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Determinants of Daily Protein Intake among Rural and Low-Income Urban Households in Nigeria

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Abstract: The study was designed to empirically identify the socio-economic and household characteristics that influence the daily protein intake of household members in the rural and low-income urban areas of Nigeria. Primary data used for the study were obtained from a field survey conducted in two Local Government Areas (LGAs) of Edo State in Nigeria-Orhionmwon LGA (representing the rural area) and Ikpoba-okha LGA (representing the low-income urban area). Structured questionnaire were used to obtain information from 384 household members (in 90 households) on the type and quantity of food each member consumed the previous day and a day after per meal and per day. The protein content in each food item consumed was determined and used in estimating the proportion in the total food intake of each household member. The Ordinary Least Squares (OLS) multiple regression was employed in identifying the variables that had significant impact on their daily per capita protein intake. The result revealed a significant positive relationship between daily per capita protein intake of the low-income urban dwellers and their age, education level, monthly income, sex, salary earning and farming. For the rural dwellers the positive relationship was between daily per capita protein intake and age, dependency ratio, monthly income and salary earning. Those with negative relationship with daily per capita protein intake were household size and education level. The latter implying that the larger household family sizes in the rural area and their low literacy level were negatively affecting their appreciation of the need to improve their daily protein intake which was also found to be much below the Food and Agriculture Organization (FAO) recommended minimum intake of 44.4g per capita per day.

Key words: Determinants · Protein intake · Rural and Urban households · Nigeria

INTRODUCTION

Basically there are two types of hunger: undernourishment (i.e a situation where an individual's food intake falls short of the minimum calorie (energy) requirement and malnourishment (when the calorie (energy) intake is sufficient but the protein and other essential nutrient intakes are inadequate). Both types of hunger are present the world over but the incidence is said to be more in developing countries.

Globally over 900 million people are said to be chronically hungry out of which 800 million are from the developing countries representing about 18 percent of the world's population [1, 2]. One out of five persons in the developing countries is unable to meet his or her basic daily needs of life [3]. Nigeria's per capita daily protein intake for instance is estimated to be 45.4g as against the FAO recommended minimum of 53.8g [4]. Similarly the International Conference on Nutrition, ICN [5], reported that low-income rural and semi-urban adult dwellers in Nigeria consumed less than 60% of their calorie (energy) needs and less than 40% of their protein needs. During the 1989-1995 period the daily calorie per capita intake of an average Nigerian was estimated to be 2,130kcal as against the recommended minimum requirement of 2500kcal for moderate activity [6].

Addo in a 2005 survey presented a more scaring scenario of the level of Nigeria's protein-energy malnutrition and undernutrition [7]. According to the report, Nigerian children below the age of 18 years, who make up 47% of the nation's population are still victims of stunting, wasting and under-weight, all of which are evidence of under-nutrition. The report further revealed that, only 26.6% of under 5 year old children met their

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Recommended Daily Allowance (RDA) while 18.5% were severely deficient. With the recent global rise in food prices the situation in Nigeria even appears to have worsened. On the global chart, Nigeria is now one of the two African nations listed among the 20 responsible for 80% of malnutrition in children, with states in the North rated as the major contributors to the country's poor rating [8]. The nutrition indices, according to the United Nation's Children's Fund (UNICEF) recent report, include 14% low birth weight, 13% exclusive breastfeeding, 14% stunting and 27% under-weight. The question then is, what factors are really responsible for this poor state of nutrition in Nigeria. A number of factors including poverty, illiteracy, intakes of improper and unbalanced diets, social norms, abandonment of traditional food products, increase in food prices, natural and man-made disasters have been highlighted in the literature [1, 9-11]. The focus of this paper is to empirically identify the socio-economic and household characteristics that have major influence on the level of protein intake among Nigerian households using the rural and low-income urban dwellers as case study. The study also examined the protein consumption patterns of the inhabitants and the level of contribution of the various food sources to their daily per capita protein intake.

METHOD

Source of Data and Sampling Procedure: The study focused on two Local Government Areas (LGAs) of Edo State in Nigeria-Orhionmwon and Ikpoba-Okha. The communities in Orhionmwon LGA represent the rural area while those of Ikpoba-Okha represent the low-income urban area. Primary data used for the study were obtained through personal interviews using structured questionnaire.

The study was divided along the current political wards to form strata. Twelve strata (wards) out of the thirty strata (wards) in the study area (14 in Ikpoba-Okha and 16 in Orhionmwon LGAs) were randomly selected (6 strata from each LGA). A total of 120 households (60 from each LGA) were randomly selected out of which 90 household questionnaire (46 from Orhionmwon and 44 from Ikpoba-Okha) were retrieved and used for analysis.

A total of 460 individuals from the 90 households were interviewed on their daily food intake using a 48-hour recall method. Of that number, data from 384 household members were found adequate and used for analysis. Children below the age of one year (10 in number) were excluded from the analysis because they were still breast-fed and the breast milk intake could not be quantified.

Each household member was asked the food he/she consumed the previous day and a day after. The data collected included type of food and quantity consumed per meal/day. The protein content in each food item consumed were used in estimating the proportion in the total food intake.

Analytical Framework: The data collected were subjected to descriptive analysis, nutrient protein estimation, multiple regression analysis, income elasticity estimation and marginal propensity to consume.

Frequencies, percentages, means, etc, were used to describe the demographic and socio-economic characteristics of the households and their food intake habit / patterns. For the analysis of food consumption patterns, the various food items were categorized into 11 groups for convenience as shown in Table 1.

Protein Intake Estimation: Food intake records collected were cooked food except in few cases where the food needs not to be cooked before consumption (fruits, gari, etc). The estimate of protein on per capita daily basis was done using the formula below [12].

Table 1: Categorization of Food Items Consumed by Respondents (In Groups)

Group	Food Items
Roots	Eba, Fufu, Amala, Lafun, Potatoes, Gari, Cocoyam
Tubers	Yam, Pounded Yam, Porridge
Cereals	Rice, Ogi/Custard, Maize, Bread, Biscuits
Legumes	Beans, Moin-moin, Akara, Melon, Groundnut
Vegetable	Vegetables (leafy and fruit), Pepper
Fats and Oils	Butter, Palm Oil, Vegetable Oil
Fruits	Plantain, Orange, Pawpaw, Banana, Garden Egg
Beverages	Tea/Coffee, Sugar, Bournvita/Milo
Meat	Pomp, Beef, Pork, Sheep Meat, Chicken
Fish	Fish of all kinds
Other Animal Products	Milk, Eggs

$$Ci=\sum_{i=1}^{m} aijBj$$

Where:

Ci = per capita daily protein (g) intake level of the i^{th} individual in the study area.
Aij = the weight in grams of the average daily intake of food commodity j by the i^{th} individual.
Bj = the standardize food protein content of the j^{th} food commodity as the case may be.

Also, the protein intake status was estimated for each household. This is referred to as the household per capita daily protein intake. This was done by averaging the weighted sum of the individual's protein intake using the male adult equivalent. The male adult equivalent refers to the total protein requirement of a household divide by the protein requirement of an adult male. An adult male was considered to be a person aged 20-45 years [13].

Multiple Regression Analysis: Ordinary Least Squares (OLS) multiple regression analysis was also carried out to identify the variables that significantly influenced the per capita daily protein intake of household members. The model used is explicitly stated as follows;

$$C = b_0 + b_1 X_1 + b_2 X_2 + b_3 X_3 + \text{-------} + b_8 X_8 + e$$

Where:

C = per capita daily protein intake of the household members (g)
b_0 = Constant term
b_1-b_8 = Regression Coefficients.
X_1 = Household Size (no of persons in the household)
X_2 = Age of household members (in years)
X_3 = Educational level (years spent in school by the respondent)
X_4 = Household Dependency ratio
X_5 = Household total monthly income (Naira)
X_6 = Household members sex, dummy (1= male, 2 = female)
X_7 = Household members Income source (1 = salary earner; 2 = Non-salary earner)
X_8 = Engagement in farming / Not farming (1 = farming; 2 = Not farming).
e = error term.

RESULTS AND DISCUSSION

Demographic and Socio-economic Characteristics of Households: The demographic and socio-economic characteristics of households and their members in Ikpoba-Okha Local Government Area (representing the low-income urban area) and Orhionmwon Local Government Area (representing the rural area) are presented in Tables 2 and 3. As shown in Table 2, 62% of the total sampled respondents were male and 38% were female in the study area. As much as 92% and 98% of household members from the low-income urban and rural areas respectively were regular residents within the households sampled. The average age of the respondents were 40 and 37 years for the low-income urban and rural areas respectively. These fall within the economically active age group.

As regards educational level about 92% of the low-income urban dwellers had formal education as against 62% for the rural dwellers. This could have significant influence on the nutritional status of the household as pointed out by Davis [14]. Since household heads are the major decision makers in the traditional African culture, their general characteristics could have major impact on the nutrition status of households. The characteristics of the household heads in the studied population are presented in Table 3. The result showed that over 95% of the household heads were male and are usually residing within the household. The presence of household heads at home is expected to have positive influence on the quality of food intake. The mean age of the household heads was 47 years for the rural area and 50 years for the low-income urban area. However as much as 43% of the low-income urban household heads were over 60 years old (the retirement age group) as opposed to 15% for the rural household heads. This age distribution pattern, could have a significant impact on both calorie and protein intake levels, as the expenditure patterns may not be the same.

In terms of education, a slightly higher percentage (39%) of the household heads in the rural area were illiterates as compared to 20% for the low-income urban area. Similarly a slightly lower number of household heads in the rural area had secondary education and more-17% in the rural area as compared to 48% for the low-income urban household heads. Given this scenario, food security in the rural household may be on the threat level,

Table 2: Socio-Demographic Characteristics of Respondents in Ikpoba-Okha and Orhionmwon LGAs

	Ikpoba-Okha		Orhionmwon		Aggregate	
Demographic Characteristics	Freq	%	Freq	%	Freq	%
1. Sex:						
(a) Male	141	59.2	146	65.8	287	62.4
(b) Female	97	40.8	7.6	34.2	173	37.6
Total	238	100	22	100	460	100
2. Relation to:						
a. Household						
b. Wife	51	21.4	49	22.1	100	21.7
c. Children	173	72.7	170	76.6	343	74.6
d. Parent	2	0.8	0	0	2	0.4
e. Close relations	10	4.2	3	1.3	13	2.8
f. Distant relations	3	0.8	0	0	2	0.4
Total	238	100	222	100	460	100
3. Residential Status:						
a. Usually resident	220	92.4	218	98.2	438	95.2
b. Not Usually resident	18	7.6	4	1.8	22	4.8
Total	238	100	222	100	460	100
4. Age:						
a. 0-19	54	22.7	49	22.2	103	22.4
b. 20-39	80	33.6	71	32	151	32.8
c. 40-59	86	36.1	73	32.9	159	34.6
d. 60-79	12	5	20	9	32	6.9
e. 80 +	6	2.5	9	4	15	3.3
Mean age	39.6		36.64		38.68	
Total	238	100	222	100	460	100
5. Educational level:						
a. No Formal education	18	7.6	84	37.8	102	22.2
b. Primary education	158	66.4	120	54.1	278	60.4
c. Sec. Sch/model/com.sch.	36	15.1	15	6.8	51	11.13.
d. OND/NCE/Bsc/HND	27	11.3	3	1.4	30	2002
						6.5
Total	238	100	222	100	460	100

Source: Field Survey, July –Oct. 2005

Table 3: Household Head Characteristics Ikpoba-Okha and Orhionmwon LGAs

	Ikpoba-Okha		Orhionmwon		Aggregate	
Demographic Characteristics	Freq	%	Freq	%	Freq	%
1. Sex:						
(a) Male	42	95.5	46	100	88	97.8
(b) Female	2	4.6	0	0	2	2.2
2. Residential Status:						
a. Usually resident	43	97.7	46	100	89	98.9
b. Not Usually resident	1	2.3	0	0	1	1.1
3. Age:						
a.< 30 years	8	18.2	6	13	14	15.6
b. 30-39 years	1	2.3	2	4.4	3	3.3
c. 40-49 years	8	18.2	20	43.5	28	31.1
d. 50-59 years	8	18.2	11	23.9	19	21.1
e. 60-79 years	7	15.9	5	10.9	12	13.3
f. > 70 years	12	27.3	2	4.4	14	15.6
Mean	50.1		47.3		49.32	

Table 3: Continued

4. Educational level:						
a. No Formal education	9	20.5	18	39.1	27	30
b. Primary education	14	31.8	20	43.5	34	37.8
c. Sec. Sch/model/com.sch.	10	22.7	6	13	16	17.8
d. OND/NCE/Bsc/HND	11	25	2	4.4	13	14.4
5. Occupation:						
a. Not Farmed	13	29.6	1	2.2	14	15.6
b. Farmed	10	22.7	22	47.8	32	35.6
c. Salary/wage earner	9	20.5	3	6.5	12	13.3
d. Non salary/wage earner	12	27.3	20	43.5	32	35.6
6. Household Size						
a. 1 - 3	5	11.4	5	10.9	10	11.1
b. 4 - 6	26	59.1	30	65.2	56	62.2
c. 7 - 9	10	22.7	10	21.7	20	22.2
d. 10 – 12	3	6.8	1	2.2	4	4.4
Mean size	6.42		5.94		6.23	
Total	44	100	46	100	90	100
7. Type of Household:						
a. One person	1	2.3	0	0	1	10.1
b. Married with no child	15	34.1	0	0	15	16.7
c. Married with children	28	63.6	46	100	74	82.2

Source: Field Survey, July –Oct. 2005

Table 4: Protein Consumption Patterns Among Low-Income Urabn Dwellers (Ikpoba-Okha) by Sex and Age Group (percentage)

	Male					Female				
Food Item	<6 yrs	6-10 yrs	11-18yrs	19-59 yrs	>60 yrs	<6 yrs	6-10 yrs	11-18 yrs	19-59 yrs	> 60 yrs
Roots	10.267	12.869	9.4687	9.478	6.3462	5.9865	11.644	11.416	11.118	6.2321
Tubers	4.3798	7.9985	4.0356	4.5269	6.4177	2.4986	9.6344	4.151	3.3512	11.091
Cereals	14.426	11.716	18.827	22.413	23.511	18.552	12.586	16.238	17.993	10.444
Legumes	40.793	36.87	34.121	32.236	24.864	52.081	36.714	33.777	30.975	5.552
Vegetables	7.975	12.3	11.094	7.3521	9.222	7.063	9.6546	12.608	10.635	10.294
Fruits	0.3267	0.1367	0.1334	0.1846	0	0.0611	0.3382	0.0279	0.1465	0
Beverages	0.2286	0.2742	0.3819	0.3595	0.3637	0	0.1248	0.5102	0.2237	0.6374
Meat	3.6003	2.3257	5.8299	6.6862	12.604	3.9714	3.328	3.8416	5.6655	39.137
Fish	14.533	15.16	13.727	14.868	14.831	9.7862	15.704	16.692	18.661	12.924
Other animal products	3.4703	0.3496	2.3806	1.896	1.8407	0	0.2708	0.7378	1.2311	3.6872
Total Protein per capita daily intake (g)	20.662	25.835	45.819	54.561	70.115	22.813	26.188	35.699	42.908	66.672

Source: Computing from field survey data, July – Oct. 2005

given the fact that nutritional value judgement/ appreciation is expected to be positively correlated with level of education.

The study showed that about 48% of the household heads in the rural area as opposed to 23% in the low-income urban area are farmers. This situation gives the rural households the possibility to be less prone to food security problems relative to the low-income urban households, since they cultivate food crops first, which they have easy access to for consumption. The household size distribution pattern was relatively uniform for both locations. For household type, all those in the rural area were married with children while only 64% of those in the low-income urban area were within this category. This household structure definitely has a great expectation in meeting the household food security demand.

Food Consumption Pattern among the Low-Income Urban Dwellers (Ikpoba-Okha) and Rural Dwellers (Orhionmwon) by Sex and Age: Food consumption pattern refers to the food eating habits, showing what constitutes the food basket of an individual or group of people (e.g. household) in a particular location [12].

Table 5: Protein Consumption Patterns Among Rural Dwellers (Orhionmwon LGAs) by Sex and Age Group (percentage)

	Male					Female				
Food Item	<6 yrs	6-10 yrs	11-18yrs	19-59 yrs	>60 yrs	<6 yrs	6-10 yrs	11-18 yrs	19-59 yrs	> 60 yrs
Roots	11.225	10.261	9.5067	9.2079	8.1214	8.3199	8.6332	11.793	9.2981	18.606
Tubers	6.9222	8.8746	3.8161	5.5975	3.7409	10.091	7.3036	4.6404	5.7145	4.2942
Cereals	22.367	24.062	21.981	23.259	26.71	24.708	27.857	19.211	22.065	7.422
Legumes	26.352	31.844	38.635	30.836	28.921	28.696	30.538	35.415	29.591	20.08
Vegetables	19.472	13.513	11.635	11.809	11.014	16.199	13.583	14.915	12.904	22.687
Oil	0	0	0	0	0	0	0	0	0	0
Fruits	0	0.0306	0.0456	0.1218	0.1423	0	0.0314	0	1.1212	0
Beverages	0	0.2311	0.5163	0.345	0	0	0	0	0.0841	0
Meat	2.3912	1.6105	2.9199	4.0687	0.3909	2.5321	0.4317	0.596	2.8544	0
Fish	11.272	9.4257	10.944	14.497	20.96	9.4536	11.623	13.429	17.366	26.91
Other animal products	0	0.1474	0	0.2582	0	0	0	0	0	0
Total Protein per capita daily intake (g)	20.64	38.71	47.034	62.644	47.904	27.966	34.083	36.38	51.375	33.184

Source: Computing from field survey data, July – Oct. 2005

The breakdown of the food eating habits of the low-income urban and rural dwellers by age and sex in terms of protein intake are presented in Tables 4 and 5 respectively. Specifically, the tables show the percentage contribution of each food group to the per capita daily protein intake of both male and female by age and location. Table 4 shows the protein intake of the low-income urban dwellers. The result showed a marked variation in protein intake pattern across sex and age group. However the common feature in the patterns of protein consumption in the low-income urban area is the dominance of legumes and cereals followed by animal protein sources. The proportion of legumes and cereals (together) varied across sex and age from 16% to as much as 70%, with a mean of 49.4%. Similarly the proportion of animal protein sources combined varied from 18% to as much as 56% with a mean of 25%. This observed protein consumption pattern is fairly consistent with the findings of Aromolaran [15] which showed that the consumption pattern of protein in Ibadan area of Nigeria followed the order-cereal (33.06%), legumes (31.99%), animal products (22.24%).

For the rural dwellers, the percentage contribution of each food group to their per capita daily protein intake is shown in Table 5. Their eating habit followed a more definite pattern compared to what obtained among the low-income urban dwellers. Variations exist across sex and age, but two patterns were observed from the table. The patterns are legumes, cereals, animal products and vegetables; and legumes, cereals, vegetables and animal products. The leguminous crops and cereals maintained the leading roles in meeting the rural dwellers protein requirement similar to the case of the low-income urban dwellers. Unlike the latter, vegetables competed with animal products in supplying the protein required by the rural dwellers. This can rightly be attributed to the fact the rural dwellers have more access to vegetables (majority being farmers) than the urban dwellers. The proportion of legumes, cereals, vegetables and animal products in the per capita daily protein intake of the various groups ranged between 20.08-38.63%, 7.42-27.86%, 11.01-22.69% and 11.19-26.91% respectively. This result showed a slight contrast from the result of Aromolaran [15] in Ibadan villages where the proportion was 14.16%, 69.95%, 4.53% and 6.99% for legumes, cereals, vegetables and animal products respectively in their per capita daily protein intake. This divergence might be as a result of locational and cultural differences. However the implication of plant protein contributing as high as 88.81% (especially among the rural dwellers in the study area) to the protein intake is that deficiency in some essential amino acids like Methionine and Lysine which are available in animal protein might be significant among the studied population. This protends nutritional inadequacy for the sampled population and highlights the claim by Braun [1] that apart from the large and familiar problems of widespread hunger and malnutrition that still faces the world, hidden hunger due to micronutrient deficiencies is widespread.

Protein Nutrient Status among the Households in Ikpoba-okha and Orhionmwon LGAs: The household is a whole entity inhabited by individuals of different ages and sex. Any adverse effect on any one of these individuals would in turn affect the household. This relationship therefore, makes it necessary to estimate

Table 6: Summary Statistics of Protein Intake of An Average Household in the Low-Income Urban (Ikpoba-okha) and Rural (Orhionmwon) Areas

Variable	Freq.	Standard	Mean	Median	Std Dev.	Min	Max.	Skewness
Study Area								
Per Capita Daily Protein Intake (g)	90	44.4	37.24	31.4	23.9	3.74	143.73	1.700
Low-Income Urban Area								
Per Capita Daily Protein Intake (g)	44	44.4	37.73	32.85	23.03	3.74	118.16	1.47
Rural Area								
Per Capita Daily Protein Intake (g)	46	44.4	36.86	30.86	24.9	10.05	143.73	1.87

Source: Computed from Field Survey Data, July – Oct, 2005

Table 7: Estimated Protein Intake Functions for Ikpoba-Okha (Lone-Income Urban) Area

	Functional Forms		
Variables	Linear Coefficients	Semi-log Coefficient	Double-log Coefficients
Constant term	10.48***	-38.11***	-2.83**
	(-2.91)	(-3.23)	(-2.68)
X1 = Household Size	-0.25	-1.9	0.27
	-0.55	(-0.69)	-1.12
X2 = Age of Household members	0.09*	4.81*	0.49**
	-1.7	-1.86	-2.02
X3 = Educational Level of Household members	0.27***	5.16***	2.05***
	-6.96	-6.29	-9.53
X4 = Household Dependency Ratio	0.27	-0.86**	-0.011
	(-1.53)	(-2.52)	(-0.94)
X5 = Household Total Monthly Income	0.0003*	2.02**	0.75**
	-1.79	-1.82	-0.53
X6 = Household Members Sex	0.92	1.61	2.19***
	-0.64	-1.08	-1.14
X7 = Household Members Income Source	-4.65**	-5.33***	0.502***
	(-2.57)	(-2.95)	(-0.75)
X8 = Farming/Non- Farming Households	3.13*	2.34	0.19***
	-1.91	-1.43	(-0.60)
n	44	44	44
R2	0.57	0.48	0.78
R2	0.53	0.4	0.72
F –value	15.58	12.59	25.09

Source: Field Survey Data, July – Oct. 2005

- Figures in parenthesis are the t-values.

*** Significant at 1% level; **significant at 5% level

* Significant at 10% level.

the household per capita daily protein intake as well. The summary statistics of the protein intake of an average household is presented in Table 6. The average household in both the low-income urban and rural areas consumed less than the recommended protein level of 44.4g per capita per day. The mean and median daily protein intakes were 37.63g and 32.85g respectively for the low-income urban households. For the rural area the mean and median values were 36.86g and 30.86g respectively. The range of protein intake at the two locations was 3.74g-118.16g and 10.05g-143.72g respectively for the low-income urban and rural areas respectively. Factors responsible for these wide variations are examined next.

Estimated Protein Intake Functions for Ikpoba-Okha and Orhionmwon Local Government Areas: The three estimated models (linear, semi-log and double-log) for per capita daily protein intake of household members in Ikpoba-Okha LGA are presented in Table 7. The three functions were significant at the 1% level. However the double-log (i.e Cobb-Douglas) model was chosen as the lead equation based on the expected sign of the coefficients, statistical judgement and econometric criteria. The model had the best fit with an R^2 value of 0.78 and an F-ratio of 25.09. This implies that all the explanatory variables (X_1-X_8) in the model combined, explained about 78% of the variation in the daily per capita protein intake of household members in the area.

Table 8: Protein Consumption Pattern in Ikpoba-Okha and Orhionmwon LGAs According to Location and Sex (percentage)

	Ikpoba-Okha			Orhionmwon			Aggregate		
Food Item	Male	Female	Both sex	Male	Female	Both sex	Male	Female	Both sex
Roots	9.182	10.533	9.718	9.524	9.667	9.586	9.358	10.054	9.644
Tubers	5.114	5.047	5.087	5.98	6.235	6.09	5.558	5.704	4.654
Cereals	20.403	16.326	18.784	23.44	22.733	23.132	21.963	19.869	21.09
Legumes	32.038	30.964	31.612	31.667	30.167	31.013	31.847	30.523	31.29
Vegetables	9.083	10.493	9.643	12.605	13.863	13.152	13.152	12.356	12.565
Oil	0	0	0	0	0	0	0	0	0
Fruits	0.138	0.145	0.141	0.086	0.073	0.08	0.111	0.105	0.145
Beverages	0.351	0.266	0.317	0.296	0.046	0.187	0.323	0.144	0.132
Meat	7.145	8.015	7.49	3.021	1.938	2.55	5.026	4.654	4.99
Fish	14.607	17.024	15.566	133.22	15.281	14.117	13.894	16.06	15.405
Other animal products	1.941	1.187	0.641	0.163	0	0.092	1.027	0.53	0.085
Total Protein per capita daily intake (g)	43.4	38.86	41.13	43.39	36.6	40	43.4	37.73	40.57

Source: Field survey data, July – Oct. 2005

The coefficients (b_i) of all the explanatory variables (apart from household size) had the expected signs based on economic reasoning. Six out of the eight explanatory variables were statistically significant at the 5% level. Household size coefficient (b_1) though not significant was aprori expected to have a negative sign, implying that with increase in household size the proportion of foods with protein available for consumption by household members would likely reduce, hence a negative influence on the protein intake level. This may however not be the case if household size transmits into an increase in the number of adults earning income; in which case a positive influence in protein intake would result.

The coefficient for age of household members (b_2) was both positive and significant at the 5% level. This implies that the daily per capita protein intake increased with age of household members hence the positive relationship. This fact is confirmed in Table 4 where the protein consumption pattern by sex and age is presented. The table showed that protein per capita daily intake increased from 20.662g for male household members below 6 years to as high as 70.115g for those above 60 years. Likewise for the female household members; it ranged from 22.813g for those below 6 years to 66.672 for those above 60 years.

The highly significant level (1%) and the positive sign of the educational level coefficient (b_3) shows the major impact education has on daily protein intake of household members. Some earlier empirical studies in Nigeria by Aboyade, [16]; Okike, [17]; Ojo, [18] and Davis, [14]; had also confirmed that apart from household size, religion and household composition, educational level has a considerable influence on dietary patterns of either an individual or the household. This finding suggests that some form of education must be built into any programme aimed at improving the quality of the diets of the low-income urban dwellers.

Household total monthly income also showed a positive and significant relationship with daily per capita protein intake of household members in the low-income urban area. This finding supports previous consumption studies which revealed that the proportion of the household expenditure on proteinous food increases as income increases [3, 14, 18].

Sex of household members also showed a positive and significant relationship with the daily per capita protein intake of household members. Since 1 (one) was assigned to the male sex and 2 to the females for the dummy variable, the positive sign of that coefficient (b_6) shows that the male sex consumed more protein than the females. This fact is well highlighted in Tables 4 and 8. The result in Table 8 showed that on the average, the per capita daily protein intake of male household members was 43.39g as against 36.60g for the females.

The positive and significant contribution of household income source (coefficient b_7) to daily protein intake again shows that a steady/regular source of income by way of salary/wage earning attracts a well planned food budget in the household particularly because proteinous food sources are usually more expensive. The positive and significant contribution of farming to daily per capita protein intake of household members again

Table 9: Protein Consumption Intake Function for Orhionmwon (Rural) Area

	Functional Forms		
Variables	Linear Coefficients	Semi-log Coefficient	Double-log Coefficients
Constant term	13.57***	27.67***	27.67***
	-5.15	-4.76	(-2.77)
X1 = Household Size	-0.64***	-3.15***	-3.15***
	-3.06	-2.77	(-6.13)
X2 = Age of Household members	0.18***	3.59***	8.12***
	-11.1	-12.48	(-3.31)
X3 = Educational Level of Household members	0.22***	-0.11	-0.37**
	-3.2	(-1.14)	-0.02
X4 = Household Dependency Ratio	0.74**	0.26	0.26**
	-2.14	-1.02	-1.08
X5 = Household Total Monthly Income	0.0001	0.60**	0.63**
	-1.22	-2.08	-4.76
X6 = Household Members Sex	0.03	0.8	0.36*
	-0.05	-1.52	(-2.48)
X7 = Household Members Income Source	2.49**	2.57***	2.57***
	-2.44	-2.62	(-1.14)
X8 = Farming/Non- Farming Households	-0.44	0.1	0.11
	(-0.26)	-0.06	-1.52
n	46	46	46
R2	0.37	0.42	0.7
R2	0.35	0.41	0.66
F –value	16.35***	20.21***	20.21***

Source: Field Survey Data, July-Oct 2005

- Figures in parenthesis are the t-values.

*** Significant at 1% level; ** significant at 5% level

* Significant at 10% level.

highlights the need to encourage urban dwellers to engage in some farming as a way of improving on their diets particularly their daily protein intake. The dominance of legume (which is a cheaper source of protein) in the diet of the low-income urban dwellers of Ikpoba-Okha LGA (Table 4) suggests that the affordability and sustainance of this dietary pattern would require the annual cultivation of some leguminous food crops by the inhabitants. The relatively higher cost of meat and fish made the inhabitants to shift to crop protein sources especially legumes for their daily protein intake.

B. Estimated Protein Intake for Orhionmwon (the rural Inhabitants): The three estimated models (linear, semi-log and double-log) for the per capita daily protein intake of household members in Orhionmwon local area are presented in Table 9. The double-log (Cobb-Douglas) model was chosen for the analysis based on the expected sign of the coefficients, statistical judgement and econometric criteria. All the explanatory variables (X_1-X_8) in the model explained about 70% of the variations in the daily per capita protein intake of household members in the area. Apart from the coefficient for household dependency ratio (b_4) all the other explanatory variables had the expected signs based on economic reasoning. Five out of the eight explanatory variables were statistically significant at the 5% level.

Household size coefficient was significant and had a negative sign, implying that as household size increases per capita daily protein intake decreases. Thus unreasonable increase in the household size of those in the rural area could reduce the proportion of food protein intake of members in the household. The coefficient of age of household members (b_2) like the case for the low-income urban dwellers was both positive and significant at the 5% level. This again implies that the daily per capita protein intake increased with increase in the age of household members. This relationship is confirmed in Table 4. The table showed that per capita daily protein intake of the rural dwellers increased from 20.64g for male household members below 6 years to as high as 62.644g for those between 19-59 years before falling slightly to 47.904g for those above 60 years of age. For the female sex it ranged from 27.966g for those below 6 years to as high as 51.375g for those 19-59 years of age.

Table 10: Marginal Propensity to Consume Protein in the Study Area

Location	Household Monthly Income (X5)	Average Per Capita Daily Protein Intake (C_i)	Protein Intake Regression CoefficientIncome (b5)	$MPCC_i$*
- Low-income				
- Urbane Area	12,242.66	40.19	0.75	0.002
- Rural Area	7,541.73	37.91	0.63	0.003

Source: Computed from Field Survey data, July – Oct, 2005

* $MPCC_i = b5 (C_i/X5)$ for double-log equation.

** The $MPCC_i$ were not computed because the regression coefficients of income (b5) in

Table 11: Protein Intake Elasticity in the Study Area

Location	Av. Per Capita Daily Protein Intake (C_i)	Protein Intake Regression Coefficient Income (b5)	Income Elasticity Coefficient (EC_i)*
- Low-income			
Urban Area	40.19	0.75	0.75
- Rural Area	37.91	0.63	0.63

Source: Computed from Field Survey data, July – Oct, 2005

* $EC_i = b_i$ for double-log equation.

The significant and negative sign for education level coefficient (b_3) highlights the negative influence absence or near absence of education has on level of daily protein intake of rural household members. As earlier shown in Table 2 with about 38% of the inhabitants in Orhionmwon LGA having no formal education and only 8% with secondary education and more, the level of illiteracy in the area can be said to be high. Those figures are in contrast with 8% for those with no formal education and 27% for those with secondary education and more for Ikpoba-okha LGA (the low-income urban dwellers). This result again emphasizes the major and positive contributory role education has to play in restructuring the dietary patterns of the rural inhabitants. Studies by Aboyade, [16]; Ojo, [18] and Lupien and Menza, [3]; have affirmed that apart from income, household size, age, religion, etc., education has a considerable influence on dietary pattern of either an individual or household.

Apriori a negative sign was expected for the household dependency ratio coefficient (b_4) implying that a larger number of household members are dependent on the few income earners in the household. However a positive sign was observed for the coefficient and significant at the 5% level. This result implies therefore that the dependency ratio is low, indicating that most household members are fending for themselves either by daily job earnings or deriving sufficient income from their farming activity. Table 3 earlier presented showed that as much as 48% of the household heads were farmers.

Household total monthly income coefficient (b_5) was significant and showed a positive relationship to daily per capita protein intake. This shows that as income of household members in the rural area increases, a significantly large proportion of their income, would be spent on proteinous food hence income has a positive impact on the daily per capita protein intake.

Salary/wage earning coefficient (b_7) was found to exert positive and significant influence on daily per capita protein intake. This, apriori was expected, bearing in mind that foods high in protein are usually more expensive than c arbohydrate foods. Hence with increase in income people are more likely to increase their consumption of proteinous foods and lesser consumption of carbohydrates. Similarly because salaries and wages are more reliable and surer sources of monthly income, households members who earn salary and/or wages are better able to plan out their daily diets and therefore tend to spend more on proteinous foods than those with irregular sources of income. This observed positive relationship between salary/wage earning and daily per capita protein intake suggests that programmes aimed at improving the dietary consumption patterns among the rural dwellers would among other things encourage them to go into enterprises or employments that would guarantee a more reliable monthly source of income in order for them to plan and have a more balanced daily diet.

Marginal Propensity to consume (MPC) Protein foods in the Area: The Marginal Propensity to Consume (MPC) refers to the slope of the estimated consumption function at any point on the curve; that is additional protein intake as a result of a N1 increase in income. Based on the lead equations from Tables 6 and-8, MPC of household members in the study area were computed and the results are presented in Table 10.

From the above Table (Table 10), the average consumer household in the low-income urban area (with average household monthly income of N12,242.66) has a marginal Propensity for consumption (MPC_{Ci}) of 0.002 while for the rural household, (with average household monthly income of N7,541.73) the MPC_{Ci} is 0.003. This implies that with an increase of N100 in the household monthly income of the low-income urban and rural households in the sampled area the respective household members per capita protein intake would increase by 0.02 and 0.03g respectively. In other words for every N100 increase in the income of the households, the household members in the low-income urban and rural areas will increase their per capita daily protein intake from 40.19 grams and 37.91 grams respectively to 40.21 grams and 37.94 grams.

Protein Intake Elasticity in the Study Area: Using the lead equations, the income elasticity for protein was computed for both the low-income urban and rural household members. The results are presented in Table 11.

The income elasticity coefficients for low-income urban and rural households respectively were less than unitary for protein intake. The protein-income elasticity coefficient for the rural households was 0.63, which is lower compared to 0.75 obtained for the low-income urban households. For both locations the protein intake was income inelastic. Also the elasticity coefficients carried the expected positive sign (for both locations). This is rational more so, when the average per capita daily protein intake in the study area (both rural and low-income urban) were below the recommended minimum of 44.4g specified by the Food and Agriculture Organization (FAO). For the low-income urban area the average per capita protein intake was 40.19g while for the rural area it was 37.91g.

The implication of the protein-income elasticity coefficients obtained in the study area is that a rise in the monthly income of an average household consumer will consequently bring about a rise in per capita daily protein intake of the household members.

CONCLUSION

Effort was made in this study to empirically identify the socio-economic and household characteristics that have major impact on the level of protein intake of the rural and low-income urban inhabitants in Nigeria using Orhionmwon and Ikpoba-okha Local Government Areas (LGAs) in Edo State as case study. The result from the study revealed a significant positive relationship between daily per capita protein intake and age, educational level, monthly income, sex, salary earning and farming in the case of the rural dwellers. For the rural inhabitants the factors that contributed positively and significantly to daily per capita protein intake were age, dependency ratio, monthly income and salary earning. Those that showed negative relationship with daily per capita protein intake were household size and educational level. The latter implying that the larger household family sizes in the rural area and their low literacy level were partly responsible for their lower daily per capita protein intake. On the whole the daily per capita protein intake in both the rural and low-income urban areas sampled were much less than the FAO recommended minimum intake of 44.4g per capita per day. For the rural area (represented by Orhionmwon) the daily per capita protein intake was 36.86 while the low-income urban dwellers represented by Ikpoba-okha inhabitants consumed 37.63g per capita per day. The study recommends the launching of nutrition education programmes to help them re-orient their daily diets towards the consumption of a little more proteinious foods. The study also recommends the promotion of business activities in the areas as a way of boosting their incomes which would in turn help encourage them to have well planned food budget.

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