

VOLUME 6: NO. 2, DECEMBER, 2016

DEMAND ANALYSIS OF TRADITIONALLY PROCESSED DAIRY PRODUCTS (GHEE AND SOUR MILK) IN SOKOTO METROPOLIS, SOKOTO STATE, NIGERIA.

Mohammed K. ABDULLAHI,¹ Usman B. KYOGWOM,² Likita TANKO³ and Muawiya JIBIR⁴

¹Usmanu Danfodiyo University Model Secondary School, Sokoto, Nigeria.

²Department of agricultural economics, Usmanu Danfodiyo University, Sokoto, Nigeria.

³Department of agricultural economics, Federal University of Technology, Minna, Nigeria.

⁴Department of Animal Science, Usmanu Danfodiyo University, Sokoto, Nigeria.

ABSTRACT

This study, analyzed the determinants of the demand for nono (sour milk) and manshanu (ghee) in Sokoto metropolis as well as calculated their income elasticity of demand. The metropolis was grouped into four clusters, namely; Sokoto main, GRAs, Resident community and Peri-urban whereby 160, 100, 90 and 150 respondents were respectively selected on a random basis. Data were collected with the aid of a structured food frequency questionnaire (FFQ). Descriptive, Tobit and Log-Log regression models were used in the analysis of the data. The results showed that the demand for sour milk was positively determined by age, marital status and household size while ethnicity and location variables were negatively related to its consumption. As for ghee, the positive consumption determinants were marital status, household size, location and income level, while ethnicity and education variables were the negative determinants. The income elasticity of demand for sour milk is negative and less than one which implies that it is an inferior good. While for ghee the results showed it to be positive but less than one, which means the good is income inelastic. It is hereby recommended that policies that will promote modern processing and packaging of these traditional dairy products should be put in place so as to encourage the uptake of this category of dairy products by the general populace.

Keywords: Demand, Sour milk, Ghee, Sokoto metropolis, Tobit, Log-Log.

INTRODUCTION

Milk is often regarded as being nature's most complete food. This is because, it is an excellent source of protein, vitamins, minerals and essential amino acids (Nebedum and Obiakor, 2007). In addition to the major constituents, milk contains a large amount of lactose sugar, phosphate, peptone and nitrogen based enzymes. Walingo (2012) noted that dairy product consumption has potential to reduce blood pressure and risk of stroke, regulate weight gain, and improve body mass index. Grace *et al.* (2008) observed that milk is high in energy, good quality protein and micro-nutrients (especially vitamin A, B12, riboflavin, calcium and phosphorus), and that studies have shown

benefits from milk consumption in terms of growth, physical activity and cognitive function.

In Nigeria, dairy products are classified into two, namely; traditionally produced dairy products and the pre-packaged dairy products. Jansen (1992) reported that, in Nigeria, dairying is virtually confined to a single ethnic group, the *Fulani*, and that traditionally produced dairy products known as *kosam* in *Fulfulde*, are usually eaten without cooking or further processing, and that pasteurisation is rarely undertaken. He noted further that, although there were many types of traditionally produced products, sour milk (*nono*) and ghee (*ghee*) are the most

important and that the consumption of most other traditionally produced dairy products appears rather insignificant.

The theory of consumer behavior assumes that a consumer is rational and aims at attaining the highest possible satisfaction given his income and the prevailing market prices (Adeniyi *et al.*, 2012). However, Eicher and Baker (1982) reported that several researchers working in Africa have hypothesized that several factors other than price and income have an important effect on demand. For example, it has been observed by many authors (Jansen, 1992; Mullins *et al.* 1994; Njarui *et al.* 2011), that demand for dairy product at the household levels, is significantly associated with socio-economic variables such as age, sex, marital status, household size, ethnicity, location, education and the income level of the household heads.

In reviewing the effect of prices on dairy consumption, Anonymous (2010) opined that in the particular context of Nigeria, differences in consumption habits, in milk quality, in marketing and in pricing policies, render the measurement of milk consumer price response a difficult task. Also, Deaton (1997) noted that although in theory prices should be used when estimating a demand function, in practice when using cross-sectional data, since prices do not vary (much) within a region (e.g., a municipality), applied econometricians do not (should not) include price in cross-sectional demand regressions.

Meanwhile, with regards to the elasticity of demand for dairy products of the traditional types, Jansen (1992) reported that the income elasticity of demand for sour milk was 0.21 while that of ghee was 0.55 suggesting an income inelastic demand. He concluded, therefore, that, sour milk and ghee were normal goods whose consumption increased with an increase in income.

Sokoto State is one of the major livestock producing States in Nigeria (Mamman, 2005). It is expected, therefore, that dairy product

consumption of the traditional types will be much more prevalent among the populace. However, limited knowledge is available regarding the present day consumption determinants for these types of dairy products in the state. Therefore, this study will serve as a valuable input to policy-making as well as provide valuable information to key stakeholders involved in the production, processing and marketing of this category of dairy products.

OBJECTIVES OF THE STUDY

The general objective of this study is to obtain a comprehensive understanding of factors affecting the demand for traditionally produced dairy product in Sokoto metropolis with special emphasis on the influence of socio-economic characteristics of the respondents on dairy product consumption. While the specific objectives are to:

1. Describe the household socio-economic characteristics of dairy products consumers in Sokoto metropolis;
2. Analyze the determinants of the demand for and consumption of traditionally produced dairy product in the metropolis; and
3. Calculate the income elasticity of demand for the traditionally produced dairy product in the metropolis

Hypotheses

For the purpose of this study, the following hypotheses were formulated:

- i Ho: The demand for the traditionally produced dairy products in Sokoto metropolis is not significantly influenced by the socio-economic characteristics of the household head.
- ii Ho: The elasticity of demand for the traditionally produced dairy products in Sokoto metropolis is not affected by the income levels of the household head.

MATERIALS AND METHODS

The Study Area

The study area is Sokoto metropolis, which lies between latitude 13° 04'N and longitude 5°14'E and at an altitude of 272 m above sea level. The metropolis is in the dry Sahel surrounded by sandy terrain and isolated hills with an average annual rainfall of 550 mm starting in May-June and ending September-October. The highest temperatures of 45°C during the hot season are experienced in the months of March and April while Harmattan, a dry, cold and dusty condition is experienced between the months of November and February (Abdullahi *et al.* 2009). The metropolis is made up of Sokoto North and Sokoto South Local Government Areas (L G As) as well as parts of Bodinga, Dange-Shuni, Kware and Wamakko L G As with an estimated population of about 1,078,092 (NPC, 2012).

The demographic structure of the metropolis is cosmopolitan albeit with the *Hausas* predominating, and Hausa is the common language. Also, residents in the metropolis were ethnic groups from within and outside Nigeria, especially *Yorubas*, *Ibos*, *Zabarmawa*, *Nupes*, *Ebiras*, and the *Togolese* among others. Occupation of the inhabitants includes trading, civil service while a reasonable proportion of the population works in organized private sectors. The metropolis is the capital city of Sokoto state and displays a classical example of urban primacy as it contains nearly 95 percent of the modern business and commercial ventures in the state (SOSG, 2012).

Sampling procedure and sample size

A cluster sampling procedure was adopted for this study. The metropolis was grouped into

four homogenous clusters, namely; peri-urban, city centre, GRAs and the resident community. For the peri-urban cluster, two townships were randomly selected. These were Dange and Kware townships. Seventy-five respondents were randomly selected from each of the township. For the city centre and GRA clusters, eight and five areas (*shiyya*) were respectively selected randomly, from which twenty respondents were also randomly selected from each of the area /*shiyya*. Finally, for the resident community cluster, three areas were randomly selected in which thirty respondents each were also selected randomly. Thus, the total sample size for the metropolis was five hundred respondents.

Data collection

The primary data for this study was collected from June-October 2013 using a pre-tested structured food frequency questionnaires (FFQ) administered by the researcher and assisted by trained enumerators to elicit information from the respondents. Meanwhile, the household was adopted as the unit of investigation and was defined, following NPC (2012) definition, as consisting of a family who live together and take at least one meal a day together and had a recognized head of authority. Information was obtained mainly from the household heads and in some cases the household food budget manager (FBM). Considering that there were no standard weights or measures for the locally produced dairy products, following Kassali *et al.* (2010) a random sample of the locally produced dairy products at various locations was taken and the average price per liter calculated as follows:

$$\text{Unit price (Naira / liter)} = \frac{\text{A ₦100 sample of the dairy product}}{\text{Weight of the dairy product (liters)}} \quad (1)$$

Analytical Techniques

Descriptive statistics were used to achieve objective 1, while Tobit regression model was used to achieve objective 2 and finally, the Log – Log regression model was used to achieve objective 3.

Tobit Regression Model

Chern *et al.*, (2003) noted that the use of household microdata on detailed commodities is complicated by the econometric problem, which arises when some households have zero consumption of one or more of the items considered. The dependent variables are zero if a household does not purchase the food item, and positive if it does. Zero shares are censored by an unobservable latent variable. Fuller *et al.* (2004), reported that it is

necessary to deploy a technique for alleviating the presence of zero-expenditure (or a censored dependent variable). Celik *et al.* (2006), observed that the zero consumption is usually handled using censored regression models, such as the Tobit model.

Fuller *et al.* (2004) as well as Akinyosoye (2006) reported that the Tobit model is built on the assumption that the observed consumption of a good by household i , Y_i is determined by a latent factor measured by y_i^* that can be represented as linear function of a vector of independent factors X_i , a vector of coefficients β , and an error ε_i , which has a normal distribution $N(0, \delta^2)$ which can be described as:

$$y_i = \begin{cases} y_i^* & \text{if } y_i^* > 0 \\ 0 & \text{if } y_i^* \leq 0 \end{cases} \quad (2)$$

where y_i^* is a latent variable.

Statistically, Gujarati (2004) express the Tobit model as

$$\begin{aligned} y_i^* &= \beta_1 + \beta_2 X_i + u_i & \text{if RHS} > 0 \\ &= 0 & \text{otherwise} \end{aligned} \quad (3)$$

Where RHS = right-hand side.

For this study, the model is specified explicitly thus:

$$y_i^* = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + U \quad (4)$$

Where

y_i^* = Consumption level of traditionally processed dairy products by the household (liters) Liquid Milk Equivalent

X_1 = Age of the household head (in years). Expected to positively affect traditional dairy product consumption

X_2 = Marital status of the household head (Single=1, Married=2 and Separated/Widowed/Divorced =3). Expected to positively affect traditional dairy product consumption

X_3 = Gender of the household head (dummy variable, whereby male=1 otherwise=0). Expected to positively affect dairy product consumption

X_4 = Household size of the household (Number of persons) Expected to positively affect traditional dairy product consumption

X_5 = Dependency ratio of the household (proxied by number of persons under 16 and above 65 years, respectively). Expected to positively affect traditional dairy product consumption

- X_6 = Ethnic group of the household head (dummy variable, whereby Hausas =1, otherwise=0). Expected to positively affect traditional dairy product consumption
- X_7 = Location of the household head (dummy variable, whereby urban=1, otherwise =0). Expected to negatively affect traditional dairy product consumption
- X_8 = Educational level of the household head (none=0, Primary=1, Secondary=2, NCE/OND=3, Degree/HND=4 and Posgraduate=5). Expected to negatively affect traditional dairy product consumption
- X_9 = Income of the household head (in Naira). Expected to negatively affect traditional dairy product consumption
- U = Error term

Finally, Tobit regression parameters were estimated by the use of ML methods instead of the OLS procedure. This is because the OLS estimates of the parameters obtained from the subset of observations will be biased as well as inconsistent (Gujurati, 2004). Also,

pseudo R^2 is used instead of the conventional measure of goodness of fit, R^2 . Nmadu *et al.* (2013) noted that pseudo R^2 , the most common of which is the McFadden's likelihood ratio index (LRI), was computed as

$$LRI = 1 - \frac{\ln L}{\ln L_0} \quad (5)$$

Where,

$\ln L$ = log-likelihood function

$\ln L_0$ = log-likelihood computed with only the constant term.

Log-Log Model

Income elasticity of a good is the degree of responsiveness of demand for a good (Y) due to changes in income (X).

$$\Sigma = \frac{\% \text{change in } q}{\% \text{ change in } I} \quad (6)$$

To measure the income elasticity of demand for dairy product in the metropolis, a Log-Log regression model was used. Gujurati (2004) observed that one attractive feature of the log-log regression model, which has made it popular in applied work, is that the slope coefficient β_i measures the elasticity of Y with respect to X, that is, the percentage change in

Y (in this case traditional dairy product) for a given (small) percentage change in X with in this case is the income levels of the respondents. Consequently, in order to achieve objective number three, a log transformation of the dependent and income variables was carried out and estimated using the log-log model.

The model is specified explicitly, thus:

$$\ln Y = \beta_0 + \beta_1 \ln X + U \quad (7)$$

Where

$\ln$ = natural log (i.e., log to the base e , and where $e = 2.718$).

$\ln Y$ = natural log of the consumption level of traditional dairy products by the household (liters) Liquid Milk Equivalent

$\ln X$ = natural log of the incomes of the household head (in NGN)

U = Error term

RESULTS AND DISCUSSIONS

Personal Characteristics

Age, marital status, household size, ethnicity, educational and income levels of the household heads were some of the personal characteristics that were evaluated and the results are presented in Table 1. The result shows that a greater percentage of the respondent households were headed by middle-aged people with the mean age being 39. Meanwhile, the fact that more than 80% of the respondents were married should not be surprising considering the mean age of the respondents being 39. This, under normal situation is a matured adult and is therefore expected to have a family of his own. The average household size of 7.8 reported in this study was slightly lower than the national average of 8 but higher than the 5.0 reported for Sokoto State by NBS (2010).

The high level of educational achievement recorded with over 50% of the respondents having attained one level of tertiary education or another, it is expected consumption of

dairy products in those households may be substantial considering that higher educational level of the household head has been linked with improved health consciousness and thus greater consumption of such nutrients rich food as dairy products. The consumer economic situation has great influence on his/her buying behavior. Therefore, considering that 66% of the respondents were middle to high income earners, the consumption of dairy products by the respondents is expected to be high. It should be noted that high income and educational attainment of respondents are some of the features associated with household demand studies set in urban areas. For example, Erhabor and Ojogho (2011) as well as Adeniyi *et al.* (2012) all reported tertiary education level of respondents greater than 50%. Similarly, over half (53%) of the household heads were in the middle income class and 20% were high income earners.

Table 1: Socioeconomic characteristics of the respondents

	Frequency	Percentage
Age (year)		
18---25	44	8.80
26---35	189	37.80
36---45	134	26.80
46--55	84	16.80
>55	49	9.80
Mean	39	
Marital status		
Single	93	18.60
Married	402	80.40
Others	5	1.00
Household sizes		
1—5	204	40.80
6—10	169	33.80
11—15	83	16.60
16—20	19	3.80
>20	25	5.00

	Mean	7.8	
Ethnicity			
	<i>Hausas</i>	380	76.00
	Others	120	24.00
Educational qualification			
	None	40	8.00
	Primary	47	9.40
	Secondary	63	12.60
	NCE/OND	84	16.80
	First degree/HND	183	36.60
	Postgraduate	83	16.60
Income levels per month			
	Less than NGN50,000	169	33.80
	NGN50,000--100,000	231	46.20
	Above NGN100,000	100	20.00

Source: Field Survey, 2013.

Tobit Analysis of the Determinants of Sour milk and Ghee Consumption in Sokoto Metropolis.

For the consumption of sour milk, age, marital status and household size were the main positive determinants of its consumption while ethnicity and location variables were negatively related to its consumption (Table 2). This implies that as the age of the household heads increase the consumption of sour milk increased. This may be attributed to the fact that in the households headed by the elderly, the household size is larger and thus more of sour milk is purchased to cater for the higher consumption units in such households. Also, considering that sour milk is a staple food item among the Hausas, it follows that its consumption increased with an increase in the family sizes. This assertion may be buttressed by the fact that both the household size and

the marital status of the household heads variables were positively significant. All these were in line with *a priori* expectations.

The negativity of ethnicity variable implies that the consumption of sour milk was mostly associated with the *Hausas* to whom it is a staple food. Akinyosoye (2006), observed that the consumption of traditionally produced dairy products is mainly associated with the *Hausas* who traditionally produced and consumed milk. Furthermore, the negativity of the location variable means that as one moves from the peri-urban areas to the city, the consumption of sour milk reduces. This is as expected as the people located in the city are more cosmopolitan and educated thus much more adaptable to the western lifestyle, in which the traditional dairy products are substituted with the pre-packaged dairy products such as yoghurt and powdered milk.

Table 2: Tobit estimates for the traditionally produced *nono* (sour milk)

	Coefficients	Standard errors	T--Value
Age	.0960743	.0350198	2.74*
Sex	.1438395	.9337486	0.15
Marital status	1.954972	.9560713	2.04*
Dependents	-.0756058	.1506803	-0.50
Household sizes	1.473078	.2607523	5.65**
Ethnicity	-3.468002	.8604737	-4.03**
Location	-3.398136	.6519202	-5.21**
Education	-.1513087	.2604183	-0.58
Income level	.0357061	.5383126	0.07
Constant	-3.084269	2.573735	-1.20
LR chi ² (9)			251.30**
Pseudo R ²			0.1080

**=P<0.01 *=P<0.05 Source: computed from field survey data, 2013

Obs. summary: 207 left-censored observations at lme<=0

293 uncensored observations

0 right-censored observations

The demand for ghee was positively determined by marital status, household size, location and income level of the household heads. While ethnicity and education variables were, however negative determinants (Table 3). All the determining variables were significant at the 1% level except for household size, which was significant at the 5% level. The results showed that ghee is mainly consumed by the married as well as well to do respondents who lives in the city. This was not surprising considering that ghee is a relatively expensive dairy product whose consumption is generally more pronounced in high income households as well as during festivities (Melesse and Beyene, 2009). The positively significant household size variable was, however surprising, as according to a *priori* expectations, household size is negatively associated with the demand for non-essential food items to which category ghee belongs. For example, Jansen (1992) as well as Yayar (2012) reported that larger

families were more likely to consume less expensive dairy product.

The negatively significant ethnicity variable was as expected as it has been reported by many authors (Jabbar and Domenico, 1990; Jansen, 1992; Akinyosoye, 2006) that the people of southern ethnic origin are said to have a non milk drinking culture. The negative education variable implies that the consumption of ghee reduces with increases in the educational level of the household heads. This may be attributed to the fact that as the respondent becomes more educated, they tend to adopt a western lifestyle and diet, thus, substituting the ghee with the pre-packaged butter. Also, Yayar (2012), reported that higher educated household heads were more concerned about safety and hygienic conditions of dairy products as such they prefer the pre-packaged dairy products.

Table 3: Tobit estimates for the traditionally produced *manshanu* (ghee)

	Coefficients	Standard errors	T--Value
Age	-.0018214	.047039	-0.04
Sex	1.103326	1.310099	0.84
Marital status	5.944627	1.491997	3.98**
Dependents	-.2886162	.195382	-1.48
Household sizes	.2133663	.0972972	2.19*
Ethnicity	-9.5915	1.429556	-6.71**
Location	2.384593	.8660889	2.75**
Education	-1.304787	.3446455	-3.79**
Income level	2.342336	.7232622	3.24**
Constant	-5.616077	3.966668	-1.42
LR chi ² (9)			169.10**
Pseudo R ²			0.1002

**=P<0.01 *P<0.05 Source: computed from field survey data, 2013

Obs. summary: 315 left-censored observations at lme<=0

185 uncensored observations

0 right-censored observations

From the analysis, it can be concluded that the null hypothesis which states that the demand for the traditionally produced dairy products in Sokoto metropolis is not significantly influenced by the socio-economic characteristics of the household head is hereby rejected in part as six of the nine socio-economic variables were significant determinants of traditionally processed dairy product consumption.

The Income Elasticity of Demand for sour milk and ghee

The income elasticity results for sour milk show it to be negative and less than one (Table 4). This implies that a percentage increase in the income level of respondents will cause a reduction in the consumption of sour milk by about 0.5 percentage points. Therefore, sour milk is

an inferior good whose consumption decreases with increase in income. This is in contrast with the results obtained by Jansen (1992) in which he reported the income elasticity for sour milk to be positive at 0.21. The income elasticity results for ghee show it to be positive but less than one, which means the good is income inelastic (Table 5). This implies that a percentage increase in the income level of respondents will increase the consumption of ghee by about 0.1 percentage point. Therefore ghee is a normal good whose consumption increases with increase in income. The results for ghee is in line with that of Jansen (1992) in which he reported the income elasticity for ghee to be positive at 0.55.

Table 4: Income elasticity of demand for *nono* (sour milk) in Sokoto Metropolis

	Coefficients	T--Value	F---Value	Adj R-squared
Income level	-.4798561 (.1280238)	-3.75**	14.05**	0.0428
Constant	1.706428 (.0823995)	20.71**		

Figures in bracket are the standard errors **=P<0.01 *=P<0.05

Source: computed from field survey data, 2013

Table 5: Income elasticity of demand for *manshanu* (ghee) in Sokoto Metropolis

	Coefficients	T--Value	F---Value	Adj R-squared
Income level	.1015018 (.0521703)	1.95*	3.79*	0.0149
Constant	1.862506 (.0347116)	53.66**		

Figures in bracket are the standard errors **=P<0.01 *=P<0.05

Source: computed from field survey data, 2013

From the results of the analysis, it is hereby concluded that the null hypothesis which states that the elasticity of demand for the traditionally processed dairy products in the metropolis is not affected by the income levels of the household heads is hereby rejected and the alternative accepted.

CONCLUSION AND RECOMMENDATION

Conclusively, it is clear that the demand for traditionally produced dairy products

specifically sour milk and ghee is determined by age, marital status, ethnicity and income of the household heads. In order to encourage more uptake of these products, measures that will strengthen these variables among the citizenry should be pursued. Most importantly, policies that will promote modern processing and packaging of these traditional dairy products should be put in place so as to encourage the uptake of this category of dairy products by the general populace.

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