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FOOD AS MEDICINE: FOOD CONSUMPTION PATTERNS AND REPORTED ILLNESSES AMONG HOUSEHOLDS

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ABSTRACT

Rapid changes in climate and urban growth, changing demographics and heterogeneity of urban lifestyles are resulting in a shift in food consumption patterns, with a preference for foods with minimal processing time, quality and taste in Nigeria; but does there exist any relationship between food consumption pattern and reported illnesses among households? For better understanding, this study uses cross-sectional primary data, to thus, examine the relationship between food consumption patterns and the reported illnesses among households in Nigeria. Using a multistage sampling procedure, 250 households in two different local government areas were randomly selected. The study revealed that male household head consumed more plant-based whole food (0.6064) and therefore reported a lower incidence of illnesses (2.18) as compared to the female head whose consumption is lower (0.5644) with higher reported illnesses (3.13). The study further revealed that household members (41-50 years) are most aware of a plant-based whole food (54.17%) with lower reported illness (2.18), whereas members (61-80 years) have the highest reported illness (2.62) because they are the least aware (0.6189). Results also showed that people in the urban areas are prone to more sickness (2.04) than rural areas (1.79) because they are exposed to more choices of processed foods as compared to fresh farm foods available in the rural areas. Households' consumption patterns were influenced by household head sex, income, location, level of awareness of plant-based whole food, and total food expenditure. Therefore, while the existence of rural-urban food linkages will ensure wider households' access to quality whole foods needed to reduce reported illnesses; increasing households' income will enhance diet diversity and reduction in Nigeria's food insecurity. Also, more attention should be given to educating the people especially through media channels on the benefits of consuming plant-based whole food.

Keywords: food consumption pattern; diet diversity; urbanisation, whole food

JEL: E21; H31; I12; P46; Q18

INTRODUCTION

A vital concept for explaining development strategies in Africa is food security, which is seen as unrestricted access to enough nourishing food for everyone at any time to maintain a healthy and active life (FAO, 2008). Despite recent concerted efforts to alleviate poverty and its multifaceted dimensions in Sub-Saharan Africa (SSA), undernourishment persists as a widespread and severe problem. Every individual requires a minimum amount of food for survival and in a balanced ration to maintain sound health because food is one of the basic essential requirements of life. Hubbard and Onumah (2001) assert that a well-balanced diet has a tremendous bearing on a person's vitality, emotional stability, and enthusiasm for life. The importance of a good diet cannot be overlooked because food and eating well can make the difference between being alive or dead and being well or sick. Some researchers, Omonona and Adetokunbo (2007), Obayelu (2010), and Omotesho and Muhammad-Lawal (2010) have shown that food or a

good diet can prolong life, well-being, and promote human development. This is because a healthy population means a healthy productive force. While food production and consumption are significant to the development and economic growth of both developed and developing nations, there is an alarming prevalence of double-burden of malnutrition (undernutrition and overnutrition) in Nigeria, as many homes rely on insufficient staple foods which do not provide them with a balanced diet leading to massive importation of foods making her incur huge foreign debts (Makinde, 2000). Evidence from literature shows that while the estimated population growth rate is increasing at 2.5% yearly, food production growth is below 2% annually (Aku, 2012). Therefore, the scenario of the ever-increasing population and its accompanying food production availability has become a contentious empirical question. This problem may likely lead to an increase in food insecurity, causing food demand-supply gap as a result of the low rate of food production compared to high population growth currently being experienced in Nigeria.

Globally, the right consumption pattern is a fundamental challenge to human health status and welfare. According to **Arulogun and Owolabi (2011)**, health researchers and market analysts for the past few years have diverted their efforts into understanding why people chose to consume foods they ate, and in the way and form, they ate such food. Similarly, while there has been a lot of changes to households' food consumption pattern globally, the rate of change in Nigeria is disturbing. Consumption of nutrient-poor and energy-dense fast foods (food high in fat, sugar, and salt) has increased in rate (**Adair and Popkin, 2005; Duffey, Pereira and Popkin, 2013**). This has resulted in the increasing number of people eating away from home, in restaurants and take-away foods. The meals are majorly composed of fried and processed food (**Meng, 2017; Wang, Zhai, Du, and Popkin, 2008**) which are poor in nutrients and quality but rich in fats and oil. While these poor diets contain high sugar, salt, refined grains, and unhealthy fats, they are however low in fruits, whole food grains, fish, animal proteins, vegetables, and nuts. People make them their choices because they are typically packaged, ready to eat, and enabled by the modern food environment (**Popkin, Adair, and Ng, 2012; WCRF, 2007**); a problem that is now visible in not only urban but also rural areas across Nigeria. However, the challenge of this trend is that without care for methods and nutritional quality of the food ingredients, this shift to processed foods often laden with high salt and sugar content have increased the percentage of persons with non-communicable diseases such as for overweight (35.2%), obesity (22.2%), hypertension (28%), cancer (15%), and diabetes mellitus (8%) in the urban cities, which is now getting prevalent in some rural areas in Nigeria, and other Africa countries (**Awosan et al., 2014**).

Although the supermarket revolution has been attributed to be the main cause of this nutrition transition in developing countries especially in Nigeria, it is not fully understood (**Ameye and Swinnen, 2019**). However, incidences of the double burden of malnutrition are becoming prevalent due to increasing urbanisation, technological developments, and changes in food consumption patterns. Evidence from literature shows the increase in consumption of dietary energy, fat, sugars, and protein but lower consumption of fruits and vegetables across West Africa (**Bosu, 2015**). Therefore, there is a need for more research into how this transition may affect food security and consumption patterns. Nevertheless, there remains a knowledge gap in research on super-marketization, rural consumption patterns, and food security in Nigeria. Moreover, the urban-rural nexus in this region is not fully understood, with most of these studies focusing on urban areas only. Similarly, with the rate of urbanization and economic development in the past decades in this region, there is a need for more holistic research. Understanding household's food consumption pattern, nutritional status, and reported illnesses in the South-West zone, especially in Ogun State is therefore very important for consumers of agricultural products. Arising from the foregoing, the general objective of the study was to determine the wholesome

food consumption patterns and the reported illness associated with food consumption among households in Ogun State. The specific objectives are to: Identify the socioeconomic factors influencing the reported diseases in households; Determine the awareness level of households on a plant-based diet; Determine the pattern of consumption of whole plant food (whole food plant based diet - WFPBD) and reported illnesses among household members and Examine the factors influencing the level of awareness of whole plant food.

DATA AND METHODS

The Study Area

This study was conducted in Ogun State, Nigeria. Ogun State is situated within the tropics, with a total land area of 16,762 square km which lies within latitude 6°N and 8°N and longitude 2¹/₂° E and 5°E of the Greenwich Meridian, and has an estimated population of 4,054,272. The state borders Lagos state to the south, Oyo and Osun state to the north, Ondo State to the east, and the Republic of Benin to the west. The state is situated in the tropical rain forest which is suitable for agricultural production making the people of the state predominantly farmers who grow both commercial and food crops. The state is blessed with abundant natural resources like gold, kaolin, and others which are being extracted for the benefit of the state and the entire country at large. The people of the state just like other southwest states are predominantly Yoruba, which is one of the three largest ethnic blocks in Nigeria (**Ogunmodede and Awotide, 2020**).

Data

A multi-stage sampling technique was used for this work. The first stage involved the random selection of one local government that is densely populated or urban (Abeokuta south) and one sparsely populated or rural local government (Odeda). The second stage involved the selection of four areas from each local government. And the last stage involved the random selection of 150 households from the urban areas and 100 households from the rural area, making a total of 250 households. Although two hundred and fifty questionnaires were administered for this research, a total of two hundred and six (206) had complete information and were returned in time and used for the analysis.

Primary data was used for this study. Data was collected with the aid of a well-structured questionnaire that was administered to households in the study area. Household food consumption patterns and reported illnesses data were collected from a cross-section of selected households in selected rural and urban communities in the two local government areas sampled (Odeda and Abeokuta South) in Ogun State, Nigeria. Other information obtained with the questionnaire includes socioeconomic characteristics of the households and household heads, the awareness level of households on plant-based lifestyle, consumption patterns, and reported illnesses.

Methods

The analytical tools used in this study include descriptive statistics, probit regression, Tobit regression, and Ordinary Least Squares regression.

Descriptive statistics such as frequencies, percentages, means, and the standard deviation were used to describe the awareness level, consumption pattern, and reported illnesses among the households in the study area. The probit model was used to determine the factors influencing the level of awareness of the households. The model is given as Eq. 1- Eq. 2.

$$Z = \partial_0 + \partial_1 X_1 + \partial_2 X_2 + \partial_3 X_3 \dots X_n + \phi \tag{1}$$

$$Z = \begin{cases} 1 & \text{if } Z > 0 \\ 0 & \text{otherwise} \end{cases} \tag{2}$$

Where:

Z is the dependent variable, which represents the awareness or not by households of a plant-based diet;

$\partial_0, \partial_1, \partial_2, \partial_3, \dots, \partial_n$ are the coefficients that were estimated while examining the factors affecting households' awareness of the plant-based diet;

ϕ is the residual term;

$X_1, X_2, X_3 \dots, X_n$ are the explanatory variables, where:

Y Awareness of plant-based food (1 = aware; 0 = not aware);

X_1 Level of Education of Household head (Years);

X_2 Occupation of the Household head (Farming=1, Non-farming=0);

X_3 Marital status of the Household head (Married=1, Single=0);

X_4 Household head income (NGN);

X_5 Household size (Number of persons);

X_6 Reported illnesses (Numbers);

X_7 Location (Urban=1, Rural=0).

Tobit Model was employed to examine factors influencing the extent of consumption of wholesome food. The Tobit model is specified as Eq. 3.

$$Y_i = [\beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \dots \beta_n X_n + \varepsilon_i] \tag{3}$$

Where:

Y_i is the extent of consumption of wholesome food plant-based diet (WFPBD) (proportion);

X_1 Age of household head (Years);

X_2 Level of Education of Household head (Years);

X_3 Total food expenditure (NGN);

X_4 Sex of the Household head (Male=1, Female=0);

X_5 Total household income (NGN);

X_6 Household size (Number of persons);

X_7 Reported illnesses (Number);

X_8 Location (Urban=1, Rural=0);

X_9 Awareness (Aware=1, not aware=0).

Ordinary Least Squares Regression model was used to analyse the socio-economic factors influencing the reported illnesses in the households. The OLS model is specified as Eq. 4.

$$Y_i = f[\beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \dots \beta_n X_n + \varepsilon_i] \tag{4}$$

Where:

Y Reported illnesses (Numbers);

X_1 Age of household head (Years);

X_2 Level of Education of Household head (Years);

X_3 Sex of the Household head (Male=1, Female=0);

X_4 Marital status of the Household head (Married=1, Single=0);

X_5 Household head income (NGN);

X_6 Household size (Numbers of persons);

X_7 Location (Urban=1, Rural=0);

X_8 Awareness (Aware=1, not aware=0);

X_9 Spouse age (Years).

RESULTS AND DISCUSSION

Description of socio-economic characteristics of the households

This section presents the discussion of results to describe the socio-economic characteristics of the households in the study area. The selected socio-economic characteristics in this study include sex, age, marital status, household size, location, education level, household occupation household income of both household head and spouse. They are hereby discussed.

Gender of household head

The result in Table 1 shows that 88.35% of the household heads were male while 11.65% of the household heads were female. This agrees with **Mfikwa and Kilima (2015), Obayelu et al. (2009)** that a larger percentage of the household head being male would improve the quality of food consumed by the household members because 85.52% of the male household head has full knowledge of plant-based whole food consumption compared to 14.58% of the female that was aware of it. Male household head averagely consumed 0.6064 proportion of plant-based whole food while the female household head averagely consumed 0.5644 proportion of plant-based whole food. The male household head had a less average number of reported illnesses of 2.18 compared to that of the female household head with 3.13.

Age of Household members

The result in Table 2 shows that about 49.51% of the respondents were within the age bracket 41-60 years and they have the highest percentage of awareness level of 54.17%. Also, they averagely consumed 0.6562 proportion of plant-based whole food with about 2.18 average number of reported illnesses. About 28.64% of the respondents were within the age group of 21-40 years and had a 33.33% awareness level. They averagely consumed 0.6524 proportion of plant-based whole food with about 2.36 average number of reported illnesses. About 20.39% of the respondents were within the age group of 61-80 years and had a 12.50% awareness level. They averagely consumed 0.6189 proportion of plant-based whole food with about 2.62 average number of reported illnesses. About 0.97% of the respondents were within the age group of 81-90 years but no awareness level. They averagely consumed 0.6038 proportion of plant-based whole food with about 2 average number of

reported illnesses. The mean age of the household head is 49.83 years which aligns with **Mustapha (2014)**. Age could be an important determinant in the quality and quantity of protein requirement of an individual and households because food consumption patterns generally follow the body consumption (**Amao et al., 2006**).

Marital status of Household Head

The result in Table 3 shows that 75.73% of the respondents were married, 70.83% of them were aware of plant-based whole food and they consumed a larger proportion of 0.6625 plant-based whole food with 2.19 average number of reported illness which is lesser compared to those that were single. About 24.27% of the respondents claimed to be single, whereby 29.17% of them were aware of plant-based whole food, 0.6321 consume plant-based whole food and had 2.58 average number of reported illnesses. This shows that respondent that are married are more aware and most likely have the highest chance of being aware since at least one of the household members can influence the consumption patterns in the house compared to a single person. This result is in tandem with the study of **Ogunmodede et al. (2020)**.

Household Size

The result in Table 4 shows that 57.28% of respondents have a family size that ranges between 1-5 people of which 54.17% of them were aware of plant-based whole food, they consumed 0.6575 proportion of plant-based whole food and reported an average number of 2.18 illnesses. About 42.72% of the respondents have a family size that ranges between 6-10 people of which 45.83% of them were aware of plant-based whole food, they consumed

0.6519 proportion of plant-based whole food and reported an average number of 2.43 illnesses. This implies that families with less Household size may have better chances of consuming plant-based whole food due to the smaller number of members they catered for. The mean household size is 5.17 people. This result agrees with the findings of **Mfikwa and Kilima (2014)** that families with large household size may not have proper consumption of plant-based whole food due to a large number of members to cater for.

Education Level of Household Head

The result in Table 5 shows that about 6.8% of respondents had no formal education with 6.8% of them were aware of plant-based whole food. They consumed 0.5652 proportion of plant-based whole food and have a 2.85 average number of reported illnesses. About 15.05% of the respondents had primary education with 4.17% of them aware of plant-based whole food, 0.6848 proportion of plant-based food was consumed by them and 2.19 average number of reported illnesses was recorded. The highest level of education is tertiary education (46.14%), of which 72.92% of them were aware of plant-based whole food, they consumed 0.6555 with an average number of reported illnesses of 2.29. It is expected that education would improve awareness level and consumption of plant-based whole food, but the result is on the contrary. The justification for this could be that households are burdened with different responsibilities like rent on shelter, school fees, charges on utilities. The result showing that tertiary education is the largest educational attainment of the respondents goes in line with the postulation of **Awosan et al. (2013)**.

Table 1: Distribution of households by sex of head

Gender of household head	Frequency No. (%)	Awareness (%)	Mean proportion of plant-based whole food consumption	The average number of reported illnesses
Male	182 (88.35)	85.52	0.6064	2.18
Female	24 (11.65)	14.58	0.5644	3.13
Total	206 (100)			

Source: Based on own field survey, 2019

Table 2: Distribution of households by age

Age of household members (years)	Frequency No. (%)	Awareness (%)	Mean proportion of plant-based whole food consumption	The average number of reported illnesses
1-20	1 (0.49)	0.00	0.6402	2.22
21-40	59 (28.64)	33.33	0.6524	2.36
41-60	102 (49.51)	54.17	0.6562	2.18
61-80	42 (20.39)	12.50	0.6189	2.62
81-100	2 (0.97)	0.00	0.6038	2
Total	206 (100)			
Mean age	49.83			
Standard Dev.	13.51			

Source: Based on own field survey, 2019

Table 3: Distribution of households by marital status of head

Marital Status	Frequency No. (%)	Awareness (%)	Mean proportion of plant-based whole food consumption	The average number of reported illnesses
Single	50 (24.27)	29.17	0.6321	2.58
Married	156 (75.73)	70.83	0.6625	2.19
Total	206 (100)			

Source: Based on own field survey, 2019

Table 4: Distribution of households by household size

Household Size	Frequency No. (%)	Awareness (%)	Mean proportion of plant-based whole food consumption	The average number of reported illnesses
1-5	118 (57.28)	54.17	0.6575	2.18
6-10	88 (42.72)	45.83	0.6519	2.43
Total	206 (100)			
Mean	5.17			
Standard Dev.	2.80			

Source: Based on own field survey, 2019

Table 5: Distribution of household by educational level of head

The educational level of the household head	Frequency No. (%)	Awareness (%)	Mean proportion of plant-based whole food consumption	Average number of reported illnesses
No formal	14 (6.80)	6.80	0.5652	2.85
Primary	31 (15.05)	4.17	0.6848	2.19
Secondary	66 (32.04)	20.83	0.6667	2.44
Tertiary	95 (46.12)	72.92	0.6555	2.29
Total	206 (100)			

Source: Based on own field survey, 2019

Table 6: Distribution of household by occupation of head

Household Head Occupation	Frequency No. (%)	Awareness (%)	Mean proportion of plant-based whole food consumption	Average number of reported illnesses
Non-farming	107 (51.94)	58.33	0.6488	2.54
Farming	99 (48.06)	41.67	0.6619	2.06
Total	206 (100)			

Source: Based on own field survey, 2019

Household Head Occupation

The result in Table 6 shows the distribution of the household head occupation, about 48.06% of the respondents were farmers, 41.67% of them were aware of plant-based whole food, they consumed more proportion of plant-based whole food of 0.6619, with 2.06 average number of reported illnesses. About 51.94% of the respondents were non-farmers of which 58.33% were aware of plant-based whole food, they consumed 0.6488 proportion of plant-based whole food having the largest average number of reported illnesses of 2.54. This study reveals that though the farmers were not aware of what plant-based whole food is all about, they do more of the consumption because they plant it and it is readily available to them compared to other households with the non-farming occupation which makes them less exposed to diseases.

Household Head Income

The result in Table 7 that the mean income of the household heads is 97,528 NGN per month. About

74.76% of the household heads had their income ranging between 1,000 NGN - 100,000 NGN per month. 72.92% of them are aware of plant-based whole food and they consumed 0.6527 proportion of plant-based whole food with 2.23 average number of reported illnesses. About 16.99% of the household heads had their income ranges between 101,000 NGN - 200,000 NGN per month with 22.29% of them aware of plant-based whole food and they consumed 0.6622 proportion of plant-based whole food with 2.49 average number of reported illnesses. About 4.37% of the household heads had their income ranges between 201,000 NGN - 300,000 NGN per month with 4.17% of them aware of plant-based whole food and they consumed 0.6739 proportion of plant-based whole food with 2.77 average number of reported illnesses which is the highest compared to all. About 0.49% of the household heads had their income greater than 500,000 NGN per month, none was aware of plant-based whole food and they consumed 0.5395 proportion of plant-based whole food with 2 average number of reported illnesses. Income

is a major driver of demand and budget share allocation among households. Tertiary education graduates will get more paying jobs than people with just primary certificates which makes room for them to consume more processed foods than plant-based whole food.

Age of Spouse

The result in Table 8 shows that about 50.51% of the respondent's spouses were within the age bracket 41-60 years and they were with a 29.08% level of awareness. They consumed 0.6554 proportion of plant-based whole food with a 2.37% average number of reported illnesses. About 30.64% of the spouses were within the age group of 21-40 years and had a 68.67% level of awareness and they consumed 0.6536 proportion of plant-based whole food with 2.35% average number of reported illnesses. About 18.85% of the spouses were within the age group of 41-60 years and had a 2.25% level of awareness and they consumed 0.6625 proportion of plant-based whole food with 2.85% average number of reported illnesses. Age could be an important determinant in the quality and quantity of protein requirement of an individual and households because food consumption pattern generally follows the body consumption (Amao *et al.*, 2006). The mean age of spouses is 31 years.

Education Level of Spouse

The result in Table 9 shows that about 18.45% of spouses had no formal education with 22.92% of them were aware of plant-based whole food. They consumed 0.6781 proportion of plant-based whole food and have 2.05 average number of reported illnesses. Only 16.50% of them had primary education with 2.08% are aware of plant-based whole food, 0.6226 proportion of plant-based food was consumed by them and 1.29 average number of reported illnesses was recorded. About 31.55% of the spouses had a secondary school certificate with 22.92% of them were aware of plant-based whole food, they

consumed 0.6591 proportion of plant-based whole food and 2.03 average number of reported illnesses. About 33.50% of them had tertiary education, 52.08% of them were aware of plant-based whole food, they consumed 0.6478 with an average number of reported illnesses of 2.36. Education improves the level of awareness as it was expected but contrary in the case of consumption of plant-based whole food. The justification for this could be that households are burdened with different responsibilities like rent on shelter, school fees, charges on utilities. The result showing that tertiary education is the largest educational attainment of the spouse goes in line with the postulation of Awosan *et al.* (2013). In addition, the educational level of the spouses who are mostly females increases their skills in, health care practices related to disease treatment and prevention, hygiene, and nutrition, and thus improving chances for survival. But this result shows that the higher the educational level the spouse attains, the less they consume plant-based whole food and are exposed to diseases because they tend to prefer to consume processed foods as they are in full employment.

Location

The result in Table 10 shows that about 45.57% of respondents reside in a rural environment with 45.83% of them were aware of plant-based whole food. They consumed 0.6765 proportion of plant-based whole food and have a 1.79 average number of reported illnesses. About 52.43% of them reside in the urban environment with 54.17% of them aware of plant-based whole food, 0.6356 proportion of plant-based food was consumed by them and 2.04 average number of reported illnesses were recorded. This result follows *a priori* expectation, though people in rural areas may not be aware of plant-based whole food. Nevertheless, they consume it more than those who reside in urban areas since it is readily available and sometimes get it at a lower cost.

Table 7: Distribution of household by income of head

Household Head Income (NGN)	Frequency No. (%)	Awareness (%)	Mean proportion of plant-based whole food consumption	Average number of reported illnesses
1,000 - 100,000	154 (74.76)	72.92	0.6527	2.23
101,000 - 200,000	35 (16.99)	22.92	0.6622	2.49
201,000 – 300,000	9 (4.37)	4.17	0.6739	2.77
301,000 – 400,0000	4 (1.94)	-	0.6125	1.75
401,000 – 500,000	3 (1.46)	-	0.5727	2
Above 500,000	1 (0.49)	-	0.5395	2
Total	206 (100)			
Mean income	97,528			
Standard Dev.	130,663.2			

Source: Based on own field survey, 2019

Table 8: Distribution of households by age of spouse

Age of spouse (years)	Frequency No. (%)	Awareness (%)	Mean proportion of plant-based whole food consumption	Average number of reported illnesses
21-40	48 (30.64)	68.67	0.6536	2.35
41-60	79 (50.51)	29.08	0.6554	2.37
61-80	29 (18.85)	2.25	0.6625	2.85
Total	156 (100)			
Mean age	30.73			
Standard Dev.	20.53			

Source: Based on own field survey, 2019

Table 9: Distribution of households by educational level of spouse

Educational level of Spouse	Frequency No. (%)	Awareness (%)	Proportion of plant-based whole food consumption	Average number of reported illnesses
No formal	29 (18.45)	22.92	0.6781	2.05
Primary	26 (16.50)	2.08	0.6226	1.29
Secondary	49 (31.55)	22.92	0.6591	2.03
Tertiary	52 (33.50)	52.08	0.6478	2.36
Total	156 (100)			

Source: Analysis based on own field survey, 2019

Table 10: Distribution of households by location

Location	Frequency (%)	Awareness No. (%)	Proportion of plant-based whole food consumption	Average number of reported illnesses
Rural	47.57	98 (45.83)	0.6765	1.79
Urban	52.43	108 (54.17)	0.6356	2.04

Source: Analysis based on own field survey, 2019

Factors influencing the level of awareness of plant-based whole food among households.

In the Probit model, the Log-Likelihood ratio, given by the Chi-square statistic test was highly significant at 1% level indicating that the chosen independent variables fit the data reasonably well. It is interesting to note that 4 out of the 7 estimated coefficients of the outcome equation are statistically significant and explained the variation in the probability of awareness level of whole plant food as explained by the explanatory variables included in the model. The results indicate that the household head years of education, household head income, reported illnesses, and location significantly influenced households' level of awareness of whole plant-based food (Table 11).

The coefficient of household head years of education has a positive and significant effect on the level of awareness of plant-based whole food and given the role of education in raising awareness level, it seems that having access to more years of education by the household's head appears to have a significant impact on the level of awareness of plant-based whole food among households, increasing the probability of the level of awareness by 8.41% at the sample mean. This implies that a year's increase in the education of household heads will increase the likelihood of awareness about WFPBD by 2.9%. This result aligns with the findings of **Babatunde et al. (2007)**. Therefore, education enables people to have access to greater information on the nutritive values of different food types including vegetables.

Similarly, the coefficient of household head income was also positive and have a significant effect on the household level of awareness implying that as the household head income increases by a thousand naira, there is a 5.6% probability that their awareness will be increased. The result shows that higher-income enables the family to afford to buy more fresh vegetables and whole food grains.

Furthermore, the coefficient of the variable reported illnesses, have a positive influence on the awareness level, and statistically significant ($p \leq 0.05$). The coefficient of the marginal effect shows that a unit increase in reported illnesses has a 4.2% probability of increasing the awareness level. The positive sign of the reported illnesses

might be confusing but increases in the number of reported cases of household illnesses will increase the likelihood of being aware of plant-based whole food among the household members. In other words, when a household member falls sick and visits the hospital, there is a high tendency that he would be informed about consuming a plant-based whole food, especially when the illness is related to nutrition. This result is similar to the findings of **Ogunkunle and Oludele (2013)**.

The location is a dummy variable indicating rural and urban residence. The location dummy variables are included primarily to control for location fixed effects including regional differences in prices, market, income, infrastructure, and economic activity. Unexpectedly, the location variable has a positive influence on the awareness level and statistically significant ($p \leq 0.05$). The coefficient of the marginal effect shows the likelihood of being aware of the WFPBD is 4.4% higher for urban households than their rural counterparts. It means that living in an urban area would lead to an increase in the probability of the level of their awareness. This may be because, in the urban area, there is the predominance of NCDs and households are getting to know that a change in lifestyle will be of help. This result is consistent with the findings of **Mustapha (2014)**.

Factors influencing the extent of consumption of plant-based whole food among households

Table 12 presents the result of the factors influencing the extent of consumption of plant-based whole food among household members. The result indicated that household size, household head sex, location, and awareness level of plant-based whole food, were all significant at 1%, 5% and 10% probability level with different signs. The Log-likelihood ratio = 324.27 and the corresponding Prob > $\chi^2 = 0.0863$, indicating that the model has a good fit to the data. Also, the Pseudo-R² statistic (0.0507) is not notably different from what has been recorded in similar investigations. Expectedly, there is an inverse relationship between household size and the extent of consumption of plant-based whole food and statistically significant ($p \leq 0.05$). The coefficient of the marginal effect shows that an increase in the size of households by one person will

reduce the likelihood of the extent of consumption of WFPBD by 0.35%. Therefore, having more household members has a strong, although diminishing effect, on the extent of consumption of plant-based whole food. This could probably mean that as household size increases, expenses increase and there is the tendency to allocate more of the family budgets to other food items that are unwholesome for better satisfaction. This result corroborates the findings of **Mfikwa and Kilima (2014)** that an increase in the number of family members would reduce their chances of consuming wholesome food. There exists a direct relationship between household head sex and the extent of consumption of plant-based whole food and statistically significant ($p \leq 0.05$). The probability of the extent of consumption of WFPBD is 5.65% higher for male-headed households than female-headed households. As expected, the influence of the household head on the extent of consumption was equally positive, suggesting that male-headed households tend to consume more of a plant-based whole food than female-headed households which could be attributed to differentials in income, status, etc. This result is following the findings of **Mfikwa and Kilima (2014)** that male-headed household is the typical situation in Africa. The coefficient of location had a negative relationship with the extent of

consumption probably because people in rural areas have direct access to fresh food and other plant-based food compared to those in urban areas. So, the probability of the extent of consumption of WFPBD is 3.3% lower for urban households than their rural counterparts. Finally, the awareness level of plant-based food was positively associated with the extent of consumption. The explanation is that households that are aware of the benefit of consuming plant-based food have a higher probability (3.81%) to consume wholesome plant-based food than those who are not aware of these benefits.

Socio-economic Factors Influencing the Reported Illnesses among Households in Ogun State.

Table 13 presents the socio-economic factors influencing the reported illnesses among household members. This result indicated that spouse age, total expenditure on wholesome food, location, household head years of education, marital status, and awareness level of plant-based foods were all significant at 1%, 5%, and 10% probability level with different signs. The Adjusted R² indicates that 50.10% variation in reported illnesses of households was explained by the explanatory variables while the remaining 49.90% was explained by variables not included in the model. The Prob >F= 0.0005, shows that the model fits the data well.

Table 11: The result of Probit model regression analysis

Variables	Coefficient	Standard error	Z	Marginal effect
Household head years of education	0.08407***	0.00613	4.71	0.02889
Household head income	0.17457*	0.00000	1.77	0.05653
Reported Illnesses	0.03899**	0.01828	2.28	0.04177
Occupation	0.12037	0.05932	1.41	0.08343
Marital status	-0.24286	0.07594	-1.02	-0.07751
Household size	0.01675	0.01047	1.00	0.01045
Location	0.70270**	0.01862	2.34	0.04362
LR chi ² (6)				31.47
Prob > chi ²				0.0000
Pseudo R ²				0.1407
Log-likelihood				-86.77188

Note: *, ** and *** denote significant at the 10%, 5% and 1% levels respectively; Pr y=1 the base category; the figures in parentheses are robust standard errors.

Source: Analysis based on own field survey, 2019

Table 12: The result of Tobit model regression analysis

Variables	Coefficient	Standard error	Z	Marginal effect
Household head Age	0.008742	0.00064	0.53	0.00034
Household head income	-6.05e-06	0.00000	-0.92	-5.94e-08
Household size	-0.009746**	0.00210	-1.66	-0.00349
Household head sex	0.024922**	0.02011	1.99	0.05653
Location	-0.008706*	0.01712	-1.93	-0.03299
Household head education	0.006902	0.00191	0.66	0.00126
Reported illness	-0.00416	0.00292	-1.20	0.00441
Awareness level of plant-based food	0.017805*	0.02011	1.89	0.03808
Spouse education	0.00126	0.00191	0.66	0.00126
LR chi ² (9)				17.90
Prob > chi ²				0.0863
Pseudo R ²				0.0507
Log-likelihood				324.26892

Note: *, ** and *** denote significant at the 10%, 5% and 1% levels respectively; Pr y=1 the base category; the figures in parentheses are robust standard errors.

Source: Analysis Based on own field survey, 2019

Table 13: The Result of Ordinary least square regression analysis

Variables	Marginal effect	Standard error	T	P> t
Household head Age	0.17242	0.16752	-1.03	0.305
Household head income	0.05868	0.13444	0.44	0.663
Spouse Age	0.38197	0.11528	3.31	0.001***
Marital status	-0.61403	0.32725	-1.88	0.062*
Household Head years of education	-0.31398	0.14206	-2.21	0.028**
Household size	0.03998	0.03999	1.00	0.319
Household Head occupation	0.26523	0.22374	1.19	0.23
Expenditure on wholesome food	-1.07307	0.48556	-2.21	0.025**
Location	0.57695	0.23671	2.44	0.016**
Awareness level of plant-based food	-0.77371	0.12374	-6.30	0.000***
Constant	1.62079			
Adj R-squared	0.5010			
Prob > F	0.0005			

Note: *, ** and *** denote significant at the 10%, 5% and 1% levels respectively; Pr y=1 the base category; the figures in parentheses are robust standard errors.

Source: Analysis based on own field survey, 2019

There is a positive relationship between the age of the spouse and reported illnesses and statistically significant ($p \leq 0.01$). The sign on the coefficient follows the *a priori* expectation. The coefficient shows that a 1% increase in spouse age would lead to a 38.19% increase in their number of reported illnesses. This implies that women are prone to several diseases as they grow older, thus they get infected with illnesses. This result is in tandem with the findings of Nagla (2007) that age can be attributed to reported diseases in women.

There is a negative relationship between marital status and reported illnesses and statistically significant ($p \leq 0.1$). The sign on the coefficient follows the *a priori* expectation. The coefficient shows that a 1% increase in the number of married respondents would lead to 61.40% decrease in the number of reported illnesses. This implies married respondents are conscious of what they consume as per nutritional contents than single respondents, which has a significant effect on their health status. This result corroborates the study of Adeyanju, (2014) that married respondents are more informed of plant-based whole food consumption which improves their health.

There is a negative relationship between household head years of education and reported illnesses and statistically significant ($p \leq 0.05$). The sign on the coefficient follows the *a priori* expectation. The coefficient shows that a 1% increase in household head years of education would lead to a 31.39% decrease in several reported illnesses. This implies that the household head level of education improves the choices of food been consumed within the family, as this could tell on their health status. This result agrees with the result of Mfikwa and Kilima (2014), which opined that level of education significantly influence consumption pattern as this may have a similar effect on reported illness.

There is a negative relationship between expenditure on whole food and reported illnesses and statistically significant ($p \leq 0.05$). The sign on the coefficient follows the *a priori* expectation. The coefficient shows that a 1% increase in expenditure on whole food would lead to a 100.1% decrease in the number of reported illnesses. This implies that households who spend more on wholesome food will have a minimal occurrence of reported illness

compared to otherwise. This result supports the postulation of Awosan *et al.* (2013) that households with a smaller number of reported illnesses are those that are aware and consume plant-based whole food.

CONCLUSION AND POLICY IMPLICATIONS

Rapid changes in climate and urban growth, changing demographics, coronavirus pandemic and heterogeneity of urban lifestyles are resulting in a shift in food consumption pattern, with a preference for foods with minimal processing time, quality and taste in Nigeria; but does there exist any relationship between climate change, food consumption pattern and reported illnesses among households? This study, therefore, examined the nexus between consumption patterns and the prevalence of reported illnesses among households. It demonstrated the occurrence of a high prevalence of unhealthy eating habits and lifestyle; together with a high prevalence of reported illnesses as a result of the type of consumption patterns adopted among various households in Ogun State. From the findings of this study, it is established that years of education, income, reported illnesses and location improved the level of awareness of plant-based whole food. It is further established that household size and location impede the extent of consumption of plant-based whole food while the level of awareness of plant-based whole food, household head sex, and total expenditure on food improves the extent of consumption of plant-based whole food. Similarly, we established that years of education, consumption of plant-based whole food, and level of awareness of plant-based food negatively influence reported illnesses. The educational attainment of the household head and gender is an important influence on household food consumption patterns. Education allows individuals to make more informed food choices and to recognize the importance of population control. Hence, it is necessary to ensure that all Nigerians become better educated to improve society as a whole. Similarly, the significance of household size as a determinant of food consumption also points to the fact that the government needs a more serious population control strategy. Generally, our results show that achieving a sustainable

diet would entail a high reduction in the intake of meat and vegetable oils and a moderate reduction in cereals, roots, and fish products, and increased intake of legumes, nuts, seeds (whole grains), fruits and vegetables.

Policy recommendations

Based on the findings of this study, the following recommendations are given as: Due to poor knowledge and awareness of the consumption of whole plant food in the study area, the government should employ more community dietitians and health professionals to educate and promote knowledge of community dietetics and healthy living. The government needs to create an enabling environment conducive for job creation so that the vast majority of the people can be gainfully employed. Closely linked to this is the fact that employers should pay wages that are commensurate with the productivity of labour. The fact that income is a strong determinant of food consumption patterns in both the urban and rural areas means that the government should design special social interventions and empowerment programmes aimed at providing economic protection to low-income earners who spend the bulk of their income on food consumption. Establishment of programs that strengthen rural-urban food linkages will ensure wider households' access to quality whole foods needed to reduce reported illnesses. The significance of household size as a determinant of food consumption patterns also points to the fact that the government needs a more serious population control strategy. At the household level, there should be an awareness of the need to adopt birth control measures. Policymakers should develop a diet action plan to work across all sectors of the food, retail, and health services such as creating leaflets and radio programs as an information source. The government should make policies that promote and support plant-based whole food production and consumption, especially in rural areas as they seem to have a lower level of awareness. This could be in the form of education and behavioural change programs to promote plant-based whole food consumption. Such should be based on local knowledge regarding the demographic and socio-cultural factors that may affect consumer choice.

Suggestion for further research: A systematic investigation of the relationship between household food consumption differential and prevalence of diseases is worth undertaking to identify empirically the nature and magnitude of relationships.

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