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IMPLICATIONS OF CHANGES IN COMMODITY PRICES AND INCOME ON NUTRIENT AVAILABILITY AMONG HOUSEHOLDS IN NORTHERN NIGERIA

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ABSTRACT

Food calorie intake has been found to have a strong empirical linkage with both human health and productivity. This study sets out to determine the probable influence of price and income changes on the availability of food nutrients to households in Northern Nigeria. Demand elasticities were obtained from survey respondents and the nutritional effects of changes arising from changes in income and prices were computed using both the Almost Ideal Demand System (AIDS) methodology and a technique developed by Huang. The findings show that yam, maize and guinea corn are the foods that would have the greatest implications for the nutrient status of the households. The study concludes with the likely applications of the methodology used to derive nutrient elasticities.

Keywords: Food, demand, AIDS, elasticities, nutritional implications, Northern Nigeria

INTRODUCTION

Nigeria, Africa's most populous country, is the single largest geographical unit in West Africa which occupies a land area of 923,768 square kilometers and is situated between longitude 30° and 150° East, and latitude 40° and 140° North (CBN, 2000). The country lies entirely within the tropics with two main vegetation zones; the rain forest and savanna zones, reflecting the amount of rainfall and its spatial distribution. The wet and dry seasons are the two major seasons in the country. With an estimated 140 million citizens, Nigeria is Africa's most populous country – and the fourth largest economy in Africa, with a national economy of USD40 billion – and boasts an abundance of natural and human resources. Nigeria is also the world's thirteenth largest oil producer, and the sixth largest oil exporter among member coun-

tries of the Organization of Petroleum Exporting Countries (OPEC). Oil provides 95 per cent of foreign exchange earnings, 20 per cent of GDP and 65 per cent of budgetary revenues. Based on these figures, Nigeria is expected to be a rich country given the enormous human and mineral resources available in the country. However, the opposite situation holds. The country is rich but the citizens are poor. Poverty in Nigeria encompasses a very complex society: regional climatic and ethnic differences are reinforced by different historical and socioeconomic legacies. Aigbokhan (2000) states that the contribution to poverty tends to be higher in Northern Nigeria than in Southern Nigeria and that while the intensity of poverty is declining in the south, it is rising in the north. The south is the economic centre of the country with economic activities much higher in the region. For instance, of all the

industries in the country only 19 per cent are located in the North, with Kano and Kaduna in the northwest zone having a lion share of 70 per cent. Furthermore, the combined industries of all the 19 northern states represents just one-third of industries located in Lagos state alone (Adamu, 2003).

Low economic activities in the north are reflected on the living conditions of the people of the region in comparison with the south. For instance, in the National Consumer Survey, the national average household expenditure was N5, 194 and the northwest zone had the least figure of N2, 941. Similar picture applies to household income and level of poverty with Northeast and Northwest occupying the bottom scale respectively. Furthermore, looking at professional data in Nigeria, the north is said to have only 10 per cent of engineers; 15 per cent of professors; 10 per cent of architects and 25 per cent of lawyers (Adamu, 2003). The proportion of undernourished children is significantly higher in the north.

Given that food consumption and expenditure decisions have long-term diet and health consequences and a direct effect on development; and the importance of per capita food intake on human welfare and productivity through its influence on the capability of man to perform work and the attitude of man towards the work. This study intends to derive the nutritional implications of the demand for food on Northern Nigeria and the effect or otherwise of unit changes in prices and income on the availability of nutrients to households in Northern Nigeria.

MATERIALS AND METHODS

The data used for this study was the National Consumer Survey (NCS) of the Fed-

eral Office of Statistics (FOS), Nigeria. This is the most comprehensive household level survey to date in Nigeria. A two-stage stratified random sampling technique was used in sample design. As a first stage, a list of all Nigerian households was obtained from the National Population Commission (NPC). This list is based on the enumeration areas (EA) used for census purposes. Within each enumeration area, five Household Units (HU) were chosen randomly using a table of random numbers.

The data set for this analysis are the portions dealing with the household characteristics and household food consumption behaviour in the 1996/1997 NCS which are targeted at all households in Nigeria. The data set provides detailed records on the money value, quantity and the types of food purchased by the households over a one-week period.

Data Analysis

A model of household demand for the different food items which compete for the household budget allocation requires a complete demand system framework. Because of its theoretical consistency with the postulate that households maximise utility (minimise cost) in their consumption decision making process, and its flexibility to encompass broad ranges of behaviour, the Almost Ideal Demand System (AIDS) was selected for modelling household behaviour. The basis for the AIDS approach comes from the minimisation of cost or expenditure function (Deaton and Muellbauer, 1980).

However, the true AIDS model is non-linear and is thus therefore difficult to estimate. The model estimated in this study is a linear approximation of the strict AIDS model (LA-AIDS) and it corresponds to those used by Savadogo and Brandt (1988), Fulponi

(1989), Mergos and Donatos (1989) and Soe *et al.* (1994). The model hypothesises that the portion of total expenditure that accrues to a particular commodity (or budget share) is related to prices and income as follows:

$$w_j = a_j + b_j \log(M / P^*) + \sum_{j=1}^n c_{ij} \log p_j \quad (1)$$

where, $i = 1, \dots, n$

n = number of food items

w_i = average budget share of commodity

M = total nominal expenditure on all goods

p_j = price of the j th good

P^* is a price index defined as:

$$P^* = a_0 + a_k \log P_k + \frac{1}{2} \sum_{k=1}^n \sum_{j=1}^n c_{kj} \log p_k \log p_j \quad (2)$$

Equation (2) allows the AIDS flexibility but complicates the estimation procedure of eq. (1) which is nonlinear in the parameters. In empirical work, the following geometric rice index is often used instead:

$$\log P = w_j \log P_j \quad (3)$$

where, w_j is the budget share of food item j . Deaton and Muellbauer and others found in their application that Stones index P closely approximates P^* . This results in the following linear (in the parameters) demand system:

$$w_j = a_i + b_j \log(M / P) + \sum_i c_{ij} \log p_j \quad (4)$$

Adding a disturbance term completes the equation.

$$w_{ih} = a_i + b_j \log m + \sum c_{ij} \log p_j + U_{ih} \quad (5)$$

$i = 1, \dots, n$

where, i indexes commodity prices; $m = M/P$ is real income and u random error.

The parameter a_i represents the average value of the budget share in the absence of price and income effects. The parameters b_j and c_{ij} represent the effects on the expenditure share of good i of a 1 per cent change in real income or price of good j . A positive (negative) b_i indicates that the good has an income elasticity greater (less) than unity. Similarly, a good for which c_{ij} is negative (positive) has an own price elasticity greater (less) than 1 in absolute value. When c_{ij} is positive (negative), the goods are considered substitutes (complements).

The formulae and procedures for the computation of elasticities after Beggs (1988) and Green and Alston (1990) are:

income elasticities

$$\zeta_{iy} = 1 + b_i / w_i \quad (6)$$

own-price elasticities

$$\zeta_{ii} = c_{ii} / w_{ii} - (1 + b_i) \quad (7)$$

cross-price elasticities

$$\zeta_{ih} = c_{ih} / w_i - b_i w_h / w_i \quad (8)$$

Furthermore, a technique used by Huang (1996) was employed to explore the linkage of the demand model to nutrient availability. To do this, information about the nutrient

values of each food consumed is needed. Let a_{ki} be the amount of the k th nutrient obtained from a unit of the i th food. The total amount of that nutrient obtained from various foods, say Φ_k may be expressed as

$$\Phi_k = \sum_i a_{ki} q_i \quad (9)$$

Equation 9 is referred to by Huang as the consumption technology of consumer behaviour. The values of a_{ki} 's for non-foods will be assigned zero, thus the terms associated with non-foods will disappear. This equation, including all foods consumed, plays a central role in the transformation of food demands into nutrient availability. By substituting a demand equation for the quantity variable of Equation (9), changes in consumer nutrient availability become

$$d\Phi_k = \sum_i a_{ki} [\sum_j (\delta q_i / \delta p_j) dp_j + (\delta q_i / \delta m) dm] \quad (10)$$

Furthermore, the relative changes of consumer nutrient availability can be expressed as functions of the relative changes in food prices and per capita income as follows:

$$d\Phi_k / \Phi_k = \sum_j (\sum_i e_{ij} a_{ki} q_i / \Phi_k) dp_j / p_j + (\sum_i a_{ki} q_i / \Phi_k) dm / m = \sum_j \Pi_{kj} dp_j / p_j + \rho_k dm / m \quad (11)$$

where, $\Pi_{kj} = \sum_i e_{ij} a_{ki} q_i / \Phi_k$ is a price elasticity measure relating the effect of the j th food price on the availability of the k th nutrient, and ρ_k represents the effect of income on the availability of that nutrient.

Obviously, the measurement represents the weighted average of all own- and cross-price elasticities (e_j 's) in response to the j th price with each weight expressed as the share of each food's contribution to the k th

nutrient ($a_{ki} q_i / \Phi_k$'s). Similarly, the measurement of ρ_k represents the weighted average of all income elasticities (η_i 's) with each weight again expressed as the share of each food's contribution to the k th nutrient. Thus the general calculation of nutrient elasticity matrix, say N, for the case of ℓ nutrients and n foods can be obtained as a product of multiplying matrix S by matrix D as follows:

$$N = S^* D \quad (12)$$

where N is the $\ell \times (n+1)$ matrix of nutrient elasticities in response to changes of food prices and income, S is the $\ell \times n$ matrix with entries of each row indicating a food's share of a particular nutrient, and D is the $n \times (n+1)$ matrix of demand elasticities. From these nutrient elasticity measurements, a change in a particular food price or per capita income will affect all food quantities demanded through the interdependent demand relationships and thus cause the levels of consumer nutrient availability to change simultaneously.

RESULTS AND DISCUSSION

Socioeconomic Characteristics of Respondents

The summary of the socioeconomic characteristics of the respondents are as presented in Table 1. The distribution of households according to the sex of the household head shows that males constitute the overwhelming majority (94%). Similarly, 88 per cent of the respondents are from households with married heads. This indicates a noteworthy level of household food demand. The north central with the largest number of respondents, has 3 per cent of the respondents attending tertiary institutions unlike the other regions with less than one per cent. This means that the demand for exotic foods will not be much in the study areas given the

Table 1: Socioeconomic Characteristics of Respondents

| Socioeconomic Characteristics | North East | | North West | | North Central | | Total |
|--|------------|------------|------------|------------|---------------|------------|-------|
| | Number | % of Total | Number | % of Total | Number | % of Total | |
| Sex of Household Head | | | | | | | |
| Male | 2415 | 27.8 | 2723 | 31.4 | 3013 | 34.7 | 8151 |
| Female | 115 | 1.3 | 40 | 0.5 | 370 | 4.3 | 523 |
| Size of Family | | | | | | | |
| Less than 2 | 241 | 2.8 | 73 | 0.8 | 442 | 5.1 | 756 |
| 2-4 | 1170 | 13.5 | 1273 | 14.7 | 1416 | 16.3 | 3859 |
| 5-9 | 958 | 11.0 | 1273 | 14.7 | 1308 | 15.1 | 3539 |
| More than 9 | 161 | 1.9 | 144 | 1.7 | 217 | 2.5 | 522 |
| Sector of Residence | | | | | | | |
| Urban | 314 | 3.6 | 232 | 2.7 | 748 | 8.6 | 1294 |
| Rural | 2216 | 25.5 | 2531 | 29.2 | 2635 | 30.4 | 7382 |
| Age of Household Head | | | | | | | |
| Less than 34 | 672 | 7.7 | 623 | 7.2 | 935 | 10.8 | 2230 |
| 35-44 | 807 | 9.3 | 955 | 11.0 | 1004 | 11.6 | 2766 |
| 45-54 | 591 | 6.8 | 744 | 8.6 | 793 | 9.1 | 2128 |
| More than 54 | 460 | 5.3 | 441 | 5.1 | 651 | 7.5 | 1552 |
| Level of Educational Attainment of Household Head | | | | | | | |
| None | 2098 | 24.2 | 2600 | 30.0 | 2159 | 24.9 | 6857 |
| Primary | 194 | 2.2 | 68 | 0.8 | 538 | 6.2 | 800 |
| Secondary | 169 | 1.9 | 79 | 0.9 | 449 | 5.2 | 697 |
| Tertiary | 69 | 0.8 | 16 | 0.2 | 237 | 2.7 | 322 |
| Occupation of Household Head | | | | | | | |
| Farming | 2143 | 24.7 | 2539 | 29.3 | 2113 | 24.4 | 6795 |
| Other Occup. | 387 | 4.5 | 224 | 2.6 | 1270 | 14.6 | 1881 |
| Total | 2530 | 29.2 | 2763 | 31.8 | 3383 | 39.0 | 8676 |

Source: Result of Analysis, 2004

relative non-exposure of the survey respondents. Respondents from the north west have the highest percentage of people involved in farming (29%). This means that the region has the potential to be food self sufficient in light of the relatively high percentage of the population currently involved in farming practices.

Food Demand Elasticities of the Households

Income elasticities for all households are as seen in Table 2. The results as presented for the North Central show that garri is an inferior food (-0.10), millet (1.62), yam (1.16) and rice (1.09) are luxury foods and the other foods are essential. Cross price elasticities show the demand for rice (1.01), millet (-1.15), guinea corn (-0.50) and beans (1.08) to be price elastic. Maize substitutes for all the other food items; guinea corn complements millet and beans and rice substitutes for garri, beans and maize.

For households in the north east, guinea corn (1.12), beans (1.71) and maize (-1.59) are price elastic. Rice (1.12) and millet (1.44) are the luxury food items in the North East. Other foods are necessities. Cross price relationships show that rice complements guinea corn and yam and substitutes for all other food items. Yam complements rice, guinea corn and garri and substitutes for other food items. Maize is a substitute for all the food items consumed in the north east. In the north west, income elasticity values show yam (3.18) and rice (1.12) to be the luxury foods in the north west and beans (-0.29) and millet (-0.30) inferior foods. Beans (1.27) is the only price elastic food of those consumed in the North West. Cross price relationships for the North West show that yam would substitute for all other food items except beans, maize would

complement other food items except rice and yam would substitute all other food items.

Nutritive Value of Foods Consumed in Northern Nigeria

Table 3 shows the nutritive values per kilogramme for selected food items. Yam has the least energy content (1190) of the food items, but the highest moisture content (690). Beans has the highest protein value (225) and yam (19) and garri (10) the least. Yam has the least carbohydrate content (278) and millet the highest calcium content (3970). Guinea corn has the highest phosphorous content (3300) while beans has no iron content. Further details on the nutrient contents of the different foods are as seen in Table 3.

In addition to the unit nutritive value of the study food items, the amount of food consumed is another factor determining the level of nutrients available to consumers. Averages of food consumption over the study period were obtained from the Central Bank of Nigeria, 1998. Maize is the food item consumed in the greatest quantity by Nigerian households and beans is consumed in the least quantity.

In Table 4, combined consumption of maize and garri accounts for more than 80 per cent of all energy consumption. Also, maize is a major source of protein, fat, phosphorous, thiamine, riboflavin and niacin. Garri and millet are the principal sources of calcium and yam accounts for 50 per cent of food moisture. Table 4 presents the source of nutrients and is the first step for obtaining nutrient elasticities for the selected food items.

Table 2: Income and Price Elasticities for Households in Northern Nigeria

| Food Items | Income Elasticities | Price Elasticities | | | | | | |
|--|---------------------|--------------------|--------|---------|-------|-------|-------|-------|
| | | Rice | Millet | G. Corn | Yam | Garri | Beans | Maize |
| Households in the North Central | | | | | | | | |
| Rice | 1.09 | 1.01 | -0.14 | 0.29 | -0.69 | 0.89 | 0.61 | 0.18 |
| Millet | 1.62 | -0.09 | -1.15 | -0.01 | -0.04 | -0.56 | -0.40 | 0.22 |
| G. Corn | 0.25 | -0.11 | -0.5 | -2.20 | 0.58 | 0.56 | 0.22 | 0.72 |
| Yam | 1.16 | -0.16 | 0.37 | 0.07 | 0.76 | -0.02 | -0.03 | -0.03 |
| Garri | -0.10 | 0.70 | -0.18 | 0.08 | 0.07 | 0.31 | 0.48 | 0.03 |
| Beans | 0.06 | 0.85 | 0.52 | -0.14 | -0.84 | 0.79 | 1.08 | 1.11 |
| Maize | 0.04 | 0.09 | 0.57 | 0.70 | -0.51 | 0.37 | 0.68 | 0.93 |
| Households in the North East | | | | | | | | |
| Rice | 1.12 | 0.05 | 0.32 | 0.14 | -0.88 | 0.22 | 0.11 | 0.72 |
| Millet | 1.44 | 0.49 | -0.82 | -0.10 | 0.19 | 0.21 | -0.02 | 0.08 |
| G. Corn | 0.23 | -0.28 | 0.96 | 1.12 | -0.08 | -0.50 | 0.01 | 0.12 |
| Yam | 0.31 | -0.02 | -0.46 | 0.23 | -0.10 | 0.23 | 0.03 | 0.13 |
| Garri | 0.31 | 0.38 | -0.15 | 0.02 | -0.59 | 0.62 | -0.01 | 0.39 |
| Beans | 0.11 | 2.22 | -0.50 | -0.48 | 0.98 | 1.71 | 3.29 | 0.48 |
| Maize | 0.36 | 0.06 | 0.29 | 0.12 | 0.68 | -0.01 | 0.04 | -1.59 |
| Households in the North West | | | | | | | | |
| Rice | 1.12 | 0.21 | -0.19 | -0.13 | 0.09 | 0.02 | 0.11 | 0.08 |
| Millet | -0.30 | -0.29 | -0.90 | 0.68 | 0.44 | 0.07 | -0.16 | -0.47 |
| G. Corn | 0.14 | 0.28 | 0.42 | -0.13 | 1.61 | 0.27 | -0.11 | -0.07 |
| Yam | 3.18 | 0.67 | -0.58 | 0.66 | 0.97 | 1.02 | -0.48 | -1.77 |
| Garri | 0.41 | -1.08 | 0.43 | 0.66 | 0.04 | 0.28 | 0.76 | -0.07 |
| Beans | -0.29 | 0.27 | 0.70 | 0.87 | -0.13 | 0.45 | 1.27 | -0.11 |
| Maize | 0.16 | 0.68 | 0.27 | -0.37 | 0.23 | 0.40 | 0.61 | 0.94 |

Source: Result of Analysis, 2004

Table 3: Nutritive Value of Food per Kilogramme and Average Food Consumption

| Nutrients | Rice | Millet | G. Corn | Yam | Garri | Beans | Maize |
|-------------------------|-------|--------|---------|--------|--------|-------|---------|
| Energy (cal) | 3630 | 3290 | 3450 | 1190 | 3510 | 3380 | 3570 |
| Moisture (%) | 120 | 109 | 101 | 690 | 126 | 114 | 116 |
| Protein (g) | 70 | 74 | 107 | 19 | 10 | 225 | 94 |
| Fat (g) | 5 | 13 | 32 | 2 | 11 | 14 | 42 |
| Carbohydrate (g) | 799 | 777 | 741 | 278 | 842 | 610 | 736 |
| Calcium (mg) | 90 | 3970 | 260 | 520 | 450 | 1040 | 160 |
| Phosphorous (mg) | 1270 | 2440 | 3300 | 610 | 790 | 4160 | 2200 |
| Iron (mg) | 17 | 171 | 106 | 8 | 16 | - | 36 |
| Thiamine (mg) | 1 | 1.8 | 3.4 | 1.1 | 0.8 | 0.8 | 3.3 |
| Riboflavin (mg) | 0.3 | 1.1 | 1.5 | 0.2 | 0.3 | 0.9 | 1 |
| Niacin (mg) | 28 | 8 | 33 | 3 | 10 | 40 | 22 |
| Food(Kg) | 35.89 | 69.83 | 88.38 | 274.59 | 394.56 | 21.74 | 1009.09 |

Source: Central Bank of Nigeria, 1998
Food and Agricultural Organisation, 1968

Table 4: Food Share of Nutrients Based on Average Food Consumption

| Nutrients | Rice | Millet | G. Corn | Yam | Garri | Beans | Maize | Total |
|------------------|--------------------|--------|---------|-------|-------|-------|-------|-------|
| | Percentages | | | | | | | |
| Energy | 2.15 | 3.80 | 5.04 | 5.40 | 22.88 | 1.21 | 59.5 | 100 |
| Moisture | 1.13 | 2.01 | 2.35 | 49.92 | 13.10 | 0.65 | 30.84 | 100 |
| Protein | 1.99 | 4.10 | 7.50 | 4.14 | 3.13 | 3.88 | 75.25 | 100 |
| Fat | 0.35 | 1.76 | 5.49 | 1.07 | 8.43 | 0.59 | 82.31 | 100 |
| Carbohydrate | 0.02 | 4.13 | 4.99 | 5.81 | 25.30 | 1.01 | 56.57 | 100 |
| Calcium | 0.40 | 34.32 | 2.84 | 17.68 | 21.99 | 2.80 | 19.99 | 100 |
| Phosphorous | 1.38 | 5.17 | 8.85 | 5.08 | 9.45 | 2.74 | 67.33 | 100 |
| Iron | 0.91 | 17.89 | 14.03 | 3.29 | 9.46 | 0.00 | 54.42 | 100 |
| Thiamine | 0.81 | 2.84 | 6.79 | 6.82 | 7.13 | 0.39 | 75.22 | 100 |
| Riboflavin | 0.76 | 5.40 | 9.32 | 3.86 | 8.32 | 1.38 | 70.96 | 100 |
| Niacin | 3.11 | 1.73 | 9.02 | 2.55 | 12.21 | 2.69 | 68.89 | 100 |

Source: Result of Analysis, 2004

Table 5: Nutrient Elasticities for Foods Consumed by Households in Northern Nigeria

| Nutrients | Income | Rice | Millet | G. Corn | Yam | Garri | Beans | Maize |
|---|----------|---------|----------|----------|----------|---------|---------|----------|
| Nutrient Elasticities for Foods Consumed by Households in the North Central | | | | | | | | |
| Energy | 16.1881 | 22.8106 | 25.2328 | 33.1865 | -24.3681 | 32.5636 | 53.4875 | 62.0543 |
| Moisture | 62.9452 | 5.2128 | 30.3845 | 21.177 | 23.0847 | 16.183 | 26.8659 | 30.6357 |
| Protein | 18.4183 | 12.415 | 37.1349 | 36.7081 | -35.4583 | 35.4703 | 57.9625 | 80.9192 |
| Fat | 8.3312 | 13.2304 | 41.284 | 46.2896 | -38.1981 | 35.913 | 61.3396 | 81.827 |
| Carbohydrate | 14.4929 | 21.8298 | 23.1185 | 30.8748 | -20.7973 | 29.955 | 50.9861 | 58.8209 |
| Calcium | 76.0218 | 13.7461 | -25.5103 | 10.1226 | 2.4276 | -1.2012 | 13.7828 | 31.4952 |
| Phosphorous | 19.8975 | 14.1459 | 29.4178 | 28.7375 | -28.1436 | 33.1936 | 53.848 | 73.5472 |
| Iron | 38.5284 | 8.7591 | 2.818 | 8.3001 | -17.7977 | 21.6505 | 37.9334 | 64.9969 |
| Thiamine | 17.4116 | 10.8167 | 37.5438 | 38.9157 | -29.7418 | 33.1463 | 55.6405 | 76.0562 |
| Riboflavin | 18.4732 | 12.0222 | 30.119 | 30.077 | -29.1676 | 32.719 | 53.975 | 75.6936 |
| Niacin | 13.1015 | 18.6188 | 32.4769 | 30.0423 | -31.5843 | 38.1988 | 58.7242 | 74.7782 |
| Nutrient Elasticities for Foods Consumed by Households in the North East | | | | | | | | |
| Energy | 39.3591 | 15.4009 | 13.1444 | 13.8246 | 26.0334 | 15.6527 | 6.505 | -81.9422 |
| Moisture | 35.4106 | 7.6564 | -15.3402 | 17.7216 | 8.0867 | 19.9024 | 4.8463 | -35.8686 |
| Protein | 39.6283 | 14.2437 | 21.9834 | 16.451 | 51.1395 | 6.3239 | 16.08 | -113.365 |
| Fat | 36.8306 | 8.7731 | 25.7574 | 16.0305 | 51.0555 | 3.3601 | 5.2395 | -126.111 |
| Carbohydrate | 37.2377 | 15.7617 | 10.8429 | 13.3245 | 24.3173 | 16.5604 | 5.4765 | -77.8956 |
| Calcium | 70.3241 | 31.4596 | -32.3222 | 5.3658 | 7.5367 | 28.1635 | 9.7081 | -16.1912 |
| Phosphorous | 40.0704 | 13.7363 | 19.0996 | 17.71 | 41.446 | 8.0038 | 11.9026 | -98.9244 |
| Iron | 53.5514 | 11.6774 | 11.9396 | 21.5283 | 32.5711 | 3.0198 | 2.0635 | -78.6407 |
| Thiamine | 38.0051 | 7.4829 | 21.8609 | 17.9846 | 45.9267 | 3.2835 | 4.5254 | -114.12 |
| Riboflavin | 40.244 | 10.48 | 21.6272 | 18.9118 | 43.922 | 4.3376 | 7.48 | -106.32 |
| Niacin | 37.7209 | 13.1716 | 23.8644 | 18.1711 | 38.8928 | 8.6052 | 11.9578 | -99.6905 |
| Nutrient Elasticities for Foods Consumed by Households in the North West | | | | | | | | |
| Energy | 37.6955 | 20.455 | 21.9067 | -0.6482 | 29.6608 | 37.9287 | 51.7026 | 42.6705 |
| Moisture | 169.8541 | 40.7575 | -15.5755 | 31.6623 | 60.7247 | 68.0127 | 5.1765 | -61.3761 |
| Protein | 27.4121 | 52.9399 | 21.0601 | -18.1144 | 35.0022 | 39.297 | 49.9596 | 60.4685 |
| Fat | 20.49 | 48.8429 | 26.2963 | -23.2338 | 29.8745 | 38.2538 | 56.0046 | 73.639 |
| Carbohydrate | 37.0891 | 15.5127 | 21.8651 | 2.6375 | 29.3804 | 37.7295 | 51.0221 | 38.7212 |
| Calcium | 58.1743 | -6.628 | -23.2126 | 44.1383 | 41.9721 | 36.624 | 18.2163 | -30.6475 |
| Phosphorous | 31.2407 | 40.9903 | 20.016 | -10.7528 | 37.0828 | 38.7716 | 47.6458 | 50.3967 |
| Iron | 20.6644 | 27.9245 | 6.4717 | -1.4974 | 46.6281 | 32.8312 | 34.501 | 35.3517 |
| Thiamine | 37.5388 | 49.3716 | 19.8346 | -17.3419 | 36.4049 | 41.2646 | 47.4125 | 56.3481 |
| Riboflavin | 27.1754 | 43.4292 | 20.374 | -14.6542 | 37.668 | 38.1814 | 47.703 | 56.0064 |
| Niacin | 27.5844 | 38.7702 | 25.8951 | -13.8079 | 34.0202 | 37.405 | 52.5679 | 57.8968 |

Nutrient Elasticities of Foods Consumed in Northern Nigeria

Table 5 presents the nutrient elasticities for food items consumed in the north central region. A one per cent increase in the price of millet (holding other prices and income constant) would positively affect carbohydrate availability by 23 per cent and increase protein and thiamine contents in the diet of the study respondents by 37 per cent. A change in the price of yam by one percent would lead to a reduction in the availability of almost all food nutrients except calcium and moisture.

Increasing income by one percentage point would result in an increase of more than 70 per cent calcium availability to residents of the north east. A similar increase in the price of maize would however have very serious implications on the well being of residents of the north east as the unit availability of all food nutrients would reduce. Conversely, increasing the price of garri would lead to an enhancing nutrient availability to the respondents.

The food items that would have the greatest negative effects on overall nutrient availability to residents of the northwest are millet and guinea corn. Percentage increase in income would improve overall health (through improved nutrition) of the respondents. Increasing the price of beans will enhance the availability of almost all nutrients by approximately 50 per cent.

CONCLUSION

There is an increasing realisation that food demand studies should go beyond the realm of being mere academic exercises to having an impact on the livelihood of people who

consume the foods. This study has attempted to do this by examining the changes in nutrient availability arising from price and income changes in Northern Nigerian households.

Using demand elasticities from traditional demand studies, the study was able to show the intervening relationship between nutrient changes arising from changes in economic factors. The major policy implications of the study are that it provides a means to derive a nexus between economic planning and the (nutritional) well being of the citizens of the nation. With this tool, therefore, it is possible to predict the remote effects of (1) food policies and pricing (2) import restrictions (3) farm subsidies (4) income distribution and (5) associated government legislation on food nutrient status.

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