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Analysis of Food Insecurity among Rural Farming Households: Evidence from Ikere Local Government Area of Ekiti State, 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

Food insecurity is a major global challenge that is more prevalent in developing nations like Nigeria with varying degrees of impact on households and demanding immediate attention from policymakers. This study assessed the level of insecurity among farming households in Ikere Local

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Government Area of Ekiti State, Nigeria using the Household Food Insecurity Access Scale (HFIAS) approach. The data for the study was collected from 140 farming households selected using a two-stage sampling technique. Descriptive statistics were employed to characterize the socioeconomic attributes of the farming households and the coping strategies adopted during periods of food shortages, and the binary probit model to examine the determining factors of the food security status of the households. The HFIAS analysis result revealed that 83.7% of the households were food insecure at varying levels. The binary probit results revealed that household size, annual household income, cooperative membership, and access to extension services are the key determinants of household food security status in the study area. Given the study findings, we recommended the need for increasing the awareness of rural farming households on the use of family planning for enhancing household food-nutrition security. Farming households are also encouraged to diversify their livelihood to improve their income and participate in cooperatives and farming groups so that they can have access to resources that can aid to improve their productivity. Additionally, extension services should be made accessible to rural farming households as this will help to improve their productivity and hence, household food security.

Keywords: Binary probit; coping strategies; farming households; food insecurity; HFIAS.

1. INTRODUCTION

In recent times, attention has been drawn to addressing the challenge of household food security, especially with the worsening economic situation particularly in developing economies. The Sustainable Development Goal 2 (SDG 2) of zero hunger under its targets and indicators, identifies hunger and food insecurity as the major problems that plague the poor and also, aims to end all kinds of hunger and malnutrition, ensure food security, better nutrition, and achieve sustainable agriculture by 2030 [1]. The foregoing makes studies on food security become extremely relevant.

According to FAO et al. [2], about 690 million people are undernourished globally in 2019, which increased by nearly 10% from 2014. Compared to other regions of the world, Africa has a significantly greater rate of food insecurity [3,4], with more than 50% of the population experiencing moderate to severe food insecurity [5], (Thome et al. 2019). Among the regions in Africa, West Africa continued to be the most afflicted, with an exceptional rise in the number of undernourished people from 9.6 million in 2014 to 115.7 million in 2020. Of the West African nations, Nigeria, popularly regarded as the "giant of Africa," has a Global Hunger Index (GHI) score of 28.3 and ranks 103rd out of the 116 countries represented in the 2021 GHI report [6]. This data denotes a “serious level” of hunger and food insecurity in the country [6].

Approximately 80% of Nigeria's population lives in rural areas with about 50% of this population mired in poverty and hunger [7,8]. Hunger, food insecurity, and poverty are inextricably related because low-income households are often without the resources to buy enough food to maintain an active and healthy lifestyle. As a result, rural households are considerably more at risk for hunger, malnutrition, inconsistent food supply, high food prices, poor food quality, and even total food shortage [9]. Since food production in rural Nigeria is often characterized by the seasonality of production, low resource input, and low productivity, achieving food security and adequate nutrition within rural farming households can be challenging [10,11].

The assessment of the food insecurity level and its associated drivers is crucial for effectively targeting high-risk population groups and designing a dependable monitoring and evaluation system for food security. Addressing food insecurity in Nigeria remains a major public policy concern, which is further complicated by the paucity of knowledge regarding the location, prevalence, and determinants. Such knowledge is however required to establish effective interventions, measure progress, and design focused support programmes.

Several studies have been conducted in Nigeria to examine the food security status at household level using objective measures [12-15]. The objective approach involves measuring household dietary diversity, calorie intake, and monetary poverty thresholds [16,17]. Approaches based on consumption or expenditure data and income are vulnerable to issues such as seasonal volatility, occasional purchases, and measurement errors resulting from inability of the respondent to accurately recall purchase data

[18]. Additionally, depending on the period the survey is carried out, consumption or expenditure data may consistently underestimate or overestimate the actual state of food security of the respondents [19]. The current study differs from the earlier studies in that it used the HFIAS approach, a subjective method of assessing the food insecurity situation of households. The subjective approach for determining the food insecurity situation of households rely on the experience and perception of the respondent on the accessibility and availability of sufficient food [19]. The subjective measure involves asking respondents how frequently they have individually or as a household encountered food insecurity [19]. Thus, this study aimed to provide empirical evidence on farming household food security in Ikere Local Government Area (LGA) of Ekiti State, Nigeria using the HFIAS approach. Specifically, the study seeks to assess the food insecurity prevalence among farming households in the study area; identify the coping strategies adopted by farming households in the study area during periods of food shortage; and examine the determinants of the food security status of farming households among farming households in the study area.

2. MATERIALS AND METHODS

2.1 Study Area

The study was conducted in Ikere Local Government Area (LGA) of Ekiti State, Nigeria. Ekiti State is situated in the Southwestern region of Nigeria and shares borders with Kwara State in the North-West, Ondo State in the South, and Kogi State in the North-East. The state is located between latitude 7˚25ˈ and 8˚5ˈN of the equator and on longitude 4˚5ˈ and 5˚46ˈ of the Greenwich Meridian. The state has an estimated population of 2,398,957 people [20]. Although some parts of the state are urbanized, a larger percentage of the population lives in rural areas and practices agriculture as their predominant occupation.

2.2 Sampling Procedure and Data Collection

The study was conducted using cross-section primary data obtained in 2021 from the sampled households. A structured, interview-administered questionnaire was utilized to collect data from 140 farming households selected through a two-stage sampling procedure. In the first stage of selection, ten districts were randomly selected in the LGA, namely, Afao, Anaye, Araromi, Ijoka quarters, Ikoyi, Kajola quarters, Moshood, Odo-Oja, Oke-Osun, and Oke-Ikere. In the second stage, 14 households were selected at random from each of the districts to make a total of 140 sampled farming households.

2.3 Analytical Techniques

The analytical tools used in this study include descriptive statistics, Household Food Insecurity Access Scale (HFIAS) module, and binary probit regression model.

2.4 Descriptive Statistics

Descriptive statistics such as standard deviation, mean, percentage and frequency distribution were employed to characterize the farming households based on their socioeconomic attributes, as well as describe the coping strategies adopted by the farming households during periods of food shortages.

2.5 Household Food Insecurity Access Scale (HFIAS)

The HFAIS was employed to assess the households' economic access to food. The HFIAS module was introduced by the Food and Technical Nutrition Assistance (FANTA) project to measure the food insecurity status of households [21]. The tool is comprised of nine generic questions which have been adopted in several past studies [22-24] to distinguish between food-secure and food-insecure households. The information provided by the respondents from every question asked can be used to assess the food access situation of households and the prevalence of Household Food Insecurity (HFI) within the past four weeks. The respondents are first asked an occurrence (yes or no) question to determine whether the situation depicted in the question actually occurred at all over the past four weeks. If the respondents provided "yes" for the answer to the first question, they are then asked a "frequency of occurrence" question to establish how frequently the situation happened over the past four weeks. Three response options that reflect the range of possible occurrences – "rarely" if 1-2 times, "sometimes" if 3-10 times, and "often" if greater than 10 times are provided for the respondents to select from [21].

The sampled households are then assigned an HFIAS Score using the generic questions and the frequency of occurrence for the situation

depicted in each question over the past four weeks. The HFIAS Score for each household is determined by adding the codes of frequency of occurrence for the nine food-insecurity-related questions. Mathematically, it is illustrated as follows:

$$\text{HFIAS Score} = \delta_{1a} + \delta_{2a} + \delta_{3a} + \delta_{4a} + \delta_{5a} + \delta_{6a} + \delta_{7a} + \delta_{8a} + \delta_{9a}$$

Where, $\delta_1 - \delta_9$ represents food-insecurity-related questions and 'a' represents the response code for each of the frequency of occurrence questions. 0 is assigned if the households responded "no" to each occurrence question; 1 if the households responded "rarely" to each occurrence question; 2 if the households responded "sometimes" to each occurrence question; and 3 if the households responded "often" to each occurrence question. Such that, the 0 and 27 are given as the minimum and the maximum obtainable HFIAS Score respectively. The higher the score for a household, the more food insecurity experienced by the household.

The HFIAS Score is further used to characterize the sampled households into four different levels of food insecurity: food secure, mildly food insecure, moderately food insecure, and severely food insecure (see Table 1). This classification is known as Household Food Insecurity Access Prevalence (HFIAP) and it depicts the severity of food insecurity in the sampled households.

The operational definitions of food insecurity of households utilized in this study, according to Coates et al. [21], are given as follows:

- A household is considered to be food secure if the conditions of food insecurity (access) do not exist in the household;
- A household with moderate food insecurity (access) worries about running out of food occasionally or frequently and often times, finds it difficult to eat favorite meals. Such household consumes a more monotonous diet than preferred, or occasionally eat some foods deemed undesirable. However, it neither reduces the amount nor exhibits any of the three most serious symptoms (running low on food supply, going to bed without food, or going without food for the entire day and night);
- A household that experiences moderate food insecurity tends to compromise quality more regularly, either by sticking to a boring or monotonous diet or choosing unsavory items on a regular basis, or beginning to reduce the quantity of their meals on a rare or irregular basis. However, it is not affected by any of the three most serious conditions;
- A household with extreme food insecurity has progressed to reducing meal size or frequency frequently, and/or experiences one of the three worst scenarios (running low on food supply, going to bed without food, or going without food for the entire day and night) even sometimes.

2.6 Binary Probit Regression Model

The binary probit model was used in this study to determine the factors influencing the food security status of the farming households. The binary probit regression is a suitable econometric model for this study because it predicts the tendency of an event occurring for multiple explanatory variables [25]. To establish the food security status of the households, the study defined the explanatory variable, Y = 1, if the households are food secure, and Y = 0, if otherwise (food insecure). The probit model as used by Inoni et al. [26] can be written as:

$$Y_i^* = \alpha + \beta_{ij}X_{ij} + \varepsilon_i \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Table 1. Household food insecurity access prevalence

Food security status		HFIAS scores
Food secure		0, 1
	Mildly food insecure	2, 3, 4, 5, 7, 10
Food insecure	Moderately food insecure	8, 9, 11, 12, 13, 14, 16, 17
	Severely food insecure	15, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27

Source: Coates et al. [21]

Table 2. Summary of variables used in the probit regression model

Variable form	Variable	Description	Measurement
Y	Food security status	Whether the household is food secure or food insecure	Binary; 1 = food secure, 0 = otherwise
X_1	Age	Age of household head	Continuous; years
X_2	Gender	Gender of household head	Dummy; 1 = male, 0 = female
X_3	Household size	Number of persons in the household	Continuous; number
X_4	Education	Highest education level attained by the household head	Categorical; 0 = no formal education, 1 = primary, 2 = secondary, 3 = tertiary
X_5	Farm size	Size of farmland holding	Continuous; hectares
X_6	Annual income	Earned income from on-farm and off-farm sources per year	Continuous; Naira
X_7	Membership of cooperatives	Whether the household head is a member of cooperatives	Dummy; 1 = yes, 0 = no
X_8	Extension access	If the household head had access to extension services in the previous production cycle.	Dummy; 1 = yes, 0 = no

Where

Y_i* = the latent or unobservable measure of food security status of households predicted using the HFIAS Score of households;
α = the constant or intercept of the equation;
β_{ij} = the vector of the parameters to be estimated;
X_{ij} = the independent variables which predict whether the households are food secure or otherwise;
ε_i = the random error term.

From equation (1), the model that predicts the food security status of the households can be implicitly expressed as:

$$P(y^* = 1/x) = F(\alpha + \beta_{ij}X_{ij}) \quad (2)$$

Where

F = cumulative distribution function (CDF) that predicts the food security status of households with a value that lies between 0 and 1. Such that a household is food secure if Y > 0 and Y≤ 0 if otherwise.

Explicitly, the model for predicting the tendency that a household will be food secure or otherwise can be expressed as:

$$P(Y_i^* = 1/x) = F(\beta X) = \int_{-\infty}^{\beta X} \frac{1}{2\sqrt{\Pi}} e^{\left(-\frac{z^2}{2}\right)\delta z} \quad (3)$$

Where

P = the probability that the i^{th} household will be food secure (y = 1) or y = 0 if otherwise;
X = vector of predictor variables;
Z = standard normal distribution;
β = vector of the parameters to be estimated;
F(βX) = the CDF of the standard normal distribution

3. RESULTS AND DISCUSSION

3.1 Socioeconomic Characteristics of the Farming Households

Table 3 presents the socioeconomic characteristics of the farming households. The household heads have an average age of 51 years, indicating that they are still within their productive age. This result is consistent with the mean farmers' age of 52 years reported by Sina and Folorunso [27]. The majority (74.3%) of the farming household heads are male. This result aligns with the DHS (2003) report that majority (83%) of households in Nigeria are male-headed. The farming households have a mean size of 6 members. This finding is similar to the average household size of farming households reported by Toluwase et al. [23]. The result further suggests that farming households with the average household size could leverage family labor for carrying out various farm operations.

Table 3. Socioeconomic characteristics of farming households (n = 140)

Variables	Frequency	Percentage	Mean ± SD
Age			
≤30	6	4.3	51 ± 11.8
31 – 40	24	17.1	
41 – 50	53	37.9	
51 – 60	22	15.7	
>60	35	25.0	
Total	**140**	**100.0**	
Gender			
Male	104	74.3	
Female	36	25.7	
Total	**140**	**100.0**	
Household size			
≤5	53	37.9	6.5 ± 2.7
6 – 10	78	55.7	
>10	9	6.4	
Total	**140**	**100.0**	
Education			
No formal education	7	5.0	
Primary	33	23.6	
Secondary	37	26.4	
Tertiary	63	45.0	
Total	**140**	**100.0**	
Primary occupation			
Farming	55	39.3	
Civil servant	39	27.9	
Artisans	35	25.0	
Clergy	11	7.9	
Total	**140**	**100.0**	
Farm size			
≤5	111	79.3	4.0 ± 5.7
6 – 10	4	17.9	
>10	3	2.9	
Total	**140**	**100.0**	
Annual income (₦)			
≤200,000	53	37.9	370,893 ± 265, 873
200,001 – 400,000	41	29.3	
400,001 – 600,000	24	17.1	
600,001 – 800,000	15	10.7	
>800,000	7	5.0	
Total	**140**	**100.0**	
Membership of cooperatives			
Yes	50	35.7	
No	90	64.3	
Total	**140**	**100.0**	
Access to extension services			
Yes	57	40.7	
No	83	59.3	
Total	**140**	**100.0**	

Source: Field survey, 2021

This is consistent with the findings of Florence et al. [28] that the constraint on the labor required in production, processing, and marketing is lessened in farming households with larger family size. Cumulatively, about 95% of the household heads have at least the basic level of formal education, with majority (45%) having tertiary education as the highest education level

attained. This result is indicative that majority of the farmers are literate. The majority (39.3%) of the households are involved in farming as their major occupation. This result corroborates [29, 30] that agriculture is the mainstay of food and livelihood for rural households in Nigeria. The households cultivate an average farm size of 4 hectares, indicating that majority of the households are smallholders operating on farms smaller than 5 hectares [31,24]. The households earn a mean income of ₦370,893 per annum. While 64.3% of the household heads are non-members of any cooperative society, 59.3% do not have access to extension services. This result suggests that the farmers in the study area receive fair to poor extension services.

3.2 Food Insecurity Condition among Farming Households

Table 4 presents the nine generic HFIAS occurrence questions of food insecurity related conditions and the pooled-responses indicated by the sampled households. The results revealed that majority of the farming households indicated the incidence of food insecurity conditions 1-6. About 67% of the households were worried that they would run out of food, with 37% of the households indicating that they are often concerned about the incidence of this condition. Similarly, about 69%, 67, and 64% of the farming households showed incidence of being unable to eat preferred food, not having variety of food options available to eat, and eating food they do not feel like eating as a result of limited resources. The result further revealed that about 74% and 78% of the households were skipping meals and rationing the quantity of meal they eat per day respectively as a result of not having enough food. These results thus affirm households' access to sufficient quantity and variety of food is limited household food insecurity (Gundernsen et al. 2011) [32]. The majority of the households also indicated no incidence of food insecurity conditions 7-9. About 96% of the households indicated that they had no incidence of not having enough food to eat throughout a whole day, with a larger percentage (4.29%) of households indicating they rarely had incidence of the condition. This suggests that as farming households, they may always have food to eat, although it may not completely satisfy the conditions of food security (access to safe and nutritious food), which is particularly prevalent in developing economies (Otekurin et al. 2021) [33].

Table 4. Distribution of households on the basis of Occurrence of Food Insecurity Related Conditions (n = 140)

s/n	Occurrence Questions	No	Yes	Frequency of occurrence		
				Rarely	Sometimes	Often
		Freq (%)	Freq (%)	Freq (%)	Freq (%)	Freq (%)
1	Worried that you would run out of food?	46 (32.86)	94 (67.14)	13 (9.29)	33 (23.57)	52 (37.14)
2	Unable to eat preferred food?	44 (31.43)	96 (68.57)	19 (13.57)	41(29.29)	38 (27.14)
3	Limited food options available to eat?	46 (32.86)	94 (67.14)	15 (10.71)	44 (31.43)	39 (27.86)
4	Eating foods you did not feel like eating?	50 (35.71)	90 (64.29)	22 (15.71)	39 (27.86)	23 (16.43)
5	Eating small meal portion due to insufficient food?	31 (22.14)	109 (77.86)	42 (30.00)	48 (34.29)	19 (13.57)
6	Skipping meals due to not enough food in a day?	37 (26.43)	103 (73.57)	11 (7.86)	60 (42.86)	35(25.00)
7	No food available to eat at all?	111 (79.29)	29 (20.71)	8 (5.71)	14 (10.00)	7 (5.00)
8	Does any household member go to bed hungry?	81 (57.86)	59 (42.14)	31 (22.14)	19 (13.57)	9 (6.43)
9	Not having anything to eat at all for a whole day?	134 (95.71)	6 (4.29)	5 (3.57)	1 (0.71)	0 (0.00)

Source: Field survey, 2021

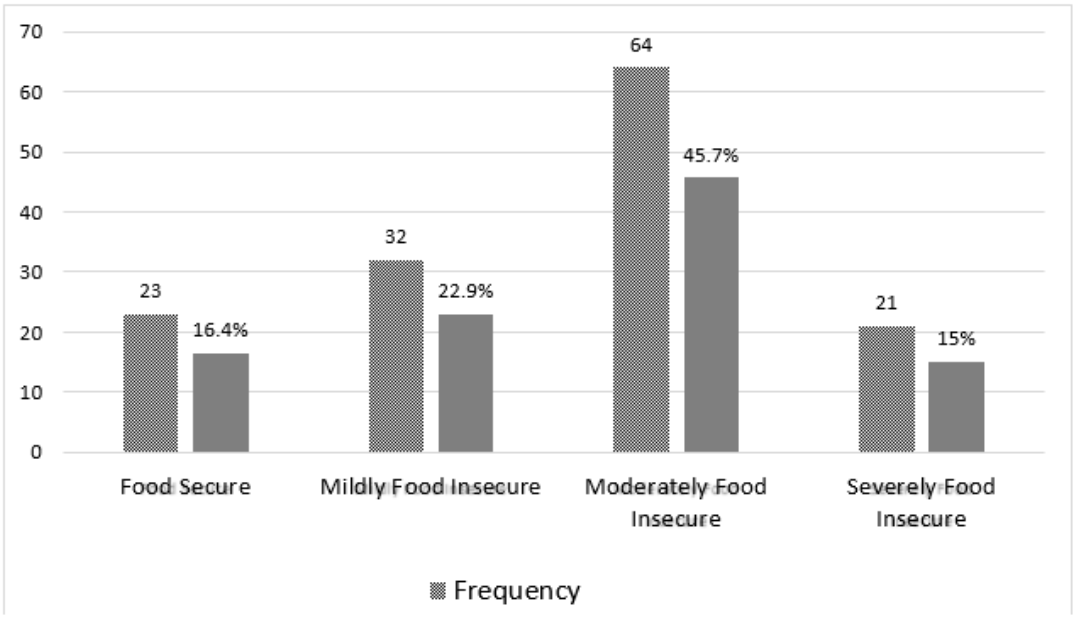

Fig. 1. Food insecurity Prevalence among farming households in the study area
Data source: Field survey, 2021

3.3 Food Insecurity Status of the Farming Households

The food insecurity status of the farming households using the HFIAS Score is presented in Fig. 1. The result revealed that 16.3% of the farming households were food secure, while 22.9%, 45.7%, and 15.0% of the households were mildly, moderately, and severely food insecure respectively. This is indicative that the majority (83.6%) of the farming households were food insecure. These results corroborate the findings reported by Toluwase et al. [23] on the food insecurity status of rural households in the study area.

3.4 Determinants of Food Security Status of the Farming Households

Table 5 presents the determining factors of the food security status of the farming households. Household size had a significant and negative effect ($p < 0.05$) on the food security status of the households. This implies that increase in the number of persons in the household will increase the likelihood of the household to be food insecure. This may be because increasing size of household translates to more persons depending on the same resources, and as a result, the members of the households may not have enough food to share, thus causing the incidence of a food insecurity condition the household. This result is similar to the findings of Babatunde et al. [34], Maksuda and Uddin [35], and Diallo and Toah [22]. The annual income of the households had a significant and positive association ($p <0.01$) with the food security status of the farming households. This translates that high-income households have more tendency to be food secure than low-income households. This is because households earning higher income may have enough money to purchase more quantity and variety of foods which can improve the food security of the households. This result corroborates the findings of Babatunde et al. [34], Maksuda and Uddin [35], and Cele and Mudhara [36]. Membership of cooperatives had a significant and positive association ($p < 0.05$) with the food security status of the households. This implies that farming households involved in cooperatives are more likely to be food secure than households that are not involved. This result is in consonance with past studies that membership of cooperatives facilitates farmers' access to credit and other productive resources [37-39], which improves the productivity of farmers and may subsequently improve the food security of farming households. Extension contact showed a significant and positive association ($p < 0.05$) with the food security status of the farming households. This is indicative that farmers who had access to extension services have a higher propensity of

Table 5. Probit estimates of the determinants of food security status of the farming households

Variables	Coefficients	Std. error	Z	p-value
Age	0.003	0.002	0.143	0.890
Gender	0.288	0.513	0.561	0.574
Household size	– 1.079**	0.459	2.355	0.020
Education	0.008	0.041	0.220	0.838
Farm size	– 0.015	0.073	– 0.200	0.084
Annual income	1.339***	0.523	2.557	0.006
Cooperative membership	0.250**	0.088	2.832	0.038
Extension access	1.835**	0.607	3.016	0.03
Constant	34.760	16.766	2.073	0.004
Number of observations = 140				
LR Chi^2 (8) = 21.42				
Prob > Chi^2 = 0.0061				
Pseudo R^2 = 1380				
Log likelihood = – 66.8982				

Source: Authors' estimate *Note: *,**, and *** indicates significance at 10%, 5% and 1% respectively*

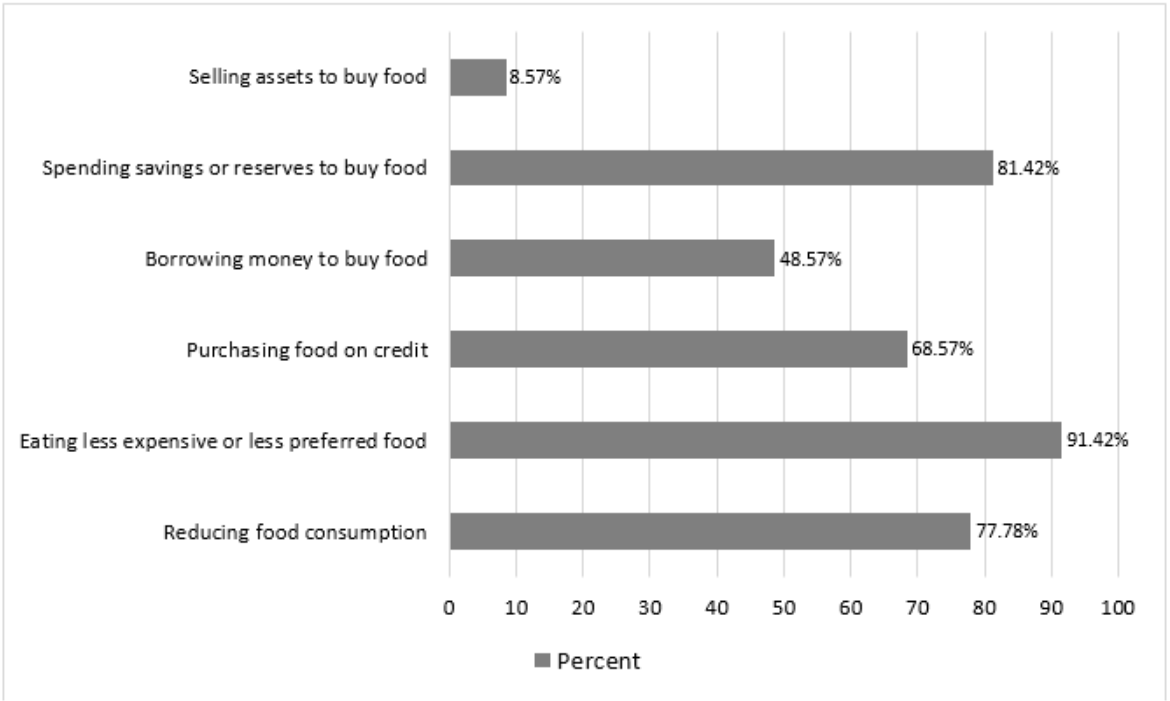

Fig. 2. Coping strategies employed during food shortage periods by households
Data source: Field survey, 2021

being food secure than farmers without access to extension services. This might be because access to extension services could facilitate access to information on productivity-enhancing techniques and other production incentives, which can positively impact productivity and subsequently improve household food security. This finding is in line with Diallo and Toah [22].

3.5 Coping Strategies Adopted by Households during Periods of Food Shortage

The short-term coping strategies employed by the farming households during period of food shortages is presented in Fig. 2. The majority (91.42%) of the households rely on eating cheaper and less preferred food as a coping measure during periods of food shortage. This result is supported by the findings of [40,41], who claimed that this strategy is the most often used coping mechanism for food shortages in developing nations. This is followed by spending savings and reserves (81.42%). Using this strategy might however have a long-term adverse effect on the food security of the farming households. According to Maniriho et al. [42], exhausting household savings on food limits their level of investment in productive resources, thereby, adversely affecting their food production and long-term food security. About 78% of the households utilize consumption reduction-related strategies such as skipping meals, reducing the number of meals eaten per day and rationing food portions per meal as coping measures for food shortages. However, eating less preferred meals and consumption reduction strategies are a reflection of the vulnerability and food insecurity access of the farming households [43-45]. About 69% and 49% of the households rely on borrowing money to buy food and buying food on credit. This is consistent with the findings of previous studies conducted in Nigeria, Ethiopia, and South Africa that borrowing money and food is a common coping measure adopted by households in the face of food shortages [46-48]. Less than 10% of the households rely on selling their assets as coping measures for food shortages. Households under this distribution claimed they resort to this measure during severe situations of food shortage. This is corroborated by the findings of [49,42].

4. CONCLUSION AND RECOMMENDATIONS

The study revealed a high prevalence of food insecurity among the farming households in the study area. The majority (83.6%) of the households were food insecure, with 22.9%, 45.7%, and 15.0% of the farming households experiencing mildly, moderate, and severe level food insecurity respectively. The most used and the least used coping measures by farming households during periods of food shortage are eating less preferred, cheap foods and selling assets respectively. Household size, annual income of households, cooperative membership, and access to extension services are factors that significantly determined the food security status of the household. While household size had an adverse effect on households' food security, annual household income, cooperative membership of household heads, and access to extension services had a positive association with the food security of the farming households. Based on the study findings, we recommended that food security strategies should be targeted at addressing the key determinants of the food security status of households. Governments should make available education programmes to farming households to enlighten them on the relevance of family planning to food and nutrition security. Farming households should diversify their livelihood by engaging in off-farm activities, as this will provide them with livelihood options for improving their household income and food security. Governments and relevant stakeholders should also make provision for extension education as well as make it accessible to rural farming households. Such efforts will help to improve the productivity, income, and food security of households. Farmers should make effort to join farming groups and cooperatives so that they may have access to credit inputs, useful information, and productive resources that can help in improving their productivity and subsequently household food security.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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