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RESEARCH ARTICLE

CONSUMPTION OF PLANT PROTEIN FOODS: INSIGHT FROM THE COVID-19 ERA

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ABSTRACT

This study was conducted in Lagos State, Nigeria during December, 2021 – January, 2022 to understand the consumption of plant protein foods, with focus on the COVID-19 era. Primary data was collected from a total of 600 households in 6 Local Government Areas of Lagos State using multistage sampling technique. The data collected were analyzed using descriptive and inferential statistics. The result concluded that households mostly consumed cowpea and groundnut at least twice a week. It also concluded that households only allocated 8% of their total household budget share to plant protein foods. In addition, the study concluded that the years of household head education, household size and total expenditure (a proxy for total household income) influenced the consumption of plant protein foods. The study therefore recommended that since the plant protein foods were income-elastic, the income of households during the periods of crisis should be protected. Also, since the study established that households allocated only a fraction of their total food expenditure share on plant protein foods, efforts should be made at orientating households on the need to consume plant protein foods as this might help households fight nutritional deficiencies.

KEYWORDS

Nutrition, Pandemic, Households, Tobit, Nigeria

1. INTRODUCTION

Food, which is needed by humans to carry out their daily activities, is one of the most basic necessities of life which is required by mankind for the supply of nutrients essential for survival, growth and development (Odunze et al., 2016; Oyebanjo et al., 2013). Adequate intake of quality food is a key requirement for healthy and productive life; hence the quantity and quality of food consumed by households undoubtedly affects their health and economic wellbeing (Helen, 2002). Despite the necessity of food, its adequate provision has continued to be a challenge facing mankind (Kansiime et al., 2021). This is a serious situation in sub-Saharan Africa (SSA) where majority of the population suffer from malnutrition (World Health Organization (WHO), 2020a). The situation of inadequate food availability and provision was inadvertently worsened by the coronavirus disease of 2019 (COVID-19). This is because with every disease comes both direct and/or indirect effects on the socio-economic status of individuals, agriculture, food security and dietary intake (Obayelu et al., 2021). In addition, the High Level Panel of Experts on Food Security and Nutrition (HLPE), submitted that the COVID-19 pandemic is being linked with increased food insecurity, poverty and malnutrition.

In Nigeria and Lagos State in particular, the government in a bid to curtail the spread of the coronavirus disease and mitigate its immediate effect introduced some measures. The measures include: social distancing, closure of educational institution, banning of interstate and international travels, and restriction of movement (Iheme et al., 2020). Though, these measures which were aimed at curbing the spread of the virus, were beneficial for the protection of people's health and life, they however obstructed a lot of economic activities such as production, distribution and marketing of goods and services (Balana et al., 2020; Paul and Chowdury, 2020; Food and Agriculture Organization (FAO), 2020a; Eichenbaum et al., 2020). In addition, these measures caused a change in the lifestyle of many, ranging from adjustments in eating habit, reduced physical activities, amongst others (Bloch et al., 2020). Moreover, the interruptions induced by the COVID-19 pandemic according to some studies, threatened the food security of many individuals and households (Torero, 2020; Zurayk, 2020).

This situation, on one hand, posed several problems on food availability, accessibility and affordability, while on the other hand, caused a disruption in the diet, decreased the dietary diversification and affected the consumption pattern of households (Balana et al., 2020; Matsungo and Chopera, 2020). This was because the enforcement of the lockdown measures happened so sudden that it caused inflation in prices of goods, which consequently degraded the purchasing power of households, hence, leading to a fall in their standard of living (Devereux et al., 2020; Ewang and Wormington, 2020). It also resulted to the reduction in the preference and consumption of nutritious foods by households, thus contributing to the already skyrocketing rate of food insecurity and malnutrition, particularly protein deficiency (Laborde et al., 2020; Amare et al., 2020; Balana et al., 2022).

Protein can be obtained from two sources – plant and animal sources, however, plant protein does not only reduce cardiovascular diseases, control obesity, reduce diabetes, and decrease inflammation, it is generally healthier, cheaper, readily available and environmentally sustainable when compared with animal protein (Guash-Ferre et al., 2019; Najjar et al., 2018; Huang et al., 2016; Pojic et al., 2018; Sabate and Soret, 2014; Langya et al., 2022). In other study, most of researcher also submitted that high intake of animal protein is not generally recommended from both nutrition and environmental points of view (Tillman, 2014; Song et al., 2016). Despite the health benefits of these plant protein foods in reversing some of the damages caused by COVID-19, a study however reported that its consumption among many households in Nigeria significantly reduced

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during the pandemic (Ogundahunsi et al., 2020; Madzorera et al., 2021).

This was among other things due to the fact that most households in the face of falling income and the corresponding increase in prices of different commodities could not afford their basic needs. This made them cut down their consumption of nutritious foods, particularly legumes like cowpeas, soybean, etc. and increase their consumption of starchy foods during the pandemic (Madzorera et al., 2021). This behavior of households thus confirms Bennett's law that the quality of food consumed by households would decrease with a decrease in their income (Clements and Si, 2018). In addition, many households during the pandemic were either unable to save or unsaved, as they drew on their savings in order to provide for their immediate consumption needs (Torero, 2020; Zurayk, 2020). This is in conformity with the past peak of income Duesenberry hypothesis, which states that, "consumption is sustained by the reduction in current saving during periods of recession" (Jhingan, 2003).

Furthermore, though different studies showed that households' consumption of different food items was affected during the pandemic, the different factors that affected households' consumption of plant protein foods in Lagos State were however unknown (Almeida et al., 2021; OECD, 2020; Kansiime et al., 2021; Inegbedion, 2021). Knowing this will help policymakers make policies that will ensure that households still consume nutritious foods during periods of crisis, it will also ensure that the food and nutritional security of households is not threatened during periods of crisis, and it will also assist in the actualization of the Sustainable Development Goals (SDGs) on good health and wellbeing. It is against this background that this study determined the factors that influenced the consumption of plant protein foods in Lagos State, Nigeria.

2. METHODOLOGY

2.1 Study Area

This study was carried out in Lagos State, Nigeria. The State, which consists of 20 Local Government Areas (LGAs), with different Local Council Development Areas (LCDAs), has an estimated population of 15,388,000 (Macrotrends, 2022). It lies in the southwestern geopolitical zone of the country and is located between the latitude 60 22′N and 60 2′N and longitude 20 42′N and 32 2′E of the equator. It is bounded on the north and east by Ogun State. In the west, it shares boundaries with the Republic of Benin and stretches over 180 kilometers along the Guinea Coast of the Bight of Benin on the Atlantic Ocean. Its southern borders are with the Atlantic Ocean. It covers an area of 358,862 hectares or 3,577 square kilometers.

2.2 Data Collection

A multi-stage sampling technique was used to obtain data for this study. The first stage involved a simple random sampling of six LGAs from the twenty LGAs in the State. The six LGAs randomly selected were Ikorodu, Oshodi/Isolo, Surulere, Eti-Osa, Badagry and Mushin. In the second stage, two (2) LCDAs were randomly selected from each LGA. In the third stage, 50 houses were systematically selected from each LCDA, while the fourth stage involved a random sampling of one household from each house to arrive at a sample size of 600 households. Primary data was collected using a well-structured questionnaire. The questionnaire which was administered between December, 2021 and January, 2022 followed the 30-day recall approach. The data collected include information on socio-economic characteristics of household head (such as: age of household head, sex of household head, primary occupation of household head), and expenditures on all items (both food and non-food) within the household. The selected plant protein foods include: cowpea (commonly referred to as Beans in Nigeria), soybean, groundnut, lentils, peas, and pigeon pea. These were selected based on preliminary survey which showed the plant protein foods as the ones mostly consumed by households. For ease of identification, samples of the selected plant protein foods were shown to households.

2.3 Method of data analysis

Descriptive statistics such as frequency and percentages was used to describe the socio-economic characteristics of households, identify the consumption pattern for plant protein foods and profile the expenditure share on plant protein foods by households, while Tobit Regression model was used to determine the factors that influenced households' consumption of the selected plant protein foods.

2.4 Tobit Regression Model

Tobit regression model was used to determine the factors that influenced the consumption of plant protein foods during the COVID-19 pandemic. In the Tobit model, the dependent variable is censored in some way (Hayashi, 2000). The Tobit model allows an examination of the effects of a number of variables on the underlying probability of a dependent variable. The model helps predict the likelihood that a household's consumption of plant protein foods is dependent on a given set of related factors. With respect to the status of households' consumption of plant protein foods, the dependent variable in the model was the amount of money that a household spent on consumption in a month. In the case that a household does not purchase any item within a month, consumption expenditure was recorded as zero.

$$y_i^* = B_0 + B_1X_1 + B_2X_2 + B_3X_3 + B_4X_4 + B_5X_5 + B_6X_6 + B_7X_7 + B_8X_8 + e$$

$$y_i = 0 \text{ if } y_i^* \leq 0$$

$$y_i = y_i^* \text{ if } y_i^* > 0$$

$$i = 1,2,3, \dots, n$$

Where y_i is the observable total household expenditure on plant protein foods, y_i^* is the unobservable total household expenditure on plant protein foods. Hence, consumption expenditure on plant protein foods is observed if $y_i^* > 0$ and unobservable if $y_i^* \leq 0$, X_i is the set of explanatory variables. The independent variables are as follows:

X_1 = Age of household head (Years);

X_2 = Sex of household head (1 = male; 0 = female);

X_3 = Years of education of household head (Years);

X_4 = Household size (Number);

X_5 = Primary occupation of household head (1 = salary earner; 0 = others);

X_6 = Marital status of household head (1 = married; 0 = others);

X_7 = Total household expenditure (₦);

X_8 = Average kilogram price of plant protein foods (₦);

e = Error term.

3. RESULTS AND DISCUSSIONS

3.1 Socio-economic characteristics of household heads

The results of the socio-economic characteristics of the household heads as presented on Table 1 showed that the average age of household heads was approximately 46 ± 10 years. This showed that these households are still economically active and can engage in productive activities. Also, these households are expected to have more household members, thus increasing their food consumption. The result also showed that majority (86.5%) of the household heads were males; this, according to a study is a true picture of most African societies, where males head the homes and are the breadwinner of their family (Ojedokun and Yesufu, 2021). In addition, the result showed that majority (88.0%) of the household heads in the study area were literate, and had spent an average of 14 ± 4 years in attaining formal education. This implies that these household heads can read and write, and are expected to understand the importance of making healthier food choices. This is because the number of years spent in attaining formal education can help shapen food and livelihood choices which are essential to improved quality of life.

The result further revealed that majority (82.0%) of household heads were married and had an average household size of approximately 5 ± 2 members. This implies that these households are naturally expected to purchase and consume more food. This corresponds to the results of different studies which argued that bigger household size tends to exert more pressure on household consumption (Stephen and Samuel, 2013; Muche et al., 2014). It was also revealed that most (57.7%) of the household heads were salary earners, that is, they are either civil servants or private salary workers. The type of job that household heads engage in can have an impact on their level of disposable income and thus their consumption of different classes of food. Finally, the result showed that only few (31.0%) household heads had other occupation asides their main occupation. The implication of this is that, household heads with secondary occupations are expected to have more disposable income thereby increasing their food expenditures. This result is similar to that of a study which also reported that some household heads had other occupation asides their primary occupation (Ojedokun and Yesufu, 2020).

Table 1: Socio-economic characteristics of household head

Socio-economic characteristics	Frequency	Percentage	Mean (Standard Deviation)
Age of household head			
21 – 30	47	7.8	
31 – 40	142	23.7	
41 – 50	216	36.0	
51 – 60	148	24.7	**46.62 (10.419)**
61 – 70	39	6.5	
71 – 80	7	1.2	
81 – 90	1	0.2	
Sex of household head			
Male	519	86.5	
Female	81	13.5	
Education of household head			
No formal education	12	2.0	
Primary education	38	6.3	
Secondary education	149	24.8	
Tertiary education	401	66.8	
Years of household head education			
0	10	1.7	
1 – 5	1	0.2	
6 – 10	41	6.8	**14.34 (3.771)**
11 – 15	186	31.0	
16 – 20	356	59.3	
21 – 25	6	1.0	
Marital status of household head			
Single	108	18.0	
Married	492	82.0	
Household size			
1 – 6	541	90.2	**4.59 (1.571)**
7 – 12	59	9.8	
Primary occupation of household head			
Civil servant	159	26.5	
Artisan	117	19.5	
Private salary worker	187	31.2	
Trader	97	16.2	
Pensioner/Retired	18	3.0	
Transporter	13	2.2	
Clergy	5	0.8	
Fisherman	4	0.7	
Secondary occupation of household head			
None	414	69.0	
Artisan	37	6.2	
Private salary worker	18	3.0	
Trader	126	21.0	
Businessman	2	0.3	
Transporter	2	0.3	
Farmer	1	0.2	

Source: Field Survey, 2022

3.2 Consumption pattern for plant protein foods by households

The result of the consumption pattern for plant protein foods by households as presented on Table 2 showed that households mostly consumed cowpea (98.2%) and groundnut (90.5%), and least consumed pigeon pea (14.2%) and lentils (5.2%) than any other plant protein foods. The fact that households mostly consumed cowpea and groundnut could be due to their availability and accessibility, as compared to lentils and pigeon pea that are least consumed. This assertion is corroborated by a study which submitted that among the legumes, cowpea is the most available followed by groundnut (Maziya-Dixon et al., 2004). The result also revealed that households on the average consumed cowpea and groundnut twice a week.

The result further showed the price of the different plant protein foods. It showed that pea had the highest average per kg price, that is, ₦817.56, and that pigeon pea had the least average price per kg, that is, ₦478.26. The high price of pea could be a turn-off for households, this is because pea cannot be eaten alone but can only be used as an ingredient in preparing other food items. Though, the result showed that groundnut had the second highest average price per kg, that is, ₦763.46, it is the second most consumed plant protein food by households. This is because this plant protein food (groundnut) can be eaten alone either as a snack or appetizer, or in combination with other food types. It can also be processed into different products, like groundnut oil, groundnut soup and groundnut cake.

Table 2: Consumption pattern for plant protein foods by households

Consumption pattern	Frequency	Percentage	Mean (Standard Deviation)
Consume plant protein food			
Cowpea	589	98.2	
Soybean	160	26.7	
Groundnut	543	90.5	
Lentils	31	5.2	
Peas	284	47.3	
Pigeon pea	85	14.2	
Number of times consumed per week			
Cowpea			
1 – 2	383	63.9	**2.29 (0.882)**
3 – 4	206	34.3	
Soybean			
1 – 2	66	11.0	**0.77 (1.399)**
3 – 4	94	15.7	
Groundnut			
1 – 2	312	52.0	**2.32 (1.559)**
3 – 4	198	33.0	
Above 4	33	5.5	
Lentils			
1 – 2	17	2.9	**0.14 (0.643)**
3 – 4	14	2.3	
Peas			
1 – 2	151	25.2	**1.29 (1.568)**
3 – 4	133	22.1	
Pigeon pea			
1 – 2	42	7.0	**0.41 (1.094)**
3 – 4	43	7.2	
Price of cowpea in kilogram (₦)			
400.00 – 499.99	77	12.8	
500.00 – 599.99	148	24.7	
600.00 – 699.99	177	29.5	**657.38 (119.13)**
700.00 – 799.99	82	13.7	
800.00 – 899.99	116	19.3	

Table 2: Consumption pattern for plant protein foods by households			
Price of soybean in kilogram (₦)			
400.00 – 499.99	77	12.8	**553.15 (79.16)**
500.00 – 599.99	422	70.3	
600.00 – 699.99	101	16.8	
Price of groundnut in kilogram (₦)			
400.00 – 499.99	50	8.3	
500.00 – 599.99	9	1.5	**763.46 (118.94)**
600.00 – 699.99	41	6.8	
700.00 – 799.99	200	33.3	
800.00 – 899.99	269	44.8	
900.00 – 999.99	31	5.2	
Price of lentils in kilogram (₦)			
400.00 – 499.99	3	0.5	
500.00 – 599.99	497	82.8	**527.61 (62.28)**
600.00 – 699.99	100	16.7	
Price of peas in kilogram (₦)			
300.00 – 399.99	52	8.7	
600.00 – 699.99	48	8.0	**817.56 (188.04**)
700.00 – 799.99	137	22.8	
800.00 – 899.99	63	10.5	
900.00 – 999.99	300	50.0	
Price of pigeon pea in kilogram (₦)			
200.00 – 299.99	18	3.0	
300.00 – 399.99	82	13.7	**478.26 (107.23)**
400.00 – 499.99	251	41.8	
500.00 – 599.99	158	26.3	
600.00 – 699.99	91	15.2	

Source: Field Survey, 2022

3.3 Expenditure shares on plant protein foods

The result of the expenditure shares on plant protein foods as presented on Table 3 showed that cowpea had the largest share of expenditure in the total household plant protein food budget relative to other plant protein foods. It showed that households allocated majority (67.2%) of their plant protein foods' budget share on cowpea, thus signifying the importance of cowpea in their diet. This result is similar to that of a study which reported that cowpea is of immense importance in the diets of households (Ojedokun and Yesufu, 2021). Also, the result further revealed that households allocated only 8.1% of their total household food expenditure on plant protein foods. This result showed that households during the pandemic spent more on other food items than on plant protein foods. This is understandable because during the pandemic, many households were more concerned about surviving and thus, concentrated more on quantity rather than quality with respect to what they consume. The implication of this result is that households will continue to be affected by price volatility of plant protein foods, which are believed to be cheaper sources of protein for households. It can also cause households to switch to nutritionally-poorer foods in the face of higher prices of these plant protein foods, most especially during periods of crisis. This can thus adversely affect their food and nutritional status and make them fall further down the malnutrition trap.

Table 3: Expenditure share on plant protein food		
Food item	**Expenditure (₦)**	**Share**
Cowpea	2,090,710	0.672
Soy Bean	137,800	0.044
Groundnut	627,680	0.202
Lentils	63,300	0.020
Peas	110,000	0.035
Pigeon pea	82,700	0.027
Total	**3,112,190**	
Plant protein foods	3,112,190	0.081
Other food items	35,229,763	0.919
Total	**38,341,953**	

Source: Field Survey, 2022

3.4 Factors influencing consumption of plant protein foods by households

The result of the Tobit estimates of the factors influencing consumption of plant protein foods by households is presented on Table 4. The result revealed that the log-likelihood function was -933.02639 and that the entire model was significant at the 1% level of significance. The diagnostic variables and the significant level thus reveals the fitness of the model. It showed that the coefficients of years of education of household head, household size and total expenditure significantly influenced households' consumption of plant protein foods.

The result revealed that the coefficient of years of education of household head is positively significant at 10%. This shows that an increase in the years a household head spent in attaining education by 1 year will make them increase their consumption of plant protein foods by 2.5%. This is because the number of years spent in attaining formal education can help shapen food and livelihood choices which are essential to improved quality of life. Also, the result revealed that the coefficient of household size is positively significant at 1%, implying that an increase in household size by a member will cause an increase in the consumption expenditure on plant protein foods by 8.9%. This shows that the larger the members within a household, the more the household will purchase plant protein foods. This is consistent with *a priori* expectation because more household size implies increased food consumption. This finding is similar to that of different studies which reported positive relationship between household size and consumption of beans (Medard, 2017; Mfikwa and Kilma, 2014).

The result also showed that the coefficient of the total household expenditure is positively significant at 1%. This implies that a decrease in income by ₦1 will cause a decrease in the consumption of plant protein foods by 55.7%. This shows that these food items are normal goods and income-elastic, and as such households will decrease their consumption when their income falls. The positive relationship between household expenditure and consumption of plant protein foods is expected because during the COVID-19 pandemic, a study submitted that macro-economic conditions were very poor which inhibited the income-generating potential of many households and as such not only caused a reduction in their income but also led to a fall in both the quantity and quality of food for these households (GAIN, 2021).

Table 4: Tobit Estimate of the Factors Influencing the Consumption of Plant Protein Foods among Households			
Variables	**Coefficient**	**t**	**P>|t|**
Age of household head	-0.0814882	-0.37	0.711
Sex of household head	0.1861804	1.06	0.289
Marital status of household head	-0.2369468	-1.44	0.149
Years of education of household head	0.0254613*	1.75	0.080
Household size	0.0891158***	2.58	0.010
Primary occupation of household head	-0.0762791	-0.69	0.493
Total household expenditure	0.5571939***	7.79	0.000
Average Price of Plant Protein Foods	0.2706349	0.79	0.431
Constant	-1.74242	-0.71	0.480
Log-Likelihood	-933.02639		
LR Chi-square(8)	77.88		
Prob>Chi-square	0.0000		

Source: Data Analysis, 2022

Note: * and *** represents 10% and 1% level of significance respectively

4. Conclusion

This study was conducted to understand the consumption of plant protein foods, with focus on the COVID-19 era. The result concluded that households mostly consumed cowpea and groundnut, and that households only allocated 8% of their total household budget share to plant protein foods. In addition, the study concluded that during the pandemic, factors like years of education of household head, household size, and total expenditure (a proxy for household income) influenced the consumption of plant protein foods. The study therefore recommends that since the plant protein foods were income-elastic, the income of households during the periods of crisis should be protected. This can be achieved by putting in place different social security measures that will ensure that households' income is not significantly affected. Also, since the study established that households allocated only a fraction of their total food expenditure share on plant protein foods, targeted and holistic efforts should be made at orientating households on the need to consume plant protein foods as this might help in the fight against nutritional deficiencies. This can be achieved by ensuring that breeding and other related institutions focus on those plant protein foods that households mostly consume. This will not only ensure that households' food nutritional status is maintained, it will also help to achieve the SDGs on good health and well-being.

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