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# Food Insecurity and Vulnerability Analysis among Rural Households in Northern Borno State, Nigeria

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## *Abstract*

*This study analysed household food insecurity and the vulnerability situation in northern Borno State. Multi-stage simple random sampling procedure was used in the drawing of sample. Structured questionnaires and focus groups discussions were used in collecting data for the study. Data were collected from 210 households in 6 villages in two Local Government Areas of the region between 2008 and 2009. The data collected were analysed using descriptive statistics and cost of calorie function. The analysis of the food insecurity situation revealed that approximately 64.5 per cent of the households in the area did not meet the minimum calorie requirement and hence were food insecurity; on the average the households in the area produce food that lasts only for about 5.6 months after harvest, while about 91.1 per cent of the households in the region did not produce food that last for 12 months after harvest. In terms of animal protein intake the household were only able to meet 25.86 per cent of their daily per adult equivalent animal protein requirement. The mean food expenditures as a percentage of total income of the households revealed that about 78.47 per cent of their daily per adult equivalent income per day was spent on food. As a result, their vulnerability to future food insecurity will be increased. This is so especially if there is food prices increase since high food prices reduce real income and worsen the prevalence of food insecurity and nutrition among the poor households by reducing the quality and quantity of food consumed. Based on the findings of the study, the following are possible areas of intervention which might mitigate the problem of food security of the households in the area: policies aimed at improving the productivity of agriculture through the increased use of improved technologies (such as the use of drought resistant crops) be promoted, also, efforts that could boost households' income generation should be promoted.*

## Introduction

Food security for the households means access by all members to enough food for an active healthy life. Food security includes at a minimum, the ready availability of nutritionally adequate and safe food, and assured ability to acquire acceptable foods in socially acceptable ways without resorting to emergency food supplies, scavenging, stealing or other coping strategies (USDA 2000). Global food supplies are sufficient to meet calorie requirements of all people (Andersen 2002, CBN 2007). For instance, available evidence shows that the total world production in the crop year 2006/2007 was 125 million bags (100 kg bag) while consumption was about 120.4 million bags (CBN 2007). Yet, the proportion of the world population facing food insecurity remained high (Tri 2008). Worldwide, about 852 million men, women and children are chronically hungry due to extreme poverty, while up to 2 billion people lack food security intermittently due to varying degrees of poverty (USGAO 2008, World Bank 2008). However, Benson (2004) points out that food security remains Africa's most fundamental

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challenge for human welfare and economic growth. Far too many people on the continent are unable to acquire and effectively use at all times the food they need for a healthy life. Under nutrition is the major risk factor underlying over 28 per cent of all deaths in Africa (some 2.9 million deaths annually) (Benson 2004).

Although, evidence in Nigeria shows that there is enough aggregate food production/supply, Nigeria accounts for one-fourth of the hungry people (Fakiyesi 2001, World Bank 2008). It has been revealed that household food insecurity, malnutrition, and micronutrients deficiencies are prevalent throughout Nigeria (UNDP 1998, Ojo 2003, Adewumi *et al.* 2006, Goni and Amaza 2006).

The paradox about food insecurity in Nigeria is that it contradicts the country's wealth consisting of human, agricultural resources, petroleum and gas reserves and solid minerals. However, these situations not only undermine the health of the households but also hinder agricultural production (Croppenstedt and Muller 2000, Khuda 2007) in Nigeria, where 71 per cent of the households are farmers (World Bank 2008). Furthermore, hunger and malnutrition which are consequences of food insecurity have significant economic consequences, leading to estimated individual productivity losses equivalent to 10 per cent of life time earnings and gross domestic product losses of two to three per cent in the worst affected countries (Alderman 2005). Understanding of the food insecurity situation of the households is an important part of improving policies that seek to reduce the problem of domestic hunger, and this is article attempts to shed some light on the matter.

The choice of Borno State and northern Borno in particular, is premised on the fact that, with regard to food insecurity specifically, the problem is most pronounced in northern Borno State, where rainfall is 600 millimeters per year or lower, and desertification, low productivity, and poorly diversified economies are more evident than elsewhere in the country (USAID 2007).

### *The Study Area*

The area according to Ojanuga (2006) is characterised by less than 508 mm mean annual rainfall. A very short rainy season (June to September) alternates with a long dry season of 8 or more months (October- May) annually. The growing season is about 75-89 days. The dry spells (droughts) are common in the growing season often resulting in crop failures. Agriculture in this zone is characterised by traditional bush-fallow shifting cultivation of arable crops; pastoral herding; and irrigation farming. Constrains facing farmers in their agricultural activities among others include: low rainfall, drought, low fertility of the sandy soils of the dunes and sand plain terrains and seasonal water-logging of the clay flats.

## Methodology

### *Sources of Data and Method of Data Collection*

The study used both primary and secondary data. The primary data sources were obtained using questionnaires while secondary data were collected from published data and other literature sources. The collection of data was carried out with the aid of

extension agents of the Agricultural Development Programme (ADP) in the study area through interview schedules, questionnaire distribution and focus group discussion. Two extension agents were used to conduct the interview/questionnaires distribution and the focus group discussions.

***Sampling Frame and Techniques***

Extension cells (administrative units in each of the ADP zones) constituted the sampling frame. Each cell is headed by an extension agent. The sampling unit was the household. Multi-stage simple random sampling procedure was used in the drawing of sample. First there was random selection of two Local Government Areas representing about 20 per cent of the Local Government Areas in the region. Second, there was random selection of one cell out of the ten cells in each of the Local Government Areas selected (each cell contains six villages, some nearby smaller villages were merged with the larger ones). Third, there was random selection of three villages in each of the cells selected. Thus a total of 6 villages were involved. Finally, due to lack of household data of the villages, the population figures of each Local Government Area for 2006 were divided by the number of villages in each of the Local Government Area selected and the average household size for northern Nigeria as provided by Olayemi (1998) was uses as a proxy for the household size in each of the selected village. The households were given identification numbers and selected by systematic sampling procedure. Finally, data were collected in all the households within some of the selected houses (as there were more than one household in some of the selected houses). Household heads were used in drawing of the data. A total of 210 questionnaires (35 questionnaires in each village which represent approximately 20 per cent of the households in each of the village with some adjustments) were distributed but 190 completed questionnaires were used in the analyses as others were discarded due to incompleteness or inconsistency, or lack of cooperation (see Table 1). Furthermore, there was no significant difference in the number of households in all the villages across the zones. The data were collected between July 2008 and January 2009.

The types of data collected included: production, consumption and expenditure data. Others included socio-economic data, such as income data, demographic data such as household size, gender of household head, and dependency ratio, composition of household members and coping strategies to food shortages.

**Table 1: Sample Size for Household Food Security Survey in Northern Borno**

| LGAS Selected | Population | Number of Villages | Selected Villages | Average Number of Household Per Village | Sample Size (20% of Household) |
|---|---|---|---|---|---|
| Gubio | 152778 | 107 | Ngetra, Gazabure and Gubio | 179 | 108 |
| Marte | 129370 | 100 | Ala, Njine and Musne | 162 | 96 |

*Source: Field Survey, 2008/2009*

***Measurement of Food Security Status***

There are many methods for measuring food security status, each with different strengths and weaknesses. Alternative approaches can generally be categorised in three ways Maxwell (1995): those comparing estimates of dietary energy availability or intakes with energy requirements; those measuring nutritional outcomes; and those measuring perceptions of food insecurity and hunger. Most conventional approaches to food insecurity measurement have relied on what is viewed as objective (actually physical) measurement, which considers target level of consumption (Maxwell 1995). According to Maxwell (1995), two major methods have been widely used. The first method is to estimate gross household production and purchases over a period of time, and presume that the food that has come into the household's possession and 'disappeared' has been consumed. The second method is to undertake 24-hour recalls of food consumption for individual members of a household and analyse each type of food mentioned for caloric content. Economists most often use the first method which is also used in this study. This is because of the drawbacks such as respondent fatigue and high data collection cost associated with the second method. To determine the food security status of the households in this study, food security line was drawn based on the recommended daily calorie required approach. A household who's daily per adult equivalent calorie intake was up to 2250 kcal, as recommended by FAO (1995) is food secure and those below 2250 kcal were regarded as food insecure households. The kilocalories of food consumed, was taken as a proxy for nutritional well-being of the household since availability of sufficient quantities of nutritionally adequate food is a prerequisite for food security (Qureshi 2007).

Furthermore, economic analysis of calorie consumption by households was derived from the important role calories play in the definition of important welfare concepts such as health and productivity (Aromolaran 2004). According to Maxwell and Frankenberger (1992), enough food is mostly defined with emphasis on calorie and on requirements for an active, healthy life rather than survival. Moreover, food energy requirements are often used as proxy for all nutritional requirements, even though adequacy in calories may occur simultaneously with serious deficiencies in other nutrients (Stiglitz 1976).

Food calorie intake has been found to have a strong empirical linkage with both human health and productivity. The human body needs energy to maintain normal body function (basic metabolic rate), engage in required minimal activity related to good health and hygiene (standard minimum requirement), and carry out productive activities to sustain the supply of energy and other required nutrients to the body. In addition, food calorie intake is needed for growth in children and also affects the assimilation of micronutrients, since the body may fail to assimilate other nutrients if there is food energy deficiency (Aromolaran 2004). Thus the level of calorie intake by an individual should, therefore, be adequate to sustain these functions over his expected lifetime. Furthermore, when this lifetime calorie consumption pattern falls short of a minimum threshold, the individual is at a health risk. Besides, whenever there is a persistent shortfall in the flow of calorie intake to the amount required for optimal productive activity, the flow of other nutrients is likely to be affected, since the resources required for acquiring these nutrients is obtained from productive work. This situation is especially evident in populations where

the major income-earning asset is human labour effort. That is, populations made up of poor households where non-earned income forms an insignificant component of full income. In such populations, increased calorie intake may imply increased productivity which subsequently leads to increased income and nutrition. For instance, Strauss (1986), using household level data from Sierra Leone, found significant effect of calorie intake on household labour productivity. Also, increased nutrition is associated with sustained increments in productivity and thus, sustained access to food energy intake. Hence adequacy of food consumption is the ultimate index of food security. This adequacy is directly reflected in the adequacy of food nutrient intake. This is because the calorie consumed in a region is a reflection of the food security situation of an area. Furthermore, knowing the number of calories missing from the diets of undernourished people helps round out the picture of food deprivation in an area (FAO 2000).

The household's calorie intake was obtained through the household's consumption and expenditure data. From the data the quantity of every food items consumed by the households in a given period of time (as provided by the households) was estimated. The quantities were converted to kilogramme and the calorie content was estimated by using the food conversion table of commonly eaten foods in Nigeria. Per adult equivalent calorie intake was calculated by dividing the estimated total household calorie intake by the household size after adjusting adult equivalent using the consumption factors for age-sex categories. To get the household's daily per adult equivalent calorie intake the household's per adult equivalent calorie intake was divided by the number of days over which a given food item was consumed. A household whose daily per adult equivalent calorie intake was up to 2250 kcal was regarded as food secure and those below 2250 kcal were regarded as food insecure households as stated above.

## Analytical Techniques

### *Descriptive Statistics*

Descriptive statistics such as frequency and per centages were used in the description of the socio-economic characteristics of the households and resource distribution, categorisation of households according to food insecurity and vulnerability to food insecurity.

### *Cost of Calories (CoC) Function*

The households were categorised into food poor and non food poor and their food expenditure patterns were used to determine their vulnerability to food insecurity. To determine the food poverty line of the households, two steps are involved: identification and aggregation. Identification is the process of defining a minimum level of calories necessary to maintain a healthy living. The "food poverty line" for the area under study, was determined. The "food poverty line" is the line below which people are classified as poor, subsisting on inadequate nutrition. Aggregation, on the other hand is the derived food poverty statistics for the study area. Several methods for establishing food poverty line are available in the literature. The CoC method of defining food poverty line as used by Goni and Amaza (2006), Amaza *et al.* (2006), Agbola *et al.* (2008); was used in this study because of its simplicity and ease of computation. In this procedure, the CoC function of the following form is estimated:

$\ln Y = \alpha + \beta x$ .....(1)

Where:

Y = household per adult equivalent food expenditure per day (Naira)

X = household per adult equivalent calorie consumption per day (Kcal)

$\alpha$ and ? are parameters estimated.

2250 kcal per adult equivalent as FAO (1995) was used to compute the food poverty line Z:

$Z = e^{\alpha+\beta L}$ ..... (2)

Where:

Z = Cost of buying the minimum calorie intake L (Naira)

L = Recommended daily energy per adult equivalent (Kcal)

e = Irrational number having a non terminating decimal expression (e = 2.72).

## Results and Discussion

### *Months of Availability of Home Produced Food*

It can be observed that (Table 2) on the average the households in the area produce food that lasts them for about 5.6 months after harvest, while only about 8.9 per cent of the households in the region produce food that last for 12 months after harvest. This might be attributed to the limiting factors, such as small farm holdings, low inputs, drought and low rainfall that is characteristic of the region.

**Table 2: Distribution of Availability of Home Produced Food Across the Year in Northern Borno State**

| Months of Availability | Frequency | Percentage |
|---|---|---|
| 1-2 | 10 | 5.3 |
| 3-4 | 70 | 36.8 |
| 5-6 | 31 | 16.3 |
| 9-10 | 11 | 5.8 |
| 11-12 | 17 | 8.9 |
| Mean | 5.6 (0.2217*) | - |

*Source: Computed from Household Survey Data, 2008/2009*

NB: Figures with* is standard error.

### *Household Calorie Intake*

Table 3 presents the percentage distribution of households by per adult equivalent calorie consumption (availability) per day. It can be observed from the findings in Table 3 that approximately 64.5 per cent of the households did not meet the minimum calorie requirement (2250 Kcal per adult equivalent). The food insecure households in the region had a mean daily energy intake of about 1553 kilocalories per day. This falls short of the FAO's recommended threshold of 2250 kilocalories per adult equivalent per day. This situation could probably be attributed to land degradation and desertification which

affected about 50-75% of the State which is also said to be advancing southwards at the rate of 0.6 Km per annum (FRN 1999). Thus soil degradation leads to decline in soil quality and productivity. Furthermore, the climatic condition of northern Borno makes annual crops such as millet, sorghum cowpea etc. very difficult to grow, and hence low food production due to drought and desertification (FRN 1999).

**Table 3: Percentage Distribution of Households by Per Adult Equivalent Calorie Consumption Per Day in Northern State of Borno State, Nigeria**

| Calorie intake | Frequencies | per centage |
|---|---|---|
| <2250 | 120 | 64.5 |
| 2250 | 66 | 35.5 |
| Mean | 1553(40.5)* | |

*Source: Computed from Household Survey, 2008/2009.*

NB: A figure in parentheses is the standard error.

***Animal Protein Intake***

It can be observed from Table 4 that beef was the most important source of protein, followed by fish as the second most important source, and mutton as the third most important source. Together, these three sources contributed about 84 per cent of the average protein intake in the zone.

The average animal protein intake per adult equivalent per day in the zones (9.05gm/day) was higher than the national average of 4.5g per capita per day (Ezike and Nwoye 2004). This might not be unconnected with the fact that Borno State is the largest producer of livestock in Nigeria (Balami *et al.* 1999, Folurunso 2001, Jabo and Mohammed 2009) accounting for about 25 per cent of the livestock production in Nigeria (Balami *et al.* 1999).

**Table 4: Households' Average Per Adult Equivalent Animal Protein Intake Per Day**

| Animal protein group | gram per day | percentage of total |
|---|---|---|
| Chicken | 0.32 | 3.54 |
| Shevon | 0.59 | 6.52 |
| Mutton | 0.91 | 10.06 |
| Beef | 3.67 | 40.55 |
| Fish | 3.00 | 33.15 |
| Egg | 0.12 | 1.33 |
| Milk | 0.44 | 4.86 |
| Total | 9.05 | 100.00 |

*Source: Computed from Household Survey, 2008/2009.*

However, it was lower than the recommended threshold of 35g per capita per day (Anamayi *et al.* 200,8; Fayemi *et al.* 2008, Odoh *et al.* 2008). It can be seen that northern Borno State had failed to meet adequate animal protein intake level despite the large number of livestock in the state. This agrees with reports of CBN (2004), Ezike and Nwoye (2004), Anamayi *et al.* (2008) who noted that the consumption of animal protein in Nigeria has been inadequate. This situation, however, might be attributed to the increasing poverty level in the country, which limits people's ability to produce or buy enough food (Orewa and Iyanbe, 2009). This also reinforces the belief that food insecurity is more of an access than an availability problem.

***Vulnerability to Food Insecurity***

From the analysis in Table 5, it can be observed that households whose average per adult equivalent income per day were less than the food poverty line spent more than their earnings on food (they might have complimented food requirement by begging, food loans etc which was not captured by the study). A similar finding had been reported by Sheriff and Khor (2008) in Malaysia. The food expenditures as a percentage of total income of this group revealed that the households in this region spent about 19.79 per cent more than their daily per adult equivalent income per day. With mean expenditure of about 19.79 per cent more than their income, these households were more vulnerable to future food insecurity. This agreed with Ibrahim *et al.* (2009) who noted that the higher the share of income devoted to food acquisition the higher the vulnerability to food insecurity. This is because, high food prices reduce real income and worsen the prevalence of food insecurity and nutrition among the poor households by reducing the quality and quantity of food consumed (Jato-Africa 2009).

**Table 5: Households Average Income and Food Expenditure Pattern Per Adult Equivalent Per Day**

| Income category (Naira) income | Food expenditure (N) | Food expenditure as a % of total |
|---|---|---|
| <66.42 | 55.68 | 119.79 |
| 66.42 | 79.19 | 38.14 |
| Mean | 67.44 | 78.47 |

*Source: Computed from Household Survey, 2008/2009.*

NB: 66.42 is the (determined from equation 2) food poverty line for the state

On the other hand, as the income of the households increases to the level of the food poverty line and above, the food expenditure as a per centage of their income decreased. In other words, about 81.65 per cent (119.79-38.14) reduction in expenditure was attained as the daily per adult equivalent income increases. This was in conformity with one of the famous economic laws which govern the relationship between income level and the share of expenditure on food that is Engel's law, which states that, as income increases, the share of income spent on food declines (Mukherjee *et al.* 1998).

## Conclusion and Recommendations

### *Conclusion*

Food insecurity is a cause of concern for many regions around the world. The issues of current and future availability of food, access to food, nutritional adequacy of food and risks and uncertainties surrounding access and availability all need to be addressed for the problem of food insecurity to be fully addressed. Food insecurity is a problem that requires immediate solutions since there are severe short and long-term physiological and economic repercussion of not addressing this problem.

To find appropriate solutions to the problem of food insecurity, it is essential to be able to measure the food insecurity situation and vulnerability. Unless we are able to measure this phenomenon precisely we cannot expect to find long lasting solutions that are in accordance with the magnitude and complexity of the issue. Moreover, if we cannot measure food insecurity we cannot determine its exact effects on the different segments of the population. Unless we can make this distinction we cannot design targeted, pre or post-crisis interventions to address the specific needs of the vulnerable group(s). In the absence of specific measure the best we can do is design the one-size-fits-all type of interventions, which are unlikely to address the special needs of the vulnerable. Aid and development agencies and institutions continue to confront the problem of separating the people and households who are most at-risk or who need immediate assistance from the relatively secure ones or who can wait to receive assistance.

Available evidence from this study would seem to suggest that household food insecurity in northern Borno State was desperate and not comforting as approximately 64.5 per cent of the households did not meet the minimum calorie requirement and whose average per adult equivalent calorie intake per day only totters at 1553 Kcal. It can be observed that on average the households in the area produce food that lasts them for about 5.6 months after harvest, while 91.1 per cent of the households in the region did not produce food that last for 12 months after harvest.

The majority of the households' members consume below the recommended level of calorie and animal protein in the study area. This is a direct reflection of the increasing incidence of poverty in the country. It is a reflection of the small per centages of the population having disproportionally higher shares of the benefits of national economic growth, with increasing per centages having disproportionately lower shares. While national food availability is increasing, increasing per centages of the population are feeding less. This reinforces the belief that physical access to food is less of a problem than economic access in the country at present. This is, however, not to say that physical access could not be a problem if some or all of those economically and nutritionally deprived were to have the economic capacity to consume more food than they now do.

### *Recommendations*

The results provide significant implication for food security in northern Borno State. Based on the findings of the study, the following are possible areas of intervention which might mitigate the problem of food insecurity of the households in the area. Policies aimed at improving the productivity of agriculture through the increased use of improved technologies must be promoted. With about 91.1% of the households not producing enough

food to last them till the next harvest, is an indication of inefficiency or low productivity of the farming households. Hence, increasing the productivity of food crops through the increased use of modern farm inputs such as fertilisers, improved seeds, pesticides herbicides etc. is an urgent need. Yield increases are feasible only through the increase in both labour and land productivity. Extension services, input supply, remunerative prices, etc. have to be tailored to support this possibility. All these might enhance efficiency or productivity in production. Improving agricultural productivity is a means of increasing both the physical availability of food and the incomes of food-insecure people. In this respect, it offers a key and direct ingredient in the quantity of home produced food. Increasi ng productivity in food production, leads to increased incomes and improvements in purchasing power. Improvement in productivity is also possible through a number of traditional farm technologies and resources adapted to the environment through long term selection of varieties and farm practices experienced and developed by the communities. These traditional farm technologies could best be adapted in areas where the majority of the households were food insecure and could not afford to buy or use modern farm technologies. These may include composting, manuring fields, mulching and other moisture conservation methods, intercropping (for diversity and risk management). Efforts that could boost households' income generation should be promoted.

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