FOOD AND NUTRITION SECURITY AND ANTHROPOMETRIC STATUS OF FARMERS IN OBOWO LOCAL GOVERNMENT AREA, IMO STATE, NIGERIA

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ABSTRACT

The cross-sectional study assessed the food and nutrition security and anthropometric status of 355 farmers from 5 randomly selected communities out of the 14 in the Local Government Area. A structured questionnaire was used to elicit their personal data, food and nutrition security status and anthropometry. Descriptive statistics was used to analyze data collected while chi-square and Pearson's correlation were used to associate food and nutrition security status of the farmers and anthropometric status. Food security indicators showed that 54.4% were food secure while the rest (40.4% and 5.2%) were food insecure without hunger and with hunger, respectively. The nutrition security indicators showed that 60.2% of the farmers were nutrition secure while 31.9% and 7.9% were moderate and severe nutrition insecure, respectively. The anthropometric status by BMI of farmers revealed that 47.1% were overweight while 13.5% were normal. Waist-hip ratio showed that 52.7% and 30.4% were of moderate and high risks, respectively. Negative but significant relationship was noted between food security status and anthropometric status. The association between some nutrition security indicators and their BMI was positive and significant. This shows that improved food and nutrition security status is very crucial for maintenance of good health.

Keywords: Food security, Nutrition security, Anthropometry

INTRODUCTION

The persistence of hunger in a world with abundant natural resources has led to food and nutrition insecurity across all populations. This is evident among the rural poor whose means of livelihood is primarily dependent on subsistence agriculture. Food insecurity remains a global concern and it can be transient or chronic. According to Agarwal & Udipi (2014), transitory or short term food insecurity is usually caused by problems with access or availability like during times of crop failure, inflation or during off-season, unemployment or illness of the person who supports the household while chronic food insecurity occurs over a long period of time, hence

the household cannot meet its requirements due to lack of money or poverty.

Globally, an estimated 820million people did not have enough food to eat in 2018 while the number of moderately or severely food insecure is 2billion or 26.4%. Of this, 29.8% was in Africa while Asia accounted for 6.9% (Food and Agriculture Organization (FAO) (2018a). The same source further stated that income inequality is rising in many of the countries where hunger is on the rise making it even more difficult for the poor and vulnerable to cope with economic downturns and the situation is worse in Africa where 256.1million persons are hungry. In Nigeria, 79.2% of households studied in two states were food insecure (Asomugha, Uwaegbute, & Obeagu, 2017). Preceding that report was the fact that not less than 70% of the Nigerian population was surviving on less than a dollar per day while food insecurity prevalence in the low income urban and rural households stood at 79% and 71%, respectively (Akerele, Momoh, Aromolaran, Oguntona & Shittu, 2013).

Threats to food security according to Agarwal & Udipi (2014) are declining productivity, increasing population, increasing incidence of pockets of poverty, declining income from traditional crops, high dependence on imports and growing incidence of food-related diseases. However, Ilaboya, Atikpo, Omofuma, Asekheme & Umukoro (2012), Otaha (2013), Behnassi, Drajgan &Yaya (2011), Adeagbo (2012), and Nwajiuba (2013) identified insufficient production, gender inequality, inefficient policies and corruption, conflicts and civil unrest, climate change and natural disasters and low technology for processing and storage as factors affecting food security. Therefore, ensuring food security involves addressing those factors and threats as well as investing on agriculture because it is the largest source of income and employment for poor rural households. Food security can be improved by helping the small farmers and their households have more resilient and sustainable farming systems (Agarwal & Udipi, 2014).

Nutrition security is more than food security because it focuses on adequate nutritional status in terms of macro and micronutrient intakes for all household members at all times as well as caring, health services and a healthy environment. Several aspects are involved in food utilization or use for nutrition and health outcome and they include safe portable water, sanitation and hygiene practices, health facilities, feeding, caring and sharing practices within households as well as contributions by women which include their decision making power, education, nutrition knowledge and behavior, health, workload and availability of time and technology (FAO, 2018b).

The problem of food and nutrition security has led to multiple forms of malnutrition which can be under or over nutrition. According to Development Initiatives (2018), the multiple forms of malnutrition can exist in the same person at the same time. It is also more prevalent in low, lower-middle and middle –income countries and concentrated among the poor. Also, obesity in

high income countries is more among the poor (FAO, 2018b). Additionally, overweight/obesity and household food insecurity also co-exist (Tabibian, Daneshazad, & Bellissimo, 2018). For instance, a household may have both a stunted child and an overweight or obese mother while a child could be stunted and overweight. Globally, adults who are obese are 672million which is 13% or 1 in 8 adults (FAO, 2018b). According to World Health Organization (WHO) (2018), overweight prevalence among adults increased from 35.7% in 2010 to 38.9% in 2016 and on the average, it is greater among women (39.2%) than men (38.5%).

Improvements in nutrition are critical to ensuring healthy lives and also plays a role in ending poverty. But the challenge lies on assessing the situation and collecting reliable data. Anthropometry is one way of assessing nutritional status through series of quantitative measurements. The core elements of anthropometric measurements are height, weight, body circumferences (waist and hip) and skinfold thickness. Casadei & Kiel (2020) opine that the measurements are important because they represent diagnostic criteria for obesity and are used to assess nutritional status among children and adults. Therefore, the study was designed to assess the food and nutrition security and anthropometric status of farmers in Obowo Local Government Area, Imo State, Nigeria.

Objectives of the study
The general objective of the study is to assess the food, nutrition security and anthropometric status of farmers in Obowo L.G.A of Imo stare. The specific objectives are to:
  i.   Assess the food and nutrition security status of the farmers.
  ii.   Assess their anthropometric status.
  iii. Determine the association between nutrition security status and their body mass indices.

Research questions
The under-listed questions guided the study:
  i.   What is the food and nutrition security status of farmers in Obowo Local Government Area?
  ii.   What is their current anthropometric status?
  iii.   Is there any relationship/association between their food and nutrition security status and their body mass indices?

METHODOLOGY
Study design: A cross-sectional study design was used.
Area of study: The study was carried out in Obowo Local Government Area of Imo State. The area is right across the Imo River. The major occupations of the people are farming and fishing. Some agricultural products of the area are palm oil, rice, yam etc. The estimated population of the Local Government Area is 64000 (National Population Commission (NPC) (2006).

Sample size and sampling procedure: The sample size was calculated using the formula, N $=Z^2*P$ (100-P)/ X^2 by Winn, Naing, & Rusli, (2006), where N= sample size; Z= confidence interval represented as 1.96; P= percentage of farmers in Nigeria (FAO, 2017), put at 70%; 100-P= percentage of persons assumed not to be farmers in Nigeria and X= width of confidence interval or required precision level taken to be 5%. Substituting the values in the equation: sample size (N)= 1.96^2*70 (100-70)/5^2= 323 approximately. Then, 10% of 323 was added as drop out making the sample size to be 355.

Imo State and Obowo Local Government Area were purposively selected from the 5 South Eastern States and 27 Local Government Area of Nigeria and Imo State, respectively. The Local Government Area was purposively selected because most of the communities were rural. Out of the 14 communities there, 5 were randomly chosen by balloting and 71 farmers were also randomly chosen from each of the selected community.

Method of data collection: A structured and validated questionnaire which consists of three sections: personal data, food and nutrition security and anthropometric status was used to elicit information from the farmers. Three trained research assistants administered the questionnaires using both interview and self-administration methods after obtaining oral informed consents from the farmers. The anthropometric measurements of weight, height, waist and hip circumferences were carried out using portable bathroom scale, stadiometer and non-stretchable tape. Prior to data collection, the questionnaires were validated for pre-test on twenty five farmers who were not part of the final study.

Weight of the farmers were measured by first setting the scale at zero and then they were asked to stand on the scale without shoes, heavy clothes and jewelries. The weights were taken to the nearest 0.1kg while standing in an upright position. Heights of the farmers were measured while they stood with their heels together and weight evenly distributed. Their shoulder blades, buttocks and heels placed on or touching the stadiometer vertical backboard. Their arms hanged loosely at their sides while their palms faced their thighs and then the horizontal bar of the stadiometer was lowered until the hair was compressed at the crown of the head. Thereafter, their heights were measured to the nearest 0.1cm (Casadei & Kiel, 2020). The weight and height measurements of the farmers were used to calculate their body mass indices using the formula BMI=weight (kg)/height (m^2).

Waist and hip circumferences were measured according to the standard procedures outlined by WHO (2008b). Prior to the measurements, the farmers stood with arms at their sides, feet positioned close together and weights evenly distributed across their feet. Then, a stretch-resistant tape was snug around each of them and slightly pulled so that it was not constricting. Thereafter, each farmer was advised to relax, take a few deep breaths and the measurements were taken at the end of normal expiration when the lungs are at their functional residual

capacity. Waist circumference measurements was done approximately at the midpoint between the lower margin of the last palpable rib and the top of the iliac crest while the hip measurement was taken around the widest portion of the buttocks. All the measurements were done twice and the average used for calculating the waist-hip-ratios which were obtained as waist circumferences divided by the hip circumferences.

Data analysis: The calculated body mass indices and waist hip ratios of the farmers were classified according to the reference values outlined by WHO (2005) and WHO (2008a), respectively.
 Food security was assessed using the core food security module with four response options (never=0, rarely=1, sometimes=2 and often=3) which were used to categorize the farmers as food secure with score of less than 3, food insecure without hunger with a score of 4-6 and food insecure with hunger with a score of greater than 7.
Nutrition security was assessed using questions that covered food preparation, proper food combination, water, sanitation and hygiene and access to health care facilities. The nutrition security status was graded into nutrition secure (0-19 points), moderate nutrition insecure (20-39 points) and severe nutrition insecure (40-60 points).

Statistical analysis: The data obtained from the personal data, food and nutrition security status and anthropometric status of the farmers were analyzed using frequencies and percentages. The relation/ association between food and nutrition security status and anthropometric status of the farmers was done using Pearson's correlation and chi-square.

RESULTS
Table I: Personal Characteristics of the Farmers

Variables	Frequency (F)	Percentage (%)
Sex		
Male	174	49.0
Female	181	51.0
Total	**355**	**100.0**
Age range (years)		
18-35	190	53.5
36-45and above	165	46.5
Total	**355**	**100.0**
Highest educational level		
No formal education	12	3.4
Primary education	170	47.9
Secondary education	104	29.3
Tertiary education	69	19.4
Total	**355**	**100.0**

Occupation

Civil/public servant	144	40.6
Businessman/woman	26	7.3
Farmer	147	41.4
Artisan	32	9.0
Not employed	6	1.7
Total	**355**	**100.0**

Range of monthly income (N)

<18000	136	38.3
18000-30000	119	33.5
>30000	100	28.2
Total	**355**	**100.0**

Toilet facility

Bush	6	1.7
Water closet	17	4.8
Bucket	123	34.6
Pit latrine	209	58.9
Total	**355**	**100.0**

Shared toilet facility

Yes	147	41.4
No	208	58.6
Total	**355**	**100.0**

Sources of drinking water

River/stream/pond	73	20.6
Well	37	10.4
Borehole	190	53.5
Piped borne water	55	15.5
Total	**355**	**100.0**

Sources of cooking fuel

Kerosene	116	32.7
Gas	30	8.5
Charcoal	70	19.7
Firewood	130	36.6
Electricity	9	2.5
Total	**355**	**100.0**

The personal data of the farmers is presented in Table I. The result showed that 51.0% of them were females while the rest (49.0%) were males. Of those proportions, 46.5% were between the age ranges of 36-above 45years while 53.5% were of age 18-35years. Highest educational level

of the farmers indicated that 47.9% had primary education, 29.35% had secondary education while the rest (19.4% and 3.4%) had tertiary and no formal education, respectively. On their occupation, 41.4% were farmers and 40.6% were civil/public servants. Their range of monthly income revealed that 38.3% earned less than N18000 while 33.5% earned between N18000-30000. The toilet facilities commonly used by the farmers were pit latrine (58.9%), bucket (34.6%) and water closet (4.8%) and 41.4% shared those toilet facilities with others. More than half (53.5%) of the farmers main source of drinking water was borehole while 20.6% indicated rivers/stream/pond. Firewood (36.6%) was the main source of cooking fuel while 32.7% used kerosene.

Table II. Food Security Indicators of the Farmers

Variables	Never F (%)	Rarely F (%)	Sometimes F (%)	Often F (%)
Were you ever worried that your household would not have enough food?	161 (45.3%)	61 (17.2%)	127 (35.8%)	
Were you or any household member not able to eat the kinds of foods you preferred because of lack of resources?	124 (34.9%)	131 (36.9%)	90 (25.4%)	6 (1.7%)
Did you or any household member have to eat a limited variety of foods due to lack of resources?	149 (42.0%)	91 (25.6%)	105 (29.6%)	10 (2.8%)
Were you or any member or your household not able to feed on nutritious animal-source foods like eggs and meat because you could not afford them?	147 (41.4%)	57 (16.1%)	104 (29.3%)	47 (13.2%)
Did you or any household member have to eat a smaller meal than you felt you needed because there was not enough food?	144 (40.6%)	78 (22.0%)	83 (23.4%)	50 (14.1%)

Was there a time when you had no food of any kind to eat in your household because of lack of resources to get food?	140 (39.4%)	81 (22.8%)	120 (33.8%) 14 (3.9%)
Did you or any household member go to sleep at night hungry because there was not enough food?	117 (33.0%)	129 (36.3%)	103 (29.0%) 6 (1.7%)
Did you or any household member go a whole day and night without eating anything because there was not enough food?	137 (38.6%)	101 (28.5%)	114 (32.1%) 3 (0.8%)
Have food stored in your home ever run out and there was no money to buy more?	141 (39.7%)	67 (18.9%)	126 (35.5%) 21 (5.9%)

Table III. Overall Mean of Food Security Status

Dimension of food security	Frequency (F)	Percentage (%)
Food secure	193	54.4
Food insecure without hunger	144	40.4
Food insecure with hunger	18	5.2
Total	**355**	**100.0**

Tables II and III present the food security indicators of the farmers and their status. In Table II, 45.3% of the farmers never worried that their households would not have enough food while 35.8% sometimes worried. Lack of resources caused 25.4% of the farmers sometimes not to eat their preferred foods while 34.9% never did that. Sometimes, 29.6% of the farmers ate foods of limited variety but 41.4% never did that. Nutritious animal- source foods were sometimes or often not part of the diets of 42.5% of the farmers because they could not afford them, however, it never or rarely was the case for 57.5% of them. Limited meals were eaten because of inadequate food sometimes for 23.4% of the farmers and 40.6% never reduced the quantity of their meals. Food was not available sometimes for 33.8% of the farmers. Going to sleep at night hungry was never and rarely an option for 33.6% and 36.3% of the farmers, respectively, but it was sometimes the situation for 29.0% of them. Sometimes, 32.1% of the farmers skipped meals a whole day and 35.5% sometimes ran out of food in the home and had no money to buy more.

Overall, 54.4% of the farmers were food secure while 40.4% and 5.2% were food insecure without hunger and with hunger, respectively.

Table IV: Nutrition Security Indicators of the Farmers

Variables	Frequency (F)	Percentage (%)
Water for meal preparation		
River/stream/pond	140	39.5
Well	18	5.1
Borehole	165	46.5
Pipe-borne water	32	9.0
Total	**355**	**100.0**
Storage of leftover food		
Refrigeration	109	30.7
Reheating	162	45.6
Others	84	23.7
Total	**355**	**100.0**
Foods to be preserved		
Meat/offal/poultry/fish	292	82.3
Beans/rice/corn/yam	27	7.6
Dried milk/dairy product	36	10.1
Total	**355**	**100.0**
Consumption of animal foods		
Fish	177	49.9
Meat	47	13.2
Chicken	94	26.5
Eggs	37	10.4
Total	**355**	**100.0**
Daily vegetable inclusion		
Once	179	50.4
Twice	84	23.7
Three times	72	25.9
Total	**355**	**100.0**
Vegetable preparation		
Wash before cutting	292	82.3
Wash after cutting	63	17.7
Total	**355**	**100.0**
Daily fruit intake		
Once	258	72.7
Twice	24	6.8
Three times	53	20.5
Total	**355**	**100.0**
Prevention of sickness		

Wash hand after going to toilet or cleaning baby bottom	142	41.1
Remove faeces from home and surroundings	43	12.1
Wash hand before preparing and eating foods	25	7.0
All of the above	141	39.7
Total	**355**	**100.0**
Visit to health facilities		
Yes	237	66.8
No	118	33.2
Total	**355**	**100.0**
If no, reasons		
No money to pay bills	55	46.6
Lack of health facilities	43	36.4
Use patent medicine stores	20	17.0
Total	**118**	**100.0**
Types of health facilities		
Primary health centre	105	44.3
General hospital	45	19.0
Teaching hospital	22	9.3
Private clinics	65	27.4
Total	**237**	**100.0**

Table V: Overall Nutrition Security Status of the Farmers

Nutrition security status	Frequency (F)	Percentage (%)
Nutrition secure	214	60.2
Moderate nutrition insecure	113	31.9
Severe nutrition insecure	28	7.9
Total	**355**	**100.0**

The nutrition security indicators identified and the nutrition security status of the farmers are presented in Tables IV and V. The result showed that 46.5% of the farmers used borehole water for meal preparation while 39.55 used water fetched from river/ stream/ pond. On storage of leftover foods, 45.6% reheated while 30.7% stored in the refrigerator. Majority (82.3%) of the farmers identified meat, offal, poultry and fish as foods to be preserved and the rest (17.7%) opted for non-perishable food items like cereals and dried milk. The pattern of consumption of animal-source foods showed that 49.9% of the farmers ate fish, 26.5% chicken while 13.2% and 10.4% ate red meat and eggs, respectively. A little above half (50.4%) included vegetables in their meals once a day, while 23.7% and 25.9% did that twice and three times, respectively.

Those vegetables were washed before cutting by 82.3% of them while 17.7% washed after cutting. Fruits were taken once daily by 72.7% of the farmers while 6.8% and 20.5% took it twice and three times, respectively. Few (39.7%) of the farmers were able to identify all the ways in which sickness can be prevented while the rest (60.3%) only chose one out of the three ways. Health care centres were visited by 66.8% while 33.2% of the farmers did not. The major reasons why they did not were lack of money to pay bills (46.6%) and lack of health centres (36.4%). The major health facilities available for the farmers were primary health centre (44.3%) and private clinics (27.4%). Based on the nutrition security indicators assessed, 60.2% of the farmers were nutrition secure while 31.9% and 7.9% were moderate and severe nutrition insecure, respectively.

Table VI: Anthropometric Status of the Farmer.

Anthropometric Variable	Male		Female		Total	
	F	%	F	%	F	%
Body Mass Index Status (BMI)						
Underweight (<18.5)	4	2.3	2	1.1	6	1.7
Normal (18.5-24.99)	32	18.4	16	8.8	48	13.5
Overweight (25.0-29.9)	73	41.9	94	51.9	167	47.1
Obesity (30 and above)	65	37.4	69	38.2	134	37.7
Total	**174**	**100.0**	**181**	**100.0**	**355**	**100.0**
Waist Circumference (WC)						
Not at risk (<94cm for males; <80cm for females)	138	79.3	144	79.6	282	79.4
Increases risk (94-101.99cm for males; 80-87.99cm for females)	36	20.7	37	20.4	72	20.6
Total	**174**	**100.0**	**181**	**100.0**	**355**	**100.0**
Waist-Hip Ratio Status (WHR)						
High risk (>1.0 for males; > 0.85 females)	54	31.0	57	31.5	111	30.4
Moderate risk (0.90-1.0 for males; 0.80-0.85 for females)	100	57.5	103	56.9	203	57.2
Low risk (<0.90 for males; <0.80 for females)	20	11.5	21	11.6	41	11.4
Total	**174**	**100.0**	**181**	**100.0**	**355**	**100.0**

Table VII: Relationship between Food Security Status and Anthropometric Status of the Farmers

		BMI	WC	WHR	FSS
BMI	Pearson correlation	1	.019	.345	.150
	Sig. (2 tailed)		.716	.567	.005[**]
	N		355	355	355
WC	Pearson correlation		1	.765	.199[**]
	Sig. (2 tailed)			.105	.000
	N			355	355
WHR	Pearson correlation			1	.126
	Sig. (2 tailed)				.002[**]
	N				355
FSS	Pearson correlation				1
	Sig. (2 tailed)				
	N				355

[**] **Correlation is significant at the 0.01 level (2 tailed).**

Key: FSS = Food Security Status. BMI= Body mass index, WC= Waist circumference, WHR= Waist-hip-ratio

Table VIII. Association between Nutrition Security Indicators of the Farmers and their BMI

	Anthropometric parameters						
Nutrition security variables	**Under weight (%)**	**Normal (%)**	**Overweight (%)**	**Obese (%)**	**Total**	**X^2- value**	**P-value**
Proper cooking of food							
They are boiled and well cooked	56(9.3)	198(68.3)	23(7.9)	19(6.5)	290	107.989[**]	0.000
They are hot	9(30.0)	13(43.3)	5(16.7)	3(10.0)	30		
The ingredients were thoroughly mixed	7(20.0)	18(51.4)	7(20.0)	3(8.6)	35		
Prevention of sickness							
Wash hand after going to toilet or cleaning baby bottom	57(37.5)	67(47.2)	10(7.0)	8(5.6)	142	67.09[**]	0.008
Remove feces from	13(30.2)	26(60.5)	4(9.3)	0(0)	43		

home and surroundings						
Wash hands before preparing and eating foods	7(28.0)	9(36.0)	7(28.0)	2(8.0)	25	
All of the above	34(24.1)	78(55.3)	22.(15.6)	7(4.9)	141	
Storage of left over						
Refrigeration	23(21.1)	56(51.4)	22(20.2)	8(7.3)	109	74.09**	0.005
Reheating	44(27.2)	87(53.7)	27(16.7)	4(2.5)	162		
Others	14(16.7)	56(66.7)	9(10.7)	5(5.9)	84		
Reasons to avoid cross contamination						
They have offensive odor	18(14.6)	75(61.0)	23(18.7)	7(5.7)	123	34.45*	0.017
They are not cooked	44(27.2)	87(53.7)	27(16.7)	4(2.5)	162		
Raw animal food often contain germ	23(32.8)	27(38.6)	15(21.4)	5(7.1)	70		
Source of water for meal preparation						
River/stream/pond	34(24.1)	78(55.3)	22(15.6)	8(4.9)	140	27.23*	0.035
Dug well	4(22.2)	6(33.3)	7(38.9)	1(5.5)	18		
Borehole	35(21.2)	90(54.5)	30(18.2)	10(6.1)	165		
Public water supply	9(28.1)	18(56.2)	3(9.4)	2(6.2)	32		

** **and * are significant at 1% and 5%, respectively**

Tables VI, VII and VIII present the anthropometric status of the farmers and the association between them, food security and nutrition security status. The result showed that 47.1% of the farmers were overweight of which 41.9% and 51.9% were males and females, respectively. The proportion of them who were obese were 37.7% with the females recording slightly higher prevalence of 38.2%. Those who were found to be normal and underweight were 13.5% and 1.7%, respectively. Waist –hip-ratios indicated that 57.2%, 30.4% and 11.4% were at moderate risk, high risk and low risk, respectively. There was negative correlation between BMI and food security status of the farmers. All the nutrition indicators associated with body mass index of the farmers showed positive and significant associations.

DISCUSSION

Age and sex are important demographic variables used mainly for classification in vital statistics, censuses and different types of surveys. Greater female farmers recorded in this study is not out of place as many reports have shown that females are more involved in agricultural activities especially at the subsistence level. The 2013 Nigerian Demographic and Health Survey reported that 68.8% of women aged 30-49years had agriculture as their occupation. Of that proportion, 22.4% resided in rural areas and specifically in Imo State, the proportion was 16.1% (National Population Commission, 2013). The age category of the farmers recorded in this study was also consistent with the same report where 57.5% and 55.3% were reported nationally to be of ages 15-34 and 35-49 years, respectively. This clearly shows that agriculture remains the main occupation and source of livelihood for most people in the country and in rural areas in particular.

To support that assertion, Sasu (2022) stated that 70% of Nigerian households practice crop farming and 87% of households practice crop farming in rural areas of Nigeria while FAO (2022) opined that over 70% of Nigerians engage in the agricultural sector mainly at the subsistence level. Other people who may have other occupations as civil/public servants, entrepreneurs use agriculture to supplement their incomes. However, the monthly incomes earned by these farmers were very low when compared to the current economic situation. This further shows that most of the farmers may be living on less than 11 dollars per person per day typical of people living in lower-middle-income countries (World Bank, 2018).

Education is an important determinant of an individual's attitude and outlook on various aspects of life. In Nigeria, educational attainment is said to be fairly high as 45% of women and 62% of men have a secondary or higher level of education (National Bureau of Statistics (NBS) (2018). The report is consistent with the findings of this survey. Access to water and sanitation facility has considerable health and economic benefits to both households and individuals. The findings from this survey noted that more than half of the farmers used pit latrine which was not an improved sanitation facility. This depicted the typical Nigerian situation where an improved sanitation facility was used by only 47% of households even though it improved from 31% in 2008 to 34% in 2012 and 37% in 2015 (NBS, 2018).

In South East and Imo State in particular, it was 56.2% and 58.8%, respectively. Improved sources of drinking water such as piped water, borehole and protected well, spring or rain water were accessible to 56.8% of households in Nigeria, 65.2% south Eastern Nigeria and 84.2% in Imo State (NBS, 2018). The present survey thus indicated that borehole has become increasingly the main and improved source of drinking water for many people in Nigeria. The rest of the farmers whose sanitation facilities and sources of drinking water were not improved could be at risks of many diseases such as diarrhea, cholera, typhoid fever etc. due to lack of access to safe drinking water and inadequate disposal of human excreta. Firewood and charcoal are solid fuels and are mainly used by the farmers in cooking. These lead to high levels of smoke, which is made up of pollutants that can increase the risk of contracting diseases. Additionally, kerosene

which is also used to cook by the farmers is now becoming increasingly expensive in comparison with cooking gas.

Food insecurity, a state in which people experience limited or uncertain physical and economic access to safe, sufficient and nutritious food to meet their dietary needs or food preferences for a productive, healthy and active life according to Keino, Plasqui & Vanden Borne (2014), remains highly prevalent in developing countries and over the past two decades has increasingly been recognized as a serious public health problem in both developing and developed countries (FAO, 2013). The high prevalence of food insecurity reported by the study corroborated the global report of 10.2% of severe food insecurity in 2017 of which 29.8% was for Africa while Asia recorded 6.9% (FAO, 2018). If nothing is done to the already precarious situation, it is going to hamper the progress towards achieving sustainable development goal target 2.1 which is: "By 2030, end hunger and ensure access by all people especially the poor and vulnerable groups (infants, children under age five, women and older persons) to safe, nutritious and sufficient food all year round".

Food insecurity in terms of poor food access contributes to different forms of malnutrition which can also be attributed to nutritional problems. The obvious effect in simple terms is nutrition insecurity and the prevalence of nutrition insecurity in this study was not far-fetched from lack of access to basic sanitation, water and health facilities as well as other underlying factors affecting nutrition security. It has been established earlier in the personal data of the farmers that most of them lacked access to those basic needs. However, in Nigeria, most rural communities lack basic primary health centers that are well-equipped and functional. This may further worsen the health condition of the people together with other factors such as lack of money.

Kapur (2011) defined nutrition security as physical, economic, environmental and social access to an adequate diet and clean water for every child, woman and man. In line with that definition the study accessed the source of water for meal preparation, storage of leftover foods, prevention of sickness, access to health facilities as some of the nutrition security indicators. The physical and economic input for nutrition security are earlier covered under food security. The study found that some of the farmers experienced instability in their access to food probably due to sickness, lack of adequate storage facilities and poor sanitation. This therefore undermine the nutrition security which exists when secure access to an appropriate nutritious diets is coupled with a sanitary environment and adequate health services and care in order to ensure a healthy and active life for all household members (FAO, 2018a). At the long run it negatively affects nutritional status of individual concerned. The few farmers who were found to have little or no access to food, experienced poor utilization and poor food stability were in congruent with the findings of Osei, Pandey, Nielson, Shrestha, & Talukdor (2010) who reported that 10% of households they studied were nutrition insecure due to poor access to and utilization of food.

The double burden of under and over-nutrition is affecting many people across all age categories globally. This double burden co-exist in the same people at the same time. The study found both underweight and overweight/obesity among the farmers indicating that overweight /obesity and household food insecurity also coexist as also asserted by Tabibian *et al*. (2018). The prevalence of overweight/obesity reported in this study was high compared to a range of 20.3%-35.5% for overweight and 8.1%-22.2% for obesity reported by Chukwuonye, Abali, Collins & Kenneth (2013). The proportion of farmers found to be at increased risk of abdominal obesity was similar to the findings of Egbe (2014). Overweight and obesity are conditions of abnormal or excessive fat accumulation that may impair health. They are causes of many non-communicable diseases such as non-insulin dependent diabetes mellitus, coronary heart disease and stroke. They also increase the risk of many types of cancer, gall bladder disease, musculoskeletal disorders (WHO, 2018). Urgent action is needed to tackle the problem of over nutrition if sustainable development goal 3 is to be achieved which proposes "good health and well-being for people". Achieving that will ensure the achievement of other goals because "health is wealth".

The negative but significant correlation found between food security status and BMI implies that an increase in food security status will lead to decrease in BMI and vice versa. Incongruent with the finding, Ruel, Garrell, Yosef, & Olivier (2014) and Kennedy and Pauline (2017), found a negative relationship between food security and weight status. The probable explanation for that negative relationship as well as the positive relation and food security status could stem from the link between food insecurity and overweight/obesity as a result of increased BMI and abdominal fat. Adequate and nutritious diets and fresh foods are often expensive, hence households that are food insecure as a way of coping often choose less expensive foods that are high in calorie and low in nutrients. Additionally, the link between food insecurity and obesity have psychosocial route such that the experience of not having certain or adequate access to food often causes feelings of anxiety, stress and depression which can lead to patterns of bingeing or overeating when food is available or choosing low cost energy dense foods rich in fat, sugar and salt. Such cycles of feast and famine have been associated with an increase in body fat and more rapid weight gain when food becomes available (Maitra, 2018).

All the nutrition security variables (proper cooking of food, prevention of sickness, storage of leftover foods, reasons to avoid cross-contamination and source of water for meal preparation) showed significant positive associations with the BMI of the farmers. Ayantoye, Yusuf, Omonona, & Amao (2011) found such association between nutrition security status of households and their anthropometric status. This implies that all the variables are all environmental and social inputs required for nutrition security. That means that improvement in any of them or all of them will improve the nutrition security status of the farmers. For instance, prevention of sickness through health services and proper food preparation through use of clean water and avoidance of cross-contamination ensures proper food utilization which improves nutrition and overall health status.

CONCLUSION AND RECOMMENDATIONS

More female farmers were studied and the entire farmers had mainly basic education operating majorly at subsistence level as shown by their income levels. A little above half of the farmers were food secure while the rest were food insecure. More than half of them were nutrition secure while the remaining were not. However, double burden of malnutrition existed among the farmers with over nutrition being more prevalent. Majority of them were not at risk based on their waist circumferences. Nonetheless, their waist-hip- ratios showed that majority were at risk, slightly evenly distributed among the male and female farmers. The study generally showed that improvement in food security status of the farmers will lead to a decrease in BMI, thus reducing the proportion of them who are overweight or obese. Additionally, the positive significant associations noted between some nutrition security variables and BMI implies that adequate sanitary and health outcomes for the farmers will help improve their overall nutrition and health status.

A sustainable nutrition education programme should focus on food procurement, hygienic preparation methods and storage to address the food and nutrition insecurity experienced. The farmers should be assisted with inputs by the government to enable them operate at a commercial level for self-sufficiency. Good food choice will also enable the farmers maintain a healthy weight even in the face of imminent food shortage.

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