk or vulnerable to future deprivation. Vulnerability is often gauged through qualitative or 'self-assessment' indicators

of food insecurity, capturing dimensions which are difficult to isolate with traditional quantitative measures, especially in the absence of panel data. Households may regard themselves as hungry, even if there are no recognizable signs of undernutrition. Further, even if households are not currently undernourished, they may have a significant probability, or well-founded fear, of future deprivation. Other measures of vulnerability to food deprivation also drawn from household surveys include the share of income spent on food and various coping-strategy indices.

Reduced forms of these subjective modules are found in many recent standard national household surveys, such as the World Bank's Living Standards Measurement Surveys (LSMS), and focus on respondents' perceived assessment of individual or household food security situation. One of the questions most commonly asked is called the consumption adequacy question (CAQ), and is generally worded as follows:

'Concerning your food consumption, which of the following is true?' Answers are generally coded as: (a) more than adequate, (b) just adequate, (c) less than adequate.

2.2.5 Barriers to Food Security in Nigeria

2.2.5.1 Climate Change, Bad Harvests, and Dysfunctional Markets

Like most African countries, Nigeria relies heavily on rain-fed agriculture, which is becoming more precarious due to climate change. In Southern Nigeria, climate-related flooding destroys farms every year while drought conditions compounded by the lack of irrigation affect food production in the North (Bello *et. al*., 2012). Desertification is also wiping out plants, animals

and freshwater resources, thus pushing people to further encroach on the few parcels of forest left in the North (Bello *et al*., 2012). Furthermore, lower yields brought about by the combination of high temperatures, less rainfall, and shrinking lakes are a significant cause of poor harvest. Lower yields mean less food for consumers and lower returns on farmers' investments. In other words, they are less able to afford setting up for next planting season and are increasingly forced to abandon their farms to find working other sectors (Bello *et. al*., 2012), thereby decreasing food production and availability.

2.2.5.2 Power Politics, Conflicts, and Food Accessibility

While droughts, arid conditions, and natural disasters can bring about famine, politics and internal strife can exacerbate such conditions. In Nigeria's predominantly farming areas of the Middle Belt Region, violent clashes between farmers and herdsmen have resulted in the destruction of lives and farmlands, threatening food security (Eme *et. al*.,

2014). Climate change and the expanding Sahara desert are reducing grazing land in Northern Nigeria, forcing herdsmen further south where they come into conflict with farmers and their land. Some states have tried to address this problem by passing antiopen grazing laws, but this has driven more herdsmen into states without these laws, thus escalating conflicts in those areas. Added dimensions to the land use struggle are religious and ethnic tensions: the herders are predominantly Muslims and farmers Christians from a different ethnicity group. The President Muhammadu Buhari government has done very little to intervene in the conflicts. Some scholars blame this on a conflict of interest since the president is from the same ethnicity as the herders (Eme *et. al*., 2014).

Moreover, Boko Haram is suspected of playing both sides against one another to stir up further unrest (International Crisis Group, 2018). Militant activities in this area have slowed down the rate of production, therebycreating food shortages and hurdles with accessibility – as fear prevents people from going to their farms and keeping aid organizations from reaching those in need of food (UNDP 2017). This problem is further exploited by Boko Haram; the group uses food shortages as a recruitment tool – promising disaffected, starving Nigerians food in exchange for enlistment, creating a vicious cycle that will not be resolved on its own without intervention from the Nigerian government (CIA, 2018). The crisis in Northern Nigeria impacts the whole nation. Urban area such as Lagos enjoyed relative food availability before the conflict became full blown. The North supplies Lagos with 90 per cent of its food and markets such as Ketu, Mile 12, and Oyingbo got their produce from northern states daily before Boko Haram infiltrated the area (Eme *et. al*., 2014), thereby creating fear and destabilizing supply. These issues show how political conundrums and conflicts in one part of the country could have reverberating effects nationwide, thereby affecting overall food security. **2.2.5.3 Weak Regulatory Regime, Land Grabbing and Sustainable Agriculture**

Power politics can be seen in the minimal support provided to small holder farmers' visà-vis big capital. On the one hand, farmers in Nigeria lack supplies, including water, vehicles, tools, fuel, fertilizer, seeds, land, training, education, and legal protection, which in turn affects their ability to scale-up food production. On the other hand, the few lands available to farmers are being threatened by the current wave of land-grabs going on across the country. Land grabbing is a large-scale acquisition (buying or leasing) of land in developing countries by domestic and trans-national companies, government, and individuals for different purposes,

including biofuel production, food, financial security, and ecotourism (Fairhead *et. al*., 2012). This is often done with little regard for local communities' rights to land, food, livelihood, and environmental sustainability. Such land appropriation has occurred in almost all 36 states of Nigeria – where the federal government, represented by Nigerian National Petroleum Corporation (NNPC) and their foreign partners, have acquired land to produce agro-fuel despite being one of the leading producers of oil in the world (Attah, 2013). Biotech companies producing GM crops have also increased their presence and participation in land grabs in Nigeria with new researchinto genetically modified forms of cassava, sorghum, cowpea and rice

(Cerier, 2017). This latter issue has implications for seed ownership and control. There are also large-scale land deals for Jathropha, an agro-fuel, which could dispossess small holder farmers from their land, reduce investment in food crops, and undermine sustainable agriculture.

2.2.5.4 Food Importation, Affordability, and Safety

Food prices have soared across Nigeria, but household income has not kept pace (Eme *et. al*., 2014). A basket of tomatoes that was sold for ₦300- ₦500 in 2004 became ₦7, 000 - ₦9,000 by 2014 (Eme *et. al*., 2014). The latter is not affordable to most Nigerians who live on less than ₦1.088 per day. Several factors affect food prices in Nigeria, including the lack of infrastructure, corruption, conflict, fluctuation in oil prices, and transportation cost associated with moving food from the North to the South. The

Federal Government's response to food shortages and the consequent rise in prices has been to increase food imports using oil revenue (Onafeso *et. al*., 2015). Nigeria spends over a trillion naira annually on food imports: N635 billion on wheat; ₦356 billion on rice; ₦217

billion on sugar; and ₦97 billion on fish (Qatar Economics, 2018). This creates an additional financial burden for the country while increasing vulnerability to price volatility in the global market. Food importation also has safety implications, especially when they come from countries with low safety standards such as China. Due to high tariffs, many food imports, including rice, are smuggled illegally through Cameroon, Ivory Coast, and Benin, without proper check for their safety. A number of people have died of food poisoning in the recent years; food regulation and control are low. For example, expiry dates are re-stamped to increase sales past actual recommendation by producers. The combined structural and socially induced problems discussed in the section are, in part, responsible for food insecurity in Nigeria. The SDG

2 offers a new opportunity to revisit these concerns and to re-appraise Nigeria's food security strategy.

2.2.6 Nigeria's Intervention Programs in Achieving Food and Nutrition Security

The Nigerian government is not relenting in her efforts aimed at reducing extreme poverty, hunger and food insecurity among her ever-growing population where the children (infants and adolescents) and women are the most vulnerable. Several policies and programs that are nutrition-sensitive with efficient frameworks to tackle food insecurity and all forms of malnutrition have been developed. Some have been implemented while many are yet to yield positive results. Efforts are being made by the Nigerian government to return agriculture to its enviable position in the Nigerian economy. Some of the policies and strategies enacted by Nigerian government aimed at reducing the level of food and nutrition insecurity are mentioned below (IITA, 2017; Olomola, 2017; Otekunrin *et al*. 2019a):

2.2.6.1 National Policy on Food and Nutrition (NPFN)

The national committee on food and nutrition of the National Planning Commission developed this document, in 2002. It focused mainly on Food and Nutrition Security

(FNS) in different sectors and among different classes of society. (IITA, 2017; Olomola, 2017; Otekunrin *et. al.,* 2019a). The policy did not yield needed improvement in nutrition as reported by the Ministry of Budget and National Planning and this occasioned its revision in 2016 better performance (FGN, 2016; Olomola, 2017; Otekunrin *et al.* 2019a).

2.2.6.2 Agricultural Transformation Agenda (ATA)

The ATA (2011-2015) was designed and implemented by the Federal Ministry of Agriculture having food security and agricultural productivity as the focal targets of the program. The main components of ATA as highlighted in Olomola and Nwafor (2018) and Otekunrin *et. al.,* (2019a) were:

(i) The Growth Enhancement Support Scheme (GESS) commissioned to enhance the availability of contemporary agricultural inputs to farmers at subsidized prices.

(ii) The Staple Crop Processing Zone (SCPZ) aimed at enhancing clustered food production, based on the comparative advantage of each region.

(iii) Agricultural Commodity Value Chain Development (ACVCD) designed to harness key commodities in crop and livestock sub-sectors in different agro-ecological zones.

(iv) Agricultural Marketing and Trade Development Corporations (AMTDCs) were commissioned to improve smallholder farmers' access to markets.

(v) The Agricultural Extension Transformation Agenda (AETA) designed to enhance diffusion of information and adoption of innovations.

(vi) The Nigerian Incentive-based Risk-Sharing System for Agricultural Lending (NIRSAL) established to surmount the bottlenecks associated with agricultural commodity and financing value chains.

It was reported that about 12 to 14 million smallholder farmers benefited from the means-based input subsidies offered by ATA 2011- 2014. Commodity marketing boards was re-established and also formal lending purposely for agricultural businesses increased from 1% - 6% in 2015 (FGN, 2016; Olomola, 2017; Otekunrin *et al.* 2019a). Other policies and programs geared towards food security and nutrition in Nigeria are listed below as cited by Olomola (2017) and Otekunrin *et al.* (2019a);

(a) National Strategic Plan of Action for Nutrition (NPAN) (2014-2019): Some basic objectives of the plan contribute to controlling diet-related non-communicable diseases and promote/strengthen community participation for nutrition interventions.

(b) Agricultural Promotion Policy (APP) (2016-2020): Some basic aims of the policy seek to raise awareness concerning nutritious foods and enhancing the quality of food through the control and use of agrochemicals.

(c) Zero Hunger Initiative (ZHI): The ZHI seeks to formulate a strategic framework for achieving Zero hunger target (SDG2) in the country using a multi-stakeholder and multidimensional approach in which all sectors have specific goals that must be met.

2.2.6.3 Social Safety Net Programs

In addition to the afore-mentioned Food and Nutrition Security policies and programs of the Nigerian government, there are other important social safety net programs commissioned in 2016 under National Social Investment Programs (N-SIP). The intervention program was launched to offer assistance to the most vulnerable people

(groups) in the society in order to offer economic assess to food and quality livelihoods while reducing the prevalence of food and nutrition insecurity in the country. According to FGN N-SIP (2018) and cited in Otekunrin *et al.*, 2019a, these programs are given as follows;

(i) National Cash Transfer Program (NCTP):

NCTP was launched in 2016 mainly to offer support to the most vulnerable groups in the population nutritional intervention, improving livelihood and human capital development through access to cash benefit (N5000) every month. It was reported that more than

300,000 households have been impacted by this scheme since it was commissioned.

(ii) National Home Grown School Feeding (NHGSF) program

This was commissioned to reduce the prevalence of chronic hunger and malnutrition among the school-age children, improve school enrolment and enhance the teaching and learning process by providing at least a meal a day to each school pupil.

(iii) N-Power Program

The basic aim of this program is to induce the learn-work-entrepreneurship culture in Nigerian youths between ages 18 and 35. The N-Power program is sub-divided into eight categories. These are: N-Power Agro; N-power Tax; N-power Build; N-Power Creative; N-Power Health; N-Power Teach; N-Power Tech Hardware and N-power Tech Software. N30,000 monthly stipend is paid to each N-Power volunteer and equipment/device support for a specific volunteer for continuous learning on the job.

There are over 200,000 beneficiaries as at the end of 2018.

(iv) Government Enterprise and Empowerment Program (GEEP)

This is also referred to as Market-Moni and was launched to provide financial incentives and training to small scale business owners (traders, youths, market women, farmers). These small-scale business owners are offered a no collateral interest loan of N10,000N100,000 payable within six months. A total of 308,737 loans were disbursed in all 36 states in 2018. In December 2019, Bank of Industry (BOI) reported that N19.9 billion has been disbursed to betty traders under this program (Punch, 2019).

2.3 The UN Sustainable Development Goals

The Sustainable Development Goals (SDGs) were born at the United Nations (UN) Conference on Sustainable Development in Rio de Janeiro in 2012 where the main objective was to produce a set of universal goals that met the urgent environmental, political, and economic challenges facing the world (Patel *et al*., 2018). Notably, 17 SDGs were to replace the eight UN Millennium Development Goals (MDGs) (Fig. 6). This marked the start of a

renewed and collective global effort to tackle the indignity of poverty, especially in low- and middle-income countries (LMICs), as well as an acknowledgment of the need for the human species to adjust its living patterns within sustainable planetary boundaries. Thus, the SDGs represented a considerable advance from the MDGs, with a substantially broader agenda affecting all nations, requiring coordinated and sustainable global actions (UN General Assembly, 2015). The processes toward the 17 SDGs were led by the nations rather than steered by international agencies as was the case with the MDGs. The UN Member States themselves guided the whole SDG process, including leading discussions and the selection of goals, targets, and indicators (Sachs, 2012).

Within the wide thematic areas covered, the SDGs' core focus is on the cross-cutting 5Ps

(Fig. 6): People's well-being; Planet with protection of the earth's ecosystems; Prosperity with eradication of poverty and inequality; Peace, and international Partnerships (World Health Organization, 2015; Tremblay *et al*., 2020).

SDG 2 'Zero Hunger' – targets and indicators

SDG 2 'Zero Hunger' includes several targets to be achieved by 2030. To monitor the progress of these targets, several indicators are defined. The targets and indicators for

SDG2 'Zero Hunger' include nutrition, food production, agriculture, and food systems (Ritchie and Mispy, 2018).

2.4 Targets of SDG-2

Sustainable Development Goals2 (SDG-2) covers a broad objective encompassing food security and sustainable production described as: *"End hunger, achieve food security and improved nutrition and promote sustainable agriculture"* (UN, 2015). This goal covers five outcome targets. This objective contains its own intrinsic set of tensions and challenges. The first two targets relate directly to the concept of food security and nutrition (FSN) developed around the recognition of human rights to adequate food (UN, 1996), and structured around the four following pillars: i) availability, ii) access, iii) utilization, and iv) stability (FAO, 1996). These dimensions are key to understanding how to achieve SDG2, in particular Target 2.1 and 2.2 on adequate food supply and malnutrition. The food security pillars highlight the importance of producing enough food ("availability") but also the role of income and food prices ("access" pillar), which raises the questions of the cost of nutritious and healthy food, independently from the diversification of food sources ("utilization" pillar), which also touches to malnutrition. Targets 2.3, 2.4 and 2.5 extend the scope of SDG2 to the modalities of agricultural production. Target 2.3 puts a strong emphasis on farm income for small-scale farmers, linking to SDG1 ("No poverty"), through an increase of their farm productivity. This target should however be reached without jeopardizing Target 2.4 that emphasizes sustainable production practices, and Target 2.5 that highlights the importance of keeping genetic diversity. The different SDG2 targets therefore represent a consistent pathway to sustainable food systems but also can contain their own points of tension: how can we produce more, in a manner that is more healthy, more sustainable and more equitable -- all at the same time? This question garnered significant attention in the literature and needs to be first examined as it conditions many of the subsequent relations to other goals.

2.4.1 Providing Adequate Food for all and Reducing Hunger (Target 2.1)

The capability of humanity to produce enough food for its own subsistence has long been a source of concern. Malthus (1798) questioned the feasibility of a continuous population increase, and the Club of Rome report emphasized the limits to a continuous economic growth within a finite world (Meadows *et. al*., 1972). The current UN projections predict 9.7 billion people globally in 2050 (+25% compared to 2020) with nearly a doubling of population in Africa (UN, 2019). FAO estimates that the total food calorie demand will increase by 39% between 2015 and 2050 (FAO, 2018), 3 and agricultural output will grow somewhat faster (40-45%), due to the need to produce feedstuffs for growing livestock consumption. Several authors anticipate even higher demand by mid-century with alternative assumptions on animal product demand: compared to FAO projected levels, Tilman *et. al*., (2011) anticipate an increase of crop needs 50% higher by 2050, and Bijl *et. al*., (2017) a 30% higher increase in food demand. Valin *et. al*., (2014) compared estimates across global model projections and found a range of +43%–70% in food demand increase from 2015 to 2050, slightly above FAO estimates. And even when models reviewed disagree on the future level, most found much higher animal product consumption increase by 2050, with a range of 45%–160% spanning well above FAO's projected increase (55%). This anticipation is also supported by more empirical estimations (Gouel and Guimbard (2018) with 64–95%, Bodirsky *et. al*., (2015) with 81%–102%, Bodirsky *et. al*., (2020) with 76%).

Under these conditions, the capacity of the global food system to sustainably supply all the food required has been questioned. To understand the possible food security implications, food availability is usually estimated using the average dietary energy supply of the food

system, in kilocalories per capita per day, but also using more sophisticatedly metrics such as the prevalence of undernourishment (Goal indicator 2.1.1). FAO estimates that 688 million people (8.9%) were undernourished in 2019, a trend increasing following the COVID-19 crisis (FAO *et. al*., 2020). To calculate such prevalence, the food distribution supply profile per capita, in dietary energy terms,is compared to the average minimum dietary energy requirement in the population (Cafiero *et. al*., 2014). This framework effectively captures the availability pillar of food security

(more domestic supply reduces undernourishment) and can also be used in modelling to examine the response to average price or income changes (access pillar). Alternative metrics have also been proposed to measure undernourishment, such as the prevalence of underweight, based on up-scaled medical surveys (Bodirsky *et. al*., 2020), or the number of children malnourished. 5 Undernourishment metrics were implemented in various global economic models (Baldosand Hertel, 2015; Bodirsky *et al*., 2020; Hasegawa *et. al*., 2015; Hasegawa *et. al*., 2019), where it is also possible to capture the role of prices and income, as these determine the final level of food demand (Valin *et. al*., 2014).

Past modelling studies have often predicted a progressive decrease in undernourishment by 2050 following this indicator, under the effect of increased incomes and reduced inequality (which decreases the food distribution spread): down to 528 million (5.7%) underweight in Bodirsky *et. al*., (2020), less than 100 million (1%) undernourished for a middle-of-the-road scenario (SSP2) in Hasegawa *et. al*., (2015). Overall, these results are very sensitive to the projections in inequality. For instance, the most unequal scenario (SSP3) in Hasegawa *et. al*., (2015) results in a comparable level for undernourishment compared to today's situation. The prevalence of undernourishment (PoU) indicator has been the workhorse of the modelling community recently to approach the question of hunger. However, this metric completely ignores the composition of the diets and the role of protein and micro-nutrients intake for a healthy diet (Springmann *et. al*., 2016b). It also overlooks the multi-dimensionality of food

security. Some first steps towards broadening the food security framework have been made recently (van Meijl *et. al*., 2020a). In addition, it has been implemented across frameworks without harmonization of inequality projections within countries, which explains the large range of undernourishment projections (only average incomes per capita are harmonized for the SSPs quantified elements, for instance). Last, but not least, that indicator ignores the role of heterogeneity in income and price effects, and in particular the contrasted dynamics between rural and urban households (Laborde and Martin, 2018). More detailed analyses are therefore needed to better inform efforts aimed at tackling the challenge of Target 2.1 and 2.2 of SDG2, better integrating especially poverty modelling.

2.4.2 Dietary Needs, Nutrition Transition and the Triple Burden of Malnutrition (Target 2.2)

What we eat is as important as how much we eat when it comes to maintaining food security. This is why the "utilization" pillar is a key for food security. The example of animal production illustrates well various aspects of the challenges accompanying economic development. The nutrition transition influences our demand for nutrients like proteins and fat, and this also applies to other products (Bijl *et. al*., 2017; Bodirsky *et. al*., 2020; Gouel and Guimbard, 2018). At the same time, producing more livestock products is resource-intensive and comes with large sustainability impacts (Herrero *et. al*., 2013; Steinfeld *et. al*., 2006; Wirsenius *et. al*., 2010). Consumption of seafood also provide high value nutrients (Béné *et al*., 2015; Hicks *et al*., 2019) but brings additional environmental challenges as one third of marine catches are unsustainable (FAO, 2020b) and fast expansion of aquaculture adds to resource pressure and generates local pollution (Ahmed *et. al*.,2018). Some other food

products have very specific footprints due to their yield and production location, and trade mediated impacts can occur (Henders *et. al*.,

2015). The choice of the diet can therefore have large implications for health and environment (Tilman and Clark, 2014). We explain below the different nutritional challenges associated to dietary patterns and discuss further in Section 3.2 the consequences for health as part of the synergies with SDG3.

To disentangle the complexity between nutrition needs and its impact, modelling diet composition is fundamental. Only a few modelling studies have examined the prospects on both macro and micronutrient provision at global level. Nelson *et. al*., (2018) analysed such scenarios at the horizon 2050 and found that dietary energy requirements would certainly be met in all regions, as well as protein intake needs, to the exception of a few least advanced countries. However, they anticipate insufficient supply of fat in low-income countries, and severe and persistent deficiencies in calcium, iron and folate, as well as several key vitamins (A, E, B12) in many parts of the developing world. These malnutrition impacts would be worsened under the effect of climate change, in particular as micronutrient concentrations in crops are expected to decrease under future elevated CO_2 concentration in the atmosphere (Beach *et al*., 2019; Myers *et al*., 2014). Besides undernourishment and micronutrient deficiencies, a third important nutritional challenge is overweight and obesity, leading to the notion of the "triple burden of malnutrition"

(Gomez *et. al*., 2013). In 2016, the global "obesity pandemic" was affecting13.1% of adults around the world (FAO *et. al*., 2020), and costing 3.3% of GDP in advanced economies (OECD, 2019). Projecting obesity in the context of food demand studies is rather recent.

Based on detailed body mass distribution data, Bodirsky *et. al*., (2020) calculated that about 45% of the population would be overweight by 2050, compared to 29% in 2010, based on the continuation of current food consumption patterns, and 1.5 billion people would become obese by mid-century (16%). Overconsumption of food associated to overweight brings large inefficiencies in the food system. Hasegawa *et. al*., (2019) estimated that halting overconsumption by 2030 would reduce total caloric requirement by 6% and protein requirement by 9% globally. Therefore, even if these reductions would not suffice to address future food needs, there is a paradox of food distribution, with food deprivation for the poorest and overconsumption of food for another part of the population, illustrating the possible win-wins within the SDG Target 2.2 on malnutrition.

2.4.3 Producing More but Growing More Sustainably (Target 2.4)

Satisfying adequate dietary needs and eliminating malnutrition will require more food production as highlighted above, which may pose important risks for environmental sustainability of the food systems. The impacts of agricultural production increases on natural resources are well-known (Springmann *et al*., 2018a) and researchers have warned about the risks of exceeding a number of planetary limits due to agriculture intensification and expansion. Therefore, Targets 2.1 and 2.2 oriented towards provision of more adequate food and nutrition may be in tension with Target 2.4 that emphasizes the need of sustainable food production systems, improved agricultural practices, and ecosystems protection. One of the most salient elements of the tension between adequate food supply and protection of the environment relates to land use. On the one hand, land needs mirror the concern that our current planet capacity may not suffice to feed its future population, and on the other hand, land use change has important implications for a number of SDG sustainability dimensions:

carbon stocks for SDG13, biodiversity for SDG15, and the occurrence of zoonotic epidemics affectingSDG3. Many models have investigated the interplay of macroeconomic drivers, diet changes and future yield to determine the future land use requirements by the mid-century and beyond (FAO,2018; Hertel *et al*., 2016; Popp *et. al*., 2017; Stehfest *et al*.,2019). These studies usually find that agricultural land will continue its expansion with a range of~5–20% for cropland and ~-10–+25% for pasture land.

Virtually all studies predict further encroachment of cropland expansion into natural ecosystems (forests, biodiverse savannahs, wetlands) and the possibilities to avoid such damages remain disputed. The special report on land from the IPCC (IPCC, 2019) identified that out of 13Gha of surface land, 9.3 Gha were already used, and only a quarter of the unused part (940 Mha) was unforested land (outside of barren, rocks etc.). Based on agroclimatic suitability consideration, FAO estimates that 400 million ha of non-protected areas would be suitable for rainfed cultivation expansion, mostly in low- and middle-income countries, in particular Africa and South America (FAO,2018). This estimate would be reduced to about 260 Mha when considering 6hours of distance to market as an extra criterion. Some other literature assumes much higher availability, with less constraining criteria on land status or suitability (Eitelberg *et al*., 2014). Yet, when these estimates are subject to closer scrutiny, they are significantly reduced. For instance, Fritz *et. al*., (2013) reduces availability estimates from remote sensing data by 300–400 Mha when using field level information. Looking at various social and ecological tradeoffs, Lambin *et. al*., (2013) also reviewed data from global scale assessment in specific locations and found that effective availability would be less than a third of the theoretical top-down estimates. On the other hand, land suitability is not a static

concept under climate change, and new regions could become cultivable as temperature and precipitation patterns evolve in the coming century, particularly in the Northern hemisphere (Sloat *et al*., 2020). The question of the pressure of agricultural production on natural resources extends much beyond land use expansion but also relate to land quality and many other elements (water, climate, nutrient balance, etc.).

2.4.4 The Crucial Role of Agriculture Productivity (Target 2.3 & 2.5)

Among the different sources of agricultural productivity increase, land productivity has been particularly scrutinized, and is usually perceived as a key factor of economic development that allows mitigating the impacts emphasized above. Modelling studies have highlighted the direct role of yield on future trajectories of land use requirements (Hertel *et al*., 2016; Stehfest *et al*., 2019). The prospects on future yield increase remain positive.

On the one hand, technical margins exist to increase attainable yields through improved technologies and crop breeding and agricultural investments should support further progress (Baldos *et. al*., 2018). On the other hand, the assessment of yield gaps indicate that large potentials exist to increase actual yields to the level achieved under best practices, but remain subject to local climatic and management constraints (van Ittersum *et al*., 2013). Folberth *et. al*., (2020) estimate that reallocating crops accordingly could reduce cropland area by 50%. Simulation models have used such assessments to better anticipate future possible scenarios of yield development (van Zeist *et. al*., 2020). Yield projections scenarios have clearly highlighted the substantial land sparing effects, but also pointed to the nitrogen consumption trade-offs (Tilman *et. al*., 2011), and the greenhouse gas (GHG) emission reductions (Burney

et. al., 2010) as well as food security co-benefits (Valin *et. al*., 2013). From an economic standpoint, increasing productivity can however lead to an ambivalent effect. On the one hand, the lower demand for resources per unit of output can lead to some environmental benefits. On the other hand, lower prices obtained through total factor productivity gains can lead to a rebound of consumption and increased exports, thereby partially or fully offsetting these benefits, an effect called the Jevons paradox (Hertel, 2012b). This effect has been particularly identified in the case of cropland intensification (Byerlee *et. al*., 2014; Phalan *et al*., 2016), but also irrigation water efficiency (Grafton *et. al*., 2018).

Modelling studies have illustrated how strategies oriented towards increasing yields could lead to mixed effect as food security (through increased production) and environmental outcomes would come in direct trade-off (Hertel *et al*., 2014). The potential for Jevons paradox calls for more attention to the ambiguous role that productivity gains (Target 2.3) could have on the environment (Target 2.4), as well as the need for protecting environmentally sensitive lands in the context of high rates of technological progress. The other challenge associated with productivity increases is to ensure that, while saving on land resources, it does not bring any other environmental degradation. A lot of attention has been devoted to identifying routes for sustainable intensification in the domain of nutrient and water management, pest control, soil protection to find win-win solutions (Foley *et. al*., 2011). In the case of livestock, mixed intensive systems could leverage substantial environmental benefits both in terms of nutrient cycling, GHG emissions and land sparing, compared to extensive ones (Havlík *et al*., 2014). This is also the case for the fish sector where substantial productivity gains can be achieved in aquaculture (Waite *et al*., 2014). Therefore,

improvements in agricultural productivity, in particular total factor productivity (related to all production factors), offers an opportunity to simultaneously lower the pressure on the environment and increase farmer income by decreasing the input requirements. To guide this change, Seppelt *et. al*., (2020) illustrates how an optimum intensification level can be reached across production and environmental objectives by using a measure of *green* total factor productivity – or total resource productivity. Taking the case of biodiversity, they explain how such approach could support sustainable intensification in low- and middleincome countries, and ecosystems value recovery in highly intensified regions. However, simulations towards 2050 suggest that more sustainable yield both for crops and livestock may also require drastic adjustments in our consumption patterns to avoid further deforestation (Erb *et al*., 2016).

Finally, increasing agricultural productivity is also key in the context of ongoing climate change impacts which are expected to grow over the coming decades and substantially affect crop yields (Rosenzweig *et al*., 2014), irrigation capacity (Schewe *et al*., 2013), labour productivity (de Lima*et al*., 2021), micronutrient availability (Beach *et al*., 2019) and ultimately food security (Hasegawa*et al*., 2016; Janssens *et al*., 2020; Lloyd *et al*., 2018; Springmann *et al*., 2016b). This paper does not delve further into the interplay of climate change impact and food security, as it has been extensively reviewed (Mbow *et al*., 2019). The importance of adaptation measures through yield responses has been largely emphasized and identified as a key factor to limit food security impacts (Leclère *et. al*., 2014; Nelson *et. al*., 2014; Weindl *et. al*., 2015). Agricultural practices should also encourage resilience, to resist to occurrence of extreme events. Crop genetic diversity (Target 2.5) is representative of

the measures fostering adaptation to climate change and resilience, also in the context of possible occurrences of new diseases and pest outbreaks.

2.5 Synergies among the SDGs to Achieve 'Zero Hunger'

An important recognition underlying the SDGs is that all the 17 goals are interrelated, in what is commonly known as a synergistic relationship. Thus, success in one goal affects the attainment of others, including SDG 2 'Zero Hunger'. For example, SDG 1 'No Poverty' has impact on the 'Zero Hunger' target since being poor negatively impacts the capacity of individuals to access adequate food both in quality and in quantity (Scaling Up Nutrition, 2016). Synergy between SDG 3 'Good Health and Well-Being' and SDG 2 is through the fact that good health is closely linked to nutrition, with good health relying on sufficient and adequate macro-and micronutrient intake. Furthermore, access to quality health care is necessary to prevent and treat diseases that may increase nutrient needs through increased catabolism and malabsorption.

Furthermore, SDG 3 'Good Health and Well-being' includes family planning and reproductive health that is important to ensure manageable family size, which is less prone to food insecurity and improved child nutritional status (Fernandez, 2020). SDG 4 on 'Quality Education' relies on the achievement of 'Zero Hunger' since food is needed to facilitate learning and cognitive development. In the long-term perspective, quality education and learning enable individuals and societies to develop. In many countries, school meals are an important source of daily nutrition and good health promotion (Verguet *et. al*., 2020). In fact, a quality education should include a curriculum involving food, nutrition, and agricultural

food production, targets within SDG 2. SDG 5 ‘Gender Equality’ is important to achieve ‘Zero Hunger’ since women with access to income typically improve the children’s nutrition and health (Scaling Up Nutrition, 2016). SDG 6 ‘Clean Water and Sanitation’ is a prerequisite for good health through avoidance of enteric infections. In fact, not having access to safe water impacts other parts of daily life activities, including nutrition. For example, lack of clean water for drinking and to prepare food increases the vulnerability to infections and sickness, which in turn affects nutritional status (Schuster *et al*., 2020). SDG 8 ‘Decent Work and Economic Growth’ is related to the ‘Zero Hunger’ target since countries with high rates of malnutrition and food insecurity may have a high loss of gross domestic product (Siddiqui *et al*., 2020).

SDG 13 ‘Climate Action’ is of major importance, especially to some of Africa’s most vulnerable societies, since climate change increases droughts, floods, and other extreme weather events, with detrimental effects on food production (Bamwesigye *et al*., 2019).

SDG 14 ‘Life Below Water’ and SDG 15 ‘Life on Land’ relate to loss of biodiversity, acidification of the oceans, and soil degradation, which threaten the ability to produce food (Scaling Up Nutrition, 2016). SDG 16 ‘Peace, Justice and Strong Institutions’ is critical to ensure ‘Zero Hunger’ as instability, war, and bad governance are among the major contributors of food and nutritional insecurity. SDG 17 ‘Partnerships for the Goals’ pinpoints the necessity for strong global collaboration to achieve the goals, including SDG 2 ‘Zero Hunger’ (Scaling Up Nutrition, 2016).

2.5.1 Challenges to Achieve SDG 2 in Africa

Several challenges are slowing down the progress to achieve the desired targets, which are discussed as follows:

a. State Fragility

Conflicts, wars, and insurgencies have affected many African countries, resulting in several conflict events at one time or another, rendering many hungry and food insecure. For example, in 2017, the South-Sudan war caused 42% of its population to face severe food insecurity (Otekunrin *et al*., 2019; Otekunrin *et al*., 2020). Somalia, South Sudan, Chad, and the Democratic Republic of Congo, known for protracted crisis, have very high child undernourishment and under-five mortality rates compared to stable nations in Africa (Otekunrin *et al*., 2020).

b. Poor Governance and Corruption

In Africa, poor governance by far has hampered the progress of food security in many nations. Governance is a key priority action area to mitigate food insecurity in terms of building and enabling policies and regulatory frameworks to enhance increased coordination of agricultural, climate change, and food system policies (Lipper *et al*., 2014). Due to poor governance, policy, and coordination of national agricultural policies, strategies, investment plans, and climate change instruments, including national adaptation programs, are lacking in many food insecure African countries (Lipper *et al*., 2014). Poor governance and corruption, specifically the lack of democracy in food and agriculture, widen the already yawning gap

between the have and have-nots in many African countries. Thus, no initiative on food security will work in the absence of ethical public behaviour because of corruption and poor governance culture (Daum and Birner, 2017). Increased reported corruption in the import and distribution of agricultural inputs by government agencies in African countries delays the end to hunger goals (Daum and Birner, 2017).

c. Climate Change

Climate shocks, as evidenced by the increasingly more frequent occurrences of cyclones and droughts, have affected the most vulnerable populations in Africa through devastating effects on their food and nutrition security. The estimated numbers of droughts and floods have increased, respectively, from 89,256,000 and 5,583,000 between 1980 and 1989 to 158,509,000 and 23,332,000 between 2000 and 2009 (Tirado *et al*., 2015). Regrettably, greenhouse gas emissions, attributed mostly to the industrialized Western World, are linked to adverse climate changes, causing food insecurity for the poorest people in the global south hardest, mostly in LMICs (MasonD'Croz *et al*., 2019). Water shortages are the most concerning aspect of climate change in Africa. Already, in parts of the Sahel region such as Mali, desertification is reducing available croplands (Food and Agriculture Organization of the United Nations, 2020). Furthermore, climate change affects local biodiversity and may contribute to new invading alien species affecting local food production. This is currently a large problem with a locust invasion in Eastern Africa that threatens to eradicate crucial harvests from the local small-scale farmers (Kimathi *et al*., 2020). A predictive model on climate change including possible determinants projects a 20% increase in child malnutrition by

2050, and a 50% decrease in crop yields in many sub-Saharan countries (Tirado *et al*.,

2015). Unfortunately, this model mentions that by 2080s, arid and semi-arid land in Africa will have increased by 5–8%, leading to significant reduction in rain-fed land for cereal production. Thus, the success of the SDG 13 'Climate Action' and the Paris Climate Accord (target of staying below 2°C warming) and the future temperature trajectory will be of major importance to food security on the African continent. Furthermore, increased competition for key resources, such as fertile land and clean water, contributes to provoking violence and armed conflicts, exacerbating the vicious circle of hunger and poverty and resulting in protracted crises.

d. Natural Resource Mismanagement

Mismanagement of natural resources, such as water, largely contributes to food insecurity and inefficacy of food production practices. African countries that have prioritized good practices and technologies utilizing efficiency in water use and management have promoted their food productivity gains, as evidenced by outcomes of research and development (R&D) investments. African countries that have made significant investments in agricultural R&D continue to reap food productivity and security gains for their population. For example, Namibia, largely a desert country, utilizes the available water resources to enhance food production by having a system of responsive and accountable governance (Yunusa *et al*., 2018).

e. The Role of Forests for Food Security, Nutrition, and the Challenge of Forest Mismanagement

In 2017, the High-Level Panel of Experts of the UN Committee on World Food Security emphasized that sustainable forest management is important to maintain and enhance the economic, social, and environmental values of all types of forests (Committee on World Food Security, 2017). This is important in the strive toward 'Zero Hunger' since deforestation is a critical sustainable development challenge, as increasing food production to meet growing demand has strikingly reduced tropical forests. This is especially true in sub-Saharan Africa that continues to face serious food insecurity issues because smallholder farming is the main driver of forest reduction (Pelletier *et al*., 2020).

During the period between 2001 and 2015, 92% loss of land area covered by forests in Africa was attributable to expansion of smallholder farming (Curtis *et al*., 2018). For example, the Democratic Republic of Congo and Cameroon have reported increasing deforestation associated with high levels of poverty and food insecurity (Ngome *et al*., 2019). Annually, about 13 million hectares of forests are lost due to deforestation, partly by agriculture, logging, mining, and infrastructure development. Deforestation is a significant factor in promoting climate change through increased emission of greenhouse gases, thus altering temperature and weather patterns globally (Bamwesigye *et al*., 2019).

f. Fisheries and Aquaculture

Fisheries and aquaculture have often been arbitrarily separated from other parts of the food and agricultural systems in food security studies, debates, and policymaking. Smallscale fisheries in

sub-Saharan Africa are threatened by overfishing, pollution, and competition for water which is a potential threat to their sustainability. The significant development of aquaculture raises many questions about its environmental impacts on land, water, and biodiversity, as well as sustainability, and has itself to face competition from other users of land (Committee on World Food Security, 2014). However, the demand for fish is growing due to a combination of factors such as population growth, urbanization, and increasing wealth and incomes. Aquaculture is one of the few food production sectors worldwide where growth in production is outpacing growth in population.

Small-scale fisheries can give opportunities to the poorest, landless, food-insecure people and households, providing them a critical (and sometimes unique) source of income and livelihood. Intake of fish can help reduce the risks of malnutrition and of noncommunicable diseases. Farmed fish contribute to improved nutritional status of households, directly through self-consumption, and indirectly through selling farmed fish to enhance household purchasing power. Notably, there is almost a consensus that women's roles in aquaculture and fisheries are not fully recognized, often go unrecorded, are undervalued, and are largely invisible in national statistics (Muzari, 2016). Thus, given the importance of small-scale fisheries and aquaculture in poverty alleviation, food security, and nutrition in sub-Saharan Africa, governments should make fish an integral component of inter-sectoral national food security and nutrition programs, with special emphasis on small-scale capture fisheries and fish farming or aquaculture projects.

Stakeholders in these fish subsectors should support self-organized local professional organizations and cooperatives, as these strongly contribute to and foster the integration of small-scale operations

into markets. State labour, finance, and policy formulation and implementation agencies, in collaboration with fisheries agencies, should improve national regulations for fish workers, including women workers in fish processing factories and markets, ensure that adequate and specific budg*et al*locations are made for small-scale fisheries and aquaculture development, and facilitate the direct involvement of farmers and other stakeholders in the process of priority setting and choice of technology (Muzari, 2016).

g. A Food System for the First Six Months of Life and Beyond

As recommended by the WHO, infants should be given exclusively breastmilk for the first 6 months of life and if possible continue with breastfeeding for up to 2 years or beyond in combination with suitable complementary foods. The interactive food systems implied have numerous dimensions economically, socially, culturally and

psychologically in relation to women's lives and rights. While breastfeeding mothers are the primary actors to ensure an ideal and functioning food system in this case, they need support at many levels: near family, practice at delivery wards, community support, workplace allowances, legal protection, etc, to maintain the protective food system needed through these critical first 1,000 days of life. Any government must decide whether it will actively promote and strengthen this critical food system with regard to actively protecting and optimizing nutrient supply to its youngest citizens. The constant and often misleading advertisements of breast milk substitutes for profit by large multinational companies must be met by strong legal regulations of such marketing and through systematic follow-up. Moreover, the International Code of Marketing of Breastmilk Substitutes and subsequent biannual resolutions should be implemented in national legislations (World Health Organization, 2018). The stakes are high,

as ‘Zero Hunger’ not least demands action for the particularly vulnerable age bracket of 0–24 months. The issue should therefore no longer be dealt with by health systems and especially primary health care alone as is typical, but be treated alongside other food system challenges in their own right.

h. Conflicting Global and National Food Policies

Global and national food policies affect food security in both rural and urban Africa. Despite food insecurity generally having been described as a rural issue, the effect of global and national policies on food insecurity is increasingly making it an urban challenge (Battersby and Watson, 2018). Increased export-driven agriculture by big companies may cause small-scale farmers to sell their farm land and migrate to cities.

Thus, the functioning of the food systems is an increasingly central issue for policymakers concerned with the future development of urban areas in Africa (Crush and Riley, 2017). ‘Super marketization’ refers to the fact that big supermarkets have taken over retail shops in many African countries. There are several concerns over the negative impacts of the ‘super marketization’ of food. They may provide cheaper food, and their contribution to dietary shifts escalates the ‘triple burden of malnutrition’ (the coexistence of overweight/obesity, undernutrition, and micronutrient deficiencies) (Demmler *et al*., 2017). ‘The global supermarket’ is another term reflecting the dominant power of transnational food companies that often control whole food chains from production to retail level. Combined with frequent unethical marketing of ultra-processed unhealthy foods to children and youth, these companies play a role in the global ‘nutrition transition’ from traditional foods to mote-

processed, energy-dense, nutrient-poor foods that contribute to increasing overweight/obesity also in many African countries.

i. Conflicting Agricultural Practices

Conflicting agricultural practices and policies have affected progress toward 'Zero Hunger' in Africa. The choice between organic and conventional agriculture may impact health. For example, biofertilizers in conventional farming containing heavy metals have shown an extremely long persistence in the soil environment, leading to metal accumulation (Urra *et. al*., 2019). In addition, mechanized farms in sub-Saharan Africa may increase gender inequalities especially among rural women in some countries (Daum *et al*., 2020). This can be observed in terms of loss of employment for casual laborers, when low-income rural workers are being replaced by mechanization, which in turn threatens their food security and nutritional status. In Zimbabwe and Malawi, reports indicated negative effects of inadequate conservation agriculture (improved soil structure and soil erosion protection) to promote food security among farmers (Mango *et al*., 2017). Notably, the majority of rural smallholders are less likely to benefit from mechanization of agriculture. For example, small-scale traditional farmers cannot afford tractors even when they are highly subsidized, which leads to elite capture (Tirado *et al*., 2015). A case example is Ghana, were it was found that distribution of governmentimported tractors was not transparent and encouraged rent-seeking behavior (Tirado *et al*., 2015). Sadly, the tractor imports were politically more attractive than investing in skills development (49). Tractors showed short-term effects and generated media attention, which was particularly valuable prior to elections just as in many other African countries (Daum and Birner, 2017).

Good agricultural practices, including the importance of food security initiatives in school curriculum, are desired, for example, through *in situ* soil application and utilization of organic waste materials via compost processing (Creegan and Flynn, 2020). This has been shown to enhance soil and plant productivity, increase soil water retention, sequester carbon, and decrease external synthetic fertilizer and chemical inputs. Such an educational model for organic waste-to-resource initiatives is positively associated with food production for long-term sustainability that is in alignment with SDG 2 'Zero Hunger' (Creegan and Flynn, 2020). Another conflicting food policy in Africa is the imbalance between agricultural extension/agricultural advisory services in the interest of large commercial producers versus those of family farmers. For example, a recent Ethiopian study identified gaps between digitalizing agricultural extension information services and stakeholders' experiences (Atinaf *et al*., 2020).

j. Population growth

Population growth will greatly increase the amount of food needed to adequately feed

Africa's people. Despite a fall in fertility rates, the number of children per family in Africa is still much higher than the global average (2.4 children per woman in 2018), and the population is growing. For example, in sub-Saharan countries, the fertility rate has gone from 6.8 children per woman in the 1970s to 4.7 children in 2018 (Shapiro and Hinde, 2018). Increasing population pressure in Africa (about 1.2 billion in 2018) has impacts on food security and has worsened land scarcity, land use intensification, and land degradation linked to food insecurity. This together with increased poverty is associated with a stronger tendency to use soil-mining practices, for example, removal of soil conservation structures to use fertile soils

within the structures (Holden and Ghebru, 2016). Remarkably, land degradation in combination with population growth

continuously leads to increasing food insecurity unless targeted policy interventions for improved food markets and agro-processing technology adoptions are introduced (Holden and Ghebru, 2016).

k. The Coronavirus Disease 2019 (COVID-19) Pandemic

The COVID-19 pandemic is here singled out as a challenge of its own as it is so thoroughly worsening all the above challenges. This global pandemic has worsened the slow progress to 'Zero Hunger' in Africa. Furthermore, the pandemic has a considerable negative effect on the economic development in Africa. Indeed, lately several households in Africa, with low levels of educational attainment and high dependence on labour income, experience an enormous real income shock that has visibly jeopardized their food security (Arndt *et al*., 2020). Informal food traders are an essential part of a wider food system going from input suppliers to farmers to the final eaters (Wegerif, 2020). By far, the 'informal food sector' in Africa is still the highest employer to the young African population and has been greatly disorganized by COVID-19 pandemic. This sector is made up of small-scale owner-operated enterprises (e.g. selling food of various kinds, including street traders, hawkers, street restaurants, etc.) that employs more people than the formal food and grocery sector or even other sectors (Wegerif,

2020).

2.5.2 Strategies to combat hunger toward SDG 2 – a mixed African perspective

As to African strategies to achieve 'Zero Hunger', there is no one-type-fits–all approach. The continent offers widely different conditions for land-, water- and forest-based food production with regard to soil and rainfall. The level of technological development, besides economic, legal, and social assets of cultivators, varies among fisher folks, forest people, and nomadic groups to achieve food security.

a) Peace, Governance, and Institutions

The 2019 Global Report on Food Crisis indicated that conflict created food insecurity in the following African countries: Democratic Republic of Congo, South Sudan, the Lake

Chad Basin, Somali, and the Central African Republic (FAO, 2019; Food Security Information Network, 2019). Therefore, African countries must establish political and financial commitment to proposed SDGs actions backed by institutional reforms, strict implementation measures, as well as quality monitoring and evaluation of progress (Caiado *et al*., 2018). In 2015, UN food agencies suggested that poverty and hunger eradication in all LMICs by 2030 would be possible (McGuire *et al*., 2015). This would involve investments in social protection combined with public and private efforts to raise investment levels in productive sectors, especially among rural areas and particularly in agriculture (Mason-D'Croz *et al*., 2019).

2.5.7.2 Food Systems and Agriculture

Robust food systems and agriculture are crucial for food security. Agricultural diversification means growing individual food crops for consumption and where possible keeping a variety of animals for meat or milk and eggs (Waha *et al*., 2018). Climate Smart Agriculture is a strategy that includes development and promotion of innovations to adapt and create resilience to climate change and extreme weather events (Zougmoré *et al*., 2018). This focuses on the use of high-yielding, drought-tolerant crop varieties, climate information services, agricultural insurance, agroforestry, water harvesting techniques, and integrated soil fertility management practices. Such climate smart agriculture will be especially important in West, Central East, and Southern African regions that are prone to challenging climatic conditions.

Africa must ensure that food production strategies are based on solid policy frameworks that safeguard food security to rural communities as well as sustainable production. Two dominant types of agricultural production systems stand in contrast to each other and may cause political tension. Simplified, the commercially based large-scale mono-crop intensified cultivation is geared to increase yields aimed primarily for the foreign markets, typically generated by multinational corporations. These often buy land and squeeze smallholder farmers out of production. On the other hand, various forms of locally based and diversified food production by small farmers have proven to be successful in both enabling healthy diets and often some income for the households, but may lose in the competition with large food-chain companies due to lack of appropriate markets. Over the last decade, the understanding of the potential of smallholder farming also with respect to yields comparable to high-tech commercial agriculture has increased. Agro-ecological farming, drawing on local environmental

condition, traditionally successful farming methods, safeguarding of ecosystems and capturing carbon, has attracted renewed interest. Less use of artificial fertilizers and pesticides brings the best of traditional knowledge to the fore as well as new research aimed at improving food security to rural families (Bosc *et al*., 2013).

2.5.7.3 Collaboration with UN Specialized Agencies, Programs, and Funds

African countries are collaborating with several UN development bodies to achieve 'Zero Hunger', including various activities explicitly aimed at ending hunger and achieving sustainable food systems in Africa (WHO Press Report, 2020). Also to be mentioned in this context is the recent (February 2021) adoption of the 'UN Voluntary

Guidelines on Food Systems and Nutrition' by the UN Committee on World Food Security. Here, experiences from and recommendations for ways to reach SDG 2 at an accelerated pace toward 2030 were negotiated. Alongside this more than 2 years long process, an initiative of the UN Secretary-General in 2019 for a UN Food Systems Summit in September 2021 is being planned in various ways, including through five separate 'Action Tracks' directed by experts in various fields together with interested states, civil society and private sector organizations, and with opportunities for wide engagement for those interested in proposing various 'game-changing solutions' toward achieving SDG2. Also, national dialogues in some 60 countries, both government-led and independent ones, will provide new information of the efforts of individual African states regarding what ought to be more coordinated efforts at national levels toward 2030.

2.6 Theoretical Framework

2.6.1 Neo-Malthusian Theory

This theory was propounded by Thomas Malthus in 1801. This was a later version of his first theory known as the Malthusian theory as propounded in the year 1798.

In his writing titled 'Essay on the Principle of Population', it explains that an increase in population of a country will affect its food security. He further explained that while the population of a place increases in geometric progression, its livelihood through agriculture increases in arithmetic progression (Malthus, 1798; Malthus, 1801; Mellos, 1988).

However, his theory went ahead to propose ways to combat population growth. The first essay proposed the use of 'positive' methods and 'preventive' methods. Positive methods such as war, famine, epidemics and Preventive methods such as the various birth control measures including abortion, infanticide, use of pills and so on. The later version of his essay which is widely regarded as the Neo-Malthusian theory enlists an additional type of population check which is the 'moral restraint' to sexual intercourse and this involves pre-marital sexual abstinence and late marriage (also regarded as postponement of age of marriage).

Both versions of the theory agree on two distinct, yet opposing positions; an increasing population expansion on one hand and a decreasing food production on the other hand

(Mellos, 1988).

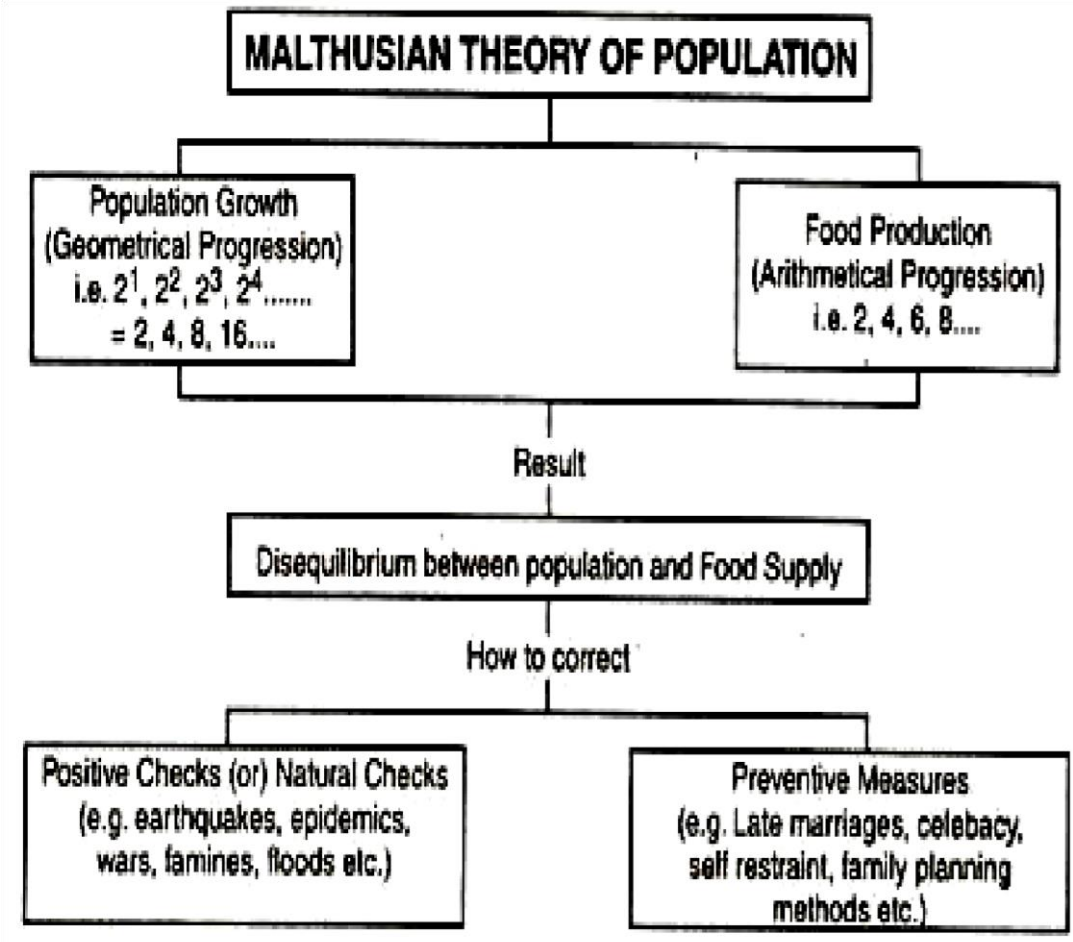

Figure 8: Malthusian Theory of Population (source: Economics Discussion, 2023)

2.7 Empirical Studies

The nexus between food insecurity and poverty reduction has received considerable attention in the literature.

a. Food Security Outcomes in relation to Agriculture and Poverty

Oshodi and Oloni (2006) used the Vector Autoregression model (VAR) to examine the impact of agricultural food policy on food security in Nigeria from 1970 to 2003. They found that agricultural food policy contributes both directly and indirectly to food security with environmental factors playing a more significant role. Their study, therefore, recommends that agricultural food policy should target environmental supported programmes such as provision of virile irrigation programmes and construction of rain silos. Food and nutrition situation in Nigeria was studied by Omotor (2009). It was observed that more Nigerians live below the poverty line and are food insecure. The study suggests that agriculture deserves all necessary support to raise its output. Also, in 2009, Oriola examined the relationship between irrigation systems, food production and poverty. The study showed that natural endowment, soil and water resources of the nation for productive agriculture and irrigation technology as remedy to the peculiarity of water as militating factors against adequate food production. Abubakar (2013) carried out an empirical analysis of household security in Gombe, using household expenditure and consumption surveys containing both objective (quantitative) and subjective (qualitative) data. The outcome showed that on average, less than 50% of the household could afford to consume the minimum dietary requirement of 2400 Kcal.

Alaimo (1998) examined the health effects of food insufficiency for children using the National Health and Nutrition Examination Survey (NHANES Ill). The study showed that food-insufficient children are more likely to be in fair or poor health. Clover (2003), Smith (2007), Swaminathan (2008) and Craig & James (2015) examined the food security in developed and developing countries and discovered that growing global food production could help to enhance GDP per capita, increase purchasing power and access to food. Empirical studies from Nigeria on the relationship between food insecurity and poverty reduction include the findings of Obasi (1997), Egbuna (2001), Hassan and

Shola (2006), Arosanyin (2006), Oshodi and Oloni (2006), Eneta (2008), Oriola (2009), Abubakar (2013), Oni and Fashogbon (2013), Otaha (2013), Ahmed and Waibel (2019) and Lamidi (2019). Obasi (1997) used Ordinary Least Square Method to examine the factors that influence food insecurity in Nigeria for the period of 1976 to 1994. The result showed that domestic food production is the main variable explaining food insecurity in Nigeria. He concluded that 87. 21 % of the Nigerian food problem would be solved by promoting domestic food production. Studies by Okunmedewa *et. al*., (1999) revealed that the risk of food security was more felt by wage earners, particularly in urban areas, which, thus, resulted in their dependence on less nutritious food items.

Hassan and Shola (2006) examined the relationship between food insecurity and the

National Question in Nigeria. He observed that food production has been on the increase, but the increase has not been proportional to the demand for food, and, thus, constitutes a major threat to the security of the nation.

b. Food Security and Transportation (Accessibility)

Arosanyin (2006) emphasized the roles of transportation in making food available to the final consumer, once it is accepted that production of any food item is not complete until it gets to the final consumers. He concluded that an efficient transportation system is a core element in Nigeria's quest for food security.

c. Food Security Outcomes Using Various Measurement Scales

Analysis of factors of food insecurity with a sustainable livelihood approach in rural

Nigeria using nation-wide cross-sectional data of Nigerian Living Standard Survey (NLSS) was done by Oni and Fashogbon (2013). The result revealed that, on the whole, farming is the predominant livelihood activity.Lamidi (2019) demonstrates that higher risks of severe food insecurity occur among households with children and those with elderly persons living with a disability. The study also shows that financial support from friends, relatives, and money lenders were associated with higher, rather than lower risks of food insecurity. Ahmed and Waibel (2019) showed that homestead aquaculture increases household food consumption, improves dietary diversity, generates additional income and stimulates higher fish consumption from home production. The empirical research in this study differs from the earlier ones, since none of the linear work has attempted the link between food insecurity and poverty, except Obasi's (1997) work. However, this study is also different from Obasi (1997) on the basis of methodology that was used. This study used Vector Autoregression model while Obasi (1997) adopted Ordinary Least Square Method. Vector Autoregression model is employed for this study because of its ability to characterize the dynamic structure of the

model as well as its ability to avoid restrictions associated with different economic theories. In addition, the model is employed for this study because of its ability to characterize the dynamic structure of the model as well as its ability to avoid restrictions associated with different economic theories.

Fakayode *et al*., (2009) using the USDA approach, examined the food security situations of farm households in Ekiti State, Nigeria.They found out that only 12.2% of the respondents were food secure, 43.6% were not food insecure without hunger, 35.9% were moderately food insecure with hunger, and 8.3% were severely food insecure with hunger. Cassava, yam and their products contribute immensely to the food security status of farm households. These results do not agree with those of Abalu (1999) and Mariyadixton *et. al*., (2004) which indicated that 84% and 60% of the country's households respectively were food secure, while only 16% and 40%, respectively of Nigerian households are food insecure. In related study, Muhammad-Lawal and Omotesho (2008) highlight the place of cereals in farming households' food security in kwara state. They found out that 60% of the total households were food secure. Cereals provided 34% of the farming households total calorie intake and 47% of protein supply respectively. Ibrahim, Uba-Eze *et. al*., (2009) assessed the state of food security among urban households in the Federal Capital Territory of Nigeria. The food security scale developed by Freedom from Hunger (FFH) was used to analyze the data. They found out that seventy percent (70%) of the respondents were food shortages were the purchase of less preferred food and reduction in the quantity of meals. However, Omonona and Agoi

(2007) analyze the food security situation among urban households in Lagos State, Nigeria. The data were analyzed using food security incidence. They found out that food insecurity incidence among urban households in the study area was 0.49. As age of household heads increases, food insecurity incidence also increases. Household heads between the ages of sixty one and seventy years had the highest food insecurity incidence (at 0.58) and least between twenty one and thirty years at 0.30. Female headed households had the highest food insecurity incidence of 0.49 compared to male headed households at 0.38. As level of education increases, food insecurity incidence reduces. Household heads that were engaged in professional occupation had relatively low food security incidence at 0.36 compare to those who were traders at 0.48. Households within the range of 1 – 4 and greater than twelve members had the food insecurity incidence ranging between 0.27 and 1.00 respectively. This shows that food insecurity incidence increases as household size increases. There was a decline in food insecurity incidence as income increases from 0.41 for the low-income group to 0.20 for the high-income group.

In South Africa, Battersby (2011) assessed household food insecurity levels in Cape Town using HFIAS, and their study revealed that 80% of households were either moderately or severely food insecure. Similarly, Sekhampu (2017) used the HFIAS in Kwakwatsi, Free State province of South Africa, and found 51.1% households to be food insecure while 48.8% were either mildly, moderately or severely food insecure.

Correspondingly, Knueppel *et. al*., (2009) categorized households in rural Tanzania using HFIAS method and their results revealed that 20.7 % of the households were food secure, 8.4 % were mildly food insecure, 22.8 % were moderately food insecure and 48.1 % were severely food insecure and the reason for the large proportion of food insecure households were attributed to two underlying factors viz; insufficient food intake and insufficient food quality. Farzana *et al*. (2017) also adopted the

HFIAS to classify households in Bangladesh into food secure, mildly food insecure, moderately food insecure and severely food insecure and further categorized the coping strategies adopted with respect to the households' food security levels.

The Food Consumption Score (FCS) developed by WFP (2008), is commonly used as a proxy indicator for determining utilization dimension of food security as well as access to food. "It is a weighted score based on dietary diversity, food frequency and the nutritional importance of food groups consumed with a reference period of seven days" (WFP, 2008). The FCS of a household is calculated by multiplying the frequency of foods consumed in the last seven days with the standardized weighting of each food group, thereby classifying households into three namely; poor (with FCS of ≤21); borderline (with FCS of 21.5 to 35) and acceptable (with FCS of >35). Ndakaza *et al*. (2016) used the FCS approach to classify households in Rwanda into food secure

(comprising households with "acceptable" FCS) and food insecure (consisting of households with "poor" and "borderline" FCS) and their results showed that 70.9% and 29.1% households were respectively food secure and food insecure. However, the FCS approach is not without challenges. An observed problem with this method is its consideration of the frequency of food groups eaten without taking cognizance of the quantity eaten within the reference period.

On the other hand, Ibrahim *et al*. (2009) assessed the state of food security among urban households in the Federal Capital Territory of Nigeria using the food security score scale developed by Freedom from Hunger (FFH), their results show that 70% of the respondents were food secure while 30% were not food secure in their study area. The per capita food expenditure measures food security on the basis of money spent on food monthly, against the

household size. “A food secure household is thus, a household whose per capita monthly food expenditure fall above or is equal to two-third of the mean per capita food expenditure while a food insecure household is that whose per capita food expenditure falls below two-third of the mean monthly per capita food expenditure” (Omonona and Agoi, 2007). Omonona and Agoi (2007) analyzed the food security situation among urban households in Lagos State, Nigeria using food security incidences from per capita food expenditure, and found out that food insecurity increases with increase in household size and ages of household heads, and decreases with higher level of education.

Similarly, Adepoju and Olawuyi (2012) applied the per capita food expenditure method to measure food security indices among farmers in Oyo State, Nigeria and found about 69% to be food insecure. Ibok *et. al*., (2014) also applied this method to assess the status of food security of urban households involved in farming in Cross River State of Nigeria, and their results revealed that 52.5% of the households were food secure whereas 47.5% were food insecure. One of the disadvantages of this method of measuring food (in)security is its emphasis on amount of money spent and household size with no account on the food composition and amount of food consumed.

Nevertheless, Ojogho (2010); Asogwa and Umeh (2012); Olagunju *et. al*., (2012) and

Yusuf *et. al*., (2015) applied the cost-of-calorie method proposed by Greer and Thorbecke (1986) to determine food security in Edo State and Benue State of Nigeria respectively. The method derived a threshold value that was close to the minimum calorie requirement for human survival which served as the minimum level, described as the “food insecurity line” and people who fell below this calorie level were classified as

"food insecure" in the study area.

Similarly, Welderufael (2014) used the Foster-Greer-Thorbecke (FGT) method proposed by Foster *et al*. (1984) to examine the extent of household's vulnerability to food insecurity in urban and rural areas of Amhara regional state of Ethiopia, where about 48% households were revealed to be food insecure (i.e. they fell below the recommended caloric requirement of 2200 kcal/Adult Equivalent/day) and these food insecure households were mostly found in the rural areas. In addition, cost-of-calorie method had been applied by Babatunde *et al*. (2007) who found 64% of the households in Kwara State of Nigeria to be food insecure because they were below the recommended daily requirement of 2260 kcal while Mitiku*et al*. (2012) found 36% households to be food insecure in Shahemene district of Oromia region, Ethiopia using the FGT method. Furthermore, the FGT method had also been used by Tefera and Tefera (2014) and Dawit and Zeray (2017) in Ethiopia; Orewa and Iyanbe (2010) in Nigeria among others. The limitation of this method is that it employs the per capita calorie supply technique which means larger household size with adults will usually be close to the minimum level or below it.

The Household Food Security Survey Module (HFSSM), developed by the United States Department of Agriculture (USDA) classifies households using a constructed linear food security scale. It measures the degree of food insecurity/hunger experienced by households in terms of a single numerical value which ranges between 0 and 10 (Bickel *et al*., 2000). Like the HFIAS, it employs responses to a set of 14-18 questions regarding households' food needs with "never true" coded as 0 while "sometimes true" and "often true" coded as1.

In the United States of America, Coleman-Jensen*et al*. (2015) assessed the household food security of Americans using the United States Department of Agriculture (USDA) approach, and their results show that 85.7% and 86% Americans were food secure in 2013 and 2014 respectively. In addition, Sanusi *et al*. (2006) measured the household food security status in Lagos and Ibadan using the USDA approach and found over 70% to be food insecure. Fakayode *et al*. (2009) also examined the food security situations of farm households in Ekiti State, Nigeria using the USDA approach. They found out that only 12.2%, 43.6%, 35.9% and 8.3% of the respondents were food secure, food insecure without hunger, moderately food insecure with hunger and severely food insecure with hunger respectively. Similarly, Ibok, *et al*. (2014) used the USDA approach to examine the food insecurity status among urban farm households in Cross River State, Nigeria and their results showed that while 12.44% of urban farmers were food secure, 55.76%, 25.35% and 6.45% were food insecure without hunger, moderately food insecure with hunger and severely food insecure with hunger respectively. An observed disadvantage of this method is the proxy answers given by parents/guardians on behalf of other members of the family, though it has more advantages such as concentrating on virtually all the dimensions of food security compared to othermethods.

However, researchers are beginning to adopt more than one measurement method to assess food security at household level as regards its complexity. For instance, Goshu (2016) in his PhD work measured the food security status of households in Gubalato district, Ethiopia using a combination of the HFIAS, FGT, Food Consumption Score (FCS) and Coping Strategies Index (CSI) methods. His HFIAS findings showed that 48.26%, 30%, 16.09% and 5.65% households were food secure, mildly food insecure, moderately food insecure and extremely food insecure respectively. The FGT findings indicated 53.9% of the households to be food

secure, 17.8 % mildly food insecure and 28.3% severely food insecure using 2,100 Kcal per adult equivalent per day as a threshold. Moreover, his FCS results revealed that about 50%, 33% and 17% of the households had acceptable FCS (greater than 35), borderline FCS (between 21 and 35) and poor FCS (below 21) respectively while his CSI results categorized about 37% as moderately/severely food insecure, 30% as mildly food insecure and 33% as food secure households in his study area. The variation in the food security status of households using various methods is because these methods have got some limitations too. Furthermore, to take care of some of these limitations, indicators harmonization has been attempted. Ogundari (2017) incorporated the food utilization and accessibility aspects of food security definition in assessing food security in an attempt to capture the multidimensional nature of food security. He harmonized two food security indicators, dietary diversity score (DDS) and food expenditure to categorize households into four different levels of food security states in Nigeria namely; completely food insecure households as revealed by both indicators, transitory food insecure households (two types) each based either on food expenditure or DDS indicators, and completely food secure households as revealed by both indicators. His results revealed that about 60% and 66% of the households were food secure based on DDS and food expenditure indicators, respectively whereas only about 42% of the households were eventually food secure when the two indicators were harmonized.

In the face of the existent literature on food security indicators, it is still devoid of an agreement on the main indicators that are needed to adequately measure and monitor household food security situations both at the micro- and macro-levels around the world (Carletto *et. al*., 2013 in Ogundari, 2017), as it is known that these indicators only centres on one dimension at a time. This is supported by the findings of Bashir and Schilizzi (2013) on

the determinants of rural household food security in Africa and Asia, which proposed a conceptual model as regards the three widely known components of food security of food accessibility, availability and utilization, who found food availability to be the most studied component, followed by food accessibility, while food utilization has been the most ignored component in both continents. To fill the gap of studying a single aspect of food security, the HFIAS approach was adopted for a comprehensive household food security assessment while other indicators have been used to assess other food security dimensions.

The HFIAS approach has been shown to be a robust approach for assessing food security status at household level since it includes virtually all of the food security dimensions and could be used to show the percentages of households that are food secure and food insecure. For this reason, it was adopted in this research to assess food security status.

However, in order to incorporate the multidimensionality of food security, this study adopted food consumption scores to analyse the utilization dimension; per capita monthly food expenditure to analyse the accessibility dimension; sufficiency in own food production to analyse the availability dimension and irrigation agricultural practice to determine the stability dimension since the sampled households are largely agrarian.

CHAPTER THREE

MATERIALS AND METHODS

3.1 Study design

A population based descriptive cross-sectional survey study design was used as the research design for this study. This type of design is essential in exploring all possible variations in level of knowledge and variations in food security status. Deliberate attempt was made to include all the adults (≥18) that are heads of household irrespective of state of origin.

3.2 Study Area

Abuja Municipal area Council (AMAC) is one of the six area councils in the Federal Capital Territory –Abuja. Abuja which is the capital city of Nigeria was built in the 1980s and officially became Nigeria's capital in 1991. According to the last national census of 2016, AMAC was estimated to have a population of 1,894,513 (Nwokoro *et.*

al., 2020).

Administratively and politically, AMAC is headed by the Chairman and it is bordered by the surrounding area councils such as Kuje, Bwari and Gwagwalada Area Councils. Bulk of the population is civil servants while the rest are into agriculture and commerce,

AMAC is inhabited by people from various tribes in the country including foreigners and has a landmass of 250sq km. The Area Council is located at latitude $8^{0}40^{1}$N and $9^{0}20^{1}$ N and longitude $6^{0}40^{1}$E and $7^{0}40^{1}$E (Okobia, 2015). The predominantly spoken language of the people is the Hausa language while English is the official language.

Findings from a recent study carried out by Sagir *et. al.,* (2021) show that AMAC has a total of about 412 (public and private) hospitals. Recent data also show that AMAC has 8 tertiary hospitals, 6 secondary hospitals and 14 primary healthcare facilities (Nwokoro *et. al.,* 2020; Sagir *et. al*., 2021; AMAC.LG, 2019). A recent outreach carried out by the Primary Health Care Secretariat of AMAC shows that AMAC has a total of 401,454 households and a total number of 1,243,668 adults aged 18 and above (AMAC, 2022).

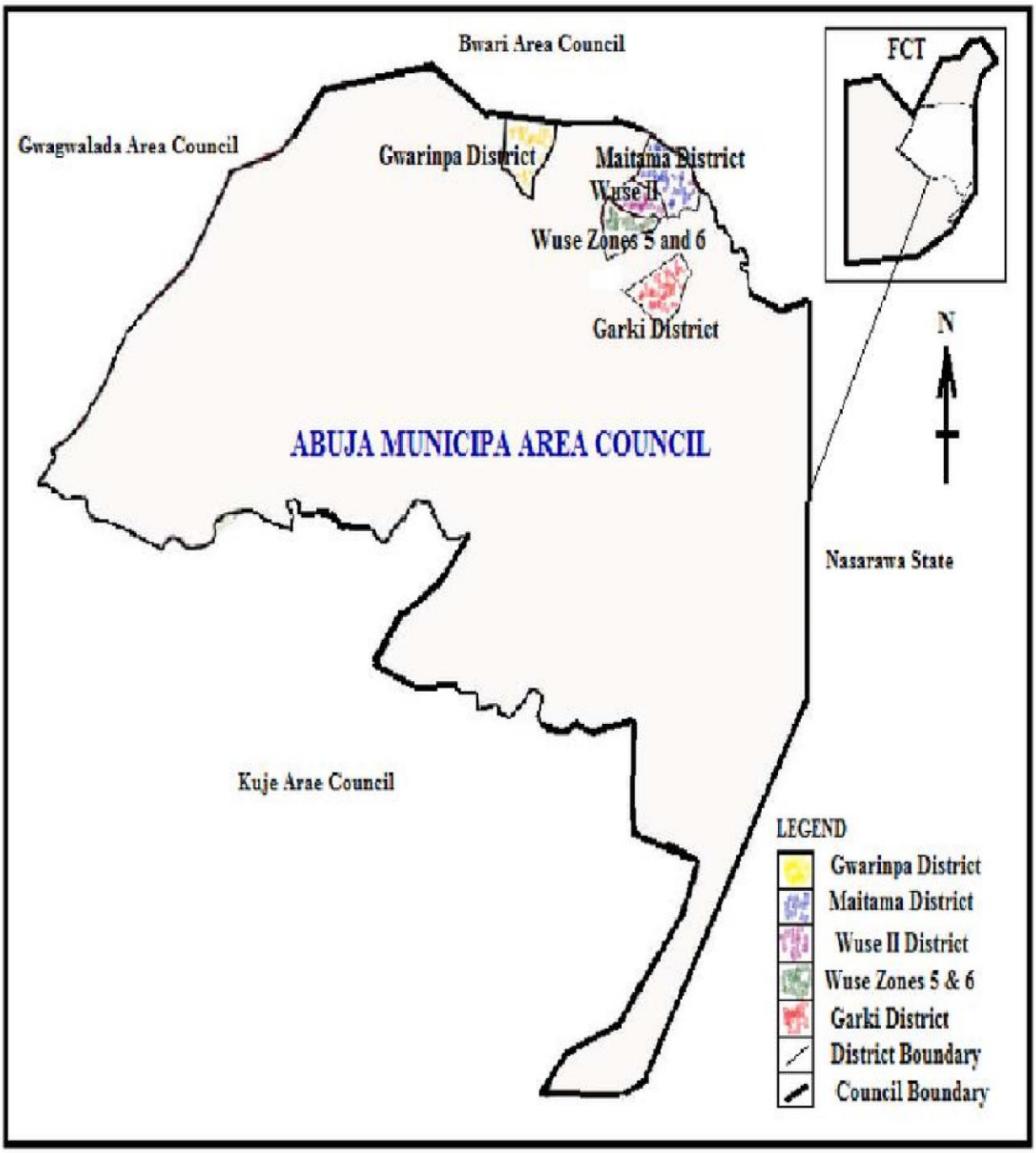

Figure 3.1: Map of AMAC, showing some of its districts (Okobia, 2015)

3.3 Study Population

The study population used is the domestic heads of households, irrespective of gender/sex who are 18years of age and above (adults) and are residing within Abuja Municipal Area Council. Household (HH) is a group of people living together and maintaining unique eating arrangement (NBS, 2010).

3.4 Sample Size and Sampling Methods

3.4.1 Sample Size

The sample size used was a total of 421 respondents. It was calculated using the Taro Yamane formula;

$$n = \frac{N}{1+N(e)^2}.$$

Where; n = sample size N = total population under study e = error margin Given; total number of households in AMAC, *N* =401,454 (*See Appendix E*) error margin at 95% confidence level, *e* = 0.05 Hence, *n* = 401454/1+401454(0.05)^2) = 399.9990 ~ 400

Therefore, sample size *n* = 400.

Using Non-Response Rate, NRR at 5%;

Adjusted sample size *n*, = *n*/1-0.05; where *n* = 400

Therefore, sample size, *n* = 400/1-0.05 = 400/0.95

=421.05 ~ 421

3.4.2 Sampling Methods

In obtaining relevant data for the study, multi-stage sampling technique was adopted and this was done in three stages.

AMAC is made up of a total of twelve wards. Namely; City Centre, Wuse, Gwarimpa, Garki, Nyanya, Orozo, Jiwa, Karshi, Karu, Gui, Gwagwa and Kabusa.

The first stage involved the selection of wards using simple random sampling method. 33% of the 12wards (which represents 4 wards) were selected using by simple balloting method. The four selected wards are; Garki, Karshi, Nyanya and City Centre.

The second stage involved the selection of households where respondents shall be drawn from using the systematic sampling method. For each household, the domestic head of the household was interviewed using the questionnaire. This was calculated thus;

$$\frac{total\ sample\ size}{sample\ size\ per\ ward}$$

Therefore, for the following sampled wards, we have the following number of households (*see Appendix G*): Garki – 32,473, Karshi – 8,282, Nyanya – 21,551 and City centre – 30,975 (AMAC, 2022).

However; to calculate sample size for each of these selected wards, we use the formula; *n* x individual ward population/total population of the 4 selected wards, *N* where; *n* = total sample size = 421 total population of households in the 4 selected wards;

Given, Garki ward = 32,473; City Centre ward = 30,975; Nyanya ward = 21,551; Karshi ward = 8,282.

Total of all four selected wards = 93,281

Hence;

Garki ward sample size = 421x32473/93281 = 146.56 ~ 147

City Centre ward sample size = 421 x 30975/93281 = 139.80 ~ 140

Nyanya ward sample size = 421 x 21551/93281 = 97.26 ~ 97

Karshi ward sample size = 421 x 8282/93281 = 37.38 ~ 37

Now calculating the interval for selection of households using the formula as stated above;

$$\frac{total\ sample\ size}{sample\ size\ per\ ward}$$

Garki = 421/147 = 2.86 ~3

Hence, household were selected for every 3rd interval from the start point. Simple random sampling was done for five households so as to select a household to serve as the starting point, beginning from the point of entry into the ward. Upon completion of the sampling, a household was drawn and households at every 3rd interval going clockwise after it were sampled. For households whose heads of household were absent, the questionnaire was taken to the next household whose head of household was available.

Karshi = 421/37 = 11.38 ~ 11

Hence, households were selected from every 11th interval from the start point in Karshi ward. Simple random sampling was done for five households, beginning from the point of entry into the ward. Upon completion of the sampling, a household was drawn and households at every 11th interval going anti-clockwise after it were sampled. For households whose heads of household were absent, the questionnaire was taken to the next household whose head of household was available.

Nyanya = 421/97 = 4.34 ~ 4

Therefore, in Nyanya ward, households were selected at every 4th interval from the start point. Simple random sampling was done for five households, beginning from the point of entry into

the ward. Upon completion of the sampling, a household was drawn and households at every 4th interval going clockwise after it were sampled.

City Centre = 421/140 = 3.01 ~ 3
Therefore, in the City Centre ward, households were selected at every 3rd interval from the start point. Simple random sampling was done for five households, beginning from the point of entry into the ward. Upon completion of the sampling, a household was drawn and households at every 3rd interval going clockwise after it were sampled.

Inclusion Criteria: This included all domestic head of households who are 18years of age and above (adults) and have given their consent to be part of the study respondents.

Exclusion criteria: This included all domestic heads of households who are below 18years of age, are not physically available at the time of this study and have not given their consent to be part of the study respondents.

3.5 Instrument for Data Collection

A structured questionnaire which included the Household Food Insecurity Access Scale (HFIAS) was used. This is an adaptation of the approach used in estimating the prevalence of food insecurity in the United States (USA) (Coates *et al.,* 2007). The method is based on the idea that the experience of food insecurity (access) causes predictable reactions and responses that can be captured and quantified through a survey and summarized in a scale. The HFIAS prevalence indicator categorizes households into four levels of household food insecurity (access): food-secure and mildly, moderately and severely food-insecure. Households were

categorized as increasingly food-insecure as these responded affirmatively to more severe conditions and/or had experienced those conditions more frequently. The questions contained in the Household Food Insecurity

Access Scale (HFIAS) were asked with a recall period of four weeks (30 days). The respondent was first asked an occurrence question, i.e. whether the condition in the question happened at all in the past four weeks (with the provision of 'yes' or 'no' response). If the respondent answered 'yes' to an occurrence question, a frequency-ofoccurrence question was asked to determine whether the condition happened rarely (once or twice), sometimes (three to 10 times), or often (more than 10 times) in the past four weeks. The operational definitions used in the current study were as follows:

Food-secure: A household was labelled 'food-secure' when the members 'rarely', in the past four weeks, worried about not having enough food and had replied 'no' to question number 1 to 9 (appendix B)

Mildly food-insecure: The members of the household worried about not having enough food sometimes or often, and/or were unable to eat preferred foods, and/or ate a more monotonous diet than desired, and/or ate some foods considered undesirable but only rarely (Coates *et al.*, 2007).

Moderately food-insecure: The household members sacrificed quality more frequently by eating a monotonous diet or undesirable foods sometimes or often, and/or had started to cut back on quantity by reducing the size of meals or number of meals, rarely or sometimes (Coates *et al.*, 2007).

Severely food-insecure: The individuals in the household had to cut back on meal-size or number of meals often, and/or experienced any of the three most severe conditions (running

out of food, going to bed hungry, or going a whole day and night without eating) (Coates *et al.*, 2007).

The structured questionnaire which was administered to the respondents was categorized into sections.

Section A was designed to elicit information on sociodemographic characteristics, including age, gender, marital status, occupation, monthly earning, etc. and this answered the question of sociodemographic characteristics of respondents associated with food security in the area council.

Section B provided information on awareness about SDG-2 goal among households in AMAC.

Section C (The FANTA-HFIAS USAID questionnaire for measurement of food access, version 3 was used to collect data on food insecurity so as to know the level of food security in the area council.

Also, Section C included The Food Consumption Score (FCS) developed by World Food Programme (WFP, 2008).

"The Food Consumption Score (FCS) was used to assess the food utilization dimension of food security. The FCS is a composite score based on dietary diversity, food frequency, and the relative nutritional importance of different food groups; it also serves as a proxy for current food security" (WFP, 2008). For example, each food item is put into a category, and each category is weighted based on relative nutritional value where condiments is given a weight

of 0, sugar and oil each is given a weight of 0.5; vegetables and fruit both a weight of 1; cereals and tubers are given a weight of 2; pulses a weight of 3 while meat, milk and fish are given a weight of 4. The standard thresholds for each food consumption group are presented in Table 3.1.

FCS Calculation Steps

"Group food items in the specified food groups

Get consumption frequencies (number of days food items is eaten) within the same group Multiply the frequency value of each food group by its weight

Sum the weighted food group scores and multiply with the number of the food groups (10) to obtain FCS

Determine the household's food consumption status based on the following thresholds:

0-21: Poor, 21.5-35: Borderline, >35: Acceptable" (WFP, 2008).

Table 3.1: Food consumption score thresholds

Food consumption group	Standard threshold

Poor food consumption	0–21
Borderline food consumption	21.5–35
Acceptable food consumption	≥ 35.5

Source: World Food Program (2008)

Section D gathered information on household coping strategies used by the respondents against food insecurity in AMAC.

3.6 Validity of Instruments

The questionnaire as the instrument for data collection was carefully developed by the researcher. It was validated for both face and content validity by the research supervisors and other lecturers and experts in the area of Food Science within reach, after all necessary corrections were made. The HFIAS component of the questionnaire as developed by the USAID funded Food and Nutrition Technical Assistance (FANTA) project was adapted to measure food insecurity levels in this study and also the Food Consumption Score (FCS) as developed by the World Food Programme was adapted alongside to measure food security status.

3.7 Reliability of Instruments

Reliability of the instruments was determined using test-retest method. 42 copies of the questionnaire were given to some respondents outside the area of study by the researcher. Bwari Area council was used for this purpose, this area shares similar characteristics with the study area. The questionnaires were re-administered to the same respondents after two weeks interval. Correlation coefficient of 0.82 was gotten using

Pearson's correlation coefficient and this showed that the instrument used for data collection was reliable.

3.8 Method of Data Collection

Data used for this study was collected through the use of structured questionnaires administered to the domestic heads of each household. The researcher recruited the participants from their various homes. This was to ensure that complete numbers of respondents as calculated from the sample size were gotten during the research. Questionnaires were distributed to participants and collected by the researcher and trained assistant researchers. Questionnaires were filled independently and privately by the participants. However, non-literate participants were assisted in filling their own questionnaires, also there was a local interpreter recruited for their purpose of communication between the researcher and the respondents where necessary.

An estimate of about 15-20 minutes was allocated to each respondent to fill their questionnaire. This was to ensure that participants completed their questionnaires appropriately.

Also, in the assessment of food security status, respondents were asked to choose a frequency defined as “rarely,” “sometimes,” or “often” to describe their responses to the questions. The food insecurity status was scored as food secure, mildly food insecure, moderately food insecure or severely food insecure.

3.9 Method of Data Analysis

All data were entered into the Microsoft Excel spreadsheet and then loaded and coded into the SPSS version 23 software for final analysis. Descriptive statistics was used to summarize sociodemographic and related characteristics. Bivariate associations between food security

and other factors was determined using chi-squared test. A P value of ≤0.05 was considered statistically significant.

3.10 Ethical Consideration/Informed Consent

Ethical consideration and approval was given by the Abuja Municipal Health and Human Secretariat.

Each participant had the study explained to them, the risks and benefits, and was given the opportunity to give consent of participating. They were also explained to that appropriate measures are taken for confidentiality of the outcome of the data. Verbal consent was given by the participants before they filled the questionnaires.

CHAPTER FOUR

RESULTS AND DISCUSSION 4.1 RESULTS

The results gotten from this study is presented as follows;

4.1.1 Socio-Economic Characteristics of the Respondents Associated with Household Food Security in AMAC

The results of the influence of socio-economic characteristics on status of food security is presented in Table 4.1.1b where it is shown that all the socio-economic attributes has significant association ($p \leq 0.05$) with status of food security. It was shown that out of the 155 households that were food secure, almost half of them 67(46%) were within the age bracket of 32 – 41 years while the least 8 of them were elderly who were within 62 years and above. The male participants 89(47%) were more food secure than their female 66(28%) counterparts. Level of food security was higher in almost half 101(49%) of the married respondents followed by the single 39(32%), co-habiting 7(21%) and separated/ divorced 8(14%). Almost half 38(51%) of the respondents who achieved tertiary level of education were more food secure than others with significant association ($p < 0.001$). Family size also had strong influence on level of food security such that proportion of the respondents who are just 2 in the family were more food secure followed by those with 3-4 family size 37(54%), 5-6 size 52(37%) and family size of 7 and above 33(21%). Equally, more than three quarter of the respondents who were satisfied with their monthly income 17(85%) were more food secure than those who were not 112(37%) and somehow 26(25%) satisfied. It was also shown in Table 4.1 that proportions of the respondents 130(45%) who earned ≥₦ 31,000(above minimum wage) were more food

secure than those who earned ≤₦30,000 (minimum wage and less) at 25 (19%).

Occupation of the respondents also had strong influence on the level of food security where respondents who are public/civil servant 47(52%) were food secure compared to the least

1(3%) who were unemployed. Equally, level of food security was highest among the proportion of them who belong to Islamic religion 93(41%) than others.

Greater proportions of the participants 36(55%) who earn above ₦100,000 were more food secure compared to other income categories with significant association ($p < 0.001$). Sociodemographic characteristics of respondents in the study area is shown in the table below.

Table 4.1.1a Socio-economic characteristics of respondents

Variables	Frequency	Percentage (%)
Age in years		
18 - 21	32	8
22 – 31	67	16
32 – 41	146	35
42 – 51	89	21
52 – 61	43	10
62 – 71	29	7

72 and above	15	4
Total	421	100
Gender/Sex		
Male	189	45
Female	232	55
Total	421	100
Marital status		
Single	122	29
Married	207	49
Separated/ Divorced	59	14
Co-habiting	33	8
Total	421	100
Highest educational level		
Primary level	169	40
Secondary level	177	42
Tertiary level	75	18
Total	421	100
Family size		
2	51	12
3—4	69	16
5—6	159	38
7 and above	142	34
Total	421	100
Satisfied with monthly income		
Yes	20	5
No	299	71
Somehow	102	24
Total	421	100
Religion		
Christianity	88	21
Islam	229	54
African Traditional Religion	33	8
Free thinkers	16	4
Atheist	29	7
Others	26	6
Total	421	100
Level of monthly Income		
≤ ₦30,000	131	31
≥ ₦31,000	290	69
Total	421	100

Occupation: ***see appendix C***

Table 4.1.1b: Association between socio-economic characteristics of respondents and status of food security among households in Abuja Municipal Area Council

Variables	Food Secure	Food Insecure	Total	X^2	p-value
Age in years					
18 – 21	8(25%)	24(75%)	32		
22 – 31	24(36%)	43(64%)	67		
32 – 41	67(46%)	79(54%)	146		
42 – 51	33(37%)	56(63%)	89		
52 – 61	15(35%)	28(65%)	43		
62 – 71	4(14%)	25(86%)	29		
72 and above	4(27%)	11(73%)	15		
Total	155	266	421(100%)	14.46	p = 0.025
Gender/sex					
Male	89(47%)	100(53%)	189		
Female	66(28%)	166(72%)	232		
Total	155	266	421(100%)	15.56	p < 0.001
Marital status					
Single	39(32%)	83(68%)	122		
Married	101(49%)	106(51%)	207		
Separated/ divorced	8(14%)	51(86%)	59		
Co-habiting	7(21%)	26(79%)	33		
Total	155	266	421(100%)	31.17	p < 0.001
Highest educational level					
Primary level	48(28%)	121(72%)	169		
Secondary level	69(39%)	108(61%)	177		
Tertiary level	38(51%)	37(49%)	75		
Total	155	266	421(100%)	11.69	p = 0.003
Occupation					
None	1(3%)	33(97%)	34		
Student	3(10%)	28(90%)	31		
Public/civil servant	47(52%)	44(48%)	91		
Artisan	31(42%)	43(58%)	74		
Trading/small and medium enterprise	44(46%)	51(54%)	95		
Farmer	3(9%)	31(91%)	34		
Company executive	22(47%)	25(53%)	47		
Others	4(27%)	11(73%)	15		

Total	155	266	421(100%)	53.83	
Religion					
Christianity	35(40%)	53(60%)	88		
Islam	93(41%)	136(59%)	229		
African traditional religion	12(36%)	21(64%)	33		
Free thinkers 6(38%)		10(63%)	16		
Atheist	5(17%)	24(83%)	29		
Others	4(15%)	22(85%)	26		
Total	155	266	421(100%)	11.67	
Level of monthly income					
≤₦30,000	25(19%)	106(81%)	131		
≥ ₦31,000	130(45%)	160(55%)	290		
Total	155	266	421 (100%)	35.23	
Satisfied with monthly income					
Yes	17(85%)	3(15%)	20		
No	112(37%)	187(63%)	299		
Somehow	26(25%)	76(75%)	102		
Total	155	266	421(100%)	25.64	p < 0.001
Family size					
2	33(65%)	18(35%)	51		
3—4	37(54%)	32(46%)	69		
5—6	52(37%)	90(63%)	142		
7 and above	33(21%)	126(79%)	159		
Total	155	266	421(100%)	43.07	p < 0.001

4.1.2 Respondents' awareness about SDG-2 goal

Presented in Table 4.1.2 below are the results of the level of the respondents' awareness about SDG-2 goal where more than half 238 (57%) of the respondents have not heard about SDG-2 goal with significant association (p = 0.007). As depicted in figure 4.1, social media 77

(42%) was the major source of first information of SDG-2 compared to the least of them 15(8%) who got the information from non-governmental organization

(NGO). However, out of these 183 participants that have heard about it, more than half 100 (55%) of them were aware that the major target of SDG-2 is to zero hunger. While some of them believed that the major target is to lend money to the poor 50 (27%), least of them believed it is targeted towards building houses for the poor 33(18%) with significant association ($p < 0.001$). Equal greater proportions of the participants (23%) were aware that to achieve SDG-2 targets by 2030, it is important to ensure food stability and all the components of food security with significant association ($p < 0.001$). However, almost half of them were unsure 83 (45%) if government and other stakeholders of SDG-2 can achieve the goal before the end of 2030 with the present

trend.

Table 4.1.2: Awareness of Respondents on SDG-2 goal

Variables	Frequency	Percentage (%)	X^2	P-value
Have you ever heard about Sustainable Development Goals 2 (SDG-2)?				
Yes	183	43		
No	238	57		
Total	421	100	7.19	p = 0.007
From which source did you first hear of SDG-2? (*See figure 4.1)*				
What is the major target of SDG-2?				
To zero hunger	100	55		
To lend money to the poor	50	27		

To build houses for the poor	33	18		
Total	183	100	39.77	p < 0.001

To achieve SDG-2 targets by 2030, it is important to ensure?

Food availability	39	21		
Food accessibility	16	9		
Food utilization	24	13		
Food Stability	42	23		
All of the above	43	23		
None of the above	19	10		
Total	183	100	24.44	p < 0.001

With the trend, do you think government and other stakeholders of SDG-2 can achieve the goal before the end of 2030

Yes	41	22		
No	59	32		
Unsure	83	45		
Total	183	100	14.56	p < 0.001

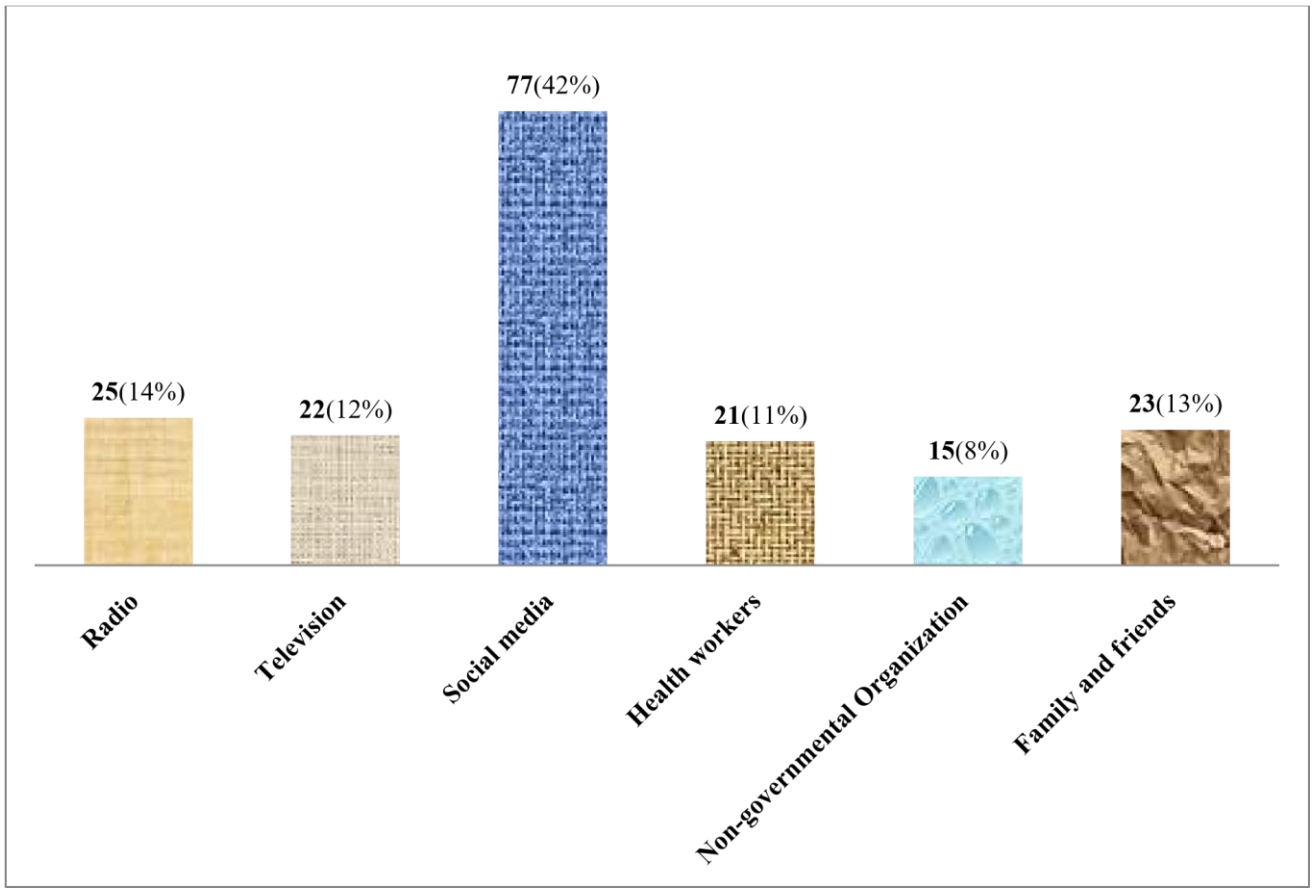

Figure 4.1.2: Source of first information of SDG-2 among respondents in Abuja Municipal Area Council.

4.1.3: Level of food insecurity among Households in Abuja Municipal Area Council

4.1.3a Using the FANTA-HFIAS Access Scale

Results of Table 4.1.3a presented the respondents level of food insecurity based on Household Food Insecurity Access Scale (HFIAS) category during the past 4 weeks. As shown, majority of the respondents worried that household would not have enough food 266(63%) whereas 155(37%) did not worry with significant association ($p < 0.001$). Out of the 266 participants that worry, more than half of them experienced it sometimes 151(57%) compared to 94(35%)

and 21(8%) of them who experience it “rarely” and “often” respectively. In the past 4 weeks, a large proportion 239(57%) of the respondents were unable to eat the preferred kinds of foods because of a lack of resources and this condition occurred “often” 144(60%) with significant association ($p < 0.001$). More than half 226(54%) of them have to eat a limited variety of foods due to a lack of resources with insignificant association ($p = 0.131$). Moreover, most of them “often” 93(41%) eat limited variety of foods due to a lack of resources compared to those who do that “sometimes” 79(35%) and “rarely” 54(24%). Equally, in the past 4 weeks, majority of them 243(58%) have to eat some foods that they really did not want to eat because of a lack of resources to obtain other types of food. However, most of them “sometimes” 95(39%) do that. It was also shown in Table 4.4 that greater proportions 232(55%) of them rarely 90(39%) have to eat a smaller meal than they felt they needed because there was not enough food.

Additionally, Table 4.1.4a showed that in the past 4 weeks, majority of the participants

248(59%) sometimes 110(44%) have to eat fewer meals in a day because there was not enough food compared to fewer of them who rarely 87(35%) and often 51(21%) experience such condition with significant association ($p < 0.001$). A good number of them 259(62%) had no food to eat of any kind in their household because of lack of resources to get food. Out of the 259 participants that had no food to eat of any kind, almost three quarter of them experienced that sometimes 179(69%) followed by 52(20%) and 28(11%) of them who “rarely” and “often” experienced it respectively. Moreover, in the past 4 weeks, almost half 219(52%) of the participants went to sleep at night hungry because there was not enough food and this condition happened sometimes 147(67%) than “rarely” 63(29%) and “often” 9(4%). Furthermore, it was shown in Table 4.4 that in the past 4 weeks, more than half 235(56%) of the participants went a whole day and night without eating anything because there was not enough food. Out of the 235 participants, 197(84%), 24(10%) and 14(6%) of them experienced it rarely, sometimes and often respectively with significant association ($p < 0.001$).

Table 4.1.3a: Level of Food Security among Households in Abuja Municipal Area Council, Using the FANTA-HFIAS Questionnaire.

Variables			Frequency(%)	Chi-square (X^2)	P value
In the past 4 weeks, worry that household would not have enough food					
Yes	266(63%)				
No	155(37%)				
Total	421	29.27			p < 0.001
In the past 4 weeks, level of worry that household would not have enough food					
Rarely (once or twice in the past four weeks)			94(35%)		
Sometimes (three to ten times in the past four weeks)			151(57%)		
Often (more than ten times in the past four weeks)			21(8%)		
Total	266.0	95.78			p < 0.001
In the past 4 weeks, there was inability to eat the preferred kinds of foods because of a lack off resources					
Yes			239(57%)		
No			182(43%)		
Total			421	7.72	p = 0.005
In the past 4 weeks, level of inability to eat the preferred kinds of foods because of a lack off resources					

Rarely (once or twice in the past four weeks)	35(15%)		
Sometimes (three to ten times in the past four weeks)	60(25%)		
Often (more than ten times in the past four weeks)	144(60%)		
Total	239	81.85	p < 0.001
In the past 4 weeks have to eat a limited variety of foods due to a lack of resources			
Yes	226(54%)		
No	195(46%)		
Total	421	2.28	p = 0.131
In the past 4 weeks, level of eating a limited variety of foods due to a lack of resources			
Rarely (once or twice in the past four weeks)	54(24%)		
Sometimes (three to ten times in the past four weeks)	79(35%)		
Often (more than ten times in the past four weeks)	93(41%)		
Total	226	10.36	p = 0.006

In the past 4 weeks, have to eat some foods that you really did not want to eat because of a lack of resources to obtain other types of food

Yes	243(58%)		
No	178(42%)		
Total	421	10.04	p = 0.002

In the past 4 weeks, level of eating some foods that you really did not want to eat because of a lack of resources to obtain other types of food

Rarely (once or twice in the past four weeks)	63(26%)

Sometimes (three to ten times in the past four weeks)	95(39%)		
Often (more than ten times in the past four weeks)	85(35%)		
Total	243	6.62	p = 0.037

In the past 4 weeks, have to eat a smaller meal than you felt you needed because there was not enough food

Yes	232(55%)		
No	189(45%)		
Total	421	4.39	p = 0.036

In the past 4 weeks, level of eating a smaller meal than you felt you needed because there was not enough food

Rarely (once or twice in the past four weeks)	90(39%)		
Sometimes (three to ten times in the past four weeks)	65(28%)		
Often (more than ten times in the past four weeks)	77(333%)		
Total	232	4.04	p = 0.132

In the past 4 weeks, have to eat fewer meals in a day because there was not enough food

Yes	248(59%)		
No	173(41%)		
Total	421	13.36	p < 0.001

In the past 4 weeks, level of eating fewer meals in a day because there was not enough food

Rarely (once or twice in the past four weeks)	87(35%)		
Sometimes (three to ten times in the past four weeks)	110(44%)		
Often (more than ten times in the past four weeks)	51(21%)		
Total	248	21.4	p < 0.001

In the past 4 weeks, there was ever no food to eat of any kind in your household because off lack of resources to get food

Yes	259(62%)		
No	162(38%)		
Total	421	22.35	p < 0.001

In the past 4 weeks, level when there was ever no food to eat of any kind in your household because of lack of resources to get food

Rarely (once or twice in the past four weeks)	52(20%)		
Sometimes (three to ten times in the past four weeks)	179(69%)		
Often (more than ten times in the past four weeks)	28(11%)		
Total	259	152.53	p < 0.001

In the past 4 weeks, went to sleep at night hungry because there was not enough food

Yes	219(52%)		
No	202(48%)		
Total	421	0.69	p = 0.407

In the past 4 weeks, level at which you or any household member went to sleep at night hungry because there was not enough food

Rarely (once or twice in the past four weeks)	63(29%)		
Sometimes (three to ten times in the past four weeks)	147(67%)		
Often (more than ten times in the past four weeks)	9(4%)		
Total	219	132.49	p < 0.001

In the past 4 weeks, went a whole day and night without eating anything because there was not enough food

Yes	235(56%)		
No	186(44%)		
Total	421	5.7	p = 0.017

In the past 4 weeks, level at which you or any household member went a whole day and nightt without eating anything because there was not enough food

Rarely (once or twice in the past four weeks)	197(84%)		
Sometimes (three to ten times in the past four weeks)	24(10%)		
Often (more than ten times in the past four weeks)	14(6%)		
			p <
Total	235	270.29	0.001

Table 4.1.3a: Prevalence of Household Food Insecurity among Households in AMAC

HFIAS categories	Frequency	Percentage (%)
Food secure	155	37
Mildly food insecure	166	39
Moderately food insecure	80	19
Severely food insecure	20	5
Total	421	100.0

Depicted in table 4.1.3a above is the overall result of the status of food security AMAC using the FANTA-HFIAS access scale where about 266 (63%) of the participants were food insecure compared to 155 (37%) who were food secured. However, the food insecurity was further categorized where it was shown that out of the 266 food insecure households, majority of them 166(39%) were Mildly food insecure followed by 80(19%) and 20(5%) who were moderately food insecure and severely food insecure respectively.

4.1.3b: Food Consumption Pattern of the Respondents (Using the Food Consumption Score, FCS)

Table 4.1.3b displays the weighted diet diversity score of the participants during < 3 days, 3-4 days and 5days and above. As shown, carbohydrate based foods including maize, maize porridge, rice, sorghum, millet pasta, bread and other cereals were consumed 182(43%) more within 5days and above with average meal weight of 0.4 compared to other consumption intervals. Within 3-4 days, there was more consumed 186(44%) of other carbohydrate-based foods (cassava, potatoes and sweet potatoes) by the participants with average meal weight of 0.4 compared to others. Also, across the consumption intervals, a large proportion 167(40%) of the respondents consumed more of proteinous food (beans. peas, groundnuts and cashew nuts) within 3-4 days with average meal weight of 0.4. Within 5days and above, majority of them 194(46%) were able to consume vegetables and leaves with average meal weight of 0.5 than were consumed within 3-4 days 178(42%) and < 3 days 49(12%) with average meal weight of 0.4 and 0.1 respectively. As regards the consumption of fruits, greater proportions of them 188(45%) were able to consume it in 5days and above with average meal weight of 0.4. Similarly, within 5days and above, equal proportion of them (49%) consumed other proteinous food (Beef, goat, poultry, pork, eggs, fish and milk yogurt and other diary) compared to other consumption intervals. However, in 3-4 days intervals 174(41%), there was more consumption of sugar and sugar products with average meal weight of 0.4 compared to < 3 days 168(40%) and 5days and above 79(19%) that showed average meal weight of 0.4 and 0.2 respectively. Table 4.3 also showed that oils, fats and butter were consumed 181(43) more within 3-4 days than 5days and above and < 3 days with average meal weight of 0.4,

0.4 and 0.1 respectively. Overall, the food consumption score of the participants was shown to be 21 (poor), 33 (borderline) and 36 (acceptable)

for the < 3 days, 3-4 days and 5days and above respectively.

Table 4.1.3b: Frequency of weighted diet diversity score	< 3 days	Total meal weight	Average meal weight	3-4 days	Total meal weight	Average meal weight	5days and above	Total meal weight	Average meal weight
	N(%)			N(%)			N(%)		
Maize, maize porridge, rice, sorghum, millet pasta, bread and other cereals	104(25)	416	0.2	135(32)	1080	0.3	182(43)	1820	0.4
Cassava, potatoes and sweet potatoes	125(30)	500	0.3	186(44)	1488	0.4	110(26)	1100	0.3
Beans. Peas, groundnuts and cashew nuts	90(21)	540	0.2	167(40)	2004	0.4	164(39)	2460	0.4
Vegetables and leaves	49(12)	98	0.1	178(42)	712	0.4	194(46)	970	0.5
Fruits	166(39)	332	0.4	67(16)	268	0.2	188(45)	940	0.4
Beef, goat, poultry, pork, eggs and fish	84(20)	672	0.2	132(31)	2112	0.3	205(49)	4100	0.5
Milk yogurt and other diary	54(13)	432	0.1	160(38)	2560	0.4	207(49)	4140	0.5
Sugar and sugar products	168(40)	168	0.4	174(41)	348	0.4	79(19)	197.5	0.2
Oils, fats and butter	61(14)	61	0.1	181(43)	362	0.4	179(43)	447.5	0.4

Food consumption score	21.0 (poor)	33.0 (borderline)	36.0 (acceptable)

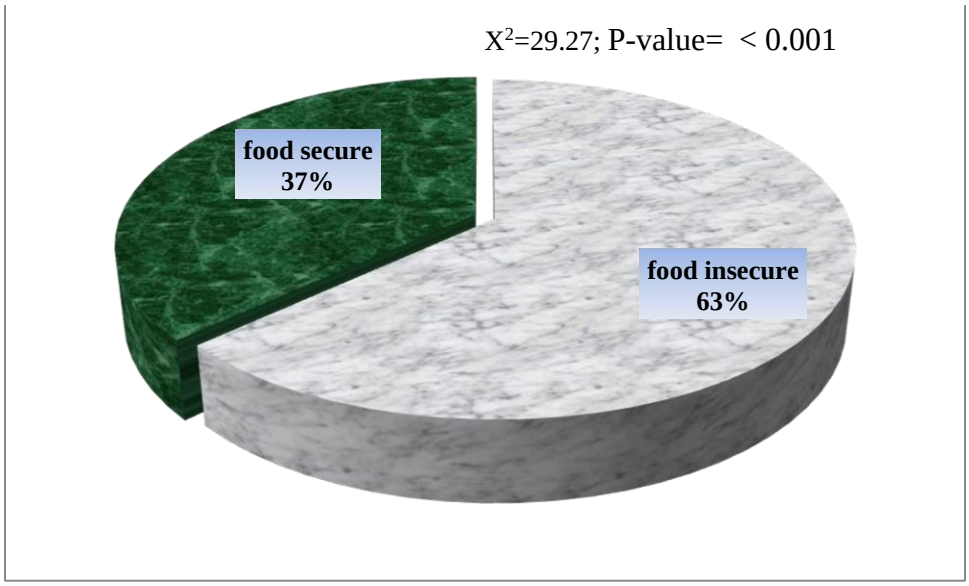

Figure 4.1.3: Status of Food Security among Households in Abuja Municipal Area Council

4.1.4: Household Coping Strategies used by the respondents against food insecurity among Households in Abuja Municipal Aerea Council

Presented in Table 4.1.4 are the results of the respondents various coping strategies used against food insecurity. Eleven different strategies were employed by the respondents to fight against food insecurity. Almost three quarter of them occasional 294 (70%) eat once a day followed by those who never 53 (13%), regularly 46(11%) and very often 28 (7%) eat once a day with significant association ($p < 0.001$). Occasionally, almost half of them 220 (52%) employ the strategy of allowing their children to eat first before eating unlike the least of them who never did that 20(5%). Equally, on occasional basis, greater proportion of the participants 201(48%) eat fruit as a coping strategy compared to 130(31%), 61(14%) and 29(7%) of them who use the strategy regularly, very often and never respectively with significant association ($p < 0.001$). As regards selling of assets as a coping strategy, a good number of them never done that 183(43%) whereas very often, is only very few of them 36(9%) did that. Buying food on credit was occasionally 179(43%) used as a coping strategy by most of them followed by those who do it very often, 103(24%), regularly 80(19%) and never 59 (14%). Similarly, almost half of the participants occasional 221 (52%) pick leftover food at social functions compared to the least proportion of them that very often 49 (12%) pick. In terms of relying on less preferred or less expensive food as a means of coping, it was shown that majority of them also occasional 179(40%) does it compared to 91(22%), 89(21%) and 74(18%) of them who never, regularly and very often do it respectively with significant association

($p < 0.001$). On occasional basis, a good number of them 175 (42%) have borrowed food or borrowed money to buy food unlike few of them 45(11%) who borrowed very often. Furthermore, results of Table 4.6 showed that out of the 421 participants, majority of them 149(35%) have occasional reduced the number of meals eaten in one day compared to those have regularly 137(33%), very often 89(21%) and never 46(11%) reduced their number of meals eaten in one day with significant association ($p < 0.001$). As in figure 4.1.5, reducing the level of essential non-

food expenditures such as education, health, etc. and illegal income activities (theft, smuggling, prostitution) as strategies used against food insecurity was occasional and never performed by most of the respondents

respectively.

Table 4.1.4: Households Coping Strategies used against food insecurity

Variables	Frequency	Percentage (%)	X^2	P-value
Very often	89	21		
Regularly	137	33		
Occasional	149	35		
Never	46	11		
Total	421	100	63.63	$p < 0.001$
Reducing essential non-food expenditures such as education, health etc		*See figure 4.4*		
Illegal income activities (theft, smuggling, prostitution etc)		*See figure 4.4*		

Eating once a day				
Very often	28	7		
Regularly	46	11		
Occasional	294	70		
Never	53	13		
Total	421	100	454.49	p < 0.001
Allowing children to eat first				
Very often	76	18		
Regularly	105	25		
Occasional	220	52		
Never	20	5		
Total	421	100	202.29	p < 0.001
Eating of fruit				
Very often	61	14		
Regularly	130	31		
Occasional	201	48		
Never	29	7		
Total	421	100	166.77	p < 0.001
Selling of assets				
Very often	36	9		
Regularly	43	10		
Occasional	159	38		
Never	183	43		
Total	421	100	167.27	p < 0.001
Buying food on credit				
Very often	103	24		
Regularly	80	19		
Occasional	179	43		
Never	59	14		
Total	421	100	78.11	p < 0.001
Picking of leftover food at social functions				
Very often	49	12		
Regularly	88	21		
Occasional	221	52		
Never	63	15		
Total	421	100	177.15	p < 0.001
Relying on less preferred or less expensive food				
Very often	74	18		
Regularly	89	21		
Occasional	167	40		
Never	91	22		
Total	421	100	49.95	p < 0.001
Borrowing food or borrowing money to buy food				
Very often	45	11		
Regularly	99	24		
Occasional	175	42		
Never	102	24		

Total	421	100	81.19	p < 0.001

Reducing the number of meals eaten in one day

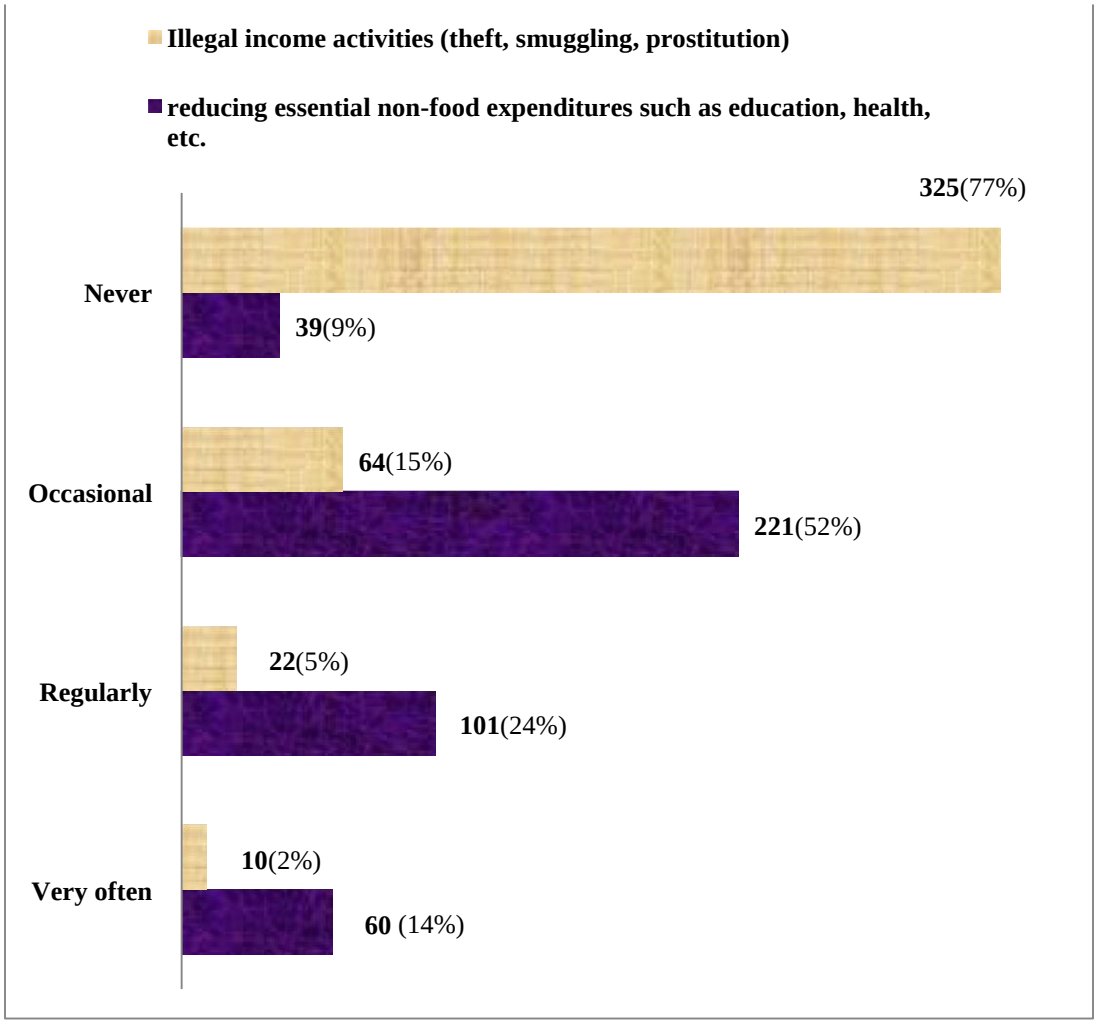

Figure. 4.1.4: Level of reducing essential non-food expenditures such as education, health, etc. and illegal income activities (theft, smuggling, prostitution) as Strategies used against food insecurity

4.2 DISCUSSION

4.2.1 Socio-Economic Characteristics of respondents associated with food security among households in AMAC

In the present study it was shown that all the socio-economic variables of the respondents had significant association (P≤0.05) on the status of food security. Food security was higher amongst the respondents within the age bracket of 32 – 41years 67(46%) compared to other age categories. Households headed by persons of different age brackets are unequally vulnerable to food poverty (Ozughalu and Ogwumike, 2015). Other workers (Babatunde *et. al*., 2007; Omonona *et. al*., 2007) reported that household food insecurity seems to worsen as the head of household ages. No statistically significant associated was found between age and food insecurity in the study of Najibi *et al*. (2011). However, age is a critical variable, which can influence the capacity and alacrity with which the head provides foods for the household. An old respondent may have bigger household size and may not have the vigour needed to work for the maintenance and nourishment of the household.

In terms of gender, food security was more prevalent in male respondents 89(47%) ($p<0.001$) compared to their female counterparts. This is in line with the findings of Babatunde *et. al*., (2007) and Omonona and Adetokunbo (2007) who reported that Nigerian children living in female-headed households are more susceptible to the problem of household food insecurity and malnutrition than their counterparts residing in male-headed households. These results also comply with the findings of Ghazi

Tabatabaii *et al*. (2011), who reported that women were more food insecure than men, and with those of with Simsek *et. al*., (2013) who stated that among elderly persons, women are at a higher risk of food insecurity in Turkey.

Prevalence of food security was also more in married 101(49%) respondents. This suggests that being married may reduce food insecurity among the households. This in line with the findings of Sekhampu (2013) who reported married respondents in Kwakwatsi, South Africa being more food secure than unmarried respondents as well as in consistence with the findings of Magaña-Lemus *et al*. (2013) in Mexico; Djangmah

(2016) in Ghana; Habyarimana (2015) in Rwanda and Yusuf *et al*. (2015) in Nigeria. The reason for married people being more food secure could be traced to relative contributions (e.g. financial, labour wise) of married couples which increases different dimensions of food security. Contrarily, the findings of Aidoo *et al*. (2013) showed that household food security for unmarried respondents was relatively more than their married counterparts. Also, this result is dissimilar to that of (Obayelu *et al*., 2021), which reported that 82.7% of married household heads are food insecure in an urban slum of Ibadan.

Equally, food security increased with increase in level of education such that those that achieved tertiary level were more food secured. Education enables the respondents to take good decisions, which may likely enhance their food security status (Babatunde *et al.,* 2007). More educated head of households have the opportunity to take more informed decisions about its consumption and the importance of a healthy diet. Furthermore, those households are potentially more able to access and make better use of social programs to improve their nutrition (Magaña-Lemus *et al*., 2016). This was contrary to the findings of Yusuf *et al*. (2015) and Djangmah (2016), who noted a significant negative relationship between food security and number of years spent in education in Nigeria and Northern region of Ghana respectively. Food security was also significantly highest ($p<0.001$) 33(65%) among respondents with lesser family size.

Household size indicates household food allocation and child's home environment (Alaimo *et al*. 2001). Incidence of food insecurity increases with household size

(Babatunde *et al*. 2007; Omonona and Adetokunbo 2007; Ozughalu and Ogwumike 2015) and large households have greater prevalence of impeded growth among children than smaller households (Baig-Ansari *et al*. 2006). This also agrees with the Malthusian theory of population which states that an increase in population will lead to food scarcity (Malthus, 1801).

Moreover, respondents 17(85%) who were satisfied with their monthly income were more food secured than others.

Another factor that was associated with food security was occupation of the respondents where most of them who are public/civil servant 47(52%) were more food secured than other categories of occupation. Food poverty varies across households depending on the means of subsistence of the household heads (Ozughalu and Ogwumike, 2015). Professionals have lower incidences of food insecurity than traders and unemployed persons (Omonona and Adetokunbo, 2007). Children experience more rapid growth and have reduced risks of stunting when they reside in households that are socioeconomically better off (Timaus, 2013). Malnourished children are more concentrated in poor households than in wealthy households (National Population Commission, 2014).

Amongst the different religions, higher food security was observed in households of the

Islam (P=0.05). Additionally, level of respondents' monthly income had strong association with food security where those earning above ₦100,000 were more food secured than others.

4.2.2 Awareness of the respondents about SDG-2 goal

There was significant variation in the level of the participants' level of awareness on Sustainable Development Goals 2 (SDG-2). More than half of the respondents 238 (57%) have not heard about Sustainable Development Goals 2 (SDG-2) whereas the major source of information for those who have heard 183 (43%) was from social media

77(42%). It was reported by previous studies (SDG Centre for Africa and Sustainable Development Solutions Network, 2019; Otekunrin *et al.* 2019c) that Nigeria also had a rather low Africa's Sustainable Development Goals Index (SDGI) rank and score

(ranked 43rd among 52 countries in Africa with 47.03/100 score) slightly behind Sudan

(ranked 42nd with 47.38/100 score) and Comoros (ranked 41st with 47.5/100 score) in Africa. Mueller *et al*. (2008) stated that the use of multiple dissemination media helps to increase the usefulness, satisfaction and further dissemination of information. However, in Nigeria, fundamental facilities and adequate enlightenment or sensitization on the importance of food safety culture are gravely lacking in many rural and sub-urban regions (Anyogu *et al*., 2021).

Around half of them 100(55%) perceived that the major target of SDG-2 was to zero hunger. Majority of them were aware that for SDG-2 goal to be achieved there must be food stability and other components of SDG-2 goal maintained (23%). The Sustainable Development Goal 2 (SDG 2) contains a global commitment to "end hunger, achieve food security, and promote sustainable agriculture" by 2030. SDG 2 seeks sustainable solutions to achieving the tripod criteria of food security (i.e., availability, affordability, and accessibility) as a means to end hunger (Ajibade *et al*., 2019). With the trend, government and other stakeholders of SDG-2 are going, a good number of the participants 83(45%) were unsure if the goal will be achieved before the end of 2030. What

is therefore clear from the analysis is that governments will need to go beyond the relatively limited scope of action set out in the "means of implementation" if they are to succeed in achieving the ambition of the individual targets established under SDG 2, as part of a broader effort to implement their Agenda 2030 commitments (United Nations General Assembly, 2017).

4.2.3 Frequency of Diet Diversity

Household dietary diversity is the number of unique foods consumed by household members over a given period. It has been validated to be a useful approach for measuring household food access (United States Agency for International Development-USAID, 2007). The Food Consumption Score (FSC) was used to assess the food utilization dimension of food security since it can be used as a proxy for current food security. The "FCS is a composite score based on dietary diversity, food frequency, and the relative nutritional importance of different food groups over a recall period of seven days" (WFP, 2008; Kuku- Shittu *et al*., 2013), though it does not provide the precise quantities of nutrient intake.

As regards the frequency of diet diversity of the respondents, in 3-4 days, most of the participants consumed more of carbohydrates in form of cassava, potatoes and sweet potatoes 186(44%), proteinous food in form of beans. peas, groundnuts and cashew nuts 167(40%), sugar and sugar products 174(41%) and fats and oils 181(43%). Meanwhile, within 5days and above, around 45% of them consumed more of carbohydrates in form of maize, maize porridge, rice, sorghum, millet pasta, bread and other cereals 182(43%). Also, in 5days and above, there was more consumption of vegetables and leaves 194(46%), fruits 188(45%) and proteinous food in form of beef, goat, poultry, pork, eggs and fish 205(49%) and milk yogurt and other diary 207(49%). This finding concur with that of other researchers (Ruel, 2003; Arimond *et al*., 2010) that poor households subsist on monotonous staple based diet and lack access to nutritious food such as vegetable and

animal source foods like fish, meat, eggs and dairy products. Generally, the household diet consists mainly of carbohydrates and this is in consistence with the findings of Kuku-Shittu *et al*. (2013). However, previous studies have affirmed that a variety and balance of foods from all food groups and moderate consumption of all food items is very important in order to maintain a healthy diet (Nnakwe and Onyemaobi, 2013).

When the food deficit is very high, people's diet tends to be deficient in protein, vitamins and carbohydrate-rich staple foods such as rice, cassava and maize that provide energy (Iyabo, 2020).

Based on the average meal weight of the participants, their food consumption score was grouped as poor (21.0), borderline (33.0) and acceptable (36.0) at < 3 days, 3-4 days and

5days and above respectively over a 7 days recall period. An FCS below 21 assumes a daily consumption of staple and vegetables by a household, which is considered a poor diet. Households with a recorded FCS between 21.5 and 35 known as the borderline food consumption consists of those with a daily consumption of staple and vegetables complemented by consumption of oil and pulses (with an exception of proteins especially animal proteins) by a frequency of four days per week (WFP, 2008). In addition, households with an FCS of above 35 have the acceptable diet due to its high dietary diversity i.e. all the food groups were consumed by a frequency of at least four days per week (WFP, 2008).

4.2.4 Status of Food Security

Food is a basic necessity of life and essential for sustenance. An adequate food intake, in terms of quantity and quality, is a key for healthy life (Chinnakali *et. al*., 2014). The current study looked at household level food insecurity in Abuja Municipal Area Council, using a valid and reliable tool, i.e. Household Food Insecurity Access Scale (HFIAS). This is because the HFIAS, apart from being the most validated and widely used of the three indicators, is still preferred in terms of having a more widely accepted universal threshold, which allows for more uniform grouping of households into categories of food security (Maxwell and Coates 2012). The HFIAS indicator

is based on the assumption that the experience of food insecurity (access to food) causes predictable reactions and responses that can be captured and quantified through a survey and summarized on a scale (Coates *et al*., 2007; Headey and Ecker, 2012).

It was shown in this study that in the past 4 weeks majority of the respondents sometimes

151(57%) worried that household would not have enough food 266(63%) but they rarely eat a smaller meal than they felt they needed because there was not enough food. However, they were often 144(60%) unable to eat the preferred kinds of foods because of a lack of resources 239(57%). Also, in the past 4 weeks more than half of them often have to eat a limited variety of foods due to a lack of resources 226(54%) and have to eat some foods that they really did not want to eat because of a lack of resources to obtain other types of food 243(58%). Many scholars highlighted that, if in the short term, food price increases could be seen as detrimental for the poor, sustained food prices could be in the long term the best way to reduce poverty and improve food security for smallholders (Headey and Martin, 2016; Ivanic and Martin, 2014; Swinnen and Squicciarini, 2012).

Moreso, most households sometimes 179(69%), was not having food to eat of any kind in their household because of lack of resources to get food 259(62%). Food availability does not ensure food accessibility. For food to be accessible, individuals or families must have sufficient purchasing power or ability to acquire quality food at all times while utilization demands sufficient quality and quantity of food intake (Omonona *et. al*., 2007). These elements of availability, accessibility and utilization in a larger context, embraces the supply, demand and adequacy of food at all times.

Furthermore, in the past 4 weeks, more than half of the participants sometimes 147(67%) went to sleep at night hungry because there was not enough food 219(52%), but rarely 197(84%) did they or any of their household member went a whole day and night without eating anything because there was not enough food 235(56%). In the study of

Lujabe *et al*., (2022), households with a household member(s) who had gone to sleep at night hungry because there was not enough food was 60% which is higher than 44% recorded in the present study. The difference could be that their study was conducted during COVID-19 characterized with much hunger. Also, the results of the present study was lower than 82.4% and 73.3% reported by Otekunrin (2022) in two different states in Southwestern Nigeria, revealing that most of the families in the present study usually eat something, although the food may be monotonous and of low diet quality which is common in developing economies (Willett *et. al*., 2019; Otekunrin and Otekunrin 2021a). Food security, according to FAO (2002) "exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life". Food security in the above context consists of four dimensions viz; food accessibility, availability, utilization and stability, and these dimensions must be fulfilled for food security objectives to be realized.

Consequently, using the categorical measure of food insecurity, four levels of food insecurity was identified which were food security 155(37%), mildly food insecure 166(39%), moderately food insecure 80(19%) and severely food insecure 20(5%). That means they were, at times, uncertain of having or unable to acquire enough food for all household members because they had insufficient money and other resources for food (Farhadian *et al*, 2015). Consequently, when the scale measure classifies a household in the more severe range, what it tells us is that at least some member, or members, of the household are experiencing hunger due to insufficiency of household resources, but not necessarily all members (USDA, 2012). On a household level, presence of food insecurity probably suggests a high degree of vulnerability to a broad spectrum of consequences, including psychosocial dysfunction in children, socio-familial problems, and overall poor health status (Chinnakali *et al*., 2014). In general, 266(63%) of the households were not food secured. This corroborates the previous findings. For instance,

Kassy *et. al.*, (2021), a study conducted in Enugu State revealed 61.1% food insecurity. Obayelu and Oyekola (2018) also reported food insecurity prevalence of 80.9% among urban slum households in Ibadan, Nigeria. Nevertheless, the results of this study was lower compared to the 42% reported in Onunka *et. al.*, (2018), a study conducted in a local government in Enugu State. Equally, using HFIAS, 50% of farming households in the study of Diallo and Asiamah (2019)

were found food insecure (41% mildly food insecure, 12% moderately food insecure, 7% severely food insecure. The disparity between prior studies and the current study can be linked to Nigeria's unstable food price increase.

4.2.5 Household Coping Strategies Used by the Respondents against Food Insecurity in AMAC

When households are faced with food shortages they tend to employ coping strategies to maintain an adequate food access (Wood *et al*., 2009). So many strategies were used by the participants in this study to cope against food insecurity with significant association ($p < 0.001$). The frequently used strategy was reducing the quantity of food eaten, as more than half of them occasional cope against food insecurity by eating once a day 294 (70%), allowing their children to eat first, picking of leftover food at social functions 221 and reducing essential non-food expenditures such as education, health, etc. 221 (52%).

This implies that when households are faced with food shortages, the immediate strategy they adopt is to reduce the quantity of food eaten. Urban households in Abuja, Nigeria

(Ibrahim *et al*., 2009), farming households in Forest Belt of the Central Region of Ghana

(Kuwornu *et al*., 2013) and smallholder farming households in Borno State, Nigeria (Mohammed *et al*., 2014) used reduction of quantity of meals as a coping strategy during food shortages.

In addition, majority of them cope against food insecurity by occasional eating fruit 201(48%), buying food on credit 179(43%), relying on less preferred or less expensive food 167(40%), borrowing food or borrowing money to buy food 175(42%) and reducing the number of meals eaten in one day 149 (35%). This was similar to the findings of Ibok *et. al*. (2014) who reported that the coping strategies mostly used by farmers against food insecurity were buying food on

credit, allowing children to eat first, and eating of fruit. Meanwhile, CFSAM (2011) reported that households in Northern Sudan apply a variety of coping strategies, the most common being to rely on less preferred or less expensive food or eat borrowed food or borrow money to buy food, and more severely to reduce the number of meals eaten in one day.

However, as a means of coping with food insecurity, a greater proportion of the participants in the current study never sold their assets 183(43%) nor engaged in illegal income activities (theft, smuggling, prostitution) 325(77%). In the study of Nkembi *et al*., (2021), a number of coping strategies in case of food shortage was adopted by the farmers; eating same food, skipping meals, eating less per meal and doing things that that they don`t prefer such as sending children to go out to work in order to get food.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

The results gotten in this research showed that all the socio-economic variables had strong influence ($P \leq 0.05$) on the status of food security of the respondents. Higher level of food security was found among male respondents who were Islams and were within the age bracket of 32 – 41 years and were also married with a family size of 2. Food security was also higher among most of them who achieved tertiary as their highest level of education and are public/civil servant. Equally, food security increased with monthly income especially for those who are satisfied with their monthly income and spend ≥₦1500 on food stocks daily purchased from the market.

It could also be concluded that there was poor awareness of Sustainable Development Goals 2 (SDG-2) with less than half of the participants being aware of SDG-2. Their food consumption score was poor (21.0), borderline (33.0) and acceptable (36.0) in < 3 days, 3-4 days and 5days and above respectively. There was a high prevalence of food insecurity in the study area where about 63 percent of the households were facing varying degrees of food insecurity. Using the categorical measure of food insecurity, four levels of food insecurity was identified in the study which were food secure 155(37%), mildly food insecure 166(39%), moderately food insecure 80(19%) and severely food insecure 20(5%). More diversified diet were consumed in 3 days and above than in less than 3days.

However, so many coping strategies against food insecurity were occasionally employed by the participants and these included eating once a day, allowing children to eat first, picking of leftover food at social functions and reducing essential non-food expenditures such as education, health, etc. as well as eating fruit, buying food on credit, relying on less preferred or less expensive food, borrowing food or borrowing money to buy food and reducing the number of meals eaten in one day. However, most of them neither sold their assets nor engaged in illegal income activities (theft, smuggling, prostitution) as coping strategies.

5.2 Recommendations

In the light of the findings of this study, the following were recommended;

There is an urgent need to remedy food insecurity problems. To remedy the food insecurity problems in the area, there should be increased production of cassava, yam, rice and maize and proteinous foods by the farmers to enhance availability viz-a-viz accessibility for household consumption.

The stakeholders should endeavour to promote nutrition training or food insecurity mitigation strategies and socio-economic status, especially for women, in order to improve household nutrition-related knowledge, thereby enhancing the food security of the households.

Households' sensitization on healthy eating and food diversification is needed to enhance their knowledge of nutrition and possible food combinations for improved household diet and nutrition. Since the likelihood of being food insecure worsened with an increase in the household size, efforts should be made at improving programmes and policies that will ensure proper family planning and promote small family size.

In order to achieve the second goal of the Sustainable Development Goals, extension agents and other development agents must find ways to encourage households that are farmers to improve their farming systems through diversification to increase dietary diversity, as well as ways to improve their source(s) of income, which can be through livelihood diversification.

There is need for agencies and institutions concerned to gear more efforts towards ensuring that the public is more aware of SDG-2. This would help in improving the food security status of the people, thereby improving their health outcomes.

5.3 Contribution to Knowledge

This study on the food security status and awareness of SDG-2 among households in Abuja Municipal Area Council, has helped to close the gap in knowledge on the recent food security levels and situation among households in Abuja Municipal Area Council (AMAC) which showed that 63% of households in AMAC are food insecure, while 37% were food secure.

Also, their food consumption score as measured was poor (21.0) for food groups consumed at less than 3days, while for food groups consumed within 3-4days was at borderline (33.0) and acceptable for food groups consumed 5days and above (36.0).

There was poor awareness of SDG-2 among the respondents in AMAC, this goes to show that most people in AMAC do not know about SDG – 2 and its goal to *zero hunger* by 2030.

Findings from this research will serve as relevant literature for related studies in the future. Other related research can adapt some methods used in this study where necessary for the purpose of conductive an extensive and reliable research work.

5.4 Suggestions for Future Research

Considering the high prevalence of food insecurity reported in this study, more studies, both qualitative and quantitative should be carried out to generate more information on the level of food insecurity in other states of the country as this will assist in the addressing of household food insecurity problems in the country as a whole.

REFERENCES

Abubakar, M.S. (2013). An Empirical Analysis of Households Food Security in Gombe State, Nigeria; Undergraduate Project, Department of Economics, Faculty of Social Sciences, Ahmadu Bello University Zaria.

Abuja Municipal Area Council (2022). Focal Persons Outreach Report – WHO oral polio immunization programme, Data Management office, Primary HealthCare

Secretariat.

Adedeji, O. H., Odufuwa B. O. and Adebayo O. H. (2012). Building Capabilities for Flood Disaster and Hazard Preparedness and Risk Reduction in Nigeria: Need for Spatial Planning and Land Management. *Journal of Sustainable Development in Africa*, **14(1):** 1- 14.

Adelaja, A. and George, J. (2019). 'Effects of conflict on agriculture; Evidence from the Boko Haram insurgency', *World Development*, **(117):**.184-195.

Ahmed, B. N. (2019). The role of homestead fish ponds for household nutrition security in Bangladesh. *FoodSecurity*, **11:** 835-854.

Aidoo, R., Mensah, J.O. and Tuffour, T, (2013). "Determinants of household food security in the Sekyere-Afram plains district of Ghana", in 1st Annual International Interdisciplinary Conference (AIIC 2013), Azores, Portugal, 1-32.

Ajibade I., Michael, E. and Arun, P. (2019). Climate change and the sustainable development goal on food security: barriers and opportunities for progressive realization in qatar and Nigeria. Afe Babalola University. *Journal of Sustainable Development Law & policy* **10**: 1-2

Akparibo, R. Aryeetey, R.N.O. Asamane, E.A. Osei-Kwasi, H.A. Ioannou, E. Infield Solar, G. Cormie, V. Pereko, K.K. Amagloh, F.K. Caton, S.J. (2021). Food Security in Ghanaian Urban Cities: A Scoping Review of the Literature. *Nutrients*.

13, 3615. https://doi.org/10.3390/nu13103615

Althabe, F., Bergel, E., Cafferata, M. L., Gibbons, L., Ciapponi, A., Alemán, A. and Palacios, A. R. (2008). Strategies for improving the quality of health care in maternal and child health in low ‗and middle‗income countries: an overview of systematic reviews. *Paediatric and perinatal epidemiology. 22*, 42-60.

Anyogu, A., Olukorede, A., Anumudu, C., Onyeaka, H., Areo, E., Adewale, O., Odimba, J. N. and Nwaiwu, O. (2021). Microorganisms and food safety risks associated with indigenous fermented foods from Africa. *Food Control*. 129: 108227.

Arcand, J.L. Rodella, A.S. and Rieger, M. (2015). 'The Impact of Land Mines on Child Health: Evidence from Angola', *Economic Development and Cultural Change*.

(63:2), .249-279.

Arimond, M., Wiesmann, D., Becquey, E., Carriquiry, A., Daniels, M.C and Deitchler, M. (2010). Simple food group diversity indicators predict micronutrient adequacy of women's diets in 5 diverse, resource-poor settings. *J. Nutr*. 140(11): 20592069.

Armah, S. and Dharod, J.M. (2017). Inter-relationship between food security status, money spending, and availability of fruits and vegetables at home. *FASEB Journal*. 31(1):791-797.

Asogwa, B. C. and Umeh, J. C. (2012). Food Insecurity Determinants among Rural Farm Households in Nigeria. International Conference on Ecology, Agriculture and Chemical Engineering (ICEACS), Phuket (Thailand)

Atinaf, M., Karanasios, S. and Anteneh, S. (2020). Digitalizing agriculture extension service in Ethiopia: a design-reality gap analysis. PACIS 2020 Proceedings, Dubai, United Arab Emirates, 28 July 2020.

Attah, N. E. (2013). "Possession by Dispossession: Interrogating The New Wave of Land Grabbing in Nigeria" *Journal of Land and Rural Studies,* **1(2):** 213-228.

Atukunda, P., Wenche B.E., Kristin, R., Kardel, Per Ole, I. and Ane C. W. (2021). Unlocking the potential for achievement of the UN Sustainable Development Goal 2 – 'Zero Hunger' – in Africa: targets, strategies, synergies and challenges. *Food and Nutrition Research.* **65**: 7686

Awoyemi, T. T., Odozi, J. C., Otekunrin, O. A., and Ehirim, N. C. (2015). Efficient Resource Use: Does Human Capital Matter? The Case of Cassava Production farmers in Oyo State, Nigeria. *International Journal of Agriculture and Rural Development.* **18(1):** 2064-2074.

Ayinde, I.A. (2019). Food Security in Nigeria: Impetus for Growth and Development. Nigerian Institute of Town Planners (Ogun State Chapter) Waheed Kadiri Annual Lecture 2019. (2 July 2019).

Babatunde, R. O., Omotesho, O. A. and Sholotan, O. S. (2007). Factors influencing food security status of rural farming households in North Central Nigeria. *Agricultural Journal*, **2(3),** 351-357.

Babatunde, R.O., Adejobi, A.O. and Fakayode, S.B. (2010). Income and calorie intake among farming households in rural Nigeria: Results of parametric and nonparametric analysis. *Journal of Agricultural Science.* 2: 135–146.

Babatunde, R.O., Omotesho, O. and Sholotan, O.S. (2007). Socio-economic characteristics and food security status of farming households in Kwara State, North-Central Nigeria. *Pakistan Journal of Nutrition, 6, 49-58.*

Baig-Ansari, N., Rahbar, M. H., Bhutta, Z. A., and Badruddin, S. H. (2006). Child's gender and household food insecurity are associated with stunting among young Pakistani children residing in urban squatter settlements. *Food & Nutrition Bulletin*, *27*(2), 114-127.

Baldos, U. L.C. and Hertel, T. W. (2015). The role of international trade in managing food security risks from climate change. *Food Security* **7,** 275-290.
Baldos, U.L.C., Viens, F. G., Hertel, T. W. and Fuglie, K. O. (2018). R&D Spending, Knowledge Capital, and Agricultural Productivity Growth: A Bayesian Approach. *American Journal of Agricultural Economics*. **101,** 291-310.

Bamwesigye, D., Hlavackova, P., Darkwah, S. A. and Verter, N. (2019). Deforestation, climate change and food security nexus in sub-Sahara Africa: content analysis. *Preprints 2019; 2019020154. doi: 10.20944/preprints201902. 0154.v1*

Battersby, J. and, Watson, V. (2018). Addressing food security in African cities. *Nature Sustainability*. **1:** 153–155.

Baumann, M. and Kuemmerle, T. (2016). 'The impacts of warfare and armed conflict on land systems', *Journal of Land Use Science*, **(11:6),** 672-688.

Beach, R.H., Sulser, T.B., Crimmins, A., Cenacchi, N., Cole, J., Fukagawa, N.K., Mason-DCroz, D., Myers, S., Sarofim, M. C., Smith, M. and Ziska, L.H. (2019). Combining the effects of

increased atmospheric carbon dioxide on protein, iron, and zinc availability and projected climate change on global diets: a modelling study. *The Lancet Planetary Health* **3,** e307-e317.

Behera, B.K, Rout, P.K, and Behera, S. (2019). Move towards Zero Hunger. *Springer.*

Bello, O. B., Ganiyu, O. T., Wahab, M. K. A., Afolabi, M. S., Oluleye, F., Mahmud, J. and Abdulmaliq, S. Y. (2012). "Evidence of Climate Change Impacts on Agriculture and Food Security in Nigeria". *International Journal of Agriculture and Forestry*, ***2*(2),** 49-55.

Béné, C., Barange, M., Subasinghe, R., Pinstrup-Andersen, P., Merino, G., Hemre, G.-I. and Williams, M. (2015). Feeding 9 billion by 2050 } Putting fish back on the menu. *Food Security* **7,** 261-274.

Berhanu, M. and Wolde, A. O (2019). 'Review on Climate Change Impacts and its Adaptation strategies on Food Security in Sub-Saharan Africa', *AGRISE*, **(19:3),** 145-154.

Bijl, D.L., Bogaart, P.W., Dekker, S.C., Stehfest, E., de Vries, B.J.M. and van Vuuren, D.P. (2017). A physically-basedmodel of long-term food demand. *Global Environmental Change* **45,** 47 - 62.

Bosc, J., Goïta, M., van der Ploeg, J.D., Sekine, K. and Zhang, L.(2013). Investing in smallholder agriculture for food security. Rome: Report by the High Level Panel of Experts on Food Security and Nutrition; Committee on World Food Security; 2013.

Bruening, Meg & Brennhofer, Stephanie & Van Woerden, Irene & Todd, Michael & Laska, Melissa. (2016). Factors Related to the High Rates of Food Insecurity among Diverse, Urban College Freshmen. *Journal of the Academy of Nutrition and Dietetics*. 116. 10. 1016/j.jand.2016.04.004.

Bundervoet, T. Verwimp, P. and Akresh, R. (2009). 'Health and civil war in rural Burundi', *Journal of Human Resources*, **(44:2),** 536–563.

Burney, J.A., Davis, S.J. and Lobell, D.B. (2010) Greenhouse gas mitigation by agricultural intensification. *Proceedingsof the National Academy of Sciences* **107,** 12052-12057.

Byerlee, D., Stevenson, J. and Villoria, N. (2014). Does intensification slow crop land expansion or encouragedeforestation? *Global Food Security* **3,** 92-98.

Cafiero, C., Melgar-Quinonez, H. R., Ballard, T. .J. and Kepple, A. W. (2014). Validity and reliability of food security measures. *Annals of the New York Academy of Sciences.* **1331,** 230-248.

Caiado, R.G.G, Leal, F. W, Quelhas, O.L.G, de Mattos, N.D.L and Ávila, L.V.(2018). A literature-based review on potentials and constraints in the implementation of the sustainable development goals. *J Clean Prod*. **198:** 1276–88. *doi: 10.1016/j. jclepro.2018.07.102*

Carletto, C., Zezza, A. and Banergec, R. (2013). Towards better measurement of household food security: harmonizing indicator and the role of household surveys.
Global Food Security **26,** 30–40.

Cerier, S. (2017) "Led by Nigeria, Africa Opening Door To Genetically Modified Crop Cultivation" . *https://geneticliteracyproject.org/2017/03/06/lednigeria-africagradually-opening-door-genetically-modified-crop-cultivation/* Accessed 10/01/2022

CFSAM (2015). Crop and Food Security Assessment Mission to the 15 Northern States of Sudan, Sudan.

Chikhuri, K. (2013). Impact of alternative agricultural trade liberalization strategies on food security in the Sub-Saharan Africa region. *International Journal of Social Economics*, *40*(3), 188-206.

Chinnakali, P., Upadhyay, R.P., Shokeen, D., Singh, K., Kaur, M. and Singh, A.K. (2014). Prevalence of Household-level Food Insecurity and Its Determinants in an Urban Resettlement Colony in North India. *Journal of Health, Population and Nutrition*. 32(2):227–236.

CIA (2018). "The World Factbook: Nigeria" *https://www.cia.gov/library/publications/the-world-factbook/geos/ni.html*. Accessed 10/01/2022

Clover, J. (2003). Food security in Sub - Saharan Africa. *African security review.* 12(515).

Coates, J., Swindale, A. and Bilinsky, P. (2007). Household Food Insecurity Access Scale (HFIAS) for Measurement of Food Access: Indicator Guide Version 3. Washington, D.C.: Food and Nutrition Technical Assistance Project (FANTA), Academy for Educational Development.

Coleman-Jensen, A., Rabbitt, M. P., Gregory, C. and Singh, A. (2015). Household Food Security in the United States in 2014 (Economic Research Report Number 194).

United States Department of Agriculture, Economic Research Service.
Committee on World Food Security. (2017). Sustainable forestry for food security and nutrition. Rome. *www. fao.org/cfs/home/events/susfor/en/* Accessed 28/02/2021

Committee on World Food Security (2014). Sustainable fisheries and aquaculture for food security and nutrition. Rome. Available from: www.fao.org/3/av032e/av032e.pdf (cited 28 February 2021).

Cook J.T. and Frank, D.A. (2008). Food security, poverty, and human development in the United States. *Annals of New York Academy of Sciences.* 1136:193-209.

Cordeiro, L.S., Wilde, P.E., Semu, H. and Levinson, F.J. (2012). Household Food Security Is Inversely Associated with Undernutrition among Adolescents from Kilosa, Tanzania. *Journal of Nutrition.* 142(9):1741-1747.

Craig, G. and James, P. Z. (2015). Food insecurity and Health Outcomes. *Applied Economic Perspectives and Policy.* **40(1),** 119-135.

Creegan, E.F, and Flynn, R. (2020). SDG 2 zero hunger. Actioning the global goals for local impact. Singapore*: Springer.* 23–37.

Curtis, P.G., Slay, C.M., Harris, N.L., Tyukavina, A. and Hansen, M.C. (2018). Classifying drivers of global forest loss. *Science*. **361:** 1108– 1111. *doi:*

10.1126/science.aau3445

Daum , T. and Birner R. (2017). The neglected governance challenges of agricultural mechanisation in Africa–insights from Ghana. *Food Security.* **9:** 959–979. *doi: 10.1007/s12571-017-0716-9*

Daum, T., Adegbola, Y. P., Kamau, G., Daudu, C., Zossou, R. C. and Crinot, G. F. (2020). Perceived effects of farm tractors in four African countries, highlighted by participatory impact diagrams. *Agronomy for Sustainable Development.* **40:** 1–19. *doi: 10.1007/s13593-020-00651-2*

Davis, O. and Geiger, B.B. (2017) 'Did Food Insecurity rise across Europe after the 2008 Crisis? An analysis across welfare regimes', *Social Policy & Society,* **(16:3),** .343360.
Dawit, D. and Zeray, N. (2017). Determinants of Rural Household Food Security in Wolaita Zone: The case of Humbo Woreda. *Journal of Poverty, Investment and Development 32*, 65-82.

Dehghan M, Akhtar-Danesh, N, Merchant, TA. (2005). Childhood obesity, prevalence and prevention. *Nutrition Journal*. **4:**24.

Demmler, K. .M., Klasen, S., Nzuma, J. M. and Qaim, M. (2017). Supermarket purchase contributes to nutrition-related non-communicable diseases in urban Kenya. *PLoS One*. **12:** e0185148. *doi: 10.1371/journal.pone.0185148*

Dereje T., and Abeje B, (2018) 'Rural livelihood strategies and household food security of farmers surrounding Derba cement factory, Oromia Region, Ethiopia' *Rural Sustainability Research,* 40(355)

DFID (1999). *Sustainable Livelihoods Guidance Sheets*. Department for International Development United Kingdom.

Diallo, A, and Asiamah, T.M, (2019). "Determinants of Food Insecurity among Maize Farming Households in the Southern Region of Mali." *Journal of Food Security*. **7(5):** 151-158. *doi: 10.12691/jfs-7-5-1*.

Economics Discussion (2023). Malthusian Theory of Population. *https://www.economicsdiscussion.net/population-explosion/malthusian-theory-ofpopulation-with-diagram/4467* Accessed 23/02/2023

Egbuna, E. N. (2001). Food security in Nigeria; The challenges and way forward: in Natural Resources use, the Environmental and Sustainable Development. Selected papers presented in the 2001: National Economic Society Annual Conference, Ibadan; 307-325.

Eitelberg, D.A., Vliet, J. and Verburg, P.H. (2014). A review of global potentially available cropland estimates and their consequences for model-based assessments.

Global Change Biology. 21, 1236-1248.

EIU (2019). Global food security index. Strengthening the food systems and the environment through innovation and investment. *A report from The Economist Intelligence Unit.*

Eklund, L. Persson, A. and Pilesjö, P. (2016). 'Cropland changes in times of conflict, reconstruction, and economic development in Iraqi Kurdistan', *Ambio*, **(45),** .78–

88.

Eme, O. I., Onyishi, A. O., Uche, O. A. and Uche, I. B. (2014) "Food Insecurity In Nigeria: A Thematic Exposition". *Arabian Journal of Business and Management Review (OMAN Chapter)*, **4(1),** 1.

Erb, K.H., Lauk, C., Kastner, T., Mayer, A., Theurl, M.C. and Haberl, H. (2016). Exploring the biophysical option space for feeding the world without deforestation. *Nature Communications.*

Etana D. and Tolossa D. (2017). Unemployment and food insecurity in Urban Ethiopia. *African Development Review.* **29:**1.

Fairhead, J., Leach, M. and Scoones, I. (2012). "Green Grabbing: A New Appropriation of Nature?" *Journal of Peasant Studies, **39*(2),** 237-261;

FAO (1996). Rome declaration on world food security and world food summit plan of action. Retrieved from: *http://www.fao.org/docrep/003/w3613e/w3613e00.htm*

FAO (2003). Measurement and assessment of food deprivation and undernutrition. Food and Agriculture Organization of the United Nations.

FAO (2014). Selecting a core set of indicators for monitoring global food security. A methodological proposal. ESS / 14-06

FAO (2017). Northeastern Nigeria: Situation Report- January 2017. Online:

http://www.fao.org/fileadmin/user_upload/FAOcountries/Nigeria/ToR/FAO_Situation_Report_Northeastern_Nigeria_January_2017.pdf (Last accessed: 31/03/2020).

FAO (2018). The Future of Food and Agriculture 2018: Alternative Pathways to 2050. Food and Agriculture Food and Agriculture Organization of the United Nations.

FAO (2020b). The State of World Fisheries and Aquaculture 2020. Sustainability in Action. Food and Agriculture Organization of The United Nations, Rome.

FAO /WFP (2009). The State of Food Insecurity in The World Economic Crises- Impacts and Lessons Learned.FAO.

FAO, IFAD, IMF, OECD, UNCTAD (2011). Price volatility in food and agricultural markets: Policy responses.

FAO, IFAD, UNICEF, WFP and WHO (2017).The State of Food Security and Nutrition in the World. Building resilience for peace and food security.

FAO, IFAD, UNICEF, WFP, & WHO. (2018). The state of food security and nutrition in the world. Building climate resilience for food security and nutrition. Rome, FAO.

FAO, IFAD, UNICEF, WFP, WHO, (2020). The State of Food Security and Nutrition in the World. Transforming Food Systems for Affordable Healthy Diets. Food and Agriculture Organization of the United Nations.

FAO. (2019). Declaration of the World Food Summit on Food Security (Rome: FAO).

FAO. FAOSTAT (2019). Statistical Database, Statistical Division. Rome. Retrieved from: *http://www.fao.org/faostat/en/#data/*

Farhadian, A., Chan, V. S.H. and Farhadian, H. (2015). Addressing Household Food

Insecurity using the Household Food Insecurity Access Scale (HFIAS) in a Poor Rural Community in Sabah, Malaysia *International Journal of Humanities and Social Science Invention.* ***4 (8):****89-100. ISSN (Online): 2319 – 7722, ISSN (Print):*

2319 – 7714.

Farzana, F.D., Rahman, A.S., Sultana, S., Raihan, M.J., Haque, M.A. and Waid, J.L. (2017). Coping Strategies related to food insecurity at the household level in Bangladesh. *PLoSONE 12(4):e0171411. https://doi.org/10.1371/journal.pone.0171411*

FEWS NET (2019). "Nigeria food security outlook, February to September 2019: Intense insurgent attacks in Northeast Nigeria lead to increased displacement and food needs". Retrieved from: *https://reliefweb.int/report/nigeria/nigeria-foodsecurity-outlook-february-september-2019*

FEWS NET (2020). "Nigeria food security outlook, February to September 2020: Persisting and escalating conflicts in the northeast and other northern areas increasing needs*".* Retrieved from: *https://fews.net/west-africa/nigeria/foodsecurity-outlook/february-2020*

FGN (2016). "The Agriculture Promotion Policy (2016 – 2020)". Federal Ministry of Agriculture and Rural Development (FMARD), Abuja

FGN National Social Investment Programs (N-SIP) (2018). "*Investing in our people: A brief on the national social investment programs in Nigeria"*. Federal Government of Nigeria, Abuja

Folberth, C., Khabarov, N., Balkovic, J., Skalsky, R., Visconti, P., Ciais, P., Janssens, I.A., Penuelas, J. and Obersteiner, M. (2020). The global cropland-sparing potential of high-yield farming. *Nature Sustainability* **3,** 281-289.

Foley, J.A., Ramankutty, N., Brauman, K.A., Cassidy, E.S., Gerber, J.S., Johnston, M., Mueller, N.D., O'Connell, C., Ray, D.K. and West, P.C. (2011). Solutions for a cultivated planet. *Nature.* **478,** 337-342.

Food and Agriculture Organization of the United Nations (2020). The state of food security and nutrition in the world 2020. Transforming food systems for affordable healthy diets. Rome: Food and Agriculture Organization of the United Nations.

Food Security Information Network (2019). Global report on food crisis. (2019). Update September 2019. Available from: *www.fsinplatform.org* Accessed 19 April 2021.

Fritz, S., See, L., van der Velde, M., Nalepa, R.A., Perger, C., Schill, C., McCallum, I., Schepaschenko, D., Kraxner,F., Cai, X., Zhang, X., Ortner, S., Hazarika, R., Cipriani, A., Di Bella, C., Rabia, A.H., Garcia, A., Vakolyuk, M.y.,Singha, K., Beget, M.E., Erasmi, S., Albrecht, F., Shaw, B. and Obersteiner, M. (2013). Downgrading RecentEstimates of Land Available for Biofuel Production.

Environmental science and technology. **47,** 1688-1694.

Fuglie, K., Gautam, M., Goyal, A. and Maloney, W.F. (2019) Harvesting prosperity: Technology and productivity growth in agriculture. The World Bank.

Gallegos, D., Ramsey, R. and Ong, K. W. (2013). Food insecurity: is it an issue among tertiary students? Higher Education, **67(5),** 497–510. *doi:10.1007/s10734-0139656-2*

George, J., Adelaja, A. and Weatherspoon, D. (2020). 'Armed Conflicts and Food Insecurity: Evidence from Boko Haram's Attacks', *American Journal of Agricultural Economics*, **(102:1),** 114–131.

Global Hunger Index (2022). Nigeria. *https://www.globalhungerindex.org/nigeria.html* Accessed 24/07/2023

Gomez, M.I., Barrett, C.B., Raney, T., Pinstrup-Andersen, P., Meerman, J., Croppenstedt, A., Carisma, B. and Thompson, B. (2013). Post-green revolution food systems and the triple burden of malnutrition. *Food Policy.* **42,** 129-138.

Goshu, M.T. (2016). Determinants of Rural Food Security and Child Nutrition: The Case Study of Gubalafto District of Amhara Regional State, *Ethiopia* (Unpublished PhD thesis). Department of Economics, Aligarh Muslim University Aligarh, India.

Gouel, C., Guimbard, H. (2018). Nutrition Transition and the Structure of Global Food Demand. *American Journal of Agricultural Economics* **101,** 383-403.

Grafton, R.Q., Williams, J., Perry, C.J., Molle, F., Ringler, C., Steduto, P., Udall, B., Wheeler, S.A., Wang, Y., Garrick,D. and Allen, R.G. (2018). The paradox of irrigation efficiency. *Science.* **361,** 748-750.

Greer, J. and Thorbecke, E. (1986). A methodology for measuring food poverty applied to Kenya. *Journal Development Economics,* **24(1),** 59-74.

Griffith, R., O'Connell, M. and Smith, K. (2013). *Food Expenditure and Nutritional Quality Over the Great Recession* (London: The Institute for Fiscal Studies).

Haaddabi, A.S., Ndehfru, N.J and Aliyu, A. (2019). "Analysis of food security status among rural farming households in Mubi North local government area of

Adamawa state, Nigeria" *International Journal of Research – Granthaalayah,* 7(7), 226-246.

Haruna, A. (2021). FAO Distributes Seeds, Fertiliser to Farmers Displaced by Boko Haram. Available online: *https://www. premiumtimesng.com/regional/nnortheast/273955-fao-distributes-seeds-fertiliser-to-farmers-displaced-by-boko-haram. html* (accessed on 26 June 2021).

Hasegawa, T., Fujimori, S., Takahashi, K., Masui, T. (2015). Scenarios for the risk of hunger in the twenty-firstcentury using Shared Socioeconomic Pathways.

Environmental Research Letters 10, 014010.

Hasegawa, T., Fujimori, S., Takahashi, K., Yokohata, T., and Masui, T. (2016). Economic implications of climate change impacts on human health through undernourishment. *Climatic Change* **136,** 189-202.

Hasegawa, T., Havlik, P., Frank, S., Palazzo, A., and Valin, H. (2019). Tackling food consumption inequality to fight hunger without pressuring the environment. *Nature Sustainability* **2,** 826-833.

Hassan, S. A. and Shola, J. O. (2006). Food insecurity and the National Question in Nigeria, Ilorin Journal of Business and Social Science in collaboration with vantage publisher limited 156-181.

Havlík, P., Valin, H., Herrero, M., Obersteiner, M., Schmid, E., Rufino, M.C., Mosnier, A., Thornton, P.K., Böttcher, H., Conant, R.T., Frank, S., Fritz, S., Fuss, S., Kraxner, F., Notenbaert, A. (2014). Climate change mitigation through livestock system transitions. *Proceedings of the National Academy of Sciences* **111,** 37093714.

Headey, D.D. and Martin, W.J. (2016). The Impact of Food Prices on Poverty and Food Security. *Annual Review of Resource Economics* 8, 329-351.

Henders, S., Persson, U.M. and Kastner, T. (2015). Trading forests: land-use change and carbon emissions embodiedin production and exports of forest-risk commodities. *Environmental Research Letters* 10, 125012.

Herrero, M., Havlík, P., Valin, H., Notenbaert, A., Rufino, M.C., Thornton, P.K., Blümmel, M., Weiss, F., Grace, D. and Obersteiner, M. (2013). Biomass use, production, feed efficiencies, and greenhouse gas emissions from global livestock systems. *Proceedings of the National Academy of Sciences.* **110**, 20888-20893.

Herrero, M., Thornton, P.K., Mason-D'Croz, D., Palmer, J., Benton, T.G., Bodirsky, B.L., Bogard, J.R., Hall, A., Lee,B., Nyborg, K., Pradhan, P., Bonnett, G.D., Bryan, B.A., Campbell, B.M., Christensen, S., Clark, M., Cook, M.T.,de Boer,

I.J.M., Downs, C., Dizyee, K., Folberth, C., Godde, C.M., Gerber, J.S., Grundy, M., Havlik, P., Jarvis, A.,King, R., Loboguerrero, A.M., Lopes, M.A., McIntyre, C.L., Naylor, R., Navarro, J., Obersteiner, M., Parodi, A., Peoples, M.B., Pikaar, I., Popp, A., Rockström, J., Robertson, M.J., Smith, P., Stehfest, E., Swain, S.M., Valin,H., van Wijk, M., van Zanten, H.H.E., Vermeulen, S., Vervoort, J. and West, P.C. (2020). Innovation can acceleratethe transition towards a sustainable food system. *Nature Food*. **1,** 266-272.

Hertel, T.W., (2012b). Implications of Agricultural Productivity for Global Cropland Use and GHG Emissions:Borlaug vs. Jevons. Global Trade Analysis Project Center.

Hertel, T.W., Baldos, U.L.C. and van der Mensbrugghe, D. (2016). Predicting LongTerm Food Demand, Cropland Use and Prices. *Annual Review of Resource Economics.* **8,** 417-441.

Hertel, T.W., Ramankutty, N. and Baldos, U.L.C. (2014). Global market integration increases likelihood that a futureAfrican Green Revolution could increase crop land use and CO2 emissions. *Proceedings of the National Academy of Sciences.*

111, 13799-13804.

Hofmeester, K., Lucassen, J., Lucassen, L., Stapel, R., Richard Zijdeman, R., (2015). The Global Collaboratory on the History of Labour Relations, 1500-2000. Background, Set-Up, Taxonomy, and Applications.

Holden, S.T and Ghebru, H. (2016). Land tenure reforms, tenure security and food security in poor agrarian economies: causal linkages and research gaps. *Global Food Security.* **10:** 21–28. *doi: 10.1016/j. gfs.2016.07.002*

Huang, J., Kim, Y. and Birkenmaier J. (2016). 'Unemployment and household food hardship in the economic recession', *Public Health Nutrition*, (19), 511-519.

Hughes, R., Serebryanikova, I., Donaldson, K., and Leveritt, M. (2011). Student food insecurity: The skeleton

in the university closet. *Nutrition & Dietetics,* **68(1),** 27–32

Hyde, S. (2017). Income and health outcomes. *Monthly Labor Review*.

Ibok O. W., Idiong, C. I., Itoro N. B., Iniobong E. O. & Uwemedimo E. O.(2014). Analysis of Food Insecurity Status of Urban Food Crop Farming Households in Cross River State, Nigeria: A USDA Approach. *Journal of Agricultural Science.* 6(2); 1916-9752

Ibrahim. H., Uba-Eze, N.R., Oyewole, S.O. and Onuk, E. G, (2009). "Food Security among Urban Households: A case study of Gwagwalada Area Council of the

Federal Capital Territory Abuja, Nigeria", *Pakistan Journal of Nutrition* 8(6), 810-813

Idrisa, Y. L., Gwary, M. M. and Shehu, H. (2008). Analysis of food security status among farming households in Jere local government of Borno State, Nigeria.

Journal of Tropical Agriculture, Food, Environment and Extension. **7(3),** 199205.

IITA (2017). "Synthesis Report of the Nigeria Zero Hunger Strategic Review*"*. International Institute of Tropical Agriculture.

International Crisis Group (2018). "Stopping Nigeria's Spiralling FarmerHerderViolence". *https://www.crisisgroup.org/africa/west-africa/nigeria/262stopping-nigerias-spiralling-farmer-herder-violence* Accessed 10/01/2022

Ivanic, M., Martin, W., (2014). Short-and long-run impacts of food price changes on poverty.

Iyabo, A.B. (2020). Food insecurity in Nigeria: implications on poverty Reduction. *AlHikmah Journal of Economics (AJEC):* 1, 1.

Izuora, A.N. (2007). Skinfold thickness, body mass index and the prevalence of obesity in school children aged 5 to 18 years in Lagos state, Nigeria. May 2007. A dissertation submitted to the National Postgraduate Medical College of Nigeria.

Lagos State, Nigeria: The National Post Graduate Medical College of Nigeria.

Jaiyeola, A. (2016). "FCT Minister Harps on Development of Satellite Towns". Archived from the original on 6 August 2017. Retrieved 22 November 2016.

Janssens, C., Havlik, P., Krisztin, T., Baker, J., Frank, S., Hasegawa, T., Leclere, D., Ohrel, S., Ragnauth, S., Schmid, E., Valin, H., Lipzig, N.V. and Maertens, M. (2020). Global hunger and climate change adaptation through international trade.

Nature Climate Change.

Karimi, V., Karimi, E. and Keshavarz, M. (2018). 'Climate change and agriculture: Impacts and adaptive responses in Iran', *Journal of Integrative Agriculture,* **(17:1)**, 1-15.

Kassy, W. C., Ndu, A. C., Okeke, C. C. and Aniwada, E. C. (2021). Food Security Status and Factors Affecting Household Food Security in Enugu State, Nigeria. *Journal of Health Care for the Poor and Underserved,* **32(1),** 565–581. *doi:10.1353/hpu.2021.0041*

Kearney, J. (2010). Food consumption trends and drivers. Philosophical Transactions of the Royal Society B:*Biological Sciences.* 365, 2793-2807.

Kehinde, T. and Eforuoku, F. (2020), "Food Insecurity and Nutrition Status of Farm Households in Northwestern Nigeria." *Journal of Food Security,* **8(3)**: 98-104. *doi: 10.12691/jfs-8-3-3.*

Kimathi, E, Tonnang, H.E, Subramanian, S, Cressman, K, Abdel-Rahman, E.M, Tesfayohannes, M. (2020). Prediction of breeding regions for the desert locust Schistocerca gregaria in East Africa. *Scientific Reports*. 10: 1–10.

Knueppel, D., Demment, M. and Kaiser, L. (2009). Validation of the Household Food Insecurity Access Scale in rural Tanzania. *Public Health Nutrition 13(3),* 360– 367.

Kuku-shittu, O., A. Mathiassen, and L. Myles. (2013). "Comprehensive Food Security and Vulnerability Analysis." IFPRI Discussion Paper 01225. Accessed July 16, 2016. *http://nssp.ifpri.info/2013/08/21/comprehensive-food-securityandvulnerability-analysis-nigeria/.*

Kuwornu, J.K.M., Suleyman, D.M., Amegashie, D.P.K, (2013). "Analysis of food security status of farming households in the forest belt of the central region of Ghana", *Russian Journal of Agricultural and Socio-Economic Sciences*, 1 (13).

Laborde D, D. and Martin, W. (2018). Implications of the global growth slowdown for rural poverty. *Agricultural Economics* 49, 325-338.

Laborde, D., Martin, W., Swinnen, J., Vos, R. (2020). COVID-19 risks to global food security. *Science*. 369, 500-502.

Lamidi, E. O. (2019). Household composition and experiences of food insecurity in Nigeria: The role of social capital, education, and time use. *Food Security,* 11. 201-218.

Leclère, D., Havlík, P., Fuss, S., Schmid, E., Mosnier, A., Walsh, B., Valin, H., Herrero, M., Khabarov, N. and Obersteiner, M. (2014). Climate change induced transformations of agricultural systems: insights from a global model.

Environmental Research Letters **9,** 1748-9326.

Leichenko, R. and Silva J.A. (2014) 'Climate change and poverty: vulnerability, impacts, and alleviation strategies', *Wiley Interdisciplinary Reviews: Climate Change*, (5:4),539-556.

Lipper L, Thornton P, Campbell B.M., Baedeker, T., Braimoh, A. and Bwalya, M. (2014). Climate-smart agriculture for food security. *Nat Climate Change*. 4: 1068– 1072. *doi: 10.1038/nclimate2437*

Lloyd, S.J., Bangalore, M., Chalabi, Z., Kovats, R.S., Hallegatte, S., Rozenberg, J., Valin, H. and Havlik, P. (2018). A Global-Level Model of the Potential Impacts of Climate Change on Child Stunting via Income and Food Price in 2030. *Environmental Health Perspectives* 126, 097007.

Lujabe, B. Pretorius, B., Goliath, V. and Sibanda, W. (2022). Exploring the Food (In)Security Status of Suburban Households and Its Determinants during COVID-19. *Sustainability.* 14, 3918. *https://doi.org/10.3390/su14073918*

MacDonald, G.K., Bennett, E.M., Potter, P.A., Ramankutty, N. (2011). Agronomic phosphorus imbalances across the world's croplands. *Proceedings of the National Academy of Sciences.* 108, 3086-3091.

Magaña-Lemus, D, Ishdorj, A. Rosson, C. P. and Lara-Álvarez, J. (2016): Determinants of household food insecurity in Mexico, Agricultural and Food Economics, ISSN 2193-7532, Springer, Heidelberg, **4(10):**1-20.

Malthus, T. (1798). An Essay on the Principle of Population. *J. Johnson*.

Mango, N, Siziba, S. and Makate, C.(2017). The impact of adoption of conservation agriculture on smallholder farmers' food security in semi-arid zones of southern Africa. *Agric Food Sec*; **6:** 32. *doi: 10.1186/s40066-017-0109-5*

Manuel, J. (2006). 'In Katrina's wake', *Environmental Health Perspectives*, **(114:1),**32-39.

Marcoux, A. (2002). Sex differentials in under nutrition: A look at survey evidence. *Population and Development Review, 28*, 275–284.

http://dx.doi.org/10.1111/j.1728-4457.2002.00275.x

Marfell-Jones, M.J, Stewart, A, and De Ridder, J. (2012). International standards for anthropometric assessment. New Zealand:International Society for the Advancement of Kinanthropometry: Wellington

Martin-Shields, C. and Stojetz, W. (2019). 'Food security and conflict: Empirical challenges and future opportunities for research and policy making on food security and conflict', *World Development,* (119), 150-164.

Mason-D'Croz, D., Sulser, T.B., Wiebe, K., Rosegrant, M.W., Lowder, S.K. and NinPratt, A. (2019). Agricultural investments and hunger in Africa modeling potential contributions to SDG2–Zero Hunger. *World Develop*. **116:** 38–53. *doi: 10.1016/j. worlddev.2018.12.006*

Mbow, C., Rosenzweig, C., Barioni, L.G., Benton, T.G., Herrero, M., Krishnapillai, M., Liwenga, E., Pradhan, P., Rivera-Ferre, M.G. and Sapkota, T., (2019) Food Security, Climate Change and Land: an IPCC special report on climate change, desertification, land degradation, sustainable land management, food security,and greenhouse gas fluxes in terrestrial ecosystems., pp. 437-550.

McGregor, J. (1994). 'Climate change and involuntary migration: Implications for food security', *Food Policy*, **(19:2),** 120-132.

Malthus, T. (1798). An Essay on the Principle of Population as it Affects the Future Improvement of Societies, with Remarks on the Speculations of Mr. Godwin, M.
Condorat, and other writers, 1798 edition (reprints of Economic Classics, N.Y., 1965).

Malthus, T. (1801). An Essay on the Principle of Population or a View of its Past and Present Effects on Human Happiness with an Inquiry into our Prospects Respecting the Future Removal or Mitigation of the Evil which it Occasions. (Richard D. Irwing, Homewood, Illinois, 1963).

Mellos, K. (1988). Neo-Malthusian Theory. In: Perspectives on Ecology. Palgrave Macmillan, London. *Springer.* 1:15-42 *https://doi.org/10.1007/978-1-349-195985_2* Accesssed 23/02/2023.

Minoiu, C. and Shemyakina, O. N. (2014). 'Armed conflict, household victimization, and child health in Côte d'Ivoire', *Journal of Development Economics*, **(108),** 237-255.

Mitiku, A., Fufa, B. and Tadese, B. (2012). Empirical analysis of the determinants of rural household's food security in Southern Ethiopia: The case of Shashemene

District. *Basic Research Journal of Agricultural Science and Review,* 1(6), 132138.

Mohammed, D., Bukar, U., Umar, J., Adulsalam, N. and Dahiru, B, (2014). "Analysis of food security among smallholder farming households in arid areas of Born State Nigeria", *Continental Journal of Economics,* 8(1), 1-8.

Mooney, E. (2005). 'The concept of internal displacement and the case for internally displaced persons as a category of concern', *Refugee Survey Quarterly*, (24), 9-26.

Muhammad-Lawal, A., and Omotesho, O. A. (2008). Cereals and farming households food security in kwara state, Nigeria. *Agricultural Journal, **3*****(3),** 235-240.

Muringai, R.T., Naidoo, D., Mafongoya, P. and Lottering, S. (2020) 'The Impacts of Climate Change on the Livelihood and Food Security of Small-Scale Fishers in Lake Kariba, Zimbabwe', *Journal of Asian & African Studies*, (55:2), 298–313.

Musemwa, L., Muchenje, V., Mushunje, A., Aghdasi, F. and Zhou, L. (2015). 'Household food insecurity in the poorest province of South Africa: level, causes and coping strategies', *Food Security*, (7:3), 647-655.

Muzari, W. (2016). Small scale fisheries and fish farming, processing and marketing in sub-Saharan Africa: implications for poverty alleviation, food security and nutrition. *International Journal of Science and Research*. **5:** 1740–1749. *doi: 10.21275/v5i1.23011604*

Myers, S.S., Zanobetti, A., Kloog, I., Huybers, P., Leakey, A.D., Bloom, A.J., Carlisle, E., Dietterich, L.H., Fitzgerald, G. and Hasegawa, T. (2014). Increasing CO_2 threatens human nutrition. *Nature*. **510,** 139-142.

Nairametrics (2021). Abuja Municipal Area Council Environmental services to tax

businesses fifty thousand naira for generator emissions. *https://nairametrics.com/2021/08/14/abuja-municipal-area-councilenvironmental-services-to-tax-businesses-n50k-for-generator-emissions/* Accessed 01/02/2022.

Najibi, N., Motlagh, A., Yegane, S. H., Eshraghian, M. and Daneshi M. (2011) Assessment of food insecurity and some effective socioeconomic factors among newly diagnosed Diabetes type 2 patients in Shiraz. *Journal of Arak.* **16(1):** 98-106.

National Population Commission (NPC) (Nigeria) and ICF International (2014). *The Nigeria Demographic and Health Survey*. Calverton, Maryland, USA.

National Population Commission (NPC) and National Bureau of Statistics (NBS) (2018). "*National population estimates"*

National Population Commission (NPC), National Bureau of Statistics (NBS), (2018). National Population Estimates. Available online: *https://nigerianstat.gov.ng/download/474*

NBS (National Bureau of Statistics) and The World Bank (2018). "Conflicts and violence in Nigeria: Results from the North-East, North-Central and South-South

Zones". Retrieved from: *http://documents.worldbank.org/curated/en/111851538025875054/Conflicts-andviolence-Results-from-the-North-East-North-Central-and-South-South-Zones* Accessed 02/02/2022.

Ndakaza, J.N., Mung'atu, J.K., Ndengo, M., Hagenimana, F., Gasheja, C. and Harerimana, J. (2016). Modeling key determinants of the household food security in Rwanda: Probit Regression Approach. *International Journal of Mathematics and Physical Sciences Research,* **4 (2),** 85-94.

Nechifor, V. Ramos, M.P. Ferrari, E. Laichena, J. Kihiu, E. Omanyo, D. Musamali, R. and. Kiriga, B. (2021). Food security and welfare changes under COVID-19 in Sub-Saharan Africa: Impacts and responses in Kenya. *Global Food Security*. **28,** 100514.

Nelson, G., Bogard, J., Lividini, K., Arsenault, J., Riley, M., Sulser, T.B., MasonD'Croz, D., Power, B., Gustafson, D.,Herrero, M., Wiebe, K., Cooper, K., Remans, R., Rosegrant, M. (2018). Income growth and climate change effects on global nutrition security to mid-century. *Nature Sustainability*. **1,** 773-781.

Ngome, P.I.T, Shackleton, C, Degrande, A, Nossi, E.J. and Ngome, F. (2019). Assessing household food insecurity experience in the context of deforestation in Cameroon. *Food Policy.* **84:** 57–65.

Nkembi, L., Deh, N.H., Tankou, C. M., and Njukeng, J. N. (2021), "Analysis of Small Scale Farmers Households Food Security in the Mount Bamboutos Ecosystem." *Journal of Food Security,* **9 (2):** 56-61.

Nnakwe, N. and Yegammia, C. (2002). Prevalence of food insecurity among households with children in Coimbatore, India. *Nutrition Research*. 22:1009-1016.

Nwawulu, C.S., Chiemela, C.J., Apeh, C.C. and Ileka, C.M. (2022). Households Food and Nutrition Security in Enugu State, Nigeria. *Journal of Agricultural Extension.* **26 (2)**: 2 ISSN(e): 24086851; ISSN(Print); 1119944X

Nwokoro, U. U., Dahiru, T., Olorukooba, A., Daam, C. K., Waziri, H. S., Adebowale, A., Waziri, N. E., and Nguku, P. (2020). Determinants of perinatal mortality in public secondary health facilities, Abuja Municipal Area Council, Federal Capital Territory, Abuja, Nigeria. *The Pan African medical journal,* **37**, 114. *https://doi.org/10.11604/pamj.2020.37.114.17108.* Accessed 05/05/2021.

Obasi, O. U. (1997). Departments of food security in Nigeria. Nigerian Economic Society, Selected papers for the1997 Annual Conference, 269-279.

Obayelu, O.A., Akpan, E.I. and Ojo, A.O. (2021). Prevalence and correlates of food insecurity in rural Nigeria: A panel analysis. Econ. Agro-Aliment. 23, 1–25.

OECD (2019). The Heavy Burden of Obesity: The Economics of Prevention. OECD Publishing.

Ogbo, A., Ebele, N. and Ukpere, W. (2013). 'Risk Management and Challenges of Climate Change in Nigeria', *Journal of Human Ecology*, **(41:3),** .221-235.

Ogundari, K. (2017). Categorizing households into different food security states in Nigeria: the socio-economic and demographic determinants. *Agricultural and Food Economics 5 (8). DOI10.1186/s40100-017-0076-y*

Ojogho, O. (2010). Determinants of Food Insecurity among Arable Framers in Edo State, Nigeria. *Agricultural Journal,* **5(3),** 151-156.

Okobia, E. (2015). Carbon Monoxide: Its impacts on human health in Abuja, Nigeria. *10.13140/RG.2.1.2067.3441*. Accessed 05/05/2022.

Olomola, A.S. (2017). Ending rural hunger in Nigeria: Mapping needs and actions for food and nutrition security. Final research report submitted to the Brookings Institution, Washington D. C., USA.

Olomola, A.S., and Nwafor, M. (2018). Nigeria agricultural sector performance review: A background report for Nigeria, Agriculture Joint Sector Review.

Omonona, B., Agoi, T and Adetokunbo, G. (2007). An analysis of food security situation among Nigerian urban households: Evidence from Lagos State, Nigeria. *Journal of Central of European Agriculture.* **8 (3),** 399-406.

Omorogbe, P. (2022). How 22 states in Nigeria face risk of malnutrition, food insecurity in 2022. *TribuneOnline. https://tribuneonlineng.com/how-22-states-innigeria-face-risk-of-malnutrition-food-insecurity-in-2022/* Accessed 22/06/2023.

Omotor, D.G. (2009). Food Security and Nutrition Trends in Nigeria. Munich Personal REPEC Archive. MPRA Paper No. 22669 *mpra.ub.uni-muen Chen.de/22669.*

Onafeso, O. D., Akanni, C. O., and Badejo, B. A.,(2015). "Climate Change Dynamics and Imperatives for Food Security in Nigeria" *Indonesian Journal of Geography, **47*****(2),*** 151-159.

Oni, O. A., Salman., K. K. and Idowu, B. O. (2011). "Social capital dimension and food security of farming households in Ogun State, Nigeria." *Journal of American Science*, **7(8):** 776-783

Onunka, C., Ihemezie, E. J., and Olumba, C. C. (2018). Household level analysis of food insecurity and coping strategies: Evidence from Enugu State, Nigeria. *Advances in social sciences research journal*, **5(6):** 330–340. *DOI: https://doi.org/10.14738/assrj.56.4764*

Orewa, S. I. and Iyanbe, C.O. (2010). Determinants of Daily Food Calorie Intake among Rural and Low- Income Urban Households in Nigeria. *Academic Journal Plant Science* **3 (4),** 147-155.

Oriola, E. (2009). A framework for food security and poverty reduction in Nigeria.

Oshodi, A. F. and Oloni, E.F. (2006). Agricultural food policy and food security in Nigeria. Geo-studies forum.

Otaha, I. J. (2013). Food insecurity in Nigeria: Way forward. *An international multidisciplinary Journal, Ethiopia***, 7(4):***31, 26-35.*

Otekunrin, O.A., Otekunrin, O.A., Sawicka, B. and Pszczołkowski, P. (2021a). Assessing food insecurity and its drivers among smallholder farming households in rural Oyo State, Nigeria: the HFIAS approach. *Agriculture.* **11:**1189

Otekunrin OA, Otekunrin, OA, Sawicka, B.*et al*.(2020a). Three decades of fighting against hunger in Africa: Progress, challenges and opportunities. *World Nutrition*. **11(3)**: 86-111. *DOI: 10.26596/wn.202011386-111*

Otekunrin, O. A and Sawicka, B. (2019). Cassava, a 21st Century Crop: How can Nigeria Harness its Enormous Trade Potential? *Acta Scientific Agriculture* **3(8):** 194-202. *https://doi.org/10.31080/ASAG.2019.03.0586*

Otekunrin, O. A., Otekunrin, O. A., Momoh, S. and Ayinde, I. A. (2019a). How far has Africa gone in achieving the Zero Hunger Target? Evidence from Nigeria. *Global Food Security*, 22, 1-12. *https://doi.org/j.gfs.2019.08.001*

Otekunrin, O.A. and Otekunrin, O.A. (2021). Healthy and Sustainable Diets: Implications for Achieving SDG2. In Zero Hunger. Encyclopedia of the UN Sustainable Development Goals. *Springer Cham.* 1-17. *DOI: 10.1007/978-3-31969626-3_123-1*

Otekunrin, O. A. and Otekunrin, O.A. (2020c) COVID-19 and Hunger in Africa: A crisis within a crisis. Proceedings of the 6th International Conference on Food Science and Technology, October 16-17, 2020 Vienna, Austria. 27-28.

Otekunrin, O.A, Momoh, S. and Ayinde, I.A. (2019b). How far has Africa gone in achieving the Sustainable Development Goals? Exploring the African dataset. *Data in Brief.* 1-7. *DOI: 10.1016/j.dib.2019.104647*.

Otekunrin, O.A. (2022). Investigating food insecurity, health and environment-related factors, and agricultural commercialization in Southwestern Nigeria: evidence from smallholder farming households. *Environmental Science and Pollution*

Research. **29:** 51469–51488. *https://doi.org/10.1007/s11356-022-19544-w*

Otekunrin, O.A., Momoh, S.**,** Ayinde, I. A and Otekunrin, O.A. (2019c). How far has Africa gone in achieving the Sustainable Development Goals? Exploring the African dataset. *Data in Brief,* 27, 1-7.

Ozughalu, U. M., and Ogwumike, F. O. (2013). "Vulnerability to Food Poverty in Nigeria." *African Development Review* **25 (3):** 243–255. *doi:10.1111/j.14678268.2013.12027.x.*

Patel, V., Saxena, S., Lund, C., Thornicroft, G., Baingana, F. and Bolton, P. (2018). The Lancet Commission on global mental health and sustainable development. *Lancet.* **392:** 1553–1598. *doi: 10.1016/ S0140-6736(18)31612-X*

Pelletier, J., Ngoma, H., Mason, N.M. and Barrett, C.B. (2020). Does smallholder maize intensification reduce deforestation? Evidence from Zambia. *Global Environmental Change.* **63:** *102127. doi: 10.1016/j.gloenvcha.2020.102127*

Perez-Escamilla, R. (2017b). Food security and the 2015–2030 Sustainable Development Goals: from human to planetary health: Perspectives and opinions, *Current Developments in Nutrition*. **1(7),** 1-8. *http://doi.org/10.3945/cdn.117.000513*

Phalan, B., Green, R.E., Dicks, L.V., Dotta, G., Feniuk, C., Lamb, A., Strassburg, B.B.N., Williams, D.R., Ermgassen, E.K.H.J. and Balmford, A. (2016). How can higher-yield farming help to spare nature? *Science.* 351, 450-451.

Popp, A. (2020). The ongoing nutrition transition thwarts long-term targets for food security, public health and environmental protection. *ScientificReports* 10.

Popp, A., Calvin, K., Fujimori, S., Havlík, P., Humpenöder, F., Stehfest, E., Bodirsky, B.L., Dietrich, J.P., Doelmann, J.C., Gusti, M., Hasegawa, T., Kyle, P., Obersteiner, M., Tabeau, A., Takahashi, K., Valin, H., Waldhoff, S.,Weindl, I., Wise, M., Kriegler, E., Lotze-Campen, H., Fricko, O., Riahi, K., van Vuuren, D.P. (2017). Land-usefutures in the shared socio-economic pathways. *Global Environmental Change.* **42,** 331-345.

Punch (2019). FG has disbursed N19.9 billion to petty traders-BOI" 2019. Retrieved from: *https://punchng.com/fg-has-disbursed-n19bn-to-petty-traders-boi/*

Qatar Economics, (2018). Retrieved on 15 December 2018, from *<https://tradingeconomics.com/qatar/employed-persons>*

Ramesh, T., Motlagh, D.A, Hosein, M, Abdolahi, M. (2010). Spread of food insecurity in the families of Shiraz city and its connection to some socioeconomic and population factors. *Journal of Nutrition Sciences and Iran Food Industry.* **4(4):**

53-64.

Ramos, K., Magbanua, J., Flores, D., de Dios, J., Bugtong, K. and Almonia, S. (2017)."What is the relationship between food insecurity and college students aged 18-22 and its effects on academic performance and how can proper nutrition be promoted?" (2017). *Student Research Posters*. 64.

https://doi.org/10.33015/dominican.edu/2017.NURS.RP.04

Ritchie, R. and Mispy, O.O. (2018). Measuring progress towards the sustainable development goals. Available from: *https://sdg-tracker.org* (cited 8 February 2021).

Rosenthal, T. C. and Fox, C. (2000). Access to health care for the rural elderly. *JAMA, **284*****(16),*** 2034-2036.

Rosenzweig, C., Elliott, J., Deryng, D., Ruane, A.C., Müller, C., Arneth, A., Boote, K.J., Folberth, C., Glotter, M.,Khabarov, N., Neumann, K., Piontek, F., Pugh, T.A.M., Schmid, E., Stehfest, E.,

Yang, H. and Jones, J.W. (2014). Assessing agricultural risks of climate change in the 21st century in a global gridded crop model intercomparison. *Proceedings of the National Academy of Sciences.* 111, 32683273.

Ruel, M. (2003) "Is Dietary Diversity an Indicator of Food Security or Dietary Quality?
A Review of Measurement Issues and Research Needs" IFPRI FCND Discussion Paper 140.
Sachs, J.D. (2012). From millennium development goals to sustainable development goals. *Lancet***. 379:** 2206–2211. *doi: 10.1016/ S0140-6736(12)60685-0*

Sagir, M., Enedah, I., Ono, M., Ojiako, J. and Igbokwe, E. (2021). Spatial Analysis of Healthcare Facilities in the Federal Capital Territory, Abuja Nigeria. *Journal of Environment and Earth Science.* **(11):** 1, 41

Saha, K.K, Frongillo, E.A, Alam, D.S, Arifeen, S.E, Persson, L.A. and Rasmussen, K..M. (2009). Household food security is associated with growth of infants and young children in rural Bangladesh. *Public Health Nutr*. **12(9):**1556-1562.

Sanusi, R.A., Badejo, C.A. and Yusuf, B.O. (2006). Measuring Household Food Insecurity in selected Local Government Areas of Lagos and Ibadan, Nigeria.

Pakistan Journal of Nutrition, **5(1),** 62-67.
Scaling Up Nutrition. (2016). Nutrition is essential for the success of the SDGs. 2016. Available from: *https://scalingupnutrition. org/nutrition/nutrition-and-thesustainable-development-goals/* (cited 28 February 2021).

Scarborough, P. (2016b). Global and regional health effects of future food production under climate change: a modelling study. *The Lancet.* **387,** 1937 - 1946.

Schewe, J., Heinke, J., Gerten, D., Haddeland, I., Arnell, N.W., Clark, D.B., Dankers, R., Eisner, S., Fekete, B.M.,Coln-Gonzlez, F.J., Gosling, S.N., Kim, H., Liu, X., Masaki, Y., Portmann, F.T., Satoh, Y., Stacke, T., Tang, Q.,Wada, Y., Wisser, D., Albrecht, T., Frieler, K., Piontek, F., Warszawski, L. and Kabat, P. (2013). Multimodel assessment of water scarcity under climate change. Proceedings of the *National Academy of Sciences* 111,3245-3250.

Schuster, R.C., Butler, M.S., Wutich, A., Miller, J.D. and Young, S.L. (2020). 'If there is no water, we cannot feed our children': the far-reaching consequences of water insecurity on infant feeding practices and infant health across 16 low-and middleincome countries. *American Journal of Human Biology*. **32:** e23357. *doi:*

10.1002/ajhb.23357

SDG Center for Africa and Sustainable Development Solutions Network (2019). Africa SDG Index and Dashboards Report, 2019. Retrieved from: *unsdsn.org/resources/publications/2019-africa-sdg-index-and-dashboards-report.*

Sekhampu, T.J. (2017). Association of food security and household demographics in a South African township. *International Journal of Social Sciences and Humanities Studies.* **9,** 157–170.

Seppelt, R., Arndt, C., Beckmann, M., Martin, E.A.and Hertel, T.W. (2020). Deciphering the Biodiversity} Production Mutualism in the Global Food Security Debate. *Trends in Ecology {\&} Evolution* **35,** 1011-1020.

Serrat, O. (2017). The Sustainable Livelihoods Approach. In Serrat, O. (Ed), *Knowledge Solutions* (pp.21-26). Asian Development Bank. DOI 10.1007/978-981-10-09839_5

Shapiro, D, Hinde, A. (2018). Laggards in the global fertility transition. Wittgenstein Centre Conference 2018: 3rd Human Fertility Database Symposium. Available from:

https://www.oeaw.ac.at/fileadmin/subsites/Institute/VID/PDF/Conferences/2018/Fertility_across_time_and_space/Presentations/Shapiro_Hinde_ WIC20183rdHFD.pdf (cited 28 February 2022).

Siddiqui, F., Salam, R.A., Lassi, Z.S. and Das, J.K. (2020). The inter twined relationship between malnutrition and poverty. *Frontiers in Public Health.* **8:** 453. *doi: 10.3389/fpubh.2020.00453*

Simsek, H., Meseri, R., Sahin, S. and Ucku, R. (2013). Prevalence of food insecurity and malnutrition, factors related to malnutrition in the elderly: A community-based, cross-sectional study from Turkey. *European Geriatric Medicine.* **4(4):** 226-230.

Sloat, L.L., Davis, S.J., Gerber, J.S., Moore, F.C., Ray, D.K., West, P.C. and Mueller, N.D. (2020) Climate adaptation by crop migration. *Nature Communications.* 11.

Springmann, M., Clark, M., Mason-D'Croz, D., Wiebe, K., Bodirsky, B.L., Lassaletta, L., de Vries, W., Vermeulen,S.J., Herrero, M., Carlson, K.M., Jonell, M., Troell, M., DeClerck, F., Gordon, L.J., Zurayk, R., Scarborough, P.,Rayner, M., Loken, B., Fanzo, J., Godfray, H.C.J., Tilman, D., Rockström, J. and Willett, W. (2018a). Options for keeping the food system within environmental limits. *Nature.*

Stehfest, E., van Zeist, W.-J., Valin, H., Havlik, P., Popp, A., Kyle, P., Tabeau, A., Mason-D'Croz, D., Hasegawa, T.,Bodirsky, B.L., Calvin, K., Doelman, J.C., Fujimori, S., Humpenöder, F., Lotze-Campen, H., van Meijl, H. and Wiebe, K. (2019). Key determinants of global land-use projections. *Nature Communications*

10.

Swaminathan, M. S. (2008). Food security and climatic change.

Swinburn, B.A., Sacks, G., Hall, K.D., McPherson, K., Finegood, D.T., Moodie, M.L. and Gortmaker, S.L. (2011) The global obesity pandemic: shaped by global drivers and local environments. *The Lancet*. **378,** 804-814.

Swinnen, J. and Squicciarini, P. (2012). Mixed Messages on Prices and Food Security. *Science.* 335, 405-406.

Tabatabai, G.M., Omidwar, N. and Alihoseini, J. (2011). Socioeconomic factors of food insecurity strength among the vulnerable population in district 20 of Tehran. *Journal of Social Sciences*. **52:** 69-94.

Tefera, T. and Tefera, F. (2014). Determinants of Households Food Security and Coping Strategies for Food Shortfall in Mareko District, Guraghe Zone Southern Ethiopia. *Journal of Food Security*, ***2*****(3),** 92-99.

Tilman, D., Balzer, C., Hill, J., Befort, B.L. (2011). Global food demand and the sustainable intensification of agriculture. *Proceedings of the National Academy of Sciences.* **108**, 20260-20264.

Tilman, D. and Clark, M. (2014). Global diets link environmental sustainability and human health. *Nature*. **515**, 518-522.

Timaeus, I.M., Simelane, S. and Letsoalo, T. (2013) Poverty, Race, and Children's Progress at School in South Africa. *The journal of development studies.* **49 (2):** 270-284.

Tirado, M., Hunnes, D., Cohen, M. and Lartey, A. (2015). Climate change and nutrition in Africa. *Journal of Hunger and Environmental Nutrition.* **10:** 22–46.

Tremblay, D, Fortier, F, Boucher, J.F, Riffon, O. and Villeneuve, C. (2020). Sustainable development goal interactions: an analysis based on the five pillars of the 2030 agenda. *Sustain Dev.* **28:** 1584–1596. *doi: 10.1002/sd.2107*

Tshediso, J. S. (2017). Association of food security and household demographics in a south african township. *International journal of social sciences and humanity studies.* **9(2)** ISSN: 1309-8063 (Online)

Tusiime, H., Renard, R. and Smets, L. (2013). Food aid and household food security in a conflict situation: Empirical evidence from Northern Uganda. *Food Policy*. **43,** 14–22. *10.1016/j.foodpol.2013.07.005*.

UN (2017b). "Sustainable Development Goal 2". Retrieved from: *https://sustainabledevelopment.un.org/sdg2.*

UN (United Nations). (2017a). "Sustainable Development Goals". Retrieved from: *https://www.un.org/sustainabledevelopment/sustainable-development-goals/*

UN General Assembly. (2015). Transforming our world: the 2030 agenda for sustainable development. Available from: *https://www.refworld.org/docid/57b6e3e44.html* (accessed 2 November 2020).

UNDP. (2018). "Qatar: Human Development Indices and Indications: 2018 Statistical Update" *<http://hdr.undp.org/sites/all/themes/hdr_theme/countrynotes/QAT.pdf>*

United Nations Development Programme (2022). Human Development Reports. Nigeria: Human Development Index. *https://hdr.undp.org/data-center/specific-countrydata#/countries/NGA* Accessed 24/07/2023

United Nations Fund for Population Activities. (2015). UNFPA in FCT, Abuja. *(Nigeria.unfpa.org/abuja.html)* National Bureau of Statistics (2010) Social Statistics in Nigeria, Federal Government ofNigeria, Abuja.

United Nations General Assembly. (2017). "Work of the Statistical Commission Pertaining to the 2030 Agenda for Sustainable Development." Resolution A/RES/71/313 adopted by the General Assembly on 6 July 2017. *ggim.un.org/documents/A_RES_71_313.pdf.*

United Nations. (2015). Zero hunger challenge 2015. Available from: *https://www.un.org/zerohunger/content/pathways-zero-hunger* (cited 28 February 2021).

United Nations (2023). Sustainable Development Goals. Goal 2: Zero Hunger. *https://www.un.org/sustainabledevelopment/hunger/* Accessed 24/06/2023

United States Agency for International Development-USAID. (2007). Preliminary Livelihoods Zoning: Northern Nigeria. A special report by the famine early warning systems network. A special report by the famine early warning systems network Pp1-49.

Urra, J, Alkorta, I. and Garbisu, C. (2019). Potential benefits and risks for soil health derived from the use of organic amendments in agriculture. *Agronomy*. **9:** 542.

doi: 10.3390/agronomy9090542

USAID (2017). "Food assistance fact sheet: Nigeria" Retrieved from: *https://www.usaid.gov/nigeria/food-assistance*

USDA (2012) U.S. Household Food Security survey Module. United States Department of Agriculture Economic Research Service, USA.

Valin, H., Sands, R.D., van der Mensbrugghe, D., Nelson, G.C., Ahammad, H., Blanc, E., Bodirsky, B., Fujimori, S.,Hasegawa, T., Havlík, P., Heyhoe, E., Kyle, P., Manson-D'Croz, D.,

Paltsev, S., Rolinski, S., Tabeau, A., van Meijl,H., von Lampe, M. and Willenbockel, D. (2014) The Future of Food Demand:

Understanding Differences in Global Economic Models. *Agricultural Economics.* **45,** 51-67.

van Ittersum, M.K., Cassman, K.G., Grassini, P., Wolf, J., Tittonell, P. and Hochman, Z. (2013). Yield gap analysis with local to global relevance—A review. *Field Crops Research* **143,** 4 - 17.

van Meijl, H., Shutes, L., Valin, H., Stehfest, E., van Dijk, M., Kuiper, M., Tabeau, A., van Zeist, W.-J., Hasegawa, T. and Havlik, P. (2020a). Modelling alternative futures of global food security: Insights from FOODSECURE. *GlobalFood Security* **25,** 100358.

van Zeist, W.-J., Stehfest, E., Doelman, J.C., Valin, H., Calvin, K., Fujimori, S., Hasegawa, T., Havlik, P., Humpenöder,F., Kyle, P., Lotze-Campen, H., MasonD\textquotesingle, C., Daniel, van Meijl, H., Popp, A., Sulser, T.B.,Tabeau, A., Verhagen, W. and Wiebe, K. (2020). Are scenario projections overly optimistic about future yield progress? *Global Environmental Change.* **64,** 102120.

Verduijn, R. (2005). Strengthening Food Insecurity and Vulnerability Information Management in Lesotho: FIVIMS Assessment Report. Maseru: FAO's Emergency Operations Service (TCEO).

Verguet S, Limasalle P, Chakrabarti A, Husain A, Burbano C. and Drake L. (2020). The broader economic value of school feeding programs in low-and middle-income countries: estimating the multi-sectoral returns to public health, human capital, social protection, and the local economy. Frontiers in Public Health. **8:** 587046. *doi: 10.3389/fpubh.2020.587046*

Vincent, K. (2004). *Creating an index of Social Vulnerability to Climate Change for Africa.* Working Paper 56. *Tyndall Center for Climate Change Research.*

von Braun, J., Zamagni, S. and Sorondo, M.S. (2020). The moment to see the poor. *Science.* **368,** 214-214.

von Grebmer K., Bernstein, J. L. and Hammond, F. (2018). 2018 Global Hunger Index: Forced migration and hunger. Bonn and Dublin: Welthungerhilfe and Concern

Worldwide

von Grebmer, K, Bernstein, J. L. and Hammond, F. (2019). Global Hunger Index: The Challenge of Hunger and Climate Change. Bonn: Welthungerhilfe; and Dublin: Concern Worldwide

Waha, K., Van Wijk, M.T., Fritz, S., See, L., Thornton, P.K. and Wichern, J. (2018). Agricultural diversification as an important strategy for achieving food security in Africa. *Global Change Biology*. **24:** 3390–3400. *doi: 10.1111/gcb.14158*

Waite, R., Beveridge, M., Brummett, R., Castine, S., Chaiyawannakarn, N., Kaushik, S., Mungkung, R., Nawapakpilai, S. and Phillips, M., (2014). Improving productivity and environmental performance of aquaculture. *World Resources Institute.*

Warr, P. (2014). 'Food insecurity and its determinants', *Australian Journal of Agricultural and Resource Economics*. **(58),** 519-537.

Wegerif, M.C. (2016). 'Informal' food traders and food security: experiences from the Covid-19 response in South Africa. *Food Security*. **12:** 797–800. *doi: 10.1007/s12571-020-01078-z*

Weindl, I., Lotze-Campen, H., Popp, A., Müller, C., Havlík, P., Herrero, M., Schmitz, C. and Rolinski, S. (2015). Livestock in a changing climate: production system transitions as an adaptation strategy for agriculture. *Environmental Research Letters*. **10,** 094021.

Welderufael, M. (2014). Determinants of Households Vulnerability to Food Insecurity in Ethiopia: Econometric analysis of Rural and Urban Households. *Journal of*

Economics and Sustainable Development, ***5(24).***
http://www.iiste.org/Journals/index.php/JEDS/article/view/17506

WHO Press Report. (2020). Africa can rely on United Nations Development System in decade of action to fulfil 2030 Agenda, Deputy Secretary-General tells Regional Forum. Available from: *https://www.un.org/press/en/2020/dsgsm1390.doc.htm* (cited 28 February 2022).

Wood, D. K., Shultz, J.A, Butkus, S.N. and Ballejos, M.E. (2009). Patterns of coping strategy among food pantry clients. *Journal of Hunger and Environmental Nutrition*. **4(2):** 185-202

World Bank (2021). Poverty and equity brief: Western and central Africa. *https://databank.worldbank.org/data/download/poverty/987B9C90-CB9F-4D93AE8C 750588BF00QA/AM2020/Global_POVEQ_NGA.pdf.* Accessed on 11th of November 2022.

World Bank. (2012). Can small farmers protect themselves against bad weather? From evidence to policy, Note 71392, Washington D. C.

World Data Lab (2020). Retrieved from: *https://worldpoverty.oi/headline* Accessed 5 May 2022.

World Food Programme (2008). Food consumption analysis: Calculation and use of the food consumption score in food security analysis. *Technical Guidance Sheet.* Rome.

World Health Organization (2018). International code of marketing of breast-milk substitutes. Geneva: World Health Organization; Available from: *https://www.who.int/nutrition/netcode/ resolutions/en/* (cited 19 April 2022).

World Health Organization. (2000). Obesity: Preventing and Managing the Global Epidemic. Geneva, Switzerland.

World Health Organization.(2015). Health in 2015: from MDGs, millennium development goals to SDGs, Sustainable Development Goals. Available from:

https://apps.who.int/iris/handle/10665/200009 (cited 8 February 2022).

Worldometers (2020). World Population Projections. Retrieved from: *https://www.worldometers.info/world-population/world-population-projections/* Accessed 8th February, 2022.

Wossen, T.; Berger, T.; Haile, M.G. and Troost, C. (2018). 'Impacts of climate variability and food price volatility on household income and food security of farm households in East and West Africa', *Agricultural Systems*, **(163),** 7-15.

Yunusa, I.A, Zerihun, A. and Gibberd, M.R. (2018). Analysis of the nexus between population, water resources and Global Food Security highlights significance of governance and research investments and policy priorities. *Journal of the Science of Food and Agriculture.* **98:** 5764–75. *doi: 10.1002/jsfa.9126*

Yusuf, S.A., Balogun, O.L. and Falegbe, O.E, (2015). "Effect of urban household farming on food security status in Ibadan metropolis Oyo state, Nigeria", *Agricultural Sciences,* **60(1),** 61-75, 2015.

Zougmoré, R.B., Partey, S.T., Ouédraogo, M., Torquebiau, E. and Campbell, B.M. (2018). Facing climate variability in sub-Saharan Africa: analysis of climate-smart agriculture opportunities to manage climate-related risks. *Cahiers Agric.* **27:** 1–9.

doi: 10.1051/ cagri/2018019

APPENDICES

APPENDIX A

QUESTIONNAIRE

FOOD SECURITY STATUS AND AWARENESS OF SDG-2 AMONG HOUSEHOLDS IN ABUJA MUNICIPAL AREA COUNCIL

INSTRUCTION: Please tick (√) the correct options besides each question and also fill in the spaces provided where appropriate with the correct options.

SECTION A: SOCIO-ECONOMIC CHARACTERISTICS

1. Age in years

19 - 21 [ ] (b) 22 – 31 [ ] (c) 32 – 41 [ ] (d) 42 – 51 (e) 52 – 61 [ ] (f) 62 – 71 [ ] (g) 72 and above [ ]

2. Gender/Sex (a) Male [ ] (b) Female [ ]

3. Marital status (a) Single [ ] b) Married [ ] c) Separated/ Divorced [ ] d) Cohabiting [ ]

4. Highest educational level (a) Primary level [ ] (b) Secondary level [ ] (c) Tertiary level [ ]

5. Occupation (a) None [ ] (b) Student [ ] (c) Public/Civil Servant [ ] (d) Artisan [ ] (e) Trading/Small and Medium Enterprise [ ] (f) Farmer [ ] (g) Company executive [ ] (h) Others(specify) ----------

6. Religion (a) Christianity [ ] (b) Islam [ ] (c) African Traditional Religion [ ] (d) Free thinkers [ ] (e) Atheist [ ] (f)Others(specify) ----------

7. Family size (a) 2 [ ] (b.) 3-4 [ ] (c.) 5-6 [ ] (d.) 7 and above [ ]

8. What is your Level of Income? (a.) ≤ ₦30,000 (minimum wage or less) [ ] (b.) ≥ ₦31,000 [ ] (above minimum wage)

9. Are you satisfied with your monthly income? (a)Yes [ ] (b.) No [ ] (c.) Somehow [ ]

SECTION B: AWARENESS ABOUT SDG-2 GOAL

1. Have you ever heard about Sustainable Development Goals 2 (SDG-2)? (a)Yes [

] (b.) No [ ]

2. From which source did you first hear of SDG-2? (a) Radio [ ] (b) Television [ ] (c) Social media [ ] (d) Health workers [ ] (e) Non-governmental Organization (NGO) [ ] (f) Family and friends [ ]

3. What is the major target of SDG-2? (a) to zero hunger [ ] (b) to lend money to the poor [ ] (c) to build houses for the poor [ ]

4. In summary, to achieve SDG-2 targets by 2030, it is important to ensure? (a) food availability [ ] (b) food accessibility[ ] (c) food utilization [ ] (d) food Stability (e) all of the above [ ] (f) none of the above [ ]

5. With the trend, do you think government and other stakeholders of SDG-2 can achieve the goal before the end of 2030? (a)Yes [ ] (b.) No [ ] (c) unsure [ ]

SECTION C: LEVEL OF FOOD SECURITY (HFIAS-FANTA FOOD INSECURITY QUESTIONNAIRE)

S/NO.	QUESTION	RESPONSE OPTIONS	CODE
1.	In the past four weeks, did you worry that your household would not have enough food?	0 = No (skip to Q2) 1=Yes	
1a.	How often did this		

	happen?	1 = Rarely (once or twice in the past four weeks) 2 = Sometimes (three to ten times in the past four weeks) 3 = Often (more than ten times in the past four weeks)	
2.	In the past four weeks, were you or any household member not able to eat the kinds of foods you preferred	0 = No (Skip to Q3) 1 = Yes	
	because of a lack of resources?		
2a.	How often did this happen?	1 = Rarely (once or twice in the past 4 weeks) 2 = Sometimes (three to ten times in the past four weeks) 3 = often (more than ten times in the past four weeks)	

3.	In the past four weeks, did you or any household member have to eat a limited variety of foods due to a lack of resources?	0 = No (Skip to Q4) 1 = Yes	
3a.	How often did this happen?	1 = Rarely (once or twice in the past 4 weeks) 2 = Sometimes (three to ten times in the past four weeks) 3 = often (more than ten times in the past four weeks)	
4.	In the past four weeks, did you or any household meber have to eat some foods that you really did not want to eat because of a lack of resources to obtain other types of food?	0 = No (Skip to Q5) 1 = Yes	
4a.		1 = Rarely (once or twice in the past 4 weeks) 2 = Sometimes (three to ten times in the past four weeks)	
		3 = often (more than ten times in the past four weeks)	

5.	In the past four weks, did you or any household member have to eat a smaller meal than you felt you needed because there was not enough food?	0 = No (Skip to Q6) 1 = Yes	
5a.	How often did this happen?	1 = Rarely (once or twice in the past 4 weeks) 2 = Sometimes (three to ten times in the past four weeks) 3 = often (more than ten times in the past four weeks)	
6.	In the past four weeks, did you or any household member have to eat fewer meals in a day because there was not enough food?	0 = No (Skip to Q7) 1 = Yes	
6a.	How often did this happen?	1 = Rarely (once or twice in the past 4 weeks) 2 = Sometimes (three to ten times in the past four weeks) 3 = often (more than ten times in the past four weeks)	
7.	In the past four weeks, was there ever no food to eat of any kind in your household because	0 = No (Skip to Q8) 1 = Yes	
	of lack of resources to get food?		

7a.	How often did this happen?	1 = Rarely (once or twice in the past 4 weeks) 2 = Sometimes (three to ten times in the past four weeks) 3 = often (more than ten times in the past four weeks)	
8.	In the past four weeks, did you or any household member go to sleep at night hungry because there was not enough food?	0 = No (Skip to Q9) 1 = Yes	
8a.	How often did this happen?	1 = Rarely (once or twice in the past 4 weeks) 2 = Sometimes (three to ten times in the past four weeks) 3 = often (more than ten times in the past four weeks)	
9.	In the past four weeks, did you or any household member go a whole day and night without eating anything because there was not enough food?	0 = No (Questionnaire is finished) 1 = Yes	
9a.	How often did this happen?	1 = Rarely (once or twice in the past 4 weeks) 2 = Sometimes (three to ten times in the past four weeks) 3 = often (more than ten times in the past four weeks)	

FOOD CONSUMPTION SCORE (DAYS OF CONSUMING THE FOLLOWING FOOD GROUPS IN A WEEK)

Food groups	< 3 days	3-4 days	5days and above
Maize , maize porridge, rice, sorghum, millet pasta, bread and other cereals			
Cassava, potatoes and sweet potatoes			
Beans. Peas, groundnuts and cashew nuts			
Vegetables and leaves			
Fruits			
Beef, goat, poultry, pork, eggs and fish			

Milk yogurt and other diary			
Sugar and sugar products			
Oils, fats and butter			

SECTION D: COPING STRATEGIES USED AGAINST FOOD INSECURITY

1. Eating once a day (a)Very often [ ] (b) Regularly [ ] (c) Occasional [ ] (d) Never [ ]

2. Allowing children to eat first (a)Very often [ ] (b) Regularly [ ] (c) Occasional [ ] (d) Never [ ]

3. Eating of fruit (a)Very often [ ] (b) Regularly [ ] (c) Occasional [ ] (d) Never [ ]

4. Selling of assets (a)Very often [ ] (b) Regularly [ ] (c) Occasional [ ] (d) Never [ ]

5. Buying food on credit (a)Very often [ ] (b) Regularly [ ] (c) Occasional [ ] (d) Never [ ]

6. Picking of leftover food at social functions (a)Very often [ ] (b) Regularly [ ]

(c) Occasional [ ] (d) Never [ ]

7. Rely on less preferred or less expensive food (a)Very often [ ] (b) Regularly [ ] (c) Occasional [ ] (d) Never [ ]

8. Borrowed food or borrow money to buy food (a)Very often [ ] (b) Regularly [ ] (c) Occasional [ ] (d) Never [ ]

9. Reduce the number of meals eaten in one day (a)Very often [ ] (b) Regularly [ ] (c) Occasional [ ] (d) Never [ ]

10. Reduction in the quantities consumed by adults/mothers for young children (a)Very often [ ] (b) Regularly [ ] (c) Occasional [ ] (d) Never [ ]

11. Reduced essential non-food expenditures such as education, health, etc… (a)Very often [ ] (b) Regularly [ ] (c) Occasional [ ] (d) Never [ ]

12. Illegal income activities (theft, smuggling, prostitution) (a)Very often [ ] (b) Regularly [ ] (c) Occasional [ ] (d) Never [ ]

APPENDIX B

OCCUPATION OF RESPONDENTS

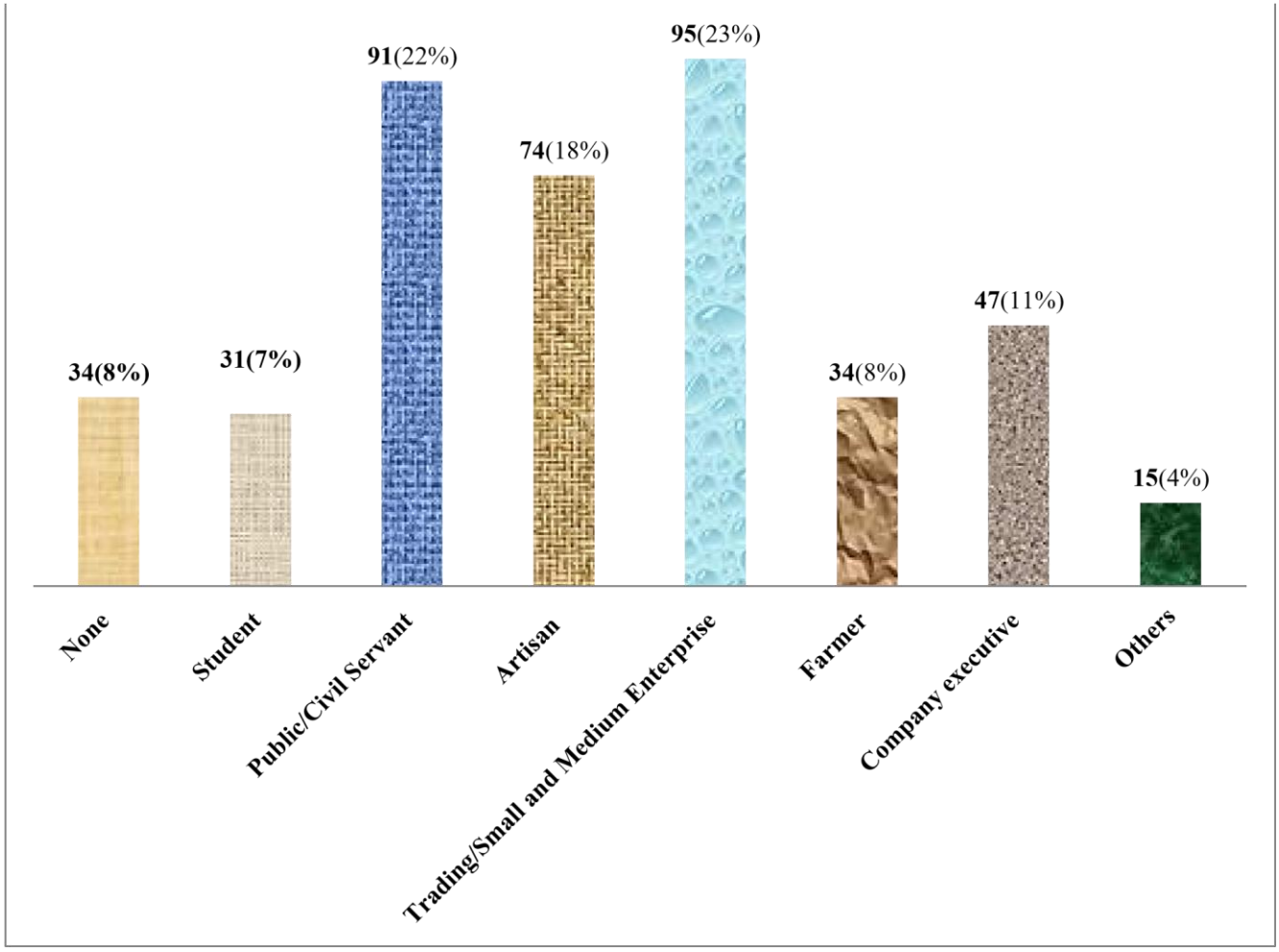

Figure 4.1.1: Occupation of Respondents

APPENDIX C

HOUSEHOLD COPING STRATEGIES USED BY RESPONDENTS AGAINST FOOD INSECURITY

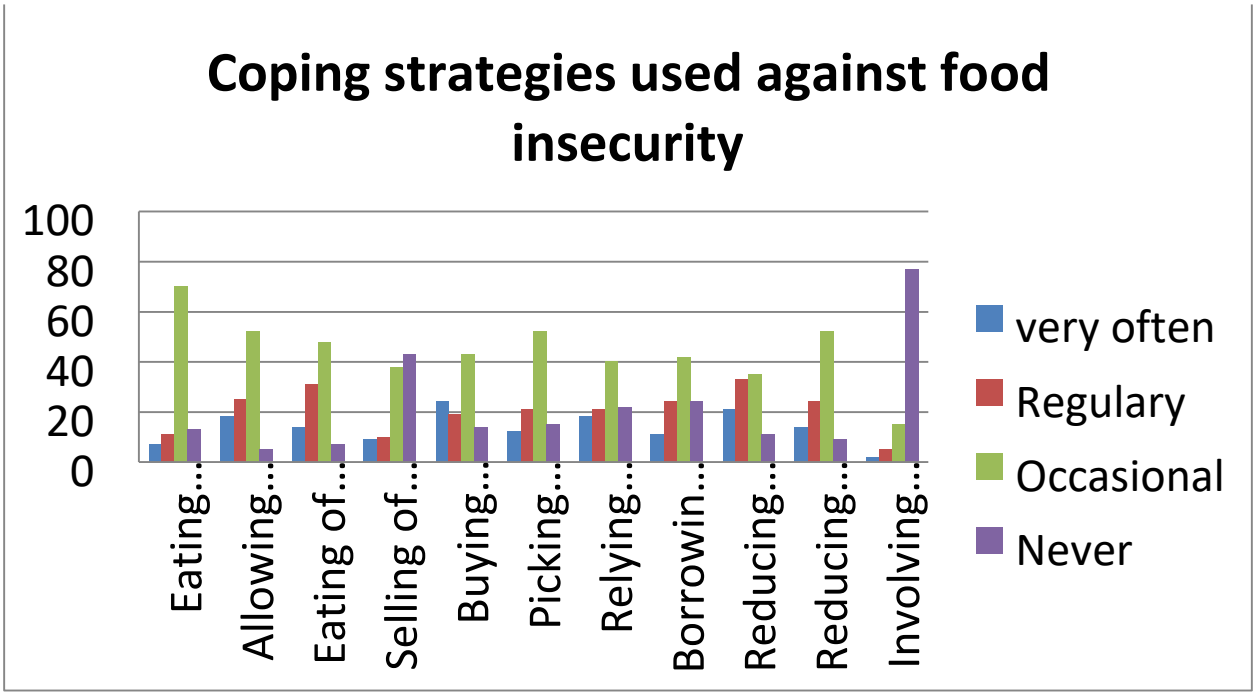

Figure 4.1.5: Household Coping Strategies used against food insecurity in Abuja Municipal Area Council

APPENDIX D

NUMBER OF HOUSEHOLDS IN ABUJA MUNICIPAL AREA COUNCIL

S/NO	WARD	NUMBER OF HOUSEHOLDS
1.	City Centre	30, 975
2.	Garki	32,473
3.	Gwarimpa	51,362
4.	Orozo	35,203
5.	Nyanya	21,551
6.	Karshi	8,282
7.	Gui	64,371
8.	Jiwa	40,202
9.	Gwagwa	41,001
10.	Kabusa	28,814
11.	Karu	32,854
12.	Wuse	14,366
Total		401,454

Source: AMAC Focal Persons Outreach Report – WHO oral polio immunization programme (2022)

Department of Public Health Technology,
School of Health Technology,
Federal University of Technology, Owerri
Imo State.
9th March, 2022.

The Director,
Primary Health Care,
Abuja Municipal Area Council,
FCT, Abuja.

Dear sir/ma,

LETTER SEEKING APPROVAL TO CARRY OUT MY THESIS RESEARCH IN AMAC

I humbly seek your approval and permission to carry out my thesis field work/data collection in AMAC.

My name is Sylvaline Chisom Njoku, I am a Masters degree student of Public Health Technology Department, Federal University of Technology, Owerri.
I am currently doing my thesis research on the topic, "Food Security and the Achievment of SDG -2 among Households in Abuja Municipal Area Council". I need the following data from AMAC so as to aid a proper research.

1. Number of 18+ adults in AMAC
2. Number of households in AMAC
3. Number of wards in AMAC, and how the wards are sub-divided, listing the wards and their sub-divisions
4. Number of residential houses in Central Area, Garki, Karshi and Nyanya.

This research will help to close the gap in knowledge on the food security situation in AMAC and also help relevant stakeholders and concerned agencies in planning and executing proper food and nutrition interventions where necessary.

I look forward to getting your kind and favourable response.

Thank you.

Yours faithfully,
S.C.N
Sylvaline Chisom Njoku
08068461801

P.D PR/M&E
Kindly Oblige.

P.D PR/M&E
Oblige

FEDERAL UNIVERSITY OF TECHNOLOGY
SCHOOL OF HEALTH TECHNOLOGY
DEPARTMENT OF PUBLIC HEALTH
E-mail: publichealth@futo.edu.ng

P.M.B. 1526
Owerri, Nigeria
Telegrams.
FEDUNITECH, OWERRI

VICE-CHANCELLOR: PROF. Nnenna Nnannaya Oti
B.Sc, M.Sc. (Nig), PGD. (Belgium), PhD (FUTO), FSSN, RSS & JP

Dean: Prof. P. U. Agbasi. B.Sc, M.Sc, Ph.D
Head of Department: DR.U.M Chukwuocha
B.Sc, MPH, Ph.D.

Our Ref: FUT/SOHT/PUH/CS.006/VOL. 1
Your Ref:

16th February, 2022

Dear Sir/Ma,

LETTER OF INTRODUCTION

The bearer **NJOKU SYLVALINE CHISOM with** Reg. No. **20184142608** is a bona-fide student of the Department of Public Health, Federal University of Technology, Owerri. As part of requirement for graduating MPH student, every student is required to carry out a well-articulated research.

Accordingly, **NJOKU SYLVALINE CHISOM** is seeking to carry out her research in your Area Council on **'FOOD SECURITY AND ACHIVEMENT OF SDG-2 AMONG HOUSEHOLDS IN ABJUA MUNICIPAL AREA COUNCIL.**

We would appreciate your kind assistance towards the realization of this compulsory requirement for her graduation.

Please give her the necessary assistance she requires for a successful programme.

Dr U.M Chukwuocha
HOD Public Health