Assessment of Animal Protein Consumption and Food Security Among Rural Households in Kwara State, Nigeria

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Abstract

This study investigated animal protein consumption and food security among rural households in Kwara State. A three-stage simple random sampling technique was used to select one hundred and twenty (120) households in the study area and data were collected through a well-structured questionnaire. The analysis was done using descriptive statistics, food security index, t-test and Tobit regression model. Findings showed that majority of the household heads were males with no formal education and agriculture is their major occupation. The study also revealed that 36.67% of the households were food secured with an average daily per capita calorie and protein availability of 2696.42 kcal and 73.92g respectively. On the difference in protein supply from different sources, the result showed that there is significant difference in the t-value of plant protein (41.288^{***}) and animal protein (27.190^{***}) consumed by respondents. Furthermore, study revealed that off-farm income, monthly expenditure on animal protein, farm size, age of household heads, adjusted household size and crop output are significant determinants of intensity of animal protein deficiency among rural households. The study recommends that rural households should be encouraged to diversify their means of generating income as well as adopting modern family plan techniques with a view of reducing household size. Besides, nutrition-oriented programmes should be organized for rural households in attempt to improve the food security knowledge of rural households. In conclusion, despite the fact that rural households are the major producers of food in Kwara State, it was observed that the average calorie and protein availability to the area is less than the minimum per capita requirement.

1. Introduction

1.1. Background to the Study

There are various interventions made by governments in modernizing agriculture in Africa which is characterized by slow growth, low productivity, decreasing terms of trade, and linked to practices that destroy the environment [35]. From 70s to mid-80s, many African countries including Nigeria have implemented macroeconomic policies as well as sectoral and institutional reforms aimed at ensuring high and sustainable poverty reduction, food security and economic growth. In recent times, few African countries have recorded a reasonable level of growth in the agricultural sector. Hence,

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the sector's growth remained insufficient to address poverty and achieve food security which could lead to a sustained economic growth on the continent [40].

Food security is defined as a situation where all people have access to sufficient food at all times for an active and healthy life. It includes at least, availability of nutritionally adequate foods, and an ability to procure acceptable foods in socially acceptable ways. The main goal of food security is for individuals to be able to obtain sufficient food needed at all times and to be able to utilize the food to meet the body's needs. Food insecurity on the other hand connotes a temporary shortfall of adequate food for a proper diet (transitory food insecurity) as well as a long term food shortage called chronic food insecurity. The inability of the poor to have access to needed food can be attributed to low income and food production [15 and 36].

A review of the data of food supplies available for consumption in different countries shows that the per caput protein intakes in developing countries, Nigeria inclusive, is comparatively low. This can be due to the total protein supply deficient and also the quality of dietary protein available is inferior to which is consumed in developed countries [10]. Most of the foods consumed in Nigeria are carbohydrates which are obtained mainly in the form of starch [22].

Furthermore, due to various forms of deprivation of basic amenities of life, the productivity of most households is reduced and their ability to utilize food to their maximum benefit is hampered. Hence, the diets of the people in the rural areas need more attention most especially their protein intake so as to address the overall prevalence of wasting, underweight and stunting that is 9 percent, 25 percent and 42.0 percent respectively as reported by Isaac [17]. However, an important issue in the development of a nation is the availability and accessibility of food for the populace.

1.2. Statement of the Problem

It was observed that most people consume the minimum level of calorie but fail to get necessary protein and essential vitamins and minerals required for leaving a healthy life. A healthy adult with nutritionally adequate diet has a higher level of economic productivity in both own-farm production and the labour market than those who eat inadequate nutrition diet [37]. The greatest challenge facing policy makers in Nigeria is how to improve household food intake. This is in terms of the good quality and quantity of diet as well as to solve the challenge of nutritional imbalance of the teeming population of the country as reported by [41]. Evidence from literature also indicates that majority of Nigerians are food insecure because of the high prevailing level of poverty and poor performance of agricultural system.

This means that majority of Nigerians are inadequately fed.

The records of the increasing cases of nutritional deficiency symptoms and relatively reduced resistance to disease in the body which proteinous food could check is the aftermath effect of inadequacy in the provision of minimum food requirement for the family by household head income [3]. A healthy and nutritionally well-fed population is indispensable for attaining economic growth and development objectives of a nation yet there have been persistent reports of widespread malnutrition among Nigerians. Malnutrition in Nigeria has been linked to food shortages, both in terms of the adequate quantity available and access to the good quality of diet to provide balanced diets [13].

Kwara State is one of the 36 states in Nigeria where farming system is characterized by low quality land, low population density, and predominantly cereal-based cropping systems [21]. Kwara State is among the six poorest States in Nigeria in terms of undernourishment and income poverty. In fact, about 83% of the population of the State are classified as being poor [25]. As a result of this, most of the rural dweller do not have the financial capability to include sufficient animal protein in their daily consumption which made them to indulge in various hunting activities which are seasonal and relatively inadequate. Therefore, there is need to carry out an empirical investigation that will provide current data on the status of food security and animal protein consumption among rural household. This leads us to the following research questions:

i. What is the food security status among rural households?

ii. What is the difference in protein supply from different sources?

iii. What is the profile of animal protein consumption in the study area?

iv. What are the determinants of intensity of animal protein deficiency in household diet?

1.3. Objectives of the Study

The main objective of this study is to assess animal protein consumption and food security among rural household in Kwara State. The specific objectives are to:

i. determine the food security status among rural households;

ii. estimate the difference in protein supply from different sources;

iii. examine the profile of animal protein consumption in the study area; and

iv. assess the determinants of intensity of animal protein deficiency in household diet.

1.4. Justification of the Study

Many research works have been conducted on determinants and status of food security in Nigeria such as [28], [30], [34], [7], [6], [27], [39] and [5]. It was observed that the studies covered the determinants of food security situation in Nigeria. However, within the scope of the knowledge of the researcher only [24] focused on animal protein consumption pattern among rural households in Kwara State.

In the recent time, a lot of changes have occurred which necessitated the need to carry out a similar research for the purpose of update and trending. As we know that food security and poverty reduction have been a major campaign issues in Nigeria and yet provision of enough food to feed the entire population has eluded many governments. The quest for improving the level of nutrition must start with the appropriate knowledge of what people eat and the factors affecting their demand for specific food products. Nutrition can be described as both the outcome and the process of providing the nutrients needed for health, growth, development and survival. The need for supply of the appropriate quantity and mix of essential nutrients to the body arises because nutrients have been found to have both human health and productivity [4].

In view of this, the research work focused on assessment of animal protein consumption and food security among rural households in Kwara State, Nigeria. The result of the study will therefore, provide adequate knowledge and also orientate the farmers on the importance of animal protein in their consumption pattern in order to promote their healthy living and productivity. Also, the result will provide policy related information that helps to prioritize among the many possibilities depending on the relative extent of influences of its determinants. More specifically, it will help concerned bodies in their effort to formulate policies and develop intervention mechanisms that are tailored to the specific need of the study area. Finally, this study will also attempt to make further contribution to the previous studies and can be used as a source reference for further studies.

2. Literature Review

2.1. The Concept of Food Security

The concept of food security has been discussed for more than two decades. A lot had been said in literature on the concepts and definitions of food security. It is defined in different ways by international organizations, institutions and researchers. According to the World Food Conference of 1974, food security was defined as: 'availability at all times of adequate world food supplies of basic foodstuff to sustain a steady expansion of food consumption and to offset fluctuations in production and prices' [38]. However, it was soon realized that this definition gave a very limited view of the food security. This is because a large number of a people could be living in hunger even if the country had sufficient food in the aggregate during normal times.

[23] further suggested many definitions for the concept of food security. However, these definitions place more emphasis on development from macro-level to micro-level concern; from adequate level of supply towards concern to meet the demand; and from short term to a long term (permanent). Macro-level food self-sufficiency cannot assure the attainment of food security at household level. According to FAO there are only two levels of food insecurity, macro-level (food supply insecurity) and micro-level (food consumption insecurity) [15]. Food supply insecurity refers to national aggregate insecurity that arises when a country is unable to supply its aggregate food requirement either through domestic food production, imports or run-down of stocks, food assistance and reserves. On the other hand, food consumption insecurity exists when certain individuals or groups cannot gain access to adequate food given their nominal incomes, the price and availability of food. Food consumption insecurity may exist within food supply security, i.e. certain groups of people may lack adequate food although a country may possess adequate aggregate food supplies to meet needs. Thus, national aggregate insecurity entails household food insecurity. On the other hand, household insecurity can exist regardless of the status of aggregate national or regional food supply.

The most widely accepted definition of food security is the one forwarded by World Food Summit in 1996 and was defined as "Food security exists when all people at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life" [15]. The inclusion of "nutritious as well as safe" stresses food safety and nutritional composition whiles the addition of food preferences" changes the concept of food security from mere access to enough food, to access to the food preferred. What is implied in the above definitions is that food must be available to the people to an extent that will meet some acceptable level of nutritional standards in terms of calorie, protein and minerals which the body needs; the possession of the means by the people to acquire (i.e. access) and reasonable continuity and consistency in its supply as reported by [11].

2.2. Government Policy to Achieve Food Security in Nigeria

Nigeria government has made many attempts to address the issue of increased food production in both quantity and quality. Some of these attempts have cumulated into several

programmes and projects aimed at boosting agricultural production. These programmes include, the National Food Programme (1973), this was a voluntary scheme launched in Nigeria to make the country self-sufficient and food secured; The River Basin Development Authority (1974), was established to under-take the development of ground water resources and maintain dams, dykes, wells or boreholes, irrigation and drainage systems to boost agricultural production; Agricultural Development Projects (1974), 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; National Seed Service (1975), has the mandate of producing certified seeds as well as to arrange for seed certification; National Cereal Research Institute (1975), was established for the genetic improvement and production of soybean, rice, sugarcane, and sesame Operation feed the Nation (1976), it's sought to increase local food production and thereby reduce food imports, citizen were encouraged to cultivate empty plot of lands to boost agricultural production; National Root Crop Research Institute (1976), was established for the genetic improvement of yam, cassava, cocoyam, irish and sweet potato and ginger; Agricultural Credit Guarantee Scheme (1977) was established to provide guarantee on loans granted by banks to farmers to boost agricultural production and agro-allied processing; Green Revolution Programme (1980), was to ensure self-sufficiency in food production and introduce modern technology into the Nigerian agricultural sector; Directorate of Food, and Rural Infrastructure (1986) was established to influence the performance of agricultural related project in rural areas to boost food production; National Seed Policy (1992) was established 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.

Nigerian Agricultural, Cooperative and Rural Development Bank (NACRDB) was established in the year 2000 and tasked basically with financing at both the micro and macro levels, it was mandated to meet the funding requirements of Nigerians in the agricultural sector to foster increase food production and subsequent food security; National Agricultural Development Fund (NADF) was established in 2002, the body was tasked to be involved in agricultural research and development, and it was designed to promote the development of the agricultural sector; in year 2005, the government assisted by the World Bank established the Fadama project, it was designed to enhance agricultural production and value addition to small holders and rural entrepreneurs in the states under the Fadama programme; the Fadama programme is to provide support for water management systems in low lying flood plains, so that farming can continue in the dry seasons and National Food Reserve Agency of Nigeria (NFRA) was established in 2007 to oversee Nigeria's food security strategy; in September 2008, a new National Food Security Programme was established to bring about sustainable access to affordable and high quality food for all Nigerians [1].

The Agriculture Transformation Agenda (ATA) was launched in 2011 and designed to ensure food security, with the main focus of the agricultural value chains. Nigeria incentive-Based risk sharing system for agricultural lending on the federal government Agricultural Transformation Agenda with main objective to ensure de-risk agricultural financing and mitigate against the impact of natural disasters on loss of agricultural investments by facilitating low interest credit to farmers through commercial banks and liberalisation of insurance sector to increase farmers access to cost effective agricultural insurance schemes in the country. The central objective of these programmes was to increase food production thereby solving the problem of food insecurity and poverty. Unfortunately, most of these programmes failed to achieve the desired results due to lack of continuity in policy implementation caused by incessant changes in government and official corruption in government project execution.

2.3. Empirical Studies on Protein Consumption and Food Security

[12] assessed the food security situation and living conditions of Tiv farming households. Data was collected from 315 heads of households using interview schedule, and the data were analysed using means and food security index. The study shows that majority (64.1%) of these households were food secured. Also on the strategies put in place to ensure households' food security were the use of high yielding crop varieties (M= 1.60), mixed cropping (M=1.53) and use of early maturing crop varieties. The study recommends that governments in these states should support various extension agencies involved in the dissemination of these technologies that enhance the food security of the farmers.

[19] examined the relationship between hired labour use and food security among rural farming households in Kwara State, Nigeria. A four-stage random sampling technique was used to select 135 rural farming households. The analytical tools used were descriptive statistics, correlation analysis and the Tobit regression model for the study. The study showed that half of the households (51.1%) were food secure and that there is a positive correlation between the hired labour use and their food security status. Dependency ratio, age and educational qualification of the household head, total household size, and household income significantly influenced hired labour use ($p<0.01$). The study recommends

the need for agricultural credit schemes in Nigeria to accord higher priority to older farmers and poor rural households.

[9] assessed the food security situation in Ethiopia. The study showed that 10% of Ethiopia citizens are chronically food insecure and deteriorating situation of food security in Ethiopia is caused by population pressure, drought, shortage of farm land, lack of oxen, deteriorating of food production capacity outbreak of plant and animal diseases, poor soil fertility, frost attack, short of cash income, poor farming technology and weak extension service. The study recommends the household head and members of the household should engage in different income generating activities for means of living and coping mechanism.

[14] analysed the challenges of food security in Nigeria: options before government. The study explores the various challenges confronting food security in Nigeria. It shows that Government policies on food security have not yielded the desired results. The study also recommends that the need to feed populace adequately requires the coordinated efforts and interaction of food producers, transporters, market operators and a myriad of retailers.

[3] examined the determinants of protein consumption in Ila Local Government Area of Osun State, Nigeria. The analytical tools used were descriptive statistics and Logit regression model to analyse the determinants of protein consumption in the study area. The study revealed that sex, age, income level and affordability of protein were the significant factors that determine the level of protein consumption in the study area. The study recommended that the need for pricing policy in order to bring down prices of protein food to make it affordable for those who claimed it to be fairly and non-affordable in the study area.

[41] analysed the demand for animal proteins in Ibadan, Oyo State, Nigeria. The analytical technique used in the study was the linear Approximately Almost Ideal Demand System (LA/AIDS) model. The results showed that the demand for fish and beef in Ibadan was elastic while that of chicken is inelastic. The cross price elasticity revealed a substitutive relationship between fish and chicken while there is a complementary relationship between beef and fish, then beef and chicken. The cross price elasticity also showed that chicken and beef are luxury goods in the study area and fish is a necessity good.

[2] assessed the protein consumption pattern of households in Orire Local Government Area of Oyo State. Systematic sampling technique was used to select two villages from five wards in the study area. The data was analysed using descriptive and inferential statistics. The findings showed that income of the household heads, educational level and household size are significant factors affect the amount spent

on the proteineous diets. It was therefore recommended that rural dwellers should be encouraged to engage in planting legumes and rearing of livestock in order to increase personal consumption and distribution to the urban centre. Educational programmes should be organized for enlightenment about the importance of protein in their diet. Finally, family planning progamme should be emphasized to rural households in order to reduce the large household size prevalent in the study area.

[27] assessed the determinants of food insecurity in Ogbomoso metropolis in Oyo state. A binary logit model was used to identify factors influencing household food insecurity. The study revealed that among variables considered, age of household head, amount of credit received, family size, annual income, farm size and livestock owned showed theoretically consistent and statistically significant effect on probability of household to be food insecure. The study therefore, recommended that the need for a policy that provides adequately trained and equipped extension workers for facilitating and disseminating improved agricultural technologies that has the potential of raising efficiency in food production that can lead to food security.

[5] analysed the determinants of households' food demand in Nigeria. The study made use of 2004 Nigerian Living Standard Survey, comprising of 18,861 households. Households' budget share and expenditure per adult equivalent on food were found to be highest for staples in the pooled data and across the 6 geopolitical zones. Households' expenditure per adult equivalent and expenditure share on food is also higher than non- food in all the zones except South-west. This however indicates that majority of households spend most of their income on food in Nigeria.

[8] investigated food insecurity determinants among rural households in Nigeria. Tobit regression model was used to analyse data. Findings indicated that a unit increment of household members working generated the highest fall in household food insecurity among the respondents. Furthermore, the study showed that a unit increase in the number of household members in school generated the highest rise in household food insecurity in the study area. Larger family size had higher probability to be food insecure. The study recommended that policy should be directed towards encouraging and creating non-farm jobs for rural households as this would help to reduce food insecurity among the respondents. Policy should also be directed towards measures leading to the release of the "educational-financing burden" from farm households as this would also help to improve food security among the respondents.

[6] investigated the dynamics of food insecurity transitions among rural households in South western Nigeria. The data were collected over two-time period from 292 rural

households from September to December 2006 during food crops harvesting season and from March to May 2007 during food crops planting season. The analytical tools used were Marcov Probability Chain and Probit regression. Results indicate movements into and out of food insecurity during the two seasons. However, more rural households (71.8%) moved into food insecurity during planting season. In the long-run, 86.1% of households would transit to food insecurity during planting season. Household size, educational status of head, age, asset ownership, remittances, occupational status of head, access to credit and access to extension services are significantly variables that determine these movements. It was therefore recommended that the training should be organised for rural households to enable them acquire skills. This will guarantee them more income to meet food needs during the planting period.

[32] analysed the food security and poverty of the rural households in Kwara State, Nigeria. The analytical tool use was food security index. The finding showed that the only about 48% of rural households are food secure. The mean daily energy and protein available to the food-secure households are 13,655.24 kcal and 340.34g respectively. The 51.72% of rural households are food insecure. The mean daily energy and protein available to food insecure households are 13593.62Kcal and 334.41g respectively.

The application of Tobit regression analysis is preferred because it employs both data at the limit as well as those above the limit. It is important to mention that estimating the model using ordinary least square would produce both inconsistent and biased estimates [16]. This is because ordinary least square underestimates the true effect of the parameters by reducing the slope. Tobit regression model better handles censored dependent variables and it is superior to the logit and probit model in terms of measuring the intensity of animal protein deficiency in household diet. This model has been used in several studies with main focus on the measurement of intensity of determinant of food security [8].

3. Research Methodology

3.1. Study Area

This study was conducted in Kwara State, which is one of the six states in North central Nigeria. Kwara State is bounded in the South by Ekiti, Osun and Oyo States, in the north by Niger State, in the East by Kogi State and in the West by Benin Republic. The state is referred to as the "gateway" between the North and the South of the country because of its unique geographical position. The state has 16 local government area and its capital is Ilorin. It is located between latitudes 8° 29'48N and longitude 4° 32'32 E. The state of

harmony is less densely populated regions in the country, with population of 2,365,353 out of which farmer accounted for about 70 per cent [26].

Kwara State has a total land size of about 32,500 km². The topography is mainly plain lands to slight gentle rolling. It has two main seasons: dry and wet. The dry season is between Novembers and late March while the wet season is between early April and late October. The average temperature ranges between 30°C and 35°C and the annual rain fall ranges between 1000mm and 1500mm. The natural vegetation cover consists of the Guinea Savannah in the Northern part of the state and rainforest in the Southern part of the state. The landscape comprises of plains, hills and valleys. The state has River Niger as a major river that transverses the state while the other rivers include Asa, Osin, and Owu fall which serves as Tourists attraction.

3.2. Population, Sample Size Sampling Method

Kwara State is divided into four (4) agricultural zones by the Kwara State Agricultural Development Project (KWADP) in consonance with project administrative convenience, cultural practices, and ecological characteristics. The zones are as follows:

Zone A: Baruteen and Kaiama Local Government Areas;

Zone B: Edu and Patigi Local Government Areas;

Zone C: Asa, Ilorin East, Ilorin South, Ilorin West and Moro Local Government Areas; and Zone D: Ekiti, Ifelodun, Irepodun, Isin, Offa, Oke-Ero and Oyun Local Government Areas [20].

The population for this study consist of all rural households in Kwara State. A three-stage simple random sampling technique was used for sample selection. The first stage involved a random selection of one local government area from each zone. The second stage involved a random selection of two villages in each of the selected local government. The third stage involved a random selection of fifteen households from each of the selected villages. A total of one hundred and twenty households was selected for the study.

Table 1. Sample Design Outlay for the Study.

ADP ZONES	SAMPLE OF LGA	SAMPLE OF RURAL COMMUNITY	SAMPLE OF HOUSEHOLDS
A	Baruteen	Okuta and Yashikira	30
B	Patigi	Patigi and Kpada	30
C	Asa	Afon and Arobadi	30
D	Ifelodun	Kabba owode and Igbo owu	30
TOTAL	4	8	120

Source: Field Survey, 2014

3.3. Method of Data Collection

The data for this study was obtained from both primary and secondary sources. A well- structured questionnaire was used to collect required data. The secondary data, such as the nutritional equivalent of unit food item consumed by households and other recommended food bench-marks was sourced from World Bank Report and Publication in Journals, Research Institute, Universities and Government Parastatals etc.

A 7-day recall method was used in collecting data from 120 household heads and available family members especially those involve in preparing food for the households. The data collected were based on their daily food consumption and, the calorific and protein in each food item was used in estimating the proportion of the total food intake. Data on the demographic/ socio-economic characteristics of household heads such as household size, sex, age, occupation, education level, income and marital status was also collected etc.

3.4. Method of Data Analysis

The food security index was used to determine food security status among the respondents while the independent sample t-test was employed to estimate the difference in protein supply from different sources. The simple descriptive statistics which includes a measure of central tendency such as mean, percentages, frequency distribution and tabulation of data were employed to examine the profile of animal protein consumption in the study area. The Tobit model was used to assess the determinants of intensity of animal protein deficiency in household diet.

3.4.1. Food Security Index

The food security index was used to determine the food security status among rural households. There are two steps involved in constructing the food security index which are identification and aggregation. Identification is the process of defining a minimum level of nutrition necessary to maintain a healthy life. The minimum level is termed as the "food insecurity line". Aggregation refers to the derived food security statistics for the households. A daily recommended level of 2470kcal and 65g of protein per capita per day [31]. Households whose daily calorie intake or recommended daily protein intake are equal or higher than recommended daily calorie or recommended daily protein required are considered food secure households and those whose daily calorie intake are below the recommended daily calorie required are considered food insecure households. This method has been applied in several studies with a main focus on food security [28, 32 and 39].

The food security index is stated as follows:

$$\text{Food security index (Z)} = \frac{\text{Household's daily per capita calorie or protein availability (A)}}{\text{Household's daily per capita calorie or protein requirement (I)}}$$

For the purpose of this study, a household is defined as a group of people living together and eating from the same pot.

Based on Z, several food security measures are calculated; the surplus / shortfall index, p is given as

$$P = 1/M \sum_{j=1}^{m} Gj$$

Where Gj = (Xj – I)/I is the deficiency (or surplus faced by household j, Xj is the average daily calorie or protein available to the jth household while M is the number of households that are food secure (for surplus index) or food insecure (for shortfall index). It measures at the aggregate level, the extent to which households are above or below the food security line. In implementing food security policies and programmes, the values of the index could be monitored over time and compared among different groups of the population.

The Head count ratio (H) is defined as

$$H = M/N$$

Where M = the number of the food insecure, N = sample population.

3.4.2. T-test

The t-test is also referred to as student's t-test (first computed by a British statistician William Seal Gosset, who used the name "Student" for publication). It is used for numerical data to determine whether an observed difference between the means of two groups (two samples or a sample and a population, or a paired sample) can be considered statistically significant.

$$t = \frac{\acute{X}_1 - \acute{X}_2}{SX_1X_2 . \sqrt{1/n_1 + 1/n_2}}$$

Where;

$$SX_1X_2 = \sqrt{\frac{(n_1 - 1) S_{X_1}^2 + (n_2 - 1) S_{X_2}^2}{n_1 + n_2 - 2}}$$

Sx_1x_2 is an estimator of the common standard deviation of the animal protein and plant protein

Where n_1 = number of respondents consume animal protein

n_2 = number of respondents consume plant protein

X_1 = mean of quantity of animal protein available to the households

X_2 = mean of quantity of plant protein available to the

households.

3.4.3. Tobit Regression Model

The Tobit model is a statistical model proposed by James Tobin in 1958 to describe the relationship between a non negative dependent variable y_i and an independent variables x_i. The word Tobit is taken from Tobin and adding "it" to it. The application of Tobit analysis is preferred because it employs both data at the limit as well as those above the limit. The model better handles censored dependent variables and it is superior to the logit and probit model in terms of measuring the intensity of animal protein deficiency in household diet.

Tobit regression model was used to examine and establish statistical relationships between the dependent variable (i.e., animal protein deficiency) and independent variables (demographic and socioeconomic variables) that are expected factors influencing animal protein deficiency at household levels.

The Tobit model is specified as follows:

$V_j = \beta X_{ij} + e$

$V_j = V_j^*$ if $V_j > 0$

$V_j = 0$ if $V_j^* \leq 0$

V_j^* = limited dependent variable, it is the measure of intensity of animal protein deficiency in household diet.

It is defined as

$$\frac{Z - Y_j}{Z}$$

Where Z = recommended daily animal protein per capita (35g)

Y_j = j^{th} household's daily per capita protein availability

β = parameter estimates

X_{ij} = vector of the explanatory variables

The independent variables hypothesised as determinants of animal protein deficiency in household diet are specified as follows:

X_1 = Age of household head (Years)

X_2 = Dependency ratio (Number)

X_3 = Educational level (years)

X_4 = Household size (in male adult equivalent)

X_5 = Off-farm income (Naira)

X_6 = Crop Output (in grain equivalent)

X_7 = Monthly expenditure on animal protein (Naira)

X_8 = Livestock production (Tropical Livestock Unit TLU).

X_9 = Farm size (hectares)

D = Sex of household head (Male = 1, 0 otherwise)

e = Error term that is assumed to be normally distributed with zero mean and constant variance.

4. Results and Discussion

4.1. Socio-economic Characteristics of Respondents

The socioeconomic factors of the studied respondents were analyzed using descriptive statistics regarding frequency and percentage distribution are shown in table 2.

Table 2. Socio-Economic Characteristic of the Rural Households of the Study Area.

Characteristics	Frequency	Percentage
Sex of the Household head		
Male	108	90
Female	12	10
Total	120	100
Age of Household head		
21-30	3	2.5
31-40	32	26.67
41-50	36	30
51-60	31	25.83
61-70	18	15
Total	120	100
Marital Status of Household head		
Single	3	2.5
Married	104	86.7
Widow (er)	13	10.8
Total	120	100
Education status of Household Head		
No Formal Education	71	59
Primary Education	26	21.7
Secondary Education	18	15
Tertiary Education	5	4.2
Total	120	100
Characteristics	Frequency	Percentage
Households Agricultural Employment Status		
Main	92	76.7
Minor	28	23.3
Total	120	100
Household size		
2-4	34	28.3
5-7	68	56.7
>8	18	15
Total	120	100
Dependency ratio		
<1	28	23.33
1.1-2	64	53.33
>3	28	23.33
Total	120	100
Household size		
2-4	34	28.3
5-7	68	56.7
>8	18	15
Total	120	100
Dependency ratio		
<1	28	23.33
1.1-2	64	53.33
>3	28	23.33
Total	120	100
Farm size		

Characteristics	Frequency	Percentage
<1	25	20.8
1.01-2	70	58.3
2.01-3	20	16.7
>3	5	4.2
Total	120	100

Source: Field survey, 2014

Table 2 showed the socio-economic characteristics of rural households in the study area. It was revealed that 36% of the household heads were between 41- 50 years of age while 32% were between 31-40 years. Only 2.5% were below 30 years of age. The mean age of household heads was 48 years, implying that the households were in their active age groups. In order words, only a few of the farmers in the study area were either too old or young to engage in one farm or off-farm activity. Age has important effect on income, calorie and protein intake because farmers within the active age are youth and can participate in more than one livelihood activities which in turn can raise their income level and thereby impact positively on their calorie and protein intake.

The majority of the households in the study area were headed by male who are married and have agriculture as their main occupation. High level of illiteracy among rural household heads may hinder the adoption of modern agricultural production technology which subsequently reduce food production of the households.

Majority of the household heads, about 57%, had 5-7 members in the household. Those with 8-10 constitute 15%. Only 28% had household size ranged between 2-4 members. The average household size was 6 members. Size of the household may enhance labour availability that can be used for different activities especially with higher proportion of working adults. However, the implication of household size on calorie and protein intake is that small-sized households are less prone to food insecurity than large households because the income per capita of the former is usually larger than that of the later [29]. High dependency ratio may also lead to high risk of insecurity

4.2. Food Security Status Among Rural Households in the Study Area

Food security index was constructed to determine food security status of rural households which followed the identification and aggregation procedure highlighted in the methodology for this study, the results on food security status are shown in table 3.

The daily per capita calorie and protein availability was estimated by dividing the estimated daily calorie or protein supply to the household by the adjusted household size for adult equivalence using the equivalent male adult scale weights in appendix 2. Household calorie and protein

availability were estimated using food composition in appendix 1. The food security indices for calorie and protein; headcount ratio and the shortfall/surplus index have been summarized in table 3 separately for households that are food secure and those that are food insecure. The reason for using multiple indices is to provide a basis for examining the extent of food insecure among rural household from different perspectives.

Table 3. Food Security Status among Rural Households in the Study Area.

	Households		
	Food-secure	Food-insecure	All
Percentage Household	36.67	63.33	100
Mean household size (adjusted)	3.627	4.968	4.476
S.D	0.912	1.366	1.378
Household daily calorie requirement (kcal)	8959.364	12269.725	11055.967
Household daily calorie availability (kcal)	9780.686	8258.867	39465.180
Household daily per capita calorie availability (kcal)	2696.42	1662.580	21969.734
Percentage Household	28.33	71.67	100
Mean household size (adjusted)	3.39	4.93	4.47
Household daily protein requirement (g)	220.278	319.893	290.270
Household daily protein availability (g)	250.548	223.871	251.007
Household daily per capita protein availability (g)	73.932	45.436	53.985
Food Security Index			
Mean Energy	1.101	0.692	0.842
S. D	0.089	0.107	0.221
Mean Protein	1.137	0.699	0.831
S.D	0.102	0.126	0.234
Headcount ratio	0.32	0.68	
Shortfall/surplus index			
Energy	1.3	0.115	
Protein	0.74	0.46	

Source: Field Survey, 2014

The table 3 revealed that 36.67% of the households were food secured with an average daily per capita calorie and protein availability of 2696.42 kcal and 73.92g respectively. This implied that majority of the households in the study area were food in secured. This is in line with the findings of [33] in their study on Household Food Insecurity in Nigeria: an Assessment of the Present Status of Protein – Energy Malnutrition among Rural and Low-income Urban Households. The study revealed that on the average only 31% of the households in the study areas met the FAO recommended minimum daily calorie intake and 69% were food insecure.

The headcount ratio showed that 32% of the respondents were food-secured and 68% were food in-secured. This revealed that majority of individuals in the study area were survive on less than per capita calorie and protein

requirement.

The surplus index of this study for food-secure households were 130% for per capita energy and 74% for per capita protein and, the food insecure households fell short of the minimum daily per capita calorie and protein requirement by 11.50% and 46%.

4.3. The Difference in Protein Supply from Different Sources in the Study

To estimate the difference in protein supply from different sources, T-test was used to test the difference in protein supply from plant protein and animal protein.

Table 4. T-test Showing the difference in Protein Supply from different Sources (Plant Protein and Animal Protein).

Variables	t-value	SD	Average value	Df	Significance
Plant Protein	41.288***	6.861	25.86	119	0.000
Animal Protein	27.190***	4.523	11.23	119	0.000

Source: Computer Result of Field Survey, 2014. *** at 1%

The result showed that there is significant difference in the t-value of plant protein (41.288***) and animal protein (27.190***) consumed by respondents. This implied that respondent consumed more of the plant protein than animal protein.

4.4. The Profile of Animal Protein Consumption in Study Area

Table 5. Showing Profile of Animal Protein Consumption in the study area.

Animal protein sources	Contribution to daily per capita animal protein (g)	Percentage (%)
Beef	5.08	45.24
Fish	3.22	28.66
Chicken	0.83	7.40
Goat	0.76	6.75
Egg	0.65	5.76
Cheese	0.62	5.51
Milk	0.08	0.68
	11.23	100

Source: Field Survey, 2014.

As shown in table 5, beef is the major source of animal protein supply among rural households. It accounts for 45.24% of dietary protein consumption in the study area. Fish is the second source of animal protein followed by chicken. A mean of 11.23g daily per capita animal protein consumption was observed among the rural households in the study area. This result corroborated with the findings of [28] in their study of animal protein consumption among rural households where beef contributed more than one third of dietary protein consumption in the study. It is also in line with work of [41] in his study of a system analysis of the

demand for animal protein in rural and urban Nigeria: a case study of Ibadan metropolis conforms to budget share indicated that the sampled households spent about 45.3% of their budget on beef. This is followed by about 36.5% on fish and about 18.2% is spent on chicken.

4.5. The Determinants of Intensity of Animal Protein Deficiency in Household Diet

To identify the determinants of intensity of animal protein deficiency, Tobit regression model was fitted. The relationship existing between the independent variables and dependent variables are shown in table 6 of the Tobit regression.

Table 6. The Tobit Result for the determinant of intensity of animal protein deficiency in household diet.

Variables	Notation	Coef	Std Err	t ratio	P > ltl
Constant	B_o	.6634057***	.054971	12.07	0.000
Age	X_1	.0012936*	.0007642	1.69	0.094
Dependency ratio	X_2	.0173062	.0147063	1.18	0.242
Education	X_3	-.0002718	.0020309	-0.13	0.894
Household size	X_4	.046826***	.0081711	5.73	0.000
Off-farm income	X_5	-7.118932***	1.117372	-6.37	0.000
Crop output	X_6	.0000204**	8.30e-06	2.46	0.016
Exp. on animal	X_7	-.000418***	3.64e-06	-11.49	0.000
Livestock Prod.	X_8	.0193948	0.0193948	0.93	0.354
Farm size	X_9	-.0338461*	.01855181	-1.83	0.071
Gender	D	-.0171525	.0232087	-0.74	0.462

LR chi2 (10) = 123.04 Prob > chi2 = 0.0000
Log likelihood = 128.99065 Pseudo R2 = 0.9118
*** P<0.01, **P<0.05, *P<0.10
Source: Computer Result of the Survey, (2014)

The table above revealed the result of determinants of intensity of animal protein deficiency in household diet. The Tobit result with log likelihood = 128.99065 revealed that, regressors such as off-farm income, monthly expenditure on animal protein and farm size were negatively significant while adjusted household size, crop output and age of household head show positive at various level of recognized significance.

A negatively significant (P<0.01) relationship was found between off-farm income animal protein deficiency in rural household diet. This shows that an increase in off-farm income will reduce the level of animal protein deficiency in household diet. This corroborated the findings of [28] on animal protein consumption among rural household in Kwara State affirmed that expenditure on animal products and household size are the significant variables affecting animal protein consumption.

At 1% significant level, the coefficient of monthly expenditure on animal protein had a negative significant relationship on

animal deficiency. It implied that an increase in monthly expenditure on animal protein will reduce deficiency in animal protein consumption of households. This is in line with the work of [28] on animal protein consumption among rural household in Kwara State affirmed that expenditure on animal products and household size are the significant variables affecting animal protein consumption.

A negatively significant (P<0.10) relationship was found between farm size and animal protein deficiency in rural household diet. The Positive relationship has been established between farm size and improvement in households' income and food security [18]. The larger the farm size of the household, the higher the expected level of food production. Therefore, it is expected that household with a larger farm size to be more food secured than a household with a smaller farm size, all things being equal. Hence, an increase in farm size of household head will reduce animal protein deficiency in household diet.

At 10% level of significance, the coefficient of household head age had a positive significance at t-value (1.69). This means that there is progressive relationship between age of household head and animal protein deficiency in household diet. The quantity of animal protein intake of household head decrease as they grow older.

A positively significant (P<0.01) relationship was found between household size and animal protein deficiency in rural household diet. This implied that an increase in the level of household size will definitely increase the level of animal protein deficiency in the household diets. The work of [28] on animal protein consumption among rural households affirmed that expenditure on animal products and household size are the significant variables affecting animal protein consumption. And also, the findings of [2] showed that household size, educational level, and income of the household heads affect the amount spent on the protein consumption in their work on evaluation of households protein consumption pattern in Orire Local Government Area of Oyo State.

At 10% significant level, the coefficient of crop output had a positive significance at t-value (2.46). This means that there is positive relationship between crop output and animal protein deficiency in household diet i.e. an increase in crop output will lead to decrease in animal protein consumption and this was in line with our a priori expectation.

5. Conclusion

Despite the fact that rural households are the major producers of food in Kwara State, the area of study could be classified as food in secure in view of the fact that the average calorie and protein availability to the area is less than the minimum per capita requirement. Thus, the study showed that majority of the households are living on less than the minimum required calorie and protein per capita per day.

In order to improve animal protein and calorie consumption of rural households in Kwara State, the following recommendations would be worthy of consideration:

- Rural household diversification of income should be encouraged in order to enhance their financial empowerment and food security;

- In view of the nutritional and economic importance of animal protein, effort should be made to improve the level of animal protein consumption among rural households in Kwara State;

- Small scale farmers are advised to form cooperative societies that can guarantee access to productive inputs that will enable them to expand their farms. This would have a significant impact on their bargaining power and hence increase their income;

- Nutrition-oriented programmes should be organized for households in order to improve the food security knowledge of rural households in Kwara State; and

- Households are encouraged to adopt modern family planning techniques which will regulate the number of child birth and reduce the number of dependants.

Appendix I

Table 7. Nutrition Composition Table.

Food item	Energy (Kcal/kg)	Proteins (g)
Maize	3600[a]	90[a]
Rice	3500[a]	60[a]
Millet and sorghum	3500[a]	100[a]
Cowpea	3300[a]	210[a]
Ground nut	5500[a]	230[a]
Soybean	4000[a]	330[a]
Cassava, fresh	1500[a]	10[a]
Cassava flour	3400[a]	20[a]
Yam, fresh	1100[a]	20[a]
Yam flour	3200[a]	40[a]
Sweet potato	1100[a]	10[a]
Orange	400[a]	5[a]
Mango	600[a]	5[a]
Banana	1200[a]	10[a]
Plantain	1300[a]	10[a]
Okra	310[b]	17[b]
Vegetable	500[b]	25[b]
Onion	320[b]	11[b]
Tomato	210[b]	10[b]
Pepper	400[c]	19[c]
Beef	2250[a]	147.29[a]
Fish	1320[a]	87.98[a]
Goat	1090[d]	200[d]

Food item	Energy (Kcal/kg)	Proteins (g)
Chicken	1360[b]	200.6[b]
Egg	1390[b]	121[b]
Cheese	661.62[a]	37[a]
Milk	750[b]	37[b]
Palm oil	9000[a]	-
Vegetable oil	9000[a]	-
Sugar	3870[a]	-
Bread	2260[a]	110[a]

Source:
[a] Omotesho *et al* (2006). Determinants of Food Security among the Rural Farming Households in Kwara State, Nigeria. *African Journal of General Agriculture*. Vol. 2, No. 1, June 30, 2006
[b] FAO (2010). Composition of Selected Foods from West Africa
[c] www.nutritionvalue.org/pepper%2c_raw%2chot_chill_nutrition_value.html.
[d] www.annecollin.com/calories/calories.goat.com.htm

Appendix II

Table 8. Equivalent Male Adult Scale Weights to Determine Adjusted House Hold Size.

Age category	Male	Female
Under 1yrs	0	0
1–4.9yrs	0.25	0.2
5–9.9yrs	0.6	0.5
10–14.9yrs	0.75	0.75
15–59.9yrs	1	0.9
60 and Above	0.8	0.65

Source: Omotesho *et al* (2006). Determinants of Food Security among the Rural Farming Households in Kwara State, Nigeria. *African Journal of General Agriculture*. Vol. 2, No. 1, June 30, 2006

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