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Analysis of the Demand for Fruits and Vegetables Among Households in Nigeria

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Abstract

The consumption of fruits and vegetables is essential in ensuring food and nutritional security due to its richness in micronutrients and vitamins. However, its consumption has always been below the recommended level in Nigeria. Thus, the need to examine the factors responsible for their low demand is germane. Data were obtained from secondary sources. Harmonized National Living Standard Survey data, collected by the National Bureau of Statistics were used. A total of 4004 respondents across rural and urban sectors were sampled. Descriptive statistics, budget share, and Quadratic Almost Ideal Demand System (QUAIDS) models were the analytical techniques adopted. The results showed that the expenditure on fruits and vegetables tends to be higher among urban households than those in rural areas. The increased price of fruits reduced the demand for vegetables. Males and older respondents consume less fruit and vegetable food group. Price stability and intensification of the awareness campaign of fruits and vegetable consumption among male, rural residents and the aged are policy options that could improve the consumption of fruits and vegetables in Nigeria.

Introduction

Fruits and vegetables, which are the major sources of vitamins, minerals and micro-nutrients required in healthy diets, cannot be over-emphasized particularly in developing countries such as Nigeria [1]. Basic food commodities play an essential role in economic development as their availability and cost impinge directly on food security, expenditures and incomes of households, particularly amongst the poorer segments of the population; both rural and urban. Despite all the benefits of fruits and vegetable consumption, consumption is far below the WHO/FAO minimum dietary recommendation of 400g per person per day or 146kg per person per year in the country [2, 3]. Due to the low level of consumption of fruits and vegetables in Nigeria, the implication on health and nutritional security could be devastating [4]. Therefore, there is a need to examine the household's demand for fruits and vegetables and also analyze the limiting factors affecting its demand and consumption. Few empirical studies of the demand structure of fruits and vegetables in Nigeria are available [5]. In order to provide empirical evidence to understand these issues, it is necessary to understand the households' demand for fruits and vegetables in Nigeria and their consumption pattern among urban and rural households, with the aim improving their demand and ensuring food security [6]. The General Objective is to examine the demand for fruits and vegetables among households in Nigeria.

The specific objectives are to estimate the share of households' expenditure on fruits and vegetables in Nigeria; to determine factors affecting the demand for fruits and vegetables in Nigeria and to determine the compensated and uncompensated elasticity of demand for fruits and vegetables in Nigeria. The result of this study would be useful in providing up to date information on fruits and vegetable consumption, consumers' responsiveness to price and expenditure changes, which would be useful in designing people-oriented food policy, as well as formulating long term policy for food security and poverty reduction.

Materials and Methods

The study was carried out in Nigeria. The data were obtained from the Harmonised Nigeria Living Standard Survey (HNLSS) conducted by the National Bureau of Statistics [7]. A total number of 4004 households across rural (3,297) and urban (707) sectors were used for the study. The data collected includes the socioeconomic characteristics of households and households' consumption and expenditure on fruits and vegetables in Nigeria. Analytical techniques used include descriptive statistics such as frequency, percentage and mean. This was used to analyze the socioeconomic characteristics of households in Nigeria.

Budget share index [14] was used to estimate the expenditure share of each of the food groups considered. These are vegetables, fruits, and others, such as cereals and pulses, which could substitute or complement vegetables and fruits. The equation is stated as follows:

$$w_r = \sum_{i=1}^{n} \frac{x_{ri}}{x_i} \quad (1)$$

Where:
w_r = budget share on each food group consumed by i^{th} household
x_r = expenditure on each of the food groups by i^{th} household ($)
x_i = total expenditure on all the food groups captured (vegetables, fruits, cereals and pulses)
i = 1,2……. n.

The probit regression was used to identify the factors that influence households' decision to consume fruits and vegetables, illustrated as:

$$Y_1 = \beta_1 X_i + \varepsilon_i \quad (2)$$

Where Y_1 = households' decision to consume either vegetables or fruits (1 = yes 0 = no)
β_1 = vector of unknown parameters
X1 = sex of respondents (1=Male, 0= Female)
X2 = marital status (1=married, 0= otherwise)
X3 = age (years)
X4 = household size (number)
X5 = households' income ($)
X6 = sector (rural = 1, urban = 0)
X6= price of vegetables
X7= price of fruits ($)
X8= price of cereals ($)
X9= price of pulses ($)

Quadratic Almost Ideal Demand System (QUAIDS) model [9] was used to determine the factors determining household' demand for vegetables and fruits in Nigeria as stated in the equation below:

$$w_1 = \alpha_1 + \sum_{j=1}^{n} Y_{ij} \ln P_j + \beta_i \ln\left[\frac{m}{a(p)}\right] + \frac{\lambda_1}{b(p)}\left\{in\left[\frac{m}{a(p)}\right]\right\}^2 (3)$$

As stated in equation 3, the researchers revealed that the coefficients of the quadratic term in these demand functions must depend on price [8, 9].

Following the previous work [8], demographic effects were also included to influence preferences through the intercept in the equation, that is:

$$\alpha_i = \rho_{io} + \sum_{j=1}^{s} \rho_{ij}\, d_j \quad (4)$$

Where *dj* is the *jth* demographic variable of which there are S.
Ij = food groups
αi, λ β γ are parameters to be estimated
Wi = average household's' budget share on item i
αi = average value of budget share in the absence of price and income effects
β_i = parameters that determine whether goods are luxuries or necessities
γ_{ij} = effects on the budget of item i on 1% change in the prices of items in group j
Pj = price of item j
d_j = vectors of socioeconomic and demographic variables
The expenditure elasticities are then derived as follows:

$$e_i = \mu_i / w_i + 1 \quad (5)$$

The uncompensated or Marshallian price elasticities [8, 9] are given by $e_{ij}^{u} = \mu/w_i - \delta_{ij}$where $\delta_{ij}$is the Kronecker delta, which is equal to one when $i = j$, otherwise $\delta_{ij} = 0$. Using the Slutsky equation, $e_{ij}^{c} = e_{ij}^{u} + w_j e_i$, the compensated or Hicksian price elasticities can be calculated and used to assess the symmetry and negativity conditions by examining the matrix with elements $w_i[e_{ij}^{c}]$, which should be symmetric and negative semi-definite in the usual way.
Explicitly,
W_i = dependent variable (Expenditure share on fruits and vegetables)
X_{is} = explanatory variables:
P_1 = price of fruits ($)
P_2 = price of vegetables ($)
P_3 = price of cereals ($)
P_4 = price of pulses ($)

Results and Discussion

As revealed in Table 1, about 50% of the total households in Nigeria were within the age range of 31-50 years in the pooled data and across the 2 sectors, while less than 10% were 70 years and above. The mean age distribution of the respondents, which is less than 50 years across the two sectors and the pooled data, indicated that the majority is still in their active and productive age. Gender distribution also showed that more than 9 out of 10 respondents were males in the pooled data and the rural sector, with the urban sector having almost 9 males out of 10 respondents. This is an indication that males are mainly the head of household and breadwinners in Nigeria. The members of each household are also 5 across the two sectors and the pooled data, implying a moderate level of household size is being maintained in Nigeria. About 94% of the respondents in Nigeria were married, while the remaining 6% were separated, widowed or living together. A similar trend was observed in the rural sector. In the urban sector; however, 87% of the total respondents were married. The distribution of households' income in the pooled data and across the sectors shows that above 80% of the respondents are within the income range of $1,400.56-$2,801.12. The mean income of households in the urban sector is; however, much higher than that of the rural.

Table 2 revealed the households' per capita expenditure and expenditure share on the food groups. In the pooled data, 68.5% of the total budget share was expended on cereals, while the per capita expenditure on cereals was about 70% of the total. The expenditure shares of vegetables were 13.7% and 1.52%, respectively. A similar trend was observed in the rural sector with 70.5% of the budget on the food groups allocated to cereals, while the per capita expenditure on vegetables and fruits, including pulses, is less than half of that of cereals. Lastly, 18.5% and 2.45% of the total budget was spent on vegetables and fruits, while 59.2% was on cereals in the urban sector. Per capita expenditure on cereals is more than twice that of vegetables, fruits and pulses combined. The trend in the pooled that and across sectors revealed that households give priority to cereals (high energy giving food group) more than fruits and vegetables. This; however, would have an implication on health and nutritional security of households in Nigeria. The demand for vegetables and fruits is higher among urban households than those in the rural sector.

The result of probit regression analysis as shown in Table 3 indicates the factors determining the decision to consume vegetables and fruits in Nigeria. These include total income, sector, sex, prices of fruits; cereals and pulses. The increased price of fruits increases household's decision to consume vegetables, but reduces that of fruits. This implies households would prefer to switch to vegetables if the price of fruits is increased. The

Table 1 Socio-economic distribution of households in Nigeria.

	Pooled		Rural		Urban	
Variables	**Frequency**	**Percentage**	**Frequency**	**Percentage**	**Frequency**	**Percentage**
Age (years)						
<30	726.00	18.132	628.00	19.048	98.00	13.861
31-50	2038.00	50.899	1679.00	50.925	359.00	50.778
51-70	1005.00	25.099	807.00	24.477	198.00	28.006
>70	235.00	5.869	183.00	5.551	52.00	7.355
Mean	45.627		45.284		47.226	
Gender						
Male	3774	94.256	3153	96.157	621	87.836
Female	230	5.744	144	4.368	86	12.588
Household size						
1-3	1092	27.273	868	26.327	224	31.68
4-7	2155	53.821	1781	54.019	374	52.899
>7	757	18.906	648	19.654	109	15.417
Mean	5.177		5.240		4.884	
Marital status						
Married	3,758	93.85	3,136	95.12	622	87. 97
Living together	16	0.40	14	0.42	2	0.28
Divorced/separated	69	1.72	42	1.27	27	3.82
Widowed	161	4.02	105	3.18	56	7.92
Household income ($)						
0-280.11	504	0.13	463	0.14	41	0.07
280.11 -1,400.56	3,348	0.83	2,748	0.84	600	0.84
>1,400.56	152	0.04	86	0.02	66	0.09
Mean	590.50		551.27		773.41	

Table 2 Expenditure of households on the vegetables and fruits in Nigeria.

Commodities	**Pooled** ($)	**Rural** ($)	**Urban** ($)
Fruits	0.891 (0.0152)	0.816 (0.0132)	1.238 (0.0245)
Vegetables	7.137 (0.137)	6.714 (0.126)	9.11 (0.185)
Pulses	8.723 (0.163)	8.441 (0.156)	10.033 (0.198)
Cereals	38.546 (0.685)	39.885 (0.705)	32.443 (0.592)

Expenditure share on different food groups is in parentheses. A dollar equals ₦357

decision to consume vegetables is; however, reduced but that of fruits is increased with a unit increase in the price of cereals, so does increase in the price of pulses. The probability of households to consume vegetables and fruits has increased with increase in the income of the respondents, conforming to the finding of [9]. The likelihood of rural residents to consume vegetables and fruits is also lower, relative to those residing in the urban sector. This is an indication that rural residents are less likely to consume vegetables and fruits compared to their urban counterpart. The addition of a member to a household tends to reduce the household's decision to consume fruits, while male respondents have a higher likelihood of consuming vegetables relative to the female respondents.

Table 4 presents the factors influencing households' food demand in Nigeria derived by Quadratic Almost Ideal Demand System (QUAIDS) model. The food groups on which the analysis was carried out include vegetables, fruits, cereals and pulses. Determinants of demand for vegetables by households in Nigeria include the price of vegetable, household size, sex, age and total expenditure at 1%. The prices of fruits and pulses are significant at 5%. A unit increase in the price of vegetables increases its demand by 7.08%, while it reduces its demand by 3.03%and 4.62% with a unit increase in the prices of fruits and pulses, respectively. The implication of this is that households would rather reduce the budget share on vegetables if the prices of fruits and pulses are increased. On the other hand, the demand for vegetables increases with an increase in its price. A unit increase in total expenditure on the food groups increases the budget share on vegetables by 0.0277,

Table 3 Households' decision to consume vegetables and fruits in Nigeria.

Variables	Vegetables		Fruits	
	Coefficient	Z-ratio	Coefficient	Z-ratio
Price of vegetables	0.6000	1.3	0.299592	1.37
Price of fruits	1.491292	3.30***	-0.52515	-2.32**
P cereals	-3.433133	-5.01***	0.9018	2.12**
P pulses	-2.01343	-4.45***	0.5533	2.29**
Total income	0 .393918	5.04***	0.3109	7.72***
Sector	-.3508678	-2.88***	-0.2159	-3.93***
Household size	0.024687	1.54	-0.02648	-3.01***
Household sex	0.5435198	2.30**	0.1283	1.44
Household age	0.00224	0.90	0.000025	0.02
Constant	11.26666	3.12***	-9.3981	-4.11***

Note: *significant at 10%; ** significant at 5%; *** significant at 1%

Table 4 Determinants of households' demand for fruits and vegetables in Nigeria.

Variables	Vegetables	Fruits	Cereals	Pulses
Price coefficients				
P vegetables	0.0879 (0.02)***	-	-	-
P fruits	- 0.0303 (0.013)**	0.0698 (0.0167)***	-	-
P cereals	-0.0113 (0.03)	0.0180 (0.0176)	-0.0584 (0.0562)	-
P pulses	-0.0462 (0.02)**	-0.0575 (0.02)***	0.0517 (0.0373)	0.0521 (0.0365)
Total expenditure	0.0277 (0.0027)***	0.0120 (0.0015)***	-0.0509 (0.0044)***	0.0111 (.0026)***
Households' characteristics				
Sector	0.0057 (0.0037)	0.0017 (0.0019)	-0.0121 (0.0066)*	0.0047 (0.0039)
HH size	0.0033 (0.0006)***	0.0012 (0.0003)***	-0.007 (0.001)***	0.0026 (0.0007)***
HH sex	-0.0138 (0.051)***	0.0017 (0.0026)	0.0181 (0.0092)**	-0.0061 (0.0056)
HH age	-0.0003 (0.0001)***	-0.0001 (0.0001)	0.0006 (0.0002)***	-0.0002 (0.0001)**
Lny	-0.028 (0.0035)	-0.0101 (0.0019)***	0.0577 (0.066)***	-0.0196 (0.004)***
IMR	0.0155 (0.0424)	0.0401 (0.0242)*	-0.0732 (0.0724)	0.0176 (0.0453)
Constant	0.0780 (0.0281)**	0.0123 (0.0186)	0.6839 (0.0400)***	0.2329 (0.0402)***

P vegetables = price of vegetables; P fruits = price of fruits; P cereals = price of cereals; P pulses = price of pulses; HH size = household size; HH sex = sex of household head; HH age = age of household head; y = income of household; IMR = inverse Mills ratio.

implying that budget share allocated to vegetables would increase if the expenditure on the food groups increases. An additional member of a household increases the budget share on vegetables by 0.3%, and this agreed with the findings of Obayelu et al. [10] who stated that the larger the size of a family, the more they demand for fruits and vegetables, while the budget share is reduced by 0.03%, with a unit increase in age of the respondents. The Male respondents' budget share of vegetables; however, decreases by 1.38% relative to female respondents.

The prices of fruits and pulses; total expenditure, household size and income are significant factors influencing demand for fruits at 1% level. Budget share on fruits is increased by 6.98% and reduced by 5.75% for every unit increase in the prices of fruits and pulses, respectively. That is, households in Nigeria would rather increase their budget share on fruits and reduce that of pulses if there is an increase in prices of fruits and pulses. Also, budget share on fruits would increase by 1.2% and reduce by 1.01% for every unit increase in total expenditure on food groups and household income. This implies that households would increase the budget share on fruits if the expenditure on the food groups increases, but reduce the budget share if households' income increases. This contradicts with the findings of Layade and Adeoye [11]. This is a pointer to the fact that households would prefer to reduce their expenditure share on fruits if their income level increases. An additional member of the household also increases the demand for fruits by 0.12%, conforming to the results of Akinleye [12] who also stated a positive relationship between household size and demand for fruits.

For cereals; however, household income, total expenditure, household size and age are significant at 1%. Sex is significant at 5%, while the sector is significant at 10%. Contrary to the trend observed under fruits, the budget share on cereals increases by 5.7% and reduces by 5.09% for every dollar

Table 5 Price coefficients showing Hicksian / compensated elasticity of demand for fruits and vegetables.

Commodity	Vegetables	Fruits	Cereals	Pulses
Price of vegetables	-0.3228	-0.6874	0.1577	-0.1370
Price of fruits	-0.1891	0.7017	0.0809	-0.2981
Price of cereals	0.6697	1.2491	-0.5035	0.9701
Price of pulses	-0.1576	-1.2634	0.2650	-0.5350
Income elasticity	0.6273	0.5541	1.1667	0.8816

Table 6 Price coefficients showing Marshallian / uncompensated elasticity of demand for fruits and vegetables.

Commodity	Vegetables	Fruits	Cereals	Pulses
Price of vegetables	-0.4165	-0.7702	-0.0166	-0.2589
Price of fruits	-0.2149	0.6790	0.0331	-0.3316
Price of cereals	0 .2710	0.8969	-1.2451	0.4514
Price of pulses	-0.2668	-1.3598	0.0619	-0.6770

dollar increase in household income and total expenditure, respectively. This implies that households would reduce the budget share allotted to cereals, if the expenditure on food groups is decreased or if income increases. This conforms to the findings of Omonona et al. [13] who found that increased income of households reduced the budget share on staples. Budget share on cereals is increased by 0.06% and reduced by 0.7% if age and household size are increased by a unit. It also increases by 1.81% and decreases by 1.21% for male respondents and those residing in the rural sector. This is an indication that male respondents consume more cereals than female. Also, rural residents consume less of cereals than their urban counterpart.

Lastly, total expenditure on the food groups, household size and income are the significant determinants of pulses at 1% level, while age is significant at 5%. A unit increase in expenditure on food groups and household size increases budget share allotted to pulses by 1.11% and 0.26%, respectively. Contrary to this, a unit increase in age and income of the respondents reduces the budget share on pulses by 0.02% and 1.96%, respectively. This means that older respondents tend to spend less on pulses, while households would also spend less on pulses if their income increases. The Inverse Mills Ratio (IMR) represented as λ is included in order to remove selectivity bias from the sampled respondents, ensuring the sample selected is representative. The insignificance of λ means the subsample of the purchasing households represents the whole population and there is, therefore, no selectivity bias in the data. Table 5 depicts the compensated (price elasticity of demand when the utility is held constant) price elasticities, as well as income (expenditure) elasticity in Nigeria by using QUAIDS specification. It is observed that expenditure elasticities for all the food groups are positive [9, 10, 14]. However, expenditure elasticities of all except that of cereals are less than unity, indicating that fruits and vegetables are regarded as necessary food groups and this supports the finding of Meng et al. [15] and Akinleye [12]. The compensated own price elasticity also revealed that the estimates of all the food groups show that they are price inelastic. This indicates that a unit change in the prices of the food groups would result in less than a unit change in their demand.

The cross-price elasticity estimates revealed that vegetables can complement other food groups with the exception of cereals. This is an indication that vegetables can act as a substitute for cereals, with a positive estimate of 0.6697. Likewise, fruits can substitute cereals with a positive coefficient of 1.2491. On the other hand, cereals can act as a substitute to other food groups, while pulses complement other food groups with the exception of cereals. As shown in Table 6, the uncompensated (Marshallian) elasticity of demand revealed that only cereals are price elastic with the value of -1.245, indicating that a unit increase in the price of cereals will reduce its demand by more than a unit. Also, the cross-price elasticity revealed that fruit and vegetables (0 .2710 and 0.8969) can substitute cereals, while cereals can substitute pulses (0.4514).

Conclusion and recommendations

Based on the findings from the study, it was established that households in Nigeria demand less of vegetables and fruits. Vegetables and fruits are known to be a good source of vitamins, minerals and micro-nutrients. Their inadequate consumption could; however, have a serious implication on

health and nutritional security of households in Nigeria. The following recommendations were highlighted based on the findings from the study. The price stability policy measure should be implemented to enhance households' demand for vegetables in Nigeria, an increase in the price of fruits lowers the demand for vegetables. Consumption of vegetables is low among males, rural residents and the aged; therefore, sensitization and awareness campaign for the benefit that could be derived from the consumption of vegetables should be intensified among males, rural residents and the older generation in order to improve their health and nutritional status. Fruits and vegetables, which are regarded as necessary food groups by households in Nigeria could serve as a substitute for cereals, which the majority regards as a luxury food group and not quite affordable.

Conflict of Interest

The authors certify that they have no conflict of interest.

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