ANALYSIS OF FOOD SECURITY AND COPING STRATEGIES OF RURAL FARM HOUSEHOLDS IN KADUNA STATE, NIGERIA

BY

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A DISSERTATION SUBMITTED TO THE SCHOOL OF POSTGRADUATE STUDIES, AHMADU BELLO UNIVERSITY, ZARIA IN PARTIAL FULFILLLMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF DOCTOR OF PHILOSOPHY IN AGRICULTURAL ECONOMICS

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DECLARATION

I hereby declare that this thesis titled **"Analysis of Food Security and Coping Strategies of Rural Farm Households in Kaduna State, Nigeria"** has been written by me and it is a record of my research work. No part of the work has been presented in any previous application for another degree or diploma in any Institution. All borrowed ideas have been acknowledged in the text and a list of references provided.

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Mukadam Omoboni KEKU **Date**

CERTIFICATION

This thesis titled "**Analysis of Food Security and Coping Strategies of Rural Farm Households in Kaduna State Nigeria",** carried out by Mukadam Omoboni KEKU meets the regulations governing the award of Degree of Doctor of Philosophy in Agricultural Economics of Ahmadu Bello University, Zaria and is approved for its contribution to knowledge and literary presentation.

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DEDICATION

This work is dedicated to my mother, wife and children and the entire members of my family both immediate and extended.

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My special gratitude and thanks is given to ALMIGHTY GOD the author and finisher of our faith for His guidance and protection throughout the period of my study. A special honour to Him for giving me the fortitude and enablement to accomplish the task of writing this thesis and courage that enhance the successful completion of the programme.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Figure **page**

LIST OF APPENDICES

LIST OF ABBREVIATIONS AND ACRONYMS

ACGS	- Agricultural Credit Guarantee Scheme
ADPs	- Agricultural Development Projects
ATA	- Agricultural Transformation Agenda
AWDR	- African Water Development Report
BOA	- Bank of Agriculture
CAADP	-Comprehensive Africa Agricultural Development Programme
CBN	- Central Bank of Nigeria
GAIN	- Global Agricultural Information Network
GHI	- Global Hunger Index
FSI	- Food Security Index
IFPRI	- International Food Policy and Research Institute
KADP	- Kaduna Agricultural Development Project
Kcal	- Kilocalories
IFAD	- International Fund for Agricultural Development
LGAs	- Local Government Areas
MDGs	- Millennium Development Goals
NACRDB	- Nigeria Agricultural Cooperative and Rural Development Bank
NAFPP	- National Accelerated Food Production Programme
NAERLS	- National Agricultural Extension and Research Liaison Services
NADF	- National Agricultural Development Fund
NALDA	- National Agricultural Land Development Authorities
NBS	- National Bureau of Statistics
NEF	- Nigerian Elite Forum
NFSP	- Nigerian Food Security Portal
NIALS	- Nigerian Institute of Advanced Legal Studies
NFRA	- National Food Research Agency of Nigeria
NCAM	- National Centre for Agricultural Mechanization
NIRSAL	- Nigerian Incentive-Based Risk Sharing System for Agricultural Lending
NPC	- National Population Commission
NSPFS	- National Special Programme for Food Security
NSS	- National Seed Service

OFN	- Operation Feed the Nation
RBDA	- River Basin Development Authority
SAP	- Structural Adjustment Programme
SME	-Small and Medium Enterprises
SMEDAN	-Small and Medium Enterprises Development Agency of Nigeria
SDG	-Sustainable Development Goals
UN	- United Nations
UNDP	- United Nations Development Programme
UNICEF	- United Nations Children Education Fund
USAID	- United States Agency for International Development
USDA	- United States Department of Agriculture

ABSTRACT

The study analyzed the food security status and the coping strategies adopted by rural farm households against food insecurity in Kaduna State, Nigeria. Primary data were used for the study and the research work was conducted in 2015. Structured questionnaire was used to collect data from rural farm households. The list of rural farm households from Kaduna State Agricultural Development Project was used to randomly select 10% of farmers from each of the sixteen villages to give a sample size of 390 farmers. The analytical tools used to achieve the stated objectives are descriptive statistics to analyze the socio-economic characteristics of respondents and crop contributions to rural households' food security. The food security index was used to determine food security status of households while logistic regression model was used to examine the determinants of food security among the households surveyed and Kendall's coefficient of concordance to describe and rank the coping strategies adopted by rural farm households. The study found that the mean age of the farmers was 49 years and most of the sampled respondents were males. About 89% were married and 30% of the farmers had no formal education. The mean farming experience in the study area was 19 years. The most widely grown crops were cereals, of which maize was the most important .The mean per capita expenditure of the households in the study area was about ₦405 per day, putting this household at extreme risk of food insecurity. The Z-Statistic result indicated that there was a significant difference between expenditure pattern of food secure and food insecure households. The study showed that about 41% of the respondents were food secured while 59% were food insecure. The food security indices for the food secured and insecure households were found to be 1.43 and 0.81 respectively implying that food secured households consumed 43% in excess of their daily calorie requirements; while food insecure households consumed 19% less than their daily calorie requirements. This study also revealed that 9.2% of the total sampled households were found to be severely food insecure and had both adult and children food intake reduced to an extent that they witnessed severe hunger .The results of the Logistic regression model revealed that age, education, access to production credit, household size, dependency ratio, household farm income and non-farm income were the determinants of food security status of rural farming households in the study area. The months of April and May were the periods in which households experienced severe food shortage. The study indicated that eating less preferred food was the most widely used of all the coping strategies considered in the study area. The Kendall's (W) of 0.56 show that there was agreement among 56% of the rankers (respondents)which was significant at 1% as indicated by the p-value of 0.000. Most of the coping strategies used by farming households were moderate in terms of the frequency at which different coping strategies were used to temporarily mitigate the impact of food insecurity. These results have implications for agricultural food policy in developing countries, especially Nigeria, because large chunk of expenditure would go into importation of food in order to reduce the severity of food insecurity and hunger to the bearest minimum level and it might be quite unsustainable at the long run especially in the period of recession. The study, therefore, recommended that rural households should be educated on the need to diversify their sources of income from agriculture to off- farm income generating activities. This is to improve food security at the household level.

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background to the Study

In Nigeria, agriculture was the most important sector of the economy from the standpoint of rural employment, sufficiency in food and fibre, and export earning prior to the discovery of crude oil (Kehinde *et al.,* 2012). The agricultural sector is still the leading sector in Nigeria's ailing economy. It provides over 70% of informal sector jobs created in the economy (Central Bank of Nigeria, 2016). The contribution of the agricultural sector to Gross Domestic Product (GDP) in the first quarters of 2016 is 24.18% (Central Bank of Nigeria, 2016).

Nigeria is facing huge food security challenges now and 67.1% of her population lives below poverty line (National Bureau of Statistics, 2016). Poverty and hunger have remained high in rural areas, remote communities and among female -headed households and these cut across the six geo-political zones, with prevalence ranging from approximately 46.9% in the South-West to 74.3% in North-West and North-East (United Nations, 2016). In Nigeria, 37% of children under five years old were stunted, 18% wasted, 29% underweight and overall, only 10% of children aged 6-23 months are fed appropriately based on recommended infant and young children feeding practices (United Nations,2016). Nigeria has about 79 million hectares of arable land of which 32 million hectares are cultivated and over 90% of agricultural production is rain-fed (Nwajiuba, 2012). Smallholders, mostly subsistence producers account for 80% of all farm holdings. Both crop and livestock production remains below potentials (Nwajiuba, 2012); although the agricultural growth was 4.03% in the fourth quarter of 2016, this growth lies below the 10% necessary for attaining food security and poverty reduction (National Bureau of Statistics, 2017).

Based on the hierarchy of human needs, food is unquestionably the most vital need considering its centrality to human existence (Obayelu and Obayelu, 2012). The country today is facing incessant worsening food crisis era unnoticed in the last twenty years and with the potential of leading to national food disaster. However, various interventions have been made by the Nigerian government in modernizing agriculture in Nigeria which was previously characterized by sluggish growth, low factor productivity, declining terms of trade, and often linked to practices that degrade the environment (Obayelu and Obayelu, 2012). Since the late 1970s to 2016 Nigeria have implemented macro-economic policies, sectoral and institutional reforms aimed at ensuring high and sustainable economic growth, food security and poverty reduction. Though, Nigeria have recorded some level of growth in the agricultural sector (National Baureau of Statistics, 2017), however, the sector's growth remained insufficient to adequately address poverty, attain food security, and lead to sustained Gross Domestic Product (GDP) growth. Food security and poverty reduction have been a major campaign issue across all political parties in the country, yet provision of enough food to feed the entire population has eluded many governments because of their inability to meet the agreed Comprehensive Africa Agriculture Development Programme (CAADP) target of investment of at least 10% of the National budget on Agriculture.

In Nigeria, concerns regarding food security and its related issues are vital for poverty reduction. Attainment of food security is core problem confronting farming households;

especially women and rural populations due to low productivity in staple crop production, seasonal variability in food supply as well as price fluctuations. These problems facing farming households come about as a result of over-reliance on rain-fed agriculture, inadequate or inappropriate usage of chemical inputs as well as inadequate improved varieties of crops and animal species (Victoria and Benjamin, 2012). Food security of farming households is of serious concern if Nigeria wants to come out of her present economic recession. Tragically, farmers who are vulnerable to food and nutritional insecurity have limited capacity to respond to agricultural programmes (Victoria and Benjamin, 2012). Nevertheless, the production of staple foods in rural areas is seen as a coping mechanism in situations of severe food insecurity and is geared towards household consumption in most part of Kaduna State. In rural areas, families have access to a small plot of land to engage in small-scale food production for their own consumption and to increase the family income. Hence, the study would analyse food security status and the coping strategies of rural farm households in Kaduna State North-West, Nigeria.

1.2 Problem Statement

Nigeria's overall performance in terms of agricultural production and productivity remains inadequate and has failed to make significant progress in the food security front. The issue of food security and coping strategies therefore is a major concern in Nigeria. This is particularly more among the rural farmers who have the highest prevalence of under nutrition (Victoria and Benjamin, 2012). They also estimated that about 66% of Nigeria's population lives below poverty line as portrayed by their level of food security. Moreover, the country is characterized by high reliance on food imports as malnutrition is widespread and rural areas are especially vulnerable to chronic food shortages, malnutrition, unbalanced nutrition, erratic food supply, poor food quality, high food cost, and even total lack of food despite the country's vast potential food production capacity (Victoria and Benjamin, 2012). The connections among dwindling food production capacity, rising food prices and dependency on food importation and the consequence of food insecurity are nowhere more clearly demonstrated in recent times than in the sahelian food crisis, which also affected many of the northern states of Nigeria (Ojeleye *et al.*, 2015). The issue of food security and coping strategies therefore is a concern in Nigeria and calls for continuous attention and strategy.

Food insecurity and malnutrition also have profound implication for health and development, and present major obstacles to attaining the Sustainable Development Goals (SDG's). In Nigeria, understanding smallholder farmers– how much they earn, what they eat, as well as broader question about the role food security plays in livelihood outcomes is crucial to designing sustainable strategies to reduce hunger, poverty, and illness. In Nigeria, a Global Food Security Index (GFSI) rank of 91st among 109 countries in 2015, together with rising food prices, malnutrition and deaths as a result of wide-spread poverty is an indication of the prevalence of food insecurity in the county. It is also a sign of extreme suffering for millions of poor people as described by Global Hunger Index Report of 2015.

In the midst of this challenging and disturbing statistics, the population of Nigeria is growing at the rate of 3.2 percent yet agricultural growth is sluggish and fluctuating (National Bureau of Statistics,2016). Available statistics indicate that the economy of Nigeria is technically in recession because of the negative GDP for more than two quarters consecutively (Central Bank of Nigeria, 2016). Equally worth-noting are the high food prices and changing climatic patterns (Ojeleye *et al*., 2015). These situations have made it needful to examine the current food security status and coping strategies of farming households already trapped in poverty web. However, some research works done on food security and coping strategies in Nigeria such as Abubakar (2010); Obayelu and Obayelu (2012); Victoria and Benjamin (2012) are very general and consider the problems from national or regional points of views. While the aggregate data are generally available at the national level, little work has been done to understand the food security problems at the household level in specific states like Kaduna and despite the increasing global concern of improving food security, the nature and extent of food security at the household level in rural areas are not well documented. It was against this background that this research was undertaken to analyze the food security and coping strategies among rural farm households in Kaduna State. Based on the foregoing, the questions of interest in this research were as follows:

i. What are the socio-economic characteristics of rural farm households in the study area?
ii. What are the food crop contributions to rural farm households' food security?
iii. What is the expenditure pattern of rural farm households in the study area?
iv. What is the food security status of rural farm households?
v. What are the determinants of food security of rural farm households in the study area?
vi. What are the coping strategies adopted by rural farm households to mitigate the stress and shock of food insecurity?

1.3 Objectives of the Study

The broad objective of this study was to analyze the food security and coping strategies of rural farm households in Kaduna State. The specific objectives are to:

i. describe the socio-economic characteristics of rural farm households in the study area;
ii. examine the food crop contributions to rural farm households' food security;
iii. assess the expenditure pattern of rural farm households in the study area;
iv. determine the food security status of rural farm households;
v. analyze the determinants of food security of rural farm households in the study area; and
vi. identify the coping strategies adopted by rural farm households to mitigate the stress and shock of food insecurity.

1.4 Research Hypotheses

The hypotheses that were tested in this research study are stated in null form as follows:

(i) There is no significant difference between expenditure pattern of food secured and food insecure household heads.

(ii) There is no difference between the socio-economic characteristics of food secured household heads and their non secured counterparts.

1.5 Justification for the Study

Food insecurity continues to be a major developmental problem across the globe undermining people's health, productivity and often their very survival. Efforts to overcome the development challenges posed by food insecurity necessarily begin with identifying the causes at household level (Lisa and Ali, 2007). This is due to the fact that identification of household behaviors relating to food access serves as a critical building block for the development of policies and programs for helping vulnerable population and the effective way of targeting assistance for them. Reliable information on household food security is a pre-requisite for accurate and effective design, monitoring and evaluation of developmental project. Hence many development agencies consider household food security as a guiding principle for designing interventions in rural areas. Measurement of food security at household level would provide the basis for monitoring future progress and assessing the impacts of various projects, programmes and policies on the rural farm household's food security status.

The World Health Organization recommends an intake of between 2500 – 3400kcal of energy per person per day. It was recommended that an individual should consume between 65-86g crude proteins per day out of which 35g (or 40%) must be animal protein (Babatunde and Qaim, 2010; Otunaiya and Ibidunni, 2014). Many Nigerians have energy intake that is far below the minimum recommended daily per capital intake and the factors responsible are not well known; hence, predisposing people to the challenges of food insecurity. This study, would therefore, examined the determinants of food security among farming households in Kaduna State, Nigeria and the coping strategies to be adopted by the farming households in the event of adverse food security conditions. Household food security is also affected by factors that would be determined in this study. Understanding these factors would go a long way in assisting the rural farm households to get appropriate information on how to mitigate the stress and shock of food insecurity and to reduce poverty to a barest minimum level. The knowledge that would be drawn from the study would enhance the formulation of sound macro and micro economic policies necessary for the emergence of sustainable food security policies. It could also indicate those key variables (areas) that would be effectively managed to better the food security status of the majority of the Nigerian populace who are mainly agrarian.

Focus on food security and coping strategies therefore ensures that the basic needs of the poorest and most vulnerable groups are not neglected in policy formulation. This is because food security is one of the several necessary conditions for a population to be healthy and well nourished. Further information would be provided on the influence of various socio-economic factors at the household level on expenditure associated with food and coping strategies of rural farm households in the study area.

The study would provide valuable benchmark information to the partially existing knowledge about the food security and coping strategies of rural farm households in the study area. The outcome of this research work would be of tremendous benefit to the policy makers and help future researchers in the field since the study would make contributions on the subject matter upon which further research work can be done in the future. It would also be a base for statistical inference to other studies on analysis of food security and coping strategies in Kaduna State in particular and Nigeria in general.

1.6 Scope and Limitations of the Study

The study covered all the four Agricultural Development Project operational zones in Kaduna State, Nigeria and it involved only farm households from rural communities who operated basically at small scale level.

Major limitation to this study is lack of physical records, data collected on household food production, food purchase and food consumption were based largely on the ones supplied by the household heads in the questionnaire. The study did not consider the effects of the anti- nutritional factors such as phytate, oxalate, saponin, tannin, hydrocyanide etc that may be present in some of the various food items which may prevent the nutrients from being available for body metabolism. The estimation of food security based on calorie consumption in this study might have underrated the importance of protein and other nutrients in the diet. The implication of this is that special attention is not given to essential nutrients which are vital for growth and development of mankind.

1.7 Organization of the Study

The study was organized into five chapters. Chapter I of the study dealt with background of the study, problem statement, objectives of the study, research hypotheses, justification for the study, scope and limitations of the study and organization of the study. Chapter II of this study dealt with review of recent literature on food security status in Nigeria, conceptual and theoretical frameworks, socio-economic characteristics of farmers, determinants of food security, measurement of food security,food insecurity types and causes in Nigeria, coping strategies to mitigate food insecurity, analysis of Nigeria government intervention against food insecurity, pillars of food security. Others include overview of food security in Nigeria, challenges and future prospects of food security in Nigeria, review of empirical studies and models and concluding remarks. Chapter III provided the methodology for conducting the study. Chapter IV is the presentation of results and discussion while Chapter V contained the summary, conclusions, recommendations and suggestion for further study.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Conceptual Framework

Food security has been defined as when all people at all times have access to sufficient, safe, nutritious food to maintain a healthy and active life and as a point when all people at all times have both physical and economic access to sufficient food to meet their dietary needs for a productive and a healthy life (Okuneye, 2001) .The general economic situation in Nigeria has subjected majority of the households into problem of food crisis (food insecurity) and this condition further aggravated the poor nutrition and health status of the citizenry. Food insecurity is defined as a condition in which people lack the basic food intake necessary to provide them with the energy and nutrient required for full productive life (Yenesew, 2015). Food insecurity is therefore the absence of food security and it applies to a wide range of phenomena from famine to periodic hunger due to uncertain food supply (Ayoade and Adetunbi, 2013).

Food insecurity can either be temporary (transitory food insecurity) or continuous i.e chronic food insecurity (Food and Agricultural Organisation, 2010). Undernourishment exists when calorie intake is below the Minimum Dietary Energy Requirement (MDER). The MDER is the amount of energy needed for light activity and to maintain a minimum acceptable weight for attained height. It varies by country and from year to year depending on the gender and age structure of the pupolation (World Food Programme, 2010). Food Availability Decline (FAD) approached explains that famine or food shortage occurs when there is an aggregate decline in food supply. According to this approach people starve because of a local, national or regional decline in food availability to a level below the minimum requirement for survival. However, FAD has been criticized for its only dealing with supply side which disregards the demands side; it said nothing about people's income and purchasing power. Furthermore, it failed to address the vulnerability differences and access to food from outside the affected area (Ejiga, 2006)

According to the Food Entitlement Theory, food availability at global or national level alone could not bring food secutrity at household level. Thus, according to the entitlement approach, a growth in domestic production does not necessarily prevent famine or hunger as far as what is produced is not equally distributed and the entitlement system that determines access to food is not changed (Yenesew, 2015). Food insecurity affecrs people who cannot access adequate food (e.g because of poverty) irrespective of food availability, food insecurity can occur even if food supplies are adequate and market are functiuoning well (Vadala, 2009).

Farmers especially among the rural population in Nigeria experience pervasive poverty due to low agricultural productivity and relatively low income consequently resulting in their inability to access qualitative and quantitative amount of food to every member of their family all through the year (Ayoade and Adetunbi, 2013). In Nigeria, the production of food has not increased at the rate that can meet up with the demand of increasing population, while food production decreases annually at the rate of 2.5% due to high rate of annual population growth of 2.83% (Ayoade and Adetunbi, 2013). Hence, the apparent disparity between the rate of food production and demand for food in Nigeria has led to a food demamd and supply gap, leading to a widened gap between the food available and the total food requirement, therefore posing a threat to national food security (Ojo, 2003).

Devereux (2006) defines coping strategies as a response to adverse events or shocks. Household pursue various precautionary (coping) measures to avoid hunger and starvation (Barret, 2010). Initial responses to food shortages include dietary adjustments (eating less preferred foods or reducing portion sizes). Such consumption coping strategies can include:

a) Household dietary change. For example, households might switch from consuming preferred foods to cheaper and or less preferred substitutes.
b) The households can attempt to increase their foods supplies short-term strategies that are not suitable over a long period. Typical borrowing or purchasing on credit, begging or consuming wild foods, immature crops, or even seed stocks.
c) If the available food is still inadequate to meet needs, households can try to reduce the number of people they have to feed by sending some of them elsewhere (for example, sending kids to the neighbor house when neighbours are eating).
d) Most common households can attempt to manage the shortfall by rationing the available to the household (cutting certain household members) over others, or skipping whole days without eating (Maxwell and Caldwell, 2008).

These are usually reversible strategies that do not generally damage long-term livelihood prospects should a food shortage materialize; households may sell off non-productive assets. This could threaten future livelihood stability or prospects. The sale of productive assets typically follows if the crisis endures or deepens (Maxwell and Caldwell, 2008). These are erosive strategies that are not as easily reversed. The most extreme strategies include dissolving a household or migration (Maxwell and Caldwell, 2008).

The various variables which influenced food security at household level are represented in the empirical framework below with the rectangles marked (a), (b), (c) and (d) respectively. The combinations of all these variables determine the status of the household indicated in box (e) which could be secured or insecured with regard to food security, thus justifying the validity of this study.

The conceptual model to identify the potential variables which influence household food security status is shown below in Figure 2.1

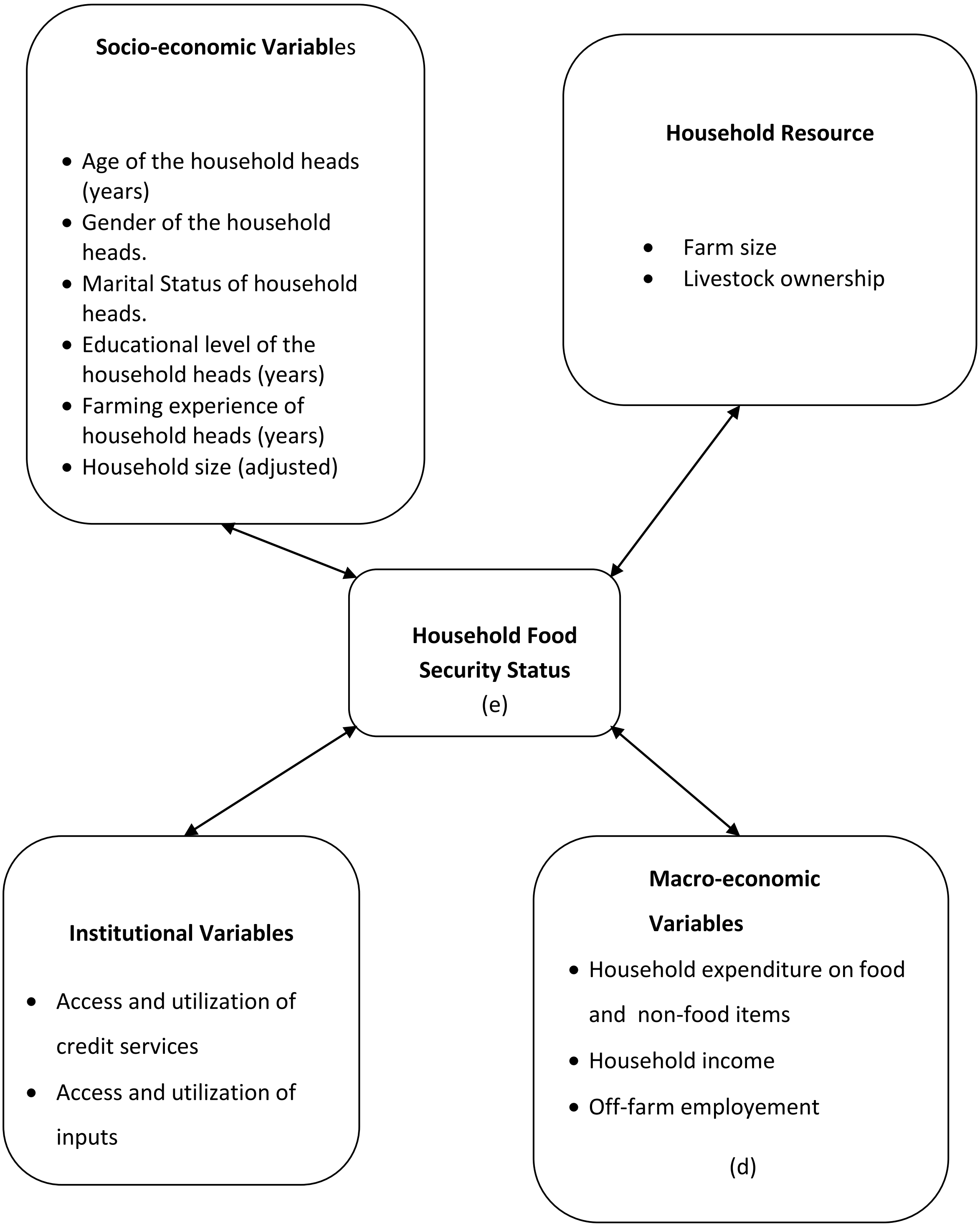

Figure 2.1: The conceptual framework to identify the potential variables which influence household food security status

Source: Meseret (2012)

2.2 Theoretical Framework

Food security is a concept that has evolved during the 1990s far beyond a traditional focus on the supply of food at the national level. This concept has been given general definitions in time past and in recent times, however there has been a divergence of ideas on what food security really means. The committee on world food security defined it as physical and economic access to adequate food by all household members without undue risk of losing the access (FAO, 1996). Access in this respect must not be only by subsistence production but also from the market with consumers having adequate purchasing power to constitute effective demand. This means everyone should at all times have food in quantity and quality, it therefore has spatial and temporal component. For a state to be food secured, residents will have food all year round. It should not only be in calorie terms but also with respect to diversified menu offering carbohydrates, fat and oil, proteins, vitamins and minerals (Adeyemo and Zuofa, 2012).

The Food and Agricultural Organization (2006) estimated that about 963 million people will be pushed into hunger or undernourishment in 2009 because of financial and economic crisis. This is a challenge to the agricultural sector, which remains the main source of food production. The aim of any agricultural policy should be: to meet local demand and assist in balancing trade in agricultural products, create employment opportunities in both urban and rural areas and improve efficiency of natural resource management. Food security cannot be achieved in the absence of Agricultural and Rural development.

Food is a necessity for human existence and access to food ensures food security. Over the years problems of food insecurity have been a global issue and ensuring food security by 2020 have been the focus of African leaders for decades (IFPRI, 2004). Inability to attain the state of food security is however not limited to the African continent, United Nations pledges to eradicate extreme hunger and poverty by 2015 (UNDP, 2000). Food security exists when all people, at all times, have physical and economic access to sufficient, safe, nutritious and culturally adequate food to meet their dietary needs for active and healthy life (FAO, 2002). This rests on the premise that food security depends on availability, accessibility, adequacy and acceptability of food.

Food insecurity thus means not being food secure and it could be a chronic or transitory problem. In chronic food insecurity, there is a continuous inadequate diet and nutrition caused by households inability to acquire food either by purchase or own production. On the other hand, transitory food insecurity results from a temporary decline in household income or a combination of factors such as seasonal fluctuations in food availability, food prices and income, which themselves may result in seasonal fluctuations in individual nutritional status. A household that cannot cope with seasonality in this way may be thought of as fragile, while a household that cope with such periodic crises is more resilient (Agboola *et al.*, 2004).

The United Nations (2007) define food security as people having at all times, 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. Hence food security encompasses availability, accessibility, consumer safety and preferences and biological utilization and stability of all the factors. At the household level, food security implies an adequate access to food over time. This is possible when there is adequate food availability to the household, and an adequate income capacity for the purchase of the available food. Stability of food implies that the food availability is not affected by any shocks or risks affecting food production at all times. Food security, by definition, is not simply about availability of food, it also entails accessibility, that is, the ability of individuals or a nation to acquire food on a sustainable basis. Food security is also about the reliability and distribution of food. The former relates to utilization and consumption of safe and nutritious food, while the latter relates to the equitable provision of food to points of demand at the right time and place. The concept of food insecurity includes not only the lack of availability, access, and utilization or use of food (for example, food preparation and intra-household food distribution), but also perceptions (for example, that food is insufficient, inadequate, unacceptable, uncertain, or unsustainable) (Wolfe and Frongillo, 2001).

Food insecurity as experienced in other locations is likely to be somewhat different but will include similar components that go beyond availability and access. Food security affects dietary intake and ultimately, nutritional status and physical well-being. Although measures of dietary intake of individuals can assess some aspects of food insecurity, such as caloric insufficiency and nutrient inadequacy, they do not assess the cognitive and affective components of uncertainty (expressed as anxiety), unacceptability, or un-sustainability. For example, current intake may be adequate, but food security may still be experienced because of concern over future intake. Alternatively, intake may be inadequate, but only temporarily to protect supplies and prevent future food insecurity (Wolfe and Frongillo, 2001).

2. 3 Socio-Economic Characteristics of Farmers

Socio-economic characteristics play significant role in the farmers' life in the sense that they influence willingness to accept changes which contributed significantly in raising farm productivity and ultimately their standard of living. Some of the most commonly used socio-economic variables includes age, sex, marital status, level of education, household size, farm size, farming experience, land acquisition, labour, access to credit facilities, membership of co-operative, extension contact and other estimated economic variables like income, output and standard of living.

Muhammed-Lawal *et al*. (2009), reported that 82.73% of the youth in agriculture are male. Ayoade *et al*. (2011) in their study on "Impact of the National Special Programme for Food Security (NSPF) on Poverty Alleviation among women " revealed that most of the participants (71.08%) had between 1-5 people in each of their households and 28.91% had between 6-10 people, while 25.51% of the non-participants had between 1-5 people in each of their households, 69.10% had between 6-10 people in their households and 5.4% had between 11-15 people. They also showed that all the respondents reported increase in their farm size, output and income. This implies that the participants' involvement in NSPFS has enabled them to expand their farm size as well as increase their output and income. An increase in level of participation decreases the intensity of poverty more than its probability was also indicated in their study.

Oruche *et al*. (2012) in their study of "Impact of the National Special Programme for Food Security on Livestock Farmers" showed that sources of income of the farmers were predominantly from personal savings which was common to both participants and non-participants. Cooperatives and banks recorded low percentages with 0.8 and 10 percent respectively. This could simply be due to low income earning of the farmers, inability of meeting the demands of the banks such as provision of collateral or could also be due to the high interest rate.

2.4 Food Security Status in Nigeria

Since 1960, Nigerian government has been striving to be one of the food secured nations, but instead of coming closer, it is observed to be going backward. The food self-sufficiency ratio fell from 98% in early 1960s to less than 54% in 1986. In 1990, 18% of the population (14.4 million) was estimated to be critically food insecured and increased to 36% (32.7 million) in 1992 and 40.7% in 1996 (Babatunde and Oyatoye, 2005). The country food insecurity status keeps increasing and recent estimates put the number of hungry people in Nigeria at over 53 million, just less than 30 percent of the country's total population of roughly 160 million (Azubuike, 2008).

In the 1960s the country relied on agriculture to provide infrastructure and run service until the end of the first republic through the military regime of 1976. In the 1960s the country was self-food sufficient to the extent that crop seedlings were exported to other countries. She was the largest producer and exporter of groundnut and palm oil to a country like Malaysia, the second largest exporter of cocoa after Ghana; and the largest exporter of cotton in West Africa (Nigeria Elite Forum, 2012). Her current status of food security may not be unconnected with the consequence of a very long neglect of agriculture.

The Global food security index which evaluates a country's ability to feed its people on the basis of the key determinants of food security – affordability, availability and quality in 2011, has however ranked Nigeria as the 80th food secured nation out of 105 countries studied. About 65% of Nigerians are food insecure (i.e do not have sufficient access to the amount and variety of food for a healthy and productive life); 64% of its population is reported as living below the international poverty line of $1.25 per day (UNICEF, 2010); about 40% of children under five years of age are stunted; 9% are wasting and 25% are underweight, owing to widespread deficiencies in Vitamin A, Iron and Iodine and general poor food lifestyle (Abubakar, 2010).

Further evidence of food insecurity and high rate of hunger in Nigeria is revealed by high rate of children undernourished (27.00 percent) in 2003-2009; under 5 mortality rate per 1,000 live births was 155, 151, 147, 143 in 2007, 2008, 2009 and 2010 respectively (UNICEF, 2010) owing to nutritional deficiencies and illnesses particularly malaria, diarrhea diseases, acute respiratory infections and vaccines preventable diseases (Bryce *et al.,* 2005). Calorie supply per capita in Nigeria stood as low as 2,741 in 2007 (FAO, 2011). Between 2005 and 2007, about 6.00% of Nigerians were undernourished and net receipts of cereals as food aid dramatically rose to 3,500 tonnes between 2004 and 2006 (FAO, 2011).

Result from the Global Hunger Index (GHI) which based its computation on calculated average (in percentage) of the proportion of the undernourished as a percentage of the population, the prevalence of underweight children under the age of five and the mortality rate of children under the age of five report shows a kind of improvement in government efforts at fighting hunger in Nigeria. GHI for Nigeria was 24.1 percent in 1990 and 21.2 percent in 1996 showing an alarming hunger situation of 20 per cent in

1999 (GHI/IFPRI, 2011). Nigeria was ranked 20th out of 42 African countries studied on the 2006 Global Hunger Index (GHI); 46th out of the 84 developing countries captured globally for the study in 2009 (Abubakar, 2010) but fell to 15.5 percent (serious hunger situation) out of the total of 122 developing countries and countries in transition analyzed in 2011 (GHI/IFPRI, 2011), thus contributed 5.7 percent of hunger problems in the world.

Nigeria is also one of the largest importers of food in the world (NIALS, 2011), spending over $10 billion annually importing wheat, rice, sugar and fish. Imported food products include wheat (N165 billion), fish (N105 billion), rice (N75 billion), and sugar (N60 billion). This is an evidence implying that the country is yet to be food self-sufficient capable of undermining food security. This implies that, Nigeria merely produces about 50 percent of these food items and the rest are supplemented by food importation.

2.5 Determinants of Food Security

The socio-economic characteristics and resources of individual households have been identified as basic factors' influencing the food security status of households *(*Sanusi *et al.*, 2006). International Fund for Agricultural Development (2007) identifies four levels of food security determinant. These are: the ability to improve and maintain the level of acquirement; the ability to cope with shocks to acquirement; the ability to improve and maintain the level of utilization, and the ability to cope with shocks of utilization.

Falake, *et al.* (2003), who in their study on the determinants of food security in Southern Ethiopia using logit regression model, found that technology adoption, farming system, farm size, land quality, household size, per capita aggregate production and access to market are the major factors that have significant impact in determining household food security. Makinde (2000) also employed logit regression model in a study of food security in Bauchi area of the northern guinea savannah of Nigeria. The study showed that initial wealth of the household which was estimated by the size of livestock measured in tropical livestock unit; family size, household income and farm size were the major factors affecting household food security.

Omotesho *et al.* (2006) in their study among rural households in Kwara State using logit regression model, revealed that farm size of the households, gross farm income, total nonfarm income and household size are the significant determinants of rural household food security in the study area. Babatunde *et al.* (2007) in their study among rural farming households in Kwara State of Nigeria using logit regression model found out that household income, household size, educational status of household's head and quantity of food obtained from own production are the determinants of food security status of farming households in the study area. Kidane *et al,* (2005) identified household size, education and farmland size and land quality as determinants of food security status of a household. Educational attainment by the household head could lead to awareness of the possible advantages of modernizing agriculture by means of technological inputs, engage them in diversification of household incomes which, in turn, would enhance household's food supply. Amaza *et al.* (2006) noted that the major determinants of food insecurity are: household size, gender, educational level, farm size and types of household farm enterprise. They concluded that policy measures towards the provision of better family planning should be given adequate attention and priority by the government in addition to improving access to education, credit facilities and agricultural extension services for rural households.

Babatunde *et al.* (2007) noted that household income, household size, education status of the household head and quantity of food obtained from own production determined the food security status of farming households in North Central Nigeria. They concluded that socio-economic variables of the households are important determinants of their food security or insecurity status. Robert *et al.* (2013) posited that the factors that affect household food security in various developing countries especially in Africa have been documented in some literature and these factors or determinants are marital status, household size, farm size, off-farm income and credit access and these factors are most often than not location-specific i.e. different study areas were found to have variant attributes as food security determinants with some attributes recurring.

The study conducted by Oluyole *et al.* (2009) using probit model found out that sex of household head, educational level, age and income have positive influence on food security; whereas, household size has negative influence on household food security. However, study by Sikwela (2008) in South Africa using binary logit model showed that per aggregate production, fertilizer application, cattle ownership and access to irrigation have positive effect on household food security; whereas, farm size and household size have negative effect on household food security. The study by Tilaye (2004) in Ethiopia using binary logit model indicated that farmland size, small ruminant holding and oxen holding affect household food security positively; whereas, family size has negative effect on it. Alem (2007) in a study of food security using Household food balance model and discriminate analysis showed that family size, low annual production, small farm size, attitude on food aid,and poor wealth status significantly affect food security status. On the other hand, Fekadu (2008) using multivariate logistic regression analysis indicated that age household heads, labour and market accessibility have shown significant and negative effect on food security; whereas, cultivable land size, fertilizer utilization, engagement in rain water harvesting have shown significant and positive effect on food security.

The study conducted by Bogale and Shimelis (2009) using binary logit model revealed that age of the household head, cultivated land size, livestock ownership, total income of the household, irrigation and amount of credit received have negative and significant effect on household food insecurity; on the other hand, family size has positive and significant effect. Similarly, Beyene and Muche (2010) using binary logit model showed that age of the household head, size of land cultivated, use of fertilizer, livestock ownership, soil and water conservation practices and oxen ownership have positive and significant relationship with household food security; whereas, education of household head, household size and off-farm/non-farm income have a negative and significant influence on household food security.

According to studies conducted in Ethiopia, ownership of livestock, farmland size, family labor, off-farm income, market access, use of improved technology, education, health, amount of rainfall and distribution, crop diseases, number of livestock and family size are identified as major determinants of household food security (Bedeke, 2012; Eden *et al.* 2009; Regassa, 2011).

The study by Gebre (2012) using binary logit model indicated that household size and age of the household head have positive and significant effect on household food insecurity; whereas, educational status of the household head, assets possession, credit access and access to employment have negative effect. According to the study conducted by Hussein and Janekarnkij (2013) in Jigjiga District of Ethiopia, use of fertilizer by farming households, total household income, access to veterinary services and access to extension services was found to have a positive and significant impact on household food security; whereas, the agro-ecology stratum in which the household's farmland was located was found to have a negative and statistically significant impact on food security. On the other hand, the studies of Kahsay and Mulugeta (2014) using multiple linear regression indicated that age of the household head, use of improved seed and adult equivalent have negative effect and statistically significant factor for calorie intake; whereas, land size in hectare and number of livestock positively affect calorie intake of households.

2.6 Measurement of Food Security

The measurement of food security, an important dimension of well-being has been approached by diverse methodologies by different researchers. As a matter of fact, no single method has been agreed on by researchers; however, they all seem to have similar objectives. According to Hoddinott and Yohannes (2002), the various methods of food security measures seek to address one or all of the following: identify the food insecure; characterize the nature of their insecurity; monitor changes in their circumstances and assess the impact of interventions.

Two objective methods of food security measurement have been widely used in most food security studies. One is to estimate gross household production and purchases overtime, estimate the growth or depletion of food stocks held over that period of time. The other method is to undertake food consumption recall for individual members of a household or for the household as a whole and analyze each type of food mentioned for calorie content. The food security line was the recommended daily per capita calorie intake of 2260 kilo-calorie (Omotesho, 2006).

A number of methods have been used to gain an understanding of food insecurity and to apply this understanding to development of measures. These include: ethnography, rapid rural appraisal, bean-ranking, coping strategies and food-economy approach. Measurement matters for at least three primary reasons (Barrett, 2010). First, each measure captures and neglects different aspect of food security, thereby influencing prioritization of food security interventions subtly. Second, observational data reports on the past but an ideal food security indicator would reflect the forward-looking time series of probabilities of satisfying the access criteria. However, there has been little success in developing forecasting indicators. Thus, national-level measure inherently only address national-scale food availability shortfalls. There is need for the development of cross-nationally comparable, longitudinal monitoring and analysis at the household and individual level (Barrett, 2010).

The five methods used to measure varying aspects of hunger and malnutrition are described below;

(1) FAO methodology for estimating the prevalence of undernourishment.

(2) The use of household expenditure survey for the assessment of food insecurity.

(3) Individual food intake survey methods.

(4) Measures of nutritional status from anthropometric survey data.

(5) Qualitative measures of food insecurity and hunger.

One of the most crucial points regarding the alternative methods of measuring hunger and malnutrition is that the methods should be seen as complementary, not competing, approaches to capturing various aspects of a multidimensional concept i.e FAO method. The most commonly cited food insecurity indicator is "undernourishment" estimates generated by FAO (Barrett, 2010). FAO uses this indicator to document global and national food security status. It is also importantly used to track progress on the first Millennium Development Goal related to hunger.

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

A central question is whether adequacy of dietary food energy intake and changes in this can actually be measured. Three of the methods outlined previously focus on this as their central concern: the FAO method, household income and expenditure surveys, and individual food intake surveys. The FAO methodology is concerned with the correlation between energy intake and need but has adopted a “cut-off” approach. The issue is that until food availability is restricted, intake will tend to meet requirement, and taking account of this must be at the individual level, for which there are virtually no data.

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

Determining expenditure is fundamental in identifying the consumption patterns of the poor (NBS, 2012). Expenditure on food depends on many other parameters including change in food prices and location. Household expenditure aggregates is commonly expressed in terms of per capita expenditure or the household expenditure divided by the household size (NBS, 2012). Basic food security analyses are possible through the use of an appropriate strategy for calculating quantities of food acquired by households, given time constraints, financial constraints and the nature of the population’s diet. This method will be adopted for this study because food security analyses are possible through the use of an appropriate strategy.

In this section, different methods of food security measures have been reviewed with their strength and weaknesses.

Dietary Diversity: This method of food security measure uses the number of different food or food groups consumed over a given reference period as an indicator security under a variety of circumstances, including poor and middle-income countries, rural and urban areas and across seasons (Hoddinott and Yohannes, 2002). It is a qualitative measure of food consumption that reflects household access to variety of foods and is also a proxy for nutrient adequacy of the diets of individuals (Kenedy, *et al*, 2010). According to Hoddinott and Yohannes (2002), its strength is that respondents find the question straight forward and non-demanding on time or recall to answer. Also, its instrumentation represents a rapid, user friendly, and easily administered, low-cost assessment tool (Kenedy, *et al*, 2010). Dietary diversity measure of food security reflects nutrient adequacy and the economic ability of a household to access a variety of food in fact, it has been reported that there is a direct relationship between dietary diversity score and nutrient adequacy (Kenedy, *et al*, 2010).

Cost of Calories (COC): In this method of food security measure; the cost of buying the minimum calories intake is used to establish a food security line which is used to classify respondents as food secure or food insecure (Amaza *et al.*, 2006), According to Ojogho (2010), it satisfies the monotonicity axiom, focus axiom, symmetry axiom, transitivity axiom and decomposability by population sub-group.

Caloric Intake Estimation: In this method, according to Orewa and Iyangbe (2010), questions on food consumed the previous day and the day after on information such as the types of food and the quantity consumed per meal day are asked. The data gathered from such information are then used. The calorific content in each food item consumed are then used in estimating the proportion in the total food intake. The complexity of this method of measure makes it a little difficult in usage.

Food Security Index (FSI): This way of measuring food security involves the construction of a food security index. In studies like Omotesho *et al*. (2006), the construction of the index involves two steps. The first one is identification which is the process of defining the minimum level of nutrition necessary to maintain healthy living.

This is the food security line. The second step is aggregation which derives food security statistics for the household as observed, using the method of Food security Index also incorporates the use of daily calories consumption. The following equation is used for estimating the food security index.

$$\textit{Food Security Index} = \frac{\textit{Household per capita calorie availability}}{\textit{Household's daily per capita calorie requirement}}$$

Other Methods: There are other methods that have been used to measure food security. Nanama and Souli (2007) did comparism between the Months of Adequate Household Food Provisioning (MAHFP) and FANTA/Cornell method a joint design of the Food and Nutrition Technical Assistance (FANTA) and the Cornell University Division of Nutritional Sciences. The MAHFP was developed in the late 90's as a tool for identifying vulnerable groups and measuring the impacts of a project on increasing or decreasing the number of people classified in the most vulnerable groups. FANTA/Cornell, a questionnaire based method was also used for the same project. Nanama and Souli (2007) reviewed that even though the FANTA/Cornell method provides a more structured systematic mechanism for learning about the quantitative and qualitative aspects of food security it has a setback in that it is brazed and elicit information from the household heads (most times males) which often are not fully aware of the survival strategies adopted. One advantage of the FANTA/Cornell method again is that it has the capacity to highlight the special needs and concerns of the most severely food insecure group. The major weakness of the MAHFP is that as it requires women to estimate the quantity of food intake, there was no uniformity in the unit of measurements which brought a major bias.

Head Count Method is another method of food security measures that have been used. It measures the percentage of the households that are food insecure. When calculated, it provides an index called the food insecurity index that is obtained by estimating the percentage of the food insecure households under study (Idrisa, *et al.*, 2008). When used along with the food insecurity gap (FIG), the depth of food insecurity could be measuring food deprivation and is based on a comparism of energy requirement norms with usual food consumption and is expressed in terms of dietary energy. One of the ways it is measured is the use of the Body Mass Index (BMI) which is used to determine the height to weight relationship. It is assumed that the underweighted individuals are food insecure. The BMI is the ratio of weight (Kg) to Height (square meters) those with BMI> 18.5 are considered to have adequate energy reserves (Idrisa *et al*., 2008).

2.7 Pillars of Food Security

The World Bank (2001) identified three pillars underpinning food security; these are food availability, food accessibility, and food utilization. This infers from the concept that food security is not just a production issue. Food availability for the farm household means ensuring sufficient food is available for them through own production. However, due to lack of adequate storage facilities and pressing needs, they mostly end up selling excess produce during the harvesting period, and sometime rely on market purchases during the off/hungry season. Food access means reducing poverty. Simply making food available is not enough; one must also be able to purchase it, especially the low-income households. Food access had three components: (1) Physical access to food; (2) Economic access to food; and (3) Sustainable access to food. Physical access implies food availability or food supply to the household, as there might be food availability at the national level which, however, may not trickle down to the household level (Oluwatayo, 2009).

One of the major problems confronting mankind in recent times is food crisis. The sustainable production of food especially arable crops and poultry is the pillar of food security for both the family and the nation. Every household is supposed to be food secured. That is a condition in which all its members have access to adequate and sufficient food (FAO, 1996). Food security implies assuring availability and access to sufficient quantities of food for all, including the poor. Food security has been defined as a situation when all people, at all times, have physical and economic access to sufficient, safe and nutritious food needed to maintain a healthy and active life (FAO, 1996). This definition implies that food security is a broad concept that is more than food production and food accessibilit (Gross *et. al*., 1999). The concept of food security is generally accepted as entailing not only food availability through domestic production, storage or trade but also and perhaps more importantly food access through home production, purchase in the market or food transfers. On the other hand, food insecurity can be permanent or temporary (Ogunsumi and Ogbosuka, 2009).

The level of food security is, therefore, one of the indicators of the level of development. Thus, it is imperative to group the level of world economic development into high, medium, and low-income food-deficit countries (Oyakhilome 1996). More than two-thirds of Nigerian people are poor, despite living in a country with vast potential wealth. Food security for a household means access by all members at all times to enough food for an active healthy life. Food security includes minimum and safe foods; and an assured ability to acquire acceptable foods in socially acceptable ways (i.e. without resorting to emergency food supplies, scavenging, stealing or other coping strategies).

Apart from food production, which a large proportion of the Nigerian populace is involved in, accessibility does not therefore guarantee that all people, especially the poor, will have access to the minimum nutrition requirement because of existing regional, economic and social inequalities (FAO, 2003). Food insecurity disproportionately affects rural people particularly rural women, minorities and children (Ayantoye *et al.*, 2011). Rural people face a high risk of food insecurity due to poverty, income inadequacies, limited access to resources, underemployment, and unemployment, and many barriers to self-sufficiency, which create family frailty and crisis (Ayantoye *et al*., 2011). In 2009, the World Summit on Food Security stated that the "four pillars of food security are availability, access, utilization, and stability" (Gregory *et al.*, 2005).

2.7.1 Availability

Food availability relates to the supply of food through production, distribution, and exchange. Food production is determined by a variety of factors including; soil management; crop selection, breeding, and management; livestock breeding and land ownership management; and harvesting. Crop production can be impacted by changes in rainfall and temperatures. The use of land, water, and energy to grow food often compete with other uses, which can affect food production (Godfray *et al*., 2010). Land used for agriculture can be used for urbanization or lost to desertification, salinization, and soil erosion due to unsustainable agricultural practices. Crop production is not required for a country to achieve food security. Nations don't have to have the natural resources required to produce crops in order to achieve food security, as seen in the examples of Japan and Singapore (Tweeten, 1999).

Because food consumers outnumber producers in every country, food must be distributed to different regions or nations. Food distribution involves the storage, processing, transport, packaging, and marketing of food. Food-chain infrastructure and storage technologies on farms can also impact the amount of food wasted in the distribution process. According to Godfray *et al*., (2010), poor transport infrastructure can increase the price of supplying water and fertilizer as well as the price of moving food to national and global markets. Around the world, few individuals or households are continuously self-reliant for food. This creates the need for a bartering, exchange, or cash economy to acquire food. The exchange of food requires efficient trading systems and market institutions, which can have an impact on food security. Per capita world food supplies are more than adequate to provide food security to all, and thus food accessibility is a greater barrier to achieving food security (Tweeten, 1999).

2.7.2 Access

Food access refers to the affordability and allocation of food, as well as the preferences of individuals and households (Gregory *et al.*, 2005). The UN Committee on Economic, Social, and Cultural Rights noted that the causes of hunger and malnutrition are often not a scarcity of food but an inability to access available food, usually due to poverty. Poverty can limit access to food, and can also increase how vulnerable an individual or household is to food price spikes. Access depends on whether the household has enough income to purchase food at prevailing prices or has sufficient land and other resources to grow its own food. Households with enough resources can overcome unstable harvests and local food shortages and maintain their access to food (Ecker and Breisinger, 2012).

There are two distinct types of access to food: direct access, in which a household produces food using human and material resources, and economic access, in which a household purchases food produced elsewhere. Location can affect access to food and which type of access a family will rely on. The assets of a household, including income, land, products of labor, inheritances, and gifts can determine a household's access to food. However, the ability to access to sufficient food may not lead to the purchase of food over other materials and services (Garrett and Ruel, 1999). Demographics and education levels of members of the household as well as the gender of the household head determine the preferences of the household, which influences the type of food that are purchased. A household's access to enough and nutritious food may not assure adequate food intake of all household members, as intra-household food allocation may not sufficiently meet the requirements of each member of the household. The USDA adds that access to food must be available in socially acceptable ways, without, for example, resorting to emergency food supplies, scavenging, stealing, or other coping strategies (USDA, 2008).

2.7.3 Utilization

The final pillar of food security is food utilization, which refers to the metabolism of food by individuals. Once food is obtained by a household, a variety of factors impact the quantity and quality of food that reaches members of the household. In order to achieve food security, the food ingested must be safe and must be enough to meet the physiological requirements of each individual. Food safety impacts food utilization, and can be impacted by the preparation, processing, and cooking of food in the community and household. Nutritional values of the household determine food choice. Access to healthcare is another determinant of food utilization, since the health of individuals controls how the food is metabolized. For example, intestinal parasites can take nutrients from the body and decrease food utilization. Sanitation can also decrease the occurrence and spread of diseases that can affect food utilization. Education about nutrition and food preparation can impact food utilization and improve this pillar of food security (Ecker and Breisinger, 2012).

2.7.4 Stability

Food stability refers to the ability to obtain food over time. Food security can be transitory, seasonal, or chronic. In transitory food insecurity, food may be unavailable during certain periods of time. At the food production level, natural disasters and drought result in crop failure and decreased food availability. Civil conflicts can also decrease access to food (Ecker and Breisinger, 2012). Instability in markets resulting in food-price spikes can cause transitory food insecurity. Other factors that can temporarily cause food insecurity are loss of employment or productivity, which can be caused by illness. Seasonal food insecurity can result from the regular pattern of growing seasons in food production (FAO, 1997). According to Ecker and Breisinger (2012), chronic (or permanent) food insecurity is defined as the long-term, persistent lack of adequate food. In this case, households are constantly at risk of being unable to acquire food to meet the needs of all members. Chronic and transitory food insecurity is linked, since the reoccurrence of transitory food security can make households more vulnerable to chronic food insecurity.

2.8 Food Insecurity, Types and Causes in Nigeria

2.8.1 Food insecurity and types in Nigeria

Food insecurity represents lack of access to enough food and can be either chronic or temporary. Food insecurity may be chronic or transitory. In chronic food insecurity, there is continuous inadequate diet and nutrition caused by household's inability to acquire food. It therefore afflicts households that persistently lack the ability to either buy food or produce their own. On the other hand, transitory food insecurity results from a temporary decline in household access to food due mainly to instability in food prices, production, household income or a combination of these factors.

In Africa, food insecurity remains a fundamental challenge and both cases of food insecurity abound and often exist together and jointly, predisposing affected individuals to disease and reduced vigour, vitality and strength needed for physical tasks. The issue of food security is of high importance to Nigeria because; with an arable land area of 71.2 million hectares but with less than 34 million hectares under cultivation (FAO, 2005). She is among the countries in sub-saharan Africa experiencing significant food shortages and over 40 percent of the country's population is estimated to be critically food insecure (Idachaba, 2004).

2.8.2 Causes of food insecurity in Nigeria

Food insecurity exists when people are undernourished as a result of the physical unavailability of food, their lack of social or economic access to adequate food. Food insecure people are those whose food intake falls below their minimum energy requirements as well as those who exhibit physical symptoms caused by energy and nutrient deficiencies resulting from an inadequate or unbalanced diet or from the body's inability to use food effectively because of infection or disease.

According to FAO (2010) food insecurity refers to the consequences of inadequate consumption of nutritious food, considering the physiological use of food by the body as being within the domain of nutrition and health. Malnourishment also leads to poor health; hence individuals fail to provide for their families. If left unaddressed, hunger sets in motion an array of outcomes that perpetuate malnutrition, reduce ability of adults to work and to give birth to healthy children and erode children's ability to learn and lead productive healthy and happy lives. This truncation of human development undermines a country's potential for economic development for generations to come.

Famine and hunger are both rooted in food insecurity. Food insecurity can be categorized as either chronic or transitory. Chronic food insecurity translates into high degree of vulnerability to famine and hunger, ensuring food security presupposes the elimination of that vulnerability. Chronic insecurity is similar to undernourishment and is related to poverty existing mainly in poor countries. No problem can be solved unless its causes are known: therefore, knowing the causes of food insecurity will help us to locate the solutions. Discussing the causes of food insecurity in Nigeria is a very difficult task; this is because most Nigerians develop apathy towards locally produced food and prefer imported food which they consider as superior to domestically produced ones. The emergence of oil sector and the substantial revenue accruing from the sector shifted emphasis from agriculture to the extent that even domestic food production is not given the requirement. The government felt that it was better to import food than to embark on local production, especially when oil money has changed the tastes of most Nigeria in favour of foreign/imported goods (FAO, 2010). The above reasons notwithstanding, the causes of food insecurity in Nigeria can be discussed under the following headings:

(a) Gender inequality

Gender inequality is a major cause of hunger and poverty. Food security can be a major concern for people who are incapable of or denied access to participation in labour – formal, informal or agricultural. In 2009, the UN estimated that 60 percent of the world's chronically hungry people are women and girls, 98% of which live in developing nations, when women have income, substantial evidence indicates that the income is more likely to be spent on food and children's needs. Women are generally responsible for food selection and preparation and the care and feeding of children. Women play many roles in land use, production, distribution, processing, marketing accessing, trading and food availability. They often work as unpaid and self – employed workers on and off farm employees, entrepreneurs, traders, providers of services and caretakers of children and elderly. Women farmers represent more than a quarter of the world population, comprising an average 43 percent of the agricultural workforces, ranging from 20 percent in Latin America to 50 percent in Asia and sub-Saharan Africa (FAO, 2010).

However, women have less access than men to agricultural assets, inputs and service. Analysts suggest that if women have the same access to productive resources as men, women would have boost yield by 20 – 30 percent, raising the overall agricultural output in developing countries by two and half to four percent. This gain in production could lessen the number of hungry people in the world. Reducing gender inequality and recognizing the contribution of women to agriculture is critical to achieving both global and national food security, there is consistent and compelling evidence that when the status of women is improved, agricultural productivity increases, poverty is reduced and nutrition improves (FAO, 2010).

(b) Poverty and hunger

Poverty and hunger prevent people from working hard to increase productivity. Food and agricultural productivity is both capital and labour intensive. Unfortunately, it is the poor peasant farmers that produce the bulk of food needs in Nigeria, due to their level of poverty, they find it very difficult to learn, work and care for themselves and their family members, let alone getting the necessary inputs and energy to produce for others. Apart from the inconsistency in policies most of these policies are neo-liberal which work against the interest of the domestic economy such as the devaluation of naira which made the importation of farm inputs very difficult and out of the reach of peasant farmers(Victoria and Benjamin,2012).

(c) Conflicts

The ethnic or religious conflict have devastating effects on the economic activities especially food production in the areas that they take place. Conflicts here do not necessarily mean physical fighting of wars. It means a disarticulated country or society that is experiencing structural violence without official declaration of war such as pervasive poverty, oppression of the poor by the rich, police brutality, intimidation of ordinary people by those in power, oppression of women and children and monopolization of resources and power by some sections of the society. It will be wrong to say there is peace in such a country like Nigeria where social and political conflicts are threatening the unity of the country. Consequently, it is quite possible not to have peace even when there is no war (Victoria and Benjamin,2012).

(d) Natural Disasters

Frequent climate changes leading to shortage of rainfall and persist drought in Northern part of the country and excessive rainfall and flood in Southern and Middle belt regions of the country contributed immensely to low food production in Nigeria (Victoria and Benjamin,2012)..

(e) **Other factors:**

Other factors such as low level of technology, low agricultural financing and rural -s urban migration pose serious threat to food production in Nigeria (Victoria and Benjamin, 2012).

2.9 Effects of Food Insecurity and Measurement

Famine and hunger are both rooted in food insecurity. Chronic food insecurity translates into a high degree of vulnerability to famine and hunger; ensuring food security presupposes elimination of that vulnerability (FAO, 2012). Food insecurity is measured in the United States by questions in the Census Bureau's Current Population Survey. The questions asked are about anxiety that the household budget is inadequate to buy enough food, inadequacy in the quantity or quality of food eaten by adults and children in the household, and instances of reduced food intake or consequences of reduced food intake for adults and for children. A National Academy of Sciences study commissioned by the USDA criticized this measurement and the relationship of "food security" to hunger, adding "it is not clear whether hunger is appropriately identified as the extreme end of the food security scale" (IFAD, 2012).

The FAO, World Food Programme (WFP), and International Fund for Agricultural Development (IFAD) collaborate to produce The State of Food Insecurity in the World. The 2012 edition described improvements made by the FAO to the prevalence of undernourishment (PoU) indicator that is used to measure rates of food insecurity. New features include revised minimum dietary energy requirements for individual countries, updates to the world population data, and estimates of food losses in retail distribution for each country. Measurements that factor into the indicator include dietary energy supply, food production, food prices, food expenditures, and volatility of the food system. The stages of food insecurity range from food secure situations to full-scale famine (FAO, 2012).

2.10 Rate of Food Insecurity

With its prevalence of undernourishment (PoU) indicator, the FAO reported that almost 870 million people were chronically undernourished in the years 2010-2012. This represents 12.5% of the global population, or 1 in 8 people. Higher rates occur in developing countries, where 852 million people (about 15% of the population) are chronically undernourished. The report noted that Asia and Latin America have achieved reductions in rates of undernourishment that put these regions on track for achieving the Millennium Development Goal of halving the prevalence of undernourishment by 2015. The UN noted that about 2 billion people do not consume a sufficient amount of vitamins and minerals. In India, the second-most populous country in the world, 30 million people have been added to the ranks of the hungry since the mid-1990s and 46% of children are underweight (WHO, 2013).

2.11 Coping Strategies to Food Insecurity

The definition by Snel and Staring (2001) captures the broad notion of coping strategies, namely that "all the strategically selected acts that individuals and households in a poor socio-economic position use to restrict their expense or earn some extra income to enable them to pay for the basic necessities (food, clothing, shelter) and not fall too far below their society's level of welfare". The later definition implies that coping strategies involves a conscious assessment of alternative plans of action. This does not necessarily mean that their choice of strategies is always successful in achieving their intended objectives. In fact, the coping strategies often have unintended negative effects.

Ellis (2000) defines coping strategies as the methods used by households to survive when confronted with unanticipated livelihood failure. The strategies pursued by households differ in several aspects, that is, within the household and between households (Maxwell *et al*, 2003). Due to varying degrees of wealth among households, different coping behaviours are adopted by households at different poverty levels. However, some coping strategies are common to all households although the extent to which such strategies enable a household to remain afloat depend on the assets at their disposal (Devereux, 2006). Above all, the general tendency is that the lower the household asset status, the more likely the household would engage in erosive responses such as selling off productive assets such as farm implements (Hoddinot, 2004).

Coping strategies by World Food Programme (WFP) has been used for warning and food security assessment in eight African countries and has proven to be an accurate index of food security (Christiaensen and Boisvert, 2000). The coping strategies provide a quantitative score for each household that is; a cumulative measure of the degree of coping and thus a measure of food insecurity. Coping strategy has been used to monitor household food security in emergencies as well as to assess the impact of various food aids intervention. The coping strategies index measures frequency and severity of household coping strategies for dealing with shortfalls in food supply. The coping strategies index includes three categories which are consumption strategy, livelihood strategy (income and expenditure) and mitigation strategy (Awotide *et al*., 2011).

The determinants of coping ability can be classified as follows: determinants that reduce fluctuations in income which is the degree of diversification of a household's livelihood strategy or, in other words, the way in which households members allocate their time in pursuit of various means of earning a living (Obayelu and Obayelu, 2012). Poor rural household seldom allocates the entire labour time of all their members to single pursuit. The harsh experience of life has taught these people not to put all their "eggs in one basket". Diversification is an essential feature of their livelihood strategy. However, the degree of diversification differs from one household to another depending on household resource constraints and the constraints opportunity presented by the external environment. In general, the greater the degree of diversification, the greater the ability to cope with temporary shock to acquirement. For example, in a situation of crop failure, the shocks to the household's income can be absorbed at least in a portion of the households labour time which is engaged in an activity other than agriculture, such as job in the public sector; or in a situation of failing food crops, the income shock will be minimal if part of the labour time has been devoted to the production of cash crops (Obayelu and Obayelu, 2012).

The second category, namely, the scope for consumption – smoothing, refers to the ability of households to maintain the normal level of food consumption in the face of an income shock. A fundamental element in this category is the household's asset base. A household with several assets can effectively maintain its consumption level by disposing of some of the assets (FAO, 2003). The most commonly practiced coping strategies during abnormal season include short term dietary change; changing intra household food distribution like skipping adults to feed children, limiting size and frequency of food, borrowing and gifts from relative and friends, mutual support mechanism, selling of livestock and fire wood, cash for work and relief assistance, etc while the commonly used adaptive strategies include risk minimization, food and income diversification mechanism, planting climate resistance crop, cultivating marginal soils etc. (Birara *et al.*, 2015).

Coping mechanisms used by farm households in rural areas include livestock sales, agricultural employment and certain types of off-farm employment and migration to other areas, requesting grain loans, sale of wood or charcoal, small scale trading, selling cow dung and crop residues, reduction of food consumption, consumption of meat from their livestock, consumption of wild plants, reliance on relief assistance, relying on remittance from relatives, selling of clothes and dismantling of parts of their house for sale. Some of them are likely to be implemented only after the possibilities of certain other options have been pursued. In addition, households who have diversified source of income are often able to cope with crisis than others as cited in Frehiwot (2007).

Coping strategies practiced by food insecure households are different depending on the degree of food shortage. Coping strategies practiced at the moderate stage to food shortage include, sale small ruminants and buy grain, sale fire wood and buy grain, engage in wage labor, cultivate and sale vegetable crops, sale chicken and eggs and buy grain, engage in petty trading, sale oxen/cows and buy grain, sale wool and buy grain, reduce the number, amount and type of meals and borrow some money or grain from acquaintances (relatives, neighbors); whereas, eat wild foods, sale property, eat crops reserved for seed, borrow some money or grain from acquaintances (relatives, neighbor), request for food aid, reduce the number of meals, go hungry for up to two days, sale cattle, move to other places in search of temporary employment, migrate to other area permanently and temporarily were practiced at the severe stage (Tilaye, 2004).

Farm households respond to the problems caused by seasonal and disaster related food insecurity in different ways. Food availability can be affected by climatic fluctuations, depletion of soil fertility, or the loss of household productive assets or some other related problems. In that case farmers' try to reduce this problem by taking actions that result in trade-offs between current and future consumption. The range of coping and adaptive strategies is large and differs according to the particular conditions. It includes expansion of production and improving of productivity, food grain purchase through sales of livestock and institutional and societal income transfer systems such as gift and relief food distribution (Frehiwot, 2007). According to Woldeamanuel (2009) the following coping strategies were identified in his study at Rural Gedeo. They are; daily wage labor, firewood gathering and charcoal burning, handicrafts and petty trade.

Household adopt several strategies in an event of severe food shortage to manage the impact of food insecurity stemming from mild strategy such as eating less preferred food to severe strategies such as skipping meal for a day which sometimes are detrimental to their well being. A review of literature revealed the following; withdrawal of children from school, a decrease in the intake of certain foods, the sale of assets to purchase food, theft, or exchange of sex for food or money (Kyaw, 2009; Salam – Blyther and Hanraham, 2010; Weiser *et al*, 2007; Quaye; 2008; Holmess *et al*, 2009).

Women tend to resort to risky coping strategies, especially when they have low education and economic opportunities (Ivers and Cullen, 2011). To alleviate the negative effects of food insecurity requires the concerted efforts of world leaders to work towards reducing poverty and improving food security situation in the world especially at the household’s level. This requires perfect understanding of the world food situation which will then inform policy.

The conceptual model depicting factors influencing use of coping strategies and their influence on food security are shown below in Figure 2.2:

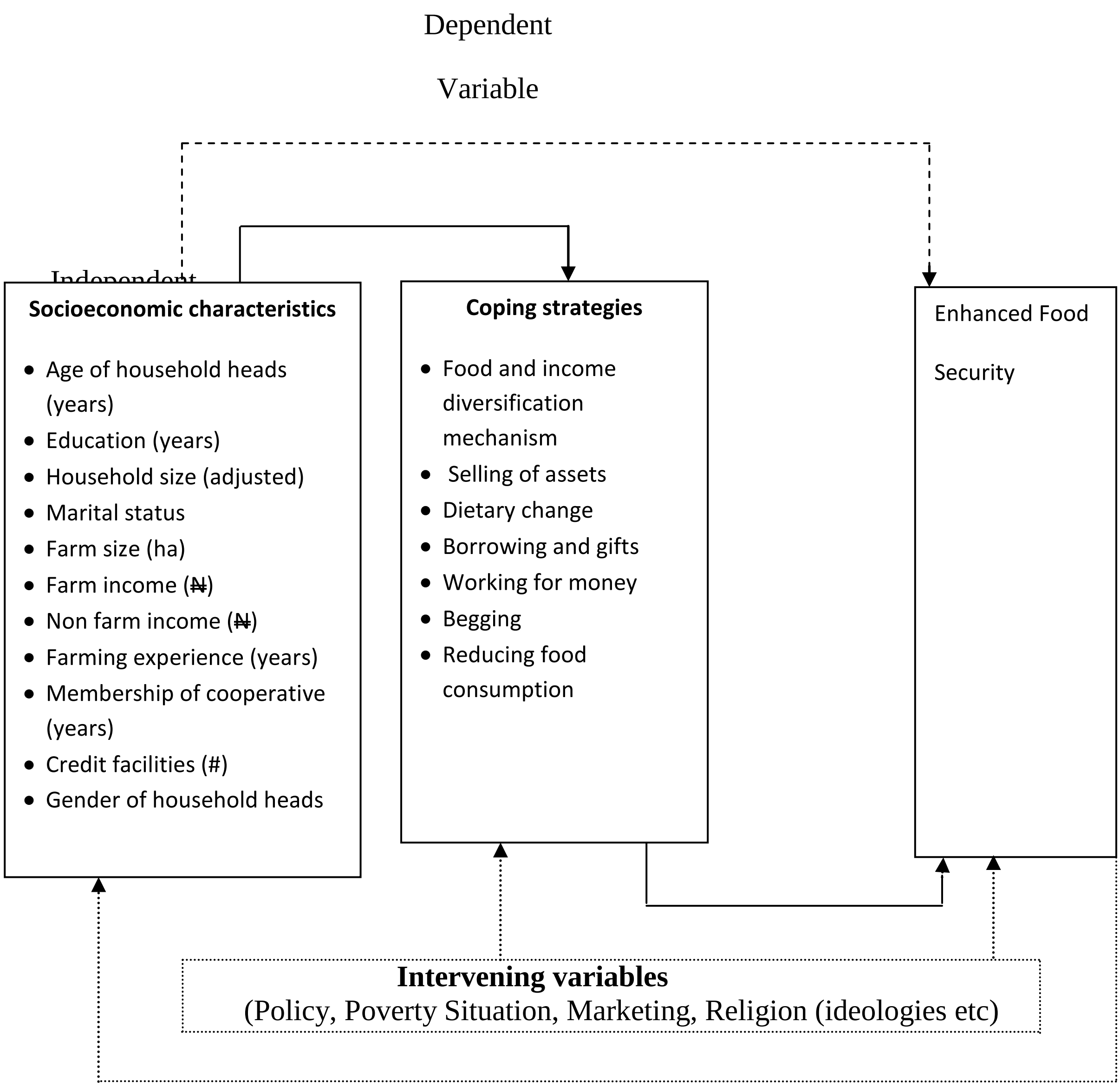

Figure 2.2: Conceptual model depicting factors influencing use of coping strategies and their influence on food security

The dependent variable in Figure 2.2 is the coping strategies while the independent variable is socio-economic characteristics. The coping strategies enhanced food security status of household. The interveining variables such as government policy, poverty situation, marketing and religious ideologies are the variables that cannot be controlled by the households in the study area but may have either positive or negative effect upon the food security status of the household. They modified variables that interfere between coping strategies and food security.

2.12 Analysis of Nigeria Government Intervention against Food Insecurity.

Nigeria government since independent in 1960 had established and launched several policies, programs and projects in order to be self-food sufficient, food reliance and food secure. Some of the major interventions include the establishment of Agricultural Development Project (ADP) in the mid-1970s as Nigeria oil production revenues were on the rise, the project was designed to increase crop production through rural development, its focuses on improved technology, increased supplies of farming inputs, and improvement of infrastructure (Obayelu and Obayelu, 2012).

In 1972 the government embarked on Farm Settlement Scheme and National Accelerated Food Production Programme (NAFPP) launched in Nigeria to make the country self-sufficient and food secured. The River Basin Development Authorities (RBDA) were established in 1975 to undertake the development of ground water resources and maintain dams, dykes, wells or boreholes, irrigation and drainage systems to boost agricultural production. National Seed Service (NSS) has the mandate of producing certified seeds as well as to arrange for seed certification (Obayelu and Obayelu, 2012). Operation Feed the Nation (OFN) was also launched in 1976, to increase local food production and thereby reduce food imports. As part of the programme, Nigerians were encouraged to cultivate empty plot of lands to boost agricultural production.

In 1977, Agricultural Credit Guarantee Scheme (ACGS) was established to provide guarantee loans granted by banks to farmers to boost agricultural production and agro-allied processing. In 1978, the Land Use Act was enacted to remove the bottleneck in land acquisition for intended farmers while in 1979, there was banned in importation of many foods, including fresh milk, vegetable, roots and tubers, fruits, and poultry. Exportation of milk, sugar, flour, and hide and skin were also banned. Green Revolution was launched in 1980 to ensure self-sufficiency in food production and introduce modern technology into the Nigerian agricultural sector. In 1985-87, import of wheat, corn, rice, and vegetable oil were banned to encourage greater attention to the agriculture sector (Obayelu and Obayelu, 2012). In 1986 the Directorate of Food, Road and Rural Infrastructure (DFRRI) was established to influence the performance of agricultural related project in rural areas to boost food production (Obayelu and Obayelu, 2012). The Structural Adjustment Programme (SAP) was established in 1986, it aims at restructuring and diversifying the production base of the economy so as to reduce the over dependency on the oil sector and imports. Also in 1986, government marketing boards were scrapped, and a free market in all agricultural products was established (Obayelu and Obayelu, 2012).

The National Center for Agricultural Mechanization (NCAM), a government parastatal, was set up in 1990 to develop and promote mechanized farming in the country through manufacturing tools, importing machinery and training of farmers. Furthermore, the National Seed Policy (NSP) was established in 1992 to provide guidelines for the development of seed subsector, it seeks to support varietal improvement, testing, registration, release, multiplication of released seed varieties, and improve the quality of seeds sold to farmers. Also established in 1992 was National Agricultural Land Development Authority (NALDA). The agency provided subsidy of up to 67% on mechanized tillage operation and a marginal relief to drudgery inherent in farm operations in the country. Nigeria Agricultural, Cooperative and Rural Development Bank (NACRDB) was established in the year 2000 and it was recently renamed as Bank of Agriculture (BOA) and tasked basically with financing at both the micro and macro levels, it was mandated to meet the funding requirement of Nigerians in the agricultural sector; and to foster increase in food production and subsequently achieve food security (Obayelu and Obayelu, 2012).

National Special Programme for Food Security (NSPFS) was launched in 2001 with the main objective of improving national and household food security and reduce rural poverty in an economically and environmental sustainable way. National Agricultural Development Fund (NADF) was established in 2002 and was tasked to promote agricultural research and development (Obayelu and Obayelu, 2012).

In 2005, Nigeria government was assisted by the World Bank to establish the Fadama project, designed to enhance agricultural production and value addition to small holders and rural entrepreneurs in the states under the Fadama programme. The programme is to provide support for water management systems in low lying flood plains, so that farming can continue in the dry seasons. The project brought about the adoption of simple, low cost irrigation technologies that helped farmers achieve substantial rise in production of horticultural crops. National Food Reserve Agency of Nigeria (NFRA), a parastatal of the Ministry of Agriculture, was established in 2007 to oversee Nigeria's food security strategy. The agency has regional offices in each of the country's six geo-political zones. It aims to store 5% of national food output to ensure supply in the event of a food crisis. It oversees the National Programme for Food Security, promotes the involvement of the private sector in agriculture and facilitates farmers' access to agricultural machinery and feedstock. In September 2008, the Federal Ministry of Agriculture and Water Resources launched a new National Food Security Programme to bring about sustainable access to affordable and high-quality food for all Nigerians (Obayelu and Obayelu, 2012).

The government set aside USD1.3 Billion for the programme, with the short-term objective of raising agricultural productivity by shifting from traditional subsistence farming to commercialized agriculture. Reform of the fertilizer sector to make it more transparent and targeted at farmers has also been launched with the introduction of electronic wallet initiative called fertilizer voucher system. Under the new system, the Federal Government is no longer in the business of buying and distributing fertilizers and seeds: no longer award fertilizer and seed contracts. The system is design to enable farmers receive fertilizer allocation notices through their mobile phones, which is meant to make the commodity easily accessible and to cut off middlemen (Obayelu and Obayelu, 2012).

Other programmes introduced under the Agricultural Transformation Agenda (ATA) of the former President Dr. Goodluck Jonathan in order to provide credit to Nigeria farmers was the Nigeria Incentive-Based Risk Sharing System for Agricultural Lending (NIRSAL) – a joint initiative programme by the Government, Ministry of Agriculture and the CBN to de-risk agricultural financing and mitigate against the impact of natural disasters on losses of agricultural investments by facilitating low-interest credit to farmers through commercial banks and the liberalization of the insurance sector to increase farmers access to cost effective agricultural insurance schemes in the country (Obayelu and Obayelu, 2012).

Government had also make a move to establish marketing corporations to coordinate the production, investments, grades and standards, market price stabilization etc. for all value chains in Nigeria. Other government incentives to support investors in agriculture include: zero percent duty on agricultural machinery and equipment imports: removal of restrictions on areas of investment and maximum equity ownership in investment by foreign investors; removal of currency exchange controls, free transfer of capital, profits, dividends; provision of constitutional guarantees against nationalization/expropriation; provision of pioneer tax holiday for agricultural investments and infrastructure support, with special focus on staple crop processing zones, for power, water and electricity (Akinwumi, 2012). The Federal Government is already implementing nation-wide activities with State Governments to improve the value chains for crops, especially rice, cassava, maize, soybeans, sorghum, cotton, cocoa, oil-palm, fisheries and livestock.

2.13 Food Security and Millennium Development Goals

The first Millennium Development Goal is to eradicate extreme poverty and hunger. The targets here are to halve it between 1990 and 2015, the proportion of people who suffer from extreme hunger and people whose income is less than $1 a day, the achievement of these targets is very important to reducing hunger and poverty. This is because it is believed that hunger perpetuates poverty by reducing productivity and poverty in turns prevents people from producing or acquiring the food they need. Less than 10 years to the target year, available statistics still cast doubt on whether this goal could be achieved by 2015 (FAO, 2005).

According to United Nation Report on Millennium Development Goal (2010), though various interventions have been put in place to improve the lots of the people, improvements, in the lives of the poor have been unacceptably slow, and some hard-won gains are being eroded by the climate, food and economic crises. According to Birara *et al.* (2015), the number of food insecure people in 76 lower income countries will increase by 37 Million (46%) for the next decade (2012 - 2022). Sub-Sahara Africa is projected to have the highest increase (15.1%) in number of food insecure people, though the share of the population that is food insecure is projected to fall from 42%

percent in 2012 to 38 percent in 2022 (Birara *et al.*, 2015). Domestic food performance is expected to play the most critical role in the food security of these countries which depend mainly on local grain supplies.

Additionally, sub-Sahara Africa populations face a number of causes that challenge the struggle against food insecurity. Within the region, progress towards improving human welfare is constrained by the high prevalence of hunger, malnutrition, and wide-spread poverty. Not surprisingly, African countries have collectively made the least progress towards achieving the Millennium Development Goal of reducing hunger by half by 2015. In fact, Africa is the only region in which levels of hunger increased in recent decade and currently, close to one third of its population lives in chronic hunger (Lobell, 2008).

On the whole, these constraints can have deleterious consequences for human development in the region. They also underscore the fact that there are still significant challenges to achieving food security in sub-Sahara Africa. At the same time, these challenges are not insurmountable. Progress towards the goal of food security requires new efforts to develop appropriate interventions for mitigating its causes and consequences for populations at risk. For these efforts to succeed, policy makers need to develop a comprehensive understanding of the causes that results in food security in sub-Saharan Africa in the coming decades. Food is one of the most basic needs for human survival. Access to it is a basic human right. Moreover, the pursuit of the Millennium Development Goal to cut hunger by half by 2015 requires a sound understanding of the related food security issues like definitions, causes, determinants, indicators and the like (Lisa and Ali, 2007).

Food insecurity continues to be a major development problem across the globe, undermining people's health, productivity, and often their very survival. Efforts to overcome the development challenges posed by food insecurity necessarily begin with identifying the causes at household level (Lisa and Ali, 2007). This is due to the fact that identification of household behaviours' relating to food access serves as a critical building block for the development of policies and programs for helping vulnerable populations, the effective targeting of assistance and the evaluation of impact. Thus, understanding the causes of food insecurity is of primary importance in choosing appropriate interventions for addressing it. Hence, the causes are usually far ranging, from unfavourable climatic conditions, economic shocks, political instability, and HIV/AIDS through poverty and unequal distribution of food within households (Lisa and Ali, 2007).

2.14 World Summit on Food Security

The World Summit on Food Security held in Rome in 1996, aimed to renew a global commitment to the fight against hunger. The Food and Agriculture Organization of the United Nations (FAO) called the summit in response to widespread under-nutrition and growing concern about the capacity of agriculture to meet future food needs. The conference produced two key documents, the Rome Declaration on World Food Security and the World Food Summit Plan of Action (FAO, 1996). The Rome Declaration calls for the members of the United Nations to work to halve the number of chronically undernourished people on the Earth by the year 2015. The Plan of Action sets a number of targets for government and non-governmental organizations for achieving food security, at the individual, household, national, regional and global levels (Godfray *et al*., 2010).

2.15 Overview of Food Security in Nigeria

Food security exists when all the people at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and preference for an active and healthy lifestyles. Food security is a critical factor for economic growth and development of a nation, improved food security is important for global reduction of hunger and poverty and for economic development (Birara *et al.,* 2015; Omotesho *et al.,* 2006).

Among the development problems facing Nigeria, food insecurity ranks topmost. Food insecurity is a global phenomenon which threatens the survival of mankind. The trend of food insecurity in Nigeria is worrisome. The proportion of food insecure among Nigerian people was reported to be about 18% in 1996, over 40% in 2005 and over 65% in 2008 (Busayo, 2011). The World Bank Records had about 325 million people in Sub-Saharan African living on less than $ 1 per day; there is a strong belief that more or less, the entire Nigeria farmers are inclusive. Since they live below the poverty line, they are plunged into a vicious cycle of poverty, inadequate information, environmental degradation, illiteracy and, of course, hunger.

The national per capital growth in the production of major food items in Nigeria has not been sufficient to satisfy the demand for an increasing population, as a result of these there is a big gap between national supply and demand for food. The Nigerian government in order to reduce the level of poverty and food insecurity has introduced several programme like FADAMA, however, the proportion of Nigerians living below the poverty line of one dollar a day has increased dramatically during the last two decades. Food insecurity is a prevalent situation in rural areas (IFAD, 2001). Several reports have been published that shows a consistent increase in the production of staple food in the country especially between 1999 and 2005, but there is still an observable gap between food demand and food supply (Sanusi *et al.*, 2006). Maziya-Dixton *et al.*, (2004) reported that over 40% of households across all agro-ecological zones in Nigeria face the problem of severe food insecurity. Idachaba (2006) also reported that many households and individuals in Nigeria merely eat for survival.

The rise of the oil sector to a position of economic prominence in the early 1970s resulted in the neglect of the agricultural sector. Consequently, Nigeria began to experience a shortfall in domestic production that transformed the country from a food sufficient net exporter of food products to a net importer of many different agricultural products including palm oil, rice, wheat, and maize (Ogen, 2007). More specifically, from a low value of N47.8 million in the 1960s, Nigeria's food imports increased to N88.2 million in 1970 and N1,027.0 million in 1988 (Ogen, 2007). In more recent years, the value of food imports has continued to grow very rapidly, reaching a value of N16 billion by 2006. Maintaining this level of imports has taken a toll on the country's finances. Between 1990 and 2001, the share of food imports in Nigeria's budget increased from 9 percent to 19 percent, peaking at 55 percent in 1995. Similarly, the share of food imports in total imports also increased from about 8 percent to 22 percent over the same period (Okolo 2004). Currently, food imports are as high as US$3.99

billion a year, which amounts to about 8per cent of total foreign exchange disbursement (CBN, 2009).

When food security is measured by anthropometric measures and macronutrient deficiencies, 42 percent of children were stunted (low height for age), while 25 percent were underweight and 9 percent wasted in 2003 (IITA 2004). For under-five children, 38 percent were reported stunted, 29 percent underweight and 9 percent wasted (low weight for age) in the same period (IITA 2004). Relative to 1990, by 2008, almost half of all children fewer than 5 were stunted while over a quarter of those populations were found to be underweight. About 30 percent of children under 5 surveyed in 2003 were found to be vitamin A deficient, while about 25 percent of children and 20 – 40 percent of adult females were reported to suffer from iron deficiency in the same period. In addition, about 25 percent of children were found to suffer from iodine deficiency, while 20 percent of children under 5, 28.1 percent of mothers, and 44 percent of pregnant women were found to be zinc deficient (IITA, 2004). In general, several studies of pregnant women in different parts of the country found unacceptably high levels of malnutrition (Idowu, *et al.,* 2005).

2.16 Challenges to Achieving Food Security

2.16.1 Challenges and future prospects of food security in Nigeria.

Some of the challenges of food security in Nigeria according to Federal Ministry of Agriculture and Water Resources (FMAWR, 2008) have been attributed to several factors such as; small area of cultivated land by farmer of less than 2 hectares for cropping; sub-optimal supply of agricultural inputs such as fertilizer which has been put to 7kg/hectare: limited access to credit, and less than 10 percent of irrigable land is under irrigation. The report further revealed that, Nigeria loses significant value of between 15-40 percent of products from its inability to process most of its agricultural production. Added to these factors affecting food security was the global food price calamity of 2007/2008. This had negative implications for food security in Nigeria. Between May 2007 and May 2008, prices of Major Nigerian staple foods such as rice increased by 107 percent; and garri by about 60 percent (Nigeria Food Security Portal, 2012; FAO, 2012).

Lack of continuity in government and frequent policy changes is another problem observed to affect Nigeria food security. For example, between 1979 and 2015 the country had four military and five civilian regimes. At the Federal and State levels, the then Ministers and Commissioners of Agriculture were changed several times on the average of one per two years. Several policy measures were initiated and changed without sufficiently waiting for policy effects or results (Ugwu and Kanu, 2011).

The extremely low share of Government budget to agriculture which is below the international standards is also putting food security at risk. Between 1977 and 1980, Nigeria spent less than 1% to 1.3% of its national budget on agriculture. This rose to 6% in 1983 but declined to 3% in 2011. The proportion of agricultural expenditure to total budget is half of the figures 28 years ago (Obayelu and Obayelu, 2012).

Most agricultural institutes are in a sorry state, as they suffer from decaying and obsolete infrastructure due to lack of adequate funding. Other challenges as observed by Nwanolue and Iwuoha (2012) are natural factors such as climate change, drought, flood, and human activities such as deforestation, over-concentration on bio-fuel (made from conversion of certain food items), environmental criminality and corruption, government failures at tackling desert encroachment, flood, land conflicts problems which impact negatively on food security. Before the introduction of payment voucher system, the procurement and distribution of fertilizer had been hijacked by influential politicians who divert a large portion of it to the market at higher prices.

The subsidy granted by the Federal Government thus ended up in the politicians pocket whilst the farmers, the target beneficiaries, were denied the benefit. For instance, fertilizer subsidy introduced as far back as 1970 in Nigeria had been assessed by United State Department of Agriculture as been largely unsuccessful and only caused distortion in distribution channels, inefficient and under-funded delivery systems prevented the subsidy from reaching small-scale farmers, and supplies were often sold to those with political connections who resell the fertilizer at much higher prices in the market (GAIN, 2012).

Laudable as the mandate of National Agency for Land Development Authority (NALDA) as contained in its Act is, NALDA was unable to translate the mandate into reality due to poor management and usurping duties or duplicating the jobs of other agricultural organizations in the country (Akinsola and Oladele, 2004). The country has the potentials of been food secure with her huge arable land of about 84 million hectares (ha) of just 30.0 million hectares currently under cultivation.

2.16.2 Challenges to achieving food security globally

The challenges of achieving food security globally are discussed under the following headings below:

(a) Global water crisis

Water deficits, which are already spurring heavy grain imports in numerous smaller countries, may soon do the same in larger countries, such as China or India (Garrett and Ruel, 1999). The water tables are falling in scores of countries (including northern China, the US, and India) due to widespread over pumping using powerful diesel and electric pumps. Other countries affected include Pakistan, Afghanistan, and Iran. This will eventually lead to water scarcity and cutbacks in grain harvest. Even with the over pumping of its aquifers, China is developing a grain deficit. When this happens, it will almost certainly drive grain prices upward. Most of the 3 billion people projected to be born worldwide by mid-century will be born in countries already experiencing water shortages. After China and India, there is a second tier of smaller countries with large water deficits – Afghanistan, Algeria, Egypt, Iran, Mexico, and Pakistan. Four of these already import a large share of their grain. Only Pakistan remains self-sufficient. But with a population expanding by 4 million a year, it will likely soon turn to the world market for grain (Molden, 2007).

Regionally, Sub-Saharan Africa has the largest number of water-stressed countries of any other place on the globe and as of an estimated 800 million people who live in Africa, 300 million live in a water stressed environment (Molden, 2007). It is estimated that by 2030, 75 million to 250 million people in Africa will be living in areas of high water stress, which will likely displace anywhere between 24 million and 700 million people as conditions become increasingly unlivable. Because the majority of Africa remains dependent on an agricultural lifestyle and 80% to 90% of all families in rural Africa rely upon producing their own food, water scarcity translates to a loss of food security.

Multimillion dollar investments beginning in the 1990s by the World Bank have reclaimed desert and turned the Ica Valley in Peru, one of the driest places on earth, into the largest supplier of asparagus in the world. However, the constant irrigation has caused a rapid drop in the water table, in some places as much as eight meters per year, one of the fastest rates of aquifer depletion in the world. The wells of small farmers and local people are beginning to run dry and the water supply for the main city in the valley is under threat. As a cash crop, asparagus has provided jobs for local people, but most of the money goes to the buyers, mainly the British. A 2010 report concluded that the industry is not sustainable and accuses investors, including the World Bank, of failing to take proper responsibility for the impact of their decisions on the water resources of poorer countries (Felicity, 2010). Diverting water from the headwaters of the Ica River to asparagus fields has also led to a water shortage in the mountain region of Huancavelica, where indigenous communities make a marginal living herding (Felicity, 2010).

(b) Land degradation

Intensive farming often leads to a vicious cycle of exhaustion of soil fertility and decline of agricultural yields. Approximately 40% of the world's agricultural land is seriously degraded. In Africa, if current trends of soil degradation continue the continent might be able to feed just 25% of its population by 2025, according to UNU's Ghana-based Institute for Natural Resources in Africa (Ian, 2007).

(c) Climate change

Extreme events, such as droughts and floods, are forecast to increase as climate change takes hold. Ranging from overnight floods to gradually worsening droughts, these will have a range of impacts on the agricultural sector. By 2040, almost the entire Nile region, which once included large areas of irrigated agricultural land, is expected to become hot desert where cultivation is impossible due to water limitation (Fraser, 2007).

According to the Climate & Development Knowledge Network report Managing Climate Extremes and Disasters in the Agriculture Sectors: Lessons from the IPCC SREX Report, the impacts will include changing productivity and livelihood patterns, economic losses, and impacts on infrastructure, markets and food security. Food security in future will be linked to our ability to adapt agricultural systems to extreme events. For example, the Garifuna women in Honduras are helping to ensure food security locally by reviving and improving production of traditional root crops, building up traditional methods of soil conservation, carrying out training in organic composting and pesticide use and creating the first Garifuna farmers' market. Sixteen towns have worked together to establish tool and seed banks. Efforts to plant wild fruit trees along the coast are helping to prevent soil erosion. The aim is to reduce the communities' vulnerability to the hazards of shifting weather patterns (Fraser, 2007).

Approximately 2.4 billion people live in the drainage basin of the Himalayan Rivers. India, China, Pakistan, Afghanistan, Bangladesh, Nepal and Myanmar could experience floods followed by severe droughts in coming decades. In India alone, the Ganges provides water for drinking and farming for more than 500 million people. The west coast of North America, which gets much of its water from glaciers in mountain ranges such as the Rocky Mountains and Sierra Nevada, also would be affected (Fraser, 2007). Glaciers aren't the only worry that the developing nations have; sea level is reported to rise as climate change progresses, reducing the amount of land available for agriculture.

In other parts of the world, a big effect will be low yields of grain according to the World Food Trade Model, specifically in the low latitude regions where much of the developing world is located. From this the price of grain will rise, along with the developing nations trying to grow the grain. Due to this, every 2–2.5% price hike will increase the number of hungry people by 1%. Low crop yields are just one of the problem facing farmers in the low latitudes and tropical regions. The timing and length of the growing seasons, when farmers plant their crops, are going to be changing dramatically, per the USDA, due to unknown changes in soil temperature and moisture conditions (Fraser, 2007).

2.17 Review of Empirical Studies on Food Security Status

Olurunsanya *et al.* (2012) carried out a study on gender analysis of food security status of rural households in kogi state and found out that gender of the household heads and household size are some of the determinants of food security status of rural farming households in the study area. Sultana and Kiani (2011) and Kidane *et al*. (2005) also found that household with educated heads were more food secured than those without education. Robert *et al.* (2013) found out that farm size, off-farm income activity and credit access were found to significantly influence household food security positively, however household size was found to influence food security negatively at the household level in Sekyere-Afram plains district of Ghana. Also household headed by married people were found to have a higher probability of becoming food unsecured compared to their counterpart headed by unmarried people.

According to Muche *et al.* (2014) educational status of household head, family size, number of oxen owned and use of farm input are the determinants of household food security. Terefe, (2013) in his study on household food security in Ethiopia identified household size, livestock ownership, farm size, access to market and technology adoption as the determinants of household food security while Kahsay and Mutugera (2014) in their study on determinants of rural household food in Thigray, Ethiopia found out that age of household head, use of improved seeds and land size have positive relationship with food security.

However, Fakayode *et al.* (2015) posited that only 12.2% of the farm households were food secure, 43.6% were food insecure without hunger, 35.9% were food insecure with hunger (moderate) and 8.3% were food insecure with hunger (severe). They stressed further that the constraints faced by farm households in the production of major staple crops were ainly those of high cost of transportation, poor receipts from farm output sales, inadequate storage and processing facilities. They therefore recommended among other things that credit and or subsidy should be made available to farmers.

Adewuyi and Hayatu (2011), in their study on effect of poverty on food security of rural households in Adamawa State using logit regression model revealed that there is a negative and statically significant relationship between the household food and the poverty status of the household. They suggested that the food security of the households will improve if household poverty is reduced. Hence, they recommended that the design of poverty reduction programme should focus more on improving food production for the growing population through increased funding of agriculture and controlled food prices. Mohammed *et al.* (2013) carried out their study on optimal farm plan and food security situation among agro-pastoralist households in Giwa Area of Kaduna State, Nigeria and found that 65% and 35% of the households were identified as food secure and food insecure respectively.

Ala and Bello (2010) carried out a study on the contribution of food crops to household food security among crop farmers in Patigi Local Government Area, Kwara State, Nigeria and found out that farmer in the study area are relatively food secure. Inputs such as fertilizer, processing and storage facilities, improved seedlings, tractor, access to credit loan e.t.c should be made available to encourage farmers to improve household food security and raise their living standard. In addition, efforts should be made by research institutes to generate improved technologies on farming. According to Ibrahim *et al.* (2009) majority of farming households (58.9%) in Nasarawa State were food insecure.Ayoade and Adetunbi (2013), in their study on the determinants of farmers' coping strategies to household food insecurity in Oyo State, Nigeria found out that 35.5% of the farmers were food secure while 64.5% of the farmers were food insecure.

Muhammad-Lawal *et al*. (2009), carried out a study on cereals and farming household's food security in kwara State, Nigeria and their study shows in spite of the abundant calorie availability in the study area, the area of study could be classified as food – insecure in view of the fact that the average protein availability to the area is less than the minimum per capita requirement. At household level, the study shows that the majority of the households are subsisting on less than the minimum required calorie and protein per capita per day. On the place of cereals in farming household food security, the study shows cereals constitute 33% of the average household food crop production, 34% of the total food availability, more than 1/3 of the average household food purchase; 33.84 and 47.29% of the average farming household calorie and protein supply in the study area, respectively. The study also shows that cereals play a significant role in food security in the study area and that any variation in cereals production and supply to the area has a major effect on farming household food security in the study area.

According to Agboola (2005), the use of the term "food security" at the national (and global) level has been often focused on issues on supply side of the food equation and particularly a country's ability to provide enough food to meet the needs or demands to the population either through domestic production or food import. Agboola (2005), in his study on the Analysis of Food Insecurity and Coping Strategies among Farming Households in Osun State reported that based on the recommended daily calorie intake of 2260 kcal, 82% of the households were food secure and 18% were food insecure for households that combined crop production with livestock production.

Land size owned by household heads was found to have significant and positive relationship with food security status of households suggesting the larger the land size, the better food secure state of the household. The possible explanation is that the major source of food in the study area comes form own production and there was limited access to other means of income generating activities. So the household who have large size of cultivated land has better production which gives a better chance for the household to be food secured (Agboola, 2005).

Ahmed (2011), in his study found improved seed to have significant positive effect with the food security status of households. Households using improved seed are more likely to be food secure than those who did not apply. Improved seed and other technological inputs help farmers to augment productivity and to boost production. Farmers can enhance their production by using high yielding varieties and other complementary farm. He also found non-farm income to have significant and positive relationship with the food security status of the household indicating farmers engaged in non-farm activities have better chance to be food secure. This might be due to the fact that households engaged in non-farm activities are better endowed with additional income and more likely to escape food insecurity..

Bashir *et al*. (2012) assessed the food security conditions of rural landless households in twelve districts in the Punjab province in Pakistan by the use of a binary logistic regression analysis. Their study found that the monthly income of households, livestock assets and education level of household heads positively impacted on household food security level. On the education, they found that household head with education up to middle (8yrs) and intermediate (10-12yrs) school levels were more food secure. However, the age of household head and the increasing household size had inverse relationships with household food security. The authors argued that income appears to be the most important determinant of food and having access to food finally depends on an individual's purchasing power to command enough food that is needed.

The results from the study of Bashir *et al*. (2012) confirms earlier studies by Idrisa *et al*., (2008), farming households in Northern-part of Nigeria who reported that households with low level of education, larger family sizes and low levels of income were mostly affected by food insecurity. A study by Modirwa and Oladele (2012) on household food security among male and female headed households engaged in farming in the rural part of the Eden district in the Western Cape of South Africa. The study aimed identifying the factors affecting the food security level of the households. Poor access to markets, storage facilities, land tenure systems and lack of credit were the major factors that affected household food security. These factors were reported by both male and female headed households in the study area. Socio-economic disadvantage is a factor which refers to seven variables: female-headed household, ethnic minorities, household crowdedness, poverty, lack of transportation mobility, low levels of home ownership and income.

Omotesho *et al. (*2006) constructed a food security line based on calories consumption of the members (age and gender specific) of survey households in Kwara State and found that one third of the rural farming households sampled were food insecure. Similar studies were carried out in other states. In Borno State, less than half of survey households (42 percent) were found to be food secure (Amaza *et al.,* 2006), while in Nasarawa State, 58.9 percent of surveyed households were food insecure (Ibrahim *et al.* 2009).

Orewa and Iyangbe (2009) study 90 households in two Local Government Areas (LGAS) in Edo State of Nigeria involved determining calorie sufficiency via the 24 hour recall method, determining protein and calorific content in each of the food items consumed to estimate the quality of food intake and constructing the incidence, depth, and severity of food insecurity. Food insecurity rates for some demographic groups in this study were as high as 75 percent.

Another study in Borno State by Idrisa *et al.,* 2008 also determined food insecurity status by constructing a food security line with minimum calorie requirements determined according to gender and age of household members as recommended by the Food and Agricultural Organization (FAO), The authors also found high levels of food insecurity particularly in households where member incomes and educational attainment were low. Using similar criteria in Ekiti State, and basing the poverty line on the FAO/WHO recommended dietary allocation for calorie intake per average male in 1985, which was 2,150; Ogunsemi (2006) estimated the incidence of food insecurity at 55 percent.

Similarly, in Oyo State, average calories intake per day was 13,440 kcal per household, below the threshold of adequacy of 15820 calories per household per day for a seven member household. By this criterion, 45 percent of surveyed households were found to be food insecure (Adio 2000). Oluwafemi (2005) also estimated a food security line in Osun State and found that 61 percent of respondents are food insecure. While also estimating a food insecurity line by applying the method of food energy intake, Ayantoye, (2009)'s study of rural households in Ondo and Ekiti States was more focused on identifying households facing chronic food insecurity. Findings revealed the seasonality of food insecurity, as 42 percent of households were food insecure in the harvesting season, and as much as 78 percent in the planting season. The majority of respondents faced chronic food insecurity in Nigeria and development cannot be said to be sustainable.

2.18 Review of Empirical Models

2.18.1 Logit regression model application in food security

The logistic function was used in this study because it represents a close approximation to the cumulative normal distribution and is simpler to work with. Meseret (2012) pointed out that a logit distribution (logit) model has gotten an advantage over the others in the analysis of dichotomous outcome variable in that, it is extremely flexible and easily used function (model) from the mathematical point of view and lends itself to a meaningful interpretation and relatively inexpensive to estimate.

Several studies on food security have employed the logit model (Robert *et al.*, 2013), Olorunsanya *et al.* (2012) and Omotesho *et al.* (2006). Following Meseret (2012), the logistic distribution function for food security can be specified as follows:

$Pi = F(z_i) = F(\alpha + \sum(B_i X_i) = \left[\frac{1}{1+e^{[\alpha+\sum(B_i X_i]}}\right]$...(1)

Where**:**

e represents the base of natural logarithm

x*i* represent the ith explanatory variable

P*i* is the probability that a household is being food secure,

α and B*i* regression parameters to be estimated.

Interpretation of the coefficients would be understandable if the logit model can be written in terms of the odds and log of odds (Meseret 2012). The odds ratio is the probability that a household would be food secured (P*i*) to the probability that it would be food insecure (1-P*i*).

$$(1\text{-}P) = \frac{1}{1+e^{zi}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(2)}$$

And putting natural logarithm

$$Z_i = Ln\left[\frac{P_i}{1-P_i}\right] = \alpha + B_1X_1 + B_2X_2 + \cdots + B_nX_n \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots.. \text{(3)}$$

Where:

Zi is a function of explanatory variables xi

α is the intercept

β's are the slope parameters in the model.

2.18.2 Kendall's Co-efficient of Concordance

Numerous methods for testing ranking of an object have been identified from literature and notable among them are Garrett's ranking score techniques, Friedman's two-way analysis of variance and Kendall's coefficient of concordance. There is close relation between Friedman's test and Kendall's coefficient of concordance (Legendre, 2005). They address hypotheses concerning the same data and use chi -square test for testing. However, they differ in the formulation of their respective hypothesis. Whereas Friedman's test focuses on the items being ranked, the hypothesis of Kendall's test focuses on the rankers themselves. Garrett's ranking score techniques on the other hand uses average score of the rankers and arrange them in either ascending or descending order.

However, the limitation of this method is that it involves a number of steps and it does not test the level of agreements between rankers. Kendall's coefficient of concordance will be employed in this study because the Kendall's (W) provide the test of agreement of the rankers (respondents) among their rankings which the Friedman's and Garrett's test lack. John *et al.,* (2013) used Kendall's coefficients of concordance to identify and rank the coping strategies used by farming households in central region of Ghana. Similarly, Demi and Kuwomu (2013), used Kendall's coefficient of concordance in their study titled "assessing the degree of food insecurity among farming households".

Based on Asiamah (2014) and Christian (1999), Kendall's coefficient of concordance was stated as follows:

Suppose m experts are ranking n items, let rij be the rank of item j provided by expert i. If there are ties then the tied items are given the mid-point of the ranks which they are the sum of all ranks given to item j by all experts is:

$$Rj = \sum_{i=1}^{n} rij \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4)$$

The average of rank sums of all items is

$$\bar{R} = \frac{l}{n}\sum_{j=1}^{n} Rj \text{ .... (5)}$$

And the sum of square deviations of item rank sums from the average of rank sums of all items is given by

$$S = \sum_{j-i}^{n} (\mathrm{Rj} - \mathrm{R})^{2} \text{ ....(6)}$$

In the absence of ties the Kendall's coefficient of concordance is defined as

$$C = -\frac{12s}{m^2(n^2-n)} \text{ .... (7)}$$

This give gives a number between O and 1 where C = O implies perfect disagreement and C = 1 implies agreement. If there is parity in ranking among the judges, then a correction factor has to be introduced in the value of C as follows. Let t be the number of items in expert í's rankings which tied for a given rank, the correction term from expert í's rankings is$T_i = -\sum\left(\frac{13-t}{12}\right)$.. (8)

The summation is over all tied groups within í's rankings. Taking into consideration all experts with ties leads to the following formula for C.

$$C = -\frac{12S}{m^2(n^3 - n) - 12m\sum_{i-l}^{m} Tl} \text{ .... (9)}$$

When $n \geq 8$ statisticians have shown that the statistic m (n - 1) C follows x^2 distribution with n-1 degrees of freedom. Hence we can test for existence of significant agreement among experts in ranking the items by testing whether or not the computed m (n - 1) C value is greater or less than the critical x^2 value. For $n < 8$ we test the computed value of S against critical values of S using Kendall's table.

Where:

Rj	sum of all ranks given to item j
rij	rank of item provided by expert i
$\overline{R}$	average of rank sums of all items (mean of the Ri)
S	sum of square deviations
n	number of problems ranked
m^2	square of the raters (judges/farmers)
n^2	square of the number of problems ranked
n	number of problems ranked
C	Kendall's co-efficient of concordance
t	number of items in expert i's rankings
Ti	correction term

2.19 Concluding Remarks

From the review, it was found that adequate research work has not been done on the rural farm household food security in Kaduna State. It was also noted from the literature reviewed that the relationship between the socio-economic characteristics of rural farm household and their food security status were not effectively examined in previous works. It becomes desirable to incorporate an investigation into the relationship between variables that affect the level of food security in the study area. An understanding of this relationship could provide the policy makers with information to design programmes that can contribute to measures needed to expand the food production potentials of the country and better measures that can enhance agriculture efficiency can be implemented.

From the review also, it was found that sufficient research work has not been done on the food crops contribution to rural farm household food security in the study area using descriptive statistics. The study also assessed the socio-economic factors influencing household food expenditure in view of its implication on socio-welfare food security in rural area using multiple regression analysis.

Finally, the gap that existed in literature on the analysis of rural household food security was that work on the coping strategies to mitigate the stress and shock to food insecurity using Kendall's coefficient of concordance has not been done comprehensively in the study area. Within these existing gaps, it was found that work on the determinants of food security among rural farm households using logit regression model is yet to be dealt with extensively. This research work examined these gaps.

CHAPTER THREE

3.0 METHODOLOGY

3.1 The Study Area

This study was conducted in Kaduna State of Nigeria. Kaduna State is one of the 36 states in Nigeria and it lies in the North-Western part of the Country. The State had a population of about 6,066, 562 people in 2006 census figure (National Population Commission, 2006). On the basis of annual population growth rate of 3.2%, the projected population of the State was 7, 813, 667 million people in 2015. The State is divided into 23 Local Government Areas (LGAs).

The State lies between latitude 9^{o}N and 12^{o}N and longitudes 6^{o}E and 9^{o}E of the Prime Meridian. It has a total land area of 48, 473.2 Square kilometers (NPC, 2006). The mean annual rainfall is 1,524 mm which spreads within 7 to 9 months. The annual temperature ranges between 14.6^{o}C and 36^{o}C. The soil and the climate favour the production of a wide variety of crops (National Agricultural Extension and Research Liason Services, 2011). The State shares common boundaries with Katsina and Kano States to the North, Plateau State to the North East, Nasarawa State and Abuja to the South, Niger and Zamfara States to the West (Kaduna Agricultural Development Project, 2007).

About 80 percent of the state's population is engaged in peasant farming producing both food and cash crops (Kaduna Agricultural Development Project, 2014). Kaduna State has Northern Guinea Savanna in the North and Southern Guinea Savanna in the South, with a soil mixture of fine sand and clay. The physical properties of the soil are moderately good and allow continuous cropping of a wide range of crops such as maize, sorghum, millet, groundnut, cowpea, rice, ginger, cotton, sugarcane, yam, cassava, potatoes and tobacco (NAERLS, 2011). During the dry season, a considerable number of people in the State are engaged in irrigation farming along some major rivers and dams (KADP, 2014).

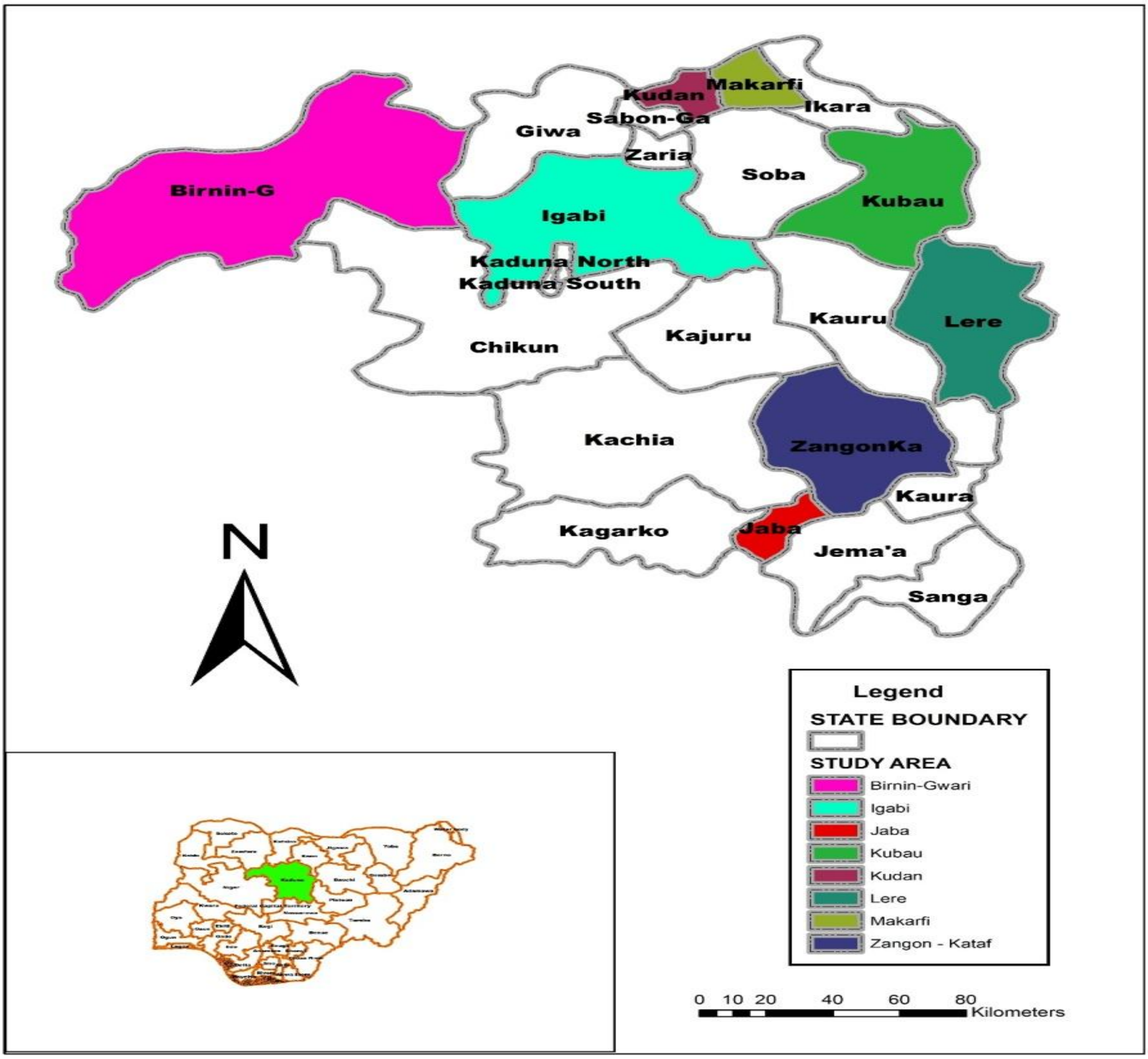

Figure 3.1: Map of Kaduna State showing the Study Areas

3.2 Sampling Procedure and Sample Size

A multi-stage sampling technique was used in selecting respondents for this study. Kaduna State is divided into four (4) agricultural zones viz: Birnin-Gwari, Maigana, Lere and Samaru-Kataf. The first stage was simple random sampling of two Local Government Areas (LGAs) from each of the zones. The randomly sampled LGAs were

Igabi, Birnin-Gwari, Kudan, Makarfi, Lere, Kubau, Zagon-Kataf and Jaba, making a total of eight Local Government Areas.

The second stage involved the random selection of two villages from each of the selected Local Government Areas. The third stage involved using the list of rural farmers obtained from Kaduna State Agricultural Development Project (KADP) to randomly select 10% of rural farm households from each of the selected sixteen villages to make the sampling design to be self-weighting thereby avoiding sampling bias [Victoria and Benjamin, 2012; and Eboh, 2009]. Thus, three hundred and ninety (390) farm households were randomly selected from the total number of three thousand eight hundred and ninety nine (3,899) rural farm households for the study. This is presented in Table 3.1.

Table3.1: Sample size of the farmers selected from the four KADP operational zones**.**

Zones	LGAs'	Villages	*Sample frame	Sample size
Birnin-Gwari	Igabi	Rigachikun	309	31
		Amana	232	23
	Birnin-Gwari	Kuyello	197	20
		Dogon-Dawa	254	25
Maigana	Kudan	U/Shekarau	263	26
		Taban-Sani	212	21
	Makarfi	Gimi	286	29
		Danguzuri	262	26
Lere	Lere	Yarkasua	213	21
		U/Bawa	279	28
	Kubau	Dutsenwai	261	26
		Kargi	233	23
Samaru-kataf	Zagon-Kataf	U/Wakili	209	21
		Magamia I	268	27
	Jaba	Sambang	228	23
		Chori	193	19
Total			**3,899**	**390**

***Source: Kaduna State Agricultural Development Project (KADP) 2014.**

3.3 Data Collection

Primary data were used for this study. The primary data pertaining to this study were collected with the aid of structured questionnaire and it was interpreted in Hausa language by the researcher and five trained enumerators in order to facilitate the collection of data. The data were collected for the study during 2015 farming season. The data were collected from October to December 2015 which is harvest season and are considered as period of food availability. Data were also collected on household heads' past experiences and coping strategies adopted during dry season which is considered as period of food shortages, in order to obtain an actual food security status of rural households in the area in 2015 farming season. The data collected also include:

(a) Households' socio-economic characteristics such as age, gender, educational level, farm size, farming experience, farm income, non-farm income, membership of association, household size, and amount of credit received.

(b) Households' food production, consumption and expenditure patterns;

(c) Households strategies of mitigating the stress and shocks to food insecurity.

3.3.1 Validity and Reliability of Instrument

In order to ensure the content validity of the questionnaire, it was given to the supervisors for validation. In the process some items were expunged while some were included to ensure that the instrument tests what it suppose to test (validity). The instrument was also validated through trial testing (pre-test) in the field using a selected small group to determine the level of its reliability and all observations and suggestions were well integrated in the final copy.

3.4 Analytical Techniques

The analytical tools that were used for achieving the objectives and hypotheses of this study include descriptive statistics, multiple linear regression analysis, food security line, logit regression model, and Kendall's coefficient of concordance.

3.4.1 Descriptive and inferential statistics

Descriptive statistics such as frequency distribution, percentage, mean, and standard error were used to achieve objectives (i), (ii) and (ii) respectively.

3.4.2 Multiple linear regression analysis

Regression analysis was used to analyse the factors influencing household expenditure in the study area. Data on household food expenditure was provided by rural household heads. The data gathered were analyzed using multiple linear regression model. The implicit expenditure function for the regression analysis is given as:

$Q = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_{8,})$ ---(10)

The explicit form of this model is as follows:

$Q = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 \ldots\ldots\ldots\ldots$ (11)

Where:

Q= Household head expenditure (in ₦) for 2015

X_1= Age of household head (in years)

X_2= Education level of household head (number of years of formal education)

X_3= Amount of credit obtained/loan facilities (naira) per year

X_4= Gender of household head (male = 1, female = 0)

X_5= Household size (adjusted) for male adult equivalent (Number)

X_6= Household head farm income (naira) per year

X_7= Household head non-farm income (naira) per year

X_8= Marital status of household head (married = 1, otherwise = 0)

Following Olayemi (1998), the relationship between the endogenous variable and each of the exogenous variables were examined using linear, exponential, semi logarithm and double logarithm functional forms. The lead equation was chosen based on the value of the co-efficient of the determination (R^2), statiscal significance and economic theory that support expenditure and consumption.

3.4.3 Food Security Index

Food security index was used to achieve objective (iv) of this study. To measure household food security, a food security index was constructed. This involved two steps: identification and aggregation. Identification is the process of defining a minimum level of nutrition necessary to maintain healthy living – the "food security line" for the population under study, below which households are classified as food-insecure. Aggregation on the other hand derived food security statistics for the households. Daily per capita calorie consumption was estimated by dividing the estimated daily calorie supply to the household by the household size adjusted for adult equivalent using the equivalent male adult scale weights in Appendix 2.

Household calorie availability was estimated using food nutrient composition of Oguntona and Akinyele (1995) which is shown in Appendix 3. The nutrients content of both produced and purchased food items are used to derive calorie availability. A daily recommended level of 2260kcal per capita per day defines the food security line used in this study (Olayemi 1998 and Omotesho *et al.*, 2006).

The nutrient content of produce was used to derive the calorie availability following Olayemi, (1998) and Olorunsanya *et al.,* (2012). It is stated as:

$$Z = \frac{K}{R} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots .(12)$$

Where:

Z = Food Security Index

K = Per capita calorie available to a household per day

R = Recommended per capita calorie intake per day

For this study, a household is defined as a group of people living together and eating from the same pot. Thus, a household is said to be food secure if its calorie food intake is more than or equal to Z, the estimated benchmark and food insecure if otherwise. Based on the estimated Z, several food security measures were calculated as follows:

The short fall or surplus index, P, which is given as:

$$P = \frac{1}{m}\sum_{j=1} G_j \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (13)$$

Where m = number of households that are food secure (food surplus index) or food insecure (food shortfall index). It measures at the aggregate level, the extent at which the households are below or above the food security.

$$G_j = \frac{X_j - R}{R} \quad \text{...(14)}$$

G_J = is the deficiency or surplus faced by jth household

X_J = average calorie available to the jth household

R= as defined above

The Head Count Ratio (H) is defined as:

$$H = \frac{M}{N} \quad \text{...(15)}$$

M = Number of food secure households

N = Sampled population

3.4.4 Analysis of the severity level of food insecurity

The calorie intake short-falls were estimated based on the nutritional reference level (2260 kcals/day/adult). According to Devereux (2006) and Meseret (2012), the calorie consumption estimates can be used directly to categorize the degree of severity of food insecurity as shown in Appendix 4.

Food secure: it refers to households that show zero or minimal evidence of food insecurity. The calorie consumption per day per person of a household that belong to this group is 2260 Kilocalories and above.

Marginally food insecure: are households that show concern about the adequacy of the household food supply. A household that belongs to this group has calories consumption that ranges between 1800 kilocalories to 2260 kilocalories.

Moderately food insecure: this group of households' food intake is reduced to a level that the household adults have repeatedly experience the physical sensation of hunger.

The household calories consumption per day per person ranges between 1500 kilocalories to 1800 kilocalories.

Severely food insecure: are households in which both adult and children food intake are reduced to an extent that they witness severe hunger. The calorie consumption per day per person for a household that belong to this group is below 1500 kilocalories.

3.4.5 Logit regression model

Logit regression model was used to achieve objective (v) and test hypothesis (ii). The USDA Household Food Security Scale (Revised in March 2000) was used to disaggregate the households into food secure and food insecure households. The dependent variable in this case, food security, is a binary variable which took a value of one (1) if a household is found to be food secure, and zero (0) if otherwise.

A variety of models can be used to establish the relationship between the potential determinants and food security. The study employed the logit model. Following Bogale and Shimelis, (2009) and Robert *et al.,* (2013), the cumulative logistic probability model can be econometrically stated as:

$$P_i = F(Z_i) = \frac{1}{1+e^{-[\alpha+\Sigma(\beta_i X_i)]}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(16)$$

Where:

Zi = function of explanatory variables

P_i = the probability that an individual is being food secure given X_i

X_i = vector of explanatory variables

α & β = regression parameters to be estimated.

e = the base of the natural logarithm

For ease of interpretation of the coefficients, a logistic model could be written in terms of the odds and log of odd. The odds ratio is the ratio of the probability that a household would be food secure (Pi) to the probability of a household not being food secure ($1-P_i$). That is:

$$\frac{P_i - e^{Z_i}}{1-P_i} \quad \text{……(17)}$$

Taking the natural logarithm of the equation yields:

$$Ln\left[\frac{P_i}{1-P_i}\right] = Z_i = \alpha + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_n X_n \quad \text{……(18)}$$

If the error term, e_i is taken into account the equation becomes:

$$Z_i = \alpha + \sum_{i=0}^{m} \beta_i X_i + e_i \quad \text{……(19)}$$

Where:

Zi = function of explanatory variables X_i

α = is the intercept

β_s = are the slope parameters in the model

In this study the explanatory variables that were used in the model include:

X_1 = Age of household head (years)

X_2 = Education level of household head (Number of years of formal education)

X_3 = Access to credit/loan facilities (Naira) per year.

X_4 = Gender of household head [Male = 1, Female = 0]

X_5 = Household size (adjusted) for male equivalent (Number)

X_6 = Dependency ratio (number/proportion of non –income earners in a house to income earners in the household)

X_7 = Marital status of household head [Married = 1, Otherwise = 0]

X_8 = Household head farm income (Naira) per year

X_9= Household head non-farm income (Naira) per year.

The parameters of the logistic regression model would be estimated using the Maximum Likelihood Approach.

3.4.6 Kendall's coefficient of concordance

This was used to achieve objective (vi). Kendall's coefficient of concordance (W) is a measure of the level of agreement among independent judges/farmers (P) assessing a given set of n objects. The approach of estimation employed in this study is adopted from Pierre (2005) and Asiamah *et al.*, (2014):

W = 12S ……………………………………………………………….(20)

$k^2 (n^2-n)$

$$S = \sum (SR)^2 - n(SR)^2 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(21)$$

Where:

W = number of judges (farmers)

n = number of problems ranked

K^2= Square of the raters (farmers/judges)

S = sum of ranks

SR = mean of sum of ranks

W, ranges between zero (0) and one (1) and indicates the strength of agreement; the closer to one (1), the higher the level of agreement or concordance while W of Zero (0) signifies disagreement.

Data on the frequency of each activity/strategy (in one (1) month) was collected from each household by requesting the respondents to indicate 'yes' or 'no' if they used any of the strategies. A 'yes' answer was assigned the value of one (1) and a 'no' answer was assigned a value of zero (0). The sum of the value of a response for each strategy qualified the indicator for the study population. The higher the frequency scores the more the coping strategy being utilized by the study population.

3.4.7 Description of index of coping strategies

Following (Kyaw, 2009,) the levels of food insecurity among households were identified by estimating the index of coping strategies used by households and categorized households based on their index of coping strategies.

The respondents were asked whether there has been an occasion where there was no enough food in the house or inadequate money to purchase food in the past 30 days. The respondents who responded yes to the question were asked to identify the coping strategies they used to reduce the impact of food insecurity situation. Respondents were further asked the number of time each strategy was used per week and also per month.

Next, to calculate the index of coping strategies the number of different strategies used by each household was first summed up. The weighted sum of these different coping strategies were then calculated where the weights represent the frequency of use of each strategy. Thus, households were categorized and assigned a score based on the number of times strategies were used per month. The household that never used any strategy at all were assigned 1; those who rarely used any strategy (used 1 to 2 times) were assigned 2; and those who used the strategies often (used the strategies 3 to 4 times) were assigned 3; and those who used the strategies frequently (more than 4 times per month) were assigned 4. Based on the index of coping strategies, the farming households were categorized into four (4) groups; no strategy, low, medium and high index coping strategies. The criterion used for the above categorization was the number of time strategies were used per month. This was summarized in Appendix 5.

No Strategy: This refers to the households that never used any strategy to mitigate food insecurity in a month and they are food secured. These households were assigned a score of one (1).

Low index strategy: The households that belong to this group used coping strategy once ort twice in a month and they were assigned a score of two (2).

Medium index strategy: The households in this group used coping strategies often. The minimum time households in this group use coping strategies in a month is three (3) while the maximum is four (4) and they are assigned a score of three (3).

High index strategy: Households that belongs to this group used coping strategies frequently (i.e more than four times) and they are extremely food insecure and they are assigned the score of four (4).

3.4.8 Z- Statistic

The Z – statistic was used to test hypothesis (i) that is: there is no significant difference between expenditure pattern of food secured and food insecure households. The Z - statistic is normally used when the sample size is sufficiently large, i.e when it is equal to or greater than 30. It is stated as follows:

$$Z = \frac{\overline{X}_1 - \overline{X}_2}{\sqrt{\frac{S_1}{n_1} + \frac{S_2}{n_2}}} \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 22$$

Where:

Z = the value of the statistic

X_1 = mean of food secure household expenditure

X_2 = mean of food insecure household expenditure

S_1 = standard deviation of food secure household expenditure

S_2 = standard deviation of food insecure household expenditure

n_1 = number of food secure households

n_2 = number of food insecure households

3.5 Measurement of Variables and a *priori* Expectation

In this study, the cross- sectional data needed for econometric analysis and the information that is specifically required were collected from farmers. Variables on which data were collected include socio-economic characteristics, food security and coping strategies.

3.5.1 Socio-economic characteristics

(a) **Age**: this is the number of years of the respondent from birth. Age of respondent was measured by the actual years the individual has lived as given by him/her. Studies have shown that young age group are mostly involved in agricultural production activities and adopt new technology and innovation faster than the older age group. However, the higher the age of the household head, the more stable the economy of the farm household, because older people have also relatively richer experiences of the social and physical environments as well as greater experience osf farming activities. More also, older household heads are expected to have better access to land than younger ones, because younger men either wait for a land distribution or have to share land with their families.

(b) **Gender**: This is the classification of the respondents according to biological sex into either male or female. It was measured with the use of dummy by allocating one (1) to male and zero (0) for female.

(c) **Marital status**: This is a condition or state of being married or unmarried as indicated by the respondents. Dummy was used for measurement of the variable thus married=1, single=0.

(d) **Level of education:** This is the number of years a respondent has spent in formal education. Level of education was measured in terms of the number of years spent in formal education. No formal education =0, adult education =1, primary education =2, secondary =3, tertiary education =4. It is expected that the higher the level of education attained by a farmer, the more he will be receptive to modern technology and innovation.

(e) **Farm size:** This is the total land area cultivated by the respondents. It was measured in hectares (ha). Relevant information with respect to this variable include; size of plot in hectares, location, distance from house, number of plots devoted to food crops production and other crops. Land was used as farm size indicating continuous area or portion in specific location on which food crops were grown.

(f) **Farming experience:** This is the total number of years the respondents spend in farming business. It was measured by estimating the number of years the respondent has spent on farming enterprise.

(g) **Household size:** This is the number of people living together and eating from the same pot. Food demand increase with increase in the number of people in the household. However, larger households are expected to have more hands to supply manual labour which is important in small scale production. Household size was measured by estimating the number of people in a household.

(i) **Membership of co-operative:** This is the membership of co-operative group for agricultural activity. It was measured in the number of years spent as a member. Co-operative membership brings about interaction and sharing of resources for attainment of common goals. Co-operative groups are organized for the promotion of special interest or meet certain needs that cannot be achieved by the individual efforts. They contribute to the dissemination of new ideas, practices and products as well as in sourcing for loan and farm input (Chikezie et al., 2012). Membership of a co-operative brings about interaction and sharing of resources for attainment of common goals. Farmers who belong to a co-operative are likely to adopt new technology easily than those not in any co-operative. This was measured in years of participation in co-operative association.

(j) **Amount of credit accessed:** This refers to the amount of credit received from both formal and informal sources of credit. It is needed to acquire or develop farm enterprise; its availability could determine the extent of production capacity and also have prospect in improving the productivity of farmers and contributing to uplifting the livelihoods of disadvantaged rural farm households. It was measured as the actual money/credit borrowed. Credit is a very important factor that is needed to acquire or develop farm enterprise (Ekong, 2003).

(k) **Income:** This is the total amount accrued to a farmer in the last one year. It was measured by sum of income from both farm and non- farm activities in naira. The larger the income the more food secure a family would be.

3.5.2 Food Security Status

A food secure household is defined as one whose calorie supply per adult equivalent is greater than or equal to the minimum daily calorie requirement for adult of 2260 Kilocalories (Omotesho *et al*., 2006). Households with lower calorie intakes are considered to be food insecured. Food quantities consumed at the household level in a day were converted to calories using the available food consumption table in Appendix 3. Resulting calorie values were divided by the number of adult equivalent in the households, in order to obtain numbers that are comparable across households of different size (Maxwell *et al.*, 2000).

3.5.3 Coping Strategies

In order to prevent food insecurity, household made changes in the consumption pattern, diversify income generation activities, sale of assets, consumption of less preferred food, limiting the portion size of food, borrowing food or money, and begging. The coping strategies used by households in the study area for a period of 30 day was taken.The different strategies adopted were identified which tried to capture experiences of the household during the period of food insecurity.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 Socio -Economic Characteristics of Rural Farm Households

4.1.1 Gender of household heads

Gender is social differentiation of an individual into either masculinity or feminity. It is an important variable as far as farming activities is concerned depending on the geographical location. The study revealed that most of the rural farm household heads (79.1%) were males. This finding corroborated with the work of Allam and Gidado (2013) that majority of the farmers were males while about 11% of them were females indicating that there are more male farmers than their female counterparts.

Generally, gender is a very good determinant of food security; this is because under normal circumstances, or if all things being equal male households are expected to withstand hardship more than their female counterparts particularly farm related activities hence more output in terms of crop yield is expected from the male household heads.

4.1.2 Age of household heads

Age is a socio-economic attributes upon which farmers' abilities and physical disposition in planning, organizing, controlling resources and accomplishing production activities and farm tasks are based (Oyewole, 2012). The role of age of farmers is very critical in agricultural production. The result presented in Table 4.1 shows that large proportions (89.2%) of the respondents were within the age range of 21 to 60 years. A mean age of 49 years was observed for the farmers in the study area.

Table 4.1: Age distribution of household heads

Age	Frequency	Percentage
21-30	30	7.7
31-40	64	16.4
41-50	141	36.1
51-60	103	26.4
61-70	42	10.8
71-80	10	2.6
Total	**390**	**100**
Min	**21**	
Max	**73**	
Mean	**49**	
S.E	**0.57**	

The implication of this finding is that large proportions of the respondents were adults and can adequately be regarded as active, agile, and physically disposed to farming activities. Age has been found to determine how active and productive the head of the household would be (Adebayo, 2010).

The age of the farm business manager is likely to influence his attitude, motivations and behavioral patterns which in turn influence sensitivity to risk investment behavior. Age has also been found to affect the rate of household adoption of innovations, which in turn, affects household productivity and livelihood improvement strategies (Amaza *et al.,* 2009). This finding also supports Yaaishe *et al*. (2009), Mohammed *et al.* (2013), Fakayode *et al.* (2015) and Ojeleye *et al.* (2015) that majority of the sampled farmers in their studies were within the productive age of between 21 and 50 years. Fakayode *et al.* (2015) posited that youthful and productive age will promote efficiency in agricultural production and enhance food security. Babatunde *et al.* (2007) found that the older the household head, the lower the probability that the household would be food secure. Ogundari and Ojo (2006) in their work on the economic efficiency of small scale food crop production in Osun State, Nigeria stated that rising age of farmers would lead to a decline in their level of efficiency and food security.

However, the finding of this research work is not in tandem with the work of Ayoade *et al*. (2011) who found that 22.2% of the farmers who used recommended food grains storage technologies for sustainable food security programme in urban south-west, Nigeria were within the age bracket of 51-60 years. The variance might be due to the fact that this research work was carried out in rural area of north-west, Nigeria.

4.1.3 Marital status of household heads

The result in Table 4.2 shows the distribution of the marital status of households in the study area. The majority (88.5%) of the farming households were married while 11.5% of the respondents were either single or widowed.

Table 4.2: Distribution of marital status of household heads

Marital status	Frequency	Percentage
Single	37	9.5
Married	345	88.5
Widow	8	2.0
Total	**390**	**100**

This implies that about 88.5% of the farmers interviewed in the study area have family responbilities, which shows that majority were married and could have children which would help in appreciable number of family labour supply to accomplish various farm operations. Marital status may influence the size of households as married farmers may have larger household sizes which may encourage them to participate in agricultural production in order to raise their income and standard of living.

The significance of marital status on agricultural production and livelihood activities can be explained in terms of the supply of agricultural family labour. It is expected that family labour would be more available where the households are married (Amaza *et al*., 2009). This finding is in line with Solomon (2008), which indicates that large household size assists more on farm and other household activities. This finding is also consistent with the work of Onubuogu *et al. (2013).* According to Onubuogu *et al.* (2013), married farmers tend to have easy access to production variables such as land and large family size which are traditionally owned and provided by household heads to compliment family labour, enhance production, resource use efficiency of the households and to reduce the cost of hired labour. Moreover, marital status may influence the size of households as married farmers may have larger household sizes which may increase consumption expenditure thereby making them more prone to food insecurity

4.1.4 Educational status of household heads

The result in Table 4.3 revealed that about 30% of the respondents had no formal education, about 26.9% of the respondents had only primary education, and 26.7% had secondary education while about 16.4% had tertiary education. However, altogether about 70 percent of the farmers are literate. Education would enable farmers to develop good coping strategies to mitigate food insecurity in the study area.

Table 4.3: Educational level of household heads

Educational level	Frequency	Percentage
No formal education	117	30.0
Primary	105	26.9
Secondary	104	26.7
Tertiary	64	16..4
Total	**390**	**100**

This finding is in agreement with Fakayode *et al.* (2015). They carried out research work on food security and found that most of the farmers were literate and this could have increased their perception and adoption of new innovations. Education will enhance respondents' ability to make informed and accurate decisions in the management of farms. However, the study is at variance with the finding of Ojeleye *et al.* (2015) which stated that about 34% of the respondents were not literate enough in being able to read or write in English language in the study area.

Muhammed *et al*. (2009) were of the opinion that education is highly important for sustainable agricultural growth and development. They explained further that formal education is a veritable attribute enhancing farmers to innovate, adapt and adopt improved recommended production practices. The level of awareness and adoption of agricultural innovations are affected by the literacy status of farmers. Those who are literate are expected to be more innovative because of their ability to get information more quickly and their ability to take more risk.

Amaza *et al.* (2009) noted that education is needed to enhance productivity among farming households in Nigeria. Sound education propels household heads to adopt innovation and technologies that are vital to enhance productivity. Amaza *et al.* (2009) elucidated further that the level of education determines the level of opportunities available to improve livelihood strategies, enhance food security and reduce the level of poverty. It affects the level of exposure to new ideas and managerial capacity in production and the perception of the household members on how to adopt and integrate innovations into the households' survival strategies. Babatunde *et al.* (2007) posited that education is a socio-economic tool which could impact positively on food security and alleviate poverty status of rural farm households. Educational attainment is very important because it could lead to awareness of the possible advantages of modern farming techniques and better coping strategies which in turn would enhance household food security.

4.1.5 Farming experience of household heads

The experience of the surveyed respondents in farming shows that 15.6% of the respondents had 1-5 years of experience. The maximum farming experience observed was forty (40) years while the minimum was one (1) year and average of nineteen (19) years of experience in farming. The farming experience shows that household heads would be able to make sound decisions as regards resources allocation on their farms. It also suggest that with increasing years of farming, farmers gain experience in the art of farming which could enhance better understanding of farming practices and raises the level of food security.

Table 4.4: Distribution of farming experience of household heads

Years of farming experience	Frequency	Percentage
1-5 years	61	15.6
6-10 years	69	17.7
11-15 years	46	11.8
16-20 years	71	18.2
21-25	57	14.6
26-30	32	8.2
≥30	54	13.9
Total	**390**	**100**
Min	**1**	
Max	**40**	
S.E	**0.56**	
Mean	**19**	

Farming experience is expected to influence agricultural production positively because the accumulation of skills overtime by experience farmers can make them combine different farming techniques which will improve their income level and food security status. This finding is in line with Ajani (2000) who carried out a research study on productivity of food crop farming in northern area of Oyo State. The study revealed that year of farming experience may increase agricultural productivity among farming households in Nigeria. This finding is also in agreement with Oyewole (2012) who found that year of farming experience increases Agricultural productivity and food security among farming households in Nigeria. Similarly, Adebayo (2010), who evaluated the United Nations Development Programmes (UNDP), micro-credit scheme on food security status of farm households in Kaduna State noted that longer a person stays on a particular job, the better his job performance and food security status.

4.1.6 Membership of cooperative society of household heads

The results in Table 4.5 revealed that 51.8% of the respondents belonged to associations, while 48.2% did not belong to any associations. The implication of this result is that most of the farmers in the study area will likely enjoy the benefits accruable to cooperative society's membership through pooling of resources together for a better expansion and effective management of resources. The farmers had an average of 10 years membership in association with a minimum of 1 year membership and maximum of 35 years membership

Table 4.5: Distribution of cooperative membership of household heads

Cooperative membership (years)	Frequency	Percentage
Cooperative membership		
Non member	188	48.2
Member	202	51.8
	390	**100.0**
Member (n=202)		
1-5 years	48	23.8
6-10 years	95	47.0
	26	
11-15 years		12.9
16-20 years	19	9.4
21-25	7	3.4
25-30	4	2.0
>30	3	1.5
Min	**1**	
Max	**35**	
S.E	**0.27**	
Mean	**10**	

Cooperative societies has propensity to provide credit facilities to members since people come together to pool their res ources so as to meet individual needs that could not be met by individual limited financial capacity. Ekong (2003) stated that participants in cooperative societies have the following advantages, such as micro-credit, input subsidy and also as avenue for cross breeding of ideas and information. This finding is in line with Oyewole (2012) that cooperative groups ensure that their members derive benefits from the groups such as they could not have derived individually. The membership of a co-operative society enables farmers to interact with other farmers, share their experience and assist themselves. Interaction of farmer with his fellow farmers is an avenue through which innovation and diffusion can occur. Similarly, Gashaw *et al.* (2013) found that membership of co-operatives enhances members' efficiencies by easing access to productive inputs and facilitating extension linkage compared to those who were not members.

Co-operative membership may enhance access of the farmers to information on improved technologies, markets and credits which in turn will enhance their production capacity and food security. Membership of co-operative afford the farmers the opportunity of sharing information on modern farming practices. However, most of these associations are grossly underdeveloped and inactive.

4.1.7 Access and amount of production credit facilities received by the household heads

The access to production credit and amount acquired by the respondents in the study area per year are presented in Table 4.6

Table 4.6: Access and amount of production credit received by household heads

Access and amount of credit received (₦)	**Frequency**	**Percentage**
Access to production credit		
No access to production credit	224	57.4
Access to production credit	166	42.6
	390	**100.0**
Amount of production credit obtained per year (₦)		
₦ 1001 - ₦ 50000	90	54.2
₦ 50001 - ₦ 100000	40	24.1
₦ 100001 - ₦ 150000	19	11.5
₦ 150001 - ₦ 200000	17	10.2
	166	**100.0**
Min	**₦ 8,000**	
Max	**₦ 200,000**	
Mean	**₦ 76,000**	

The study revealed that 57.4% of the respondents had no access to credit while 42.6% have access to production credit from both formal and informal sources in terms of loan acquired for farm production, 54% of the respondents who had access to production credit acquired loan within the range of ₦ 1,001 – ₦ 50,000 per year with the minimum and maximum amount of ₦ 8,000 and ₦ 200,000 respectively. This access to production credit by some of the respondents may not be unconnected with the fact that many of the respondents belonged to a cooperative society which is the major means of obtaining assistance either from Government or Non-Governmental Organizations (NGOs). Ekong (2003) asserted that credit was a very strong factor that was needed to acquire or develop any enterprise; its availability could determine the extent of production capacity. According to Tijani *et al.* (2006), access to credit provides the farmer with a means of expanding and improving his farm. It also determines the ease with which he adopts new practices and technologies on his farm. Therefore, lack of production credit facility will have a negative effect on profit efficiency. Annon (2009) asserted that loan is a crucial input as it is used to establish and expand farm size.

4.1.8 Farm size of household heads

Farm size in the context of this research work refers to the land area that was actually used for crop production during the survey year. The result presented in Table 4.7 revealed that 59.5% of the respondents cultivated farm size of between 1 to 3 hectares.

Table 4.7: Distribution of farm size of household heads

Farm size (hectare)	**Frequency**	**Percentage**
Less Than 1	50	12.8
1-3	232	59.5
4-6	108	27.7
Total	**390**	**100**
Min	**0.5**	
Max	**5**	
S.E	**0.11**	
Mean	**3**	

The average farm land cultivated by the respondents in the study area was 3 hectares with a minimum of 0.5 hectare and maximum of 5 hectares. This shows that all the respondents have small farm sizes. Ojuekaiye (2001), classified farm size that ranges between 0.1 to 5.9 hectares as small farms; this finding therefore indicates that all the household heads were small scale farmers. Farm size is an indicator of the level or scale of production of an individual farmer. Under subsistence agriculture, farm size is expected to play a significant role in food availability because size of the land under cultivation will determine the size of food production. The finding of this study is consistent with Ekong (2003) who reported that most Nigerian farms are small-sized family farms in which family members contribute the required labour. Small farm size may affect the size of food production which in turn will affect the food security status of the farmers. Also, limited farm size may encourage the farmers to diversify into non-farm activities. According to Oyewole (2012), food production can be increased extensively through expansion of area under cultivation. Therefore under subsistence agriculture, farm size is expected to play a significant role in influencing food security of the rural farm households.

4.1.9 Household size of household heads

The distribution of the respondents by household size is presented in Table 4.8.The study revealed that 21.5% had 4 to 6 members. Those with 7 to 9 members constituted 39.0 percent. Only 10.5% had household size which ranged from 1 to 3 members. The average household size was 9 members. The significance of household size in agriculture hinges on the fact that the availability of labour for farm production, the total area cultivated for different crop enterprises, the amount of farm produce, the amount of farm produce retained for domestic consumption, and the marketable surplus are all determined by the size of the farm household (Amaza *et al.*, 2009). Size of the household may enhance labour availability that can be used for different activities. However, the implication of household size for food security is that small- size households are less prone to food insecurity than large-sizes households because large household sizes have low per capita Oluwatayo (2008).

Table 4.8: Distribution of household size of household heads

Household size	Frequency	Percentage
1-3	41	10.5
4-6	84	21.5
7-9	152	39.0
10-12	51	13.1
13-15	36	9.2
16-18	19	4.9
>18	7	1.8
Total	**390**	**100**
Min	**2**	
Max	**23**	
Mean	**9**	
S.E	**0.61**	

Ahmed (2011) argued that large household size is associated with increased household consumption expenditure which reduces the money that could be used for production purpose.The extended family system still exists in the study area. The finding of this study is in conformity with Muhammad *et al.* (2011) that large household size depicts common characteristic of rural households particularly in Northern Nigeria where polygamy is mostly practiced and family labour utilized for farming activities. Oluwatayo *et al.* (2008) posited that there is a positive and significant relationship between household size and farmers' efficiency in food production. However, the absolute number of people in a certain family cannot be used to justify the potential for productive farm work. This is because it can be affected by some important factors namely; age, sex and health status. Essentially, it is the composition of the household that determine labour supply for the accomplishment of farm operations in order to boost food production and reduce food insecurity.

The finding of this research work is also in agreement with Awotide *et al.* (2013), Olawuyi and Adetunji (2013) and Ojeleye *et al.,* (2015). They carried out research work on farm households' food security and observed that large household size may provide the needed labour requirement for farming but their impact can be limited by the small farm cultivated.

4.1.10 Farm income of household heads

The income from farming is a major determinant of per capita household expenditure and food security status. The result in Table 4.9 revealed that many of the respondents had farm income less than ₦201, 000 per year. The reason for this relatively low income could be due to the fact that farm households usually satisfied their food needs before the excess are sold in the market. The result also shows that average farm income of the rural households in the study area was ₦182, 905 per annum. This translates to a monthly farm income of ₦ 15,242 which is lower than the minimum national wage of ₦ 18,000 per month.

Table 4.9: Distribution of farm income of household heads

Farm income per year (₦)	Frequency	Percentage
≤100, 000	110	28.2
101, 000- 200, 000	153	39.3
201, 001-300, 000	85	21.8
301, 001-400, 000	29	7.4
≥ 401,000	13	3.3
Total	**390**	**100**
Min	**₦ 26,130**	
Max	**₦937,163**	
Mean	**₦182,905**	

The study revealed that respondents did not earn enough income to meet their food need especially during the off season. This finding is consistent with Ojeleye (2015), Adebayo (2010) and Omotesho *et al.* (2006). They found that many rural farm households earned less than Two Hundred and One Thousand Naira (₦201, 000) per annum. Babatunde *et al*. (2007), stressed that the higher the farm household head's income, the higher the probability that the households would be food secure. This could be expected because increased income, other things being equal leads to increase access to food.

4.1.11 Household non-farm income

The result presented in Table 4.10 shows that 53.6% of the respondents had non-farm income while the remaining 46.4% relied on income earned from sales of farm produce.

Table 4.10: Non-farm income of rural households

Non-Farm income per year (₦)	Frequency	Percentage
Farmers without non-farm income	181	46.4
Farmers with non- farm income	209	53.6
	390	**100**
Non-farm income (n=209)		
≤ 100, 000	34	16.3
101, 000 -200, 000	92	44.0
201, 000-300, 000	35	16.8
301, 000- 400, 000	27	12.9
≥ 401,000	21	10.0
Min	**₦24,280**	
Max	**₦856,137**	
Mean	**₦197,605**	

The mean non-farm income for rural households in the study area was ₦197, 605 per year, which translates to a monthly non-farm income of ₦16, 467 and a daily non-farm income of ₦548.90.

Household non-farm income is an important factor in household access to food. Non-farm income in the study area comes from formal and informal jobs such as education, construction, health, and self-employment which include handi-crafts, shoe-cobbling, barbing, tailoring, bricklaying, and carpentary, driving and trading.

4.2 Food Crops Contribution to Farm Household Food Security

4.2.1 Food crops grown by household heads

Food crop production is important in meeting the food need of the rural households in Kaduna State in particular and Nigeria in general. Food crop made significant contribution to food security of rural population by providing a vast array of foods that supply essential nutrients to them. Results presented in Table 4.11 revealed that 63.8% of the farmers planted maize, 56.7% planted sorghum and 50.5% planted millet.

Table 4.11 Types of food crops grown by rural farm households

Major food crops grown	Frequency*	Percentage	Rank
Maize	249	63.8	1st
Sorghum	221	56.7	2nd
Millet	197	50.5	3rd
Groundnut	183	46.9	4th
Cowpea	161	41.3	5th
Rice	154	39.5	6th
Yam	150	38.5	7th
Cassava	74	19.0	8th

Multiple responses

Maize and sorghum are grown more in the study area because they serve as important food crops and also earn them income. African Water Development Report Interim Version (2009) on food security indicates that, household food security will only be stable when there is good food availability at relatively low prices while Ojogbane (2003) reported that the harvest of new crops is a source of small agricultural jobs and income for poor households who use their labour force for harvesting, and transporting crops to market.

4.2.2 Food crops contribution to farm household food security

The daily household food consumption of the respondents consists mainly of maize, sorghum, millet and rice and their products (different processed forms) which constituted the largest percentage of total food consumption from both household own food production and food purchases as shown in Table 4.12 below.

Table 4.12: Daily household food consumption of the households in the study area

Daily food consumption	Frequency*	Percentage	Rank
Maize	335	85.9	1st
Sorghum	319	81.8	2nd
Millet	280	71.8	3rd
Groundnut	251	64.4	4th
Cowpea	243	62.3	5th
Rice	218	55.9	6th
Yam	126	32.3	7th
Cassava	97	24.9	8th

****Multiple responses***

This implies that a deficit in the availability of cereals and legumes like maize, sorghum, millet, rice and cowpea and their products in the area could mean serious food insecurity problem for the household. However, considering the situation of the rural farm households in the study area, important staple like the cereals have many advantages as food crops for household food security, with maize and sorghum possibly the two most significant. According to FAO (2009), food production by the farmers forms the basic pre-requisite for improved household food security.

4.2.3 Constraints to major food crops production in the study area

The problems faced by respondents in the production of major food crops like rice, maize, sorghum, millet; cowpea and groundnut in the study area were ranked according to their severity as presented in Table 4.13.

Table 4.13: Production constraints of major food crops in the study area

Constraining factors	Frequency*	Percentage	Rank
Inadequate capital	349	89.5	1st
High cost of fertilizer	346	88.7	2nd
High cost of improved seeds	332	85.1	3rd
Inadequate storage & processing facilities	301	77.2	4th
Pest and diseases attack	262	67.2	5th
High cost of transportation	209	53.6	6th
Accessibility to market	154	39.5	7th
High cost of hired labour	103	26.4	8th
Total	***2056**	***527**	

***Multiple responses**

The problem of inadequate capital was the most severe constraint in the study area with 89.5% of the respondents attesting to this fact. According to Ijarotimi and Oyeneyin (2005) and Ala and Bello, (2010); food insecurity exists when people lack access to capital to produce food and this leads to insufficient amount of safe and nutritious food required for normal growth and development of healthy life. However, 88.7% of the respondents were more concerned with high cost of fertilizer and their availability and was ranked second. This has limited their production capacity. According to the respondents, fertilizer is made available when farmers are far into the production period, sometimes at the middle of the raining season at exhorbitant price. This has aggravated food security situation in the study area. Farmers also perceived that high cost of seeds contributed immensely to the low output often recorded in their farm. Seeds of good quality are generally scarce in the study area; hence, farmers rely on local/unimproved seeds. The poor storage of available seeds causes the seed to lose its viability before planting time.

Inadequate storage and processing facilities was ranked fourth. Post harvest losses account for about 15-50% of food shortage in Nigeria depending on food type (Edache, 2002). The provision of storage and processing facilities is very essential for sustainable food crops production in the study area. It was observed in the course of this research work that the method of storage was traditional in nature.. The problem of pest and disease attack was equally pointed out by 67.2% of the respondents. Major diseases in the study area were rust and smut while locust and weevil were the major pests affecting crops of the respondents. Some of the respondents are faced with the problems of high transportation cost from the farm to the market while the problem of high cost of hired labour was the least constraint affecting production of food crops in the study area. According to the farmers, during active period of production; every household would have been engaged in his family farm work. The demand for labour is normally very high and expensive during the peak period of land clearing, ridging, fertilizer application, weeding, harvesting and processing.

The findings of this study agree with Omonona and Agoi (2007), and Ala and Bello (2010) who reported that poor accessibility to credit facilities, high cost of fertilizer, storage and marketing facilities and production inputs are important factors causing food insecurity in Nigeria. The implication of this finding is that if farmers can have access to all these inputs listed above, it can go a long way in improving food security in the area as this can help farmers to achieve high crop yield, ability to process and store their farm products, time spend on farm will reduce and purchase all the necessary things needed for farming. They will also be able to transport their farm products to market and to control pest and diseases.

4.3 Expenditure Pattern of Rural Farm Household Heads

Expenditure is the total amount of money that a government, organization, or person spends during a particular period of time. Household expenditure is the amount of money the poeple in a house spends on food and non-food items respectively; while pattern refers to the ways, in which things happened, developed or arranged. The consumption aggregates were computed from food and non-food expenditures. In view of its importance to the nutritional well-being of individuals, food constitutes a larger proportion in the expenditure pattern of the rural households. Food consumption levels of farm households in Kaduna State are presented in Table 4.14.

Table 4.14: Expenditure pattern of rural farm household heads

Food Commodity	Mean ₦	Expenditure/month ₦	Expenditure/day ₦	% of food
Food expenditure				
Maize	23,567.89	1963.99	65.47	16.17
Sorghum	12,237.70	1,019.81	33.99	8.40
Rice	10,213.45	851.12	28.37	7.01
Cowpea	9,789.88	815.82	27.19	6.72
Meat/fish	28,401.22	2366.77	78.89	19.49
Cassava	8,698.12	724.84	24.16	5.97
Oil	11,220.69	935.06	31.17	7.70
Sugar	10,789.43	899.12	29.97	7.40
Sub Total	**114,918.38**	**9,576.53**	**319.22**	**78.85**
Non-food expenditure				
Firewood for cooking	7,250.00	604.17	20.14	4.97
Electricity	6,538.14	544.85	18.16	4.49
Furniture	9,002.15	750.18	25.00	6.17
Kerosene	4,569.00	380.75	12.69	3.14
Transportation	3,456.77	288.06	9.60	2.37
Sub-total	**30,816.06**	**2,568.01**	**85.60**	**21.15**
Grand total	**145,734.44**	**12,144.54**	**404.82**	**100**

The food items are maize, sorghum, cowpea, meat/fish, cassava, oil and sugar while non-food expenditure includes those on: firewood, electricity, furniture, kerosene and transportation. The expenditure in study area is very low (i.e less than 2 dollars per day). The per capita expenditure mean was ₦ 404.82 per day in the study area, putting these households at extreme risk of food insecurity. This study also shows that a rural household had an average monthly expenditure of ₦ 9,576.53 on food items. This was estimated at a sum of ₦ 319.22 daily per capita food expenditure. The expenditure results are similar to the finding of National Bureau of Statistics (2012). The application of the dollar per day in the computation of poverty measure as computed for Nigeria for 2011 revealed that the relative poverty measure estimates poverty to be 71.5% and the absolute poverty measure to be 61.9% (NBS, 2012). Expenditure on food as a percentage of total expenditure is a strong indicator of food security as well (Omonoma *et al.,* 2007).

The mean household expenditure spent on food as a percentage of total expenditure is 78.85%. while the mean household expenditure spent on non-food items as a percentage of total consumption expenditure is 21.15%. This shows that the households may be spending the large proportion of their money on food and have very little flexible income to cope with adverse events and costs such as medical, electricity and water bills. This result is in line with the finding of (NBS, 2012), which shows that food expenditure outweighed non-food expenditure, In a similar yet different context, food security was measured from expenditure patterns in Harare, Zimbabwe (Tawodzera *et al.*, 2012). In his study, food also constituted the single largest expenditure but was not given as a percentage of total expenditure (Tawodzera *et al, 2012*).

4.3.1 Factors influencing household expenditure

The result of the analysis of factors influencing household expenditure is presented in Table 4.15. The result showed that cumulative contributions of independent variables to the household expenditure had coefficient of determination (R^2 Adjusted) value of 0.51.

Table 4.15: Regression results of the factors influencing household expenditure of rural farm households

Variables	**Coefficient**	**Std. Error**	**t-value**
Constant	0.4623	0.168	2.75***
Age	0.256	0.535	0.479
Education	0.414	0.099	4.15***
Credit	0.821	0.463	1.77
Gender	-0.192	2.683	-0.72
Household size	0.007	0.005	1.57
Farm income	0.485	0.246	1.972*
Non-farm income	0.526	0.209	2.52**
Marital status	0.532	0.205	2.59**
R^2	0.51		
F-value	52.37***		

*** $p<0.01$, ** $p<0.0$ 5 and * $p<0.10$

The estimated coefficients of education, farm income, non-farm income and marital status were statistically significant. Thus, education, credit, farm income and marital status of the households have implications on the welfare of households and their members. Education was found to be positive and significantly influence expenditure at p<0.01 level of probability. The implication of this is that increase in education would increase farmers' opportunity to different jobs because educated households can easily diversify and this would enhance their income and expenditure a s well. Education is associated with skills enhancement that ought to contribute positively to well-being.This result agrees with that of Onyenweaku *et al.,* (2005) that showed a positive relationship between education and household expenditure in Nasarawa State, Nigeria.

The coefficient of farm income (0.485) had a significant and positive influence on rural farm households expenditure at p<0.1 level. The implication of this result is that increase in farm income invariably influences higher expenditure level of the household. This finding is in agreement with the finding of Adebayo (2010). Also, the regression coefficient of non-farm income was positive and significantly influences households' expenditure level at 5% (p<0.05). This implies that as the non-farm income increases, the household expenditure would also increase. This could be expected because increased income other things being equal, means more production and eventually increased access to food.

The estimated coefficient of marital status (0.532) was positive and significantly influenced expenditure level of rural farm households at p<0.05 level. The implication of this is that married household heads would spend more which could be as a result of large family size. This is expected because an additional increase in the number of non-working member of household could increase the food requirement.

4.3.2 Test of Hypothesis I

H_0: There is no significant difference between expenditure pattern of food secured and food insecure households.

The null hypothesis (H_o) which stated that there is no significant difference between the expenditure pattern of food secured and food insecure households in the study area was tested using the result of a z-test presented in Table 4.16.

Table 4.16: Z- Statistic showing significant difference between pattern of expenditure of food secured and food insecure households.

Item description	Food secure household expenditure	Food insecure household expenditure
Mean	111,507.23	34,227.21
Variance	6.89276E+11	6912597817
Observations	159	231
Pearson correlation	-0.058618157	
Hypothesized mean difference	0	
Df	389	
Z Stat	5.23298115	
P(Z<=z) two-tail	1.78109E-09	
Z Critical two-tail	1.96^{**}	

**$P \leq 0.05$

From the result, an average expenditure of food secured household was ₦111, 507.23 while the average expenditure of food insecure household was ₦ 34, 227.21. The calculated z-value was 5.23 and it exceeds the critical value (z-critical two tails) of 1.96. Therefore, the null hypothesis (H_o) is rejected at $P \leq 0.05$ level of significance. The result of the analysis indicates that there was significant difference between the expenditure pattern of food secured and food insecure household in the study area.This might be due to the fact that food secured households have many opportunities of getting more income than food insecure households. The implication of this finding is that food secured households spend more of their earning on food items when compared to food insecure households; as a result of this, the food secured households are less prone to the danger of malnutrition, hunger and starvation.

4.4 Food Security Status of Rural Farm Households

Food security status of farming households in the study area is presented in Table 4.17. Based on the recommended daily energy levels (L) of 2260 Kcal, the food security line (S) was estimated at ₦ 1262.43 per day per adult equivalent, also ₦ 8,837.01 per week per adult equivalent, while ₦ 37,872.90 per month per adult equivalent and finally ₦460, 786.95 per year per adult equivalent for rural farm household. The result showed that 40.8% of the sampled rural farming households were food secure while 59.2% of the sampled households were food insecure.

Furthermore, the aggregate income gap (G) of -161.23 indicates that food insecure households would need ₦161.23 per adult equivalent to meet their daily basic food requirements. Differences in income levels predispose households to different consumption patterns due to their economic access to food. Households are primarily involved in own food production which include mostly cereals, legumes and tubers and also had home gardens which reduced household cost on vegetables. Engagement in livestock, poultry and fishing equally provide animal sources of protein. When own production depletes, available incomes are spent on food or assets liquidated to cater for consumption and general welfare. Households with insufficient economic access to food ultimately become food insecure (Ahmed *et al.,* 2011).

Table 4.17: Summary of statistics and food security measures of rural farm households

Item Description	**Values**
Cost-of-calories equation: lnX=a +bC	
Constant	0.462 (1.602)
Slope coefficient	-1.65E-02(2.234)
FAO recommended daily energy levels (L)	2260 kcal
Cost of calories per day	₦1262.43
Cost of calories per week	₦8,837.01
Cost of calories per month	₦37,872.90
Cost of calories Per year	₦460,786.95
Head count (H)	
Mean FSI (Food secure)	1.43
Mean FSI (Food insecure)	0.81
Food insecurity gap/Surplus index (Food secure)	0.43
Food insecurity gap/Surplus index (Food insecure)	0.19
Food secure(number)	159
Food insecure(number)	231
Aggregate income gap (G)	-161.23
Food secure(percentage)	40.8%
Food insecure(percentage)	59.2%

The result presented in Table 4.17 indicates that many (59.2%) of the rural farm households were food insecure. This implies that the study area is potentially food insecure since the number of food insecure households (231) was greater than food secured households (159). This finding is at variance with Ojeleye *et al.* (2015) who found that 66.39% of the household were food secure while the remaining 33.61% to be food insecure in Kaduna State. The variance might be due to the comprehensive and wider coverage of this research study unlike Ojeleye *et al.* (2015) which covered only two agricultural zones.

The mean food security index of food secured and food insecure households were 1.43 and 0.81 respectively. The food insecurity gap of 0.19 and 0.43 implies that on average, the food insecure households consumed 19% less than their daily calorie requirements while food secured households consumed 43% in excess of their daily calorie requirements. Per capita daily calorie requirement was estimated to be 2,260kcal which is lower than the national weighted average of 2,849 kcal (World Food Program, 2010). However, households suffering from food insecurity were more likely to have adults who have lower nutrient intakes than their food secured counterparts (Kirkpatrick and Tarasuk, 2007). This is in accordance with FAO (2010) which stated that most farming households in Africa were food insecure.

4.4.1 Test of hypothesis II

H_0: There is no significant difference between the socio-economic characteristics of food secured household heads and their non-secured counterparts.

It was hypothesized that socio-economic characteristics of food secured household heads and their non-secured conunterparts had no significant difference on farm household food security. The socio-economic characteristics were: age, education, gender, marital status, farming experience, farm size, farm income, non-farm income, membership of association and access to credit. The result of linear regression analysis presented in Table 4.18 shows that the coefficient for education was positively and significantly influenced the household heads food security. This variable was significant at 5% level of probability. The implication of this is that education increase farmers' ability to be food secured. This is as expected, since the level of education should positively affect the income earning capacity and level of efficiency in managing the household's food resources. This result implies that households who have household heads with relatively better education are more likely to be food secured than those headed by uneducated (illiterate) household heads. The result agreed with the theoretical evidences that educational improvement could lead to awareness of the possible advantages of modernizing agriculture and improve the quality of labor. It is similar with the findings of Ramakrishna and Assefa, (2002) and Haile, (2005).

Table 4.18 : Socio-economic factors influencing farm household food security

Variable	Coefficient	Standard error	t– value
Intercept	0.5316	0.4307	1.23
Age	0.0269	0.0085	3.17
Education	0.1893	0.0764	2.48**
Gender	-0.0327	0.0249	-1.32
Marital status	0.0010	0.0006	1.15
Farming experience	0.1534	0.2026	0.76
Farm size	0.894	0.433	2.07**
Farm income	0.037	0.022	1.66
Non-farm income	0.381	0.1104	3.45**
Membership of association	0.1804	0.06772	2.66***
Access to credit	3.5380	0.3608	9.81***

*** = p< 0.01, ** = p<0.05%, * = p<0.10

Membership of association was positive and significantly influenced food security. This was significant at 1% level of probability and met the *a priori* expectation implying that households who were members of co-operative societies or other farmers' organizations had higher tendency of being food secure than those households who were not members. This can be closely linked to the beneficial effects of their membership, in terms of production and other welfare enhancing services that these societies and organizations often offer. This indicates that membership of associations enhanced food security. The coefficient of access to credit was found to have positive influence on food security status of households and met the *a priori* expectations. This is expected since credit serves as consumption smoothing mechanism which gives households temporal relief against the effects of food insecurity. The results of the study implies that household heads that received credit had greater chances of being food secured compared to those who did not have access to credit, all things being equal (*ceteris paribus*). The result of the study is in line with the findings of Pappoe (2011), who found that access to credit improves the food security status of farming households among bio-fuel producers.

The coefficient of farm size is positive and statistically significant at the 5% level of probability. That is, households with larger farm sizes tend to be more food secure than those with smaller sizes, and vice-versa. As a household's farm size increases, food security tends to increase. Reddy (2004) Observed that greater efficiencies in the use of resources are associated with the large farms than the small farms. They pointed out that the smallness of holdings deters the use of mechanization and does not allow the use of modern inputs due to lack of purchasing power in the hands of small farmers. In reality, small scale producers are not always efficient. This often results in low productivity and low income, and consequently incidence of food insecurity among the farm households. The result of linear regression analysis presented in Table 4.18 above shows that non-farm income coefficient was positive and significantly influenced food security with coeffeicient of 0.381; and the variable was significant at 5% level of probability. The result of the analysis indicates that there was significant relationship between the socio-economic characteristics of farm household and their food security status.

4.4.2 Level of food security among the rural farm households

The calorie intake shortfalls are estimated based on the nutritional threshold level (2260 Kcals/day/adult). The level of food insecurity according to Devereux (2006) and

Meseret (2012), measures the calorie consumption directly by categorizing the degree of severity of food insecurity. Thus, the result of this survey is presented in Table 4.19.

Table 4.19: Food insecurity level of farm households

Food security status	Calorie consumption per Person per day	Number	%
Food secure	Above 2260 Kcals	159	40.8
Marginally food insecure	Between 1800 and 2260Kcals	118	30.3
Moderately food insecure	Between 1500 and 1800Kcals	77	19.7
Severely food insecure	Below 1500 Kcals	36	9.2
Total		**390**	**100**

Based on the level of food insecurity, 40.8% of the sampled households were found to be food secured which means that these households show zero or minimal evidence of food insecurity and the other 59.2% are found to be food insecured with different severity levels. About 30.3% of the sampled households were marginally food insecure which means that these households show concern about the adequacy of the households food supply and therefore show adjustment in their daily food management. The insecurity levels of these households have not reached a stage of experiencing physical sensation of hunger. About 19.7% of the rural farm households are moderately food insecure. These groups of households have their food intake reduced such that the household adults had repeatedly experienced the physical sensation of hunger while 9.2% of the total sampled households were found to be severely food insecure and have both adult and children food intake reduced to an extent that they witnessed severe hunger.

4.5 Determinants of Food Security Status of Rural Farm Households

The Logit model was used in determining factors that influence food security status of rural farm households in the study area. The estimated coefficients of the Logit model, along with the standard error, t-values and marginal effect are presented in Table 4.20.

The analysis revealed that all the variables included in the Logit model are jointly significant in influencing rural farm households' food security. Therefore, the socioeconomic characteristics of farmers have a significant effect on their food security status. The result shows that age, education, access to production credit, household size, farm income and non-farm income were statistically significant determinants of household food security. However, the estimated coefficient of the Logit model provides only the direction of the effect of the independent variables on the dependent (response) variable: estimates do not represent actual magnitude of change or probabilities. Thus, the marginal effects from the model, which measure the expected change in probability of a particular choice being made with respect to a unit change in an independent variable, are also reported in Table 4.20.

Table 4.20: Logistic estimate of determinants of food security status of rural farm households

Variable	Coefficient	Standard error	T-value	Marginal effect
Constant	-17.625	13.376	- 1.317	
Age	-2.196	1.895	- 1.895*	0.083
Education	0.142	0.069	2.058**	0.561
Credit	0.765	0.438	1.747*	0.812
Gender	0.489	0.6531	0.7487	0.098
Household size	-0.971	0.421	- 2.306**	0.645
Marital status	0.256	0.535	0.479	0.021
Farm income	0.485	0.246	1.972*	0.059
Non-farm income	0.278	0.095	2.926**	0.623
Numbers of observation		390		
Log likelihood ratio test		- 191.241		
F-distribution		0.467		
McFadden R-square		0.632		

***p<0.001, **p < 0.05, *p < 0.10

The estimated coefficient of age was found to be negative and statistically significant at p<0.10 level. This suggests that the higher the age of the household head, the lower the probability of being food secure as there may be small opportunity of making food available from both agricultural and non-farm opportunities. Age is an important determinant of food security status. The marginal effect of 0.083 shows that one extra year of age increases the probability of being food insecure by 8.3%. This is so because older farmers are less energetic when compared to their younger counterparts. This is contrary to the *a priori* expectation which stated that older hosehold heads have better access to land and more food secure than younger household heads.

The coefficient of education was positive and statistically significant at $p<0.05$ level, thus suggesting that the higher the educational level of the household head, the higher the probability of being food secure the household tends to be and vice versa. This is as expected, since the level of education should positively affect the income earning capacity and level of efficiency in managing the household's food resources. This result implies that households who have household heads with relatively better education are more likely to be food secure than those headed by uneducated household heads. The marginal effect of 0.561 shows that one extra year of western education increases the probability of being food secured by 56.1%. The result agreed with the theoretical evidences that educational improvement could lead to awareness of the possible advantages of modernizing agriculture and improve the quality of labor. It is similar to the findings of Haile, (2005) who carried out a research work on food security in sub Sahara Africa. However, this finding is at variance with Ibekwe *et al*., (2010) and Parasada (2002).

The coefficient of household size was found to be negative and statistically significant at $p<0.05$ level of probability which signified an inverse relationship with household food security. The marginal effect of 0.645 shows that increase in the number of household members reduce the probability of being food secured by 64.5%.This result is expected because increase in the household size implies that more people are eating from the same resources, hence, the household members may have less food to go round when compared with a smaller household size.

The estimated coefficient of access to production credit had direct relationship on food security status of households and statistically significant at $p<0.10$ level. This is expected since credit serves as smoothing mechanism which gives households temporal relief against the effects of food insecurity. The marginal effect of 0.812 shows that increase in access to production credit increases the probability of being food secured by 81.2%. The results of the study implies that household that received production credit had greater chances of being food secured compared to those who did not have credit, *ceteris paribus*. The result of the study is in line with the findings of Pappoe (2011) and John *et al*., (2013), who found that access to production credit positively influences food security status of farming households. However, it is at variance with Adebayo (2010) who found that access to production credit had negative co-efficient with food security.

The coefficient of farm income was statistically significant at $p<0.10$ level and found to positively influence food security status of farming households. The marginal effect of 0.059 shows that increase in farm income of household increases the probability of being food secured by 5.9%. This indicates that the higher the farm-income of households, the greater the probability of being food secure. The result is consistent with Babatunde *et al*, (2007); Adenegan and Adewusi (2007) and; Adebayo (2010) who revealed positive and significant relationship between household farm-income and food security.

The coefficient of non-farm income was positive indicating that there was a positive relationship between off-farm work and food security. Off-farm income was significant at 5% level of probability. Households diversified their incomes by working as daily labourers, petty traders, and artisans. Non-farm income generating activities have a paramount significance to diversify the sources of farm households' livelihoods. It enables farmers to modernize their production by giving them the opportunity to reduce the risks of food shortage during period of unexpected crop failures. Income from these off-farm activities is also invested in agriculture to increase production and food availability at the household level. This outcome agrees with the works of Robert *et al.* (2013) and Adebayo (2010). According to Amaza *et al.* (2006), this is plausible because households that had other sources of income in addition to farming are more resilient in times of food crises than those that are into farming alone.

4.6 Coping Strategy Adopted by Rural Farm Households

The food insecurity coping strategies adopted by farming households in the study area to mitigate effects of food insecurity is presented in both Figure 4.1 and Table 4.20 respectively.

Fig. 4:1 Distribution of households according to coping strategies adopted

The result from the analysis in Figure 4.1 revealed that the most widely used strategies by the farming households in the study area in order of importance are reducing food consumption, sales of livestock, borrowing, working for money and begging. About 75.6% of the rural farm households employed reducing food consumption as a strategy to mitigate effects of food insecurity. This implies that when households are faced with food shortage, the immediate strategy they adopt is to eat less preferred and less expensive food. It might be argued that food intake and expenditures cannot be reduced, because households are already at subsistence level, and further reductions in consumption will present potentially severe consequences for lives. The result of the study is consistent with the findings of Orewa and Iyangbe (2010); and Demi and Kuwormu (2013) who revealed that eating less preferred food, limiting size of food consumed (rationing) and skipping meal within a day were preferred strategies households adopted to minimize the impact of food insecurity.

However, the finding of this study did not conform to the finding of Idrissa *et al.*, (2008) who revealed that allowing children to eat first, buying of food on credit and eating once a day as preferred strategies among farming households in Borno State. The finding of this study is not consistent with the finding of Awotide *et al.*, (2011) who found that cutting down of expenditure on non – food items, and withdrawal from personal saving were preferred strategies among farming households in Osun – State.

The result in Figure 4.1 also revealed that 63.6% of the rural farm household employed sales of livestock to generate money to purchase food items in order to reduce the effect of food insecurity. To some extent, this is to be expected, because livestock is a commonly held asset amongst sampled households. In addition, the sale of livestock may not undermine the household's productive base as much as some other strategies, such as selling land or one's home, or disrupting children's education. This high frequency of livestock ownership and willingness to cope via livestock sale supports the claim that farmers in the rural developing world use livestock as a form of asset/ savings for the rainy days.

The result also shows that 53.8% of the households employed the use of borrowing of money from relatives and friends to cushion the effect of food insecurity. This strategy was seen by households as loss of pride and those who practiced this strategy borrowed money mostly from relatives and friends and not from a neighbour for fear of being insulted when misunderstanding break up. The result in Figure 4.1 revealed that some (21.3%) of the sampled household heads employed coping strategy of working and sending out children to work in both farming and non-farming ventures to raise money in order to mitigate food insecurity and hunger.

However, the least strategy used in the study area to curb the effect of food insecurity was to go out begging for food and money. In this situation, food crises had persisted and the households need to take a drastic action to mitigate the stress and shock of food incsecurity.

Table 4.21: Kendall's result and rankings of coping strategies used by rural farming household heads

Coping strategy	Mean rank	Rank
Reducing food consumption	1.44	1st
Sale of livestock	2.36	2nd
Borrowing	3.08	3rd
Working for money	3.35	4th
Begging	3.81	5th
Kendall's (W) = 0.561		**df = 4 sig 0.000**

The result of the Kendall's (W) of 0.561 in Table 4.21 shows that there were agreement among 56% of the rankers (household heads) which was significant at 1 % as indicated by the p-value of 0.000

4.6.1 Coping strategy index used by household heads

To determine the level of food insecurity among farming households in the study area, the index of coping strategies used by farming households to reduce the impact of food insecurity were converted into indices and presented in Table 4.22.

Table 4.22: Index of coping strategies used by household heads as a proxy for degree of food security.

Coping strategy	Frequency	Percentage
No strategies	159	40.8
Low index	71	18.3
Medium index	140	35.8
High index	20	5.1
Total	**390**	**100.0**

The study revealed that the proportion of households who are food secured and need no coping strategy to mitigate food insecurity was 40.8%. The table also shows that about 18.3% of households practiced low index of coping strategies. However, 35.8% of the respondents practiced medium index coping strategies in the study area. It was observed that only 5.1% of the farming households practiced high index of coping strategies.

The overall result revealed that 40.8% households in relation to others practiced no coping strategy. This implies that only 40.8% of the households were food secured throughout last year (2015) and many (59.2%) were food insecure since they practiced one form of strategy or the other. Among households who practiced coping strategies to mitigate food insecurity , medium index of coping strategies were the highest (35.8%)

followed by low index of coping strategies (18.3%) and high index of coping strategies were the lowest (5.1%)

4.6.2 Months in which households experience severe food shortages

Households were asked whether they have experienced food shortage in year (2015). Those who responded in the affirmative were further asked to indicate the month(s) (from January to December) in which they experienced food shortage. The frequencies were illustrated in a line graph as shown in Figure 4.2

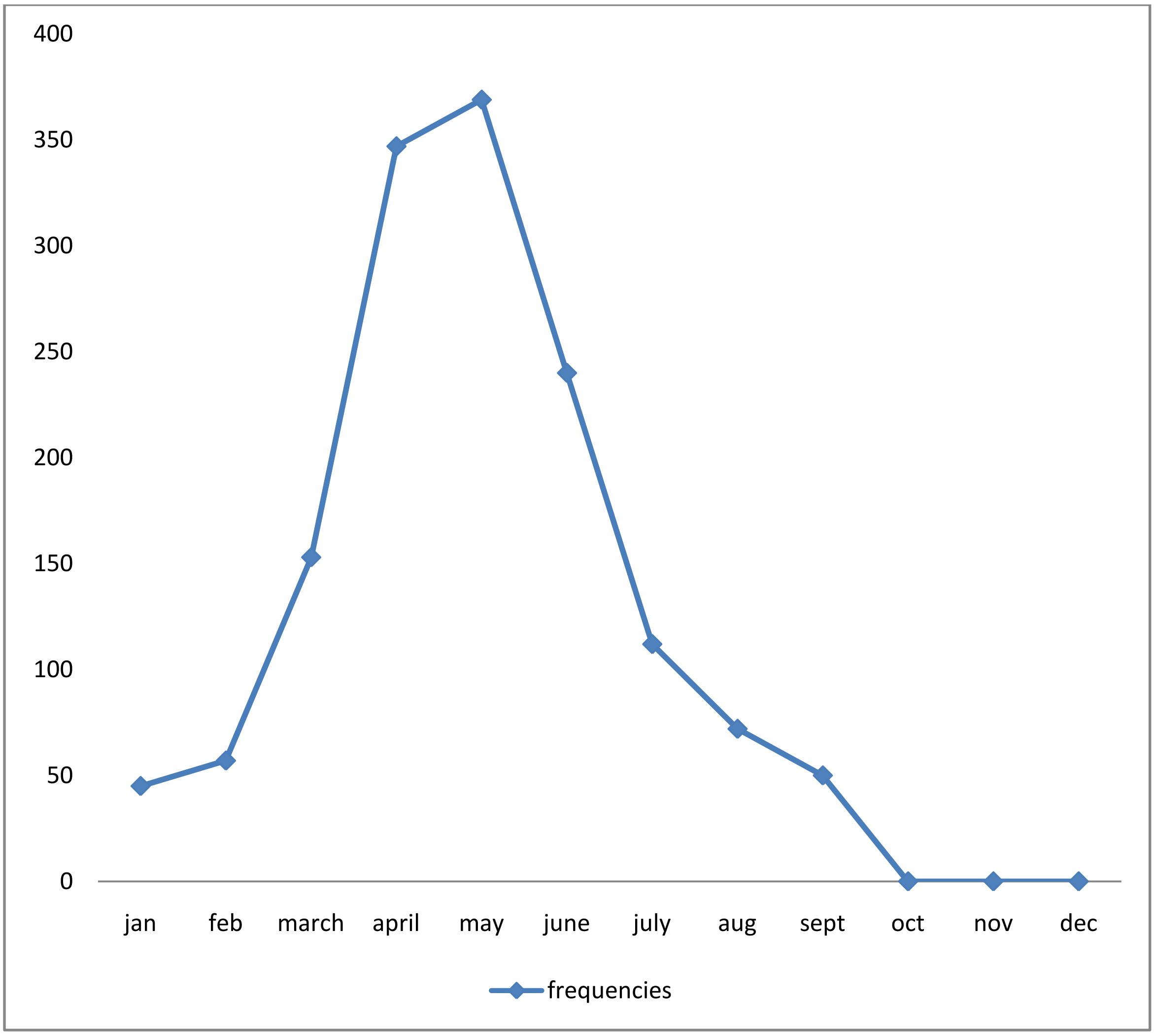

Figure 4. 2 Months households experience severe food shortage

The result in Figure 4.2 revealed that households experienced severe food shortage in the months of April and May. The farming season starts in May and ends in October during which the study area received rainfall. However, it was during this period that most serious farming activities take place and just few farmers engaged in farming in the off-season. Farmers start planting in May; by August, some farmers would have harvested their farm produce which marks the commencement of abundance of food or glut depending on the changes in the weather. This continues till December, and depletion of household harvested food begins from January. Hence, it is not surprising that households experienced severe food shortage in the months of April and May respectively.

The implication of this finding on food security was that rural farm households would witness severe food shortage and hunger in these two months and at the extreme cases it would lead to severe nutritional diseases such as kwashiorkor, marasmus, osteomalacia and ricket. Rural farm households would then need coping strategies within these periods to mitigate food insecurity and hunger. The policy implication is that both federal and state government would spend more money for acquisition of modern storage facilities such as silos to reduce the negative impact of food insecurity and hunger in the study area.

CHAPTER FIVE

5.0 SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary

The study focused on the analysis of food security status and coping strategies of the rural farm households against food insecurity in Kaduna State, Nigeria. In order to achieve this multi-stage sampling technique was employed to select the farm households. The primary data were collected from 390 randomly selected rural farm household heads using structured questionnaire. The statistical tools used to analyse the data were descriptive statistics, food security index, logit regression model and Kendall's co-efficient of concordance. Descriptive statistics was used to describe the socio-economic factors influencing food security status of farming households. The results of linear regression analysis revealed that the socio-economic characteristics of the households in the study area have significant effect on their food security status. The average age of farming household head was 49 years and 70% were literate while the mean household size of the farm households in the study area was 9 persons.

The expenditure of the rural farm households in the study area was very low, with the average individual living in poverty below 2 dollars per day. The mean per capita expenditure was ₦ 405 per day in the study area, putting these households at extreme risk of food insecurity. This study also showed that a rural household had an average monthly expenditure of ₦ 9,576.53 on food items. This was estimated at a sum of ₦319.22 daily per capita food expenditure. The result of the determinant of household expenditure showed that the cumulative contributions of independent variables to the household expenditure had coefficient of determination (R^2 Adjusted) value of 0.51.

Based on the recommended daily energy levels (L) of 2260 Kcal, the food security line (S) was estimated at ₦1262.43 per day per adult equivalent, also ₦8, 837.01 per week per adult equivalent, while ₦37, 872.90 per month per adult equivalent and finally ₦460, 786.95 per year per adult equivalent for rural farm household. The result showed that 40.8% of the sampled households were food secured while 59.2% of the sampled households were food insecure. Furthermore, the aggregate income gap (G) of -161.23 indicates that food insecure households would need ₦161.23 per adult equivalent to meet their daily basic food requirements.

In order to determine the factors influencing food security status of farming households, socioeconomic characteristics of households were regressed on their food security indices and result showed five variables: education, farm size, non-farm income, access to production credit and membership of co-operative association significantly influenced rural farm household's food security. The food security coping strategies adopted by farming households in the study area to mitigate effects of food insecurity were: reducing food consumption, sales of livestock, borrowing, working for money and begging.

5.2 Conclusions

Based on the findings of this study, it could be concluded that the expenditure of rural farm households in the study area was very low; with the average individual living in poverty i.e below the World Bank recommended two dollars per day. The mean per capita expenditure was ₦ 405 per day, putting these households at extreme risk of food insecurity. Furthermore, there is high incidence of food insecurity among many of the rural households and age, education, access to production credit, household size, farm income and non-farm income are the determinants of food security status of the sampled households. Food crops like maize, sorghum, millet and rice played crucial role in the food security drive of rural farm households in the study area.

5.3 Recommendations

From the findings of this study, the following recommendations are made:

i. Access to production credit was significantly and positively related to food security status in the study area; hence farmers should be assisted to access credit through reduced interest rate and waiver of collateral security requirement for a small amount of loans. Morever, commercial banks can be encouraged by government at all levels to give loans for small and medium scale productive activities by guarantee some proportions of the credit giving to such businesses.

ii. Government and farmers groups should provide agricultural inputs to farming households during farming seasons at affordable prices in order to increase their farms size and food production capactity since farm size was one of the factors that influenced farm household food security.

iii. Education was positively and significantly related to food insecurity status of the farmers, thus reduction in food security should involve an integrated approach by both the government and private sectors through regular orientation that promotes education among farm households on the need to diversify their sources of income from agriculture to off-farm income generating business.

iv. Co-operative membership was a significant factor that influenced food security; participation of rural household's in co-operative societies is important for them to be able to acquire the necessary funds needed. Besides, agencies of government such as Bank of Agriculture (BOA), Small, and Medium Scale Development Agencies of Nigeria (SMEDAN), should be made to give training to rural households on Small and Medium Scale Enterprises (SME).

v. Food insecure households should be assisted by both Government and Non-Government Organizations to increase production of maize, sorghum, millet, rice and cowpea to enhance their food security status; through improve access to better food production technologies and provision of incentives that would motivate farmers to produce more; such as good market, accessible road, electricity and buying off the excess produce in the market in order to prevent glut and stabilize price.

vi. The Non-Governmental Organizations which intend to provide food aid to these communities should do that in the months of April and May since households normally face severe food insecurity and hunger during these periods. It would go a long way in mitigating the impact of food insecurity.

vii. Food insecurity coping strategies adopted by households in the study area can only temporarily minimize the impact of food insecurity. Therefore Non-Governmental Organizations should empower them through vocational/skill development trainings in order to make the coping strategies more sustainable.

5.4 Suggestion for Further Studies

Further studies on food security analysis should be done on the upscaling of this study to cover all the six geo-political zones in the country.

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APPENDIX 1

DEPARTMENT OF AGRICULTURAL ECONOMICS AND RURAL SOCIOLOGY, FACULTY OF AGRICULTURE, AHMADU BELLO UNVERSITY, ZARIA

RESEARCH QUESTIONNAIRE FOR RESPONDENTS

ANALYSIS OF FOOD SECURITY AND COPING STRATEGIES OF RURAL FARM HOUSEHOLDS IN KADUNA STATE, NIGERIA

Dear Respondent,

This questionnaire will be used by a student of the Department of Agricultural Economics and Rural Sociology, Ahmadu Bello University, Zaria. Please, fill as appropriate. All information will be treated with confidentiality and strictly for the purpose of research. Thanks for your co-operation.

Village/Community………..………………………L.G.A……………………………
…………….…………………………………………

SOCIO ECONOMIC CHARACTERISTICS

1. Name of Farmer ………………………………………………………………
2. Gender: Male ( ) Female ( )
3. Age (Years) ……………..…………………………………………………...
4. Marital Status: Married ( ) Single ( )
5. Highest level of Education

   (a) No Formal Education ( ) (b) Primary School Education ( )

   (b) Secondary School Education ( ) (d) Tertiary Education ( )
6. Family Size (All the number of the people depending on you for living)…….

   (a) No. of Adult Male ( ) (b) No. of Adult Female ( )

   (c) Children > 15yrs ( ) (d) Children < 15yrs ( )
7. How long have you been in farming? (Years of experience) ……………………
8. Do you belong to any co-operative/association? Yes ( ) No ( )

9. If yes, (Years of participation)……………………………..

10. What benefit did you derive as a member?..

11. What is you major source of capital for farming?

12. If you borrow, what were the sources of the credit and the amount borrowed?

SOURCE OF LOAN	AMOUNT (N)	INTEREST RATE (%)
Commercial Bank		
Bank of Agriculture		
Cooperative Societies		
Money Lenders		
Friends and Family		
Others (Specify)		

13. Have you been visited by an extension agent in the last one year? Yes ( ) No( )

14. If yes, how many times in the last one year. ?……………………………………

15. Did you visit an extension agent last year? Yes ( ) No ( )

16. If Yes, How many times in the last one year?..

17. Have you been trained on any aspect of farming? Yes ( ) No ( )

19. If Yes, what activities, which organization conducted the training and what benefit did you derive from the training? ....

Activities/Technology	**Organization**	**Benefit**
Fertilizer application		(a)Not beneficial( ) (b) Somehow beneficial ( ) (c) Beneficial ( ) (d) Very beneficial ( )
Intercropping		(a)Not beneficial( ) (b) Somehow beneficial ( ) (c) Beneficial ( ) (d) Very beneficial ( )
Plant Spacing		(a)Not beneficial( ) (b) Somehow beneficial ( ) (c) Beneficial ( ) (d) Very beneficial ( )
Pest Control		(a)Not beneficial( ) (b) Somehow beneficial ( ) (c) Beneficial ( ) (d) Very beneficial ( )

19. Of what benefit were the techniques learnt to you to the success of your farm apart from the one listed on the table above?,……………………………………

B. FIXED FACTOR

20. What is the size of your farm?

Plots	Size(Hectare)	Crops
1		
2		
3		

21. How did you acquire your land? (Tick below)

Plot	**Plot Size (ha)**	**Mode of Acquisition**				
		(a) Inheritance	(b) Lease	(c) Borrowed	(d) Gift	(e) Purchased
1						
2						
3						

22. How much does it cost to rent one Hectare of land per season in your village? ……………….. Naira

C. VARIABLE INPUTS (LAST PRODUCTION CYCLE)

(i) What is the quantity of seed you planted last year?

Plot No.	Quantity of Seed (Kg)	Cost (N)
1		
2		
3		

23. What is the quantity of fertilizer you applied to your farm last production year?

Plot No.	Fertilizer type	Quantity (Kg)	Cost (N)
1			
2			
3			

24. What is the quantity of agrochemical you applied to your farm last production year?

Plot No.	Agrochemical type	Quantity (litres)	Cost (N)
1			
2			
3			

D. LABOUR INPUT

25. How many people did you engage for land preparation?

Plot No	Labour		
	No of people	No of Hours	Cost (N)
1			
2			
3			

26. How many people did you engage for planting in your farm?

Plot No	Labour		
	No of people	No of Hours	Cost (N)
1			
2			
3			

27. How many people did you engage for fertilizer application in your farm?

Plot No	Labour		
	No of people	No of Hours	Cost (N)
1			
2			
3			

28. How many people did you engage for first weeding in your farm?

Plot No	Labour		
	No of people	No of Hours	Cost (N)
1			
2			
3			

29. How many people did you engage for second weeding in your farm?

Plot No	Labour		
	No of people	No of Hours	Cost (N)
1			
2			
3			

30. How many people did you engage for harvesting in your farm?

Plot No	Labour		
	No of people	No of Hours	Cost (N)
1			
2			
3			

E. INFORMATION ON CROPS OUTPUT

31. What is the total quantity of output produced from your farm?

Plot No.	No. of output of crop(s) produced (kg)	Total Qty. sold	Price/Unit
1			
2			
3			

32. Number of months that harvest lasted in 2014 season

Crop	Name of Crop	How long did the harvest last? (No. of months out of 12)	How long do you think your harvest will last this time (no. of months).
Cereal crop			
Legume crop			
Root/tuber crop			
Others			

F. FOOD SECURITY STATUS

33. In the past 12 months, were there months in which you did not have enough food to meet your family's needs? Yes (   ) No ( )

34. If yes, which were the months in the last 12 months that you did not have enough food to meet your family's needs?

Months	Did you have enough food to meet your family's needs 1 = Yes, 0 = No
January	
February	
March	
April	
May	
June	

July	
August	
September	
October	
November	
December	

35. In which months does your household rely on food purchase for feeding?..................

36. Give the months when food prices are highest……………………………………...

37. How much do you spend on food purchase for last season?......................................

38. How many times do you eat in a day?...

39. What type of food do you eat for your breakfast?..

40. What type of food do you eat for your lunch?..

41. What type of food do you eat for your dinner?..

42. What is the quantity of food mentioned above? (a) half plate (   ) (b) full plate

G. INFORMATION ON EXPENDITURE

43. Household expenses (LAST YEAR CROPPING SEASON)

Items	Amount (₦)/week	Amount (₦)/month
1. Food		
2. Rent		
3. Clothing		
4. Housing maintenance		
5. Light/electric power		
6. Fuel		
7. Pharmaceutical products		
8. Hospital care		
9. Schooling		
10. Community levy/contribution		
11. Financial assistance/monetary gifts		

(present)		
12. Travels		
13. Contributions to associations and groups		
14. Others (pls. specify)		

H. INFORMATION ON INCOME

44. On-farm and off-farm income (provide estimation)

Source	Crop	Amount (₦)
1. Farm Income	a = Maize	
	b = Cowpea	
	c = Rice	
	d = Sorghum	
	e = Vegetable	
	f = Millet	
	g = Tubers	
	h = Others (Specify)	
2. Off-farm income	I = Civil Service	
	J = Trading	
	K = Others (Specify)	

45. Wealth and Assets: LIVESTOCK

Kindly indicate how many livestock you own and also provide other related information.

	Number of livestock presently owned	How many did you have last year 2014?	How many have you sold this year 2014?	Amount realized (₦)	How many have you consumed this year 2015?	Amount of animal products consumed last week (Qty/unit)	Amount of animal product sold last week (Qty/unit	Amount realized (₦)
Cattle								
Cattle meat								
Sheep								
Sheep meat								
Goat								
Goat meat								
Chickens								
Ducks								
Others								

I COPING STRATEGIES

46. What are the coping strategies employed to reduce the problems?

i ……………………………………………………………………………………
ii. ……………………………………………………………………………………
iii. …………………………………………………………………………………
iv. ……………………………………………………………………………………
v. ……………………………………………………………………………………

J. CHALLENGES FACED BY FARMERS

47. State the constraints affecting your production

i ……………………………………………………………………………………
ii. ……………………………………………………………………………………
iii. …………………………………………………………………………………
iv. ……………………………………………………………………………………
v. ……………………………………………………………………………………
vi. ……………………………………………………………………………………
vii. …………………………………………………………………………………
viii. …………………………………………………………………………………
ix. ……………………………………………………………………………………
x. ……………………………………………………………………………………

48 What suggestions will you give to help in solving the above constraints?

i ……………………………………………………………………………………
ii. ……………………………………………………………………………………
iii. …………………………………………………………………………………
iv. ……………………………………………………………………………………
v. ……………………………………………………………………………………

Thanks for your Attention.

APPENDIX 2

Table 3.2: Equivalent male adult scale weights to determine adjusted household size.

Age category	Male	Female
Under 1yr	0.00	0.00
1 - 4.9yrs	0.25	0.20
5 - 9.9yrs	0.60	0.50
10 - 14.9yrs	0.75	0.75
15 - 59.9yrs	1.00	0.90
60yrs and above	0.80	0.65

Source: Omotesho et al., 2006

Appendix 3: Calorie content of some commonly eaten foods in Nigeria

Food items	Kcal/kg	Food items	Kcal/kg
Staple foods		Mango	590
Cassava Tuber	1500	Pawpaw	300
Cassava flour	3800	Pineapple	320
Cassava Chips	3000	Apple	570
Garri	3840	Coconut	580
Yam Tuber	1100	Guava	730
Yam flour	3810	Sugar cane	360
Yam chips	3000	*Meat and animal products*	
Sweet potato Tuber	1100	Cow meat	2370
Sweet potato chips	900	Goat meat	2370
Irish potato	1200	Sheep meat	2370
Cocoyam Tuber	3830	Pork	2370
Maize green	3100	Bush meat	2370
Maize grain	4120	Chicken	2380
Maize flour	4120	Turkey	2380
Sorghum grain	3500	Fish	2230
Sorghum flour	3500	Snail	2245
Millet grain	3500	Shrimps	2230
Millet flour	3500	Crayfish	2200
Rice	1230	Crabs	2200
Wheat grain	3400	Eggs	1400
Wheat flour	3300	*Dairy products*	
Cowpea (beans)	5920	Milk	4900
Groundnut	5920	Cheese	4000

Soyabeans	4050	Yoghurt	4100
Soyabeans flour	2600	Ice cream	4100
Melon (shelled)	5670	Beverages	
Plantain	770	Cocoa	1200
Banana	960	Tea (leaves)	1200
Vegetables		Tea (liquid)	1200
Okra	4550	Coffee (powder)	1340
Tomato	880	Coffee (liquid)	1340
Pepper	3930	*Drinks*	
Onion	440	Soft drinks	620
Carrot	400	Orange juice	400
Egg plant	440	Apple juice	550
Cucumber	270	Pineapple juice	560
Chochorus/ewedu	500	Local beer	740
Spinach	220	Bottled beer	460
Bitter leaf	220	Wine	330
Water leaf	180	*Condiments and spices*	
Cabbage	230	Magi	220
Pumpkin	440	Salt	180

Source: Oguntona and Akinyele, (1995)

APPENDIX 4

Table 3.3: Level of food security

Food security status	**Calorie consumption per person per day**
Food secure	Above 2260 kcals

Marginally food insecure	Between 1800 kcals and 2260 kcals
Moderately food insecure	Between 1500 kcals and 1800 kcals
Severely food insecure	Below 1500 kcals

Source: Devereux (2006) and Meseret (2012)

APPENDIX 5

Table 3.4: Description of index of coping strategies.

Description of coping strategies	Number of time strategies were used per month	Index of coping strategies	Level of strategies
Not used	0	1	No strategy
Rarely used	1-2	2	Low
Often used	3-4	3	Medium
Frequently used	5 & above	4	High

Source: Kyaw (2009)