ANALYSIS OF TOMATO DEMAND AMONG HOUSEHOLDS IN MAIDUGURI METROPOLITAN AREA, BORNO STATE, NIGERIA

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ABSTRACT

This study analyzed the demand for tomato in Maiduguri Metropolitan Area of Borno State, Nigeria. Purposive sampling was used to select households from stratified wards in the study area. The study covered the three socio-economic strata of residential areas in Maiduguri Metropolitan Area wards which are; low income areas (Gwange, Bulabulin), middle income areas (Hausari, Gamboru) and high income areas (Bolori and Maisandari). Eighty respondents were selected for the study. Data were analysed using descriptive statistics, inferential statistics and price elasticity of demand. The findings of the study indicated that 65.43% of the respondents were females with 45.3% of the respondents falling within the age of 31 – 40 years of age for all income areas. The result further showed that 69.8% of the respondents were married for all income areas and 44% for low, middle and high income were literate. The household size of the majority (43%) of the respondents from low and high income areas ranged from 1–5 (persons) while the middle income areas the range was 6–10 persons. Also50% compared with 40.7%of the respondents for low and middle income areas had an income of less than ₦20,000 while majority of the respondents from high income areas had an income of ₦51,000–₦80,000 per month. The results also revealed that majority of the respondents (43.5%) from all the income areas consume tomato on daily basis and prefer fresh tomato (62.2%). About 45.4% of the sampled population of middle and low income areas considered freshness as the reason for preference while 46.1% of the high income areas considered nutrition. Also 70% of all sampled population claimed to consume tomato in different kind of dishes. Average quantity of tomato consumed monthly was found to be 1kg for all respondents and also majority of the respondents 58.1% from all income areas buy there tomato from retailers. Multiple regression analysis revealed the R^2 was estimated at 0.840 and that gender, household size, monthly expenditure on tomato, price of tomato, monthly expenditure on complimentary products have a positive coefficient while age, marital status, level of education have a negative effect on demand for tomato. The result of the price elasticity of demand was (-0.8) which implied that a proportionate change in price of tomato leads to less than a proportionate change in quantity demanded. The major constraints to tomato consumption were rapid deterioration in quality and off-season tomato scarcity for all income groups in the study area.

Key words: Tomato, Demand, Households, Maiduguri Metropolitan Area

INTRODUCTION

Consumption of vegetable is very important in the dietary intakes of Nigerians. It helps in protecting the body against diseases and improves digestion as it contains fibre, low fat and calories (Asian Vegetable Research and Development Center (AVRDC) 2006). Vegetables form an important part of our daily food. They help in protecting the body against diseases (Shettima and Bukar 2018). Tomato (*Lycopersicon esculentum L.*) is one of the most important and widely distributed vegetable crop in the world. It belongs to the family of potato, eggplant, tobacco and peppers known as Solanaceae family and has vitamin A, B and C (Naika *et al*., 2005). Tomato is an outstanding vegetable with global per capita consumption of 20 kilograms per year and represents about 15% of world average total vegetable consumption (Garming, 2017). The demand for food, especially fresh vegetables, has increased steadily over the last years (U.S. Environmental Protection Agency, EPA 2012). And thus, market demand varies with season and location of country. Consumption patterns have also changed over the years.

Tomato is one of the most important and major vegetable grown in Nigeria. It plays a critical role in meeting domestic and nutritional food requirements, generation of income and creation of employment to producers (Ibrahim *et al*., 2020). The country is the 14th largest producer of tomato in the world and first in Sub-Saharan Africa (Pastuszek, 2017). Nigeria is said to be one of the largest consumer of vegetable in Sub-Saharan Africa with about 22kg per capita consumption (Ogundari and Aarifalo 2013). Specifically, Nigeria consumes an estimate of 2.3 million tonnes of tomato annually (Growth and Employment in State - wholesale and retail sector, GEMS4 2016), with tomato consumption per capita at 12kg in 2016 (Food and Agriculture Organization and Price Water-house Coopers Analysis, 2016). Currently, tomato production in Nigeria is still short of what is demanded particularly during the second and third quarters of the year (that is during the rainy season when tomato is scarce). While about three million metric tonnes is the national requirement, about 2.3 metric tonnes are produced (National Horticultural Research Institute, NIHORT 2020). The demand for tomato far outweighs the supply. The failure of tomato farms to meet demand in Nigeria has raised concern over the ability of these farms to increase tomato output, thus all year round availability of tomato in the market is very important for farmers as well as consumers (Akinniran *et al*., 2020).

Tomato is one of the most important vegetables that is consumed by almost all households in Borno State. It is consumed fresh, in stew, salad and other soups and in the form of tomato ketchup and tomato puree. Owing to its importance, the demand for good quality tomato is high and the returns to growers are substantial. It is locally produced with less investment but under intensive labour and management practice (Baba *et al*., 2008).

Tomatois an important vegetable crop both in scale of production and level of consumption which has universal demand. Due to continuous demand for tomato in Nigeria, farmers have increased production, cultivating tomato "in and out of season" so as to meet demand (Agele *et al*., 2002). Given the upward trending consumption patterns for tomato, an understanding of the demand patterns among consumers become increasingly valuable for producers and distributors in order to meet the nation's need.

It is against this background that this study was designed to analyse the demand for tomato in Maiduguri Metropolitan Area, Borno State,

Nigeria. Specifically the study sought to determine socioeconomic characteristics of tomato consumers in Maiduguri Metropolitan Area, identify the consumption patterns of tomato consumers, identify the factors influencing demand for tomato, determine price elasticity of demand for tomato and examine constraints that limit tomato demand in the study area.

This study covered the analysis of tomato demand among households in Maiduguri Metropolitan Area, Borno State with no restriction to varieties of tomato demanded. The study also cut across three income groups (low, middle and high) within the Metropolitan Area. Data on tomato consumed in the months of February and March, 2022 were used.

METHODOLOGY

The Study Area

The study was conducted in Maiduguri Metropolitan Area (MMA) of Borno State. Maiduguri is the capital and largest city of Borno state, situated in the North-Estern corner of Nigeria. It serves as the capital of Borno state and it once served as the capital of the entire North-Eastern region of Nigeria (Borno, Bauchi, Yobe, Adamawa, Taraba and Gombe states). Administratively, it has about 15 wards. The current metro area population of Maiduguri in 2021 is 803,000, at 2.16% increase from 2020. The metro area population of Maiduguri in 2020 was 786,000, at 1.81% increase from 2019 (Nigerian Metro Area Population,2021). Maiduguri is located on latitude 11°46′N to 11°55′N and longitude $13^0$03'E to $13^0$12'E of the equator. It occupies an area of 50,778 square kilometers (Solomon *et al*., 2020).

The average mean annual rainfall is about 650 mm. The rainy season in Maiduguri Metropolitan Council usually starts in April and ends in October. The temperature ranges from 25^0C - 47^0C but instantaneous temperature might reach up to 47^0C during the hottest months of March-May (Borno State Agricultural Development Programme,BOSADP, 2010).

The major occupation of the inhabitants is farming. Food crops commonly cultivated include millet, sorghum, maize, groundnut, cowpea, rice and wheat. Fruits and vegetables mostly grown include mango, orange, guava, tomato, onion, pepper, carrot, eggplant and lettuce.

The state capital is known for its vegetable production throughout the year. Vegetable is grown both under irrigation(November to January) and during the raining season (June to October) (Shettima and Bukar 2018). The MMC is also blessed with rivers and lakes such as the River Ngadda and Lake Alau, which serve as main source of water for irrigation farming. As a result of common agronomic practices, the vegetable are mostly cultivated as mixed crop especially tomato, pepper and onion which are mostly cultivated during dry season under irrigation (Shettima *et al*., 2015).

Sampling Technique and Sampling Size

Purposive sampling was used to select households from stratified wards in the study area. Maiduguri Metropolitan Area has about 15 wards which are stratified into low, middle and high income areas. Random selection was used to select two wards from each of the stratum. The wards selected are; low income area (Gwange, Bulabulin), middle income area (Hausari, Gamboru) and high income area (Bolori and Maisandari). The various households were selected proportionately using the proportion of 3:2:1 for low, middle and high income areas, respectively. This is because the low-level income areas are more densely

populated compared to the middle and high income areas. In all, 80 respondents were selected for the study.

The data were collected from both primary and secondary sources. The primary data were obtained using structured questionnaire and interview schedules administered to respondents. The secondary source includes journals, books, theses, internet and dissertations. Analytical tools that were employed for this study include: descriptive statistics, multiple regression and elasticity of demand analysis. Descriptive statistics such as mean, percentage and frequency distribution were used.

Double log functional form was chosen due to its high R^2 and significant number of coefficients.The explicit form of the multiple regression model is specified as follows:

$$\ln Y = b_0 - b_1 \ln X_1 + b_2 \ln X_2 - b_3 \ln X_3 + b_4 \ln X_4 - b_5 \ln X_5 - b_6 \ln X_6 + b_7 \ln X_7 + b_8 \ln X_8 + E$$

Where;

Y=QD = Quantity of tomato demanded (kg/month)

X_1= price of tomato (₦)

X_2 = average monthly expenditure on tomato (₦)

X_3 = monthly expenditure on tomato or complimentary products (₦)

X_4= household size (No.)

X_5 = sex (Dummy:0,1)

X_6 = marital status (Dummy:0,1)

X_7= educational level of respondents (Years)

X_8 = age of respondents (Years)

E = error term

b_0= constant

b_1-b_8= coefficient of X_1-X_8

A priori Expectation:

It is expected *a priori* that the coefficients of X_2, X_4, X_7 and X_8 will positively influence total household monthly demand for tomato, while the remaining four X_1, X_3, X_5, and X_6 will have a negative effect on total household monthly demand for tomato.

The price elasticity of demand which is the percentage change in quantity demanded as a result of a one percent change in price, is explicitly expressed as follows:

$$Ed = \frac{\triangle P}{\triangle Q} \times \frac{Q}{P}$$

Where,

P is price

Q is market demand and

Δ is change

Numerous factors can affect the price elasticity of demand, including closeness of substitute products, importance of the good in terms of expenditure, time for adjustment, product durability and range of uses (Fibich*et al*.,2005).

RESULTS AND DISCUSSION

Socio-economic Characteristics of the Respondents

The result of thesocio-economic characteristics of the respondents is presented on Table 1.

Table 1: Socio-economic Characteristics of the Respondents (n =80)

Variables	Low Income Area N=40		Middle Income Area N=27		High Income Area N=13	
	Frequency	%	Frequency	%	Frequency	%
Gender						
Male	16	40	11	40.7	3	23
Female	24	60	16	59.2	10	77
Age						
<20	13	32.5				
21 – 30	17	42.5	5	18.5	5	38.5
31 – 40	7	17.5	12	44.4	6	46.2
>40	3	7.5	10	37	2	15.4
Educational Level						
Primary	5	12.5			1	7.7
Secondary	17	42.5	5	18.5	6	46.2
Tertiary	7	17.5	12	44.4	2	15.4
Quranic	9	22.5	10	37	3	23
No Education	2	5			1	7.7
Households size						
<5	13	32.5	7	25.9	7	53.6
6 – 10	10	25	13	48.9	5	38.5
>10	2	5	7	25.9	1	7.7
Marital Status						
Single	15	37.5	6	22.2	4	30.8
Married	25	62.5	21	77.1	9	69.2
Level of Income						
<N20,000	20	50	11	40.7	1	7.7
N21,000 - N50,000	12	30	6	22.2	3	23
N51,000 - N80,000	5	12.5	5	18.5	5	38.4
N81,000 - N110,000	3	7.5	2	7.4	4	3.8
>N110,000	–	–	3	11.1	0	0

Source: Field Survey Data, 2022

The result presented on Table 1 reveals that majority of the respondents for low (60%), middle (59.2%) and high (77%) income areas were females while males were 40%, 40.7% and 23% for low, middle and high income areas, respectively. This is probably due to the fact that females are more involved in household food purchase and preparation. This is similar to the findings of Oladejo and Oladiran (2014) in there study of marketing analysis and consumption pattern of tomato in Oyo State, Nigeria which revealed that 82.9% sampled consumers belonged to the female gender.

The study revealed that 42.5% of the low income groups fell within the age range of 21-30 years while majority of the middle (44.4%) and high (46.2%) income area respondents were within the age group of 31-40 years. This implied that majority of the consumers in the study area were in their active age which requires diet that need the incorporation of a lot of vegetables. This is in line with study of Adeoye *et al.* (2015) on consumer purchasing behavior for tomato in Ibadan, Oyo State,
Nigeria, which revealed that the consumers were mostly in the middle age (30-40).

Table 1 also revealed that 62.5%, 77.8% and 69.2% of the respondents in the low, middle and high income groups respectively were married. Such result is expected since married women significantly influence tomato consumption to augment dishes. This result conformed to the findings of Adeoye *et al.* (2017) who obtained a similar result for tomato consumption in Ibadan,Oyo State, Nigeria, where about 69.7% of the consumers were married and 29.1% were single.

The findings on educational level of the respondents presented on Table 1 showed that about 96% of the respondents from all the income areas were literate. This indicated that consumption of tomato is for both educated and non-educated classes. This is in line with the studydone by Adeoye *et al.* (2017). The study revealed that 79.1% of the respondents were literate.

Information on the household size of the respondents in the study area presented on Table 1 indicated that majority (35%) of respondents from all the income areas had a household size of 6-10 members in the study area. This is likely due to fact that every percentage increase of young members in total number of households corresponds to an increase in the probability of purchasing tomato. This is contrary to the findings of Adeoye *et al*. (2015) who revealed that majority of the respondents had a household size of 1-5 individuals in the study area.

The income level of the respondents presented on Table 1 revealed that 40.7% of middle income area and 50% of low income area had an annual income of less than twenty thousand naira (<N20,000) while majority of the high income area (38.4%) had an annual income of ₦51,000–₦80,000. This implied that there is a positive relationship between income and tomato consumption partly because increase in income will result in an increase in the expenditure of vegetable thereby, increasing tomato purchase and consumption. This is similar to the findings of Oladejo and Oladiran (2014) who revealed that more than half of the respondents in the study area had an income of ₦10,000–₦50,000.

Consumption Pattern of Tomato Consumers

The result showing the consumption pattern of the consumers is shown on Table 2.

Table 2: Consumption pattern of Tomato Consumers (n=80)

Variables	Low Income Area N=40		Middle Income Area N=27		High Income Area N=13	
	Frequency	%	Frequency	%	Frequency	%
Source of Tomato						
Farm gate	10	25	8	29.6	3	23
Retailer	24	60	18	66.6	6	46.1
Neighbourhood	6	15	1	3.7	3	23
Others			3	11.1	2	15.3
Consumption rate						
Daily	30	40	12	44.4	6	46.1
Weekly	9	22.5	9	33.3	2	15.3
Monthly	1	2.5	1	3.7	1	7.6
Seasonal			3	11.1	2	15.3
Quantity consumed/month						
Small basket (0.5kg)	23	57.5	7	25.9	5	38.4
One basket (2kg)	11	27.5	12	44.4	7	53.8
One & half baskets(3kg)	3	7.5	3	11.1	1	7.6
Two baskets(4kg)	3	7.5	5	18.5		
Type preferred						
Fresh	30	40	23	85.1	8	61.5
Paste	3	7.5	3	11.1	4	30.7
Canned	3	7.5	1	3.7	1	7.6
Others	4	10				
Reason for preference						
Nutritious	8	20	9	33.3	6	46.1
Freshness	20	50	11	40.7	3	23
Accessibility	7	17.5	1	3.7	2	15.3
Ease of use	5	12.5	4	14.8	2	15.3
Others			1	3.7		
Kind of dish prepare						
Stew	14	35	6	27	4	30.7
Other dishes	26	65	20	73	9	69.2

Source: Field Survey Data, 2022

The result on Table 2 reveals that majority of the respondents from the low (60%), middle (66.6%) and high (46.1%) income areas sourced their tomato from the retailers. This is because respondents usually purchase tomato from retailers and places they can easily reach, since they only need to buy what they would need for a day or two. This is because they are not able to buy in bulk and store in the refrigerator due to lack of constant power supply.

The findings on Table 4.2 reveals that 40%, 44.4% and 46.1% of the respondents of low, middle and high income areas respectively, consumed tomato on daily basis. The result further reported that majority of the respondents in the low (57.5%) income areas consumed a small basket (0.5kg) of tomato, while those in the middle (44.4%) and high income areas (53.8%) consumed one basket (2kg) monthly. This implies that regardless of season, majority of the consumers are used to consuming tomato on always. This result goes with the findings of Oladejo and Oladiran (2014) which revealed that 65.7% of the consumers consumed tomato daily with an average tomato consumption of 3kg per month.

The result presented on Table 2 reveals that majority of the respondents for low (40%), middle (85.1%) and high (61.5%) income areas preferred fresh tomato. Also, the statistical distribution of the respondents showed that majority of the consumers for low (50%) and middle (40.7%) income area considered freshness in process of tomato purchase, while 46.1% in the high income areas considered its nutritive value. This is because most respondents in the study area are constraint with lack of reliable storage facilities to store the unused produce due to poor electricity supply, therefore they buy fresh tomato when they need it. This result conforms to the findings of Adeoye *et al.* (2015) which revealed that almost all the respondents prefer fresh tomato and considered freshness, nutrition and taste in the process of tomato purchase.

The study also shows that a significant number of consumers, 65%, 74% and 69.2% in the low, middle and high income areas respectively prepare different kinds of dishes with tomato. This may be due to the fact that tomato adds quantity and variety of taste to food.

Factors Influencing Quantity Demanded of Tomato

The result for the factors influencing quantity demandedof tomato is presented on Table 3.

Table 3: Factors Influencing Quantity Demanded of Tomato

Variables	B	Std. Error	t value	R squared	Adjusted R Squared
(constant)	1.304	.479	.008*	.858	.840
Gender	.978	.148	.000*		
Age	-.682	.108	.000*		
Marital status	-.190	.108	.082*		
Level of education	-.055	.062	.378*		
Household size	.421	.104	.000*		
Monthly expenditure on tomato	.438	.084	.000*		
Price of tomato	.750	.066	.000*		
Monthly expenditure on compliments	.332	.062	.000*		

Source: Field Survey Data, 2022

NOTE: * is significant at 5%

The adjusted R^2 is 0.840 implying that about 84.0% of the variation in the demand for tomato in the study area is accounted for by the independent variables in the model.

Table 3 revealed that seven of the estimated variables were found to significantly have effect on the quantity of tomato demanded by consumers. The variables are age, gender, marital status, household size, monthly expenditure on tomato, price of tomato and expenditure on complimentary products. Monthly expenditure on tomato and household size have a positive effect on tomato consumption. This is in line with the *a priori* expectation of the study. This explained the fact that as these variables increases, the quantity of tomato demanded will increase. Age and level of education have a negative effect on tomato consumption. The former suggest that as age increase, the demand for tomato decrease and the later suggest that increase in education will result in an increase in tomato consumption. This is not in line with the *a priori* expectation of the study.

Marital status have a negative effect on tomato consumption suggesting that married women will increase tomato consumption while those not married would probably decrease consumption. This is in line with the *a priori* expectation of the study.

Price of tomato, monthly expenditure on complimentary products and gender have positive effect on tomato consumption. Despite increase in price of tomato, consumers that prefer tomato will still purchase it. The increase

in price of tomato may force some consumers to purchase complimentary products such as tomato puree, pepper and onion. These are not in line with the *a priori* expectation of the study.

Price Elasticity of Demand for Tomato

The result of the price elasticity of demand is presented on Table 4.

Table 4: Price Elasticity of Demand for Tomato

$$\% \text{ change in quantity demand} = \frac{0.8 - 1}{1} = -0.20$$

$$\%? \text{ in quantity demand} = -20\%$$

$$\% \text{ change in price} = \frac{750 - 600}{600} = 0.25$$

$$\%? \text{ in price} = 25\%$$

$$\text{Price elasticity of demand} = \frac{-0.20}{0.25} = -0.8$$

$$\text{PED} = -0.8$$

Source: Field Survey Data, 2022

The study revealed that the average quantity of tomato demanded (for all the income groups) was 1kg daily at a price of ₦600, when the price of the same quantity increased to ₦750. The quantity demanded slightly dropped to 0.8kg. This is probably due to fact that consumers mostly compliment tomato with tomato puree, pepper or onion, when tomato price increases in the study area. This is also in accordance with the law of demand, that increase in price leads to decrease in quantity demanded

Price elasticity of demand for tomato in the study area was relatively inelastic (-0.8). It carries the expected negative sign (-) which indicates inverse relationship between price and quantity. This implies that as price increase, quantity demanded decreases. The result agrees with the findings of Khaliukova (2013) where thevalue of the elasticity of demand was (-0.784) indicating that the demand is inelastic. This implied that when the price of tomato changes, the demandchanges almost proportionately.

Constraints to Tomato Demand

Tomato demand is constraint by some factors which are shown on Table 5.

Table 5: Constraints to Tomato Consumption (n=80)

Variables	Low Income Area N=40		Middle Income Area N=27		High Income Area N=13	
	Frequency	%	Frequency	%	Frequency	%
Rapid deterioration	26	65	21	77.8	8	61.5
Off-season tomato scarcity	30	75	14	51.8	6	46
Long distance to market	7	17.5	9	33.3	–	–
Unstable market price	11	27.5	10	37	7	53.8
Unsteady availability	19	47.5	13	48.1	3	23
Health condition	7	17.5	3	11.1	4	30.7
Others	3	7.5	4	14.8	3	23

Source: Field Survey Data, 2022

Table 5 reveals that off season tomato scarcity (75%) was the major problem identified with tomato consumption in the low income areas. Majority of the respondents from middle (77.8%) and high (61.5%) income areas reported rapid deterioration of tomato as the major factor militating against tomato consumption. Due to its perishable nature, losses may occur during transportation and storage at home. This is as a result of poor storage facilities and lack of electricity supply in the study area. This finding agrees with that ofOladejo and Oladiran (2014) conducted in Oyo State, Nigeria which revealed that the most common challenge indicated by tomato consumers include off-season tomato scarcity, unstable market price and rapid deterioration in tomato quality.

CONCLUSION AND RECOMMENDATION

Conclusion

It can be concluded that tomato consumers in Maiduguri Metropolitan Area, Borno State, Nigeria, are young, married, literate women that have large households and earned an average monthly income of less than ₦100,000.00. Also the consumers sourced tomato from retailers and demanded for fresh tomato more than any other type of tomatowith a monthly average consumption of 1kg/day for all the income areas. The consumption of tomato is inelastic and the factors influencing demand for tomato were age, gender, marital status, household-size, price of tomato, monthly expenditure on tomato and expenditure on complimentary

products. And the major constraints to tomato consumption in the study area were rapid deterioration and off -season tomato scarcity.

I. There is need for the farmers to intensify tomato production to increase its supply in other to solve the problem of scarcity during the off-season.
ii. Modern storage/transportation facilities should be made available in the market stores in order to ensure longer lifespan of the produce.
iii. In addition to the specific nutritional benefits of tomato consumption, encouraging greater tomato and tomato product consumption may be a simple and effective strategy for increasing overall vegetable intake in the study area.

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