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ANALYSIS OF URBAN HOUSEHOLDS' DEMAND FOR SWEETENERS IN OGUN STATE, NIGERIA

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Abstract

Sweeteners, jointly demanded with food and beverages, have been proven to be good sources of energy, vitamins, minerals and amino acids. This study examined urban households' demand for sweeteners in Ogun State, Nigeria. Primary data were obtained using a pre-tested questionnaire in a cross sectional survey of 160 households through a multi-stage sampling technique. Data were analysed using descriptive statistics and the Linear Approximate Almost Ideal Demand System (LA-AIDS) model. Results revealed that 51.2% of the households were headed by females with an average age of 37 years and an average household size of five persons. Majority (62.3%) of the household heads had tertiary education. The average monthly household demand for honey, sugar and other sweeteners were 1.31liters, 1.06kg and 0.30kg respectively. About forty-one percent of the household heads had salaried occupation and 6.3% were unemployed. The mean monthly household income was ₦93,347.90 with the average monthly food expenditure as ₦12,289.98 of which ₦1,445.70 was expended on honey and ₦392.35 on sugar. Own-price and income had an increasing effect on demand for honey ($p<0.01$) while own-price had an increasing effect on demand for sugar ($p<0.01$). The age of household head had incremental influence on honey demand ($p<0.01$) while it had a decreasing influence on sugar demand ($p<0.05$). Also, marital status had incremental influence on honey demand ($p<0.10$) while it had a decreasing influence on sugar demand ($p<0.05$). The study concluded that the demand level for honey was higher than sugar and other sweeteners in all of the households. The study recommended that increased household income should be enhanced to boost household demand for honey.

Key words: Urban households, Demand, Sweeteners, Ogun State, Nigeria,

Introduction

Sweeteners are ingredients that are added to food to enhance sweetness (Hornby, 2000) and thereby facilitating consumption. They can also be described as any natural or artificial substance that provides sweet taste in foods and beverages (Hornby, 2000). In addition to their sweetening power they are also used in baking, tenderization, food browning and caramelisation (Hornby, 2000; Sigman-Grant and Hsieh, 2005; Drewnowski and Rehm, 2014). Sweeteners are usually categorized into two main groups which are the nutritive and non-nutritive sweeteners (Fitch and Keim, 2012; Shankar *et al.,* 2013). Non-nutritive sweeteners are those that are not digested by the body and thus have a negligible food energy value. They might be artificial (synthetic) or derived from plants while the nutritive sweeteners are those that have calories, edible and provide nourishment. Artificial sweeteners are synthetic sugar substitutes but may be derived from naturally occurring substances, including herbs or sugar itself. Artificial sweeteners like saccharine and aspartame are also known as intense sweeteners because they are many times sweeter than regular sugar. Saccharine was first discovered in 1878 by Constantine Falbherg and its use became widespread during sugar shortage of

World War 1 (Parker, 1978). Natural sweeteners are mostly categorized under nutritive sweeteners and are favourable and are thus popular both as a food and flavouring (Fitch and Keim, 2012; Shankar *et al.,* 2013). Natural sweeteners with a variety of uses both at home and in processed foods, are often promoted as healthier options than processed table sugar or other sugar substitutes (Sigman-Grant and Hsieh, 2005; Drewnowski and Rehm, 2014). Among the recognized natural sweeteners in Nigeria is honey (Igwe *et al*., 2008; Adams *et al*., 2010; Adeola *et al*., 2011).

Table sugar (sucrose), an example of nutritive sweeteners (many of which are used in food) is the generalized name for a sweet, short-chain, soluble carbohydrates - composed of carbon, hydrogen and oxygen (Sigman-Grant and Hsieh, 2005; Shankar *et al.,* 2013). Simple sugars and the table or granulated sugar most customarily used as food is sucrose, a disaccharide (Powers and Crapo, 1982; Wiebe *et al*., 2011).

Honey contains a diversity of substance which is indispensable to all living things making it an important food component in nutrition as sources of energy, proteins, vitamins, minerals and amino acids and is often proclaimed to be more nutritious than sugar (NHB, 2001; Nichollis and Miragilli, 2003; Abagwa and Frank-Peterside, 2010; Adeola *et al*., 2011; Tandel, 2011). It can also be used as a symbol of sweetness and some believe it has practically many health benefits (Igwe *et al*., 2008; Adams *et al*., 2010; Adeola *et al*., 2011). This claim is confirmed by the fact that honey is used in the treatment of various ailments such as acetomenia (a disease of cow) in veterinary medicine; cough, constipation, diabetes, sore, burns, indigestion, arthritis, and as elixir to relieve sore throat in human medicine (Keystone, 2001; Randerson, 2007; Abagwa and Frank-Peterside, 2010; Adeola *et al*., 2011).

National productivity is dependent on households' dietary and demand pattern in the sense that diet is an important indicator of the quality of life of any nation's workforce. Sound diet and dietary habits is a *sine qua non* for good health in order to be able to cope with communicable disease (e.g. cough) and non-communicable diseases (e.g. diabetes mellitus).

Sugar is an inseparable part of the food humans consume but too much sugar is not ideal for the teeth, waistline and the general body health. Artificial sweeteners like aspartame are opted for in other to avoid other health challenges posed by table sugar (Tandel, 2011) but these are also viewed as being carcinogenic. However, honey consumption fulfils several needs such as nutrition, health maintenance and rehabilitation as well as physical embellishment (Bianca, 2011). For several years, honey has been recognized as one of the most natural home remedies to treat a wide range of ailments and complaints including yeast infection, athlete foot and arthritic pain, treatment for wounds, burns and cuts (Randerson, 2007).

Understudying the demand for sweeteners therefore will help dieticians understand the dietary habit of people towards the consumption of sweeteners, thereby equipping them with adequate information to be disseminated to the general public and subsequently improve the general wellbeing of the populace. Also, this study is important for entrepreneurs in developing managerial strategies in the field of apiculture and other sweetener production process.

Problem Statement

In recent years the trend towards better health, figure and fitness has increased; and the growing health awareness has increased demand for product that supports better health. As a result, sweeteners have been the subject of intense scrutiny for decades being an inseparable part of the food human beings consume. People have divergent view on sweeteners with many believing that sweeteners cause a variety of health problems (Tandel, 2011).

According to Igwe *et al* (2008), artificial sweeteners like saccharine and aspartame (though not readily available) can be good for diabetic patients because it contains no calories and can also help trigger the release of insulin when consumed in little amounts. These sweeteners other than their non-availability and high cost have negative health implications. They are believed to cause more harm

than good and disease like cancer and headaches are linked to their consumption, though many researchers have disputed this hypothesis.

FAO (2008) revealed that, after cereals and vegetable oils, sugar derived from sugar cane and beet provided more kilocalories *per capita* per day on the average than other food groups. FAO (2008) further stated that an average of 24 kilograms of sugar, equivalent to over 260 food calories per day, was consumed annually per person of all ages in the world in 1999. Even with rising human population sugar consumption is expected to increase to 25.1 kilograms per person per year by 2015 (FAO, 2008) but data collected in multiple nationwide surveys between 1999 and 2008 show that the intake of added sugars has declined by 24 percent with declines occurring in all age, ethnic and income groups. However, there have been controversial suggestions that excessive sugars and artificial sweeteners may play an important role in certain degenerative diseases. Sugar has been linked to obesity and suspected of or fully implicated as a cause in the occurrence of diabetes, cardiovascular disease, dementia, muscular degeneration, and tooth decay (Sigman-Grant and Hsieh, 2005; Tandel, 2011; Wiebe *et al*., 2011; Shankar *et al.,* 2013; Drewnowski and Rehm, 2014).

On the other hand, the importance of honey as a sweetener in the life and general health of an average Nigerian cannot be overemphasized. Honey consumption can help in ameliorating the problem of malnutrition and solving some health problems because it contains essential nutrients that promote quality of life (NHB, 2001; Nichollis and Miragillio, 2003). Furthermore, honey is the only sweetener that comes from an unrefined source. Despite its importance, good honey is beyond the reach of average Nigerians and many cannot stand its taste.

Factors that might be affecting demand for sweeteners in Africa (Nigeria inclusive) are price, health-link information and low level of production (NHB, 2001; Babatunde *et al*., 2007; Berenschot, 2008). For instance, the price of African honey is too high to compete with the major honey exporting countries like China and Argentina (Berenschot, 2008).
Based on the highlights enumerated above, this study attempted to proffer answers to the following questions:

1. What are the characteristics of households that demand for sweeteners?
2. What is the pattern of households' demand for sweeteners?
3. What are the factors affecting the demand for sweeteners in the study area?
4. What is the degree of response of households' demand for sweeteners to change in price and income?

Research Objectives
The broad objective of the study is to examine the demand for sweeteners among urban households in Ogun State. This study specifically attempted to:

1. describe the socio economic-characteristics of households in the study area.
2. describe the demand pattern of sweeteners among households in the study area.
3. determine the factors influencing the demand for sweeteners by households in the study area.
4. estimate demand elasticity for sweeteners with respect to price and income in the study area.

Review of Literature
Demand is defined as the quantity of a good or service that consumers are willing and able to purchase at a given price in a given time period (Lipsey, 1974). Everybody has an individual demand for particular goods and services and the level of demand at each market reflects the values that consumers place on a product and the expected gain in satisfaction obtained from purchase and consumption (Koutsoyiannis, 1985). In order to explain the reason why consumers buy at a particular price, the concept of utility commonly describes as the theory of consumer choice (behaviour) serves as basis on which the analysis should be premised. This is because consumers demand a commodity if they derive or expect to derive utility from that commodity (Burk, 1978).

Consumer demand analysis can be described as a science of consumer choice or preferences among different goods and services (Seale *et al*, 2003). Analysing consumer demand is essentially the act of analysing consumer preferences i.e. how consumers choose to allocate resources (especially income) among different products. This is because the demand for any good or group of goods is dependent on the price and availability of other products (Lipsey, 1974 and Burk, 1978). Essentially, prices (both own-price and cross price) as well as income determines the quantity of a particular good or service a consumer will purchase. This is usually measured by the degree of responsiveness of quantity demand of the good or service to changes in the price of the good or service, prices of alternative good or service and the income of the consumer. In other words, the quantity demand of a good or service depends on the price (own-price and cross-price) and income elasticity of the good or service.

Mathematically:

$Q_d = f(\varepsilon_p, \varepsilon_{xy}, \varepsilon_y)$

where:
Q_d = quantity demanded of good or service X
f = function of
ε_p = (own-)price elasticity good X
ε_{xy} = (price-)cross elasticity of good X (relative to Y)
ε_y = income elasticity of good X.

Based on the advancement in other field of social sciences, a number of demand models have been developed by economists thereby incorporating factors regarded as hidden by the neo-classical theories of demand and consumer (Burk, 1978; Akerlof and Dickens, 1982; Quisumbing, 1986; Saha *et al*., 1997; Malik, 2011).

Conceptually, demand is empirically measured with the use of mathematical equations involving the estimation of functional forms; it is the most straight forward and convenient approach in demand analysis. A system of demand equation (Burk, 1978) can be specified as:

$q = D(p, v)$…… (1)

Where:

q = vector of quantities demanded of commodities
p = vector of prices of the commodities
v = vector of exogenous variable that shift demand.

Models of demand developed and estimated by economists mainly focused on specifying D(p, v) in a way that is flexible and simultaneously consistent with economic theory (Blundell and Ray, 1984; Blaylock and Blisard, 1993; Blanciforti *et al*., 1993). These models include Linear and Quadratic Expenditure System (LES and QES), the Working-Lesser Model, the Rotterdam System, the Translog System and Complete Demand System (Blundell and Ray, 1984; Blaylock and Blisard, 1993; Blanciforti *et al*., 1993; Borenstin and Shepard, 1996; Tash *et al*., 2012). The complete demand system originated from the contribution of Stones (1954) to demand analysis and seek to eliminate the limitations of earlier models. The complete demand system has been extensively used in theoretical and applied literature in the study of demand (Deaton and Muellbauer, 1980; Deaton, 1986; Moschini, 1995; Moschini, 1998; Oyekale, 2000; Mazzocchi, 2003; Obayelu *et al*., 2009; Malik, 2011).

Methodology
This study was carried out in Ogun State, located in the South west region of Nigeria. Ogun State has a total land mass of 16,400sq kilometres (NBS, 2010) and a climate that follows a tropical pattern with the rainy season starting from March and ending in November; followed by the dry season from

December to February. The mean annual rainfall varies from 128cm in the southern parts of the State to 105cm in the northern areas. The average monthly temperature varies from 23˚c in July and 32˚c in February (IFSERAR, 2009). The twenty (LGAs) in the State are divided into four major (agricultural) zones namely Abeokuta, Ijebu-ode, Ilaro and Ikenne by the Ogun State Agricultural Development Programme (OGADEP). The urban areas are mainly dominated by civil servants and other professionals.

Primary data were collected for this study with the use of a pre-tested questionnaire through personal interviews of respondent households in the study area. A multi-stage sampling technique was employed to select 160 households with the first stage involving a simple random selection of four Local Government Areas out of the 20 LGAs within Ogun State. The second stage was a random selection of four Community Development Associations (CDAs) each from the existing CDAs in the four selected LGAs while the last stage was the random selection of 10 households from each CDAs to give a total of 160 households.

The data collected were subjected to analysis using descriptive statistics and Linear Approximate Almost Ideal Demand System (LA-AID) model. Each of the analytical tools was used to address specific objective(s).

Descriptive statistics such as tables of frequency and percentages were used to describe the socio-economic characteristics of the respondents such as household head's age, marital status and educational level as well as household size, income and food expenditure.

The AIDS model is based on consumer expenditure function and is expressed as the budget share of a given commodity as a function of total expenditure and prices. The LA-AIDS used to analyze the demand for sweeteners is as shown in equation (1).

$$w_i = \alpha_i + \sum_{j=1}^{n} \chi_{ij} \ln P_{ij} + \beta_i \ln[\frac{X}{P^*}] + \sum_{k=1}^{m} \lambda_k D_k + e_i \qquad \text{j = 1,…n} \quad \ldots\ldots\ldots\ldots\ldots(1)$$

Where:

$w_i = budget$ (expenditure) share of the jth commodity (honey, sugar, saccharine and glucose).

n = numbers of items considered

α_i = the constant coefficient in the ith share equation

γ_{ij} = slope coefficient associated with j^{th} good in the ith share equation

P* = stone price index define by lnP = $\sum_{1=1}^{n} w_i \ln p_i$

p_j = price/unit of jth commodity,

$\ln(\frac{X}{P^*})$ = log of total expenditure deflated by the stone price index

λ_k = slope coefficient associated socio-economic parameters for j^{th} good in the ith share equation

D_k = socio-demographic and socio-economic characteristics of the kth household (following Blanciforti *et al*., 1993; Sanusi, 2006; Malik, 2011; Tash *et al*., 2012).

The included socio-demographic and socio-economic variables (D_k) are as follows:-

AGE = age of household head (years)
FEXP = household food expenditure (₦)
SEX = sex of household head (1 if male, 0 if female)
MSTAT = marital status of household head (1 if married, 0 otherwise)
HHSZ = household size (number of persons)

REAS = reason for consuming sweeteners (1 if food additive, 0 otherwise)
LOCT = location of respondents in the study area (1 if Abeokuta south, 0 otherwise)

The inclusion of socio-demographic/economic characteristics in the demand system allows better parameter estimates (Mazzocchi, 2003). The type of model employed provides greater efficiency of estimating the unknown parameters, capturing cross commodity impact and allowing the imposition of the restrictions in economic theory to be incorporated during estimation. A Seemingly Unrelated Regression (SUR) was therefore used to estimate the model and the result was used to estimate the cross-price, own-price and expenditure elasticities. Thus equation (1) satisfied the adding-up, homogeneity and symmetry properties in standard demand theory:

Adding up restriction:- $\sum_i \alpha_i = 1, \sum_i \gamma_{ij} = 0, \sum_i \beta_i = 0$ ……..……. (2)

Homogeneity restriction:- $\sum_l \gamma_{ij} = 0,$ ……. (3)

Symmetry restriction:- $\gamma_{ij} = \gamma_{ji} \quad i \neq 0$ …….…….. (4)

Following Buse (1994), Koc and Alpay (2002) and Hutasuhut *et al* (2002); the Marshallian and Hicksian elasticities of demand were computed.

The Marshallian expenditure and price elasticity were derived using formulae as follows:

$\eta_i = 1 + (\beta_i + w_i)$ …… (5)

$\varepsilon_{ii} = -1 + (\gamma_{ii} / w_i) - \beta_i$ …….. (6)

$\varepsilon_{ij} = (\gamma_{ij} / w_i) - \beta_i w_j / w_i$ ..... (7)

Hicksian price elasticity (e_{ij}) was derived using the following relation:

$e_{ij} = \varepsilon_{ij} + \eta_i \ * w_j$ …….. (8)

where:

η_i = expenditure elasticity

w_i = budget share of good *i*

ε_{ii} = own price elasticity

ε_{ij} = cross price elasticity.

Result and Discussion

The socio-economic characteristics of the respondent households considered include household head's age, marital status, sex and educational level as well as household's income, size and monthly *per capita* income. Table 1 present the result of the description of the socio-economic characteristics of the respondents. About half (51.2%) of the household heads were females while 48.8% were males with an average household size of 5 persons. Albeit, specifically, 48.1% had a household size of 5-8 members while 1.9% had 13 or more members. The implication is that households with large family size will bear more burdens in terms of attention given to the nutritional status of members of the household (Adebayo, 2012). Most (69.4%) of the respondent households were headed by married persons while 1.2% were headed by single parents. This shows that most of the respondent household heads in the study area were married. This implies that marriage will be a dominant factor in the demand for honey because married heads will have additional responsibilities in terms of spouses and children. The average age of the household heads was 37years; however, less than half (40.0%) of the household heads were in the age group 31-40 years while 12.5% fell within the age group 51 years and above. This implies that, overall, majority (87.5%) of the respondents were in economically productive years (of between 21 and 50 years age bracket).

Furthermore, majority of the household heads had some form of formal education with 62.3% having had tertiary education while 1.9% had informal education. The evidence of high literacy level is expected to enhance the level of information on (human) nutrition and, consequently, boost household demand for specific type of sweeteners such as honey. A lot (40.5%) of the household heads had paid or salaried employment while 6.3% were involved in other private enterprise or had nothing doing. This indicates that the household heads in the study area had steady incomes meaning that the households would at least be able afford one or more of the sweeteners.

Table 2 shows the average price per unit of all the items (sweeteners) considered in the study area. The average (mean) price per litre of honey is ₦1,163.40. Also, the average price per kilogram for sugar was ₦608.51 and the mean price for other sweeteners per Kg was ₦77.01. This implies that the price per unit for honey was the highest of all sweeteners; hence making honey to probably the most expensive of all the sweeteners.

The average monthly consumption of honey, sugar and other sweeteners by the households were 1.31liters, 1.06kg and 0.30kg respectively. Consequently, the average monthly expenditure on honey was ₦1,445.70 while that of sugar and other sweeteners were ₦392.35 and ₦231.05 respectively. The mean budgets share for honey, sugar and other sweeteners were 0.61, 0.23 and 0.16 respectively. This implies that honey had the largest budget share at 61.0% while other sweeteners had the least budget share at 16.0%. The large budget share of honey has to do more with price than the quantity purchased.

Table 3 represents the result of LA-AIDS (the expenditure share equations) for honey, sugar and other sweeteners. The R^2 values were between 0.6195 for honey, 0.3781 for sugar and 02979 for other sweeteners. This indicates that variations in the independent variables in the model accounted for about 62.9% of the variations in expenditure share on honey, 37.8% on sugar and 29.8% on other sweeteners. The result also revealed that different socio-economic factors affect different items apart from the usual variable such as income and price. It can be seen from the table that own price had significant influence on demand for all sweeteners (honey and sugar) except other sweeteners ($p<0.01$). Furthermore, age of household heads had an incremental effect ($p<0.01$) on the households' budget share of honey in the study area while the household's budget share of sugar decreased ($p<0.01$) as the age of the household head increases. Also, honey had higher budget share in households with married heads ($p<0.1$) while that of sugar was lower ($p<0.05$). However, households in the State Capital (Abeokuta) had lower budget share for sugar ($p<0.05$) than households in other parts of the study area.

Expenditure and price elasticity provide valuable information on how consumers react to price and income changes. The elasticity estimation was derived from the LA-AIDS model and the summary of the estimates of the (compensated) Hicksian own-price and cross-price as well as expenditure elasticity of demand for the three categories of sweeteners were presented in Table 4 while the (uncompensated) Marshallian elasticity estimates were omitted. The Marshallian estimates were not included (in Table 4) because its estimates violated *a priori* expectations in terms of the relationships between the sweeteners; for instance, Marshallian (price) cross elasticity suggests that the sweeteners were complements while in reality the sweeteners were mostly substitutes. This could be due to the fact that the (uncompensated) Marshallian elasticity estimates contain both income and price effects (Taljaard *et al*., 2003). The (compensated) Hicksian elasticity estimates contain only the price effects and compensate for the effect of income on demand (Taljaard *et al*., 2003).

The Marshallian (compensated) own-price elasticity estimate for all the sweeteners were negative as expected in consonant with economic theory. The estimates revealed that honey, sugar and other sweeteners were own-price inelastic. However, compensated own-price elasticity of sugar (0.425) was the highest followed by the own-price elasticity of honey (0.149) and other sweeteners (0.013). This suggests that a percentage change in (own-)price will lead to 14.9%, 42.5% and 1.3% change in the quantity demanded of honey, sugar and other sweeteners. Cross-price elasticity estimates were also in concord with *a priori* expectations. This suggests that there was a complementary and substitutive

relationship between the sweeteners in household budget in the study area. The estimates revealed that a percentage increase in the price of honey will result in 40.8% percent increase in the quantity demanded of sugar and a percentage increase in the price of sugar will result in 14.9% percent increase in the quantity demanded of honey. These (cross-price elasticity) estimates show a substitute relationship between the two commodities (sugar and honey).

Furthermore, expenditure elasticity estimates for all the sweeteners were positive implying that demand for these items can be expected to increase as income increases since expenditure was taken as a proxy for income in this study. The expenditure elasticity estimates were 1.223, 0.912 and 0.252 for honey, sugar and other sweeteners respectively; implying that as income increases, demand increased by 122.3%, 91.2% and 25.2% for honey, sugar and other sweeteners respectively.

Conclusion and Recommendations

Respondent households had an average monthly demand of 1.31liters, 1.06kg and 0.30kg respectively of honey, sugar and other sweeteners in the study area. Honey had the highest average mean price per unit and monthly expenditure of all the sweeteners. Although the sweeteners were (own-)price inelastic; of all the sweeteners considered, sugar was the most responsive to price. Furthermore, honey was a luxury while sugar and other sweeteners were necessities. Hence, price reductions would not be an incentive for increased demand for honey while income increases would be. Arising from the results of this study, it is recommended that there should be conscious and concerted efforts to implement programs that will boost household income in the study area in other to enhance the demand for honey.

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Table 1: Distribution of households by socio-economic characteristics

Variables	Frequency	Percent
Marital Status		
Single	40	25.0
Married	111	69.4
Divorce	3	1.9
Widow	4	2.5
Single parent	2	1.2
Total	**160**	**100.0**
Age Group (years)		
21-30	51	31.9
31-40	64	40.0
41-50	25	15.6
>51	20	12.5
Total	**160**	**100.0**
Mean	**37**	**-**
Level of Education		
Primary	13	8.2
Secondary	37	23.3
Tertiary	99	62.3
Adult education	7	4.4
Informal education	4	1.9
Total	**160**	**100.0**
Sex		
Male	78	48.8
Female	82	51.2
Total	**160**	**100.0**
Household Size		
1-4	60	37.5
5-8	77	48.1
9-12	20	12.5
≥13	3	1.9
Total	**160**	**100.0**
Mean	**5**	-
Primary Occupation		
Employed	65	40.50
Trading	27	16.90
Artisans	13	8.10
Self-employed	45	28.10
Others	10	6.30
Total	**160**	**100.0**

Table 2: Descriptive statistics of households' demand for sweeteners

Description	*Minimum*	*Maximum*	*Mean*	*Std. Error*
Purchase price (₦)	900.00	1,500.00	**1,163.40**	24.51
Honey (₦/liter)	600.00	631.58	**608.51**	87.02
Sugar (₦/kg)	33.33	100.00	**77.01**	1.25
Others (₦/kg)				
Purchase quantity				
Honey (liter)	0.25	7.00	**1.31**	0.09
Sugar (kg)	0.25	6.67	**1.06**	0.07
Others (kg)	0.30	0.30	**0.30**	0.00
Expenditure (₦/month)				
Honey	250.00	6,500.00	**1,445.70**	94.41
Sugar	156.20	3,000.00	**392.35**	29.23
Others	100.00	300.00	**231.05**	3.76
Budget share				
Honey	0.21	0.94	**0.61**	0.013
Sugar	0.01	0.71	**0.23**	0.010
Others	0.03	0.50	**0.16**	0.007

Table 3: Determinants of households' sweeteners demand

Variable	**Honey**	**Sugar**	**Other Sweeteners**
Price coefficient			
Constant	-0.5313***	0.4832***	1.0406***
	(-4.904)	(4.701)	(2.215)
LNP HONEY	0.1447***	-0.0468***	-0.0979***
	(14.54)	(-6.13)	(-5.215)
LNP SUGAR	-0.0468***	0.0790***	-0.0322***
	(-6.13)	(9.967)	(8.708)
LNP OTHERS	-0.0979	-0.0322	0.1301
	(-2.335)	(-0.113)	(0.319)
Ln(X/P)	0.1370***	-0.0198	-0.1173
	(7.524)	(-1.136)	(-0.859)
Socio-economic Coefficient			
FEXP	-3.237×10^{-7}	-7.76×10^{-7}	4.5×10^{-7}
	(0.392×10^{-4})	(-0.963)	(1.017)
AGE	4.54×10^{-3}***	-3.64×10^{-3}***	-9.0×10^{-4}
	(5.463)	(-4.498)	(-1.631)
SEX	2.2×10^{-3}	-0.0020	-1.7×10^{-4}
	(0.1432)	(-0.135)	(-0.204)
MSTAT	3.79×10^{-2}*	-0.0398**	0.0018
	(-1.937)	(-2.086)	(0.489)
HHSZ	-1.43×10^{-4}	2.45×10^{-3}	-0.0023
	(-0.0404)	(0.775)	(-1.254)
REAS	0.0215	-0.0025	0.0052
	(1.2000)	(-1.572)	(0.859)
LOCT	0.0196	-0.0374**	0.0177
	(1.052)	(-2.049)	(0.335)
R^2	0.6195	0.3781	0.2979

Figures in parentheses are t-values. *Sig. at 10%, **Sig. at 5% and ***Sig. at 1%.

Table 4: LA-AIDS elasticity estimates for honey, sugar and other sweeteners

Elasticity	Honey	Sugar	Others
Cross Price Elasticity			
Honey	-0.1489	0.1493	0.00003
Sugar	0.4084	-0.4245	0.0154
Others	-0.0085	0.0197	-0.0125
Own-price Elasticity			
Honey	-0.1489	-	-
Sugar	-0.4245	-	-
Others	-0.0125	-	-
Expenditure Elasticity			
Honey	1.2225	-	-
Sugar	0.9124	-	-
Others	0.2520	-	-