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Eat Green: Households' Consumption of Whole Plant Food and Incidence of Illnesses

Coma Verde: Consumo de Alimentos Vegetais Integrais pelas Famílias e Incidência de Doenças

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Abstract

Dietary habits among other factors such as urbanization and westernization of lifestyle are responsible for the surge in the cost associated with non-communicable diseases globally and especially in developing countries. The study sheds light on the level of awareness of whole plant food, its consumption and its relationship with the number of reported illnesses among households. A structured questionnaire was used to collect primary data for the study. Two hundred and forty households were selected using a multistage sampling technique. Descriptive statistics, logistic regression technique and ordinary least squares regression were utilized in the data analysis. The study revealed a low level of awareness of whole-plant food among households. Male-headed households have a higher level of awareness of whole plant food than households with female head. However, male-headed households consumed a smaller share of whole plant food (62.86) when compared with female-headed households with average extent of whole plant food of 63.10. Consequently, female-headed households recorded a lower incidence of illnesses. From the result of the logistic regression model, location, years of formal education, monthly income of spouse, and marital status significantly influenced the level of awareness of whole-plant food. The age of the household's head, location and years of formal education have significant effect on how much whole-plant food is consumed. The incidence of illness reduces with increased extent of whole-plant consumption. Hence, there should be concerted and collective actions involving government and private sectors in creating more awareness of the health benefits of whole plant food consumption.

Keywords: Diets, Health, Nigeria**,** Nutrition security**,** plant-based.

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Resumo

Os hábitos alimentares, entre outros fatores, como a urbanização e a ocidentalização do estilo de vida, são responsáveis pelo aumento dos custos associados às doenças não transmissíveis a nível mundial, especialmente nos países em desenvolvimento. O estudo esclarece o nível de conhecimento sobre alimentos vegetais integrais, o seu consumo e a sua relação com o número de doenças notificadas entre os agregados familiares. Um questionário estruturado foi utilizado para coletar dados primários para o estudo. Duzentos e quarenta domicílios foram selecionados utilizando uma técnica de amostragem em múltiplos estágios. Estatística descritiva, técnica de regressão logística e regressão de mínimos quadrados ordinários foram utilizadas na análise dos dados. O estudo revelou um baixo nível de conscientização sobre alimentos vegetais integrais entre as famílias. Os agregados familiares chefiados por homens têm um nível mais elevado de conhecimento sobre alimentos vegetais integrais do que os agregados familiares chefiados por mulheres. No entanto, os agregados familiares chefiados por homens consumiram uma percentagem menor de alimentos vegetais integrais (62,86) quando comparados com os agregados familiares chefiados por mulheres com uma extensão média de alimentos vegetais inteiros de 63,10. Consequentemente, os agregados familiares chefiados por mulheres registaram uma menor incidência de doenças. A partir do resultado do modelo de regressão logística, a localização, os anos de escolaridade formal, a renda mensal do cônjuge e o estado civil influenciaram significativamente o nível de conhecimento sobre alimentos vegetais integrais. A idade do chefe do agregado familiar, a localização e os anos de educação formal têm um efeito significativo na quantidade de alimentos vegetais integrais consumidos. A incidência de doenças diminui com o aumento do consumo de plantas inteiras. Portanto, deve haver ações concertadas e coletivas envolvendo os sectores governamental e privado na criação de uma maior consciência sobre os benefícios para a saúde do consumo de alimentos vegetais inteiros.

Palavras-chave: Dietas, Saúde, Nigéria, Segurança nutricional, à base de plantas.

1. Introduction

Food security for everyone and consumption of enough safe, high-quality food to support a healthy diet must be the goal of food strategies (Vasileska and Rechkoska, 2012). A diet is healthy when it contains balanced and diverse food consumption from different food groups. This protects against malnutrition and Non- Communicable Diseases (NCDs) like cancer, diabetes, heart disease and stroke (WHO, 2013). However, in sub-Saharan Africa (SSA), more than 50 percent of the populace cannot afford a healthy diet (WFP, 2020). The inability to afford healthy diets has a strong relationship with malnutrition in its many forms and food insecurity. Consequently, Africa is home to over one-third of the world's undernourished (FAO *et al*., 2019). Nigeria is not exempted as the prevalence of undernourishment increased from 9.6% in 2015 to 13.45% in 2018 (FAO *et al.,* 2020).

It is evident that dietary habits among other factors such as urbanization and westernization of lifestyle are responsible for the surge in the burden of NCDs globally and especially in

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developing countries (WHO, 2010; Panda *et al*., 2018; Bricas, 2019). Non-communicable diseases are responsible for over three-quarters of all deaths in SSA. Due to the epidemiologic transition of diseases, Africa is projected to experience the largest increase in NCDs in the next decade. This will without doubt continue to escalate in the absence of exigent measures and policies to arrest the trend (WHO, 2014; Panda *et al*., 2018). Although, communicable diseases continue to be the largest cause of death in Nigeria, the burden of NCDs in the nation is currently rising (WHO, 2019). According to the 2018 WHO national profile, NCDs were responsible for about 29% of all fatalities in Nigeria with cardiovascular diseases serving as the leading cause of NCD-related death followed by cancers, chronic respiratory diseases and diabetes.

Moreover, in addition to having an impact on our health, what we consume and how it is produced also have repercussions for the environment and climate change. This results in what is known as hidden climate cost. There are evidences that cutting back on meat and dairy intake will be good for the health and the environment. Healthy diets help to reduce greenhouse gas emissions because of their richness in plant-based foods that emit lower GHG. Consequently, environmentally responsible practices include consuming fewer animal products and more plant-based foods (Garnett, 2010). According to FAO *et al* (2020), a shift to healthy diets will not only contribute to the reduction of health costs but will also reduce climate change costs by 2030. From the foregoing, there is need to encourage healthy diets and lifestyle to decrease the conundrum of NCDs and climate change. This will however, involve a combination of different strategies including food-based strategies that promotes the consumption of a wide range of foods that are locally produced, minimally processed products and little or no animal products (Fischer and Garnett, 2016; FAO *et al.,* 2020).

These foods are nutritious and of high-quality sanitary standards. Furthermore, there are evidences that transition to Whole Plant-Based Foods (WPBF) which centered on whole, unrefined, or minimally refined plants, has positive relationship with the prevention and treatment of c hronic illnesses (FAO, 2019; Health Canada, 2018; Health Canada, 2018; Dinu *et al*., 2017; Morenga and Motez, 2017). Therefore, this study examined whole plant food consumption and the incidence of illnesses among households in Oyo State, Nigeria. The specific objectives are to: find out to what extent are households aware of whole-food plant-based diets; isolate factors influencing the awareness level of households on WPBF; determine

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the variables that affects the extent of whole-plant foods consumed and lastly, examine the socio-economic variable affecting the number of illnesses reported in homes.

2. Methods and Data

Ibadan South East Local Government Area of Oyo State, Nigeria served as the study area. A structured questionnaire was used to collect primary data using a multi-stage sampling technique. In the initial stage, four wards were purposively selected (2 densely populated wards and 2 sparsely populated wards) from the 12 wards in the Local Government Area. A community was randomly picked from each of the chosen wards, in the second stage. In the final stage, households from the selected communities were randomly chosen according to size. A total of two hundred and forty households were selected for the study.

Descriptive statistics, Logistic regression, and ordinary least square regression were the analytical tools used in the study.

Logit Regression Model

$$\text{Logit} = \ln[p/1-p] \qquad \text{for } 0 < p < 1 \ldots\ldots\ldots\ldots\ldots \text{(Eq.1)}$$

$$Y_1^* = B_0 + B_1 x_{1i} + \ldots + e_i$$

Where Y_1^*= Awareness of households on plant-based diet (1 aware, 0 not aware)
B_i= parameters or coefficients to be estimated
e_i= error term
X_i= vector of explanatory variables

The explanatory variables include:
X_1= Age of household head (years)
X_2= Years of formal education of households' head
X_3= Sex of household head (1 for male, 0 for female)
X_4= Marital status of household head (1 married, 0 otherwise)
X_5= Income of household head (in Naira)
X_6= Income of spouse (in Naira)
X_7= Household size (in number)
X_8= Location (1=densely populated, 0= sparsely populated)

The Ordinary Least Squares (OLS) Regression Model

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The Ordinary least square regression model was employed in the study to isolate the variables influencing the extent of consumption of WFPB in the last one week. Using the proportion of WFPB in the household's overall consumption, the extent of consumption was calculated.

$$Y_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \ldots\ldots\ldots\ldots\beta_n X_n . + U_i \ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Where:

β_0 = Constant term or intercept

β_i = Coefficient of independent variables

X_i = Independent or explanatory variables

U_i = error term

Y= Extent of consumption of WFPB (proportion)

X_1= Household head's age in years

X_2= Education level of household head (years)

X_3= Sex of household head (0 female, 1 male)

X_4= Marital status of household head (1 married, 0 otherwise)

X_5= Income of household head (in Naira)

X_6= Household size (number)

X_7= Location (1 densely populated areas, 0 sparsely populated areas)

The OLS Regression model was also employed in to examine the variables influencing the number of reported illness among households in the study area.

$$Y_i = \beta_0 + \beta_i X_i + \beta_2 X_2 + \beta_3 X_3 + \ldots\ldots\ldots\ldots\beta_n X_n . + U_i \ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$

The explanatory variables include:

Y_i = Number of reported illnesses (in number)

X_1= Household head's age (years)

X_2= Education level of household head (years)

X_3= Marital status of household head (1 married, 0 otherwise)

X_4= Location (1 densely populated areas, 0 sparsely populated areas)

X_5= Extent of consumption of wholesome food (whole plant food/total food consumed)

X_6= Toilet facilities (water closet 1, otherwise 0)

X_7= Housing (1 for good ventilation, otherwise 0)

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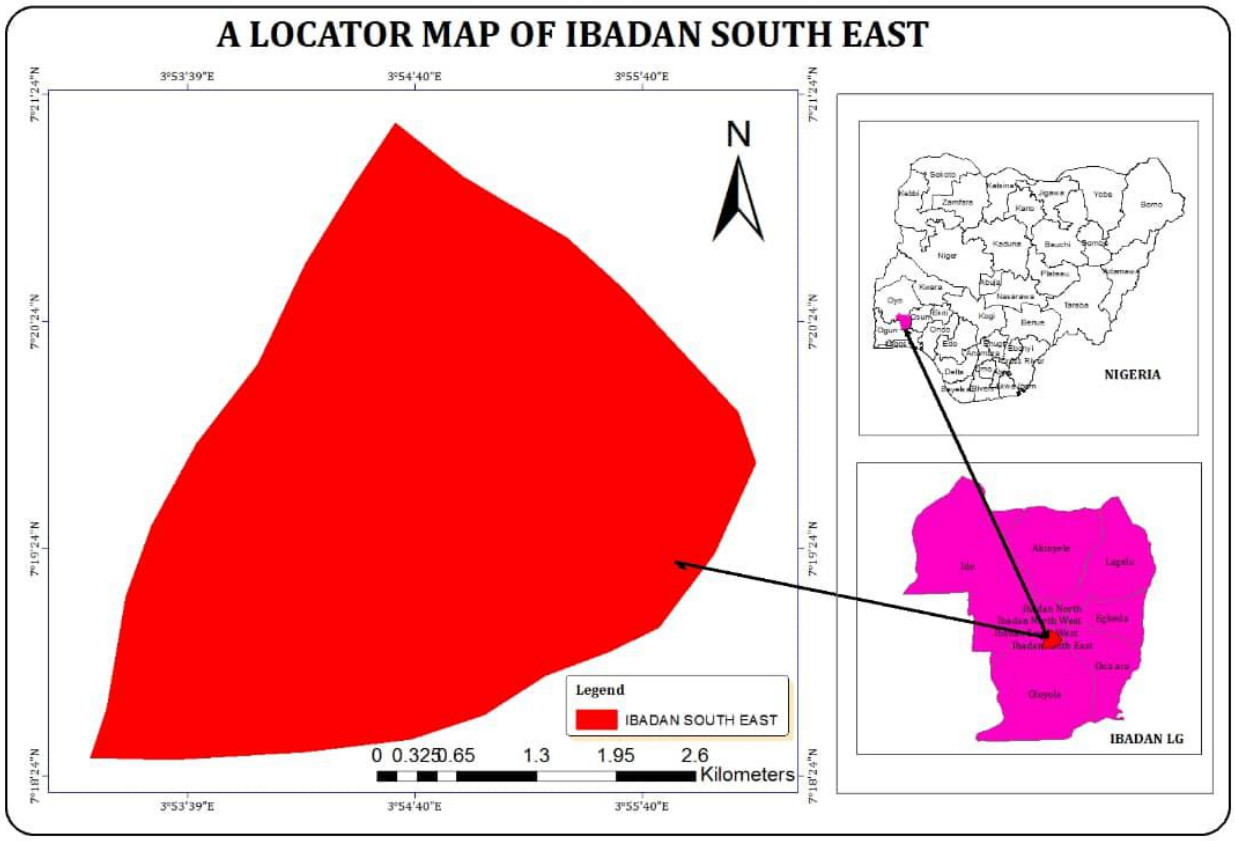

Figure 1 Map indicating Ibadan South East LG as study area

3. Empirical Results and Discussion

Descriptive Analysis of the Socio-economic Characteristics of the Households

In relation to the level of awareness, extent of consumption of WFPB and the number of reported illnesses, the socio-economic variables are distributed as shown in Table 1. Majority (78.75 %) of the household heads are male while 21.25% are females. Despite lower awareness of whole food plant based diets in female-headed households, they consumed more whole plant food (63.10%) than male-headed households (62.86%). Furthermore, female-headed households have a lower number of reported illnesses than households with male heads. This agrees with

Ogunmodede & Omonona (2020) who argued that diet quality is improved when women have more control over household decisions in developing countries.

The mean age of the respondents was 50.85 years. This showed that they are relatively in their active age. Respondents within the age group 51-70 record the highest extent of whole plant food consumption (63.94%). This could be a result of the fact that older people tend to be more conscious of their food intake due to certain illnesses peculiar to old age. Considering the marital status of the respondents, majority of the respondents are married and belong to a monogamous family. Respondents in this category have the highest awareness level of 22.5% and consume a larger proportion of whole plant food (62.90%) compared to singles. Consequently, they recorded the lowest reported illnesses. This is in tandem with Mfikwa & Kelima (2014) that being married influences consumption pattern in favor of WPBF in Ogun State, Nigeria.

Distribution by the level of education shows that most of the respondents have secondary school as their highest level of education. Those with only primary education are not aware of WPBF but consumed the highest proportion (64.95%) of whole plant foods. They also have the least average number of illnesses (2.50). On the other hand, those with tertiary education have the highest level of awareness (15.42%) but have the least average whole- plant food consumption. Thus, they recorded the highest number of reported illnesses (3.54). The results revealed that education enhanced awareness of whole plant food. However, contrary to expectation, this did not translate into more consumption of the whole plant food. This can be justified by the fact that respondents with tertiary education earn more than those with lower educational level. An increase in income increases the household's disposable income. This invariably leads to change in taste and preference for processed and canned foods. Hence, reducing household's expenditure on whole plant foods.

The mean income of the respondents was ₦137, 267 (274.53USD). This reveals that households' income is low in the study area. The results further showed that despite that awareness of WPBF is high among households with higher income, their consumption of whole plant food is low. Consequently, they record the highest average number of reported illness (3.73). This could be justified by the fact that those who earn high income are likely to be domiciled in areas where there is varieties of highly processed foods rich in fats and salt. Thus, resulting in incidence of certain illnesses usually termed "diseases of affluence". More than half

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of the households have less than 5 members. Households with the least members are the most aware of the WPBF diet. They record a mean of extent of whole plant foods of 62.09% and reported the least number of illnesses. This could be as a result of proper care and better nutrition. Households with more than 10 members have the least awareness level and have the highest mean number of illnesses. Overcrowding could be an issue here and this could trigger the easy spread of illnesses. This outcome is consistent with Mfikwa & Kelima (2014) that homes with fewer people tend to eat more of WPBF as they have smaller number of people to satisfy.

Table 1. Socio-economic characteristics, WPBF awareness, consumption and reported illness of respondents.

Variables	Frequency	Percentage (%)	Awareness	Mean of extent of whole food consumed	Mean number of reported illness
Sex male Female	189 51	78.75 21.25	20.42 8.33	62.86 63.10	3.01 2.80
Age <31 31-50 51-70 Mean – 50.85	6 100 134	2.50 41.67 55.83	1.78 15.0 12.08	63.70 61.46 63.94	1.83 2.94 3.04
Marital status Married(monogamous) (Polygamous) Never married Separated Widowed	 200 23 11 3 3	 83.3 9.58 4.58 1.25 1.25	 22.5 2.5 2.5 0.04 0.04	 62.90 64.83 61.07 56.82 60.96	 2.89 3.04 3.27 5.0 4.67
Level of education Primary Junior secondary Senior secondary Vocational Tertiary No formal education	 26 35 89 20 65 5	 10.83 14.58 37.08 8.33 27.08 2.08	 0 1.25 10.0 0.08 15.42 0	 64.95 63.06 62.38 62.10 62.43 69.78	 2.50 2.70 2.81 3.10 3.54 3.0
Household income 1000-50,000 50,001-100,000 100,001-150000 150,0001-200,000 Above 200,000 Mean- 137,267	 11 93 72 24 40	 4.58 38.75 30.00 10.00 16.67	 2.10 7.10 4.60 5.41 9.60	 60.99 63.84 63.66 61.50 60.73	 2.64 2.72 2.90 3.10 3.73
Household size 1-4 5-9 >10	 122 111 7	 50.83 46.25 2.92	 17.08 10.83 0.08	 62.09 63.77 63.21	 3.0 3.0 3.43

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Determinants of Awareness of Whole Plant Foods

The chi^2 statistic is significant at 1% indicating the overall fitness of the model to the data (Table 2). The pseudo R^2 of 33.68% shows that 33.68 of the dependent variables are explained by the independent variables. The estimates of the logistic regression model show that location, education, marital status and the income of the spouse significantly influenced the awareness level. The result shows that households located in the sparsely populated areas had a lower likelihood of being aware of the whole plant food. This might be that those domiciled in these areas are not well informed compared to those in the densely populated areas. Respondents in densely populated areas have better access to information. This conforms to the findings of Mustapha (2014) that urban residents have easier access to information than rural residents of Oyo state, Nigeria. It also agrees with Mfikwa & Kelima (2014) that being located in densely populated areas increases the likelihood of awareness of whole plant foods.

The likelihood of being aware of WFPB is positively and significantly affected by the household head's years of formal education. From the study, a unit increase in the years of formal education of the household head will increase the likelihood of being aware of whole plant food by 0.0362. The more educated the household heads are, the more their enlightenment on healthy diets. This result agrees with the findings of Babatunde, Omotesho & Sholatan (2007) that education improves the food security status of households in North-Central Nigeria. The study further explained that married household heads have a higher likelihood of being aware of whole food plant based diets. This result corroborates the study of Adeyanju (2014) that married respondents are more informed on the health benefits of vegetable consumption in Ogun state, Nigeria.

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Table 2. Estimates of Logistic Regression Model Showing Variables Affecting Awareness

Awareness	Marginal effect	Co-efficient	Std. Err.	P>|z|
Age of household head	-.0026966	-.0175649	.0207969	0.398
Location	0.3336822	-2.173476***	.4873046	0.000
Household-head formal education years	0.0362384	.2360427***	.0593736	0.000
Marital status	-0.2893733	-1.409178**	.6385317	0.027
Household size	0.0022615	.0147302	.1145231	0.898
Spouse monthly income	2.01×10^{6}	.0000131**	5.53×10^{6}	0.018
Household-head sex	0.0798272	.5199635	.4523857	0.250
Household-head income	-4.63×10^{7}	-3.02×10^{6}	3.76×10^{6}	0.422
Constant		0.0354378	1.581004	0.982

Number of observation=240; Pseudo R^2= 33.68; Log likelihood= -94.875327; LR $chi^2(8)$= 96.36
Prob.>chi^2= 0.0000; Survey data ***significant at 1%, **significant at 5%

Factors Affecting Households' Extent of Whole Plant Food Consumption

The study further examines the various factors affecting the extent of households' consumption of WPB diet as shown in Table 3. The Prob>F shows that the model is significant at 1%. The semi-log model was chosen as the lead equation because it has the best fit for the data. The result revealed that age, location and the years of formal education significantly influenced the extent of consumption of whole-plant food. Extent of consumption of whole-plant food is positively affected by age. The consumption of whole-plant food will increase significantly by 0.0504 for every unit increase in household head's age. This might be as a result of the fact that as people advance in age, they tend to be more conscious of the health impact of the food consumed. The location of households in densely populated areas negatively affects the extent of consumption of whole plant food. The results revealed that being located in a densely populated area will decrease the extent of consumption by 0.0323. Households in densely populated areas have less access to fresh and whole-plant foods than their counterparts in sparsely populated

areas. This result is consistent with Mfikwa & Kelima (2014) that urban households consume less of whole plant foods than rural households.

Furthermore, there is an inverse relationship between the consumption of whole plant food and household heads' years of formal education. The extent of consumption of whole food decreases by 0.0244 for every unit increase in years of education. The result contradicts the findings of Ruel (2004) that education improves the extent of intake of vegetables and fruits in sub-Saharan Africa.

Table 3. Result of Ordinary Least Squares Regression Showing Factors Affecting Extent of Consumption of Whole Foods

Variable	Coefficient	Standard error	p>/z/
Location	0.0325398**	0.0149918	0.031
Household-head monthly income	0.0001633	0.0042832	0.970
Age	0.0503885*	0.0281723	0.075
Sex	0.0112957	0.0182509	0.537
Household-head formal education years	-0.0243697**	0.0106183	0.023
Marital status	-0.0006882	0.0273953	0.980
Household size	0.0146195	0.0121363	0.230
Constant	0. 4540403	0.122277	0.000
Adjusted R^2= 0.5057			
Prob.> F= 0.0018			
Numberof observation=240			

**significant at 5%, *significant at 10%,

Factors Influencing the Number of Reported Illnesses

The factors affecting the number of reported illnesses are shown in Table 4. The Prob>F shows that the model is significant at 1%. The linear regression model was chosen as the lead equation. From the results, the age, location, and education of household head significantly influenced number of reported illnesses. Households' location in sparsely populated areas reduces the recorded cases of illnesses by 0.5839. The household head's age has a positive and significant effect on number of reported illnesses. The reported cases of illnesses increase by 0.0196 for every unit increase in age.

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Furthermore, a year increase in the years of formal education of the household head leads to increase in cases of reported illnesses increase by 0.0773 for every one year increase. The more educated the household head is, the more the likelihood of eating more processed foods that would eventually increase illnesses in the household. The result is not in tandem with Adeyanju (2014) & Mfikwa & Kelima (2014) which opined that years of formal education reduces the incidence of illness among households in Ogun state, Nigeria and Tanzania respectively. The extent of consumption of whole plant food reduces incidence of illnesses though not significantly.

Table 4. Estimates of the Ordinary Least Squares Regression on the Factors Affecting the Number of Illnesses.

Variables	Coefficient	Standard error	P>/z/
Location	0.5838537**	0 .1973352	0.003
Marital status	-0.4240796	0 .3467993	0.223
Household head age	0 .01963*	0 .0103226	0.058
Household-head education years	0 .0772922***	0. .0229915	0.001
Extent of whole-food consumption	-0.6702478	1.18032	0.571
Housing	-0.1547939	0. 2325323	0.506
Toilet type	-0.0109494	0.2065067	0.958
Constant	2.966542	1.039419	0.005
Number of observation=240			
Prob.>F= 0.0002			

*significant at 10%, ** significant at 5%, ***significant at 1%

4. Conclusion

The study established inadequate awareness of whole plant-based diets among households. The location, age and education of the household head and the monthly income of the spouse significantly influenced the awareness of households on whole food plant-based diets. The whole plant-based food extent of consumption and reported illness differ across the households' socio-economic characteristics. **C**onsumption of whole food and cases of reported illnesses are significantly influenced by location, household head's age and years of education. Hence, this study recommends collective and concerted efforts in increasing the awareness of households on

the health benefits of whole plant food consumption by the Nigerian Ministry of Health and Non-governmental organizations. Furthermore, Nigerian government should increase the budget allocation on agriculture so that whole-plant food especially fruits and vegetables could be made affordable and accessible to households all year round. Citizens should make good diet-related choices by opting for healthy diets.

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