Research Article

Empirical Analysis of the Determinants of Food Insecurity in Katsina state

Abdullahi Abdurrahman[1], Moukhtar Muhammad Idris (Ph.D)[2], Ibrahim Abubakar Sani[3]

[1]Department of Economics, Al-Qalam University Katsina, Nigeria
[2]Department of Economics and Development Studies, Federal University Dutsin-ma, Katsina, Nigeria
[3]Department of Economics, Umaru Musa Yar'adua University Katsina, Nigeria

*Corresponding Author
Abdullahi Abdurrahman

Abstract: Not until recently, the study on the determinant of food insecurity did gained important acknowledgement from researchers and policy makers alike. However, the topic had generated a great momentum over the years. This study investigated empirically the determinants of food insecurity among households in Katsina state. Primary data was employed as the major source of data collection through the aid of questionnaire. The sample size of 384 respondents was taken based on Krejie & Morgan (1970) sample table. The sampling technique adopted was stratified and simple random sampling. The study used simple table, percentage, and frequency table and logistics regression in the analysis of the data for the study. Cronbach alpha reliability test was performed and the result shows that the measurement reached high reliability coefficient of 0.87 and the study revealed absence of Multicollinearity and Heteroskedasticity. The finding of the study from the logistic regression reveals that food availability, accessibility, utilization and stability were found to be major determinant of food insecurity in Katsina state and they have significant impact on food insecurity in the study area (P<0.05). Based on these, the paper recommended improving programmes and policies that will ensure a proper family planning which will reduce the number of children which the household can adequately cater for and farming should be encourage to make food available couple with legislation that will fight against hording and good storage facilities that will improve food utilization in the study area.
Keywords: Food Insecurity, Determinants, Household, Empirically.

INTRODUCTION

Human food requirement consists principally of four sources namely; water, agricultural crops, livestock and fisheries. Essentially the demand for food depends on population and dietary habits/per capita daily calorie intake of the people under consideration. Also, the food requirement of a nation depends on additional factors namely, food import and export balance. Consequently, there are three basic ways to produce these food requirements- through rain-fed agriculture, irrigated agriculture and food import (Umar 2014). Before the discovery of oil in Nigeria, agriculture was the mainstay of the economy. It contributed the majority of the GDP, provided raw materials for industries and as well the provision of job opportunities. Despite the change in the trend following oil discovery, agriculture still plays a significant role in the country's economy. The agricultural sector was the largest earner of foreign exchange during the first decade of independence, but its role has since been overtaken by crude oil exports which currently accounts for about 95% of export earnings. Between 1970 and 1985, agricultural production declined at an average annual rate of 0.9%. Crop and fish production fell by 1.6 and 2.0% per annum, respectively while livestock and forestry outputs increased by 2.4% and 1.6% respectively. During this period, GDP registered an average growth of 3.4% and the share of agriculture in total GDP averaged 36.0% (Umar 2014).

The above period also witnessed an increase in government spending on agriculture. However, there was a serious drought within this period which affected agricultural output. The performance of agricultural sector under this period was also undermined by disincentives created by the macro-economic environment notably, the changing tastes arising from imports which resulted in low demand for traditional crops; and the overvaluation of the naira exchange earnings from oil revenues aided large food imports and also put agricultural exports at a disadvantage (Mukhtar, 2011)

Quick Response Code

As a result of the decline in agricultural output, domestic food supply had to be augmented with large imports. This caused a rise in the food import bill between 1970 and 1981. The country opted for a home-grown structural adjustment programme (SAP) in an attempt to reverse the low trend in agricultural production; make food available at reasonable prices and increase farm incomes, the Federal Government launched the SAP in 1986. The performance of the agricultural sector under SAP was an improvement over the preceding period. Agricultural production grew at an average annual rate of 8.6%. All the subsectors – crop, fishery, livestock and forestry contributed to this growth. The GDP grew at average rate of 4.8% and the share of agricultural output in GDP rose to 40%. There was a reduction in food importation. The growth in agricultural output was attributed to reforms that encouraged farmers to produce massively (Mukhtar, 2011).

The period 1994-1998 saw a shift in policy from structural adjustment to one of the guided regulation. The growth in agricultural products during this period was 2.3% per annum in line with GDP growth of 2.8%. All the subsectors recorded lower growth rates except fishery which grew by 12.6%. This led to a rise in the GDP. However, there was a slow rise in volume of food imported which later grew astronomically (Mukhtar 2011).

The period 1999-2003 coincided with the return of democracy in the country. This period witnessed a massive government investment in agricultural infrastructure, especially water resources. This period also recorded a massive government investment in agricultural infrastructure especially water resources. This period also recorded a high budgetary allocation to agriculture. However, the output of the agricultural sector did not reflect the inflow of investments as the sector only grew at an average rate of 3.53% during this period. All the major staple crops recorded increases in output – livestock, fishery and forestry etc. (Mukhtar, 2011)

Globally, there is enough food for all, but more than 780 million people are chronically undernourished (FAO, 2001). Millions of people in developing world simply cannot obtain the food they need for a healthy and productive life. Much of the scholarly debate on agricultural growth and poverty in Nigeria have followed the general trend of regressing measures of poverty against agricultural output per head and a time trend (World Bank, 2009). This is based on the knowledge of agricultural production landscape in Nigeria.

Globally, certain groups of people are more vulnerable to food insecurity than others (Idachaba, 1991). Food insecurity is a problem in many households in developing world including Nigeria (Idachaba,

1991). Many poor households lack access to food in the right quantities and qualities at all times and therefore are described as food insecure (FAO, 1999; 2001).

Food insecurity has been described as a condition in which people lack basic food intake to provide them with the energy and nutrients for fully productive lives (Umar, 2014). It may also result in severe social, psychological and behavioral consequences. Food insecure individual may manifest feelings of alienation, powerlessness, stress and anxiety, and they may experience reduced productivity, reduced work and school performance, and reduced income earning. Household dynamics may become disrupted because of a preoccupation with obtaining food, which may lead to anger, pessimism, and irritability. Adverse consequences for children include higher levels of aggressive or destructive behavior, hyperactivity, anxiety, difficulty with social interactions (e.g more withdrawn or socially disruptive). Others include; increased passivity, poorer overall school performance, increased school absences, and a greater need for mental health care services (Umar 2014).

The government of Nigeria and the UNICEF in 2004 carried out a nutrition survey in Kano State captioned 'Household food security and nutrition: Nigeria'. The findings revealed that the northern savannah zone of the country was facing worsening food insecurity. It had the highest prevalence in the country of stunting or chronic under-nutrition among children under the age of five and an alarming statistics for micronutrient deficiencies of iron, vitamin A and iodine in adults and children. This has led to a high incidence of malnutrition-related diseases, including marasmus, kwashiorkor and goiter, which were not only undermining health but hindering agricultural production in a region traditionally considered the bread basket of Nigeria (Hussaini, 2016).

Even though Katsina State as one of the northern states of the country is richly endowed with potentials for the development of agriculture to ensure safe, adequate and quality food production for the State, the State is still characterized with a large number of people who are food insecure and therefore vulnerable (Hussaini, 2016).

Katsina state has all it takes by natural potential to produce food that will enable her attain sufficient food supply (Hussaini, 2016). This is not yet a reality due to some problems, one of which is the poor strategies employed in the attainment of food security. This has provided the impetus for this research study. It now becomes pertinent to raise the following question: What are the principal determinants of food security insecurity in Katsina State? And what is the extent of food insecurity situation among the households in the study area?

Hence, the motivating factor behind the choice of this research is informed by the inability of the erstwhile researches to implicitly determine the basic determinant of food insecurity in Katsina and moreover, there is generally a deficit of empirical researches on the topic in the present area of study. Meanwhile, we have not come across any empirical research the same to the present one in the study area, this therefore reignite my effort to delve on the topic.

According to Mukhtar (2011) food riots have recently taken place in many countries across the world. Many countries experience perpetual food shortages and distribution problems. These result in chronic and often widespread hunger amongst significant numbers of people. Human populations respond to chronic hunger and malnutrition by decreasing body size, known in medical terms as "*stunting or stunted growth*". This process starts *in uterus* if the mother is malnourished and continues through approximately the third year of life. It leads to higher infant and child mortality, but at rates lower than during famines. This has very serious adverse effect on economic growth and development of a society especially in terms of its labor force and human capital development.

Food Security Components
Common to most definitions of food security according to Food and agricultural organization (1998) are the elements of availability, access, utilization and stability or sustainability. These are briefly discussed below:

i.   **Food availability**
In this context, availability refers to the physical existence of food, be it from own production or on the markets. On national level food availability is a function of the combination of domestic food stocks, commercial food imports, food aid, and domestic food production, as well as the underlying determinants of each of these factors. Use of the term availability is often confusing, since it can refer to food supplies available at both the household level and at a more aggregate (regional or national) level. However, the term is applied most commonly in reference to food supplies at the regional or national level (Riely*et al*., 1999 cited in Robert, 2013).

ii.   **Food accessibility**
Food accessibility emphasizes on having sufficient resources to obtain appropriate foods for a nutritious diet. It is the way different people can obtain the available food. Normally, we access food through a combination of home production, stocks, purchase, barter, gifts, borrowing or food aid. Food access is ensured when communities and households and all individuals within them have adequate resources, such as money, to obtain appropriate foods for a nutritious diet (Riely*et al*., 1999 cited in Robert, 2013). Access depends normally on; income available to the household, the distribution of income within the household, the price of food, and other factors worth mentioning are individuals' access to market, social and institutional entitlement/rights (ibid).

iii.   **Food utilization**
Utilization has a socio-economic and a biological aspect. If sufficient and nutritious food is both available and accessible the household has to make decisions concerning what food is being consumed (demanded) and how the food is allocated within the household. In households where distribution is unequal, even if the measured aggregate access is sufficient some individuals may suffer from food deficiency (Robert, 2013).

iv.   **Food stability**
Stability or sustainability refers to the temporal dimension of nutrition security (i.e. the timeframe over which food security is being considered). In much of the food security literature, a distinction is drawn between chronic food insecurity—the inability to meet food needs on an ongoing basis—and transitory food insecurity when the inability to meet food needs is of a temporary nature (Maxwell and Frankenberger, 1992 cited in Robert 2013).

REVIEW OF EMPIRICAL STUDIES
Studies on the determinants of food insecurity reported conflicting results in the literature. These inconsistencies in the subject remain yet debatable among economists and policy makers.

Hussain, Segun and Hassan (2016) examined the determinants of food insecurity in Katsina state, Nigeria. They employed an ordinal logit regression approach to analyze the determinants of food insecurity among farming households in katsina state. The farming household food insecurity level in the study area was very high with the majority of the households being less food secure and more than one strategy was used to cope with periods of food shortages. They recommended that farming households be provided with opportunities for livelihood diversification, access to credit, market linkages and training on post-harvest handling to enhance their food security.

In another study conducted by Sunusi (2016) in Lagos and Oyo states of Nigeria, the determinants of food insecurity identified includes but not limited to income of households, level of education of households, and household's size. The study revealed that about 70% of the sampled households are food insecure. In a nutshell therefore the deductions that can be made based on the above studies is that the major determinants of food insecurity in Nigeria are household's income, educational statuses of households and size of households. However in the rural areas of Nigeria, one major determinants is farm size and income from farming based activities, while in the

urban areas the off farm income and other alternative sources of income are among the determinants.

Food insecurity may contribute to poorer mental and physical health. Marc, Jodie and Chuan (2016) examined the associations of housing and food insecurity and health status among U.S adults with and without prior military service in United States. They analyzed data from nine states administering the social context module from the 2011 and 2012 Behavioral Risk Factor Surveillance System. Multivariable logistic regression was used to examine the associations of housing and food insecurity with poor mental and physical health and potential modification by military service. Compared with those with a history of military service, those without had higher prevalence of food insecurity (23.1% versus 13.7%) and housing insecurity (36.0% versus 22.5%). The study found that food insecurity was associated with poor mental and physical health (mental health: odds ratio (OR) =3.47, 95% Confidence interval (CI) = (3.18-3.77); physical health: OR=3.21, 95% CI= (2.91-3.53). Similar associations were observed between housing insecurity and poor mental and physical health. Prior military service was significantly associated with poor physical health. Interaction terms of prior military service with food and housing were not statistically significant. Food and housing insecurity does not appear to differentially impact mental and physical health among those with and without military service.

Omotesho *et.al.,* (2015) conducted a study in Nigeria to identify the determinants of food insecurity situation in Nigeria, the study shows that one third of the sampled rural households were food insecure. The authors considered annual gross farm income, household size, annual non-farm income of households and total farm size in hectares as determinants of food insecurity. The study revealed that farm size, gross farm income and household size were the major determinants of food insecurity in among the sampled households.

Ahmed (2015) examined the determinants of household food security and coping strategies in Blue-Hora, Borana zone, Oromia, Ethiopia. Ordered logit regression model was fitted to analyze the potential variables affecting food insecurity in the study area. Among 14 explanatory variables included in the logistic model, 6 of them were significant at less than 5% probability level. These are; cultivated land size, livestock holding and improved seed, sex of household head, soil fertility status and non-farm income.

Abdullahi, Hassan and Ayanlere (2015) analyzed the determinants of food security status among rural farm households in North-western Nigeria using logit regression model. The study showed that age, extension contact, source of labour and per capita income were the main determinants of food security in the study area. The result of marginal effect also shows that the probability of food security among the households is more responsive to a change in age than to extension contact, source of labour and per capita income.

Ahmed, Eugene and Abah (2015) also analyzed the determinants of food security among farming households in Borno state, Nigeria. The study measured food security status among farming households across the three agro-ecological zones of Borno State, Nigeria. Well-structured questionnaire was used to source information from 120 randomly selected households. Descriptive statistics, Cost-of-Calorie Function (COC) and Logit model were used to analyze the data. The result of analysis indicated that about 81% of the respondents were males, 48% of the respondents fell within the active work-age bracket of 31 – 40 years, about 57% had informal education and about 47% had an estimated monthly income of between N100000 - N149999. About 40% of the households were food secure and the model revealed that 11 of the 12 independent variables were significant at 1% and 5%. The Logit analysis revealed that the major determinants that positively influenced food security in the study area were gender, age, level of education, cooperative membership, and extension agents' contact, farming experience, access to credit, income, and farm size while household size and child dependency ratio negatively influenced food security. Food diversity result showed that about 57% belong to the low food diversity group.

Ahmed, Mohammed and Abah (2015) undertook an empirical analysis of socio-economic characteristics and food security situation among semi-urban households. The Study analyzed the socio-economic characteristics and food security situation among semi-urban households in Biu and Bama Local Government Areas in Borno State, Nigeria. Well-structured questionnaire were used to source information from 198 randomly selected households. Descriptive statistics, Cost-of-Calorie Function (COC) and Logit model were used to analyze the data. The study revealed that mean age of respondents was 45 years and they spent an average of 8 years in formal education. Also, mean monthly income level was about N40, 000 and assets base was at an average of N194,000. The food security line was found to be N66.17 per day per adult equivalent and 44% of the households were food secure. Significant and positive variables in explaining the variation in food security status include education, farm size, income, contacts with extension agents, cooperative membership, family labour, assets, farm enterprise, farming experience and food diversity. Child dependency ratio and gender though significant, negatively influence food security. Results also showed that crop production, monthly wages and petty trading were the major sources of income in the study area. The study, therefore recommended improvement of wage earning capacity,

more income diversification opportunities and increased awareness to family planning facilities were proffered.

Seydou, Liu and Baohui (2014) investigated the factors affecting household food security in Niger. Based on survey data covering 500 households, drought, high food prices, poverty, soil infertility disease and insect attacks are reported by the respondents to be the main causes of food insecurity. The empirical result from logistic regression revealed that the gender of the head of household, diseases and pests, labor supply flooding, poverty, access to market, the distance away from the main road and food aid are significant factors influencing the odds ratio of a household having enough daily ratios. The findings of this study provide evidence that food insecurity continues to affect the Nigerien population.

Edgar, Tamuka, Desmond, Tendai and Onias (2014) examined the determinants of household food security in Murehwa district, Zimbabwe. Cross – sectional data fitted to a logistic model was used, with a household food security being the binary dependent variable. The results showed that household size, farmland size, farmland quality, availability of draught power and climate adaptation had a significant impact on the food security status of households. Household size was found to have a negative relationship with food security while the other four variables had a positive impact on food security. Gender of household head, age of household head, education of household head, employment status of household head and fertilizer application by the household were found to be statistically insignificant in determining the food security status of households.

Ahungwa, Umeh and B.G (2013) undertook an empirical analysis of food security status of farming households in Benue state, Nigeria. The study employed a stage-wise random sampling technique to obtain 180 households. Descriptive statistics were used to access the socio-economic characteristics of the households and food security index was used to measure the household food security. The food security indicators for the state showed that 63.33% were food insecure, subsisting on less than 2500kcal per day, while 36.67% were food secure. The household daily per capita calorie availability for the food secure households was 3431.93kcal, exceeding the minimum requirement of 2500kcal by 33.8% while the daily per capita calorie available for the food insecure group was 1719.42kcal, fallen short of the minimum requirement by 29.6%. The head count ratio showed that 36.7% of the individual members of the households were food secure and 63.3% were food insecure. The study concludes that, in spites of the tremendous efforts made in the agricultural at the national and state levels in the areas of policy intervention, the resultant effects are yet to be felt and the state, The Food Basket State, remains generally food insecure.

Nuruddeen (2013) conducted a study on food security and vulnerability in drought prone northern state of Nigeria. Descriptive statistics was used to analyze the socio-economic and demographic data of the households, while regression analysis was used to determine the food security and insecurity status of the households by using Global and Nigerian Bench marks provided by FAO. The results of the study have shown that households size, level of education as well as per capita income have significant effect on status of food security in the study areas.

Using descriptive tools (mean, frequencies and percentages) Abimbola, Adepoju and Kayode (2013) conducted a study on food insecurity status of rural household during the post-planting season in Nigeria. The study showed that almost half of rural households during the post-planting season in Nigeria were food insecure. The study also identified key rural food poverty determinants as gender, tertiary education, expenditures on non-food items, access to both formal and informal credit and remittances, marital status, household size, dependency ratio, living in north-central, north-eastern, south-eastern and south-western zone.

Akarue and Bakporhe (2013) examined the determinants of food insecurity in Delta state, Nigeria. The study investigated attempts to estimate the food security status and identify the determinants of food security among households in Ughelli North Local Government Area of Delta State, Nigeria. A multi-stage sampling technique was used to select 80 households while a pre-tested well-structured questionnaire was used for data collection. Analysis of results indicates that majority of respondents are between the ages of 49-45 years with average household size of 1 -4 persons. Respondents" distribution by gender reveals that there are more male-headed households than female-headed households with about 88.80 percent and 11.10 percent of the former and the latter. However, respondents" distribution by food security status showed more food-insecure male-headed households than female-headed households. It was also found that about 70 per cent of the households are food insecure; using expenditure method of estimating food security status. Further analysis using the binary logistic regression method identified only income of household head as important determinant of food security. Income of household head impact positively on food security, implying that gainfully employed household heads tend to be food secure.

Robert, James and Thomas (2013) also undertook an empirical study of determinants of household food security in the Sekyere-Afram plains district of Ghana using logistic regression model. Among the variables considered in the model, household size, farm size, off-farm income, credit

access and marital status were found to significantly influence household food security. The study has shown that majority (79%) of households in the Sekyere-Afarm plains district were food insecure during the survey.

Ana, Bill and Sekher (2013) conducted a study on the determinants of food security in rural India. They employed probit and ordered probit models to analyze the determinants of food security in rural India. Using household assets, land ownership, access to food safety nets and the demographic characteristics of the residents of the area under study, the study finds strong evidence to show that poverty, income from agriculture, religion and district heterogeneity influence food security. Food based safety appear to be implemented differentially.

Girma (2012) used binary logistic regression model to examine the determinants of food insecurity among households in Addis Ababa city, Ethiopia. He considered the following variables: household size, age of household head, household education head education, access to credit, household asset possession, access to employment, dependency ratio, food aid, gender of household head and household access to various services. The result of the logistic regression indicated that six (6) out of the ten variables namely household size, age of household head, household head education, asset possession, access to credit and access to employment were found to be statistically significant as determinants of food insecurity in the study area.

Patrick (2012) undertook an empirical study of determinants of food accessibility of rural households in the Limpopo province, South Africa. The study has assessed household food security (access) and its determinants across selected rural households from all the five districts in the Limpopo province in South Africa, using a large cross-sectional household survey. Data were collected by using structured questionnaires. Two municipalities were randomly selected from each district. A total of 600 households were involved in the study with 60 households selected from each municipality. Approximately 15% of the households were categorized as food secure, 6% as mildly food-insecure, 26% as moderately food-insecure and 53% as severely food-insecure. Majority of the households purchase their food from the market rather than their own production and in many situations, market purchases of the major food staples such as *mielies* constituted more than 90% of the food consumed by the households. A factor analysis of the household responses to their food access experiences of the past 30days prior to the study revealed two main factors: (1) mild-to-moderate food insecurity; and (2) severe food insecurity. The factors, jointly, explained approximately 82% of the total variance in the responses. The factors were used in further multiple linear regressions analyses. The findings clearly suggest that education,

gender, age of household head and household size affect both mild-to-moderate food insecurity as well as the experience of severe household food insecurity in the study area. Additionally, household production of vegetables, low dependency ratio, steady income source such as those from formal employment as well as household receipts of social grants and remittances were associated with lower levels of mild-to-moderate food insecurity.

Olagunju, Oke, Babatunde and Ajiboye (2012) undertook an empirical analysis of determinants of food insecurity in Ogbomosho metropolis of Oyo state, Nigeria using binary logit model. Socio-economic variables such as asset holding (mainly cultivated land, farm income, non-farm income and household production enterprises) and access to services like credit are found to be important correlates which affect household food security favorably in the study area. While controlling for all other variables, households with better access to credit, education, extension agents and cooperative membership are found to have significantly higher food security and so more likely to be food secure. However, among demographic variables considered in the study, only age was found to have a negative and statistically significant effect on household food security. Contrary to usual expectation, the coefficient of farm income, dependency ratio, family and hired labour were not statistically significant. These may imply that household headship has not yet enhanced households' capabilities to adopt better production technologies accept technical advice from extension workers and diversify their source of income which would have reduced the risk of food insecurity among households.

Ojogho (2010) examined the determinants of food security among arable farmers in Edo state, Nigeria, using binomial logit model. The education level of farmers, household size, output level of household and per capita income of the household are the major determinants of food insecurity in the area while the probability of a household being food insecure is due to household size, household dependency ratio, sex of household head, age and the level of education of the household head.

The problem of food insecurity is pervasive in Nigeria. Babatunde, Omotesho and Sholotan (2007) analyzed the socio-economic characteristics and food security status of farming household in kwara state, Nigeria using logit regression model. The study has shown that the socio-economic variable of the farm households are important determinants of their food security or insecurity status. The study showed that household's income, quantity of food from own production, education of household's head and the household's size are important determinants of food security among rural households. They also showed that

household's head education is one of the significant determinants of food security.

METHODOLOGY
The Study Area

The study area is Katsina State, and Katsina State was created out of the defunct Kaduna State on 23rd September, 1987 and like the former Katsina Province of Old Northern Nigeria, the State comprises Katsina and Daura Emirates. It borders Kaduna State to the south, Jigawa and Kano States to the East, Zamfara State to the west and shares an international border with Republic of Niger to the North (Katsina state investor's handbook 2016).

It occupies an area of about 24,192 square kilometers, with an estimated population of about 5.8 million people as per 2006 projection. Katsina is a mono-ethnic and monolingual state and the people are generally Hausa/Fulani (Wikipedia, 2017).

The creation of Katsina State in 1987 brought with it the usual increase in the volume of economic and social activities attendant to a new State. Major cash crops produced in the state are millet, guinea corn, groundnut, cotton, maize, beans, rice and wheat. Katsina State is the largest producer of cotton in Nigeria and livestock production is also a major preoccupation of people in the state (Wikipedia, 2017).

The agricultural products of the state provide good raw material base for a variety of industries such as oil and flour milling, textiles and dairy products (Wikipedia, 2017).

The state extends from the tropical grassland known as Sudan Savannah to Arid Zone in the North. The State is blessed with fair rainfall with the rainy season longer in the southern part where it lasts for up to six months, while in the Northern part; it usually lasts for five months. This accounts for the decreasing density of vegetation from south to north (Wikipedia, 2017).

About 95% of the state population is engaged in subsistence agriculture namely: farming and animal rearing. Both food and cash crops are produced in the state. During the dry season, people engage in irrigation farming in fadama areas and along river basins. Animals reared include cattle, sheep and goats (Wikipedia, 2017).

Katsina State as earlier indicated has two climatic seasons, namely dry and rainy seasons. The rainy season which lasts for five months covers the period between May and September while the dry season covers about seven months of the year between October and April. The dry season is usually accompanied by the dry Harmatan winds with lower temperatures (Wikipedia, 2017).

The state has an average temperature of between 21oC and 30oC. Due to its border with the Sahelian zone, the state vegetation density reduces from the southern part of the state to the northern part (Wikipedia, 2017).

Katsina State has a total of 34 local government Areas (LGAs). These LGAs are Bakori, Batagarawa, Batsari, Baure, Bindawa, Charanchi, Dan Musa, Dandume, Danja, Daura, Dutsi, Dutsin-Ma, Faskari, Funtua, Ingawa, Jibia, Kafur, Kaita, Kankara, Kankia, Katsina, Kurfi, Kusada, Mai-Adua, Malumfashi, Mani, Mashi,Matazu, Musawa, Rimi, Sabuwa, Safana, Sandamu and Zango(Wikipedia, 2017).

Population of the Study

The group of people, objects, events or things that a researcher has interest in investigating is called a population (Sekaran & Bourgie, 2010). The target population for the study is the households in Katsina state.

Sampling Technique and Sample Size

One of the most important tasks for the researcher is to select educational settings and negotiating access to the participants or respondents (Steyn and Van Wyk, 1999).

Adopting a sample size in scientific approach becomes necessary; an ideal sample size is needed to reduce the cost of sample error and to truly represent the population. (Krejcie & Morgan, 1970) has provided the following formula for determining a sample size:

$$S = X^2 NP(1-P)/d^2(N-1) + X^2 P(1-P)$$

S= required sample size
$X^2=$ the table value of chi-square for 1 degree of freedom at the desired confidence level (3.84)
N= Population Size
P= Population proportion (assumed to be 0.50 since this would provide the maximum sample size
D= Degree of accuracy express as a proportion (0.50)

The application of Krejie& Morgan (1970) model requires no calculation because they have a table for selecting an appropriate sample size. Therefore for a scientific approach, the researcher would use Krejcie & Morgan sample table.

Table 1: Krejcie & Morgan Sample

Population of Katsina state	Sample size
6,483,429 (2010 est.)	384

Looking at Krejcie & Morgans' (1970) table the researcher used sample size of 384. Furthermore, the study applied Stratified sampling technique whereby

the researcher divide the population in to strata and then simple random sampling technique was used to draw the sample (Spector, 2008).The questionnaires was administered among the 384 sampled household respondents. The study area i.e. Katsina state is divided into three strata by senatorial zone and in each senatorial zone simple random sampling was used to select 128 respondents from each zone randomly.

Theoretical Framework
Malthusian Population Theory

In his famous theory of population, "An Essay on the Principles of Population Thomas Malthus argued that population exhibits a natural growth rate described by geometric progression while food production grew in arithmetic progression Malthus further concludes that without restrains, there will be continued pressure on living standard both in terms of input and output. Malthus was more particular to agricultural production because of the fear of hunger and famine due to scarcity of land relative to the size of population. Malthus posits that population will soon outstrip the available resources and signified disaster, he therefore prophesized checks both natural and moral that will control population. These checks includes hunger, famine war, abstinence from sex and etc. however Malthus failed to consider the technological advancement and international trade in improving food situation. Despite the above the Malthusian theory of population have succeeded in explaining the food insecurity situation especially in developing countries like Nigeria where there are constraints to technological progress and international trade and at the same time the growth in food production is not encouraging.

This theory is considered relevant to this research considering the fact that the population growth rate of Katsina state has been increasing over the years while our production pattern is mostly done using tradition equipment with dearth of technological progress. This perhaps as proposed by Reverend Malthus makes food production to be increasing at slow rate of growth while early marriage, culture and the religious believe in the area encourage high birth rate which consequently left many family vulnerable to hunger and starvation.

Against this explanation the theory will serve as a theoretical guide to our research and all findings will be made reference to the theory.

Method of Data Collection

While,
FAV = Food availability
FAC = Food accessibility
FUT = Food utilization
FST = Food stability.
The choice of these variables was informed by the fact that they measure food security as proposed by FAO and were used in the study of food insecurity

The choice of data collection is important to the research process. The nature of the research question, the methodology, the strategy and the theoretical approach all influence the research choice of data collection (Ader, Mellenberg & Hand 2008). The study employed a multiple choice structured questionnaire, that is designed for the collection of primary data that are considered crucial for the success of the study; it is designed in such a way that it permits empirical investigation on various issues relating to the objectives of the study.

The data from the study was collected from primary sources. Questionnaire was used as the main data collection technique for this study, the researcher utilized to obtain the needed information from respondents, which gives the respondents a number of alternative options to choose from and gives them the necessary time to answer questions asked.

Measurement of Variables

The research has 2 major constructs, the independent variable (food availability, accessibility, utilization and stability) and the dependent variable (binary dependent i.e. food secured or unsecured).

Model Specification

The research work is based on two major constructs namely: food insecurity and its determinant, the model for the study were derived from the research efforts of previous studies in this area of study. The model specification for the study employed a linear regression model to assess the determinant of food insecurity among household in Katsina state.
$Y_i = f(X_i)$

Where Y=food insecurity measured by binary dependent (food secured or unsecured)
X= determinant of food insecurity proxied by different indices given by FOA such as Food availability, accessibility, utilization and stability. Thus, following Abdallah (2012) and Usman (2013) model with modifications, the model for this study is specified thus;

$$FIs = \alpha_0 + \beta_1 FAV + \beta_2 FAC + \beta_3 FUT + \beta_3 FST + \mu_i$$

Where FI_S =is the Binary dependent variable, measuring extent of food insecurity;

$$\int_0^1 = \begin{array}{l} 1 \; if \; they \; are \; food \; secured \; and \; 0 \\ if \; they \; are \; food \; insecured \end{array}$$

determinants in most advanced countries of the world (Usman, 2013).
$\beta_1, \beta_2, \beta_3,$ and β_4 =are respectively the slope coefficients measuring the marginal effect of the independent variables
α_0 = Constant Value
μ_i= random error term

RESULTS AND DISCUSSIONS
Method of Data Analysis
Following the data collection from the field, Normality (Descriptive) and Diagnostic tests (Autocorrelation, Hetroscedasticity and Multicollinearity) will be conducted to examine nature, validity and reliability of the data. Meanwhile, the data will be analyzed via linear logistic regression through the use of SPSS v.16.

Table 2: Questionnaire Distribution and Response Rate

ITEM	FREQUENCY PERCENTAGE
Distributed questionnaires	384 100.00
Returned questionnaires	361 94.01
Rejected questionnaires	9 2.49
Retained questionnaires	352 91.67

Source: Fieldwork, 2017

A total of 384 questionnaires distributed to the target households among which only 288 were retained and used for data analysis which represent 79.77% of the total questionnaire returned and this constitutes the sample of the study which give an effective response of the study. This rate is considered sufficient considering the Sekaran's (2003) argument as cited in (Bambale, 2013) that response rate of 30% is acceptable for surveys (Bartlett, Kotrlik, & Higgins, 2001; Hair et al., 2010).

Reliability
Cronbach alpha reliability was performed and the result shows that the measurement reached high reliability coefficient of 0.87, although the coefficient of 0.60 can be considered average, whilst 0.70 could be regarded as high reliability coefficient (Hair et al, 2006, Nunnally, 1978; Sekaran & Bougie, 2010, Sekaran, 2003).

ASSUMPTIONS OF MULTIPLE REGRESSIONS
To satisfy the basic requirements of multiple regression analysis as enshrined in the classical linear regression assumptions, the variable for this study were subjected and checked for normality, diagnostic and linearity assumptions test (Hair et al, 2010).

i.   Normality
When distribution is normal, the value of skewness and kurtosis must be close to zero. Graphically, normality of the study variable is usually determined through the use of histogram residual plot. This is a shape of data distribution to an individual continuous variable and its correspondence to normal distribution (Gujarati, 2007).

In this study, normality assumption was tested by checking the histogram residual plots. Based on the analysis in this paper, the residual appears to be normal. Therefore, the normality assumption was not violated (Afifi & Clark, 1998).

ii.   Linearity
Regression analysis is a linear procedure, and the relationship between dependent and independent variables, and it is only applicable when the relationships are linear in nature (Osborne and Waters, 2002). If a nonlinear relationship is presented, the regression R-square will underestimate the variance explained overall and the betas will underestimate the importance of the variables involved in the non-linear relationship (Pedhazur, 1997). This may cause the regression result to be unusable for the researcher (Garson, 2008). Hair (2006) suggests that examining the residual scatter plots is the most common way to identify any nonlinear patterns in the data. Therefore, this study used residual plot, which proves that the assumption of linearity was not violated as the plot shows that residual converged at the centre along the zero point. Hence able to achieved linearity assumption.

iii.   Multicollinearity
It is required in linear regression model that high relationship should NOT exists among the independent variables, otherwise, marginal effect of each of the independent variable on the dependent variable could not be determined (Gujarati, 2007).

Table 3: VIF AND THE TOLERENCE VALUE OF THE IV'S

Independent variable	Tolerance Value	VIF
Food availability	.151	6.614
Food accessibility	.141	7.104
Food utilization	.373	2.684
Food stability	.323	2.981

Source: SPSS output, 2017.

Garson (2006) suggest the rule of thumb is that when VIF is greater than 4.0, multi-collinearity is a problem. However, more lenient cut-off of points was used in application, for instance, Dielman (2001) use 10 as the cut off points. O'Brien (2007) indicate the most common rule of thumb for a VIF is 10, which is regarded by many researchers as a sign of severe or serious multicollinearity problems (O'Brien, 2007). Myers (1990) also shared the similar view that if average VIF is greater than 10, then multicollinearity may be affecting the least-squares estimates of the regression coefficient, Conversely, VIF values below 10 indicate that multicollinearity is not a problem (Myers, 1990).

Condition Index Garson (2007) suggests a condition index which uses square roots of the ratio of the largest eigenvalues to each other eigenvalue as an alternative approach to assess multicollinearity in data. Many researchers suggest condition indices over 15 indicate possible multicollinearity problems and over 30 indicate serious multicollinearity problems (Amiama, Bueno, and Álvarez, 2008; Garson, 2007; Joshua, 2008). However, Belsley, Kuh and Welsch (1980) argue that condition index values greater than 30 do not necessarily indicate problematic multicollinearity. William (2008) argued there is still no clear cutoff criterion for condition index to evaluate multicollinearity. Therefore, it is suggested to consider a condition index as a reference (William, 2008).

Thus, from the above table it was revealed that VIF values are less than 10 while the tolerance values are more than .10 indicating the absence of multicollinearity among independent variables.

iv. **Homoscedasticity**

The basic assumption of homoscedasticity is that variance should be constant or approximately the same at each level of the independent variables (Hair et al, 2010). In other word, it is assumed that the error term in the regression model has a constant variance. It is usually assess via visual inspection of the scatter plot of the regression residual. Homoscedasticity appears to be indicated when the width of the band of the residuals is approximately the same at dissimilar level of the dependent variables and scatter plot shows a pattern of residuals normally disseminated around the mean.

Table 4: Socio-Economic characteristics of the respondents

Variables	Frequency	Percentage (%)
Gender:		
Male	188	53.41
Female	164	46.60
Age:		
20-30 Years	58	16.48
31-40 Years	137	38.92
41-50 Years	118	33.52
51-above	39	11.07
Marital Status:		
Single	38	10.80
Married	187	53.125
Divorced	53	15.05
Widow	74	21.02
Educational Qualification:		
Primary	22	6.25
Secondary	73	20.77
Tertiary	134	38.06
Others	123	34.94
Household size:		
1-4	36	10.23
5-9	158	44.89
10-14	127	36.08
15-above	31	8.81
Occupation:		
Farming	122	34.66
Trading	99	28.13
Salary earner	58	16.48
Others	73	20.74

Source: Fieldwork, 2017.

Gender

Gender refers to state of being male or female. In this study, 53.41% of the respondents are male, whereas, 46.60% of the remaining respondents are female. The justification for male being the majority in the total distribution is virtue of their economic dominance and accessibility to certain opportunities against their female counterpart in the society as equally dictated by their culture, tradition and perhaps religion

to which the area owes a great debt. This is also depicted in the pie chart below:

Age

Age refers to length of time one has been alive. Age may also be referred to as condition of having to live for many years. It is usually measured at interval levels. The table shows that only 58 respondents fall between the ages of 20-30 which is 16.48%. 137 respondents constitute the majority in the study area with 38.92% who fall between the ages of 31-40. While 118 respondents fall between the ages of 41-50 with 33.52% and only 39respondents fall between the ages of 51 and above constituting 11.07%. Majority of respondents in the study area are within their active age of partaking in to one form of business or economic activity or the other to earn a living which perhaps explains the need for food security in the realm.

Marital Status

Marital status can be seen as the fact of somebody's being married, unmarried or formally married. This is purely a marital phenomenon that is trying to show whether food secured or unsecured person is single, married, divorced, or widow.

The table shows that 38 of the respondents are single with a percentage of 10.80%, where 187 of the respondents are married which constitute 53.13% in the study area, and 53 divorced respondents which is equivalent to 15.05 of 100%, and 74 widows were they represent 21.02%

Therefore, most of the respondents in Katsina state area are married. This is perhaps due to religion and cultural setting in the area which encourage early marriage.

Qualification

This is the highest educational level a person has attained. From the above table, it was depicted that 22 respondents which constituted 6.25% of the total response have primary education. 20.77% of the respondents have secondary education. Respondents with Tertiary education (ND/NCE/HND/B.sc etc) in the study area constituted 38.06% whereas; respondents with Informal education in the study area amounted to 34.94% of the total response as depicted in the bar chart below:

Household size

Household size refers to the extent, population or number of all the people living together in a house either rent or owned. In this study, 36 respondents fall between 1-4 household sizes which constitute 10.23%. The majority of the respondents fall between 5-9 household sizes which constitute 44.89%, while 127 respondents fall between 10-14 household sizes with 36.08% and only 31 respondents fall between 15 and above household size which is equivalent to 8.81%.

Based on the survey, household size of respondents in Katsina state area is averagely normal.

Occupation

Occupation here means the level of engagement and/or disengagement of an individual in some activities apart from their own personal or primary responsibilities. The table shows that 122 of the respondents representing the greater percent of 34.66% do engaged in farming, followed by trading 28.13%, 16.48% of the respondents are salary earners and 20.74% engaged in other occupations.

According to the result, most of the respondents in the study area engaged in farming, this is because farming ensures food security among households.

Data Analysis

Linear regression method was used to investigate the determinants of household food insecurity in Katsina state. The result of the analysis is presented thus:

Table 5: Linear Regression Result

Variable	Coefficient	Std. Error	t-statistic	Prob
Constant	2.373535	0.929076	2.5547264	0.0781
FAV	-0.222378**	0.012815	-17.35294	0.0002
FAC	-0.190988*	0.0644671	-2.962565	0.0440
FUT	0.209516**	0.020041	10.248462	0.0013
FST	-0.424991**	0.120018	-3.5410605	0.0039

Source: Researcher's computations using SPSS V.21
*** (*) indicates significance at 1% and 5% levels respectively*
R^2=0.541
R^{-2}= 0.537
F-stat. = 97.399
Prob. (F-stat)=0.0000

Table 5, above revealed that, holding the other explanatory variables constant, the magnitude of food insecurity bedeviling households in Katsina state will be 2.373 on average. However, the result shows that there exist a negative and statistically significant relationship between food insecurity and food availability with corresponding p-value coefficient (p<.01). This further means that as food availability increase in Katsina state, the magnitude of food insecurity among household decrease by 22% or 0.22 units. The result also shows that there is a negative and statistically significant impact of Food accessibility on food insecurity among household in Katsina with the corresponding p-value <0.05. This result goes with reality and with our *a priori* expectation and theoretical underpinnings. Moreover, tremendous literature reviewed reaffirms our findings such as the work of Mesfin (2014) and Ahmed (2015).

However, the result indicates food utilization has positive and statistically significant impact on food insecurity among household in Katsina with corresponding p- value <0.01. But, this outcome may sound surprising and it goes against the reality. Meanwhile, it is possibly due to the fact there are inadequate storage facilities in Katsina state to fully and adequately preserve the food from decay and spoilage. This is why our result indicates a positive relationship and another reason may be attributed to the data utilized in the study which was elicited from respondent's opinion, and hence they are human whose response may be altered and change at any moment.

The magnitude of eta squared for the coefficient of determinants of food insecurity variables

Table 6: Correlation Result

Variable	r	Prob
FIs		
Determinants of food insecurity	0.613	0.004**

Source: Researcher's computations using SPSS V.21
*** (*) indicates significance at 1% and 5% levels respectively*

The above table 5 reveals the correlation result between food insecurity and its determinant, in which case, the result shows that determinants of food insecurity has positive and statistically significant association with food insecurity with 67.1% degree of association with corresponding probability value of Pearson correlation reads 0.001 which is less than 0.05. This reaffirmed the findings of Mefsin (2014) and Ahmed (2015) who posits that food availability, accessibility, utilization and stability significantly affect food insecurity. However, the result refuted the assertion of Robert and James (2013) who found significant association between food insecurity and its determinants.

DISCUSSIONS

Findings of this study above conforms to the findings of Jean (2013) and Habyarimana (2013) who posit that food availability, accessibility, utilization and stability have significant bearing on food insecurity. Meanwhile, correlation result above also conforms to the findings of the above regression analysis in that; it established strong correlations between food insecurity and its determinant. Although, the issue of food insecurity in its very fabric attracts macroscopic attention which makes drawing inference as per specific or case study area at best limited. Mukhtar (2011) and Ojogho (2010) posit that food should be secured, available and accessible, in that as more and more people engages in to self-employed business, farming and other economic activities, there would be tendency for reducing or solving the menace of food insecurity. Tremendous literature reviewed, *a priori* expectation and theoretical underpinnings reaffirm and validate the

used in this study was large (eta=0.08) based on Cohen (1988) formulation. Moreover, the result also indicates a negative and statistically significant relationship between food stability and FIs with corresponding p-value coefficient (p<0.01). The impact size coefficient eta squared=0.04 revealed medium effect size (Cohen, 1988).

The coefficient of determination R^2 reads 0.541 indicating a strong explanatory power of the explanatory variables on the dependent variable. The value of F-statistic reads 97.399 indicating that overall model is statistically significant as revealed also by its probability value =0.0000 (p<0.05).

outcome of our findings. This marvelous outcome will undoubtedly contribute to the scholarly debate on the subject matter and will of course serve as a policy tools to policy makers.

CONCLUSION AND RECOMMENDATIONS

From the above study, we can deduce that the food availability, accessibility, utilization and stability were found to be major determinant of food insecurity in Katsina state. Thus, the variables used in the study (notably; food availability, food accessibility, food utilization and food stability) were found to be the major determinants of food insecurity in the study area. Based on the findings of the study, the following recommendations are made in an attempt to improve the food security status of households and therefore, the regional and national food security status.

- Since food insecurity incidence increases with increase in household size, efforts should be made at improving programmes and policies that will ensure a proper family planning which will reduce the number of children to that which the household can adequately cater for.
- Farming should be encouraged to make food available couple with legislation that will fight against hording of food.
- Provision of good and adequate storage facilities that will improve food utilization should be given utmost priority so as to improve the food utilization capacity in the study area.
- Food accessibility should be improved by provision of good rural transportation system that would assist farmers to convey their farm produce to the market at cheaper cost.
- Government should provide basic inputs and farm implements such as fertilizers, tractors/animal drawn equipment, improved seeds, among others in order for households to increase their food production levels to make food available, since food availability was one

- of the significant determinants of food security in the study area.
- Public policy makers must as a matter of urgency include food as component of welfarism and as such develop sufficient political will to achieve:
    i. Increased food production.
    ii. Evolve food policy and
    iii. Eventually attain food security level.
- Government Agencies, Development Partners and NGOs should also come up with meaningful programmes aimed at assisting farmers at household level especially in communities where no interventions have taken place.

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