



Determinants of Food Insecurity during COVID-19 Pandemic in Nigeria: A Random Effects Ordered Probit Approach

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Abstract: COVID-19 is reversing the global development progresses already attained over the past few decades. Attainment of zero hunger in the Sustainable Development Goals (SDGs) is being threatened, and comprehensive approach in managing the pandemic is urgently required. This paper analyzed the determinants of food insecurity status during COVID-19 pandemic in Nigeria. The data were the second, fourth and seventh rounds of COVID-19 National Longitudinal Phone Survey (NLPS), that were carried out in June, August and November 2020, respectively. Food insecurity status was computed with questions on Food Insecurity Experience Scale (FIES), and analyzed with Random Effects Ordered Probit Regression. The results showed that food security improved from 12.19% in June to 24.65% in November. There was a decline in the percentage of severely food insecure households in urban areas from 54.67% in June to 44.53% in November, while that in rural areas declined from 60.69% in June to 45.34% in November. The Panel Probit regression showed the presence of significant heterogeneity across the panels. Household size, age, male, tertiary education, North West residence, public administrator, business or traders and construction job showed statistical significance ($p < 0.05$) with negative sign, while social assistance has positive sign. Nonperception of COVID-19 morbidity and financial risks significantly reduced food insecurity ($p < 0.01$). It was concluded that interventions to address the COVID-19 pandemic must critically evaluate its welfare impacts given absence of effective social assistance with adequate focus on female headed households, the illiterates, unemployed and youths.

Keywords: COVID-19; Food Insecurity; Random Effects; Ordered Probit Regression; Nigeria

JEL Classification: Q1; Q10; Q18; C01; C33

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1. Introduction

Consensus exists among policy makers on the notion that food security is attained “when all people, at all times, have physical and economic access to sufficient, safe and nutritious foods meeting their dietary needs and food preferences for an active and healthy life” (Food and Agriculture Organization [FAO], 1996). The essentiality of food access as a fundamental right of people is also anchored in the Sustainable Development Goals (SDGs), with the second goal seeking to “end hunger” in all its forms by 2030 (United Nations, 2020). Although there have been several indications that achievement of the Sustainable Development Goals (SDGs) is being slowed down by the COVID-19 pandemic, efforts at attaining zero hunger is specifically facing some heightened challenges (FAO et al., 2021). This is based on the magnitude of economic disruptions that have been associated with many of the COVID-19 containment measures. As many countries therefore try to cope with several economic impacts of COVID-19, the pandemic remains a major cause of concern among healthcare practitioners and policy makers.

Food security remains one of the major indicators for assessing the impacts of the COVID-19 pandemic on any country. This is based on the age-long assertion that food remains the basic need of a man. Available statistics have shown that global indicators of hunger and malnutrition worsened during COVID-19 pandemic (FAO et al, 2021). Specifically, in 2020, some global projections have shown that between 720 and 811 million people faced hunger crises, while Asia (418 million) and Africa (282 million) remain the hotspots of hunger and malnutrition (World Bank, 2021, FAO et al., 2021). The impact of COVID-19 on households’ vulnerability to food insecurity is better understood from the fact that between 2019 and 2020, the number of people that were affected by hunger in Africa, Asia and Latin America increased by about 46 million, 57 million and 14 million, respectively (FAO et al., 2021).

Although some tentative estimates by the World Food Programme (WFP) reveal that 272 million more people may suffer from acute food insecurity due to the ongoing COVID-19 pandemic (WFP, 2021), acute vulnerability to hunger may be worsened when other pertinent issues such as climate change, environmental hazards, outbreaks of pests and diseases and conflicts are considered. This scenario implies that there have been significant increases in the number of people experiencing acute and severe food shortages. Perplexingly, however, this would likely be the case for the rest of 2021 because of recurring waves of COVID-19 infections in some countries.

It should be emphasized that the Nigerian government responded to the COVID-19 pandemic with complete economic lockdowns in some states. The sudden restrictions in social, religious, and economic activities hindered the ability of several formal and informal businesses to effectively thrive since early 2020. The pandemic is affecting food security status of many households because of job losses and

reduction in incomes. More importantly, the global disturbances to economic activities affected the Nigerian economy given an onset of a global economic recession that resulted in reductions in the international prices of oil. Since the Nigerian economy depends heavily on oil revenues, there were predictions that the economy will contract by 3.5 to 5 percent in 2020 (World Bank, 2020a; International Monetary Funds [IMF], 2020; Andam et al., 2020). However, contrary to these predictions, the economy contracted by 1.8% in 2020, while it was projected that a growth rate of 1.8% will be had in 2021 (Joseph-Raji et al., 2021).

The Nigerian government had implemented some fiscal and monetary reforms in order to ensure a quicker economic recovery. However, majority of these reforms have spelt more woes for the average Nigerians, with indisputable adverse welfare consequences. Although government's decision to remove lingering subsidies on petrol and electricity was welcomed with loud criticisms, policy makers considered it as one of the safest routes to speedy economic recovery. Therefore, increase in the prices of petrol and electricity resulted into increase in inflation rates. Specifically, food price inflation rates have increased from 14.98% in March 2020 to 21.03% in July 2021 (Central Bank of Nigeria [CBN], 2021).

Exchange rate devaluation also contributes to inflation as prices of imported goods and services increased. In addition, Nigeria's food import dependence increases its vulnerability to external trade shocks, like the one imposed by the COVID-19 pandemic. It should be noted that the prices of major staple foods have registered marked price increases, thus creating an added financial burden that is directly affecting households' food security status (World Bank, 2020b). This study seeks to analyze households' food security status during the COVID 19 pandemic and determine the factors influencing it using an on-going nationally representative data. The findings from the study will assist policy makers to understand the magnitude of impacts that COVID-19 had made on food security with the aim of coming up with marginal reforms to assist vulnerable households.

2. Materials and Methods

2.1. The Data

This study used the COVID-19 National Longitudinal Phone Survey (NLPS) that was carried out in 2020 (National Bureau of Statistics [NBS], 2021). This survey was motivated by the need to provide policy supports during COVID-19 pandemic that are founded on empirical researches. The survey was based on the sampling frame of the fourth wave of the 2018/19 General Household Survey - Panel (GHS-Panel) and implemented by the National Bureau of Statistics (NBS) with technical and financial supports from the World Bank. The Nigeria National COVID-19 NLPS is a subset of the previous survey of the 2018/19 GHS-Panel. This was made possible

through phone calls since phone numbers of some of the respondents were collected during the fourth wave of the 2018-2019 GHS-Panel (World Bank, 2020c).

The survey was carried out by trained enumerators who possess relevant experiences in phone interviews. The enumerators were trained virtually with the contents of the questionnaire and pilot tests were carried out with some selected individuals. The consent of the respondent to be interviewed was first sought after clearly explaining the objectives of the survey. The respondents were the heads of their households or someone within the households that had sufficient knowledge on the socio-economic affairs within the households.

Data were collected with Computer Assisted Telephone Interview (CATI) techniques (NBS, 2021). The data were captured on the Survey Solutions software, which was developed by the World Bank. Also, the enumerators conducted the interviews in English language and several other local dialects since some did not possess any form of formal education. Also, in order to facilitate data collection, enumerators were provided with two internet-enabled tablets. Data that were captured were sent to central server after synchronization. The server was based at <https://ngnlps.mysurvey.solutions> and only authorized individuals could access the website. Data cleaning was implemented by a supervisory team, who were to crosscheck any captured information that is suspected to be erroneous (NBS, 2021).

This study was based on the surveys that have food security component. From the questionnaires, only rounds 1, 2, 4 and 7 met this criterion. However, only 3 of the 8 indicators of the Food Insecurity Experience Scale (FIES) were included in the baseline survey that was conducted in April/May 2020. Since this study sought to compare food insecurity across different time of the survey, the baseline was therefore considered as inadequate for inclusion. The other rounds of the survey (2, 4 and 7) had all the 8 indicators and were therefore used for this study. However, some of the socioeconomic data of the households were obtained from the baseline survey.

The baseline survey proceeded with the 4934 households that provided their telephone numbers during the fourth wave of the 2018-2019 GHS-Panel being the sampling frame. A total of 3000 households were to be interviewed. However, only 69% (2070) of these households were reachable on phones, and 1950 households gave the consents to participate in the survey. During the second round, all the 1950 households that completed the baseline survey formed the sampling frame. Out of these, 1852 households were reached on their phones and 1820 households successfully completed the survey. During round 4, 1881 households were targeted but 1819 households were contacted. However, only 1789 households successfully completed the survey. In the seventh round, 1811 households were targeted, but 1740 households were reached on their phones. Out of these, 1726 households successfully completed the survey (NBS, 2021).

2.2. Computation of Food Insecurity Status

The households' food insecurity status was computed based on the eight questions in the Food Insecurity Experience Scale (FIES) that was proposed in the Voices of the Hungry (VoH) by the Food and Agriculture Organization (FAO) (Reagan, 2018). These questions probed into experiences of hunger or food problems due to lack of money or other resources with the following questions:

- i. Worried about not having enough food to eat?
- ii. Unable to eat healthy and nutritious/preferred food?
- iii. Ate only a few kinds of foods?
- iv. Had to skip a meal?
- v. Ate less than you thought you should?
- vi. Ran out of food?
- vii. Were hungry but did not eat?
- viii. Went without eating for a whole day?

These questions are summarized in a scale with progression from question i to viii revealing severity of hunger exposures and experiences. The above responses were reclassified into four classes of food insecurity by adopting the scaling procedures that were provided by Ballard et al. (2013). This method divides the 8 questions into four categories.

- i. The *first* category comprises of food secure households comprising those that responded with *no* answers to all the questions above.
- ii. The *second* category comprises of those that are considered as being mildly food insecure. This group comprises of those households that answered *yes* to any of questions i to iii but answered *no* to all the other questions.
- iii. The *third* group comprises of those that have been classified as being moderately food insecure. This is a group of the households that answered *yes* to any of the questions iv to vi, but answered *no* to questions vii and viii.
- iv. The *fourth* group comprises of households that are severely food insecure. This group comprises of those households that answered *yes* to any of questions vii or viii.

2.3. Random Effects Ordered Probit Regression

We used the Random Effects Ordered Probit regression model to analyze the determinants of food insecurity status. This model was implemented using the

xtprobit command of STATA 17 software (StataCorp, 2013). The model is specified with a maximum likelihood random effect model,

$$\Pr(y_{it} > k \mid \kappa, X_{it}, v_i) = \Phi(X_{it}\beta + v_i - \kappa_k) \tag{1}$$

where $i = 1, \dots, n, t = 1, \dots, n_i, v_i$ are independent and identically distributed $N(0, \sigma_v^2)$, and κ is a subset of cutpoints $\kappa_1, \kappa_2, \dots, \kappa_{k-1}$, where the number of possible outcomes is denoted as k and the function $\Phi(\cdot)$ is a standard normal cumulative distribution function.

$$\begin{aligned} p_{itk} &\equiv \Pr(y_{it} = k \mid \kappa, X_{it}, v_i) \\ &= \Pr(\kappa_{k-1} < X_{it}\beta + v_i + \epsilon_{it} \leq \kappa_k) \end{aligned} \tag{2}$$

$$= \Pr(\kappa_{k-1} - X_{it}\beta - v_i < \epsilon_{it} \leq \kappa_k - X_{it}\beta - v_i) \tag{3}$$

$$= \Phi(\kappa_k - X_{it}\beta - v_i) - \Phi(\kappa_{k-1} - X_{it}\beta - v_i) \tag{4}$$

In equation 4, κ_0 takes the value of $-\infty$ and κ_k is $+\infty$. Furthermore, X_{it} does not have a constant term since its effect will be submerged within the cutpoints. This model as noted by StataCorp (2013) can therefore be expressed in the latent linear response form with the observed ordinal responses y_{it} generated from the latent continuous responses in a way that allows equation 5 to be specified as:

$$y_{it} = X_{it}\beta + v_i + \epsilon_{it} \tag{5}$$

and

$$y_{it} = \begin{cases} 1 & \text{if } y_{it}^* \leq \kappa_1 \\ 2 & \text{if } \kappa_1 < y_{it}^* \leq \kappa_2 \\ \vdots & \\ K & \text{if } \kappa_{K-1} < y_{it}^* \end{cases} \tag{6}$$

The error term (ϵ_{it}) follows a normal distribution such that $N(0,1)$ and $\text{Cor}(\epsilon_{it}, v_i) = 0$. In the estimated equation, the dependent variable y_{it} is going to be coded as 0 if food secure, 1 if mildly food insecure, 2 if moderately food insecure and 3 if severely food insecure. The variable X_{it} denotes the exogenous variables. These variables are household member unable to work (yes =1, 0 otherwise), got social assistance (yes =1, 0 otherwise), male (yes =1, 0 otherwise), age (years), urban area (yes =1, 0 otherwise), household size, agriculture job (yes =1, 0 otherwise), mining and manufacturing job (yes =1, 0 otherwise), energy and water supply job (yes =1, 0 otherwise), construction job (yes =1, 0 otherwise), business and trading (yes =1, 0 otherwise), transport job (yes =1, 0 otherwise), professional services (yes =1, 0 otherwise), public administration job (yes =1, 0 otherwise), education, health and others services job (yes =1, 0 otherwise), North East (yes =1, 0 otherwise), North West (yes =1, 0 otherwise), South East (yes =1, 0 otherwise), South South (yes =1,

0 otherwise), South West (yes =1, 0 otherwise), primary education (yes =1, 0 otherwise), secondary education (yes =1, 0 otherwise), tertiary education (yes =1, 0 otherwise), vocational education (yes =1, 0 otherwise), somewhat worried of COVID-19 (yes =1, 0 otherwise), not too worried of COVID-19 (yes =1, 0 otherwise), not worried at all (yes =1, 0 otherwise), COVID-19 is moderate threat to finance (yes =1, 0 otherwise), COVID-19 is not much threat to finance (yes =1, 0 otherwise), and COVID-19 is not threat at all to finance (yes =1, 0 otherwise).

3. Results and Discussion

3.1. Food Insecurity Status versus Demographic Variables

Figure 1 shows the distribution of the respondents' food insecurity status across selected demographic characteristics. The results showed that the proportions of the respondents that were food secure progressively increased from 12.19% in June 2020 to 24.65% in November 2020. Similar trend was also observed for those who were mildly food insecure. Some reductions were observed in the proportions of the respondents who were severely food insecure from 58.48% in June 2020 to 45.02% in November 2020. These results are indicating the extent of economic hardship that the pandemic brought on several households as a result of curfews and economic lockdowns in some states (Amusan & Agunyai, 2021; Okaisabor, 2021).

COVID-19 has worsened the state of hunger and food insecurity in Nigeria. This had been heightened by high rate of unemployment, environmental degradation and insecurity in some parts of the country. Available statistics show that between 2004 and 2006, the number of people suffering from undernourishment was 9.1 million, but the number increased to 25.6 million between 2016 and 2018 (Food and Agriculture Organization (FAO) et al. (2019). NBS (2018) submitted that there was an increase in the rate of unemployment from 18.8% in the third quarter of 2017 to 23.1% in the third quarter of 2018. However, during lockdown, Olurounbi (2021) submitted that underemployment and unemployment rose to 33.3% in the last quarter of 2020. This was noted as a significant increase from the 27.1% rate in the second quarter of 2020. Other factors that are for noting in explaining the deplorable situation of food insecurity during COVID-19 are increase in fuel price, increase in electricity tariffs and worsening state of national insecurity.

Figure 2 further reveals the food insecurity status of the respondents across the different sectors of the economy. It reveals that the proportions of urban respondents that were severely food insecure in June, August and November 2020 were 54.67%, 52.90% and 44.53%, respectively. Similarly, in June, August and November 2020, rural households that were severely food insecure respectively constituted 60.69%, 58.80% and 45.34%. On the other hand, Figure 2 shows the increase in the proportions of the urban and rural respondents that experienced food security

between June and November 2020. Specifically, the proportions of urban residents that were food secure increased from 14.09% in June 2020 to 26.04% in November 2020. Similarly, there were some increases in the proportions of rural food secure households from 10.36% in June 2020 to 23.76% in November 2020.

These results are further showing that as restrictions in human movements were being eased in August and November 2020, and daily economic activities resumed by some of the respondents, food security status gradually improved. This is expected because for some of the respondents, inability to attend to their daily jobs was the major cause of economic hardship (Despard et al., 2020; Adebawale et al., 2021). This is particularly a problem in Nigeria, given the perplexingly inefficient distributional approach of government's social assistances and deliberate hoarding of these food and relief materials by some political office holders (Eranga, 2020). It should also be noted that one would have expected rural households to be less affected by COVID-19 since majority of them are engaged in farming. The results are revealing persistent poverty in rural Nigeria (World Bank, 2014) and the fact that COVID-19 is affecting every sector of the economy (Despard et al., 2020; Adebawale et al., 2021).

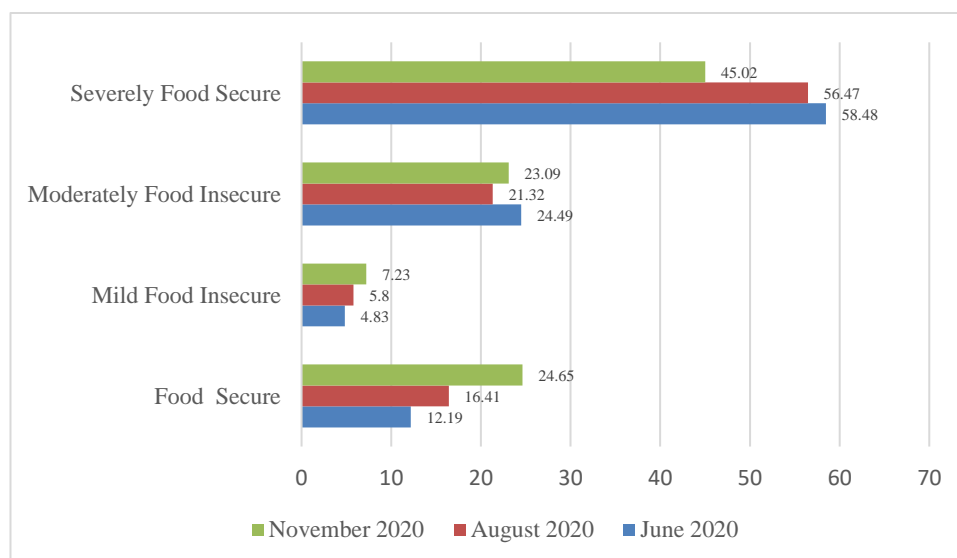


Figure 1. Distribution of Respondents' Food Security Status across the Panel Periods

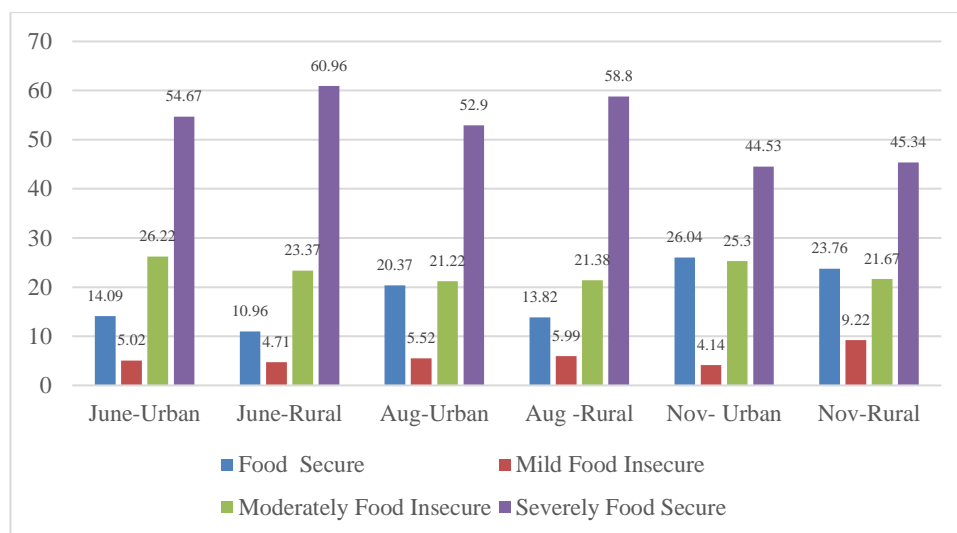


Figure 2. Distribution of Respondents' Food Insecurity Status across Rural and Urban Areas

Table 1 shows the distribution of the respondents' food insecurity status across their household sizes, ages and gender. The results showed that between June and November 2020, experience of food security improved across all the different demographic groups. Precisely, across the different classes of household size, the proportions of the respondents that were food secure were highest among those with 1-3 members, with 14.32% in June 2020 and 18.77% in August 2020. However, in November 2020, being food secure was highest among those respondents with 10 or more members with 27.47%. The results are in accordance with expectation of higher deprivation for those with larger family sizes as restrictions were placed on some economic activities at the first few months of the pandemic.

Table 1 also shows that respondents from male headed households reported higher proportion being food secure than those that were female headed. In June and August 2020, more than 60% of the female headed households experienced severe food insecurity. Table 1 further reveals that across the age groups, as age increased, the proportion of the respondents that were food secure increased, while experience of severe food insecurity decreased. These results are indicating higher vulnerability of female headed households to hunger and food insecurity during the pandemic (Babatunde et al. 2008; Felker-Kantor et al, 2012; Tibesigwa & Visser, 2016; Verpoorten & Arora, 2013).

Table 1. Demographic Characteristics of the Households Across Food Insecurity Status

	Household	Food		Mildly		Moderately		Severely		Total
		Fre	%	Fre	%	Fre	%	Freq	%	Freq
Second Round (June 2020)	1-3	55	14.3	15	3.9	87	22.6	227	59.1	384
	4-6	84	11.4	32	4.3	196	26.5	425	57.6	737
	7-9	50	11.8	25	5.9	95	22.5	252	59.7	422
	>=10	33	11.8	16	5.7	68	24.4	161	57.9	278
	Total	222	12.1	88	4.8	446	24.4	1,06	58.4	1,82
Fourth Round (August 2020)	1-3	67	18.7	13	3.6	79	22.1	198	55.4	357
	4-6	113	15.7	43	6.0	158	22.0	402	56.1	716
	7-9	68	15.5	28	6.4	97	22.2	244	55.8	437
	>=10	46	16.3	20	7.0	48	17.0	168	59.5	282
	Total	294	16.4	104	5.8	382	21.3	1,01	56.4	1,79
Seventh Round (November 2020)	1-3	72	23.2	15	4.8	77	24.8	146	47.1	310
	4-6	151	23.5	37	5.7	155	24.1	299	46.5	642
	7-9	114	25.2	43	9.5	108	23.8	187	41.3	452
	>=10	89	27.4	30	9.2	59	18.2	146	45.0	324
	Total	426	24.6	125	7.2	399	23.0	778	45.0	1,72
Gender										
Second Round	Male	192	12.9	71	4.7	362	24.3	859	57.8	1,48
	Female	30	8.90	17	5.0	84	24.9	206	61.1	337
	Total	222	12.1	88	4.8	446	24.4	1,06	58.4	1,82
Fourth Round (August 2020)	Male	255	17.4	95	6.5	305	20.8	806	55.1	1,46
	Female	39	11.7	9	2.7	77	23.2	206	62.2	331
	Total	294	16.4	104	5.8	382	21.3	1,01	56.4	1,79
Seventh Round (November 2020)	Male	380	26.8	115	8.1	316	22.3	606	42.7	1,41
	Female	46	14.7	10	3.2	83	26.6	172	55.3	311
	Total	426	24.6	125	7.2	399	23.0	778	45.0	1,72
Age										
Second Round (June 2020)	<25	1	5.56	0	0.0	1	5.56	16	88.8	18
	25<35	26	10.7	14	5.8	60	24.9	141	58.5	241
	35<45	61	12.9	14	2.9	130	27.6	266	56.4	471
	45<55	45	10.5	20	4.6	99	23.2	262	61.5	426
	55<65	48	13.7	21	6.0	80	22.8	201	57.4	350
	>=65	41	13.0	19	6.0	76	24.1	179	56.8	315
Total	222	12.1	88	4.8	446	24.4	1,06	58.4	1,82	
Fourth Round (August 2020)	<25	1	4.76	2	9.5	3	14.2	15	71.4	21
	25<35	37	15.8	13	5.5	36	15.3	148	63.2	234
	35<45	78	16.9	29	6.3	106	23.0	247	53.7	460
	45<55	66	15.6	30	7.1	79	18.7	247	58.5	422
	55<65	59	17.2	18	5.2	85	24.7	181	52.7	343
	>=65	53	16.9	12	3.8	73	23.4	174	55.7	312
Total	294	16.4	104	5.8	382	21.3	1,01	56.4	1,79	
	<25	0	0.00	1	4.7	4	19.0	16	76.1	21
	25<35	62	27.1	14	6.1	45	19.7	107	46.9	228

Seventh Round (November 2020)	35<45	115	25.8	33	7.4	110	24.7	187	42.0	445
	45<55	98	24.1	30	7.3	81	19.9	197	48.5	406
	55<65	80	24.3	23	7.0	86	26.2	139	42.3	328
	>=65	71	23.6	24	8.0	73	24.3	132	44.0	300

3.2. Food Insecurity Status versus COVID-19 Concerns

Table 2 shows the distribution of the respondents' food insecurity status based on their perceptions of individual vulnerability to contracting the virus or their households' finances being negatively affected. The results showed a progression from being very worried of being sick of COVID-19 to not being worried at all increased the percentages of the respondents that were food secure. Similarly, a progression from perceiving COVID-19 as a substantial threat to households' finance to perceiving it not as a threat at all reduced the proportions of the households that were severely food insecure.

Table 2. COVID-19 Concerns and Food Insecurity Status

	COVID-19 Illness Concern	Food Secure		Mildly Insecure		Moderately Insecure		Severely Insecure		Total Freq
		Freq	%	Freq	%	Freq	%	Freq	%	
Second Round (June 2020)	Very	137	11.3	64	5.28	280	23.1	731	60.3	1,21
	Somewhat	24	11.6	5	2.43	58	28.1	119	57.7	206
	Not Too	23	16.9	5	3.68	39	28.6	69	50.7	136
	Not	38	14.3	14	5.28	68	25.6	145	54.7	265
	Total	222	12.2	88	4.84	445	24.4	1,06	58.4	1,81
Fourth Round (August 2020)	Very	152	13.7	60	5.44	228	20.6	662	60.0	1,10
	Somewhat	27	17.0	13	8.23	39	24.6	79	50.0	158
	Not Too	43	22.1	16	8.25	44	22.6	91	46.9	194
	Not	72	21.4	15	4.46	71	21.1	178	52.9	336
	Total	294	16.4	104	5.81	382	21.3	1,01	56.4	1,79
Seventh Round (November 2020)	Very	234	23.0	73	7.18	224	22.0	486	47.7	1,01
	Somewhat	43	24.0	13	7.26	42	23.4	81	45.2	179
	Not Too	55	31.4	11	6.29	33	18.8	76	43.4	175
	Not	94	26.4	28	7.89	99	27.8	134	37.7	355
	Total	426	24.6	125	7.24	398	23.0	777	45.0	1,72
	COVID-19 is A Threat to Finance									
Second Round (June 2020)	A	142	9.78	61	4.20	355	24.4	894	61.5	1,45
	A moderate	44	18.7	17	7.23	63	26.8	111	47.2	235
	Not much	16	23.1	5	7.25	13	18.8	35	50.7	69
	Not a threat	19	29.6	5	7.81	15	23.4	25	39.0	64
	Total	221	12.1	88	4.84	446	24.5	1,06	58.5	1,82

Fourth Round (August 2020)	A	156	12.7	58	4.72	249	20.2	765	62.3	1,22
	A moderate	51	18.0	17	6.01	80	28.2	135	47.7	283
	Not much	45	32.6	15	10.8	28	20.2	50	36.2	138
	Not a threat	42	29.7	14	9.93	25	17.7	60	42.5	141
	Total	294	16.4	104	5.81	382	21.3	1,01	56.4	1,79
Seventh Round (November 2020)	A	212	19.0	76	6.82	267	23.9	560	50.2	1,11
	A moderate	78	28.4	23	8.39	65	23.7	108	39.4	274
	Not much	61	36.5	9	5.39	32	19.1	65	38.9	167
	Not a threat	75	43.8	17	9.94	35	20.4	44	25.7	171
	Total	426	24.6	125	7.24	399	23.1	777	44.9	1,72

3.3. Determinants of Food Insecurity

Table 3 shows the results of random effects ordered Probit regression. The model produced a good fit of the data as evident from the statistical significance of the computed Wald Chi Square statistics ($p < 0.01$). The results also showed the likelihood ratio test statistics that justifies the existence of heterogeneity among the variables across the different panels. The computed statistics is statistically significant ($p < 0.01$) and implies that the use of random effects is justified and estimating the model with standard ordered Probit regression would produce inconsistent parameters.

Among the included exogenous variables, access to social assistance is statistically significant ($p < 0.01$). It shows that access to social assistance increased households' food insecurity status. This finding is expected because only poor and food insecure households would seek for social assistance as alternative means of survival during the COVID-19 pandemic (Ezirigwe et al., 2021). The implication is that depending on the amount of money or the quantity of foodstuffs received as a form of COVID-19 palliative support from individuals or government, social assistance may not be able completely meet the food needs of the recipients. The findings are also revealing the fact that social assistance programmes that were implemented to ease financial burdens during the COVID-19 pandemic in Nigeria may not have yielded some positive results (Dixit et al., 2020).

Furthermore, the results showed that male respondents were significantly ($p < 0.01$) more food secure than their female counterparts. This finding is in line with expectation because COVID-19 is compounding gender imbalance in households' access to capital and financial resources (Shahbaz et al., 2021). The existing nutritional inequity, which is currently in the disfavor of women is being made worse as the pandemic intensifies restrictions to some employment opportunities that are largely explored by the womenfolk (Bibi, 2020). Table 3 also shows that being a young household's head significantly ($p < 0.05$) increased food insecurity. This can be a reflection of the reality of unemployment among Nigerian youths. It can also be an indication of the tendency of old people to have accumulated some wealth and

savings that can ease financial needs during the pandemic. Contrary to expectation, the results also showed that increase in household size significantly ($p < 0.01$) reduced food insecurity.

Among the variables that captured occupation, public administration, business/trading and construction showed statistical significance ($p < 0.05$) and are all with negative sign. These results showed that compared to those without jobs, being engaged in public administration, business/trading and construction sectors significantly reduced food insecurity. These findings are reflecting some occupational advantages that some households explored during the pandemic. In some Nigerian states where lockdowns were completely implemented, normal trading activities were allowed at certain periods of the day. Therefore, it was not a case of complete lockdown and some business activities were still allowed. Similar case could be made for those working as public administrators, who may still have their salaries paid during lockdowns, if they were in government employment. The individuals that were working in the construction company may also be able to work during lockdown, since movements were not entirely restricted within the states.

Among the geopolitical zone variables, the results in Table 3 showed that compared to the respondents from north central, residence in north west zone significantly reduced food insecurity. It should be noted that there was complete lockdown in the Federal Capital Territory (FCT), which is a major economic hub within the north central zone of Nigeria. Similarly, The north west zone comprises of Kaduna, Katsina, Kano, Kebbi, Sokoto, Jigawa,, Zamfara states. Among these, Kano is the topmost urban conglomerate in northern Nigeria (Lawal & Kalu, 2018).

Table 3 also shows that in comparison with those without formal education, attainment of tertiary education significantly reduced food insecurity. This finding is expected because attainment of tertiary education is a major prerequisite for being gainfully employed in the public and private sectors of Nigerian economy. Table 3 further shows that compared to those who were worried about the risk of household members contracting COVID-19, respondents that were not too worried or worried at all had significantly ($p < 0.01$) lower food insecurity status. The results also show that compared to those that perceived COVID-19 as threat to households' finance, perception of COVID-19 as moderate threat, not much threat and no threat at all to finance significantly ($p < 0.01$) reduced food insecurity status. These findings are expected since being vulnerable to COVID-19 will affect several channels of generating income for attainment of food security (Udmale et al, 2020; Pereira & Oliveira, 2020; Singh et al., 2020; Singh et al., 2021).

Table 3. The Results of Random-Effects Ordered Probit Regression

Variables	Coefficient	Std. Err.	Z	P>z
<i>Demographic characteristics</i>				
Member unable to work	0.0880	0.0943	0.93	0.351
Got social assistance	0.1856**	0.0826	2.25	0.025
Male	-0.3244***	0.1179	-2.75	0.006
Age	-0.0065**	0.0033	-1.99	0.046
Urban area	-0.1175	0.0933	-1.26	0.208
Household size	-0.0319***	0.0077	-4.14	0.000
<i>Occupation</i>				
Agriculture	0.0406	0.1066	0.38	0.703
Mining and manufacturing	0.1704	0.5177	0.33	0.742
Energy and water supply	-0.1149	0.6153	-0.19	0.852
Construction	-0.5157**	0.2401	-2.15	0.032
Business and trading	-0.4093***	0.1436	-2.85	0.004
Transport	0.2868	0.2713	1.06	0.290
Professional services	-0.1365	0.3759	-0.36	0.716
Public administration	-0.7419**	0.3101	-2.39	0.017
Education, health and others	-0.0993	0.1534	-0.65	0.517
<i>Geopolitical Zones</i>				
North East	-0.1099	0.1397	-0.79	0.431
North West	-0.3600**	0.1472	-2.45	0.014
South East	0.0161	0.1450	0.11	0.912
South South	-0.1453	0.1551	-0.94	0.349
South West	-0.0199	0.1425	-0.14	0.889
<i>Education</i>				
Primary education	0.2431	0.1661	1.46	0.143
Secondary education	0.0634	0.1694	0.37	0.708
Tertiary education	-0.6955***	0.1726	-4.03	0.000
Vocational education	0.0416	0.1945	0.21	0.831
<i>Perceived risk of coronavirus</i>				
Somewhat worried of being sick	0.0040	0.0843	0.05	0.962
Not too worried of being sick	-0.3034***	0.0890	-3.41	0.001
Not worried at all of being sick	-0.2377***	0.0760	-3.13	0.002
Moderate threat to finance	-0.1986***	0.0713	-2.78	0.005
Not much threat to finance	-0.5715***	0.0961	-5.95	0.000
Not threat at all to finance	-0.8040***	0.0994	-8.09	0.000
/cut1	-2.7558***	0.2740	-10.06	0.000
/cut2	-2.3893***	0.2728	-8.76	0.000
/cut3	-1.3375***	0.2701	-4.95	0.000
/sigma2_u	1.5712	0.1236		
Number of observations	4307			
Wald Chi Square(30)	255.78***			
LR test vs. oprobit regression:	824.31***			
Integration point	12			

Note: *** - statistically significant at 1% level; ** - statistically significant at 5% level

4. Conclusion

This paper food insecurity status during COVID-19 outbreak in Nigeria using the FIES questionnaire. The paper is making some contributions to policy dialogues on COVID-19 and households' food insecurity given the comprehensiveness of the dataset and robustness of the estimation procedures. The results have shown the need to take cognizance of time variant heterogeneity in the parameters of variables influencing food insecurity during the COVID-19 pandemic. This is very important given the monthly income dynamics that are associated with COVID-19 lockdowns. The findings have also shown some important policy relevant issues in the management of the COVID-19 pandemic in Nigeria. The results showed that food security improved as lockdowns were eased in Nigeria. This is pointing at the need for critical evaluation of the benefit-cost components of any interventions that would affect economic activities of people in the course of managing the ongoing pandemic. In addition, conscientious efforts at managing COVID-19 through some intervention programmes should prioritize female headed households, those without formal education, those without jobs and those in some vulnerable occupations. More importantly, the youths and those with peculiar vulnerability to COVID-19 due to some underlying medical conditions need to be specially considered in some intervention programmes for post-COVID economic recovery.

References

- Adebowale, A.S.; Fagbamigbe, A.F.; Akinyemi, J.O.; Obisesan, K.O.; Awosanya, E.J.; Afolabi, R.F.; Alarape, S.A. & Obabiyi, S.O. (2020). Situation Assessment and Natural Dynamics of COVID-19 Pandemic in Nigeria, 31 May 2020. *Scientific African*, Vol. 12, e00844. doi: 10.1016/j.sciaf.2021.e00844.
- Amusan, L. & Agunyai, S. (2021). The COVID-19 pandemic and the crisis of lockdowns in Nigeria: The household food security perspective. *Africa's Public Service Delivery & Performance Review*, Vol. 9, No. 1, doi:https://doi.org/10.4102/apsdpr.v9i1.484.
- Andam, K.; Edeh, H.; Oboh, V.; Pauw, K. & Thurlow, J. (2020). *Impact of COVID-19 on Production, Poverty and Food Systems*. Washington, D.C.: International Food Policy Research Institute (IFPRI).
- Babatunde, R.; Omotesho, O.; Olorunsanya, E. & Owotoki, G. (2008). Determinants of Vulnerability to Food Insecurity: A Genderbased Analysis of Farming Households in Nigeria. *Indian Journal of Agricultural Economics*, Vol. 63, pp. 1–10.
- Ballard, T.J.; Kepple, A.W. & Cafiero, C. (2013). *The Food Insecurity Experience Scale Development of a Global Standard for Monitoring Hunger Worldwide*. https://www.fao.org/fileadmin/templates/ess/voh/FIES_Technical_Paper_v1.1.pdf.
- Bibi, S. (2020). Gender Disparities and CEDAW: A Case of Pakistan, *RMC Journal of Social Sciences and Humanities*, Vol. 1 No. 2, pp. 16-24.
- Central Bank of Nigeria (CBN) (2021). *Inflation Rates (Percent)*. <https://www.cbn.gov.ng/rates/inflrates.asp>.

Despard, M.; Chun Y. & Roll, S. (2020). *COVID-19 Job and Income Loss Leading to More Hunger and Financial Hardship*. <https://www.brookings.edu/blog/up-front/2020/07/13/covid-19-job-and-income-loss-leading-to-more-hunger-and-financial-hardship/>.

Dixit, S.; Ogundeji, Y.K. & Onwujekwe, O. (2020). *How Well Has Nigeria Responded to COVID-19?* <https://www.brookings.edu/blog/future-development/2020/07/02/how-well-has-nigeria-responded-to-covid-19>.

Eranga, I. O. (2020). COVID-19 Pandemic in Nigeria: Palliative Measures and the Politics of Vulnerability. *International Journal of MCH AIDS*. Vol. 9, No. 2, pp. 220-222. doi: 10.21106/ijma.394.

Ezirigwe, J.; Ojike, C.; Amechi, E. & Adewopo, A. (2021). 'COVID-19/Food Insecurity Syndemic': Navigating the Realities of Food Security Imperatives of Sustainable Development Goals in Africa. *Law and Development Review*, Vol. 14, No. 1, pp. 129-162. <https://doi.org/10.1515/ldr-2020-0071>.

FAO (1996). *Rome Declaration on World Food Security*. Rome: Food and Agriculture Organization of the United Nations. 13 November 1996.

FAO, IFAD (International Fund for Agricultural Development), UNICEF (United Nations Children's Fund), WFP (World Food Programme) and WHO (World Health Organization). (2019). *The State of Food Security and Nutrition in The World 2019: Safeguarding Against Economic Slowdowns and Downturns*. Rome: FAO.

FAO; IFAD; UNICEF; WFP & WHO (2021). *The State of Food Security and Nutrition in the World 2021. Transforming Food Systems for Food Security, Improved Nutrition and Affordable Healthy Diets For All*. Rome, FAO. <https://doi.org/10.4060/cb4474en>.

Felker-Kantor, E. & Wood, C.H. (2012). Female-Headed Households and Food Insecurity in Brazil. *Food Security*. Vol. 4, pp. 607- 617.

IMF (2020). *Nigeria: Request for Purchase under the Rapid Financing Instrument*. International Monetary Fund Country Report No. 20/142, Washington, D.C. 20090

Joseph-Raji, Gloria Aitalohi; Saldarriaga, Noel; Angel, Miguel; et al (2021). *Resilience through Reforms*. Nigeria Development Update Washington, D.C.: World Bank Group. <http://documents.worldbank.org/curated/en/389281623682704986/Resilience-through-Reforms>.

Lawal, O. & Kalu, I.E. (2018). Measuring Geographic Distribution of Economic Activity in Nigeria Using Gross Domestic Product. *Ghana Journal of Geography* Vol.10, No. 1, pp. 22-41. <https://dx.doi.org/10.4314/gjg.v10i1.2>.

National Bureau of Statistics (NBS) (2018). Labor Force Statistics - Volume I: Unemployment and Underemployment Report (Q4 2017-Q3 2018). <https://nigerianstat.gov.ng/download/856>, date: 15/10/2021.

National Bureau of Statistics (NBS) (2021). *Nigeria COVID-19 National Longitudinal Phone Survey (COVID-19 NLPS) 2020*. Dataset <https://microdata.worldbank.org/index.php/catalog/3712/get-microdata>.

Okaisabor, J. O. (2021). Public Policies Against Covid-19 Pandemic in Nigeria: Challenges, Effects, and Perceptions. *Journal of Public Administration and Social Welfare Research* Vol. 6 No. 1, pp. 16-28.

Olurounbi R. (2021). Nigeria Unemployment Rate Rises to 33%, Second Highest on Global List. <https://www.bloomberg.com/news/articles/2021-03-15/nigeria-unemployment-rate-rises-to-second-highest-on-global-list>.

Pereira, M. & Oliveira AM. Poverty and food insecurity can increase as threats of COVID-19 spreads [Internet]. *Public Health Nutrition*. Cambridge University Press; 2020. p. 3236. <https://doi.org/10.1017/S1368980020003493>.

Reagan HA. (2018). Measuring Food Insecurity Experience Scale (Fies) In Indonesia. https://unstats.un.org/sdgs/files/meetings/sdg-inter-workshop-june-2018/Day3_Session8_Indonesia_update.pdf.

Shahbaz, P.; Haq, S.U.; Khalid, U.B. & Boz, I. (2021). Gender-Based Implications of the COVID-19 Pandemic on Household Diet Diversity and Nutritional Security in Pakistan. *British Food Journal*. <https://doi.org/10.1108/BFJ-05-2021-0464>.

Singh, D. R.; Sunuwar, D. R.; Adhikari, B.; Szabo, S. & Padmadas, S.S. (2020). The Perils of COVID-19 in Nepal: Implications for Population Health and Nutritional Status. *Journal of Global Health*, Vol. 10, pp. 1-4. <https://doi.org/10.7189/jogh.10.010378>.

Singh, D. R.; Sunuwar, D. R.; Shah, S. K.; Sah, L. K.; Karki, K. & Sah, R. K. (2021). Food Insecurity during COVID-19 Pandemic: A Genuine Concern for People From Disadvantaged Community and Low-Income Families in Province 2 of Nepal. *PLoS ONE* Volume 16, No. 7: e0254954. <https://doi.org/10.1371/journal.pone.0254954>

StataCorp (2013). *Stata: Release 13. Statistical Software*. College Station, TX: StataCorp LP, USA.

Tibesigwa, B. & Visser, M. (2016). Assessing Gender Inequality in Food Security among Small-holder Farm Households in Urban and Rural South Africa. *World Development*, Vol. 88, pp. 33–49.

Udmale, P.; Pal, I.; Szabo, S.; Pramanik, M. & Large, A. (2020). Global Food Security in the Context of COVID-19: A Scenario-Based Exploratory Analysis. *Prog Disaster Sci*. Vol. 7, 100120. <https://doi.org/10.1016/j.pdisas.2020.100120>.

United Nations (2020). *The Sustainable Development Goals Report 2020*. <https://unstats.un.org/sdgs/report/2020/The-Sustainable-Development-Goals-Report-2020.pdf> date: 06/09/2021.

Verpoorten, M.; Arora, A.; Stoop, N. & Swinnen, J. (2013). Self-Reported Food Insecurity in Africa during the Food Price Crisis. *Food Policy*, Vol. 39, pp. 51–63.

World Bank (2014). Nigeria Agriculture and Rural Poverty: A Policy Note. Washington, DC. *World Bank*. <https://openknowledge.worldbank.org/handle/10986/19324> License: CC BY 3.0 IGO.

World Bank (2020). Nigeria COVID-19 National Longitudinal Phone Survey. Federal Republic of Nigeria National Bureau of Statistics Abuja.

World Bank (2020a). *Nigeria Development Update: Nigeria in Times of COVID-19: Laying Foundations for a Strong Recovery*. Washington DC: World Bank. <https://documents.worldbank.org/en/publication/documentsreports/documentdetail/695491593024516552/nigeria-in-times-of-covid-19-laying-foundationsfor-a-strong-recovery>.

World Bank (2020b). *The Impact of COVID-19 (Coronavirus) On Global Poverty: Why Sub-Saharan Africa Might Be the Region Hardest Hit*. *Data Blog*. <https://blogs.worldbank.org/opendata/impact-covid-19-coronavirus-global-povertywhy-sub-saharan-africa-might-be-region-hardest>.

World Bank (2021). *Food Security and COVID-19*. <https://www.worldbank.org/en/topic/agriculture/brief/food-security-and-covid-19>.

World Food Programme (WFP) (2021). *WFP at A Glance*. <https://www.wfp.org/stories/wfp-glance>.