

# Does Microfinance Participation Affect Food Insecurity? An Empirical Evidence from Fish Farmers in Osun State, Nigeria.

OLARINRE, Abiola Adebunmi<sup>1</sup>, OLADDEEBO, Job Olatunji<sup>2</sup>, AJALA, Adedolapo Kemi<sup>3</sup>, JABARU, Muritala Oyedele<sup>4</sup>, Adio, Matthew Olufemi<sup>5</sup>

<sup>1,3</sup>Department of Agricultural Economics, Ladoko Akintola University of Technology, Ogbomoso, Nigeria.

<sup>2</sup>Department of Agricultural Economics and Extension, National University of Lesotho, Lesotho, Southern Africa.

<sup>4</sup>Department of Agricultural and Resource Economics, Federal University of Technology, Akure, Nigeria.

<sup>5</sup>Department of Agricultural Economics, Federal University, Oye Ekiti, Nigeria.

DOI: <https://dx.doi.org/10.47772/IJRISS.2024.8100188>

Received: 04 October 2024; Accepted: 11 October 2024; Published: 14 November 2024

## ABSTRACT

Nigeria at the moment is currently experiencing a surge in prices of food items with inflation on the rise. Although food insecurity affects the entire world, it is more severe in developing countries; hence, the need to examine the impact of Microfinance Participation on food insecurity among fish farming households in Osun State, Nigeria. A total of 284 respondents who are into fish farming were used for this study. Household food insecurity access scale (HFIAS) and Recursive Bivariate Probit Regression Model were used for the analysis and the impact study. The findings from this research established that most of the fish farming households were food insecure (86.6%) while only a few were food secured (13.4%). Age, years of education, household size, pond size, farming as major occupation and fish farming experience significantly influenced microfinance participation. Conclusively, microfinance participation is established to reduce food insecurity among fish farmers in Osun State, Nigeria. It is recommended therefore, that there should be establishment of more microfinance institutions which will be strictly for fish farmers so as to reduce their food insecurity status and other fish farmers who are not into microfinance participation be encouraged to do so through effective extension agent services.

**Keywords:** Microfinance Participation, Food Insecurity, Fish Farmers.

## INTRODUCTION

Although food insecurity affects the entire world, it is more severe in developing countries. One of the main issues facing developing nations, including Nigeria, is food insecurity. When people lack access to enough, safe and nourishing food for proper growth, development, and an active and healthy life, it is called food insecurity (Awoh, 2010). According to Amos (2018), fear of hunger or famine is a defining feature of food insecurity. Obayelu and Orosile (2015) opined that food insecurity is more of a rural problem in Nigeria. According to the Food and Agriculture Organization (FAO)'s 2017 estimate of the Global Hunger Index (GHI), 13 million Nigerians were suffering from acute hunger and Amos in 2018 reported that 60 percent of the 21.6 million undernourished individuals in West Africa are from Nigeria. Hunger and food insecurity are growing in Nigeria. The United Nations Children's Fund (UNICEF) estimated in January 2023 that by the third quarter of 2023, about 25 million Nigerians will be at risk of hunger. In lieu of this, there will be almost 8 million more hungry people than in 2022. According to Economist Impact (2022), Nigeria got a Global Food Security

Index (GFSI) score of 42percent in the GFSI 2022, placing it at 107<sup>th</sup> position out of 113 nations and 25<sup>th</sup> out of 28 in sub-Saharan Africa. Additionally, Nigeria scored 27.3percent, ranking 103<sup>rd</sup> out of 121 nations in the 2022 Global Hunger Index (GHI). This means that Nigeria is not on track to meet the Sustainable Development Goal 2 (SDG2) objective by 2030 and points to a significant level of hunger (Otekunrin *et al.*, 2023, Von *et al.*, 2022). The primary agricultural activity of rural households, which is associated with hazards and limited resource accessibility, is the cause of their food insecurity.

In Nigeria, microcredit services have been offered mostly to low-income rural and urban people but there are other unofficial sources of microfinance which includes cooperative societies and money collectors known as “Baba Alajo” (Kolapo *et al.*, 2022). These institutions help those who are unable to obtain loan in overcoming poverty and funding self employment activities such as fishing activities. These services to small and medium-sized businesses has been a key tool in promoting the growth of industrialization, enhancing the effectiveness of the business, and increasing their production, thereby leading to food security. Much more than the expansion of the business for which microcredit is needed, food security is of utmost importance. In lieu of this, microcredit offered by microfinance banks is crucial to the sustenance of fish farmers especially the less privileged. Commercial banks and even microfinance banks are hesitant to provide loans to these ones due to the perceived risky nature of small firms and the lack of government guarantee programs to cover the loan (Nosiru, 2010; Oke and Kehinde, 2019). Microcredit issued through the microfinance banks enables fish farmers to buy the inputs required for production and increases the value of fish (Nosiru, 2010). Successive Nigerian governments introduced a variety of microcredit sources, including the Bank of Agriculture (BOA), Bank of Industry (BOI), commercial banks, microfinance or community banks, and cooperative organizations as a collaborative effort to spread the use of microfinance in Nigeria (Kolapo *et al.*, 2022). Loans could be accessed by fish farmers through any of these sources to enhance their productivity which will also lead to food security. Going forward, fish farmers have been advised by BOA and BOI to form fish cooperatives so they can apply for microcredit. This will ultimately enable them produce enough and abolish food insecurity among farmers. Nigerian rural farmers, the class to which the fish farmers in Osun state belong have rightful access to both formal and informal funding sources such as the Nigerian Agricultural Bank (NAB) and Micro Finance Institutions in the formal sector and cooperative societies, support groups, farmers’ associations, saving societies like “Esusu” and “Ajo”, as well as friends, family, and spouses at the informal sources (Badiru, 2010; Okojie *et al.*, 2010). These sources typically don't require a deposit relationship or the requirement for collateral (Badiru, 2010). As a result, small rural holdings in Nigeria have easier access to credit facilities as informal sector financing remains the country's main source of credit for the rural economy.

The fish sector is relied upon by many individuals globally and the well being of most Nigerians is also impacted greatly and significantly by fish farming. A nation's ability to secure its food supply and nutrition depends heavily on fish aquaculture. One cannot overstate the importance of aquaculture to a country's economic success. In Nigeria, households in both rural and urban areas depend on fish as source of money in addition to nutrients. Fish is a direct source of micronutrients such zinc, vitamin A, iodine, calcium, vitamin B12, iron, and vital fatty acids. These nutrients may help ensure food and nutrition security (Bradley *et al.*, 2020). Fish in Nigeria is a less expensive form of animal protein when compared to other sources as chicken, beef and mutton (Omowa, 2016; Sogbesan and Kwaji, 2018; Olaleye *et al.*, 2019). It is less expensive when compared to other protein sources like beef, chicken and turkey; contributing to sustained food security with economic, social, and cultural significance (Omoare *et al.*, 2013; Kehinde, 2022). Fish is the cheapest source of animal protein, making up around 40% of a typical Nigerian’s daily intake (FDF, 2007; 2010). Consumption of fish can help prevent the spread of diseases caused by malnutrition like anemia and kwashiorkor as well as other illnesses (Oke and Kehinde, 2019). Global fish output has increased gradually, with the supply expanding at an average yearly rate of 3.2% faster than the growth of the global population (FAO, 2020). Estimates of fish production reached a peak in 2016 at \$362 billion, of which \$232 billion came from aquaculture (FAO, 2018). It is worth noting that about one-third of Nigeria’s GDP comes from the fish farming industry (Olaoye *et al.*, 2013; Baruwa and Omodara, 2019) and it makes up around 373 billion naira of Nigeria’s GDP (CBN, 2012; Omodara *et al.*, 2021). According to Esu *et al.*, (2009); Oke and Kehinde, (2019), fish serves as raw material for the agro-industry especially feed mills.

In Osun State, the fact that fish farming is widely adopted has led to youth empowerment, leading to job creation and poverty alleviation (Oyedele and Akinola, 2012). In spite of all these, there is a significant imbalance in the demand and supply of fish to Nigerians even in Osun State as discovered by Omodara *et al.*; (2021) and this has led to importation from other countries to make up for the deficit which is worth \$500 million annually, or around 0.7 million metric tonnes (Baruwa and Omodara, 2019). According to CBN, (2017) and Omodara *et al.*, (2021), the importation cost of Nigeria is estimated to be over ₦288 billion. This challenge is as a result of some factors some of which include lack of access to finance and credit facility for fish farmers. These farmers seldom have access to official funding sources as a result of some bottlenecks such as high interest rates, delayed approval, collateral requirements, guarantors, lack of nearby banks, payment defaults, lack of information, attitudes, and insufficient credit (Nwaru *et al.*, 2011; Oke *et al.*, 2019; Omodara *et al.*, 2021). Kehinde and Ogundeji in 2022 opined that an insignificant number of farmers had access to bank loan while Kolapo *et al.*, (2021) argued that attention has shifted to microcredit. Approximately 1.75 million of Nigeria's 14 million hectares of inland water surface are suitable for aquaculture. In Nigeria, aquaculture is mostly a large land-based sector that is practiced at subsistence levels in freshwater (Olaoye *et al.*, 2013). Fagbenro in 2005 opined that commercial farming is still relatively uncommon. At the moment, most fish farmers operate on a small scale, using ponds ranging in length from 25 to 40 meters to tiny clay ponds. Nigeria has abundant fisheries resources and comparatively high fish consumption (FDF, 2005; 2008), but the 0.62 million metric tons of fish that are available are not enough to meet Osun State's and the country's needs. Fish farming currently has a relatively low growth rate, despite the interest that the government and the commercial sector have shown in fish production generally. This could be due to a number of factors, including limited access to microcredit, which is a necessary tool for fish firms to become more commercialized and intensive. Hence, limited access to capital has made it difficult for fish farms to expand. According to Orimogunje *et al.*, (2020), people don't borrow money for personal gain; rather, they do so because it gives them power over goods and services. Therefore, smallholder farmers' access to loans could increase family income and help the poor accumulate savings so they can invest in businesses that create jobs (Oke *et al.*, 2019).

Nigeria at the moment is currently experiencing a surge in prices of food items with inflation on the rise and political instability. Life in the city is becoming difficult not to talk of those dwelling in the rural areas, especially the farmers. The time frame for the achievement of the SDGs is almost here with little or nothing to show as a nation. To the best of my knowledge, empirical studies on how microfinance participation affects food security status among farmers and its connection appear to be scarce in Nigeria, especially in Osun State. It is therefore necessary to carry out this study which develops a framework that measures the impact of microfinance participation on food insecurity in Osun State, Nigeria. This was achieved through the following objectives:

1. Determining the food insecurity status of fish farmers in Osun State.
2. Examining the impact of microfinance participation on food insecurity among the respondents.

## LITERATURE REVIEW

A number of researchers like Izekor and Alufohai, (2010), Alufohai (2006); Alufohai and Ahmadu (2005) have attempted to elucidate the factors affecting rural farmers' ability to obtain financing in form of microcredit. Asekome and Ogbechie (2011) claimed that financing is hard to come by and that when it is, moneylenders demand exorbitant interest rates that are out of reach for small businesses. The study by Olaoye *et al.*, (2021) is one of the literatures that looked into the causes of food insecurity among fish farming households. They examined the socioeconomic factors influencing household food security using primary data from 120 fish producers in Ogun State's Odogbolu Local Government Area. The United States Department of Agriculture's (USDA) 2012 household food security survey and multiple regression analysis were used in the study. The study's conclusions showed that fish farming significantly increases household food security by ensuring dietary diversity, higher food consumption, the creation of jobs, a stable food supply, higher household per capita income, lower household costs associated with protein consumption, and a decrease in

malnutrition. According to the findings, fish farmers' food security is highly influenced by their age and size of household. The study suggested that women and young people should be encouraged to start fish farming businesses in order to increase their level of food security.

Numerous research have looked into household food insecurity in various parts of Nigeria utilizing both micro and macro data (Akerele *et al.*, 2013, Agbola (2014), Ahmed *et al.*, 2015, Ibrahim *et al.*, 2016, Obayelu *et al.*, 2021.). Additionally, food insecurity has been studied through empirical investigations that have defined the food insecurity status (Foster *et al.*, 2010, Ahmed *et al.*, 2015, Ibrahim *et al.*, 2016), food consumption score (Biam and Tavershima, 2020), food poverty index (Von *et al.*, 2020), and Household Food Insecurity Access Scale (HFIAS) (Omotayo *et al.*, 2021). Using fixed effects regression, Owoo (2018, 2020) demonstrated the spatial patterns of food insecurity in Nigeria. Other studies that have employed the HFIAS approach in assessing the prevalence of food insecurity in other part of the world was carried out by Nour and Abdalla (2021), who investigated the incidence and variation of food insecurity in Kassala State, Eastern Sudan; and (Samim *et al.*, 2021), who examined the incidence and drivers of HFI in Takhar, Afghanistan.

In another study by Oladimeji *et al.*, (2020) where investigations on how the Shiroro dam project affected the food security and poverty status of rural fishermen in Nigeria's north-central geopolitical zone, the local average treatment effect model and propensity score matching was employed and the study found that the Shiroro dam farmers had twice as much food security as the non-beneficiary farmers. The study also showed that using the Shiroro dam increased farmers' income by about eleven units and suggested that, in order to improve the state of food security, fish production be integrated into dam construction and related water management systems.

Also, Oparinde (2019) investigated the impact of risk management strategies adoption on fish output and food security among women aquaculture farmers in Ondo State, Nigeria. The study analyzed primary data from 90 respondents using a multi-stage sampling process. Recursive bivariate Probit model and endogenous switching regression model was used in the analysis of data. The study's findings revealed that a number of factors, including age, education, household size, non-farm income, credit constraints, pond systems, risk attitudes, and feed amount, had a substantial impact on the risk management techniques used. Additionally, among female fish farmers, the implementation of risk management techniques boosts fish productivity and food security.

## **Theories of Microfinance Bank Credit**

### **1. Vulnerable Group Theory of Financial Inclusion**

From this view, members of society who have low incomes, living in rural areas, women and elders are presumed to be vulnerable and hence must be the focus of any nation's financial inclusion programs. It is believed that people in this category bears the brunt of economic hardship and crises. There is a need to include these people in the official financial system of the government. Ozili in 2020 reiterated in line with the theory's conclusion that efforts to increase financial inclusion should concentrate on those members of the population who are identified as vulnerable. It is worthy of note that majority of the fish farmers in Osun State are vulnerable and hence need the intervention of the government.

### **2. Classic Microfinance Theory of Change**

Dunford in 2012 stated that the Classic Microfinance Theory of Change stated that entrepreneurs usually employ microfinance services to get capital before investing it into other micro businesses, thereby increasing their household income and consumption leading to reduction in poverty level. These micro businesses which may involve fish processing activities like smoking and frying are well managed to bring profit. This is very consistent with the idea of Development Economists. They opined that expanding financial access is crucial in the reduction of income disparity, household income raise and employment opportunities for the world's poor and extremely poor. Access to credit enables an individual and family, fish farmers in this case to increase



their employment and income generating capacities which will ultimately lead to an increase in household income and the value of their assets (Orji *et al.*; 2023).

### 3. Social Capital Theory in Microfinance

This theory is based on social networks, trust and community ties in getting access to financial services and supports in the community. This promotes the effectiveness of the intervention of microfinance institutions. This theory identifies the importance of social relationships as a fundamental element in building trust for effective transactions and outcomes, more importantly where formal financial service is limited, like in the rural areas and set up. It further states that an individual is embedded in social networks such as family, friends, neighbors, and farmer groups. These networks are very important in microfinance to enhance sharing of information, financial assistance and mutual support.

### 4. Group Lending Model

In 2009, Schurmann and Johnston emphasized that the group lending model of microcredit is a development intervention which is giving to individuals who do not have any collateral to get loan which enables them to turn a small scale credit to income generating activities. People with same economic or professional backgrounds are often grouped in small groups of five to ten people in group lending such as farmers association. In this type of lending, a major strength is joint liability, where members share the responsibility of repaying a loan taken by an individual. This simply means when a member of the farmer group defaults on repayment of loan, all other group members take the responsibility of paying back the loan.

### Household food insecurity access scale (HFIAS)

As opined by Coates *et al.*, (2007) and Jones *et al.*, (2013), the HFIAS module is mostly used to evaluate household economic access to food, food preferences, anxiety about household food supply, and food quantity. Nine incidence questions that show a rising category of food insecurity extremity are part of the Household food insecurity access scale (HFIAS) questionnaire. Nine repetitiveness-of-condition questions are asked right after each incidence question to find out how frequently the incident occurred. Only when the respondent confirmed that the incident described in the preceding incidence question had not occurred in the previous 30 days was the repetitiveness-of-condition question removed. Without regard to age group, the questions determine each household member's circumstances (Coates *et al.*, 2007). Using Household food insecurity access scale, a tool created by the Food and Nutrition Technical Assistance Project (FANTA) and its collaborators, the food insecurity status of fish farmers in Osun State, Nigeria was assessed. The Household Food Insecurity Access Scale Generic Questions are a set of questions developed by FANTA that have been utilized in multiple countries and have demonstrated their capacity to differentiate between homes that are food secure and those that are food insecure. Households and populations can be categorized using the Household food insecurity access scale (HFIAS) questions in the order of extremity, which captures the Household Food Insecurity experience [Obayelu *et al.*, 2021, Samim *et al.*, 2021, Nour and Abdalla 2021, Obayelu *et al.*, 2018, Coates *et al.*, 2007). The data from Household food insecurity access scale (HFIAS) can be used to determine the prevalence of Household Food Insecurity (HFI) and track changes in a population's HFI circumstances over time. All of the questions are asked throughout the 30-day recall period. To find out if the scenario in the question occurred at all in the previous 30 days, the respondent is first asked an incidence question (yes or no). In case the response was affirmative, an inquiry concerning the repetitiveness of the circumstance was posed to determine the frequency at which the said event occurred: seldom that is 1-2 times, sporadically that is 3-10 times, or regularly that is less or equal to ( $\geq$ ) 10 times throughout a 30-day memory span. The "skip rules" must be scrupulously followed by the researcher in order to prevent asking repetitiveness-of-condition questions when it is inappropriate (Coates *et al.*, 2007).

### Recursive Bivariate Probit (RBP) model

Scholars like Awotide *et al.*, (2013); Kuntashula *et al.*, (2014) have used Heckman two-stage selection method in evaluating the impact of a dichotomous variable on a dichotomous outcome. This method was used to in

order to account for observed and unobserved heterogeneity between adopters and non-adopters. Howbeit, Lokshin and Sajaia (2004) claimed that heteroskedastic residuals are only generated by two-stage approach, which cannot be used to obtain consistent standard errors without laborious modifications. This study then employed RBP model to examine the impact of microfinance participation on food insecurity among fish farmers in Osun State. In order to conquer the flaw as used by Amare *et al.*, (2012), the model is stated as follows;

$$S_h^* = X_h' \Theta + \varepsilon_h, S_i = 1[S_i^* > 0] \dots \dots \dots (1)$$

$$Y_h = K_h' + S_h' \omega + \mu_h \dots \dots \dots (2)$$

where variable  $S_h^*$  represents microfinance participation status of the fish farmers;  $X_h$  includes all factors influencing food insecurity;  $Y_h$  represents food insecurity status of the household;  $K_h$  is a vector of factors influencing food insecurity like age and education;  $S_h$  indicates the participation of the fish farmers in microfinance;  $\mu_h$  and  $\varepsilon_h$  are random error terms which are assumed to follow a bivariate distribution;  $\theta$  and  $\phi$ , and  $\omega$  are parameters to be estimated. Marra and Radice (2011) assumed that the error terms follow a bivariate distribution and it is expressed as follows;

$$\begin{pmatrix} 1 & \rho \\ \rho & 1 \end{pmatrix} \dots \dots \dots (3)$$

where  $\rho$  represents correlation coefficient among unobserved explanatory variables in both equations.

In order to facilitate identification as it is in ESR model, it is essential to ensure that the exclusion restriction on the exogenous variables hold, that is  $X_h$  and  $K_h$  must be different by the minimum of a variable (Maddala, 1983). If  $\rho$  is significant in the bivariate normal cumulative distribution function specified in equation (4), it suggests that correlation of disturbance terms exists.

$$\mathcal{R}(X_k, K_k, \rho) = \frac{e^{-1/2(X_k^2 + K_k^2 - 2\rho X_k K_k)/(1-\rho^2)}}{2\pi(1-\rho^2)^{1/2}} \dots \dots \dots (4)$$

The nonlinear conditional expectation expressed in equation (5) is meant to estimate the marginal effects, while the average treatment effect on the treated (ATT) is estimated using equation (6).

$$E\{S_h | Y_h, K_h\} = \frac{\mathcal{R}(\phi X_h, (2Y_h - 1)\phi K_h, (2Y - 1)\rho)}{\mathcal{R}[(2Y_h - 1)\phi K_h]} \dots \dots \dots (5)$$

$$ATT = E(Y_{hA} | S = 1) - E(Y_{hN} | S = 1) \dots \dots \dots (6)$$

where  $Y_{hA}$  is the expected probability of microfinance participation, and is the expected probability of food insecurity index outcome in the counterfactual case.

**METHODOLOGY**

This study was carried out in Osun State which was carved out of the old Oyo State in August, 1991 and standing on a land mass of about 8,602 square kilometers. The State has her borders in the West in Oyo State, in the East in Ondo and Ekiti States, in the North in Kwara State and in Ogun State in the South. There are thirty Local Government Areas and one Area Office in Osun State.

**Population, Sampling Procedure and Sample Size**

The fish farmers in Osun State, Nigeria constitute the population of the study. There are three Agricultural Development (ADP) Zones in Osun State and one hundred fish farmers were randomly chosen from each zone through their registered fish farmers association. By this, 300 questionnaires were administered but at the end of the exercise, only 284 questionnaires were used for the research. Majorly, this was as a result of giving incomplete information, hence a total of 284 respondents were used.

## Method of Data Collection

Primary data was used for this research. This involves the use of structured questionnaires used to obtain information from the respondents. All the questionnaires were given out to individual fish farming households as they were interviewed by trained field workers used as enumerators. This ensured higher response rates.

## Method of Data Analysis

Objective 1: Household food insecurity access scale (HFIAS).

Objective 2: Recursive Bivariate Probit Regression Model.

## RESULTS AND DISCUSSIONS

The food insecurity status of fish farmers in Osun State is revealed in Table 1 and 2 below. Most of the farming households were food insecure (86.6percent), from mildly food insecure (15.1percent), moderately food insecure (36.6percent), to severely food insecure (34.9percent), while only a few (13.4percent) were food secured. This result is in line with the findings of Yahaya *et al.*, (2021), Akanbiemu *et al.*, (2016), Danladi and Ojo (2018) where it was discovered that only 27percent of the farming households were food secured, 35percent mildly food insecure, 18.3percent moderately food insecure and 20percent were severely food insecure using the HFIAS method of analysing food insecurity; and Omotayo *et al.*, (2022) where 63percent, 80.9percent, and 78percent of respondents were food insecure in a study carried out in Southwest Nigeria at different times.

Table 1: Household Food Insecurity Access Score (HFIAS) of Fish Farmers in Osun State.

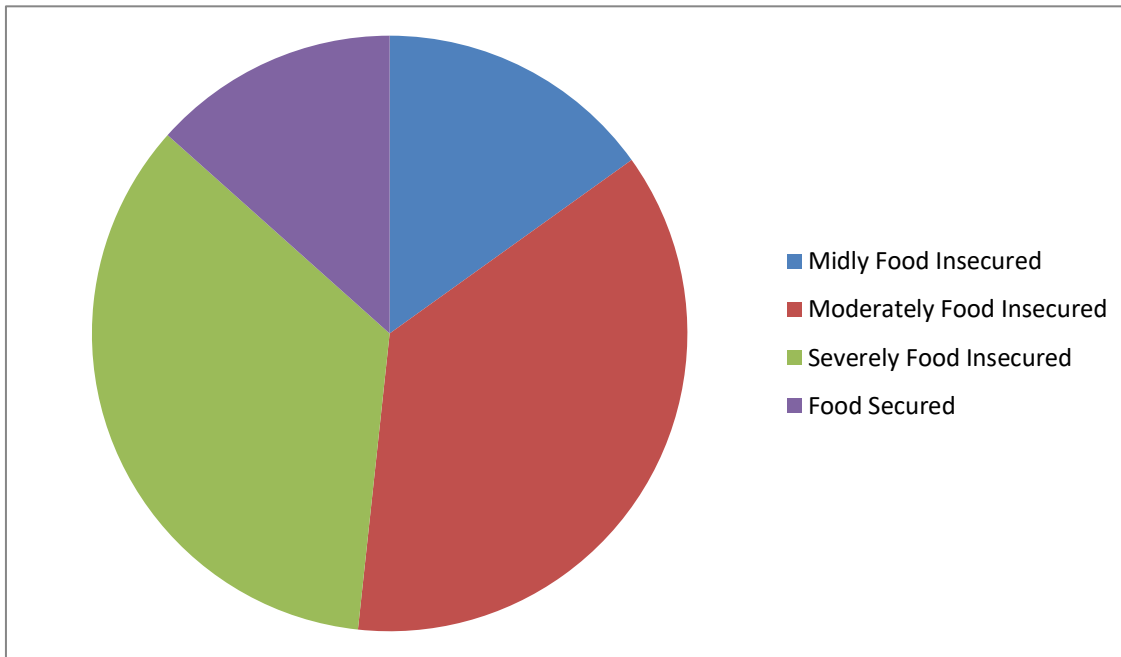
HFIAS Questions	NO		YES						TOTAL	
			How often Did this happen in a month							
			Rarely		Sometimes		Often			
	Freq	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%
1. Did you worry that your household would not have enough food?	105	36.7	54	19.0	48	16.9	78	27.4	284	100
2. Was anyone unable to eat a preferred food because of lack of resources?	75	26.4	60	21.1	66	23.2	83	29.2	284	100
3. Did anyone eat a limited variety of food due to lack of resources?	82	28.9	64	22.5	66	23.2	72	25.4	284	100
4. Did anyone eat what they did not want because of lack of resources?	92	32.4	78	27.5	50	17.6	64	22.5	284	100
5. Did anyone eat less than needed because of the lack of enough food?	68	23.9	66	23.2	85	30.0	65	22.9	284	100
6. Did anyone eat fewer meals per day because of insufficient food?	58	20.4	44	15.5	82	28.9	100	35.2	284	100
7. Was there no food in the house because of lack of resources?	60	21.1	52	18.3	72	25.4	100	35.2	284	100
8. Did anyone go to bed without food?	90	31.7	25	8.8	75	26.4	94	33.1	284	100
9. Did anyone go without food throughout the day and night without any food?	127	44.7	29	10.2	106	37.3	22	7.7	284	100

Source: Field Survey, 2023

Table 2: Food Security Status of fish farmers

Food Security Status	Frequency	Percentage
Midly food insecure	43	15.1
Moderately food insecure	104	36.6
Severely food insecure	99	34.9
Food secured	38	13.4
<b>TOTAL</b>	<b>284</b>	<b>100</b>

Source: Field Survey, 2023



Picture 1: Diagram showing Food Security Status of the Fish Farmers in Osun State.

### Determinants of Microfinance Participation and Its Impact on Food Insecurity Status

Table 3 revealed the impact estimates under food insecurity column showing that there is a negative relationship between microfinance participation and food insecurity, indicating that microfinance participation among fish farming households is likely to reduce the probability of being poor. This means that actively participating in microfinance is very important when food security is been looked into. This is supported by Rashid and Patrick (2011) when they emphasized that joining and participation of farmers in microfinance groups positively affects household income and reduces poverty. Household size exhibits positive and significant relationship with food insecurity status, meaning that an increase in household size tends to increase the food insecurity status of fish farmers in Osun State. This could be traced to an increased pressure on household resources especially food as household size increases, which may make such households to become poor, hence been food insecure. This is in line with the findings of Ibok *et al.*, (2014) which explained that large size households tend to be more food insecure than small size households. Contact with extension agents has a positive and significant relationship with food insecurity status; hence the more a fish farmer has contact with the extension agents, the higher his food insecurity status. This can occur when we have extension agents who are not properly trained on field or possibly not patient enough to train the fish farmers well.

However, age of the farmers and fish farming experience negatively and significantly influenced food insecurity status of the farmers. This revealed that as a fish farmer ages, there tends to be a drop in the food insecurity status. This is because at the early stage of life there is always greater energy and lots of family members to cater for, but as the farmer ages, the people in his household have become heads also in other



households and so the fish farmer is able to use his resources well and possibly increasing their output and income. The years of fish farming experience of the farmers as implied from the result has a negative impact on the food insecurity status. This may not be unconnected with the fact that experienced fish farmers are aware of some practices to put in place in order to realize optimum output which is able to boost their income, hence make them food secured. This is contrary to the findings in the study carried out by Oladimeji *et al.*, (2013) and Iruo *et al.*, (2018) who observed positive and significant relationship between fish farming experience and food insecurity.

The marginal effect estimates of the Recursive Bivariate Profit specifications are interpreted as elasticities. This gives the magnitude of the response of food insecurity to any increase in each of the independent variables. For example, the marginal effect of household size with positive and significant estimate shows that any additional household member is more likely to increase food insecurity status by 4.5%. Age has negative and statistically significant marginal effect estimate and this suggests that an increase in age of the fish farmers is more likely to contribute to the household being food insecure by 1.2%. The negative and significant marginal effect estimate of contact with extension agents reveals that an additional visit to the fish farmers is more likely to increase their food insecurity status by 27.3%.

Table 3: Full information maximum likelihood estimates of Recursive Bivariate Probit Model for Microfinance Participation on Food Insecurity

Variables	Selection		Food Insecurity Status		Marginal Effect
	coefficient	t- value	Coefficient	t- value	
Constant	-1.639	-1.29	1.546	1.93	
Microfinance Participation			-0.566	-6.12***	-0.328
Age	0.021	1.16	-0.025	-2.21**	-0.012
Sex	0.316	1.41	0.177	0.74	0.055
Years of Education	0.143	6.03***	-0.025	-0.83	-0.012
Marital Status	0.274	1.01	-0.386	-1.35	-0.127
Household size	0.107	2.14**	0.147	3.40***	0.045
Farm Size	0.132	3.49***	-0.025	-0.64	-0.012
Major Occupation	0.753	3.54***	-0.229	-1.06	-0.073
Farming Experience	0.028	1.81*	-0.015	-2.06**	-0.008
Contact with Extension Agents	-0.367	-0.71	-0.717	2.56**	-0.273
P	0.6012251	2.01			
Log likelihood	-331.74565				

\*, \*\* and \*\*\* represent significance at 10%, 5% and 1% levels respectively. Source: Model results

### Microfinance Participation Impact on Food Insecurity Status

The impact of microfinance participation on food insecurity status of the fish farmers is revealed in Table 4. The average treatments effects (ATT) on the expected outcomes are estimated. ATT estimates account for other confounding factors which include selection bias resulting from potential differences between those that engage in microfinance activities and those that did not. The results revealed that those into microfinance participation significantly reduce food insecurity status. To state this categorically, those into microfinance participation are 227 compared to 57 who did not. The result further revealed that there is a negative impact of microfinance participation on food insecurity status from RBP estimates. This means that there is increase in the probability of reducing food insecurity from 89% from the fish farmers that did not participate in microfinance to 36% from members into microfinance participation.

Table 4: Impact of Microfinance Participation

Variable	Microfinance Participation	Non- Participation in Microfinance	ATT
Observations	227	57	175***
Food Insecurity Status	0.36	0.89	-0.48***

: \*\*\* represent significance at 1% levels

## CONCLUSION

The findings from this research established that most of the fish farming households were food insecure while only a few were food secured. Age, years of education, household size, farm size, farming as major occupation and fish farming experience significantly influenced microfinance participation. Conclusively, microfinance participation is established to reduce food insecurity among fish farmers in Osun State, Nigeria. It is therefore recommended that there should be establishment of more microfinance institutions which will be strictly for farmers based on their production expertise, (e.g fish farmers) so as to reduce food insecurity status of the farmers.

## REFERENCES

1. Agbola, P.O. Factors Influencing Food Insecurity among Small Farmers in Nigeria. *Afr. J. Agric. Res.* 2014, 9, 2104–2110.
2. Ahmed, F.F.; Eugene, C.E.; Abah, P.O. Analysis of Food Security among Farming Households in Borno State, Nig. *J. Agric. Econ. Environ. Soc. Sci.* 2015, 1, 130–141.
3. Akanbiemu, F.A.; Fatiregun, A.A.; Adejugbagbe, A.M. Nutritional Status of Under-Fives in Rural and Urban Communities of Southwest, Nigeria. *World Acad. J. Community Health Epidemiol.* 2016, 2, 64–73.
4. Akerele, D.; Momoh, S.; Aromolaran, A.B.; Oguntona, C.R.B.; Shittu, A.M. Food Insecurity and Coping Strategies in South-West Nigeria. *Food Secur.* 2013, 5, 407–414. [CrossRef]
5. Alufohai, G.O. and Ahmadu, J. (2005). Queue management by Nigeria agricultural cooperative and rural development bank (NACRDB) in farm credit delivery. The case of Benin Branch, Edo state. Nigeria proceedings of the 39th conference of agricultural society of Nigeria (ASN) held at the University of Benin, Nigeria. 9th–13<sup>th</sup> October, 300–303.
6. Alufohai, G.O. (2006). Sustainability of Farm Credit delivery by Cooperatives and NGOs in Edo and Delta states, Nigeria. *Educ. Res. Rev.*, 1(8), 262.
7. Amare, M., Asfaw, S. and Shiferaw, B. (2012) “Welfare impacts of maize–pigeon pea intensification in Tanzania”, *Agricultural Economics*, Vol. 43, No.1, pp. 27-43. E-ISSN 1574-0862. DOI 10.1111/J.1574-0862.2011.00563.X.
8. Amos, T.T. (2018). Agricultural Production and Productivity: The Game Changing Food Security Paradigm in Nigeria. An Inaugural Lecture Delivered at the Federal University of Technology, Akure, on the 13th February, 2018.
9. Asekome, M.O and Ogbechie, I.C.O. (2011). Principle and Practice of Microfinance. Justice Jeco Printing and Publishing Global, Benin City.
10. Aworh, O.C. (2010). Food Technology and National Development A Global Perspective. University Lecture, Ibadan, Ibadan University Press pp136.
11. Awotide, B.A., Diagne, A. and Awoyemi, T.T. (2013) “Agricultural Technology Adoption, Market Participation and Rural Farming Households’ Welfare in Nigeria,” *RePEc: Research Papers in Economics* [Preprint]. Available at: <https://doi.org/10.22004/ag.econ.160428>.
12. Badiru, I.O. (2010). Review of small farmer access to agricultural credit in Nigeria. Nigeria Strategy Support Program Policy Note. IFPRI, Supported by CGIAR.
13. Baruwa, O.I. and Omodara, O.D. (2019). Technical efficiency of aquaculture system in Oyo State, Nigeria: Stochastic frontier approach. *J. Aqua. Res. Mar. Sci.*, 2(1), 114–120.

14. Biam, C.K. and Tavershima, T. Food Security in Rural Farming Households in Benue State, Nigeria. *Afr. J. Food Agric. Nutr. Dev.* 2020, 20, 15677–15694. [CrossRef]
15. Bradley, B., Byrd, K. A., Atkins, M., Isa, S. I., Akintola, S. L., Fakoya, K. A., Ene-Obong, H., & Thilsted, S. H. (2020). *Fish in food systems in Nigeria: A review*. WorldFish Program Report. <https://ideas.repec.org/b/wfi/wfbook/40859.html>
16. CBN (Central Bank of Nigeria). (2012). Statistical Bulletin, 23.
17. CBN (Central Bank of Nigeria). (2017). The credit crunch. Nigerian financial literacy baseline survey. How the use of movable collateral and credit reporting can help finance inclusive economic growth in Nigeria?
18. Coates, J.; Swindale, A. and Bilinsky, P. Household Food insecurity access scale (HFIAS) for measurement of household food access: Indicator guide (v.3). In Food and Nutrition Technical Assistance Project; Academy for Educational Development: Washington, DC, USA, 2007.
19. Danladi H. and Ojo CO (2018). Analysis of Food Access Status among Farming Households in Southern Part of Gombe State, Nigeria. *Greener Journal of Agricultural Sciences*, 8(3): 059-064, <http://doi.org/10.15580/GJAS.2018.3.021018022>.
20. Dunford, C. (2012). What if we turn the microfinance theory of change on its head? Evidence Project.
21. Economist Impact. Global Food Security Index 2022. 2022. Available online: <https://impact.economist.com/sustainability/project/food-security-index/> (accessed on 14 May 2023).
22. Esu, B.B., Asa, U.A., Iniedu, M.O. (2009). Costs and returns of fish production using earthen ponds in Akwa Ibom State, Nigeria. *Nig. J. Agric. Food Env.*, 5(2–4), 26–29.
23. Fagbenro, O.A. (2005). Soybean meal substitution with Roselle (*Hibiscus sabdariffa* L.) seed meal in dry practical diets for fingerlings of the African Catfish, *Clarias gariepinus* (Burchell 1822). A report of FAO World Fish Centre Workshop. Cameroon.
24. FAO. (2018). Food and Agriculture Organization. The state of world fisheries and aquaculture 2018: Meeting the sustainable development goals. Rome.
25. FAO. (2020). Food and Agriculture Organization. The state of world fisheries and aquaculture 2020: Sustainability in action. Rome. <https://doi.org/10.4060/ca9229en>
26. FDF (Federal Department of Fisheries). (2007). Fishery Statistics, FDF. Abuja, Nigeria.
27. FDF (Federal Department of Fisheries). (2010). Federal Department of Fisheries. Press Report of the Federal Ministry of Agriculture and Water Resources Abuja. Delivered by the Director of Fisheries at Nicon Noga Hilton Hotel on 24 December 2010.
28. Foster, J.; Greer, J.; Thorbecke, E. Foster–Greer–Thorbecke (FGT) poverty measures: Twenty-five years later. *J. Econ. Inequal.* 2010, 8, 491–524. [CrossRef]
29. Ibok, O. W. et al. (2014). Food Security Determinants among Urban Food Crop Farming Households in Cross River State, Nigeria. *Asian Journal of Agricultural Extension, Economics & Sociology*, 3(1), pp. 76–90. doi: 10.9734/AJAEES/2014/6560.
30. Ibrahim, H.Y.; Adeola, S.S.; Ibrahim, H.I. Determinants of Food Insecurity among Farming Households in Katsina State, North Western Nigeria: An Ordinal Logit Regression Approach. *J. Agric. Sci.* 2016, 61, 291–301. [CrossRef]
31. Iruo F. A., Onyeneke R. U., Eze C. C., Uwadoka C., Igberi C. O. (2018): Economics of Smallholder Fish Farming to Poverty Alleviation in the Niger Delta Region of Nigeria. *Turkish Journal of Fisheries and Aquatic Sciences* 19: 313 – 329. [http://doi.org/10.4194/1303-2712-v19\\_4\\_06](http://doi.org/10.4194/1303-2712-v19_4_06)
32. Izekor, O., Alufohai, G. (2010). Assessment of cooperative societies effectiveness in agricultural credits delivery in Ikpoba Okha Local Government Areas, Edo State, Nigeria. *Afr. J. Gen.Agric.*, 6, 36–67.
33. Jones, A.D.; Ngure, F.M.; Peltó, G.; Young, S.L. What are we assessing when we measure food security? A Compendium and review of current metrics. *Adv. Nutr.* 2013, 4, 481–505. [CrossRef] [PubMed]
34. Kehinde, A.D. (2022). Economics of catfish production in Osun State, Nigeria. *Economics*, 22(1)
35. Kehinde, A.D., Ogundeji, A.A. (2022). The simultaneous impact of access to credit and cooperative services on cocoa productivity in South-western Nigeria. *Agric. Food Sec.*, 11(1), 1–21.
36. Kolapo, A., Ogunleye, A.S., Kehinde, A.D., Adebanke, A.A. (2021). Determinants of farmers' access to microcredit from cooperative societies in Ondo state, Nigeria. *Int. J. Agric. Res. Innov. Technol.*, 11(2), 103–107.

37. Kolapo, A., Ogunleye, A.S., Kehinde, A.D., Odingbe-James, W. (2022). Effect of microcredit on investment decision of smallholder farmers in Osun State. *Agric. Conspect. Sci.*, 87(1), 69–75.
38. Kuntashula, E., Chabala, L. M. and Mulenga, B. P. (2014) “Impact of minimum tillage and crop rotation as climate change adaptation strategies on farmer welfare in smallholder farming systems of Zambia”, *Journal of Sustainable Development*, Vol. 7, No. 4, pp. 95-110. ISSN 1913-9071. DOI 10.5539/jsd.v7n4p95.
39. Lokshin, M. and Z. Sajaia. (2004). Maximum likelihood estimation of endogenous switching regression models. *Stata Journal*, 4(3): 282–89.
40. Maddala, G. 1983. *Limited-dependent and qualitative variables in econometrics*. Cambridge: Cambridge University Press.
41. Marra, G., & Radice, R. (2011). Estimation of a semiparametric recursive bivariate probit model in the presence of endogeneity. *Canadian Journal of Statistics*, 39, 259–279. <https://doi.org/10.1002/cjs.10100>.
42. Nosiru, M.O. (2010). Microcredits and agricultural productivity in Ogun State, Nigeria. *World J. Agric. Sci.*,6(3), 290–296.
43. Nour, S.S.; Abdalla, E.M. Food security in Sudan: The case of Kassala state. *WJSTSD* 2021, 18, 1–20.
44. Nwaru, J.C., Essien, U.A., Onuoha, R.E. (2011). Determinants of informal credit demand and supply among food crop farmers in Akwa Ibom state, Nigeria. *J. Rural Comm. Dev.*,6(1), 129–139.
45. Obayelu, O.A. and Orosile, O.R. (2015). Rural Livelihood and Food Poverty in Ekiti-State, Nigeria. *Journal of Agriculture and Environment for International Development*, 109(2), 307-323. <https://10.12895/jaeid.20152.373>
46. Obayelu, O.A.; Oyekola, T. Food Insecurity in Urban Slums: Evidence from Ibadan Metropolis, Southwest Nigeria. *J. Adv. Dev.Econ.* 2018, 7, 1–17.
47. Obayelu, O.A.; Akpan, E.I.; Ojo, A.O. Prevalence and correlates of food insecurity in rural Nigeria: A panel analysis. *Econ. Agro-Aliment.* 2021, 23, 1–25. [CrossRef]
48. Oke, J.T.O., Kehinde, A.D., Akindele, A.J. (2019). Determinants of access to credit by cocoa farmers in Osun State, Nigeria. *Int. J. Agric. Res. Innov. Technol.*, 9(2), 57–61.
49. Oke, J.T.O., Kehinde, A.D. (2019). Profitability of investment in fish farming enterprise in Ibadan Metropolis, Oyo State, Nigeria. *Ecol. Evol. Biol.*, 4(3), 28.
50. Okojie, C.A., Monye-Emina, K., Eghafona, G., Osaghae, J.O. (2010). Institutional environment and access to microfinance by self-employed women in the rural areas of Edo State. Washington. D.C.: International Food Policy Research Institute.
51. Oladimeji Y. U., Abdulsalam Z., Damisa M. A., Omokorem D. F. (2013): Estimating the Determinants of Poverty among Artisanal Fishing Households in Edu and Moro Local Government Areas of Kwara State, Nigeria. *Agriculture and Biology Journal of North America* 4: 422 – 429. <https://dx.doi.org/10.5251/abjna.2013.4.4.422.429>.
52. Olaleye, A.D., Odeseye, A.A., David, E.I., Aregbesola, E.A., Asogwa, U., Adams, S.A. (2019). Analysis of profitability of processed catfish marketing in Ilorin Metropolis of Kwara State, Nigeria. *Int. J. Res. Innov. Soc. Sci.*, 3(4), 332–339.
53. Olaoye, O.J., Ashley-Dejo, S.S., Fakoya, E.O., Ikeweinwe, N.B., Alegbeleye, W.O., Ashaolu, F.O., Adelaja, O.A. (2013). Assessment of socio-economic analysis of fish farming in Oyo State, Nigeria. *Glob. J. Sci. Front. Res. Agric. Vet.*, 13(9), 45–55.
54. Olaoye, O. J., Ojebiyi, W.G., Duye, O. F., & Soyoye V. O. (2021). Socio-economic determinants of household food security among fish farmers in Odogbolu local government of Ogun state, Nigeria. *Ife journal of Agriculture*. 33(2), 15-25.
55. Oparinde, L. O. (2019). Fish output and food security under risk management strategies among women Aquaculture farmers in Ondo state, Nigeria. *Agris on-line papers in Economics and informatics*, 11(1), 93-105. <https://doi.org/10.22004/ag.econ.294149>
56. Omoare, A.M., Fakoya, E.O., Abiona, B.G., Oyediran, W.O. (2013). Fish Marketing: A panacea towards sustainable agriculture in Ogun State, Nigeria. *J. Biol. Agric. Bio-sys. Life Sci. Eng.*, 7(7), 270–274.



57. Omodara, O.D., Fayemi, O.G., Ojo, T.O., Oluwasola, O., Ngidi, M.S.C. (2021). Determinants of institutional credit rationing impact on the net farm income of catfish processors in Nigeria. *Agric. Conspect. Sci.*, 86(4), 361–373.
58. Omotayo, A.O.; Olagunju, K.O.; Omotoso, A.B.; Ogunniyi, A.I.; Otekunrin, O.A.; Daud, A.S. Clean water, sanitation and under-five children diarrhea incidence: Empirical evidence from the South Africa's General Household Survey. *Environ. Sci. Pollut. Res.* 2021, 28, 63150–63162. [CrossRef]
59. Omotayo, A.O.; Omotoso, A.B.; Daud, S.A.; Omotayo, O.P.; Adeniyi, B.A. Rising Food Prices and Farming Households Food Insecurity during the COVID-19 Pandemic: Policy Implications from SouthWest Nigeria. *Agriculture* **2022**, 12, 363. [CrossRef]
60. Omowa, A.E. (2016). Marketing of Processed Catfish in Kaduna-Metropolis Kaduna State, Nigeria Unpublished Msc. Thesis. Amadu Bello University Zaria, Nigeria (pp. 45–50).
61. Orji A., Ideba T.E., Mba N.P., Ogbuabor, J. E., Suleiman Y., Yusuf Y., & Anthony- Orji, O. I. (2023) "Does Access to SME Credit enhance Employment Generation in Developing Countries? A New Evidence from Nigeria". *Journal of Xi'an Shiyou University, Natural Science Edition*, 19 (6): 302-324. ISSN: 1673-064X, available at: <https://www.xisdjxsu.asia/V19I06-26.pdf>
62. Orimogunje, R.V., Ogunleye, A.S., Kehinde, A.D. (2020). Effect of microcredit on profit efficiency of small-scale poultry farmers Oyo State, Nigeria. *Agricultura*, 17(1–2), 37–46.
63. Otekunrin, O.A.; Ayinde, I.A.; Sanusi, R.A.; Onabanjo, O.O. Dietary diversity, nutritional status, and agricultural commercialization: Evidence from rural farm households. *Dialog. Health* 2023, 2, 100121. [CrossRef]
64. Owoo, S.N. Food insecurity and family structure in Nigeria. *SSM-Pop Health* 2018, 4, 117–125.
65. Oyedele, G.A., Akintola, J.O. (2012). Determinants of access to credit in Nigerian agriculture. *J. Dev. Agric. Econ.*,4(10), 275–286.
66. Ozili, Peterson K, 2020. "Theories of financial inclusion," MPRA Paper 101810, University Library of Munich, Germany.
67. Rashid Hassan & Patrick Birungi (2011) Social capital and poverty in Uganda, *Development Southern Africa*, 28:1, 19-37, DOI: 10.1080/0376835X.2011.545168
68. Samim, S.A.; Hu, Z.; Stepien, S.; Amini, S.Y.; Rayee, R.; Niu, K.; Mgendi, G. Food Insecurity and Related Factors among Farming Families in Takhar Region, Afghanistan. *Sustainability* 2021, 13, 10211. [CrossRef]
69. Schurmann, A. T., & Johnston, H. B. (2009). The group-lending model and social closure: microcredit, exclusion, and health in Bangladesh. *Journal of health, population, and nutrition*, 27(4), 518.
70. Sogbesan, O.A., Kwaji, B.P. (2018). Sustainable artisanal fisheries practices in Nigeria. *Oceanogr. Fish Open Access J.*, 6(1), 555677. doi: 10.19080/OFOAJ.2018.06.555677
71. UNICEF 2023: 25 million Nigerians at High Risk of Food Insecurity in 2023. Available online: <https://www.unicef.org/press-releases/25-million-nigerians-high-risk-food-insecurity-2023> (accessed on 21 May 2023).
72. Von Grebmer, K.J.; Bernstein, D.; Resnick, M.; Wiemers, L.; Reiner, M.; Bachmeier, A.; Hanano, O.; Towe, R.; Ni Cheilleachair, C. 2022 Global Hunger Index: Food Systems 7. Transformation and Local Governance; Welthungerhilfe: Bonn, Germany; Concern Worldwide: Dublin, Germany, 2022.
73. Yahaya, S.P.; Sanusi, R.A.; Eyinla, T.E.; Samuel, F.O. Household Food Insecurity and Nutrient Adequacy of under Five Children in Selected Urban Areas of Ibadan, Southwestern, Nigeria. *Afr. J. Biomed. Res.* 2021, 24, 41–46.