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DETERMINANTS OF FOOD SECURITY LEVEL OF GINGER FARMING HOUSEHOLDS IN KADUNA STATE, NIGERIA

[1]Fashina, A. O., [1]Ugbabe, O. O., [2]Usman, S. and [3]Baba, D.
[1]Department of Agricultural Economics, Ahmadu Bello University, Zaria, Nigeria
[2]Department of Agricultural Extension, NAERLS, Ahmadu Bello University, Zaria, Nigeria
[3]Department of E-Extension, NAERLS, Ahmadu Bello University, Zaria, Nigeria
Corresponding Authors' E-mail: dahirugombe@gmail.com **Tel.:** +234 (0) 8020535348

ABSTRACT
Socio-economic factors are known to be important in achieving food security especially among farming households. This paper analyzed the major determinants of the food security level of ginger farming households in Kaduna State, Nigeria. A sample survey of ginger farming households in three Local Government Areas in Kaduna State was conducted. Primary data collected were analyzed using descriptive statistics, principal component analysis and logistic regression. The socio-economic characteristics of the ginger farming households showed that about 77% of the respondents in the sampled areas were of an average age of 40 years. Female headed households were 24% of the sampled households, while 76% were male headed. A total of 66.3% had farming experience of more than 10 years with 92% of the household heads having one level of formal training or the other. More than half of the household sizes were within the range of two to seven persons. The analysis of the food security status of the ginger farming households which encompassed four dimensions of food security showed that 37.8% were food secure while 62.2% were food insecure. The major determinants of the food security level of the ginger farming households in Kaduna State were sex, age, marital status, years of formal education, years of farming experience, household size, secondary occupation, income from primary occupation and farm size. It was concluded that a higher proportion of the ginger farming households were not food secure which could be attributed to their socio-economic factors amongst other factors. The study recommended that social protection interventions that are more nutrition sensitive need to be promoted farming households to eradicate poverty and address food security issues.

Keywords: Determinants, Farming, Ginger, Households and Food security.

INTRODUCTION
Nigeria is largely an agrarian country. Agriculture is the single largest contributor to the well-being of the rural poor in Nigeria, sustaining approximately 86% of rural households in the country (International Food Policy Research Institute, 2013). The performance of agriculture, however, in terms of feeding the country's population, which is growing at about 2.83% per annum, is poor (Oluyole and Lawal, 2008). This poor performance has resulted in food insecurity and poverty, which in turn, creates food availability and accessibility problems at the household and national levels (Irohibe and Agwu, 2014).

Food security has become an issue of global concern and it goes beyond food availability. The term has been defined in various ways. However, food security exists when all people, at all times, have physical, social and economic access to sufficient safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life (FAO, 2015). Food insecurity and hunger are forerunners to nutritional, health, human and economic development problems. They connote deprivation of basic necessities of life which

has grievous consequences as they compromise people`s immune systems and force them to adopt risky survival strategies. Poor nutrition for women is one of the most damaging outcomes of gender inequality. It undermines women`s health, stunts their opportunities for education and employment and impedes progress towards gender equality and empowerment of women. The burden of chronic poverty and hunger forces livestock herders, subsistence farmers, forest dwellers and fisher folk may use their natural environment in unsustainable ways, leading to further deterioration of their livelihood conditions. Nigeria which is the most populous country in Sub Saharan Africa, has recorded insufficient progress towards international hunger targets (FAO, 2015). This has resulted in a bloat in the percentage of food insecure households, especially those residents in the rural areas. There is need for a proper diagnosis of food insecurity through the exploration of its determinants and the design of effective policies to bolster household welfare.

Ginger is the topmost spice cash crop grown in Nigeria, mostly in the southern part of Kaduna State (Northern Nigeria) for export. It is a tropical monocotyledons herbaceous root crop with leafy shoots. Its pungent rhizome is thick, hard and palmate branch of about 15-25mm in diameter. Ginger requires a mean annual rainfall of 1,000mm that is well distributed over a period of six months. There are two major varieties of ginger grown in Nigeria which differ in the colour of their rhizomes namely, the reddish and yellow varieties. The yellow variety is more widely cultivated than the reddish variety. The various cultivars available include UG1 and UG2 (Chukwu and Emehuite, 2003). The UG1 (locally called *Tafin giwa* meaning elephant‘s foot type) gives a higher yield than UG2 (*Yatsun biri* meaning monkey‘s finger type).

An average of 50,000 metric tons of fresh weight ginger per annum is produced in Nigeria and about 10% of the produce is consumed locally as fresh ginger while the remaining 90% is dried for both local consumption and export (Yusuf, 2016). In the world market, the major five exporting countries have been China, Nigeria, India, Jamaica, and Brazil (Asumugha, 2009; and United States Agency for International Development, 2011)). Nigerian ginger is known to produce the highest quality essential oil mainly oleoresin. Traditionally, ginger is used in Nigeria for both medicinal and culinary purposes as well as in confectionery industry. Locally, ginger rhizome is used in preparation of seasoned grilled meat (*suya*) as well as some local drinks like ―*Kunu* (NRCRI, 2004). Ginger in powdered form is used as a stimulant in tea, corn pap, and as soup spice in some homes in Nigeria. Ginger is also used in brewing ginger wines, ginger beer, ginger ale, ginger bread, pudding biscuits and other beverages, as well as confectionaries. Dried ginger is used in spices industries, pharmaceutical and perfumery industries (Asumugha, 2009). If farmed sustainably, ginger can contribute to food security in Nigeria as its production is profitable.

Every farming household is characterized or defined by certain factors that make them peculiar and sustainable. Socio-economic characteristics focuses on identifying the capacity of individuals based on their characteristics such as, education, wealth, and health status, access to credit, access to information and technology, formal and informal capital and political power. The socio-economic characteristics of farmers are mainly concerned with the social, economic and political aspects of farmers in any given society (Adger, 1999; and Yusuf, 2016). The variations of these factors are responsible for the variations in socioeconomic characteristics of farmers usually found in studies. Several socio- economic factors are known to influence household food security level. The objective of this study was to describe the socio-economic characteristics of the ginger farming households, determine

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their food security level and also to identify major determinants of the food security level of the ginger farming households in Kaduna State.

MATERIALS AND METHODS

The Study Area

The study was carried out in Jaba, Kachia and Kagarko Local Government Areas which lies between 9°11' and 10°11' N and longitudes 7°10' and 8°30'E and located at the southeast part of Kaduna State (Nmadu and Marcus, 2017).The common ethnics in the area are Bajju, Jaba, Adara, Koro, Ham, Kanikon, Kagoma and Gbagi. The climate is generally characterized by alternating dry and wet seasons. The rain fall usually starts in April and ends early November, while the dry season sets in mid-November and ends in March. Ginger is normally planted in March and harvested in November. The bulk of agricultural production in these zones is under-taken by small scale farmers most of whose labor force, management and capital originate from the household. The main crops grown in the area includes maize, millet, sorghum, rice, sorghum, yam, cocoa yam and ginger.

Sampling Techniques

Purposive and random sampling procedures were employed in selecting the respondents for this study. Southern Kaduna region was purposively selected based on a *priori* knowledge that it is a ginger producing area. Three Local Government Areas Jabba Kachia and Kagarko Local Government Areas (LGAs) were also purposively selected from the 11 Local Government of Southern Kaduna because of the concentration of ginger farming households (KADA, 2017). The primary data for the study were obtained from a sample survey of ginger farming households in the study area through the use of structured electronic questionnaires. A random sampling technique was used to select a sample of two hundred and seventy ginger farming households from the Local Government Areas selected. The data collected were analyzed with the use of Descriptive Statistics and Multivariate Analysis and Logistic Regression.

Analytical Techniques

Descriptive statistics such as frequency and percentages were used to describe the socio-economic characteristics of the ginger farming households and their coping strategies. Principal Component Analysis was used in determining the food security level of the ginger farming households. Logistic regression model was used to identify the determinants of food security level of the ginger farming household.

This study used principal component analysis (PCA) to construct a composite food security index, such that the weights are derived objectively from the data. PCA is a multivariate technique that can reduce dimensions, or uncover latent variables, by extracting linear combinations that best describe the co-variance among all elements (Abeyasekara, 2005; and Wineman, 2014). This multivariate technique finds patterns in data of high dimension. Once the patterns hidden in data are identified, PCA helps to compress the data by reducing the number of dimensions without much loss of information. In the language of Linear Algebra it is a linear transformation of the original variables. PCA allows us to compute a linear transformation that maps data from a high dimensional space to a lower dimensional space. In original data variables may be correlated and PCA help to transform them into uncorrelated variables. This method involves sophisticated calculations like eigen values and eigen vectors and hence software packages was used. In determining the weights for the indicators, the weights are determined by the factors loadings of the first principal component. Once the first component is identified, the food security index for each household is derived as follows:

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$$FSI_j = \frac{\sum F_i[x_{ji} - \bar{x}_i]}{s_i} \quad \ldots (1)$$

where;
$FSIj$ = Food Security Index, which follows a normal distribution with a mean of 0.
Fi = weight for the ith variable in the PCA model (the squared factor score of i).
Xji = jth household's value for the ith variable, and
Si = mean and standard deviations of the ith variable for overall households.

Essentially, the FSI is the sum of the weighted minimum and maximum scores for each variable. Each PCA index is based on a scale which is relevant only to that estimation, such that a set of indices from different estimations cannot be meaningfully compared. Gbetibouo and Ringler (2009) have applied this method to construct the vulnerability of South African farming sector. They retained the first principal component which explained about 33% of the variation and based on over all vulnerability indexes they classified the farming provinces into 4 categories in terms of vulnerability as high, medium, low-medium and low.

Logistic regression model was used to identify the determinants of food security level of the ginger farming household. The model assumes that the probability of the ginger farming households being food secured (Pi) is expressed as:

$$P_i = \frac{1}{1 + e - Zi} \quad \ldots (2)$$

where;
Pi ranges between zero and one and it is non-linearly related to Zi. Zi is the stimulus index which ranges from minus infinity to plus infinity and it is expressed as:

$$Zi = ln\frac{Pi}{1 - Pi} \quad \ldots (3)$$

To obtain the value of Zi, the likelihood of observing the sample were formed by introducing a dichotomous response variable. The explicit logistic model is expressed as:

$$Y=\beta o+\beta_1 X_1+\beta_2 X_2+\beta_3 X_3+\beta_4 X_4+\beta_5 X_5+\beta_6 X_6+\beta_7 X_7+\beta_8 X_8+\beta_9 X_9+\beta_{10} X_{10}+\beta_{10} X_{10}+\beta_{12} X_{12}+u \quad \ldots(4)$$

where;
Y = Food Security Status of the households (Food secured =1; Food in secured =0)
X_1 = Sex of household head (Male =1 and Female = 0)
X_2 = Age (Years)
X_3 = Marital status (Married =1, Single = 2, Divorced=3, Widowed = 4)
X_4 = Education (Years of Formal Schooling)
X_5 = Farming Experience (Years)
X_6 = Household Size (Persons)
X_7 = Primary Occupation
X_8 = Secondary Occupation
X_9 = Income from Primary Occupation per annum (Naira)
X_{10} = Farm Size (Hectares)
X_{11} = Yield from ginger Production (Kilograms per hectare)
X_{12} = Sales from Yield of ginger Production (Kilograms per hectare)
βo = Constant Term
$\beta 1 - \beta 9$ = The coefficients for the respective variables in the Regression model
u = Error term

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RESULTS AND DISCUSSION

Socio-economic and Demographic Factors

The distribution of the ginger farming household heads according to their ages is presented in Figure 1. About 52% of the household heads were between the age ranges of 21-40 years which is the active age range with a mean age of 40 years. At this age, the household head is expected to be agile and able to do a lot of farm work. Over 25% of the household heads were between the ages of 41- 50, 17% were between the ages of 51- 60 while about 6% were more than 60 years. The age of the farmer is expected to have effect on his level of activities. It determines the quality and quantity of work he can do on the farm thereby influencing his household level of food security. This result is consistent with the findings of Saleh and Mustafa (2018) in analysis of food security and productivity among urban farmers in Kaduna State, Nigeria.

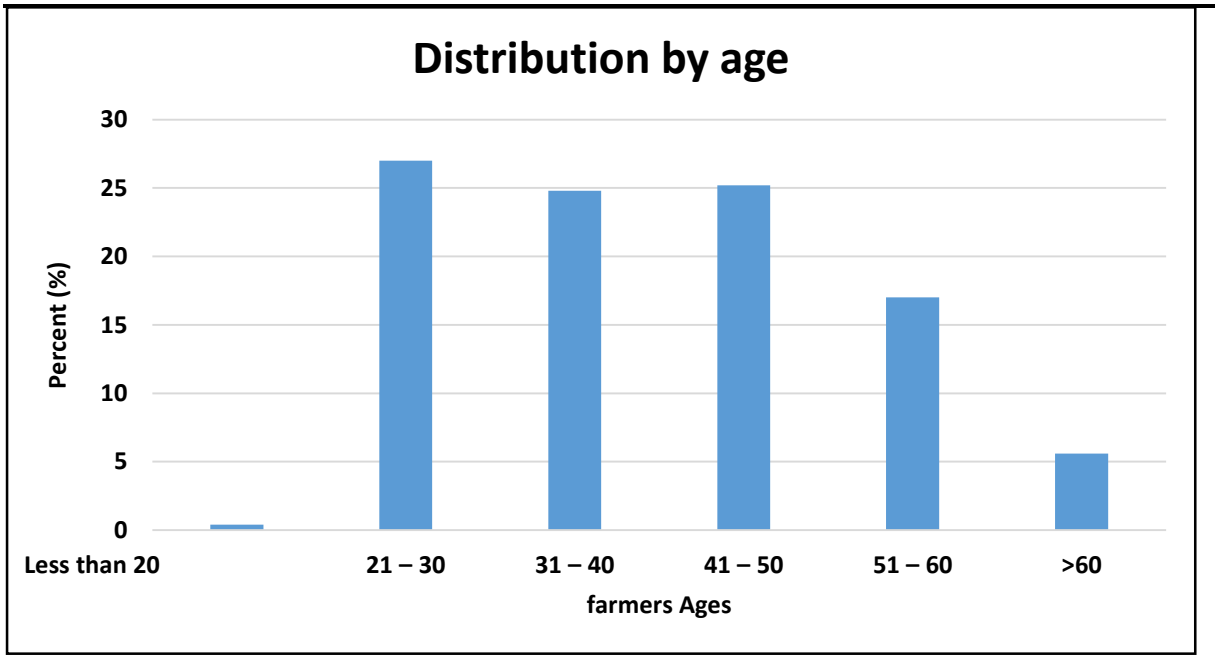

Figure 1: *Distribution of the respondent based on their age*

The result in Figure 2 shows that about 55% of the ginger farming household sizes ranged between two to seven persons, which was the predominant range, while the remaining 45.2% ranged between eight persons and above. The average number of persons in a household was four. Since resources are limited, the increase in household size may put more pressure on consumption than it contributes to the production which could have a negative impact on the food security level of the household. This finding is consistent with Kuwenyi *et al*. (2014) who reported that a higher percentage of the household sizes were between the ranges of one to seven.

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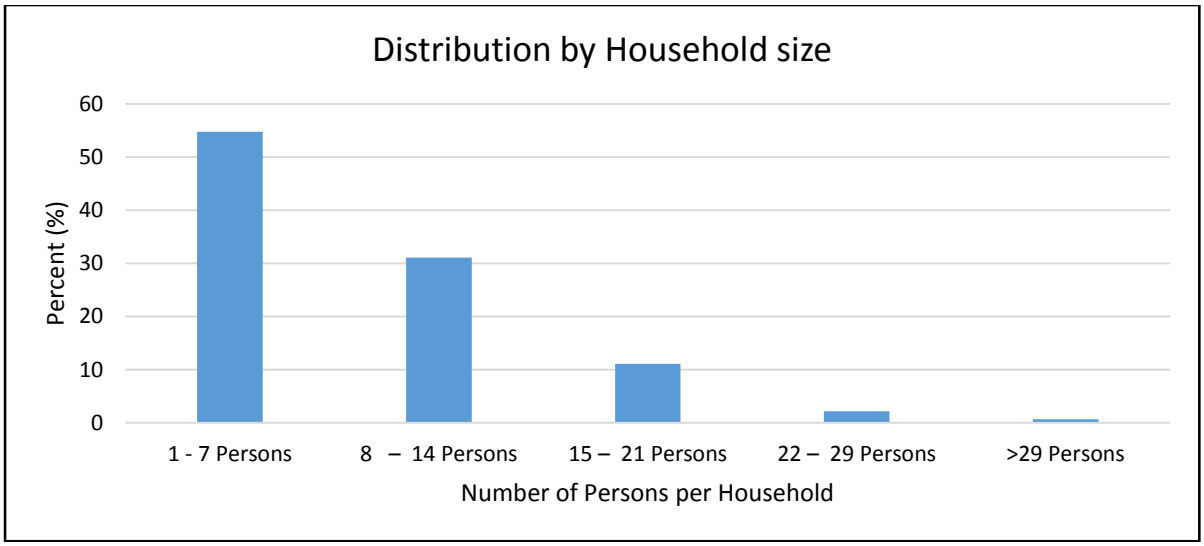

Figure 2: *Distribution of the respondent based on household size*

The level of education of the household heads is given in Figure 3. It was found that 1.5% of the household heads had adult education. 2.2% had Quranic (Arabic) education while 8.9% had no education at all; 7.4%, 40.7% and 39.3% had primary, secondary and post-secondary education level, respectively. The level of literacy among the ginger farming household head in the study area was high as shown in Figure 3. Education is fundamental to promoting food security as educated and informed people are more likely to select valuable objectives in life such as having stable access to food for their household. An educated household head is more likely to get a job to supplement his farm income and has also the capacity to use more rationally the resources he or she owns. Ishaya (2014) reported similar observations in investigating the factors that affect marketing of maize, ginger and soybeans in Kachia Local Government Area of Kaduna State, Nigeria.

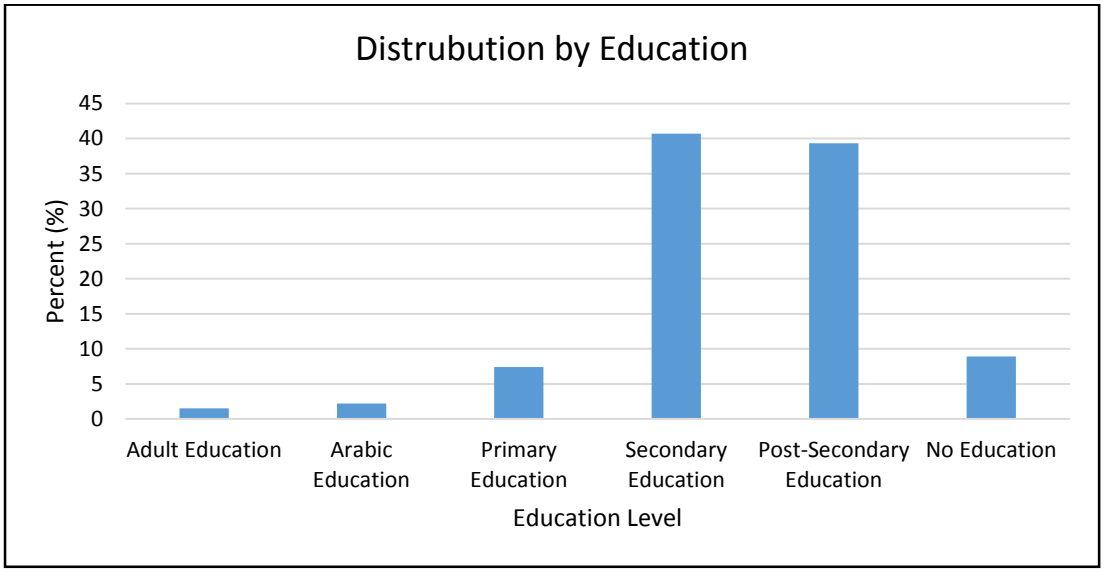

Figure 3: *Distribution of the respondent based on education level*

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As indicated in Figure 4 majority of the households (59.6%) had farm sizes that were less than one hectare, 40.4% had farmlands between 1.1 -5.0 hectares and the average land holding was 1.56 hectares. This implied that most of the ginger farming households was small scaled despite their family size, young and energetic household heads. Small farm size impedes productivity, crop diversification and consequently food security status of the farm households. Kolade and Harpham (2014) reported that about 44% of male farmers and 72% of female farmers cultivate less than 1 hectare per household in Nigeria and that 90% of Nigeria`s food is produced by small scale farmers cultivating small pieces of land.

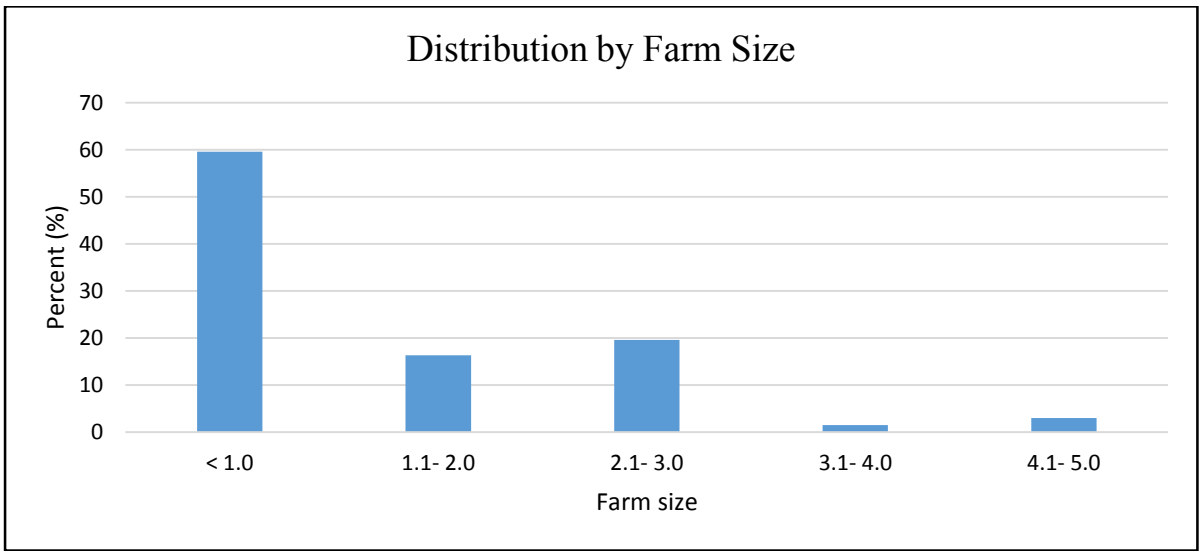

Figure 4: *Distribution of the respondent based on farm size*

Food Security Status and Classification of the Ginger Farming Households

The composite index of food security for the households which is an aggregate of the sub-indices from the different indicators used was analyzed using Principal Component Analysis and the result is presented in Table 1. The composite food security index has a mean of 0 and a standard deviation of 1. The food security indices of the ginger farming households were classified into food secure (with index ≥ 0) and food insecure (with index < 0). The mean composite food security index of zero for the re-classification of the households is in consonance with Tefera *et al*. (2017) who re-classified households into relatively resilient and less resilient for food security with a mean index value of zero.

Table 1: Level of Food Security classification of the Ginger Farming Households

Food Security Level		**Frequency**	**Percentage**
Food Secure	(Index ≥ 0)	102	37.8
Food Insecure	(Index < 0)	168	62.2
Total		**270**	**100**

The result as presented in Table 1 showed that 38% of the ginger farming households were food secure and 62% were food insecure. This result is in agreement with the findings of Idrisa *et al*. (2008) and Saleh and Mustafa (2018) who found that more than half of the households in their study were food insecure.

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Determinants of the Food Security Level of the Ginger Farming Households

Logistic regression model was used in identifying the determinants of food security of ginger farming households. The dependent variable which was dichotomous (food secure = 1, food insecure = 0) was regressed with the socioeconomic characteristics of the ginger farming households and the result is presented in Table 2. The likelihood ratio test was 119.14 with 12 degrees of freedom significant at ($p \leq 0.000$). This indicates that all the variables included in the model are jointly significant in predicting the households` level of food security. The result showed that age, sex, years of farming experience, household size, secondary occupation, income from primary occupation and farm size were positive and statistically significant determinants of the food security level of the ginger farming households in the study areas. The odds- ratio of these significant variables provides the marginal effect of the independent variable on the dependent variable. The marginal effects give the expected change in probability of a particular level of food security with respect to a unit change in an independent variable.

The estimated odds ratio for sex was positive and significant at 5% level of probability, suggesting that moving from female headed households (assigned 0) to male headed households (assigned 1), the level of household food security increases. This implies that male household heads are more food secure than the female household heads in the study area. It also means that the food insecurity situation in the study area is worse for the female headed households compared to the male headed household heads. This can be attributed to the fact that ginger production is laborious and men have such strength and ability to take the risks of cultivating larger farms than their female counterparts. Larger farm size implies more output which means more food is available to the male headed households. This result tallies with Akadiri *et al*. (2018) that male headed households are more food secured than female headed households.

Age was statistically significant at the 1% level and has with a positive marginal effect on the level of food security of the ginger farming households. The implication of this is that, the higher the age of the ginger farming household heads, the higher the probability of their level of food security. The older ginger farming household heads though less active and employable have higher farming experience and accumulated skills. Based on their high level of experience and skills, they are able to make effective farm management decisions with respect to resource allocation that translates to increase in their productivity and consequently their level of food security. This finding is similar to Bala (2016) who observed that the higher the age of ginger producers, the better their food security situation.

The odds ratio obtained for years of farming experience was positive and statistically significant at 1%. This implied that as the farming experience of the household head increases, the probability of level of food security of the households to increase. Households with more farming experience have accumulated skills and are likely to be effective in their resource use which will enhance their output and probability of being food secured.

Household size has a direct relationship with the level of food security of the household and was significant at 1% level of probability, suggesting that the higher the household size the higher the chances of the household being food secure. This suggests that as large household sizes increases the probability of food security than those with small household sizes. Large household size translates into more labour that can increase ginger production as it is laborious. Larger households can cultivate more lands, can increase their engagement in non-farm income generating activities and therefore cater for their consumption expenditure which increases their chances of being food secured. Although small households have reduced consumption

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expenditure compared to large households, they have limited labour which will increase their production expenditure if they are to cultivate more lands. This reduces their probability of being food secured. This result is similar to that obtained by Oyewole (2012) who observed household size to be positively related to the probability of a household being food secured.

The secondary occupation of the ginger farming household had a positive effect on their level of food security with a significance level of 1%. If household heads had a secondary occupation as a means of livelihood diversification, then the probability of the household being food secures increases. Having a secondary occupation supplements the income of the household and they are able to increase their probability of food security.

The odds ratio of income from primary occupation years was statistically significant at 5% level and is positive, thus suggesting that the higher the income from primary occupation of the ginger farming household head, the higher the chances of the household being food secure and vice versa. Income has multiple benefits on household, child and overall food security. One of such benefits is economic and financial accessibility to food. Low income earners have poor food access while high income earners have a better chance of accessing food.

Farm size of the household had a positive odds ratio and was statistically significant at 1%. Farm size is expected to play a significant role in influencing a farm household's food security because the size of the land under cultivation will determine the size of food production and their probability of being food secure. The results suggest that the larger the farm size of the household, the higher the probability of their food security. This finding is dissimilar with Bala (2016) who found that farm size had a negative relationship with the food security of women ginger producers in Kaduna State.

Table 2: Determinants of Food Security Level of the Ginger Farming Households

Variables	Odds Ratio	Standard Error	Z-Value	P > | z |
Constant	3.10708	3.79973	0.93	0.354
Sex	2.626875	1.110084	2.29**	0.022
Age	0.3735665	0.0923486	-3.98***	0.000
Marital Status	0.8737189	0.1390323	-0.85	0.396
Years of Formal Education	1.121725	0.1539596	0.84	0.403
Years of Farming Experience	1.046583	0.0172774	2.76***	0.006
Household Size	2.240148	0.4828342	3.74***	0.000
Primary Occupation	1.301344	0.2224002	1.54	0.123
Secondary Occupation	0.4573838	0.0760967	-4.70***	0.000
Primary Occupation Income	0.6298902	0.1175327	-2.48**	0.013
Farm Size	4.658945	2.062728	3.48***	0.001
Yield	16.34998	48.61544	0.94	0.347
Sales	0.048453	0.1514515	-0.97	0.333
Log likelihood Function		-119.42966		
LR Test		119.14		
Prob>Chi2		0.0000***		
Pseudo R2		0.3328		
Number of Observation		270		
Degree of Freedom		12		

***, ** and *statistically significant at 1%, 5%, and 10%

CONCLUSION AND RECOMMENDATIONS

The study observed that 37.8% of the gingers farming households were food secure while 62.2% were food insecure. Therefore, it can be concluded that majority of the ginger farming households examined were food insecure. The determinants of food security status as obtained from the regression analysis were sex, age, years of farming experience, household size, secondary occupation, primary occupation income and farm size which were all statistically significant. Based on the findings of this study, it is recommended that:

1. The improvement of the food security status of the ginger farming households largely depends on their economic and social environment. Therefore, increasing access to finance, productive resources, extension services, cooperative membership and addressing social insecurities can go a long way in achieving a higher level of food security among the ginger farming households.
2. Social protection is already being recognized as a key strategy for eradicating poverty but it is also instrumental in the fight against hunger and malnutrition. Social protection interventions can be made more nutrition sensitive when they are integrated with complementary measures that facilitate access services and include messaging to promote good nutrition and sanitation practices.

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