

Evaluation of Plant-Based Protein Consumption among Rural Households in Igbo-Eze North Local Government Area, Enugu State, Nigeria

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Abstract

The study evaluated plant-based protein consumption among rural households in Igbo-Eze North Local Government Area, Enugu State, Nigeria. The plant-based protein sources studied include soya bean, cowpea, Bambara nut, pigeon pea and black beans. Data were collected from 120 out of 18,989 households in the study area using a stratified random sampling technique. Data for the study was collected using a questionnaire and oral interview. Descriptive statistics were used to analyze the data generated from the respondents. The result showed that the consumption rate of plant-based protein sources was encouraging as a majority of the respondents consumed Bambara beans (okpa) with a daily consumption of 35%, followed by cowpea (black-eyed beans) with a daily consumption of 26.66%. Many (53.33%) of the respondents spent above ₦31,000 in the consumption of plant-based protein sources monthly indicating that they spend reasonably in their consumption of plant-based protein. Constraints encountered by the respondents in the consumption of plant-based protein include a lack of knowledge about the nutritional benefits of plant protein and the household size of the respondents. It is recommended that agricultural extension agents, health workers and nutritional policymakers should intensify efforts in public enlightenment to rightly inform rural households of the health benefits of plant-based protein foods, as this will help to increase its availability and thereby strengthen their consumption.

Keywords: Plant-Based Protein, Consumption, Rural Households, Health Benefits.

Introduction

Globally, statistics hold that above 900 million people are living in hunger, out of which about 800 million are from developing countries, representing

approximately 18 per cent of the world population (Akerele et al., 2015). Buttressing this, Chardigny (2016) asserts that 1/7 of the world population suffers

from hunger and one billion people have inadequate protein intake.

Proteins are the major structural components of all cells of the body. It forms the foundation of muscles, heart, hair, skin, brain, blood, teeth and innumerable biomedical activities going on in the body (Ekwe, 2019). Amino acids, which are the building blocks of proteins, are divided into two different types: essential and non-essential amino acids. Essential amino acids are obtained from the food we eat while the non-essential amino acids can be created out of other chemicals found in the body. Proteins play a diversity of roles in the human body and they are very essential for life. Protein is required for growth, maintenance and repair of all body tissues and they function as enzymes, membrane carriers and hormones (Akerelle et al, 2015). The cells of plants contain different proteins which make for a balanced diet, support the growth and development of the body system, production of vaccines and antibodies used for the prevention and treatment of diseases. It also plays a role in the production of seed oils which are very important in boosting agricultural and biofuel production. Proteins contain nitrogen and are sourced from both plants and animals.

Most plant-based protein diets according to Obayelu et al. (2021) including the plants of interest in this research are rich in health-promoting nutrients such as minerals, vitamins,

fibre, antioxidants, amino acids and phytochemicals. They are advantageous to the human body in that they improve digestion as they contain many soluble and non-soluble fibres that naturally stimulate digestion and improve metabolism. Plant protein is digested more slowly than fat or carbohydrate because of all the fibres it contains. It strengthens cardiovascular health as it contains very small amounts of saturated fatty acids except coconut and palm oil (Vitalabo, 2003). Aggarwel et al. (2019) propagating the benefits of plant-based protein opined that plant-based protein sources decrease the risk of chronic diseases such as heart disease, high blood pressure (hypertension) high cholesterol, obesity, stroke and type 2 diabetes. In support of this Fitpple (2023) asserts that plant-based protein helps to make our bodies function at their highest level, helps to develop healthy muscles, lose weight, boost immunity, cleanse and energize the body and can aid in quickly getting rid of viruses and infections. Hence, a need for an increased consumption of plant-based protein by man.

According to Wadhaave et al. (2014), the requirement of protein in humans according to level of activity, body weight and age are as follows; men from 19 to 70 years (56g of protein daily), women from 19 to 70 years (46g of protein daily) and children under the age of 8, 19g of protein daily. Depending on the activity level energy needs and body

weight of the individual, protein requirements may increase or decrease. Buttressing this, Palacios (2011) asserts that a registered dietician can be consulted to get the exact requirements for a particular individual. On body weight, 0.8g of protein is required per kg of body weight for adults or about 56g of protein for a 70 kg individual. To support growth in children, 2kg of protein is required per kg of body weight (Wadhaave et al. 2014).

Plant protein which is the focus of this work is obtained from various sources such as soya beans (*Glycine max*), Bambara beans “okpa” (*Vigna subterranean*), pigeon pea “fiofio” (*Cajanus cajan*), cowpea “black eyed beans” (*Vigna unguiculata*), black beans “akidi” (*Vigna unguiculata*), mushroom “ero” (*Agaricus bisporus*), sweet potato (*Ipomea batatas*), avocado (*Persea americana*) and green leafy vegetables such as moringa (*Moringa oleifera*), spinach (*Spinach oleracea*), water leaf (*Talinum fruticosum*), pumpkin (*Telfaria occidentalis*) etc. are rich in vitamins, amino acids, energy and protein. Unlike animal-based protein food which is expensive and not always available, they are low in cholesterol. Bambara nut is sometimes termed as a “complete food” due to its balanced macronutrient composition. It contains 64.4% carbohydrate, 23.6% protein, 6.5% fat and 5.5% fibre and is rich in minerals. The protein content of Bambara groundnut ranges from 9.6 to 40% with

an average value of 23%. It is also rich in leucine and lysine which are essential amino acids, but low in fats and fibres (Obayelu et al., 2021). Soya bean also is considered a complete protein as it contains all essential amino acids and possesses 31-36g of protein. Soya bean is said to be the only vegetable food that contains all eight essential amino acids with no cholesterol and is very low in saturated fat (Dudek, 2001; Obayelu et al., 2021). Pigeon pea (*Cajanus cajan*) known as “fiofio” in the study area is rich in proteins, vitamins and lipids. According to Nwokolo (2022), pigeon pea helps to reduce blood pressure, assist in the formation of cells, tissues, muscles and bones, prevent anaemia, help to enhance the immune system and boost energy levels. Cowpea (*Vigna unguiculata*) is the most consumed legume in Nigeria; contains between 22-29% protein and is rich in both essential and non-essential amino acids but low in fat content (Isaac, 2017).

The production capacity of plant protein in Nigeria is high. This is as Obayelu (2021) mentioned in a FAOSTAT report of 2014 where Nigeria was mentioned as the highest producer of cowpeas in the world. This assertion is supported by Abba (2013) who stated that Nigeria is the largest producer of cowpeas in Africa. Most research works done on the consumption of protein are animal-based and hence, various research works on the consumption of animal protein abounds, despite its

associated risk of total mortality, cardiovascular disease, colorectal cancer and type 2 diabetics in both men and women (Richi et al. 2015) This include Ekwe (2019), Akerele et al.(2015), Amao (2013), Abdulahi (2014), Ogunniyi et al. (2012), Lusk and Tousor (2016). Animal protein intake is high in industrialized nations with about 65 to 70% of total protein intake. Rylee et al. (2019) however, worked on plant-based protein consumption but focused on its global acceptance. The only available work that meets the Nigerian peculiarity is Obayelu et al (2021), whose focus was on the demand for plant-based protein by the staff of the University of Ibadan, Nigeria. This is so as Ekwe (2019) reported that protein consumption in Nigeria is mostly animal-based. Buttressing the above argument Chardingny (2016) asserts that it is possible to strike a balance between animal and plant sources on a 1:1 ratio as recommended by the United Nations.

Markie-wicz (2010) argued that the best solution to reduce problems associated with meat consumption would be to replace meat with plant-based protein foods. Grigg (1995) cited by Obayelu (2021) asserts that the protein content of pulses (beans, peas and lentils) is higher than that of meat, fish, eggs or fresh milk and that a plant-based diet can also provide the essential amino acid when combined correctly with cereals and pulses. Striking a balance is a possibility as in most dishes

plant proteins are often incorporated into the formulation of foods as Vegetable Protein Products (VPP). These VPP are fractions rich in proteins, obtained by fractionation of raw materials such as seeds of legumes, cereals, grains, oil seeds, tubers (like potatoes) or leaves (foliar proteins from alfalfa). There is therefore the need to investigate the household consumption of plant-based protein in a developing country like Nigeria as there is a dearth of empirical studies on the consumption of plant-based protein sources, especially in Nigeria. The specific objectives of the study are to:

- i. examine the socio-economic and demographic characteristics of the respondents;
- ii. determine the consumption frequency of plant-based protein sources in the study area;
- iii. determine the monthly expenditure on plant protein in the study area and
- iv. identify the constraints to the consumption of plant protein in the study area.

Methodology

Study design: This study employed a descriptive survey research design. A descriptive survey research design makes use of interviews, questionnaires and observations to determine people's opinions, attitudes, preferences and perceptions (Anyakoha, 2009). The survey research design was considered

appropriate for this study as it elicits information about the consumption of plant protein by the respondents' households.

Study area: This study was carried out in Igbo-Eze North Local Government Area of Enugu State. The Local Government has Umuozzi, Ezzodo, Essodo and Umuitodo as the four major town communities. The population of the Local Government is 259,431 people with an area of 293km² (113 sqm). The inhabitants of the area are mostly farmers, businessmen and civil servants.

Population of the study: The population of the study consists of all rural households in Igbo-Eze North Local Government Area. The household population of the Local Government Area is about 18,989 households (Geonames, 2016).

Sample size selection: A multistage sampling technique was used. In stage one, the LGA was divided into clusters based on the number of autonomous communities that make up the LGA, This gave a total of 36 clusters. Stage two involved a random selection of 20 (56%) of the autonomous communities. The purpose of this was to produce a fair representation of the entire Local Government area. In stage three, six households with an active household head(father/mother) representing 30% of each village, were purposively sampled from each of the 20 selected communities. This procedure gave 120 households which were used for the

study. Only the heads of the households (father/mother) participated in the study.

Instrument for data collection: A structured questionnaire titled Plant Protein Consumption Questionnaire (PPCQ) was used for data collection. The questionnaire was divided into sections A, B, C and D. Sections A, sought information on the socio-economic background of the respondents, usually the household head (father or mother). The respondents were selected based on who purchases foodstuffs for the household. Section B elicited information on the frequency of their consumption of plant-based protein among rural households. Percentages were used to determine the frequency of their consumption of plant-based protein in the study area. Items in section C were used to determine the monthly expenditure of the households on plant protein in the study area, while section D sought information on the constraints to the consumption of plant protein in the study area.

Validity and reliability of the instrument: The instrument was validated by three experts, two from the Department of Agricultural Education and one from the Department of Home Economics, Federal College of Education, Eha-Amufu, Enugu State. The instrument was assessed for proper representation, wording and consistency. The internal consistency was determined by the use of Cronbach's Alpha

reliability method with a reliability coefficient of 0.83. Hence, the instrument was reliable and suitable for the study.

Method of data collection: One hundred and twenty copies of the instrument were administered to the respondents with the aid of four trained research assistants recruited from the community. They helped in conducting some oral interviews interpreting the questions to the illiterate respondents and filling out the questionnaire items. All the 120 copies of the questionnaires were retrieved and used for data analysis. This indicates a 100% return rate for the instrument. The administration of the questionnaire by the trained research assistants lasted for three weeks. Data was also collected by the use of oral interviews. Their responses were recorded. The essence of the oral interview is also to give the participants opportunities to express themselves rather than restricting them to the questionnaire items.

Data and Statistical Analysis: Descriptive statistics such as frequency and percentages were used to analyse all the research questions. For research question two, items were rated on a 7-point scale rating from Everyday to Never. The overall percentage of frequency of consumption of plant-based protein sources was presented. For research objective 4, items were rated on a 4-point scale of Very High Extent, High Extent, Low Extent and Very Low Extent. The items considered as

constraints to the consumption of plant-based protein were accepted if the total percentage of responses for “High Extent” was greater or equal to 50%.

Results

The socio-economic data of the respondents presented in Table 1 revealed that 81.7% of the respondents who purchase family food-stuffs were women and many of them (48.3%) were between 40 to 59 years old. Most (68.3%) of the respondents were married, 56.7% had a household size of 5-8 persons, 48.3% had primary education and 26.7% had secondary education. Information gathered from oral interviews showed that females purchase household consumption of selected plant-based protein sources than males. Findings showed that more than one-third (42.5%) of the respondents were traders (businessmen/women) while 35% were farmers with many (44.2%) of them having occupational experience of 11- 19 years. Data also showed that 43.3% of the respondents had an annual income between the range of N501,000 – N900,000 per annum.



Table 1: Socio-Economic Characteristics of the Respondents

Socio-Economic Variable	<i>f</i>	%
Age		
20-39	26	21.70
40-59	58	48.30
60 and above	36	30.00
Purchase of household foodstuffs by gender		
Male	22	18.30
Female	98	81.70
Household size		
1 - 4	30	25.00
5 - 8	68	56.70
9 and above	22	18.30
Occupation		
Farmer	42	35.00
Artisan	15	12.50
Trading	51	42.50
Civil servant	12	10.00
Education		
Primary	58	48.30
Secondary	32	26.70
Tertiary	8	6.70
No education	22	18.30
Occupational Experience		
Less than 10 years	17	41.10
11 - 19 years	53	44.20
20 - 29 years	32	26.70

30 and above	18	15.00
Estimated Annual Income (₦)		
Less than ₦500,000.00	45	37.50
501,000 - ₦900,000.00	52	48.30
901,000 - ₦1,200,000.00	23	19.20
Marital Status		
Married	82	68.20
Single/divorced	16	13.30
Widowed	22	18.40

Table 2 shows the respondents’ rate of consumption of selected plant protein. The result shows that among the selected plant protein sources, Bambara nut “okpa” is consumed more frequently, with daily consumption of 35%, and a 21.66% consumption rate of 5-6 days per week. Cowpea had a daily consumption rate of 26.66% and a 19.16% consumption rate for 5-6 days per week. Black beans “Akidi” was the least consumed with a daily consumption rate of 5.00%, while Soya beans had a 7.50% consumption rate 5-6 days per week. The table also gave an overall consumption of selected plant protein to be 85.83% daily, 79.16% 5- 6 days a week, and 37.50% consumed plant protein only during festivities.

Table 2: Respondents Frequency of consumption of selected plant protein

Selected plant protein sources	Every day(7)	5-6 days/week(6)	3-4 days/week(5)	1-2 days/week(4)	Once in 2 days(3)	During festivities(2)	Never(1)
Cowpea (Black-eyed beans)	32(26.66)	23(19.10)	18(15.00)	30(25)	10(8.3)	6(5)	1(0.80)
Bambara nut (okpa)	42(35.00)	26(21.60)	30(25.00)	14(11.66)	2(1.6)	6(5)	0(0.00)
Pigeon pea (fiofio)	15(12.50)	19(15.80)	25(20.83)	24(20)	29(24.16)	8(6.66)	0(0.00)
Soya beans	8(6.66)	9(7.50)	15(12.50)	14(11.66)	32(26.66)	22(18.33)	20(16.66)
Black beans (Akidi)	6(5.00)	18(15.00)	20(16.66)	28(23.33)	15(12.5)	3(2.50)	28(23.33)
Overall consumption	103(85.83)	95(79.16)	108(90)	110(91.66)	88(73.33)	45(37.50)	49(40.83)

The distribution of the respondents according to their monthly expenditures on selected plant protein sources (Cowpea, Bambara nut, Pigeon pea, Soya beans, and Black beans) in the study area is presented in Table 3. The result shows that 35.67% of the households studied spend between ₦16,000 and ₦30, 000 monthly on the consumption of selected plant protein sources. The table further shows that a greater proportion (53.33%) of the respondents spend ₦31,000 and above in the consumption of plant proteins monthly, while a few spend less than ₦15,000 monthly on plant protein.

Table 3: Monthly Expenditure of the Respondents on Selected Plant Protein Sources

Monthly Expenditure Ranges (₦)	f	%
Less than 15, 000	12	10.00
16,000 - 30,000	44	35.67
31,000 and above	64	53.33
Total	120	100

Table 4 shows the constraints to the consumption of plant-based protein in the study area. The result showed that lack of knowledge about the health benefits of protein had a total rating percentage of 69.16%, the financial status of the household head (72.49%), lack of knowledge about the health benefits of protein (75.83%), household size and

composition (72.49%), and limited availability of various plant protein (82.0%); and were therefore accepted as the constraints reported by the respondents. The educational status (42.49%) and health condition of the household members (47.50%) were not considered constraints to the consumption of plant-based protein sources in the study area since their total High Extent ratings were less than 50%.

Table 4: Constraints to the Consumption of Plant-Based Protein Sources

Constraints to the consumption	Very High Extent	High Extent	Low Extent	Very Low Extent	Total High Extent rating	Remarks
	F (%)	F (%)	F (%)	F (%)	F (%)	
Price of the commodity	40(33.33)	43(35.83)	22(18.33)	15(12.5)	83(69.16)	Accepted
Financial status of the household head	37(30.83)	50(41.66)	15(12.50)	18(15.0)	87(72.49)	Accepted
Lack of knowledge about the nutritional benefits of plant proteins	61(50.83)	30(25.0)	17(12.50)	14(11.66)	91(75.83)	Accepted
Educational status of the household head	28(23.33)	23(19.16)	54(45.0)	15(12.50)	51(42.49)	Not Accepted
Household size and composition	56(46.66)	31(25.83)	16(13.33)	17(14.16)	87(72.49)	Accepted
Health condition of household members	30(25.00)	27(22.50)	49(40.83)	14(11.66)	57(47.50)	Not Accepted
Limited availability of various plant protein	54(45.00)	45(37.50)	13(10.83)	8(6.66)	99(82.50)	Accepted

Discussion

The research study analysed the consumption frequency of selected plant protein sources in Igbo-Eze North Local Government Area of Enugu State, Nigeria. The findings of this study based on oral interviews and information gathered from the questionnaires showed that females patronize the purchase of household consumption of selected plant protein than males. This is an indication that women are more committed to kitchen activities in the family than men. This assertion is in agreement with the findings of Babayemi et al (2017) and Uloh et al (2022), whom both asserted that culturally, men financially empower their wives, while the women select the daily menu for the family. The finding further revealed that the respondents were mostly middle-aged adults. Hence, they are mentally alert to know the dietary needs of their households. This statement agrees with Ekwe (2019) who asserted that respondents' being at their productive age helps to provide family food security. From the findings, most of the respondents were married with a mean household size of six persons indicating that the respondents are displaying their responsibility to family sustainability and livelihood. Educationally, the finding revealed a good level of literacy among the respondents as a good number (48.3% and 26.7%) of them had their primary and secondary education respectively. This could help to enhance their dietary consumption of plant protein having known its health benefits. The respondents' expenditure on selected plant protein was encouraging as 28.3% of the respondents spend ₦25,000 and above monthly on the consumption of plant protein sources. This disagrees with the findings of Ekwe (2019) where due to low levels of income, the

consumption of plant protein in Agwu, Enugu State, Nigeria was equally low.

The finding shows that plant protein sources generally were frequently consumed among the rural households in the study area. The plant protein sources mostly consumed by the households in this study were Bambara nut (okpa), cowpea and pigeon pea. This frequent consumption could be because of the availability and preference of the foods. It could also be due to the societal acceptance of the end products of their preparations, method and skill for the preparation and also the means of storage of the prepared food products. This agrees with Obayelu et al (2021) where cowpeas had the highest demand and consumption among the selected plant-based proteins among the staff of the University of Ibadan, Nigeria. From the findings, the respondents occasionally consumed soya beans and black beans (Akidi). This is possibly due to the cost and unavailability of akidi all year round, the people's level of exposure and education about the health benefits of soya beans. It could also be because black beans and soya beans are not readily used in a variety of dishes as the other plant protein sources.

The monthly expenditure on the consumption of plant-based protein sources in the study area was high and encouraging. This implies that average households in the study area spend reasonably on the consumption of plant-based protein. This could be a result of their likeness to the food forms of Bambara nut (okpa), cowpea (moi moi and akara) and pigeon pea (fiofio) that are mostly used as breakfast, lunch and supper by households and individuals in the study area. These findings correlate with that of Amao (2013) where a great number of households in Ila Local Government Area of Osun State,

Nigeria spend ₦20,000 and above monthly in their consumption of both plant and animal protein.

The constraints to the consumption of plant protein sources identified in the study area include lack of knowledge about the health benefits of plant protein, the financial status of the household head, the price of the commodity, lack of knowledge about the nutritional benefits of protein, household size and composition, and limited availability of various plant protein. For instance, the knowledge of the nutritional benefits of soya beans will help enhance its consumption in the study area. However, the educational status of the household head and the health condition of the household members were not considered as constraints to the consumption of plant-based proteins in the study area. This finding disagrees with that of Obayelu et al (2021) where the educational status of the respondents positively affected the demand for soybean consumption amongst the staff of the University of Ibadan, Nigeria. The finding of the current study indicates that adequate consumption of plant proteins might not be constrained by how educated the household heads are, but rather how knowledgeable they are about the nutritional benefits of plant proteins. In addition, the financial status of the family, the price of the foods and the household size might constrain the affordability of plant-based proteins by households.

Conclusion and Recommendation

This study has provided information on the consumption of plant-based protein among households in Igbo-Eze North Local Government Area of Enugu State. Findings revealed that the rate of consumption of some plant-based proteins such as Bambara

nut (okpa) and Cowpea (black-eyed beans) in the study area was encouraging. There was more female patronage of plant-based protein foods than males. This is probably because women are more involved in kitchen and cookery activities than men. Constraints to the consumption of plant-based consumption were mostly the lack of knowledge about the nutritional benefit of plant-based protein foods to the body, and the limited availability and affordability of the foods. From the ongoing, considering the nutritional benefits of protein in the body, there is still a need for increased consumption of plant-based proteinous food in the study area, especially soya beans and black beans which are least consumed in the study area.

Recommendations

Having evaluated the consumption of plant-based protein in the study area, it is recommended that:

- i. There is a need for the government, farmers and marketers to emphasize increased production and marketing of plant-based proteins, especially Bambara nut (okpa) and cowpea (black-eyed beans) as it is the most demanded among the selected plant-based protein sources in the study area.
- ii. Agricultural extension, health workers and nutritional policymakers should intensify efforts for public enlightenment to rightfully inform rural households of the health benefits of plant-based protein sources especially for black beans (akidi) and soybeans which are the least consumed selected plant-based protein foods.
- iii. Considering the high cost of plant-based protein sources as complained by the respondents, government intervention towards pricing is recommended at all

levels to bring down prices of protein food sources to make them affordable to

all and sundry.

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