FOOD DEMAND IN NIGERIA

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Abstract
Research on household food demand on a National level have received very little attention and emphasis has been laid on the need to understand the supply side rather than the demand side in the efforts to understand and improve the food security situation in the country. In this study, the demand for food in Nigeria was investigated using 2009 Harmonised National Living Standard Survey (HNLSS) data of the National Bureau of Statistics (NBS). Data on food prices were also obtained from the International Food Policy Research Institute (IFPRI) and the National Bureau of Statistics (NBS).Data from 33,012 households were analysed using a Quadratic Almost Ideal Demand System (QUAIDS). The results showed that the average age of household heads and household size in Nigeria were 47.67years and 4, respectively. Food expenditure share was highest for staples, followed by animal protein, vegetables, fats and fruits. Urban households spend more than twice (₦16,430.17) the amount spent by the rural households (₦7,077.88) on staples. Key determinants of the demand for any food group in Nigeria were the prices of the food group (except for fruits), the age of household head (except for animal protein), total expenditure on food, number of spouses of household head and marital status of household head (except for fats).Staples and animal protein were normal goods while fats, fruits and vegetables were luxury goods. Staples and animal proteins are demand inelastic while fats, fruits and vegetables are demand elastic. Cross price elasticity results suggest substitutability amongst most of the food groups in the country. To this end, the study suggests the need to implement food policy strategies capable of stimulating demand for food groups such as fruits and vegetables (sources of vitamins and minerals) that can strengthen the immune system and prevent nutrition-related diseases outbreak.

Key Words: Food expenditure, food demand, household income, QUAIDS.

1.0 Introduction

Food demand is the amount or quantity of food purchased by a person(s) at various prices, at a given time and place (Adegeye and Dittoh, 1985). FAO (2006) report which tracked the incidence of hunger in different regions of the world indicates that it is highest in the sub-Saharan Africa (SSA), where one in every three persons suffers from chronic hunger. Runge and Senauer (2007) also projected that by the year 2030, there will be 600 million more chronically undernourished people in the world due to continued pressure on staple food prices, which may, in part, be due to the conversion of one of the major staple food, maize, away from food-uses to industrial uses such as

the production of ethanol. The projected increase in the number of undernourished people may also be attributed to the fact that global demand for crops is increasing. This striking challenge of malnutrition all over the world cannot be overemphasized. This is the reason a thorough understanding of households' food demand and its determinants is important for policy targeting in sub-Saharan Africa (SSA) including Nigeria.

Rising incomes in poorer countries are reported to have also increased food demand, thereby diminishing global food reserves (ECOSOC, 2008). According to Ashagidigbi *et al.* (2012), income

growth is one of the most important factors driving changes in global food demand/consumption patterns in both developed and developing countries of the world. With growing incomes, shifting rural-urban populations and changing preferences over the years, domestic consumer demand for food has been on the increase. Also, food preferences are changing from grains and other staple crops to vegetables, fruits, meat and dairy because as purchasing power increase among most consumers in the world, consumers respond by shifting to more expensive and western forms of nutrients (Drewnowski and Popkin, 1997; King, 2011).

Nigeria is in a very precarious situation in terms of food insufficiency. This situation is evident in the report by NINCID (1999) corroborating the study done by the Food and Agriculture Organization (FAO) of the United Nations that Nigeria was among nations that were at that time, technically unable to meet their food needs from rain-fed production. Several years down the line, this assertion seems to still exist in Nigeria and may have been exacerbated by the low level of modern inputs used for production. It appears likely to remain this way even at intermediate levels of inputs at some time between 2000 and 2025 according to the report. This scenario was further corroborated by Ojo (2003) who reported

that Nigeria's domestic food supply has been far short of the need of the population and production of food was not increasing in a way that can meet up with the high demand. According to Idrisa *et al*. (2008), food demand in Nigeria has generally grown faster than either food production or total supply.

The pattern of food nutrient supply in Nigeria shows that food calorie (energy) consumption by an average Nigerian rose by 15.6% from 2091.50 calorie/caput/day in 1980 to 2418.40 cal/caput/day in 1990 and to 2725 cal/cap/day (a 30.3% increase) in year 2002; and aggregate protein consumption also rose from 48.5g /cap/day in 1980 to 56.2g /caput/day (15.9%) in 1990 and 61.1g per caput/day (26%) in 2002 (FAO 2004). This obvious disequilibrium between food demand and supply, in consonance with the pressure of increasing population and resultant food price hike, has led to a big gap between food availability and requirement with an enormous challenge on the national food security (Fashogbon and Oni, 2013). Furthermore, there is an increasing interest in recent years on food demand in Nigeria. This may be due to the increasing demand pressures on food in the urban areas arising from the increasing rural-urban migration and population growth (Abdulrahman, 2013)

2.0 Justification of the study

Several earlier studies on food demand have been done independently at varying levels such as state, regional or zonal levels. Some researchers (Onyemauwa, 2010; Bamiro, 2011) have looked at the analysis of consumption of different classes of food (cassava and protein-rich foods) in some parts of the country (Ebonyi and Ogun States respectively). They, however, did not look at all the classes of food and their studies were localized. Ashagidigbi *et al*. (2012) studied the determinants of food demand at National level albeit using the Harmonised National Living Standard Survey (HNLSS) data of 2004. This study, however, differs from that of Ashagidigbi *et al*. (2012) in that while looking at households' food demand in Nigeria and the underlying issues, we have used a more recent National Living Standard Survey data of 2009. The 2008/2009 HNLSS covered more households than the 2003/2004 HNLSS; while the 2003/2004 HNLSS covered 21,900 households; 2008/2009 HNLSS covered77,390 households which is more than three times greater than 2003/2004 HNLSS sample data. Ashagidigba *et al.* (2012) analysed data of

18,861 households while this study analysed data of 33,012 households which give more representation of Nigeria households.

Two models have been mostly used by researchers in analyzing the demand for food. They are the Almost Ideal Demand System (AIDS) and Quadratic Almost Ideal Demand System (QUAIDS) models. Several researchers (Blanciforti and Green, 1983; Abdulai *et al.,* 1999; Adejobi, 2005; Akinleye, 2007 and Muhammad-Lawal *et al.,* 2011) have used the AIDS model. However, only a few such as Obayelu *et al.,* 2009; Ashagidigbi *et al.,* 2012 and Fashogbon and Oni, 2013 have used the QUAIDS model to analyze food demand in Nigeria. QUAIDS model is preferred to AIDS model in that it has the property of non-linear Engel function which, according to Banks *et al.* (1997), is more appropriate for household data. For this study, therefore, we adopted the QUAIDS in our analysis due to the aforementioned reason.

Successive governments had over the years introduced different intervention programmes

and policies to ensure that the goals of poverty eradication and better food security are attained. These include amongst others: National Accelerated Food Production Programme and the establishment of Nigerian Agricultural and Co-operative Bank (1972); Operation Feed the Nation (1976), which was a mass awareness and mobilization programme on increasing food production in Nigeria; River Basin Development Authority (1976), aimed at harnessing the potential of existing water bodies through improved irrigation services, fishery development, and control of flood, water pollution and erosion; Green revolution (1979), aimed at accelerating the achievement of the objectives of the agricultural sub-sector of increasing local agricultural production/output and reducing food imports; Agricultural Development Project, aimed at enhancing the technical and economic efficiencies of small farmers; National Special Food Security Programme (2011), aimed at improving productivity and sustainability of agricultural system; National Fadama Development Project (Fadama I, II and III) amongst others. There was also a plan to implement a Young Graduate Commercial Farmers' Scheme in 2013 as part of efforts to ensure the country attains food self-sufficiency and other current food security programmes. Most of these interventions have focused on increasing food supply as a way of attaining food security. This is, however, just only a necessary but not sufficient condition to eradicate food insecurity. Little wonder most of these interventions fell short of achieving the intended goals. The results of this research, therefore, gives credence to the argument by Devereux *et al.,* (2008) that efforts at ensuring food security should not only be focused on the supply side but should also look at the demand side that food has to be safe, nutritiousand appropriate to meet food preferences. Given the above, the main objective of this study was to examine food demand among households in Nigeria. To achieve this objective, we specifically examined the following:

(i) the profile of households' food expenditure in Nigeria.
(ii) the determinants of household food demand in Nigeria, and
(iii) households' food demand responsiveness to changes in price and income.

3.0 Methodology
3.1 Scope of the study
The scope of the study covered households in Nigeria. We focused on prices and expenditure on food groups including staples, animal protein, fats and oil, fruits, vegetables and other food items such as spices, condiments, sweets, beverages etc. We also identified factors influencing the demand for food as well as the responsiveness of food demand to income and price changes.

3.2 Description of Data Source, Collection Procedure and Sample Size
This study made use of secondary data collected during the 2009/2010 Harmonised Nigeria Living Standards Survey (HNLSS) by the National Bureau of Statistics (NBS) with a sample of 33,012 households.The two-stage cluster sample design was employed for HNLSS 2008/2009. The first stage was the Enumeration Areas (EAs) or Primary Sampling Units (PSUs) while the Housing Units (HUs) from the EAs make up the second stage sample. In the HNLSS 2008/2009, ten (10) EAs were selected in 774 Local Government Areas in Nigeria including the Federal Government Territory making a total of 7,774EAs. Overall, 77,390 households were covered from a sample of 77,400 households giving the survey a 99.9% coverage rate. After cleaning the data, our final sample for the analysis consists of 33,012 household-level data. Data on food prices for the various food items (by States) covered in the survey for the period November 2009- October 2010 were also obtained from International Food Policy Research Institute (IFPRI), National Bureau of Statistics website and others were projected using previous year prices and Consumer Price Index (CPI).

3.3 Empirical Model Specification
Descriptive statistics such as percentage, and mean were used to determine households' socio-economic characteristics and expenditure on food groups which were: staples, animal protein, fats and oil, fruits and vegetables. The QUAIDS model was used to determine factors influencing households' food demand and preferences. Quadratic Almost Ideal Demand System (QUAIDS) was used to establish the determinants of households' food demand in Nigeria, following Obayelu *et al.,* (2009); Ashagidigbi *et al.,* (2012) and Fashogbon and Oni, (2013). QUAIDS is a model derived by

Banks *et al.,* (1996 and 1997). It was used to describe consumer behaviour and is favoured over the Almost Ideal Demand System (AIDS) because it has the property of allowing goods to have the characteristic of luxuries at lower levels of expenditure and necessities at higher levels of expenditure. QUAIDS is derived from a generalization of Price Invariant Generalized Logarithmic (PIGLOG) preferences (i.e. a system with budget shares linear in log total expenditure) and starts from an indirect utility function of the form:

$$\text{Ln } V = \left\{\left[\frac{\ln m - \ln a\,(p)}{b(p)}\right]^{-1} + \mu(p)\right\}^{-1} \text{------ (1)}$$

Where: Ln V is the log of the per capita food expenditure; $\frac{\text{Ln } m - \ln a\,(p)}{b(p)}$ = the indirect utility function of the PIGLOG demand system (i.e. a system with budget shares linear in log total expenditure); m = household income

$a\,(p)$, $b\,(p)$ and $\mu h(p)$ are functions of the vector of prices. To ensure the homogeneity property of the indirect utility function, a (p) must be homogenous of degree one in *p*, and *b (p)* and $\mu(p)$ must be homogenous of degree zero in *p*.

The ln a (p) has the usual translog form Ln a (p) $= \alpha_0 + \sum_j \propto_I \ln p_j + \frac{1}{2}\sum_i \sum_j \gamma_{ij} \ln p_i p_j$--- ----- (2)

b (p) is the simple Cobb-Douglas price aggregator defined as b (p) $= \prod_{i=1}^{n} p i^{\beta i}$-------(3)

$\mu(p)$ is defined as $\mu(p) = \sum_{i=1}^{n} \mu(p) \ln p_i$

Where: $\sum_i \mu(p) = 0$ -------------------------(4)

By applying Roy's identity to the indirect utility function, the budget share in the QUAIDS is given by;

$w_i = \alpha_i + \sum_{j=1}^{n} \gamma_{ij} \ln p_j + \beta_I \ln \left[\frac{m}{a(p)}\right] + \frac{\mu i}{b(p)}\left\{ln\left[\frac{m}{a(p)}\right]\right\}^2$ ----------------------------(5)

Banks *et al.* (1997) showed, as is evident in equation 9, that the coefficients of the quadratic term in these demand functions must be price dependent. For theoretical consistency and to reduce the number of parameters to be estimated, it is common to impose additivity, homogeneity and symmetry restrictions. A sufficient condition for the expenditure shares to be homogenous of degree zero in prices is $\sum_i^n \gamma_{ij} = 0$, $\forall i$. Symmetric changes in compensated demand is imposed by setting $\mu ij = \gamma_{ij}$, $\forall i \neq$ j. Additivity requires $\sum_i^n \alpha_i = 1$ and $\sum_i^n \beta_i = 0$. These conditions are trivially satisfied for a model with n goods when the estimation is

carried out on a subset of n-1 independent equations. In line with Banks *et al.,* (1997), demographic effects were included to influence preferences through the intercept in equation (6), or

$\alpha_i = p_{io} + \sum_{j=1}^{s} p_{ij} d_j$---------------------------- (6)

Where: d_i is the jth demographic variable of which there are S. According to Pollak and Wales (1978), this translating approach is used to include the demographic variables because of its simplicity. Therefore, from equations 6 and 7; where:

Ij = food groups;

α_i, μ, β, γ are parameters to be estimated

w_i = average budget share of item I by the household

α_i = Average value of the budget share in the absence of price and income effects

β = Parameters that determine whether goods are luxuries or necessities

γ_{ij} = effects on the budget of item I of 1% change in the prices of items in group j

p_i = price of item j

d_i = vector of socio-economic and demographic variables

u_i = error term

The budget share of individual food group was calculated as:

$W_{GI} = (P_{GI}q_{GI})/ X_G$ --- budget share of the ith food group G relative to total expenditure in Group G;

G- specific group with G = 1,2, 3…N

P_{GI} and q_{GI} are the price and quantity of ith food in group G

$W_G = \frac{X_G}{X}$ -----

The budget share of group G -------------- (7)

W_1 = expenditure share for staples

W_2 = expenditure share for fats

W_3 = expenditure share for animal protein

W_4 = expenditure share for fruits

W_5 = expenditure share for vegetables

$X_G = \sum P_{GI}q_{GI}$ ----

Total expenditure in group G ----------------- (8)

X = Total expenditure of the food groups

The state prices of the food items, as at the survey period 2009/2010, to be categorized into different food groups were obtained from price questionnaire obtained from National Bureau of Statistics and International Food Policy Research Institute (IFPRI). Socio-economic and demographic variables that were used are as given below:

Socio-economic characteristics

Age = Age of Household head

Sex = Sex of household head (male=1, 0 otherwise)

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

Hhsize = household size

Expenditure = household total food and non-food expenditure

Regional dummies

Rural (=1, 0 otherwise)

Prices of food groups

Pstaples = Price of staples/grain equivalent (₦)

Panimpro = Price of Animal Protein/grain equivalent (₦)

Pfats = Price of fats and oil/grain equivalent (₦)

Pfruits -= Price of fruits/grain equivalent (₦)

Pveg = Price of vegetables/grain equivalent (₦)

Perhtexp = Per capita household expenditure

To estimate households' food demand responsiveness to changes in price and income, the formulae for the elasticities in the QUAIDS as given by Banks *et al.,* (1997) was derived by first differentiating equation (9) with respect to ln m and ln pj, respectively, to obtain:

$$\rho i = \frac{\partial wi}{\partial \ln m} = \frac{\mu \lambda i}{b(p)} \left\{ \left[\frac{m}{a(p)} \right] \right\} \text{--------------(9)}$$

$$\rho ij = \frac{\partial wi}{\partial \ln pj} =$$

$$\gamma ij - \rho i \left(\propto j + \sum_k \gamma jk \ln Pk \right) -$$

$$\frac{\lambda i \beta j}{b(p)} \left\{ \ln \left[\frac{m}{a(p)} \right] \right\}^2 \text{------------------ (10)}$$

The expenditure elasticities are then derived as;

$$ei = \frac{\rho i}{wi} + 1. \text{------------------------- (11)}$$

The uncompensated or Marshallian price elasticities are given by $e_{ij}^u = \frac{\rho}{wi} - \delta ij$ where δij is the Kronecker delta, which is equal to one when I = j, otherwise $\delta ij = 0$. Using the Slutsky equation, $e_{ij}^c = e_{ij+wjei}^u$, the uncompensated or Hicksian price elasticities can be calculated and used to assess the symmetry and negativity conditions by examining the matrix with elements wi $\left[e_{ij}^c \right]$ which should be symmetric and negative semi-definite in the usual way.

As shown in Table 1, 75.6% of the respondents sampled were from the rural sector while 24.4% were from the urban. The majority (84.9%) of the households were male-headed. Age distribution of respondents showed that majority (40.4%) of household heads sampled were ≤40years while about 20% were greater than 60years. Mean age of 47.67years old showed that the respondents were still in their active age range. Majority of the households (68.4%) had 1-5 household members. The mean household size of 4 indicated that the sample had a moderate household size. Households' adult equivalent also revealed that households within two to four adult equivalent range (38.2%) were most prominent, while the range of >6 was the least (11.8%). Also, 21.8% of the respondents were extremely poor while 54.4% of them were moderately poor.

Table 1: Socio-economic Characteristics of Households in Nigeria

Variables	Frequency	
Sector	24941	75.6
Urban	8071	24.4
Age of Household head		
≤ 40	13,330	40.4
41-60	13050	39.5
> 60	6632	20.1
Mean	47.67	
Standard Deviation	15.978	
Gender of Household Head		
Male	28033	84.9
Female	4979	15.1
Marital Status		
Never Married	1	0.0
Married Monogamous	27739	84.0
Married Polygamous	284	0.9
Living together	197	0.6
Divorced/Separated	1100	3.3
Widowed	3691	11.2
Household size		
1-5	22575	68.4
6-10	10437	31.6
Mean		
Standard Deviation	3	
Adult Equivalent		
<2.0	8739	26.5
2.0-3.9	12627	38.2
4.0-5.9	7760	23.5
≥6.0	3886	11.8
Mean	3.43	
Standard Deviation	1.931	
Core-Poor		
Extreme poor	7198	21.8
Non-poor	25814	78.2
Moderately-Poor		
Poor	17948	54.4
Non-poor	15064	45.6

Source: Authors' computation from HNLSS 2009/2010

4.0   Results and Discussion

4.1   Households' Socio-Economic Characteristics

4.2   Households' Expenditure on Food Groups in Nigeria

As shown in table 2, six food groups namely staples, animal protein, fats, fruits, vegetables

and other foods such as sweets, condiments, spices, beverages etc. were considered. The data density which shows the proportion of the total population that consumes a particular food group revealed that staples recorded the highest density of 92.3% while fruits recorded the least density of 26.7%. Furthermore, staples have the highest yearly food expenditure share (35.92%) of all food groups consumed in the country followed by animal protein having yearly expenditure share of 26.46%. Yearly expenditure on vegetables takes 13.18% of all food expenditure and fruits have the lowest food expenditure share of all food groups, take 0.89%. This implies that staples were the most consumed food group in Nigeria. Households also spent their highest food expenditure on staples. This is not surprising as staples are a main dietary source of food nutrients to households in Nigeria and the country budgeted more than 50% of her food budget on staples annually (Musa *et al.,* 2012; NBS, 2012). Previous authors also reported that majority of households in Nigeria allocated the highest percentage of food spending on staples (Ashagidigba*et al.,* 2012; Fashogbon and Oni (2012); Ogunniyi *et al.,* 2012). The low percentage expenditure on fruits relative to staples and animal protein found in this study aligned with the findings of Obayelu *et al.,* (2011).

Sectorial disaggregation in Table 3 also shows that staples recorded the highest density while fruits recorded the least density in rural and urban sectors however more proportion of the total population consumed staples and fruits in the urban sector than rural sector. In terms of expenditure, the urban households spent more than twice (₦16,430.17) the amount spent by the rural households (₦7, 077.88) on staples. This

implies than urban households spent more on staples than rural households. This result is consistent with the findings of Obayelu *et al.,* (2011).It was further revealed that the urban sector households spent a higher proportion of their food expenditure share on staples (44.32%) and fruits (1.34%)as opposed to the rural households (staples-37.30%; fruits- 1.14%). This implies that expenditure per adult equivalent and yearly expenditure share on staples and fruits were more in the urban sector than the rural sector. Rural sector households spend a higher proportion of yearly food expenditure on the other food groups (Animal protein- 25.63%; fats- 7.82%; vegetables- 13.03%; and others- 15.08%) compared to their urban sector counterparts, however, urban sector households spent more, on per adult equivalent basis, on animal protein (₦8588.54) than to their rural counterparts (₦4997.67).

Table 2: Households' Expenditure on Food Groups in Nigeria

Food Groups	Data Density	Yearly Expenditure per adult equivalent (₦)	Yearly Expenditure Share
Staples	0.923 (30464)	9364.39	0.3592
Animal protein	0.891 (29419)	5875.59	0.2646
Fats	0.721 (23788)	1586.76	0.0779
Fruits	0.267 (8805)	286.81	0.0089
Vegetables	0.931 (30731)	2833.65	0.1318
Others	0.930 (30696)	3373.33	0.1575

Note: Frequency in parenthesis
Source: Authors' computation from HNLSS 2009/2010

4.3 Determinants of Households' Food Demand in Nigeria.

Factors influencing demand for staples in Nigeria as shown in Table 4 were identified as; prices of staples and vegetables, age of household head, number of spouses, marital status and income at $p<0.01$. Other factors include the price of fruits and household size which were significant at 10% level of significance. The coefficient of the price of staples was positive and significant. This implies that the increase in the price of staples would

increase the demand for staples. Most households in Nigeria sourced their dietary requirement from the consumption of staples therefore the price of staples would potentially not have any negative impact on demand. This is consistent with the findings of Ashagidigba *et al.* (2012). The coefficients of prices of fruits and vegetables were negative and significant. This implies that more staples would be demanded if the prices of fruits and vegetables decrease.

Table 3: Households' Expenditure on Food Groups by Sector

Food Groups	Rural (24,941)			Urban (8, 071)		
	Data density	Expenditure per adult equivalent (₦/year)	Expenditure share	Data density	Expenditure per adult equivalent (₦/year)	Expenditure share
Staples	0.908 (22651)	7077.88	0.3730	0.968 (7813)	16430.17	0.4432
Animal protein	0.871 (21738)	4997.67	0.2563	0.952 (7681)	8588.54	0.2302
Fats	0.711 (17730)	1375.47	0.0782	0.751 6058)	2399.66	0.0630
Fruits	0.235 (5849)	218.88	0.0114	0.366 (2956)	496.71	0.0134
Vegetables	0.923 (23013)	2432.62	0.1303	0.956 (7718)	4072.91	0.1102
Others	0.923 (23015)	2787.51	0.1508	0.952 (7681)	5183.60	0.1400

Note: Frequency in parenthesis
Source: Authors' computation from HNLSS 2009/2010

With regards to the influence of socio-economic characteristics on the demand for staples, the coefficients age of household heads and household size were positive and significant. This implies that households with older household heads and more members would demand more staple food. Omonona and Agoi (2007) opined that food insecurity incidence increases with the age of household head. Obayelu *et al.,* (2011) also reported that expenditure on food increased with household members. The coefficients of income, number of spouses and marital status were negative and significant. This implies that households with household heads that were not married would demand more of staples. Also, household heads with lower income and lesser number of spouses would demand more of staples. Staples are generally cheap relative to other food groups so households with low income would prefer to buy more food groups with lower prices than food groups with higher prices. Seid (2011) also attributed food consumption expenditure to household demographic characteristics and economic factors.

The demand for fats was found to be determined by the prices of fats, animal protein, fruits and vegetables. Other determining factors include the age of household head, number of spouses of household head and income. All were significant at $p<0.01$. Gender and marital status of household head were however not significant in determining the demand for fats in Nigeria. Demand for fats was found to be increasing with an increase in the prices of vegetables and the number of spouses of household heads. It was

however found to decrease with increase in prices of fats, animal protein and fruits as well as an increase in the age of household head.

Demand for animal protein was found to be determined by factors such as the prices of animal protein and fruits, income, household size, number of spouses, and the marital status of the household head. The demand for animal protein was found to increase with an increase in the price of protein, price of fruits and was found to be higher in households where the household head is married. Demand was however found to decrease with increasing household size and the number of spouses.

The demand for fruits was found to be determined by the prices of fruits and vegetables, the number of spouses and income at $p<0.01$, and age of household head at $p<0.05$. Marital status of household head was however significant at 10% level of significance. The demand for fruits was found to increase with an increase in the price of vegetables. Demand, however, decreased with an increase in the price of fruits and age of household head. Households with older heads were found to consume fewer fruits. Also, household heads that were unmarried consumed more fruits compared to their married counterparts.

Factors determining the demand for vegetables were found to include the price of vegetables, household size, age of household head, income, and marital status of the household head at $p<0.01$. The number of spouses was significant at $p<0.10$. Demand for vegetables increased with an increase in the price of vegetables and households with married heads also consumed

more vegetables. Consumption was however observed to decrease with increases in household sizes, age of household head and the number of spouses of the household head.

Table 4: Determinants of Households' Food Demand in Nigeria

Variable	Staple	Fat	Animal protein	Fruit	Vegetable
Price coefficients					
Pstaple	0.1384 (5.65)***				
Pfats	0.0053 (0.35)	-0.0846 (-7.82)***			
PAP	-0.0040 (-0.89)	-0.0114 (-3.66)***	0.0132 (8.24)***		
Pfruit	-0.0043 (-1.75)*	-0.0115 (-6.89)***	0.0045 (5.94)***	-0.0009 (-1.34)	
Pveg	-0.1353 (-12.98)***	0.1023 (16.69)***	-0.0023 (-0.90)	0.0123 (8.72) ***	0.0231 (3.68)***
Households' characteristics					
HH Size	0.0002 (1.76)*	0.00003 (0.51)	-0.00006 (-1.91)*	-0.00002 (-1.46)	-0.0002 (-2.63)***
Age	0.00009 (5.84)***	-0.00006 (-6.54)***	2.73e-06 (0.66)	-3.99e-06 (-2.08)**	-0.00003 (-3.58)***
Texp	-0.2267 (-17.89)***	0.1143 (11.19)***	-0.0110 (-2.28)**	0.0151 (6.52)***	0.1083 (17.12)***
Spouses	-0.0022 (-4.79)***	0.0031 (10.49)***	-0.0008 (-4.93)***	0.0003 (4.24)***	-0.0004 (-1.70)*
Gender	0.0006 (0.29)	0.0010 (0.69)	-0.0011 (-1.59)	-0.0003 (-0.85)	-0.0002 (-0.19)
Maritalstat	-0.0020 (-3.75)***	0.0005 (1.17)	0.0005 (2.36)**	-0.0002 (-1.70)*	0.0013 (4.51)***
Constant	-0.0307 (-0.66)	0.6005 (15.76)***	-0.017 (-0.92)	0.0733 (8.16)***	0.3739 (15.16)***

Source: Authors' computation from HNLSS 2009/2010

3.4 Elasticity Estimates of Food Groups in Nigeria

Table 5 shows the uncompensated (Marshallian) and compensated (Hicksian) own- and cross-price elasticity estimates as well as income (expenditure) elasticity estimates of all the food groups in Nigeria using the QUAIDS model specification. The expenditure elasticity for all food groups are positive (Ashagidigba *et al.,*2012; Okoruwa *et al.,* 2008; Abdullahi, 2001 and Obayelu, 2009) and was found to range from 0.5050- 2.8585. Results show that both staples and animal protein are normal goods in Nigeria, as they have elasticity values that are less than unity. This means that as income/expenditure increases, the proportion of income expended on the stated food groups' decrease. This is consistence with findings of Ashagidigba *et al.* (2012).

Fats, fruits and vegetables, however, have values greater than unity meaning they are luxury goods. This means the proportion of income spent on the food groups tends to increase as income increases. In the study of Ashagidigba *et al.* (2012), only fats and fruits were found to be luxury while other food groups were normal goods but this study found that vegetables have also become luxury food group in Nigerian diets.

Own price elasticity estimates (represented by the diagonal of the matrices) using both the compensated and uncompensated demand functions are all negative meaning that for all the food groups, an increase in the food group's price will lead to a decrease in the consumption of items belonging to that food group. Fats, fruits and vegetables with absolute values greater than unity (elastic in demand), are all

8

own-price elastic in demand, meaning that a percentage increase in price will lead to more than one percent decrease in the quantities demanded of that food group. Staples and animal protein, with absolute own-price elasticity, values less than one are inelastic in demand meaning a less than proportionate decrease in quantity demanded as a result of a percentage increase in food group's price. This implies that staples and animal proteins are inelastic in demand while fats, fruits and vegetables are elastic in demand. This result is contrary to findings of Ashagidigba *et al.,* 2012 who found that own-price elasticities of staples, animal protein, fat and vegetables are elastic (with absolute values greater than unity)except for fruit with own-price elasticity less than unity thus making fruit to be inelastic in demand.

The compensated cross-price elasticity estimates for staples revealed that all food groups are complementary goods to staples (with negative cross-price elasticities) except fats which are a substitute food group to staples (with a positive cross elasticity). Fats also have all food groups as complements except for staples and vegetables which are substitutes. While it is understandable that fats can be a substitute to staples as a source of energy, the positive cross elasticity with vegetables can be because most vegetables are consumed alongside staples. All other food groups were found to be complementing animal protein except fruits. The results also show that any increase in the price of fruits will lead to an increase in the demand for vegetables, animal protein and staples. The cross-price elasticity for vegetables shows that fruits are substitutes for vegetables.

Table 5: Price and Income Elasticity Estimates in Nigeria.

(Marshallian/Uncompensated)

	PSTP	PFT	PAP	PFR	PVG	INCOME
STP	-.5111	0.3903	0.0193	0.0372	0.0640	0.7495
FT	1.2306	-1.5660	0.0585	-0.1009	0.3779	1.0955
AP	0.3901	0.0911	-0.7379	0.1019	0.1546	0.5050
FR	1.3214	-1.3217	0.5371	-1.1623	0.6258	2.8585
VG	0.3549	0.5848	0.1287	0.0364	-1.1047	1.6585

Source: Authors' computation from HNLSS 2009/2010

(Hicksian/Compensated)

	PSTP	PFT	PAP	PFR	PVG
STP	-0.8307	0.2917	-0.0119	0.0309	0.0038
FT	0.1159	-1.9101	-0.0507	-0.1229	0.1678
AP	-0.0861	-0.0558	-0.7846	0.0925	0.0648
FR	-0.2074	-1.7936	0.3873	-1.1925	0.3376
VG	-1.0217	0.15990	-0.0061	0.0093	-1.364

Source: Authors' computation from HNLSS 2009/2010

5.0 Conclusion and Recommendations.

The study used the QUAIDS model to analysed the 2008/2009 Harmonised National Living Standard Survey, comprising of a sample of 33,012 households to update knowledge on food demand and its determinants in Nigeria. The study revealed that 75.6%of households used in the study were from the rural sector while 24.4% were from the urban sector. The mean age of the household head was 47.67 years. Majority of the respondents were male (84.9%) with a very large percentage of the

respondents being married-monogamous. The average household size was 4.

Staples have the highest yearly food expenditure share of all food groups consumed in the country followed by animal protein. In terms of expenditure, urban households spend more than twice the amount spent by rural households on staples. Urban sector households spend a higher proportion of their food expenditure share on staples and fruits while rural sector households spend a higher proportion of yearly

food expenditure on animal protein; fats, vegetables and others.

The results on determinants of food demand revealed that prominent among the determinants of the demand for any food group in Nigeria were - the prices of the food group in question (except for fruits), the age of household head (except for animal protein), total expenditure on food, number of spouses of household head and marital status of household head (except for fats). Household size was found to significantly determine the consumption/demand for staples, animal protein and vegetables.

The expenditure elasticities results showed that staples and animal protein were normal goods while fats, fruits and vegetables were luxury goods. It was further revealed that staples and animal proteins are inelastic in demand while fats, fruits and vegetables are elastic in demand. Cross price elasticity results suggest substitutability amongst most of the food groups in the country. The study thus suggests the following recommendations:

(i) There is need for government to implement strategies that will stimulate demand for food groups such as fruits and vegetables that serve as sources of vitamins and minerals to prevent an outbreak of nutrition-related diseases.

(ii) There is need for stability of food prices to ensure households' access to sufficient and nutritious food in Nigeria because the high cost of a particular food group might account for the lower consumption and expenditure on such food group.

(iii) There is need for well-targeted income-related strategies as well as food safety net programmes to enhance access to safe and nutritious food, increase in expenditure and demand for fats, fruits and vegetables which are considered as luxury food groups among households.

(iv) There is need for nutrition-oriented programs to create awareness and improve the knowledge of food substitutability among households.

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