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Food Security and Nutrition of Smallholder Farming Households in South-East Nigeria: Evidence from Imo State

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Abstract: Smallholder farmers play a significant role in rural economic growth, as they contribute a large portion of the workforce in the rural areas. Consumption of less diverse diets and inadequate access to sufficient food poses a danger for their health. We assessed the food security status and nutrition of smallholder farming households in Imo State, South-East Nigeria. We identified sources of food availability of the households, determined the food security status of the farming households and also determined factors affecting the food security status of the farmers. This study used survey data from 195 smallholder farming households in Imo State, South-East Nigeria. Household dietary diversity score (HDDS) and binary logistic regression model were employed to estimate the food security status and the determinants. The results show that the farmers engaged in different farming systems, including crop production, livestock production and mixed farming. The farming households relied on their farm production and food purchases to meet their energy and dietary needs, with food gifts supplementing the food available to some households. We found that male-headed households were more food secure than female-headed households. The number of food insecure households were relatively higher than the percentage of households that were food secure. The age of the household head, education, sex, household size and market-orientation significantly influence the food security status of the farming households. It is recommended that farmers should engage in diverse farming systems as well as market orientation to enhance the nutrition and food security of their households.

Keywords: Dietary Diversity, Food Consumption Score, Market Orientation, Food Security, Female-Headed Household

1. Introduction

One of the greatest challenges facing the world today is the provision of sufficient, healthy, accessible and affordable food for all households at all times. The Sustainable Development Goals (SDGs) are geared towards ending poverty in all its forms everywhere (SDG 1); ending hunger, achieving food security and improved nutrition and promoting sustainable agriculture (SDG 2); and, ensuring healthy lives and promoting well-being for all at all ages (SDG 3) [1]. This is in recognition of the fact that food security is an integer of economic development. Hunger, under nutrition and malnutrition are all associated with the concept of food insecurity, and people experiencing moderate or severe food insecurity have been forced to compromise on the quality and/or quantity of the food they consume [2].

In developing countries, it is reported that there is a higher prevalence of food insecurity in households [3]. In these countries, the poor are composed mainly of smallholder farmers. These smallholder farmers play a significant role as they are a major part of the agricultural workforce, providing

food and fibre for the growing populace. Inadequate access to sufficient and nutritious food affects their productivity. In sub-Saharan Africa, staple foods that are high in starch such as cereals, roots and tubers are the major sources of dietary energy supply while the share of protein of animal origin in diets remains insignificant in sub-Saharan Africa [4].

Food security has two angles; guaranteeing that satisfactory food supplies are accessible, and that families whose individuals experience the ill effects of under sustenance can procure food, either by creating it themselves or by having the option to buy it [5]. Given the significant position of smallholder farmers, this study was designed to assess the food security and nutrition of smallholder farming households in South-East Nigeria.

The specific objectives were to;

i. describe the socio-economic characteristics of the smallholder farming household head;
ii. identify the sources of food availability to the smallholder households;
iii. determine the food security status of the farming households, and by gender; and
iv. determine factors affecting the food security status of the smallholder farming households.

2. Materials and Methods

We conducted a cross-sectional survey of smallholder farming households in Imo State, Nigeria from October 2019 to March 2020. Imo State Nigeria is located in South-East Nigeria and comprises 3 agricultural zones namely Owerri, Orlu and Okigwe Agricultural zones comprising 27 Local Government Area's (LGA's). Imo State has a population of 3,934,899 persons [6]. The inhabitants of Imo State are mainly farmers, civil servants and artisans. The farmers in Imo State cultivate either crop, rear livestock or practice mixed farming. The major food crops produced in the State are yam, cassava, cocoyam, palm oil and maize. A multistage sampling technique was adopted in the selection of respondents. We used a proportionate sampling technique to select 5 LGA's for the study. In Owerri and Orlu Agricultural Zones, we selected 2 LGA's each, and 1 LGA from Okigwe Agricultural Zone, to give a total of 5 LGA's sampled. In each of the sampled LGA, 2 villages were selected to give a total of 10 villages. From each of the sampled villages, 20 smallholder farming households were selected. Overall, 200 smallholder farming households were sampled using a random sampling technique. However, data were successfully collected from 195 respondents. The list of the contact farmers which formed the sampling frame was drawn from the Agricultural Development Programme (ADP) list of contact farmers. Food frequency data, socioeconomic characteristics, and data on other economic activities were collected from the sampled farming households with the aid of a structured questionnaire.

There is no standard methodology for measuring food security. The FAO notes that there exists no "perfect single measure that captures all aspects of food insecurity" [7]. A household's level of food insecurity or hunger must be determined by obtaining information on a variety of specific conditions, experiences, and behaviours that serve as indicators of the varying degrees of severity of the condition [8]. Two commonly used approaches as identified by [9] in measuring household food consumption are first, the expenditure technique that estimates gross household's production and purchases over the given time. Estimates of the increase or reduction of food stocks held over time are made, and the balance is considered as consumed by the household. The limitation of the expenditure survey is that it tends to underestimate expenditures on food if the value of food produced at home or gathered locally is not recorded or recalled. The second method uses a recall method to measure the amount of food consumed by the household members during 24 hours. This technique, with the expenditure method, gives more reliable household consumption information, but it is costly due to the considerable time required for collecting the data.

For the study, the Food Consumption Score (FCS) and binary logistic regression model were employed to estimate the food security status and the determinants. Food frequency data were collected for all foods consumed in the household and the data were used to compute the FCS. The FCS has an advantage in that it captures the dietary diversity and food frequency of each household as a measure for nutrition and food security. Dietary intake information was collected using a food frequency questionnaire (FFQ). The FFQ included a list of 60 common foods and beverage items consumed in South-East Nigeria. Participants were asked to recall the frequency of consumption of each food item over the last 7 days. Using the World Food Program Vulnerability analysis and mapping (VAM) [10] guide the 60 food items were grouped into 9 categories with definitive weights:

1. Main staples (grains, roots, and tubers, etc) [weight = 2];
2. Pulses [weight =3];
3. Vegetables [weight =1];
4. Fruits [weight =1];
5. Meat and Fish (includes eggs) [weight = 4];
6. Milk (and other dairy products) [weight = 4];
7. Sugar [weight = 0.5];
8. Oil (Oil, fats and butter) [weight = 0.5];
9. Condiments (tea, beverages and spices) [weight = 0].

The weighed food group scores were summed and multiplied by their weight to calculate the food consumption score (FCS). Mathematically, Food Consumption Score (FCS) can be computed as follows;

$$FCS = \sum i^{9} = 1\ a_i\ X_i$$

Where X_i is the number of day's i^{th} food category was consumed by household in the past 7 days and a_i is the weight assigned to i^{th} food category.

Measurement of food security

Food security is measured in this study using a threshold, which is the mean FCS of 85. Households with FCS below the calculated mean were classified as Food Insecure (FCS< 85), and farming households with FCS above the mean FCS were

classified as Food Secure (FCS > 85). Using the FCS, we further profile the Food insecurity level of the smallholder farming households using pre-determined thresholds (Table 1).

The thresholds were calculated as:

Table 1. *Food security level.*

FCS	Food Insecurity level
≤55	Severe/ Moderate
55.5 – 85	Mild
> 85	Secure

A binary logistic regression model was used to determine factors that affect the food security status of the smallholder farming households. The binary logistic regression model was presented as follows;

$$Y = \text{logit}(p) = \text{Ln } P/1\text{-}P = a + b_1X_1 + \ldots + b_7 X_7)$$

Where:

Y is a binary response variable. The variable takes the value 1 if the household was food secure (FCS > 85), and 0 if otherwise (FCS< 85);

P = is the probability that the smallholder farming household is food secure (FSS = 1);

1 – P = is the odds ratio that the farming household is not food secure (FSS =0);

a= is the intercept or constant;

β= is the vector of coefficients of the vector of covariates or coefficients, Xi.

Ln = Natural logarithm

The dependent variables, Xi were:

X_1 = Age of household head (years), X_2 = Education of household head (years), X_3 = Gender of Household head (Male =1, Female =0); X_4 = Marital Status (single = 0, married = 1), X_5 = Household Size (no of persons), X_6 = Farming Experience (years), X_7 = Livelihood diversification, X_8 = System of farming (1= crop, 2= livestock, 3= mixed farming) and X_9= Market orientation (Commercial = 1; Subsistence =0).

3. Results

3.1. Socio-economic Characteristics of the Head of Household

The results of the socio-economic characteristics of the smallholder farming household head are reported in Table 2. The results showed that most of the heads of households were male (mean = 0.84), with a mean age of 49.4 years. This indicates that the household heads were within their active age and capable of undertaking farming activities to provide for their families, as about 92.31% were married. The household heads were experienced farmers with mean years of experience of 19 years. They were more subsistence-oriented farmers than market-oriented farmers, with a mean of 1.22.

Table 2. *Socio-economic characteristics.*

Variable	Min	Max	Proportion/Mean	Std. Dev.
Sex of head of household (Male = 1, Female =0)	0	1	0.84	-
Age of household head (years)	26	77	49.40	10.66
Marital Status (Married =1, Single = 0)	0	1	0.92	-
Education of household head (Years)	0	31	12.3	4.93
Household size (No. of persons)	2	12	6	2.00
Farming experience (Years)	1	60	19	14.26
Livelihood activity (Count)	1	5	2	0.65
Market orientation (Subsistence = 1, Commercial =2)	1	2	1.22	0.42
Membership of cooperative group (Yes = 1, No = 0)	0	1	70.37%	-

3.2. Farming System

The distribution of the farming households based on their farming system is presented in Figure 1. The result shows that the farming households were engaged in crop production (44%), Livestock production (9%) and Mixed farming (47%). Diversifying into multiple farming enterprises has the potential to influence the diversity of household diets, as they can get the needed calories and nutrients requirement from more than one source of food. Farming households who practice mixed farming (crop and livestock production) are better able to support the nutrient requirements of their families from both plant and animal sources. [11] opine that farm diversification has great prospects to affect the dietary diversity of these rural producers by introducing new farm enterprises involving nutritious foods and encouraging own consumption from production and income from sales.

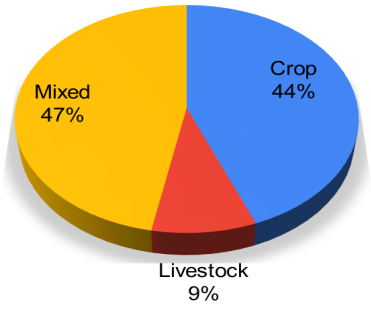

Figure 1. *Farming system.*

3.3. Food Availability

The results of the sources of food availability to the farming households as presented in Table 3 shows that all the farm families (100%) consume food from their production and also purchases from markets. Only 15% of the farming households reported receiving food items also as gifts. Most

of the farming households are subsistence-oriented and the bulk of the food produced is to meet households' dietary needs, with a little marketable surplus sent to the market to raise incomes. Low marketable surplus is a result of low productivity. It may imply that the smallholder farmers are constrained by the low ownership of factors of production to expand their farms.

Table 3. *Sources of food availability of the smallholder farming households.*

Sources of food availability	Frequency*	Percentage
Own production	195	100
Purchase	195	100
Gifts	15	7.69

*Multiple responses recorded.

3.4. Food Security Status of the Farming Households

The result of the food security status of the farming households, and by gender is presented in Table 4. The results showed that 48.8% of the male-headed households were food secure, while 41.90% of the female-headed households were food secure. The pooled result showed that 49.23% of the smallholder farming households were food secure. The number of food-insecure farming households was 50.25%. This implies that there were more food insecure smallholder farming households than food-secure farming households. The distribution showed that male-headed farming households were more food secured than female-headed farming households. It has been opined that women spend more of their income in feeding the members of their household; however, they are constrained by the ownership of productive resources, and this may affect the food security of their household. [12] report that male-headed households are more food secure than female-headed households in their study on 'Assessing Gender Inequality in Food Security among Small-holder Farm Households in urban and rural South Africa.

Table 4. *Food security status of the farming households.*

Gender of Head of Household	Male	Female	Pooled
Food secure	84 (48.8%)	13 (41.94%)	97 (49.74%)
Food insecure	80 (51.2%)	18 (58.06%)	98 (50.25%)
Mean FCS	71.14	63.5	69.78
Number of farming households	164	31	195

3.5. Food Security Level of Farming Households

The analysis of the food security level of the farming households is presented in Table 5. The results showed that 24.10% of the smallholder farming households experienced moderate or severe food insecurity, while 51.80% experienced mild food insecurity. The severity of food insecurity as computed from the food consumption score shows that only about 24.10% were food secured signifying that only a few percentages had access to diverse diets and could afford it. The higher number of farming households with mild and moderate food security implies that the farming households consumed less diverse diets with low nutrients. This may also imply inadequate access to diverse foods that are needed for body building and growth. It has been reported that farming households relied more on their staples foods (cassava, rice, maize, etc) which are made up primarily of carbohydrates [13]. The availability and accessibility of farming households, as well as their utilization of the available food, is important, as farming households play a very significant role in economic development.

Table 5. *Food security level of farming households.*

Food insecurity level	Frequency	Percentage (%)
Moderate or severe (FCS ≤55)	47	24.10
Mild (FCS 55.5 – 85)	101	51.80
Secure (FCS > 85)	47	24.10
Total	195	100.00

3.6. Determinants of the Food Security Status of the Farmers

The determinants of the food security status of farming households is presented in Table 6. The Chi (X^2) value of 74.847 was significant at 1% level of probability and this confirms the fitness of the model. The Cox & Snell R Square of 0.77 imply that all the explanatory variables included in the model were able to explain 77% of the variation in food security status of the households. The log-likelihood ratio of 248.826 confirms the fitness of the model in explaining the probability of the effect of the explanatory variables on the farming household food security status.

The coefficient of age was negative and significant at 1% level of probability. This implies that as the age of the farming household head increases, the food security status of the farm family declines... The inverse effects of the age of household heads on the food security status suggest a decline in the quantity and diversity of foods consumed within the household. The result is consistent with the findings of [14] who found that as farmers' age, there is a higher probability of moving toward the food insecurity line.

The coefficient of the educational level was positive and significant at 1% level of probability implying that increases in the years of formal education may increase the food security status of the farming household. This implies that educated farming household heads tend to have more food secure than those with an uneducated household head. The result corroborates the findings of [15] who found that education is a social capital, which could impact positively on a household's ability to take well–informed production and nutritional decision.

The coefficient of sex was positive and significant at 5% level of probability implying that male-headed households are more food secure than female-headed households. Men are culturally inclined to have greater control over farm production resources in the study area, and this, in turn, leads to higher productivity and incomes for male-headed households, than female-headed households. [16] opines that access to land, agricultural extension services, inputs and agricultural information are gendered and largely discriminate against women.

The coefficient of household size was significant at 1%

level of probability and inversely related to food security. This is an indication that increases in household size, decreases the probability of households being food secure. An increase in household size especially the non-working members put pressure on consumption expenditure than production and thus increase the food insecurity level of households [17].

The coefficient of farming experience was positive and significant at 1% level of probability implying that increases in the magnitude of farming experience lead to a significant increase in food security. This is an indication that households with higher years of farming experience were more food secured than their counterpart with no farming experience. The more experienced the farmer is, the more food secure he will be. The study of [18] opined that more experienced farmers are more food secure. This is expected, as experienced farmers can adopt new technologies easily, as well as has a better understanding and ability to diversify production in other to minimize the risk that could lead to food shortages and reduced income.

The coefficient of market orientation was positive and significant at 1% level of probability implying that increases in the magnitude of market orientation lead to a significant increase in food security. Market orientation is one of the ultimate results of agricultural commercialization and diversification. Market orientation increases the income of the farm families, and hence their means to acquire more diversified diets for food and nutrition security.

Table 6. *Determinants of the food security status of the farming households.*

Explanatory variables	Coefficient	Wald	Standard Error
Constant	12.772	2.704***	0.000
Age (X_1)	-0.027	-2.568***	0.109
Educational (X_2)	0.093	5.724***	0.017
Gender (X_3)	0.159	2.098**	0.004
Marital Status (X_4)	0.110	0.064	0.800
Household Size (X_5)	-0.137	-2.881***	0.010
Farming Experience (X_6)	0.032	5.569***	0.018
Livelihood Diversification (X_7)	0.006	-.000	0.983
System of Farming (X_8)	0.121	0.521	0.470
Market Orientation (X_9)	1.444	9.481***	0.000
Nagelkerke R Square	66.204***		
Cox & Snell R Square	77.149***		
-2 Log likelihood	248.826***		

4. Conclusion and Recommendation

Smallholder farming households are still faced with the challenges of food security. The results show that the farming households relied on their farm production and food purchases to meet their energy needs. We found that male-headed households were more food secure than female-headed households, and that food secure farming households have a wider variety of crops on their farms and are more market-oriented than are the food insecure. Different farming systems are engaged in by the smallholder farming households are engaged in diverse farming systems and this contributes to their income and increases their purchase of diversified diets for improved nutrition security. The level of food insecurity calls for policy action, to enable farmers to increase their productive capacity.

Author Contributions

"Conceptualization, Chidiebere-Mark, N. M. and Adewale Adeyemi.; methodology, Ahaneku, C. E.; software, Chidiebere-Mark, N. M; validation, Ahaneku, C. E.; formal analysis, Chidiebere-Mark, N. M.; investigation, Adewale Adeyemi. and Chidiebere-Mark.; resources, Chidiebere-Mark, N. M. and Ahaneku, C. E.; data curation, Ahaneku, C. E..; writing—original draft preparation, Chidiebere-Mark; writing—review and editing, Ahaneku, C. E. and Adewale Adeyemi; supervision, Chidiebere-Mark, N. M..; project administration, Chidiebere-Mark, N. M. and Adewale Adeyemi.

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Conflicts of Interest

The authors declare that they have no competing interests.

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