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Determinants of Food Insecurity among Smallholder Farming Households in Southwest Nigeria

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The study analysed the determinants of food insecurity among smallholder farming households in South western part of Nigeria with Ondo and Osun States in focus. Multi-stage sampling procedures were employed to gather data from 389 farming households (194 from Ondo State and 195 from Osun State) spread across 4 agricultural zones, 8 local governments and 24 communities. The data was analysed using descriptive statistics, Ordinal regression and Friedman test. Results revealed

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the average age of the respondents was 47 years with majority being male 63.75% and married 82.26% and having an household size of 6. Most household heads were educated (94.09%), engaged in farming for about 19 years, and do not belong to cooperatives (73.26%). Respondents derived income from both farming and non-farm activities with the average farm income being N216,066.8/annum and non-farm income being about N360,000/annum. Multiple technologies were adopted by respondents such as application of herbicides (77.63%), pesticides (73.26%) and fertilizers (66.58%). Using the FANTA Cornel model, food insecurity was found to be prevalent in the study area with the majority (61.44%) of the households been severely food insecure, 35.73% were moderately food insecure while 1.80% and 1.03% were food secured and mildly food insecure. The most significant constraints to food security among the farming households were inability to access credit (mean rank = 8.78), poor storage infrastructure (8.57), inadequate capital (8.56) and high cost of farm chemicals (8.35). Significant factors related to food insecurity among the farming households were age (b = -0.059), education (b = -0.376), family size (b = 0.197), adoption of technology (b = -0.198), farm income (b = -0.335), association membership (b = -0.999), engagement in non-farm activities (b = -1.538), and access to credit (b = -0.853). Linking farmers groups to credit institutions and input suppliers were proposed.

Keywords: Food insecurity; FANTA cornel; Ondo; Osun; Nigeria; southwest; livelihood.

1. INTRODUCTION

Access to food is a challenge that leaves close to 800 million people chronically hungry [1], (GHI, 2020). Poor access to food in Sub-Saharan Africa is largely caused by a variety of factors, such as poverty, loss of livelihood, rising food prices, political unrest, policy gaps, and an imbalance between the population's needs and the food supply [2,3]. Idiake-Ochei, Onemolease, and Erie [4] reported a rapid decline in food production in Nigeria, despite a rapidly growing population. Due to growing urbanization, food and nutrition insecurity has increased in low-income nations in Sub-Saharan Africa including Nigeria [5]. Infact, the Global Report on Food Crises (GRFC) [6] confirms the enormity of the task of achieving food security by 2030. According to GRFC, in 2023, almost 282 million people representing 21.5% of the surveyed population in 59 countries, faced high levels of acute food insecurity while Nigeria ranks 163rd of 192 countries in the 2024 Human Development Index [6].

Every region of Nigeria still experiences chronic and seasonal food insecurity, which is made worse by high food prices that occur frequently. The effects of insurgency-related conflict (particularly in the Northeast), armed banditry, pastoralist/farmer crises, kidnapping, cattle rustling, and climate change (FEWS NET, 2020) has worsened the situation. Furthermore, there is a strong likelihood that Nigeria would experience more persistent food insecurity as a result of the recent COVID-19 pandemic [7]. In Nigeria's rural areas, the prevalence of chronic malnutrition and food insecurity is dangerously high. Numerous kids in rural areas are chronically undernourished, which has an impact on both their physical and cognitive development [8].

Every regime of government works to end food insecurity and restore Nigeria's agricultural prowess and food sufficiency [9]. Over the years, several programs and policy frameworks aimed at alleviating food insecurity have arisen such as the Family Economic Advancement Programme (FEAP), Family Support Programme (FSP), National Fadama Development Project (NFDP), National Accelerated Food Production Programme (NAFPP), Agricultural Development Program (ADP). However, many of these initiatives and programmes recorded few successes based on poor understanding of the sources of food insecurity, mistargeting of interventions and failure to identify and analyse the major determining factors of food insecurity [10].

Several studies such as those by Olayiwola, Tashikalma, and Giroh [11], Adamu [12], and Akinyele [8] have addressed food insecurity – its status and determinants; however, these studies did not focus on Southwestern Nigeria particularly Ondo and Osun States. Also, while these studies highlighted the status of food insecurity among their target sample, they failed to highlight the magnitude of food insecurity, which is crucial to understanding the nature of this insecurity.

It is against these backgrounds that this study will not only analyse the status of food insecurity

among the target States of Ondo and Osun, but will equally explore the dimensions and determinants of food insecurity among smallholder farming households in these States using an approach developed by FANTA / Cornell in 2007, with USAID support. This methodology or approach not only explores the status of food insecurity among the target population but equally measures the severity and dimensions of food insecurity among the population against a set of standardized questions, that makes it possible to compare trend in food insecurity across times, communities, regions, and countries [13].

1.1 Objectives of the Study

The general objective of the study is to analyse the determinants of food insecurity among smallholder farming households in selected southwest States in Nigeria. Specifically, the study seeks to:

1) examine the socio-economic characteristics of smallholder farming households in Southwest States of Ondo and Osun in Nigeria.
2) determine the level of food insecurity among the smallholder farming households.
3) determine the significant constraints to food security among the farming households.
4) determine the relationship between the socio-economic characteristics of the smallholder farming households and food insecurity.

1.2 Hypotheses of the Study

The null hypotheses tested are stated as follow:

1) There is no significant difference among the constraints to food security among the farming households.
2) There is no significant relationship between the socio-economic characteristics of the smallholder farming households and food insecurity.

2. METHODOLOGY

2.1 Study Area

The study was carried out in Ondo and Osun States, both located in the Southwestern part of Nigeria. Ondo State is divided into 18 administrative or local governments areas (LGAs) and has a projected population of 5,902,216 in 2024, based on Nigeria's expected annual growth rate of 3.01%. Osun State has 30 LGAs, home to a projected population of 6,034,368 people in 2024, based on an annual growth rate of 3.21 [14]. Over 70% of the population receives income and employment opportunities from agriculture, which has been the state's economic pillar. Many of the inhabitants of these States are peasant farmers who operate on a small scale and cultivate both food and cash crops. Cassava, yam, maize, citrus, cocoa, kola nuts, and sorghum are the main crops farmed, and goats, pigs, chickens, and to a lesser extent, snails, are the main animals raised.

2.2 Population and Sampling Size

All rural smallholder farming households in Ondo and Osun States constituted the population for this study. Unfortunately, due to dearth of data on actual population of these farming households in the study area, the recommended sample size for an unknown population (i.e., 384), at a confidence level of 1.96, was target [15]. However, 10% margin was taken to cater for non-response. Thus, the total sample targeted was 422 (384 + 38). However, the final or post-field response was 389 while the remaining 33 was not accounted for because it was not returned.

2.3 Sampling Procedure

A multi-stage sampling procedure was employed in selection of the respondents. At stage 1, two agricultural zones were purposively selected from each state based on the predominance of farming households. Thus, Osun East and Osun central zones were selected in Osun State while Ondo central and Ondo south were selected in Ondo State. At stage 2, purposive selection of 2 LGAs per zone was taken based on the predominance of farming households to give a total of 8 LGAs. At stage 3, purposive selection of 3 communities per LGA was taken, given a total of 24. At stage 4, purposive selection of 16 households per community was done, given a total of 384 households. The selected households were engaged in farming and operated at small-scale (less than 2ha).

2.4 Data Sources and Instruments

Primary data were used for this study, complimented with information from secondary

sources such as journals and reports. Primary data was collected from the respondents using a structured and validated questionnaire A section of the instrument addressed questions relating to the FANTA/Cornel food insecurity scale items. The reliability of the instrument was established using the split half (Cronbach's coefficient) reliability test. The instrument was pre-tested in a community in Ondo State that was excluded from the study's final selected communities. The reliability result (0.889) was taken to indicate a good reliability given the benchmark of 0.70 [16].

2.5 Measurement of Variables (food insecurity)

FANTA CORNELL method of food insecurity measurement was used to determine the food insecurity prevalence among the farming households in the study area [13]. The FANTA/Cornel instrument consists of 2 sets of 9 of questions each. The first set of 9 questions (representing food insecurity conditions), refers to the '*occurrence questions',* and represent an increasing level of severity of food insecurity (access). Responses to these questions are dichotomous i.e., "yes" or "no", where 'no' is coded 0 and 'yes' is coded 1. The second set of questions refer to the '*frequency of occurrence questions',* and determine how frequent or often the condition occurred. It is measured as follows: '1' for 'never', '2' for 'sometimes' and '3' for 'often'.

Thereafter, the result of the analysis was used to categorize the food insecurity prevalence of the respondents into *Food Secure Household (coded 1), Mild Food Insecurity (coded 2), Moderately Food Insecure (coded 3), or Severely Food Insecure (coded 4)*.

The categorization of households was guided by the following matrix (list 1) which ensured that each household is assigned to a single, distinct category based on its responses.

2.6 Data Analysis

Descriptive statistics (Frequency, percentages, mean, and charts) were used for analysis in this study. Also, ordinal logistic regression and Friedman test were used to analyse the hypotheses. The Statistical Package for the Social Science (SPSS) was used for the analyses.

2.7 Ordinal Regression

Ordinal regression is a statistical method for predicting the behaviour of a set of independent variables at the ordinal level. The independent variables are categorical or continuous, while the dependent variable is an ordered response category variable [17]. The dependent variable in this study, i.e., food insecurity, is divided into four ordinal categories namely "food secure," "mildly food insecure," "moderately food insecure," and "severely food insecure".

List 1. Categories of food insecurity (access)

Question	Frequency		
	Rarely (1)	Sometimes (2)	Often (3)
1a			
2a			
3a			
4a			
5a			
6a			
7a			
8a			
9a			

Where,

Food secure	
Mild food insecurity	
Moderate food insecurity	
Severe food insecurity	

List 2. Explanatory variables

X_1 = Age (years)	**X_8 = Income (N)**
X_2 = Education (years of formal school education)	X_9 = Number of household size economically active
X_3 = Gender (dummy variable: male =1; female = 0)	X_{10} = Credit volume accessed(N)
X_4 = Household size (number of people feeding from the same pot)	X_{11} = Land Ownership (dummy: yes = 1; No = 0)
X_5 = Farm size (measured in hectares)	X_{12} = Household savings as proportion of income
X_6 = Occupational status (dummy variable: full time farming = 1, part-time = 0)	X_{13} = Membership of social organization (dummy variable: Yes=1, No= 0)
X_7 = Farming experience (in years)	X_{14} = Proportion of technology practice (numbers of technology practice)

The implicit model is given as: Logit $[P(Y \leq j)] = \alpha_j - \Sigma\beta_i X_i$,

Where, *j = 1, ……., j-1 and i = 1, ……, m*

Here, j is the level of an ordered category with J levels and i corresponds to independent variables.

The mathematical representation of the model is specified as:

$P(Y_i/1\text{-}Y_i) = bo + b_1X_1 + b_2X_2 + \ldots\ldots\ldots + b_nX_n + e$

Where

Y = Food insecurity levels (ordered variable: *food secure = 1, mildly food insecure = 2, moderately food insecure = 3, severely food insecure = 4*)

2.8 Friedman Test

The one-way Anova with repeated measures had a non-parametric counterpart, which is the Friedman test, when the dependent variable is ordinal [18]. The test, which is a chi-square distribution test, was used to determine significant difference among the constraints to food insecurity. The formula is given as;

$$\chi^2 = \frac{12}{nk(k+1)}\sum R^2 j - 3n(k+1)$$

where:

χ^2 = Chi-square
l2 = Constant
n = number of blocks (subjects/ respondents);
k = number of groups/factors / treatments or variables being tested/compared

R^2 = Sum of square ranks for group *j (j = 1, 2……. c)*.

3. RESULTS AND DISCUSSION

Socio-economic characteristics of respondents: The results are presented in Table 1. It revealed 31.62% of the respondents were 41 to 50 years old, with the average age being 47 years, indicating they were in their active age cadre. This result lines up with that of Apata Temidayo [19], who stated that the mean age of farmers in Ondo and Ekiti States was 44 and 47 years, respectively. Ehiwario [20] and Ahmed, Eugene and Abah [21], reported a positive correlation between age of farmers and their food security status. Many (42.42%) respondents had secondary education, suggesting that farmers in the study area had formal education, and should have the capacity to comprehend the need for technology utilization which can strengthen their food security. According to Ahmed, Eugene and Abah [21], educational level of respondents is a factor which positively influences the food security of his/her household.

Most of the farming households in the study area were headed by men (86.12%). The average family size was 6 with the modal range being 5-8 persons (54.24%). This revealed that many of the farmers had large households, and this has implication on food insecurity. According to Ojeleye [22], the impact of family size affects the family's per-capita food consumption, escalating food insecurity in that home. Most (73.26%) respondents do not belong to any association or cooperative. This has implication on their food security as they may not benefit from the advantages accrued to members of an association e.g., access to trainings, incentives, subsidized farming materials, finance or loans to boost their farming operations and thus increase their food security. Fakayode [23] and Ojeleye [22] affirmed that farmers' associations provide members information on improved farm

practices, marketing outlets, and others that impacts farmers' decisions about food consumption and, as a result, food security. The result revealed that majority (78.15%) of the respondents had no access to credit while 21.85% had access. The high proportion of respondent not having access to credit might be due to their non-involvement in any associations or cooperatives.

The majority (37.79%) cultivated a farm of 1ha or less, while the average size was 1.7ha, which suggest that most of the farmers in the study area were small scale. The modal farming experience of the respondents was 11-20 years, with the average being 19 years. This suggest that the farmers were quite experienced in their farming business and are likely to have technical know-how in managing farming problems and thus improve their food security. This is similar to Otekurin's result in Ondo State [24]. The income distribution revealed a modal range of N100,000 or less (28.79%) with the average being N216,066.8 yearly. The findings suggest that most of the farmers are operating on a small-scale basis and below the national poverty line which has implication on their food security. Not surprisingly, more than half of the respondents are involved in non-farm activities (58.10%) while 41.90% were full-time farmers. The former are likely to earn more income and enhance their standard of living and food security. The pooled average income yearly from non-farm activities of respondents was N360,000 per year.

Access to extension workers: Fig. 1 revealed that majority (80.98%) of the respondents had no contact with extension workers in the last 6 months while only 19.02% had contact with the workers. The average frequency of visit by the few respondents that had contact with extension workers was 3 times. Extension workers play a major role in disseminating modern and improved technologies to farmers to boost production and improve standard of living. This inability to access extension agents by most of the respondents in the study area may adversely impact on their food security as they may lack access to knowledge of modern technologies that can boost their production and enhance food insecurity.

Adoption of improved farming technologies: Table 2 revealed the 77.63%, 73.26%, and 66.58% of the respondents adopted the application of herbicides, pesticides and fertilizers respectively. The average number of technologies adopted by respondents was 3 out of the eight listed. This implies a low adoption behaviour by the farmers in the study area and this may impair their productivity. Their low adoption behaviour may be due to their little or no contact with extension workers as earlier revealed or laggard attitude. Technology adoption is a factor in boosting agricultural production which will in turn enhance food security [25].

Food insecurity prevalence among farming households: Fig. 2 display the prevalence of food insecurity among the sampled households. Results revealed that 61.44% suffer severe food insecurity, 35.73% suffered moderate food insecurity and 1.03% suffered mild food insecurity. The results show that there is a high level of food insecurity among households in the research area, with only 1.80% reported to be food secure. This is consistent with Seid and Biruk's [26] finding, which found that farming households in Delta/Edo States and Western Ethiopia, respectively, experienced a significant level of food insecurity.

Significant constraints to food security faced by farming households: Friedman test (Table 3) was used to test the hypothesis which states thus, "There is no significant difference among the constraints to food security faced by the farming households". The Friedman test (*Chi-square = 1710.85; df = 11; P<0.05*) is significant at 5% level and implies that significant differences exist among the constraints to food security faced by farming households in the study area. The post-hoc test revealed five group of constraints, ranked "a" to "e". The highest significant group ranked "a", comprise four constraints namely, high cost of farm chemicals (8.35), poor storage facility (8.57), inability to access credit (8.78) "a" inadequate capital (8.56). The next lower significant group (ranked "b"), comprise two constraints which includes high transport cost (7.55) and non-availability of improved seeds (7.51). The next lower significant group (ranked "c") comprise two constraints namely theft of farm produce (5.73) and low market price of produce (6.05). The next lower significant group (ranked "d") comprise three constraints including herdsmen attack (4.35), low soil fertility (4.30) and poor yield (4.73). The least significant group or constraint is flooding (3.54).

Table 1. Personal characteristics of respondents

Characteristics	Categories	Freq (n = 389)	%
Age range (years)	30 & below	40	10.28
	31-40	73	18.77
	41-50	123	31.62
	51-60	98	25.19
	61-70	47	12.08
	>70	8	2.06
Education	No formal education	23	5.91
	Primary	99	25.45
	Secondary	165	42.42
	NCE/OND	67	17.22
	BSc/ HND	31	7.97
	Postgraduate	4	1.03
Sex of household head	Female	54	13.88
	Male	335	86.12
Family size range	1-4	133	34.19
	5-8	211	54.24
	9-12	45	11.57
Farming experience (years)	10 & below	84	21.59
	11-20	152	39.07
	21-30	97	24.94
	31-40	36	9.25
	>40	20	5.14
Association membership	Non-member	285	73.26
	Member	104	26.74
Farm size (ha)	<=1.0	147	37.79
	1.1-2.0	100	25.71
	2.1-3.0	91	23.39
	3.1-4.0	25	6.43
	4.1-5.0	15	3.86
	>5.0	11	2.83
Farm income (N)	<=100,000	112	28.79
	100,001-200,000	71	18.25
	200,001-300,000	99	25.45
	300,001-400,000	65	16.71
	400,001-500,000	28	7.20
	>500,000	14	3.60
Engaged in non-farm income	No	163	41.90
	Yes	226	58.10
Accessed Credit	No	304	78.15
	Yes	85	21.85

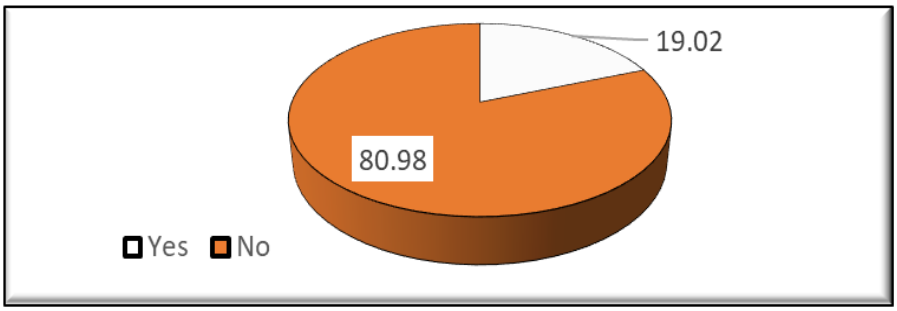

Fig. 1. Respondents access to extension agents

Table 2. Technologies adopted by farming households

Technologies	Freq*	%	Mean
Application of herbicides	302	77.63	
Application of pesticides	285	73.26	
Application of Fertilizers (organic or inorganic)	259	66.58	
Use of improved varieties of crop and animals	148	38.05	
Recommended harvesting (time/ method)	98	25.19	
Use of recommended planting space	96	24.68	
Use of tractors and farm machines	66	16.97	
Improved storage methods	60	15.42	
Adoption Total			**3**

**Multiple response hence total exceeds sample size*

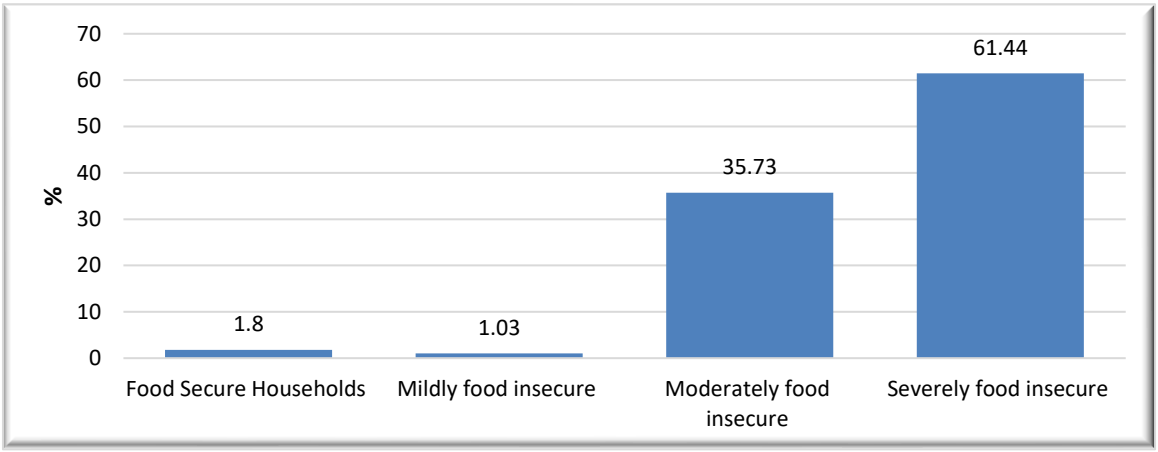

Fig. 2. Food insecurity prevalence among households

Table 3. Significant constraints to household's food security (Friedman's test)

Constraints	Mean rank*	
Inability to access credit	8.78	a
Poor Storage facilities/system	8.57	a
Inadequate Capital	8.56	a
High cost of farm chemicals	8.35	a
High cost of transport	7.55	b
Non-availability of improved seeds	7.51	b
Low market price	6.05	c
Theft of farm produce	5.73	c
Poor yield	4.73	d
Herdsmen attack	4.35	d
Low or poor soil fertility	4.30	d
Flooding	3.54	e

Chi-square = 1710.85; df = 11; N = 389; P<0.05

Socio-economic determinants of smallholder farming households' food insecurity: Ordinal regression was used to analyse the hypothesis which states as follows, 'There is no significant correlation between the socioeconomic characteristics of the smallholder farming households and their level of food insecurity'. Based on the *Model statistics* (Table 4), four statistics were estimated including the model chi-square, Goodness-of-fit test, Pseudo coefficient of determination (R-square) and Test of Parallel lines.

The *model chi-square* result ($\chi^2 = 154.9; df = 12$) is significant ($P < 0.001$) which shows that the regression model containing the explanatory

variables is better than that with no explanatory variables. In other words, the model with explanatory variables included is a good or better predictor of the dependent variable (food insecurity) among the farming households in the study area.

The *Goodness-of-fit* tests the null hypothesis, which states that the model is a good fit i.e., whether the observed data are consistent with the fitted model. The result or goodness-of-fit test ($\chi 2 = 447.5; df = 1074$) is non-significant ($p>0.05$), and the null hypothesis is therefore accepted, implying that the model is a good fit. A good fit means that the data and the model predictions are similar.

The *Test of parallel lines* evaluates the proportionate odds presumption and is anticipated to be greater than 0.05. (i.e., not significant). The ordinal model, which has a single set of coefficients for all thresholds of the dependent variable (i.e., the null hypothesis), is compared to a model with a separate set of coefficients for each threshold in this test (also known as the test of "proportional odd") (labelled General). The proportional odds assumption is rejected if the general model considerably better fits the data than the ordinal (proportional odds) model (i.e., if p<0.05). The results of the analysis ($\chi^2 = 115.7; df = 24; p < 0.05$) reveals a significant value and hence rejection of the null hypothesis. This suggests the model thresholds have different coefficients. However, the "test of the proportional odds" assumption has been labelled as anti-conservative since, according to O'Connell [27], it almost always leads to the rejection of the proportional odds assumption. This can having a large or enormous sample size, especially when there are many explanatory variables [28,29,30], or there is a continuous explanatory variable in the model [29]. All these factors are present in this analysis i.e., large number of explanatory variables (k = 12), large sample size (n = 389), and inclusion of continuous variables in the model (e.g., age, adoption, farm size, farming experience, family size).

The coefficient of determination (*Pseudo* $R^2 = 0.415$) means that the explanatory variables explain 41.5% of the variation observed in food insecurity prevalence among the farming households. The t values show only 8 variables are significant at the 5% level namely age, education, family size, adoption, farm income, association membership, engagement in non-farm income and access to credit. These are discussed as follows.

Table 4. Parameter estimates for socio-economic factors affecting food insecurity

	Parameters	Coefficient (b)	Wald	df	Prob. Level	Odd ratio
Threshold	[1 - Food secure]	-11.529	96.972	1	.000	
	[2 - Mildly food insecure]	-11.067	93.063	1	.000	
	[3- moderately food insecure]	-7.259	49.233	1	.000	
Location	Age*	-0.059	16.122	1	.000	0.943
	Education *	-0.376	6.867	1	.009	0.687
	Family size*	0.197	11.224	1	.001	1.218
	Farming experience	0.013	0.605	1	.437	1.013
	Farm size	0.006	0.002	1	.964	1.006
	Adoption (technology)*	-0.198	6.828	1	.009	0.820
	Farm income*	-0.335	9.150	1	.002	0.715
	[Association membership=No]*	-0.999	9.316	1	.002	0.368
	[Engaged in non-farm = No]*	-1.538	28.773	1	.000	0.215
	[Sex of household head = No]	-0.673	2.920	1	.088	0.510
	[Extension Contact= No]	-0.266	0.445	1	.505	0.766
	[Accessed Credit= No] *	-0.853	4.666	1	.031	0.426

Dependent variable = Food insecurity

(For the polytomous ordered categories, 'severely food insecure' is the dependent variable to which the independent variables are correlated.)

The odd ratio for age (0.943) implies that younger farmers are 6% ($^1/_{0.943}$) more likely to be food insecure compared to the older farmers. This is expected as some of the younger household may not be able to engage in some income generating ventures to meet their food demands. This finding disagrees with that of Seid and Biruk [26] who reported that younger farmers tend to be more food secure than the older ones. The odd ratio for education (0.687) implies that the odd of being food insecure is 45% (1/0.687) more for the less educated farmers than the more educated farmers. This is expected as it may be difficult for the less educated households to understand, comprehend and adopt technologies that will boost their farming activities thereby reducing their food insecurity.

The odd ratio (1.22) implies that households with larger families are 1.22 times (22%) more likely to be food insecure. This is expected as the consumption of food is higher for those with large family than those with smaller ones. This finding corroborates that of Ojeleye (2019) who reported similar results. The odd ratio (0.820) implies that farmers with lower adoption rate are 22% ($^1/_{0.820}$) more likely to be food insecure compared to farmers with higher adoption. The odd ratio for farm income (0.715) implies that respondents with lower income are about 40% (1/ 0.715) more likely to be food insecure compared to those with higher farm income. This is expected as those with lower income don't have enough to purchase the food items needed for themselves and households.

The odd ratio for association membership (0.368) implies that non-association members are almost three times ($^1/_{0.368}$ = 2.7 times) more likely to be food insecure than those who are members. This is expected as cooperatives give members opportunities to access incentives such as planting materials at a subsidized rate which boost farming productivity thereby reducing their food insecurity.

The odd ratio for engagement in non-farm enterprises (0.215) implies that respondents not engaged in non-farm enterprises are 4.6 ($^1/_{0.215}$) times more likely to be food insecure than those who have non-farm enterprises. This is expected as the income generated from the farm alone might not be enough to meet the food demand of the households hence increasing their food insecurity status. Studies by Obionna and Onu (2017) shows that farmers engaged in non-farm ventures expand their earnings and capacity to live a more quality life this was also corroborated by Odoh and Nwibo [31]. The odd ratio for access to credit (0.426) means that respondents without access to credit are 2.3 times more likely to be food insecure relative to those who had access to credit. This finding is expected as access to credit helps boost business including farming enterprise as it facilitates access to inputs [32]. Lack of access to credit may hamper farmers production thereby increasing their chances of being food insecure.

4. CONCLUSION AND RECOMMENDATIONS

According to the findings, agricultural households in the research area have a very high incidence and prevalence of food insecurity. Furthermore, socio-economic characteristics like age, education, family size, technology adoption, farm revenue, association membership, involvement in non-farm activities, and loan availability had a substantial impact on the food insecurity status of farming households. Furthermore, the findings revealed significant constraints hampering the household's ability to mitigate food insecurity. Based on the findings, the following recommendations are proposed:

- Given the high correlation between family size and food insecurity, the study recommends farmers adopting birth control measures to maintain a family size they can adequately cater for.
- Farming households should be linked with appropriate financial institutions to provide adequate capital for farm investment purposes such as land, improved inputs and storage facilities so as to maximize yield and income.
- The State extension agency should develop training programme for farming households to create awareness of and deepen the capacity of farmers towards adopting improved farm technologies.
- Farmers group should be linked to ready markets where their produce can be sold directly at a better price instead of through middlemen who tend to take advantage of the primary producers (farmers).

- Farming households in the study area should be encouraged to join cooperate societies to enhance access to farm credit to expand their farm business.
- Smallholder farming households should be encouraged to increase their scale of production and increase land size.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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