Assessing the impact of corona virus (Covid-19) on rural household food security in South-western Nigeria: A Gender-household head Perspective

[1&2]Daudu, A.K., [4]Salami, O.S., [1]Kareem, O.W., and [3]Olatinwo, L.K
[1]Department of Agricultural Extension and Rural Development,
University of Ilorin, Ilorin, Nigeria
[2]International Institute of Tropical Agriculture (IITA), Ibadan, Nigeria
[3]Department of Agricultural Economics and Extension,
Kwara State University, Malete, Nigeria
[4]Agricultural & Rural Management Training Institute, Ilorin, Nigeria
Corresponding author: daudu.ak@unilorin.edu.ng
Tel: +2348032853580

Abstract

Actions to minimize the spread of the COVID-19 (self- isolation, lockdown, restaurant closing, etc.) have an impact on food security and nutrition, and the disease itself is influencing food production and distribution especially among rural households. This study therefore, assesses the impact of COVID-19 on rural household food security in South-western Nigeria by gender. Five indices of household food security developed by international agencies were adopted with little modification to suit this study. These indices include measures of "food consumption score," "household dietary diversity score," "coping strategies index," the "household food insecurity access scale," and "months of adequate household food provisioning." A multi-stage sampling technique was used to select 540 respondents for the study. Data were collected through structured questionnaire. Collected data were analysed using frequency counts, percentages, mean, standard deviation, and food security index, while independent sample *t*-test demonstrated the existing gender gap's level of food security and Pearson Product Moment Correlation was used to assess degree and direction of linear relationship between the composite FSI index and each classical indicators of food security. Overall results indicate that male headed households are more food secure with food security index (0.5519) compared to their female headed household counterparts with an index of 0.3453. Findings show that 48.8 and 33.9% of the male and female headed household were food secure by all the indicators and more than half (51.2 and 66.1%) of them respectively failed to meet all the required indices of food security and thus we categorized them food insecure. The result showed that there was positive and significant correlation of indicators with food security index in the two categories of household heads at 1% and 5% level. It is concluded that the impact of COVID-19 is felt more in female headed households compared to their male counterpart. This study recommends household based COVID-19 education and enlightenment campaign by agricultural and health extension workers with view to bridge gender gap especially among the female headed households is required. Rural household should be given necessary financial support in terms of affordable loans, so that they can flexibly and resiliently respond to the threats posed by COVID-19.

Keywords: Corona virus, food security, gender, household head, index, lockdown, rural

INTRODUCTION

In January 2020 the World Health Organization (WHO) declared COVID-19 a world health emergency that call for global attention. This COVID-19 is highly contagious and caused by SARS-CoV-2, the most recently discovered coronavirus in Wuhan, Hubei Province, China in December 2019 has been spread to almost countries and the entire continents of the World. (Mapping the Spread of the COVID-19, 2020). But on March 11, the WHO officially announced the COVID-19 outbreak a pandemic, the highest level of health emergency globally (Chappell, 2020). A growing list of economic indicators makes it clear that the outbreak is having a significant negative impact on global economic growth (Mapping the Spread of the COVID-19, 2020). Global trade and gross domestic product (GDP) are forecast to decline sharply at least through the first half of 2020. Apart from the global economic growth, food security implications of a COVID-19-triggered economic slowdown, an extensive spread of the disease in a poorer and more food insecure country could take a heavier toll on the economy than it has in those countries which currently see a rapid spread of the virus. Region, countries or household levels with high levels of food insecurity are generally more vulnerable and less prepared for an epidemic outbreak than those which see a rapid spread of the disease at present. If the corona virus persists, it could create food supply hitches and a threat to food security more importantly for vulnerable groups (Ou, Wu, Yang, Tan, Zhang, and Gu, 2020). Restrictions on transportation and people movement have also led to some food logistics challenges across the continents (Beltrami, 2020).

Across the globe, COVID-19 is a public health catastrophe, concerns arise on its possible implications for both local and global food systems and their capacity to guarantee safe and affordable food accessibility and utilization as well as adequate incomes for those located particularly in the rural setting of developing countries. But if proper measures are not taken by appropriate quarters and agencies of government, it could also complicate food security crisis. The world is already facing food and nutrition security challenges. According to the FAO (2020), more than 820 million people across the world are suffering from hunger and of this, 113 million are coping with acute severe insecurity – hunger so severe that it poses an immediate threat to their lives or livelihoods and renders them reliant on external assistance to get by. These people can ill-afford any potential further disruptions to their livelihoods or access to food that COVID-19 might bring. Beltrami (2020) states that while the food and agricultural sector were supposed to be less affected by the pandemic than other sectors, the illness-related labour shortages, transport disruptions, quarantine procedures restricting activities on farms, as well as access to markets and supply chain will engender food insecurity. This is supported by Danley (2020) who opined that as companies across all sectors, including agriculture, are banning travel for workers and instituting work-from-home programs, a challenge emerges for farmers and their workers who need to be on the fields to produce. The impact of COVID-19 pandemic would be felt more in developing countries where hunger and poverty and inability to curtail the spread pose serious threat to food production, accessibility, and security as long as the virus persist and lockdown continue. Thus the impact of COVID-19 range from mild to extreme sickness and death (Beltrami, 2020; Elham, 2020). This results in households having to use their meagre savings, loans, and remittances to pay for the hospitalization of sick members. These impact could go beyond economic implications and

health, in terms of morbidity and mortality, but it also affects individual household livelihoods and food security.

Moreover, Food and Agriculture Organization is particularly concerned about the pandemic's impacts on vulnerable countries already grappling with hunger/hit by other crises like insurgency/insecurity especially in sub-Saharan Africa and Nigeria inclusive. Vulnerable groups also include small-scale farmers, who might be hindered from working on their land/accessing markets to sell their products or buy seeds and other essential inputs, or struggle due to higher food prices/limited purchasing power, as well as millions of children who are already missing out on the school meals they have come to rely upon. We also know from dealing with past health crises that these can have a drastic effect on food security, especially that of vulnerable communities. According to early research indicates that older persons are most likely to suffer serious complications from COVID-19 and that men are more likely to experience high mortality rates than women, but this analysis may change as COVID-19 more data becomes available (Begley, 2020). Regardless, all vulnerable populations will experience COVID-19 outbreaks differently. The research on COVID-19 is just evolving, and there is thus, limited knowledge about the possible impact on the global, regional, national or local and household level food security and livelihoods of vulnerable categories of society such as subsistence smallholders. However, in terms of public health emergency response and caregiving burden, social norms in some contexts dictate that women and girls are the last to receive medical attention when they become ill, which could hinder their ability to receive timely care for COVID-19. This could have serious implications for older women or those with chronic conditions or weakened immune systems—such as women infected with HIV, malaria, or tuberculosis, diabetics—who appear to be at greater risk of contracting COVID-19 (Sands, 2020) or for women and girls experiencing malnutrition.

Household food security does not necessarily mean the same as food self-sufficiency, which refers to sufficient domestic production to meet the needs of the population. It refers both to the availability and stability of food, and the purchasing power of the household where food is not produced. At the household level, individual members may be malnourished while others have sufficient food. In some societies, women and/or children are the victims of food discrimination. At the national level, there may be sufficient food supplies, but food-insecure households or areas may exist due to production/supply shortages, low income levels and general lack of access to those supplies. Internationally, food production levels are more than sufficient to feed all people, but food is not equally available or accessible. Therefore the need to measure household food security at this trying period of COVID-19 pandemic is imperative irrespective of their gender.

Gender equity and improved nutrition are increasingly recognized as closely linked. According to FAO (2012), gender has been identified as the key element in the linkage between agriculture and nutrition. Lambrecht (2016) termed gender as basically a social construct, which is founded past the boundaries of individual households. Gender inequality of rural farming household, which involves uneven allocation of resources, decision-making, unequal treatment, or perception of an individual by virtue of being male or female, can contribute to imbalances in

nutrition outcomes. Studies have shown women to be critical actors in agricultural households and communities for improved health and nutrition status such that high levels of gender inequality are associated with higher levels of both acute and chronic under-nutrition (Herforth *et al.,* 2016; FAO 2012). In sub-Sahara Africa, female-headed households continue to increase at a higher rate. Some of the main causes of the increase in the number of female-headed households include; male migration due to work, deaths of male household heads, family conflicts and troubles leading to divorce, women remaining single, increased empowerment of rural women and changes in women's roles. This has increased the importance of women as sole decision makers as well as breadwinners for their households (Kassie *et al*., 2014). Based on the aforementioned scenario, this study thus sought to investigate the impact of COVID-19 pandemic on the food security of rural farming household in Southwestern Nigeria based on gender. Specifically to;

i. examine the knowledge level of male and female headed households on COVID-19;
ii. determine the level of food security among male and female headed households; and
iii. investigate if there exist the significant difference in the level of food security among male and female headed rural farming households during COVID-19 pandemic in the study area.

METHODOLOGY

Study Area: This study was carried out in South-western region of Nigeria. The choice of this region for this study was because is the epicenter of the COVID-19 in Nigeria. The region comprised of six states which include: Ekiti, Lagos, Ogun, Ondo, Osun and Oyo States. The region falls within latitudes 6° N, 4° S and longitudes 4° W, 6° E; covering about 114, 271 kilometre square. The average annual rainfall of South-western Nigeria ranges between 1, 200 to 1, 500mm with a mean monthly temperature range of 18 - 24°C during the rainy season and 30 - 37°C during the dry season (Adepoju *et al.,* 2011). This region of the country is predominantly agrarian due to the rich alluvial soil in the area. Notable food crops cultivated in the area include: cassava, maize, yam, cocoyam, cowpea, vegetables and cash crops such as cocoa, kola nut, rubber, citrus, coffee, cashew, mango and oil palm. The study population of study comprised all rural farming households in the region.

Sampling procedure and sample: A four-stage random sampling technique was used for the selection of respondents for the study. Stage one: involved random selection of 50% of the 6 states in the region and these states include; Ogun, Ondo and Oyo. At stage two; 3 agricultural zones were randomly sampled from each of the 3 selected states and making a total of 9 agricultural zones. In stage three; from each of the selected 9 agricultural zones, 3 rural farming communities were randomly selected to make a total 27 rural farming communities for the study. Lastly, stage four: from each of the selected farming communities, 20 smallholder (10 male and 10 female headed) farming households were randomly selected giving a total of 540 respondents. Effort to get equal number of male and female headed households for the study proof abortive as 283 male and 245 female headed households with total sample size of 528 were eventually used for the study.

Interview were conducted under strict COVID-19 guidelines with the help of both agricultural and health extension workers/enumerators. The data collected from the respondents' were on socioeconomic characteristics, COVID-19 awareness and safety guidelines, and household food security components as developed and used by Sahu, Chüzho, and Das, (2017) and modified by Mutea *et al.*, (2019) such as household dietary diversity score (HDDS), food consumption score (FCS), coping strategy index (CSI), household food insecurity access scale (HFIAS), months of adequate household food provisioning (MAHFP) and food security index (FSI), and related variables. Data collected were analysed with both descriptive and inferential statistics such as frequency counts, percentages, charts and mean, standard deviation and food security index and independent sample *t*-test. Pearson's Product Moment Correlation was also used to assess degree and direction of linear relationship among the indicators of food security indices used for the study.

Measurement of variables

Variables measured include both independent and dependent variables. The independent variables measured comprised age (in actual years), marital status (as single = 1, married = 2. divorced = 3, widowed =4), level of education (as no formal education = 1; primary education = 2, secondary education = 3, and tertiary education = 4), household size (as number of people living under the same roof and eating from the same pot), farm size (as in hectare under cultivation) and farming experience (in years) and income (in Naira), awareness on COVID-19 (as aware=1, not aware=0), contract COVID-19 (as Yes=1, No=0).

Knowledge level of household heads on COVID-19: The respondents were allowed to undergone knowledge test on COVID-19 symptoms and different ways of preventing and contracting COVID-19 and these were evaluated on a scale of I know (1) and I don't know (0). This knowledge test was assessed on 5 items. Then, the overall respondents' total scores was calculated from accumulating the 5 items. The scores could then, range from 0 (5 items x 0 point) to 5 (5 items x 1 points); 0 for the very low knowledge and 5 for the very high knowledge. This is therefore calculated from knowledge index as:

$$Knowledge\ Index\ (KI) = \frac{Respondents\ Total\ Score}{Total\ Possible\ Score} \times 100 \ldots\ldots\ldots (1)$$

Depending upon the knowledge level of respondents' on COVID-19, an index score was also fractile into four categories of Very low (0 – 24), Low (25 – 49), High (50 – 74) and Very High (75 – 100). The possible knowledge index score could range from 0 to 100, where 0 means "no knowledge" and 100 for "very high knowledge".

The dependent variable which is the food security index of male and female headed households were measured based on five mostly used indicators/components and these include; household dietary diversity score (HDDS; Swindale and Bilinsky, 2006), food consumption score (FCS; World Food Programme, 2008), coping strategies index (CSI; Maxwell and Caldwell, 2008),

household food insecurity access scale (HFIAS; Coates et al., 2007), and months of adequate household food provisioning (MAHFP; Swindale and Bilinsky, 2010),

Household dietary diversity score (HDDS): is the number of different food groups consumed over a given reference period and questions on dietary diversity can be asked at the household or individual level. This involves grouping of food into 12 food groups i.e., cereals, tubers and roots, vegetables, fruits, meats, eggs, fish and other seafood, legumes, nuts and seeds, milk and milk products, oils and fats, and sweets, spices, condiments, and beverages. The responses were assigned either consumed "1" or not consumed "0" by household over the 24 hours recall period (FAO, 2012). Summing all the food groups provides a household dietary diversity score ranging from 0 to 12. For the total number of food groups consumed by respondents, values for example of different food groups were assigned letters from A through L and coded either "0" or "1." The HDDS for each household head was then the sum of food group values (see equation 1):

$$HDDS = (A + B + C + D + E + F + G + H + I + J + K + L) \dots\dots\dots (1)$$

According to Rajendran (2012), there are no established cut-off points in terms of the number of food groups which indicate adequate or inadequate dietary diversity for the HDDS. Therefore, the household dietary diversity index (HDDI) was later computed to classify into low dietary diversity (≤3), medium dietary diversity (4 - 6) and high dietary diversity (≥6) using equation (2).

$$HDD\ Index = \frac{Number\ of\ food\ goups\ consumed\ by\ household\ head}{Total\ number\ of\ food\ groups\ (12)} \times 100\% \dots . (2)$$

Food Consumption Score (FCS): The Food Consumption Score (FCS) for a given household is the frequency-weighted HDDS (IFPRI, 2008) and which can be said to be an indicator of dietary and frequency of consumption, and is calculated using the frequency of consumption of 8 different food groups (United States Agency for International Development (USAID), 2015). In this study 12 different food groups were therefore considered. Household Food Consumption Score is then measured using a standard 7 day food data set (none=0, once a week=1, twice a week=3, 3 times a week=4, 4 times a week=5 and 5 and more time a week=6) and by classifying food items into food groups then summing the consumption frequencies of food items within the same group (any consumption frequency greater than 7 is recoded as 7, and multiplying the value obtained for each food group by its weight). The guiding principle for determining the weight is the nutrient density of the food groups. Cereals = 2, Vegetables = 1, Fruits = 1, Meat and fish = 4, Pulses = 3, Milk = 4, Oils = 0.5, Sugar = 0.5, and Condiments = 0. Summing all food groups provides a household food consumption score. Thus, a typical formula for calculating FCS is shown on equation (3):

$$\begin{aligned} FCS = {} & (cereals * 2) + (legumes * 3) + vegetables + fruits \\ & + (flesh\ \&\ organ\ meat * 4) + (roots\ \&\ tubers) + (eggs) \\ & + (fish\ \&\ seed\ foods) + (milk\ \&\ dairy\ products * 4) + (fats * 0.5) \\ & + (sugar * 0.5) + (spices, condiments\ \&\ beverages) \dots\dots\dots\dots\dots\dots (3) \end{aligned}$$

Then finally the food consumption score were categorized into: 0 - 46 (poor), 46.5 - 92 (borderline), and above 92 (acceptable) (FAO, 2011).

Coping Strategy Index (CSI): This index was developed by the World Food Programme, is a weighted score that study the frequency and severity of coping strategies during food crisis. CSI could be calculated based on different weekly food possessions per household member for food groups consumed over a period of time i.e. frequency for each coping strategy response, multiplied by its weight. The weights are developed from qualitative observation or focus group discussion, e.g., purchasing food on credit. Summing all the responses provides a household coping strategy index. The coping strategy index was therefore categorized into: 0–2 =No or low coping (Food secure), 3–12 =Mildly food insecure, and ≥ 13 =High coping (Moderately/severely food insecure).

Household Food Insecure Access Scale (HFIAS): This tool measures insufficient quality and quantity of food, as well as anxiety over insecure access to food or market. HFIAS captures a mix of sufficiency and psychological factors. The tool was developed and used by the USAID to measure food security having nine low food status occurrence questions with responses 'yes' or 'no' and another set of corresponding nine questions on frequency-of-occurrence during last 30 days of recall (Coates, Swindale, and Bilinsky, 2007). For instance, some of the nine questions were used in the construction of the household food insecurity access scale (HFIAS) model and these questions were asked based on a dummy approach with the respondents expected to either say yes or no. In this study, the responses were used to generate the raw food security scores ranging between 0 and 9 points with 0 representing the most food secure households while 9 indicates an extremely food insecure household (Melgar-Quinonez, *et al.*, 2006, and Sseguya, 2009). The scale was then classified into four-food security categories (1=food secure, 2=mildly food insecure, 3=moderate food insecure, and 4=severely food insecure) based on each household responses.

Months of Adequate Household Food Provisioning (MAHFP): This tool identifies whether there was limited access to food during the last 12 months, regardless of the source. This could be calculated as follows: twelve months minus the total number of months out of the last 12 months during which a household was unable to meet their food needs. For the purpose of classification of household, we calculated the mean for all the households in the sample and households above the mean were classified as food secure and below the mean classified as food insecure (i.e. 10–12 months = food secure and 0–9 months = food insecure).

Computation of Food Security Index

In order for a household to achieve food security (i.e. male or female headed household), it must fulfill all food security dimensions simultaneously. In this study, first we standardized each of the original indicator score into a Z-score for each household to achieve algebraic requirements (see Equation 2), followed by aggregation of indicators and correlation analysis to determine the degree of linearity between the indicators of food security index (FSI) and the final composite FSI. Using non-weighted approach, normalization of all indicators food security index which was done to make all the indicator values comparable and congruent using standardization method. The indicators were standardized to fit within the range zero (0) to one

(1) using either linear normalization or Z-score, depending on the type of data. In this study, the normalized scores or Z-score for each indicator was computed using equation (4)*:*

$$z_n = \frac{x_n - \mu_n}{\sigma_n} \ldots\ldots\ldots\ldots\ldots\ldots\ldots (4)$$

where z_n = normalized score or Z-score for each food security indicator for the n^{th} household
x_n = original score of an indicator
μ_n = mean of the original distribution
σ_n = standard deviation of the original distribution of household *n*

To aggregate the standardized value of all the indicators, we adopted Sahu *et al.* (2017) with slight modification that uses the difference between minimum of food security (HDDS, FCS and MAHFP) and maximum of food insecurity (CSI and HFIAS) indicators form a composite food security index (FSI). Since food security increases with household dietary diversity, food consumption and months of adequate household food provision but reduces with coping strategies and household food insecure access scale, therefore the Composited Food Security Index (x_n^{FSI}) of a household in each state is expressed as:

$$x_n^{FSI} = [(z_n^{HDDS} + z_n^{FCS} + z_n^{MAHFP} + (-z_n^{CSI}) + (-z_n^{HFIAS})] \ldots\ldots (5)$$

Where, x_n^{FSI}= composite food security index for *n*th household in a state *i*;
z_n^{HDDS}= normalized value of HDDS;
z_n^{FCS}= normalized value of FCS;
z_n^{MAHFP}= normalized value of MAHFP;
z_n^{CSI} = normalized value of CSI and
z_n^{HFIAS}= normalized value of HFIAS.

However, the composite food security index so computed lies between 0 and 1, with 1 indicating maximum food security and 0 indicating no food insecure at all.

For the purpose of categorization, a simple ranking of the households based on the indices viz., $\bar{y}_i$ would be enough. Moreover, for a meaningful characterization of the different levels of food security, suitable fractile categorization from an assumed probability distribution is hence needed. A probability distribution which is appropriate for this study is Beta distribution, and takes the values in the interval (0, 1), and this distribution is given by

$$f(z) = \frac{z^{a-1}(1-z)^{b-1}}{\beta(a,b)}, 0 < z < 1 \; and \; a, b > 0 \ldots\ldots\ldots\ldots (6)$$

Where $\beta(a,b)$ is the beta function defined by

$$\beta(a,b) = \int_0^1 x^{a-1}(1-x)^{b-1} \ldots\ldots\ldots\ldots\ldots\ldots (7)$$

The Beta distribution is skewed. Assuming$(0, z_1)$ and $(z_1 z_2)$ be the linear intervals such that each interval the same probability weight of 50 percent. Therefore, the fractile intervals can be

used to categorize the food security into; food secure (if $0<\overline{y_i} < z_1$), and food insecure (if $z_1<\overline{y_i} < z_2$).

RESULTS AND DISCUSSION

Socioeconomic characteristics of respondents

Results in Table 1 show socioeconomic characteristics of male and female headed households in the study area. The mean age of male headed households was 55.2 years and standard deviation of 23.5 years while mean age of female headed households was 52.6 years with standard deviation of 19.9 years old suggesting both categories of respondents are elderly groups of people but they are still active and productive. The difference in age gap between male and female headed households suggest that age could be consider as important factor because it can influence a household's farm productivity as well as food security. Sometime, a wider age gap between spouses makes women more vulnerable and in most cases deny them an opportunity to participate in household decision-making process thus giving men a chance to dominate when making key household decisions. This is corroborated by Baba and Zain (2016) found that the wider the spousal age gap, the narrower the spousal communication which may affect women involvement in the household decision making process. Findings show that majority (92.5 and 73.7%) of male and female headed households respectively were married with more married in male headed households. This finding implies that both categories of headed households were more likely to be primary care givers especially the female headed households since they are responsible for arranging and preparing food for other members of their household. The higher percentage of married households could be attribute to the fact that most rural people get married at an early stage of their live. The distribution of household heads' education level shows that most (75.1 and 58.8%) of the male and female headed households had one form of education or the other with more non-literate in female households' category. This suggests that male headed household are more educated than their female counterparts in the research area. Therefore, a household with higher level of education would likely utilize the information passed on to them efficiently including health on how to prevent the spread of corona virus in their various homes. Also, in male headed household the average household size was 12 person while in female headed household the household size was 8 person. Since most of male and female headed households are married, it's expected that the household size would undoubtedly increase and this would not only affect the household food security but also their response to curtail the spread of COVID-19 pandemic. However, in boosting household food security a household with relative higher number of household size would have comparative advantage of family labour over their counterparts with lower household size. Households with more members rely on farm produce to keep their members food secure, therefore constant food availability motivates them to participate in farming activities. Altman *et al. (*2009*)* agreed that an increased household size and the associated demand for more food encourages engagement in subsistence production as a way of feeding a larger group of dependents. Also, in terms of farming experience, majority (81.3%) of the male headed households and slightly above average (58.3%) of their female counterparts had over 20 years of farming experience with the mean of that was 26.2 and 21.4 years respectively. Results in Table show that the mean farm size of male headed households was 5.3 hectares and standard deviation of 3.1 hectares while mean farm size for female headed households was 3.8 hectare and standard deviation of 2.6 hectares. The results suggest that male headed household cultivate more farm land than their female counterparts in the study area. The implication is that household that cultivate more farm land and grow variety of crops would likely have dietary diversity options and which would likely translate household food security.

Table 1: Distribution of socioeconomic profile of respondents by gender

Socioeconomic profile		Male HH (n=283)			Female HH (n=245)		
Variable	**Group**	**(f)**	**(%)**	**Explanation**	**(f)**	**(%)**	**Explanation**
Age (years)	≤25	21	7.4	Mean: 55.2 S.D: 23.5	13	5.5	Mean: 52.6 S.D: 19.9
	26 – 50	109	38.5		112	45.7	
	>50	153	54.1		120	48.8	
Marital status	Married	262	92.5	Mode: Married	181	73.7	Mode: Married
	Divorce	21	7.5		24	9.9	
	Widowed	0	0		40	16.4	
Level of education	Non formal	70	24.9	Mode: No Primary education	98	40.2	Mode: No formal education
	Primary	166	58.7		97	39.4	
	Secondary	33	11.5		45	18.5	
	Tertiary	14	4.9		5	1.9	
Household size (number)	1 – 5	45	15.8	Mean: 12 S.D: 7	85	34.7	Mean: 8 S.D: 5
	6 – 10	90	31.7		124	50.8	
	>10	148	52.5		36	14.5	
Farming experience (years)	1 – 10	18	6.2	Mean: 26.2 S.D: 18.5	26	10.5	Mean: 21.4 S.D: 15.3
	11 – 20	35	12.5		76	31.2	
	>20	230	81.3		143	58.3	
Farm size (hectare)	≤4	75	26.4	Mean: 5.3 S.D: 3.1	133	54.3	Mean: 3.8 S.D: 2.6
	4.1 – 8.0	143	50.4		90	36.8	
	>8.0	65	23.2		22	8.9	

Source: Field survey (2020), HH= Household Head, f= frequency, %= percentage
SD= Standard Deviation

Knowledge of household heads on COVID-19 pandemic

The results in Table 2 show the knowledge of respondents on corona virus ravaging the globe in the study area. The findings show that 100 and 99.8% of male and female headed households aware of novel virus COVID-19 in their respective localities. Also, almost (95.2 and 98.7%) of male and female headed households respectively did not know their COVID-19 status or have not being tested for corona virus as at the time of carrying out this research. This may be due to slow pace of testing or inadequate health personnel and personal protective equipment (PPE). Findings show that most (73.8 and 66.7%) of male and female headed households aware and had knowledge of key symptoms of COVID-19 such as: fever, dry cough, persistent cough, Tiredness/fatigue, difficulty breathing, with 88.1 and 76.2% of male and female headed households respectively agreed that they are aware and know the best ways to prevent the spread of COVID-19 which include: washing hands often, washing hands often with soap, coughing or sneezing into a napkin/elbow, avoid touching eyes, nose and mouth, keeping distance from others/ avoiding crowded areas/ avoiding physical contact (handshakes etc.), remaining at home/ avoiding non-essential travel. Also, 92.9% of male and 73.8% of female headed households know that social distancing measures are (e.g., through a general lockdown) are effective measure for slowing down the spread of the coronavirus since no known drug for the treatment of novel virus yet.

Table 2: Distribution of respondents by their knowledge of COVID-19

Knowledge test	Male HH		Female HH	
	Yes or I know (%)	*No or I don't know (%)*	*Yes or I know (%)*	*No or I don't know (%)*
Have you heard about the coronavirus or COVID-19?	100	0	99.8	0.2
Do you know your coronavirus or COVID-19 status?	4.8	95.2	1.3	98.7
Do you aware that the following are key symptoms of COVID-19: fever, dry cough, persistent cough, Tiredness/fatigue, difficulty breathing	73.8	26.2	66.7	33.3
Do you aware that the following are top ways to prevent the spread of COVID-19: washing hands often, washing hands often with soap, coughing or sneezing into a napkin/elbow, avoid touching eyes, nose and mouth, keeping distance from others/ avoiding crowded areas/ avoiding physical contact (handshakes etc.), remaining at home	88.1	11.9	76.2	23.8
Do you think social distancing measures are (e.g., through a general lockdown) are effective measure for slowing down the spread of the coronavirus?	92.9	7.1	73.8	26.2

Source: Field survey (2020), HH= Household Head

Table 3 show the categorization of household heads by their level of knowledge of COVID-19 in the study area. The results show that no respondents (either male or female headed households) had very low knowledge of COVID-19, with only 8.8 and 19.4% of male and female headed households respectively had low knowledge of COVID-19 both in term of awareness and prevention to curtail the possible spread of the novel virus. This depicts that there is still need for continuous education of rural household heads through organizing symposium and campaign on radio and other possible means of reaching them in their remote areas, and which would increase the rural household heads' knowledge on the novel virus. Also, some 43.9% of male headed households and more than half (58.9%) of female headed households were categorized to have high knowledge on COVID-19, while 47% of male and 21.7% of female headed households are very highly knowledgeable on corona virus. It is expected that these reasonable percent of household heads with high knowledge of COVID-19 would translate into high adoption rate of prevention practices.

Table 3: Categorization of respondents' knowledge level on COVID-19

Category	Knowledge Index	Male HH		Female HH	
		Frequency (f)	*Percentage (%)*	*Frequency (f)*	*Percentage (%)*
Very low	0 - 24	0	0	0	0
Low	25 - 49	25	8.8	48	19.4
High	50 - 74	124	43.9	144	58.9
Very high	75 - 100	134	47.3	53	21.7
Total		**283**	**100**	**245**	**100**

Source: Field survey, 2020

HH=Household Head

Food consumption score or pattern of male and female headed rural households

The results in Table 4 show the food consumption pattern of male and female headed rural households in the South-western Nigeria. Both male and female headed households were asked how many times they had consumed the food groups in the last 7 days based on 12 food groups and their responses are shown in Table 4. Findings show that all (100%) male headed households consumed any form of cereals or food made from cereals while only 89.4% of female headed households consumed these cereals or food made from cereals during the week preceding the survey. The high consumption of food made from cereals may be due to the fact that cereals are one of the major staple foods among the male and female headed households in the region. This is corroborated by FAO (2010), there is an upward consumption trend in world cereals. Other studies also documented high consumption of cereals compared to other food groups (Ajani, 2010; Vakili, *et al.*, 2013). Consumption of vegetables ranged from 86.3 to 94.6% across the two categories of household heads. This suggests that female headed households consumed more vegetables than their male counterparts in the study area. This is in line with Nicklett and Kadell (2013) that female headed households are observed to show more favourable attitudes and greater perceived behaviour control regarding fruit and vegetable consumption than male counterparts. Fruits consumption among male and female headed households appear to be low with 47.8% and 35.4% respectively. Also, male headed households seem to consume more (78.7 and 56.9% for roots & tubers and flesh & organ meat respectively) compared to female headed households (55.7 and 48.4% for roots & tubers and flesh & organ meat respectively).

Results show that both male (38.1%) and female (29.3%) headed households had relative low consumption of egg. This may be as a result of their low income or purchasing power or high cost of egg. Meanwhile, fish and other sea foods appeared to be an alternative for both male (58.4%) and female (47.6%) headed households but more than average of male headed households consumed fish compared to their counterparts. Consumption food made from pulses seem to be more in female headed household (49.8%) than in the male headed households (37.5%). This finding implies that female headed households might see food made from pulses as protein supplement to improve the nutritional status their household members. More findings in Table 4 show that milk and other dairy production had low consumption rate among male (27.9%) and female (32.5%) headed households. This also confirm that protein rich food are not usually afforded by both male and female headed households and which may impact more on their nutritional imbalance. The results indicated low consumption of animal based protein rich food groups such as meat, eggs and milk. Oils and fats consumption in terms of palm oil, groundnut oil was very high with 93.1 and 92.9% among male and female headed households respectively. Also, more than average (69.6%) of male headed households consumed sweets & biscuits (sugar, chocolates, sweetened soda, cakes) compared to about average (53.1%) of female headed households in the previous week before the survey.

Table 4: Consumption of various food groups among male and female headed households over a period of 7 days

Food groups	Male Headed Households (n=283)							Female Headed Households (n=245)						
	Household Food Consumption Score per week						Total HFCS (%)	Household Food Consumption Score per week						Total HFCS (%)
	None (%)	*Once (%)*	*Twice (%)*	*3 Times (%)*	*4 Times (%)*	*5 & more times (%)*		None (%)	*Once (%)*	*Twice (%)*	*3 Times (%)*	*4 Times (%)*	*5 & more times (%)*	
Cereals	0	9.4	12.1	17.7	28.3	32.5	100	10.6	2.1	5.3	9.5	25.3	47.2	89.4
Vegetables	13.7	14.5	17.6	22.5	20.8	10.9	86.3	5.4	6.8	9.4	12.9	18.9	46.6	94.6
Fruits	52.2	10.6	9.9	7.8	9.8	9.7	47.8	64.6	16.1	10.5	6.4	2.4	0	35.4
Roots and tubers	21.3	6.9	12.6	14.8	19.6	24.8	78.7	44.3	2.8	4.7	4.9	18.8	24.5	55.7
Flesh and Organ Meat	43.1	6.5	8.8	11.9	12.6	17.1	56.9	51.6	5.4	6.8	9.5	11.3	15.4	48.4
Eggs	61.9	21.1	10.5	6.5	0	0	38.1	70.7	18.6	7.3	3.4	0	0	29.3
Fish and other seed foods	41.6	5.8	5.4	4.8	19.5	22.9	58.4	52.4	2.7	4.8	6.9	14.4	18.8	47.6
Legumes, Nuts and Seeds	62.5	15.3	12.4	8.3	1.5	0	37.5	50.2	12.3	14.5	9.2	8.5	5.3	49.8
Milk and milk products	72.1	16.5	11.4	0	0	0	27.9	67.5	19.2	11.1	2.2	0	0	32.5
Oils and Fats	6.9	1.5	3.2	10.1	23.2	55.1	93.1	7.1	0	3.9	4.7	22.8	61.5	92.9
Sweets and Biscuits	30.4	6.9	9.2	13.4	16.2	23.9	69.6	46.9	24.6	13.7	8.6	6.2	0	53.1
Spices, condiments, beverages	44.5	0	3.4	7.5	12.5	32.1	55.5	41.3	4.1	8.5	10.4	17.4	18.3	58.7

Source: Field survey, 2020

HFCS= Household Food Consumption Score

Categorization of household heads food consumption score (FCS)

The results in Table 5 show that 12.3% of male headed households had poor food consumption score compared to their female headed households counterparts of 17.2% food consumption score. Also, household food consumption score show that about 41.1% of the male headed households were at the borderline, while more than average (54.3%) of the female headed households fell within the borderline level. Results show that 46.6% of male headed households had adequate dietary level of food consumption score whilst only 28.5% of female headed households were also at this level. This level of food consumption score among about half of male headed households and relative low percent of female headed households is thus acceptable.

Table 5: Classification of household heads food consumption score (FCS)

Categorization	FCS Index	Male Headed Households		Female Headed Households	
		Frequency (f)	*Percentage (%)*	*Frequency (f)*	*Percentage (%)*
Poor	0 - 46	35	12.3	42	17.2
Borderline	46.5 - 92	116	41.1	133	54.3
Acceptable	≥92	132	46.6	70	28.5
Total		**283**	**100**	**245**	**100**

Source: Field survey, 2020

Household Heads Dietary Diversity Score (HDDS)

Results on household dietary diversity was collected based on number of food groups consumed over a period of 24-hour recall and this is presented in Table 6. Results show that only (5.8 and 13.3%) of male and female headed households had consumed up to 3 food groups in the last 24 hours prior to this survey and considered as low dietary diversity (LDD). About 40.5% of male headed households had consumed between 4 to 6 food groups while more than half (56.2%) of female headed households fell in to this category and regarded as medium dietary diversity (MDD). However, slightly above half (55.7%) of male headed households had high dietary diversity that is, they had consumed more than 6 food groups in the last 24 hours as compared to only 30.5% of their female headed households counterparts in the study area.

Table 6: Classification of household heads dietary diversity score

Categorization	Household Dietary Diversity Score Index	Male Headed Households		Female Headed Households	
		Frequency (f)	*Percentage (%)*	*Frequency (f)*	*Percentage (%)*
Low Dietary Diversity	≤3 food groups	16	5.8	33	13.3
Medium Dietary Diversity	4 - 6 food groups	115	40.5	138	56.2
High Dietary Diversity	≥6 food groups	152	53.7	74	30.5
Total		**283**	**100**	**245**	**100**

Source: Field survey, 2020

Coping Strategies used by Household Heads

Figure 1 present various coping strategies employed by household heads during COVID-19 lockdown in the research area. The results show that cutting down expenditure on food items was commonly used by 74.1 and 85.7% of male and female headed households respectively, followed by reliance on less preferred and less expensive foods by 72.8% of male respondents while in female category it was engagement in home garden farming by 72.3%. Findings show that 64.4 and 71.1% of male and female headed households purchased food on credit from vendors, some 62.7 and 69.3% of them respectively resulted into reducing the quantity of meals taken per day, while about 66.5% of male and 54.8% of female headed households reduced the number of time to eat on daily basis. Also, 40.8% of male and only 29.6% of female headed households goes spiritual by fasting and praying, some 27.7 and 33.5% of male and female respondents sold their assets including arable land and jewelries, while about 43.9% of male and more than half (56.2%) of female headed households resulted borrowing money from friends and relatives. More findings show that 61.6% of male and 50.4% of female headed households employed pre-mature harvesting of food crops from their farms.

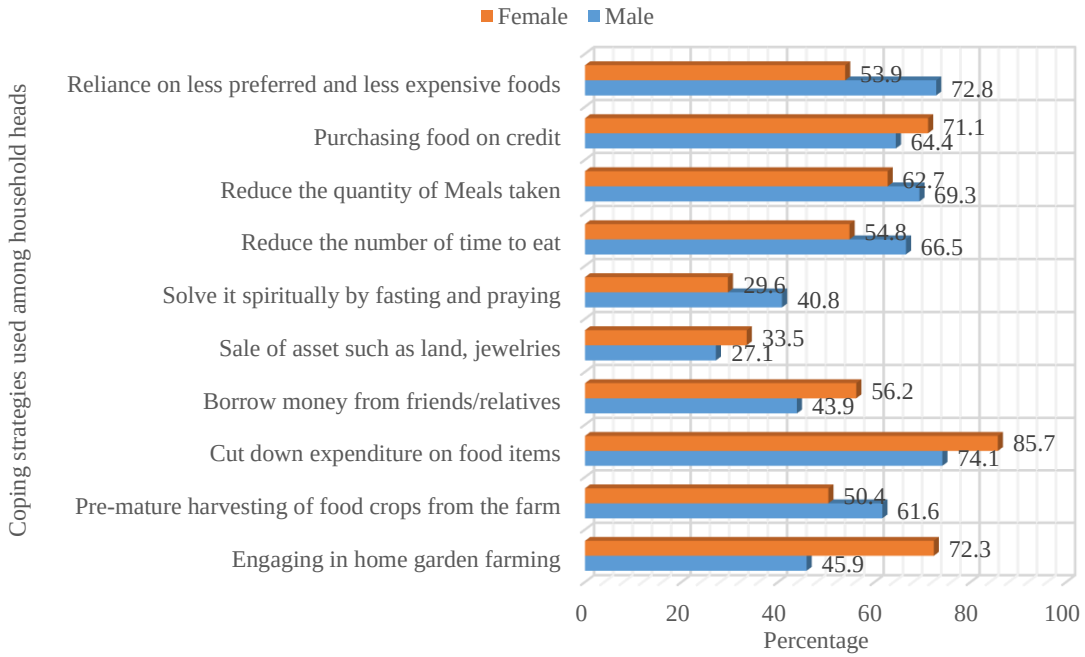

Fig. 1: Distribution of household heads by coping strategies used during COVID-19
Source: Field survey, 2020

Categorization of household heads based on coping strategies employed during COVID-19 lockdown

Table 7 show that about quarter (25.9 and 29.2%) of male and female headed households employed high number of coping strategies during corona virus lockdown and are classified as food insecure, while 43.6 and 48.5% of male and female household heads respectively used coping strategies ranging from 3 to 12 and regarded mildly food secure. Also, findings in Table 7 show that 30.5% of male headed households categorized into low or no coping whilst only 22.3% of female headed households fell into this category and therefore classified as food secure.

Table 7: Classification of household heads coping strategy

Categorization	Coping Strategy Index (CSI)	Male Headed Households		Female Headed Households	
		Frequency (f)	*Percentage (%)*	*Frequency (f)*	*Percentage (%)*
Low or No coping (food secure)	0 - 2	86	30.5	55	22.3
Mildly food secure	3 - 12	124	43.6	118	48.5
High coping (food insecure)	≥13	73	25.9	72	29.2
Total		**283**	**100**	**245**	**100**

Source: Field survey, 2020

Household Food Insecurity Access Scale

Results in Figure 2 represent household food insecurity access scale questions posed to respondents during COVID-19 lockdown in the research area. The results show that 54.6 and 67.3% of male and female respondents worried about getting enough food to eat during lockdown, 63.9 and 69.1% of them respectively actually failed to get enough food, while 71.5% of male and 76.4% of female ate poor quality foods during the COVID-19 lockdown. Also, 68.3 and 70.9% of male and female headed households relied on a few kinds of foods, most (72.6 and 77.1%) of male and female headed households reduced the amount of food eaten with 74.7 and 66.5% of them respectively skipping meals during the pandemic lockdown. Further findings show that some 56.8% of male and 61.3% of female household heads eating less than what one feels they have eaten per day, 25.2% of male and 39.7% of female did not eat for a day because of lack of food, while 37.4 and 33.6% of them growing thinner because of not eating enough food during COVID-19 lockdown.

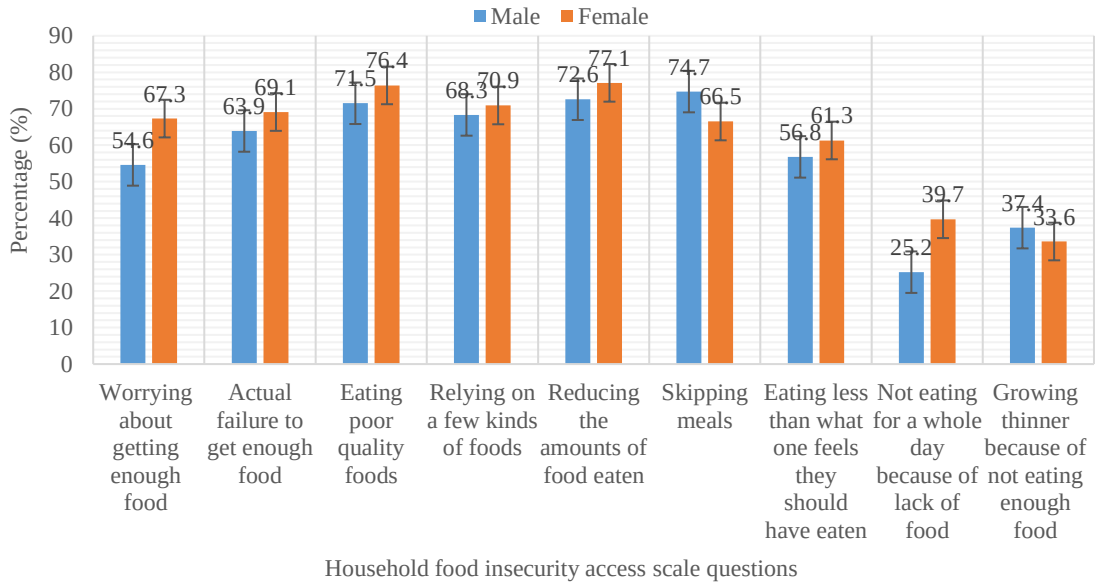

Fig. 2: Distribution of household heads by food insecurity access scale during COVID-19
Source: Field survey, 2020

Classification of household heads based on household food insecurity access scale (HFIAS) during COVID-19 lockdown

The results in Table 8 show that only 4.2% female headed households are severely food insecure and no one in male headed households classified or fell into this category. Results also show that 15.4% of male and 21.7% of female household heads were moderately food insecure while most (44.7 and 46.6%) of both household heads respectively classified into mildly food insecure in the study area. Findings show that few 39.9% of male headed households classified into food secure whilst only 27.5% of female headed households fell into this category. The implication of having few to very few of male and female headed households in food secure category shows the impact of COVID-19 are felt relatively on them but more in female headed households.

Table 8: Classification of household heads based on food insecurity access scale

Categorization	Household Food Insecurity Access Scale Index	Male Headed Households		Female Headed Households	
		Frequency (f)	*Percentage (%)*	*Frequency (f)*	*Percentage (%)*
Food secure	1	113	39.9	67	27.5
Mildly food insecure	2	127	44.7	115	46.6
Moderately food insecure	3	43	15.4	53	21.7
Severely food insecure	4	0	0	10	4.2
Total		**283**	**100**	**245**	**100**

Source: Field survey, 2020

Months of Adequate Household Food Provisioning (MAHFP)

Results in Table 9 show that relatively half (52.4%) of the male headed households had between 10 and 12 months of adequate provisioning indicating a very high food security with only 44.9% of the female headed households fell into this category. Findings indicate that 22.1 and 36.3% of the male and female headed households respectively were highly food secure with adequate food for 7–9 months, 19.6 and 8.6% of them were moderately food insecure with adequate food for 4–6 months while only 5.9% of the male and 10.2% of the female headed households were severely food insecure with adequate food less than 3 months a year.

Table 9: Classification of household heads based on months of adequate food provisioning

Categorization	Months of Adequate Household Food Provisioning Index (MAHFPI)	Male Headed Households		Female Headed Households	
		Frequency (f)	*Percentage (%)*	*Frequency (f)*	*Percentage (%)*
Very high	10 - 12	148	52.4	110	44.9
High	7 - 9	63	22.1	89	36.3
Medium	4 - 6	55	19.6	21	8.6
Low	0 - 3	17	5.9	25	10.2
Total		**283**	**100**	**245**	**100**

Source: Field survey, 2020

Food Security Index by gender

The results in Table 10 present the composite food security index of the male and female headed rural households in the research area. Results indicate that male headed households are more food secure with food security index (0.5519) compared to their female headed household counterparts with an index of 0.3453. The discrepancies between the two categories of household heads could attributed to how well they were able to cope and adapted to the food insecurity crisis during COVID-19 lockdown. The implication is that the effect of corona virus on rural households are more felt in female headed households than in their male counterparts.

Table 10: Composite food security index of household heads by gender

Household Heads (HH)	Food Security Indicators					Food Security Index (FSI)
	Food Consumption Score (FCS)	*Household Dietary Diversity Score (HDDS)*	*Months of Adequate Household Food Provisioning (MAHFP)*	*Coping Strategy Index (CPI)*	*Household Food Insecurity Access Scale (HFIAS)*	
Male	0.4993	0.2984	0.1875	0.1319	0.3014	0.5519
Female	0.3691	0.3117	0.0669	0.1036	0.2988	0.3453

Source: Field survey, 2020

Level of household heads food security

Table 11 present the distribution of rural household heads by their level of food security during corona virus lockdown in the study area. The food security index so computed lies between 0 and 1, with 1 indicating maximum food security and 0 indicating no food or food insecure at all. Based on results in Table 11 about half 48.8% of the male headed household and some 33.9% of the female headed households were food secure by all the indicators and more than half (51.2 and 66.1%) of the male and female headed households respectively failed to meet all the required indices of food security and thus we categorized them food insecure. This finding suggests that both the male and female headed households felt the impact of COVID-19 during lockdown but at a varying degree. Among the food insecure household heads, 29.1 and 32.6% of the male and female headed households were food secure by four indicators, 39.3% of the male and 35.9% of the female were food secure by three indicators, 28.5 and 19.3% of them respectively were food secure by two indicators, and only 3.1% of the male and 12.2% of the female headed households were food secure by one indicator.

Table 11: Gender distribution of household heads by their level of food security

Categorization	Food Security Index (FSI)	Male HH		Female HH	
		Frequency (%)	Percentage (%)	Frequency (%)	Percentage (%)
Food secure	0.50 - 1.00	138	48.8	83	33.9
Food insecure	0.0 - 0.49	145	51.2	162	66.1
Total		**283**	**100**	**245**	**100**

Source: Field survey, 2020

Correlation between indicators and composite food security index

In male headed household category, the results in Table 5 show that all indicators except months of adequate household food provisioning (MAHFP) and food consumption score (FCS) are significantly correlated with composite food security at 1% and 5% level of significance respectively. This suggests that there is linear relationship among these indicators and composite food security index. Also, there was no significant relationship between household dietary diversity score and coping strategy index and therefore the non-significant relationship between indicators and composite food security could be negligible and inconsequential as this would not distort final food security index. In female headed households' category, results in Table 5 show that all indicators indicated a significant relationship with composite food security index, except household food insecurity access scale (HFIAS) and food consumption scale (FCS) at varying degree. The positive relationship indicates that as an indicator increases the composite food security index (FSI) would also increase.

Table 12: Results of correlation between food security indicators

Male Headed Households						
	FCS	***HDDS***	***MAHFP***	***CPI***	***HFIAS***	***FSI***
FCS	1.000					
HDDS	0.126**	1.000				
MAHFP	-0.007	-0.109*	1.000			
CPI	0.189*	-0.431	-0.171*	1.000		
HFIAS	0.043**	0.296*	-0.341*	-0.207**	1.000	
FSI	0.537**	0.192**	0.168**	0.114**	0.205**	1.000
Female Headed Households						
	FCS	***HDDS***	***MAHFP***	***CPI***	***HFIAS***	***FSI***
FCS	1.000					
HDDS	0.489*	1.000				
MAHFP	-0.136**	0.294*	1.000			
CPI	-0.410*	-0.017*	0.626**	1.000		
HFIAS	-0.618	0.393*	-0.224**	-0.512**	1.000	
FSI	0.116**	0.157*	0.491**	0.002*	0.421**	1.000

* Significant at p=0.05 and ** Significant at p=0.01

Source: Field survey, 2020

Relationship of male and female headed households' in their level of food security

Table 13 shows that there was a positive and significant difference between male and female headed households' level of food security during COVID-19 lockdown in the research area. The t-test values were 5.106 and 5.014 for male and female headed households respectively at a p-value of 0.001. Also, male headed households had a mean value of 15.112 and standard deviation of 0.786 while female headed households had a mean value of 14.688 and standard deviation of 0.757. These findings suggest that male headed households were more food secure compared to their female headed household counterparts in the study area. Suhiyini (2019) opined that female-headed households were significantly more vulnerable to socio-demographic profile, livelihood strategies, social network, water and food than male-headed households. Further results in Table 13 show that the mean difference for male and female

headed households was 0.424 which may be accounted for the significant difference in their level of food security.

Table 13: Results of independent sample t-test showing differences in the level of food security among male and female household heads during COVID-19 pandemic

Variable	N	Mean	SD	SE	MD	t-test	*p-value*	Decision
Male	283	15.112	0.786	0.016	0.424	5.106	0.001	Significant
Female	245	14.688	0.757	0.012		5.014		

Source: Field survey, 2020

$p \leq 0.05$

CONCLUSION

Based on this study, indicator-based approach was adopted to compute composite food security index at household level and by gender using guidelines provided by World Food Programme (WFP) and the Food and Nutrition Technical Assistance communities (FANTA) that serve as alternative to conventional methodology. The study found that male headed households were relatively more food secure compared to their female headed household counterparts during the COVID-19 lockdown in the study area. There was positive and significant correlation between composite food security index and each classical indicators of food security at varying degree. Also, this study has confirmed that COVID-19 is major cause of food insecurity during lockdown at rural household level in South-western Nigeria where the region was declared as epicenter of the disease. The impact of COVID-19 on household food security was more felt in female headed households than male headed households and this was evidence across all indicators of food security used. There existed a significant difference in the level of food security and the two headed households in the study area. This study recommends household based COVID-19 education and enlightenment campaign by agricultural and health extension workers with view to bridge gender gap especially among the female headed households is required. Rural household should be given necessary financial support in terms of affordable loans, so that they can flexibly and resiliently respond to the threats posed by COVID-19. Respective state governments should provide personal protective equipment and advice services tailored for smallholder rural farmers involved in food production, handling and processing to help avoid catching and spreading COVID-19. Nigeria government should continue collect, update and share data, as well as support research, on the impact of the COVID-19 pandemic on household food security. Also, more studies should conducted to test the composite Food Security Index (FSI) in other areas using similar indicators or together with other indicators not included in this study such as Household Hunger Scale (HHS), Self-assessed food security (SAFS).

REFERENCES

Adepoju, A.O., S.A. Yusuf, B.T. Omonona and F.Y. Okunmadewa. (2011). Vulnerability Profile of Rural Households in South West Nigeria. J. Agric. Sc., 3(1).

Ajani, S. R. (2010). An assessment of dietary diversity in six Nigerian states. *African Journal of Biomedical Research, 13*, 161–167

Altman, M., Hart, T.G.B. & Jacobs, P.T. (2009). Household food security status in South Africa. *Agrekon*, 48 (4), 345-361.

Baba, I. B. and Zain, R.MD. (2016). Spousal Age Gap and Its Effects on Reproductive Health

Decision Making Process in Nigeria. *Journal of Culture, Society and Development,* 17: 40-45.

Ballard, T., Swindale, A., Coates J. and Deitchler, M. (2011). Household Hunger Scale: Indicator definition and measurement guide Washington DC, Food and Nutrition Technical Assistance Project-2 Bridge.

Begley, Sharon (2020). "Who Is Getting Sick, And How Sick? A Breakdown of Coronavirus Risk By Demographic Factors," March 3, 2020, https://www.statnews.com/2020/03/03/who-is-getting-sick-and-how-sick-a-breakdown-of-coronavirus-risk-bydemographic-factors/

Beltrami, S. (2020). How to minimize the impact of coronavirus on food security. The World Food Programme Insight. https://insight.wfp/how-to-minimize-the-impact-of-coronavirus-onfood-security-be2fa7885d7e. (Accessed 23/04/2020).

Chappell, Bill (2020). "COVID-19: COVID-19 Is Now Officially a Pandemic, WHO Says," *National Public Radio*, March 11, 2020, https://www.npr.org/sections/goatsandsoda/2020/03/11/814474930/COVID-19-COVID-19-is-now-officiallya-pandemic-who-says.

Coates, A., Swindale, A. and Bilinsky, P. (2007). Household food insecurity access scale for measurement of food access: indicator guide (v. 3). Washington, DC: Food and Nutrition Technical Assistance Project. DOI: 10.1007/s13398-014-0173-7.2

Danley, S. (2020). Food industry braces for coronavirus impacts. Food Business News. (accessed 17/03/2020).

Elham, H, A. (2020). Coronavirus COVID-19. *Poster J,* 9(1):5-13.

Food and Agriculture Organization (FAO). (2010). *The economic Review of Agriculture, Ministry of Agriculture.* Nairobe Kenya.

Food and Agriculture Organization (FAO). (2011). *The state of Food and Agriculture, Food and Agriculture organization of The United nations*, Rome.

Food and Agriculture Organization (FAO). (2012). Gender and nutrition. Gender and Nutrition Issue paper (Draft). Food and Agriculture Organization. Rome, Italy.

FAO (2020). Responding to the impact of the COVID-19 outbreak on food value chains through efficient logistics. Available at: www.fao.org/documents/card/en/c/ca8466en/1/04.20

Herforth, A., Nicolo, F.G., Veillerate, B., and Dufour, C., (2016). Compendium of Indicators for Nutrition-Sensitive Agriculture Final Draft. Rome, Italy: Food and Agriculture Organization of the United Nations.

IFPRI (International Food Policy Research Institute). 2008. Validation of Food Frequency and Dietary Diversity as Proxy Indicators for Household Food Security. Report submitted to WFP. Washington DC: IFPRI.

Kassie, M., Ndiritu, S. W. and Stage, J. (2014). What Determines Gender Inequality in Household Food Security in Kenya ? Application of Exogenous Switching Treatment Regression. *Journal of World Development,* 56: 153-171.

Lambrecht, I. B. (2016). ''As a Husband I Will Love, Lead, and Provide". Gendered Access to Land in Ghana. *Journal of World Development*, *88*: 188-200.

"Mapping the Spread of the COVID-19 in the U.S. and Worldwide," Washington Post Staff, *Washington Post*, March 4, 2020. https://www.washingtonpost.com/world/2020/01/22/mapping-spread-new-COVID-19/?arc404=true.

Maxwell, D., and Caldwell, R. (2008). The Coping Strategies Index A Tool for Rapid Measurement of Household Food Security and the Impact of Food Aid Programs in Humanitarian Emergencies Field Methods Manual The Coping Strategies Index Field Methods Manual Second Edition, January 2008, 2nd Edn.

Melgar-Quinonez, H.R., Zubieta, A.C., McNelly, B., Nteziyaremye, A., Gerardo, M.P.D., Dunford, C (2006). Household food security and food expenditure in Bolivia, Burkina Faso, and the Philippines. *Journal of Nutrition*. 2006; 136:1431s–7s.

Mutea, E., Bottazzi, P., Jacobi, J., Kiteme, B., Speranza, C.I., and Rist, S (2019). Livelihoods and Food Security among Rural Households in the North-Western Mount Kenya Region. Front. Sustain. Food Syst. 3:98. doi: 10.3389/fsufs.2019.00098

Nicklett, E.J. and Kadell, A.R (2013). "Fruit and vegetable intake among older adults: a scoping a review," *Maturitas*, 75.305-312.2013.

Ou, F., Wu, H., Yang, Y., Tan, W., Zhang, J., and Gu, J. (2020). Countermeasures for rapid spread of new coronavirus pneumonia in Wuhan. Chinese General Practicing Nursing. http://kns.cnki.net/kcms/detail/14.1349.R.20200131.1319.002.html. (Accessed 23/04/2020).

Rajendran, S. (2012). *Dietary diversity scores measurements.* Available online: http://www.slideshare.net/nfpcsp/topic-21-diet-diversity-stata (Accessed: 23-05-2020).

Sahu, A. K., Chüzho, Z., and Das, S. (2017). Measuring household food security index for high hill tribal community of Nagaland, India. *Journal of Food Security.* 5, 155–161. doi: 10.12691/jfs-5-5-1.

Sands, Peter (2020). "COVID-19 Threatens the Poor and Marginalized More than anyone," The Global Fund to Fight AIDS, Tuberculosis and Malaria, March 5, 2020, https://www.linkedin.com/pulse/covid-19-threatens-poor-marginalized-morethan-anyone-peter-sands-1f/.

Sseguya, H (2009). Impact of social capital on food security in South east Uganda. Graduate Theses and Dissertations, 2009: Paper 10747, Iowa State University.

Suhiyini, I. A., John, K.M.K., and Yaw, B. O. (2019). Gender dimension of vulnerability to climate change and variability: Empirical evidence of smallholder farming households in Ghana. *International Journal of Climate Change Strategies and Management.* Vol. 11 No. 2, (2019), pp. 195-214. DOI: 10.1108/IJCCSM-10-2016-0156

Swindale, A., and Bilinsky, P. (2006). Household Dietary Diversity Score (HDDS) for Measurement of Household Food Access: *Indicator Guide (Version 2).* FHI360/FANTA, Washington, DC. Available online at: www.fantaproject.org.

Swindale, A., and Bilinsky, P. (2010). Months of Adequate Household Food Provisioning (MAHFP) for Measurement of Household Food Access*: Indicator Guide VERSION 4*. FHI 360/FANTA, Washington, DC.

United States Agency for International Development (USAIDS). (2015). *FFP Indicators Handbook part1: Indicators for baseline and final evaluation survey*. Food and Nutrition Technical Assistance III Project (FANTA III), Connecticut Avenue, NW Washington, DC.

Vakili, M., Abedi, P., Sharifi, M., & Hosseini, M. (2013). Dietary diversity and its related factors among adolescents: A survey in Ahvaz-Iran. *Global Journal of Health Science, 5*, 181–186. doi:10.5539/gjhs.v5n2p181

World Food Programme (2008). *Food Consumption Analysis Calculation and Use of the Food Consumption Score in Food Security Analysis*. Rome. Available online at: www.wfp.org/odan/senac