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Examining the Incidence, Depth and Severity of Food Insecurity among rural Households in Nigeria

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Abstract
A nationally representative sample of 3380 rural households from General Household Survey-panel data that adopt the World Bank Living Standard Measurement Survey (LSMS) technique was used for this study. Based on 2120 kcal Food and Agricultural Organization (FAO) recommended per adult equivalent and USD 0.87 purchasing power parity (PPP), an annual food poverty threshold of (₦50, 331.67) equivalent to USD 317.55 per annum was derived for Nigeria. This threshold is the cost for purchasing recommended daily food allowances (RDA) of an adult equivalent for healthy life in rural Nigeria estimated at ₦138. Despite the fact that agricultural sector employed over 70% of the country's population overwhelmingly large segment of Nigerians especially farming families in rural areas are the most food insecure. The food security situation in Nigeria was examined using the Foster Greer and Thorbecke (FGT) class of decomposable food poverty measures that satisfy both monotonicity and transfer axioms. The food insecurity indices at national level was reported as ($\propto$=0, 46.36, $\propto$=1, 0.43 and $\propto$=2, 1.11 for and $\propto$=0, 42.78, $\propto$=1, 0.348 and $\propto$=2, 7.45) for post-harvest seasons respectively. This implies that almost half of the rural households in Nigeria are food insecure subsisting on less the RDAs, however, depth and severity of food insecurity also differ. Disaggregating the households based geo-political zones and some key socio-economic characteristics, further indicates a significant differences based on the relative size of the coefficient of $\propto$. We conjecture that, the higher incidence of food security during post harvesting season might likely be due to inability of smallholder farmers to utilize their time into non-farm income generating activities due to high demand for labour for farm operations. The study recommends public policies that ensure provision of infrastructure such as roads and boosting farming among rural households.
Keywords: Food Insecurity, FGT Index, Rural Households and Nigeria

1. Introduction

Hunger is a pervasive problem in developing countries, which undermines people's health, productivity, and often their survival. As a results of this, much of the development agendas of these countries especially in SSA focused on directing scarce resources to providing food to people in need or enabling them to acquire it themselves (Smith et al. 2006). Recently, Food and Agriculture Organization, (FAO 2012) reported that nearly 870 million people were suffering from chronic undernourishment between 2010 and 2012 majority whom are living in developing countries. These global statistics of hunger and undernourishment is alarming, as such eradication of hunger remains the major global challenge facing both developed and developing countries, but the task is enormous in later.

The major task facing the world today is that of feeding the ever-increasing population of over 7 billion people subject to climate change and natural resource constraints. FAO (2012) asserted that, "the global demand for food is expected to increase by 60 percent between 2005/2007 to 2050". The global food demand is further compounded by the production of biofuels in the industrialized countries; this alone posed a major stress to agriculture and food systems. To cope with these challenges, smallholder agriculture needs to effectively play a key role in addressing these challenges especially in developing countries.

Even though, Nigeria has great agricultural potentials and abundant natural resources for all round development, most indicators of the economic well-being are still very low. Food insecurity and poverty are still widespread across different parts of the country. Food insecurity situation in Nigeria is worsening with the passage of time due to the wide gap between the national supply and demand for food. For example the percentage of food insecure households rose from 18% in 1986 to over 40% in 2005 (Sanusi et al. 2006). Reducing the number of food insecure households, therefore, continues to be a top priority of Nigerian governments. This is necessary because as is the case of many developing countries Nigeria is faced with a major challenge of feeding its ever-increasing human population, which currently stood at 167 million. It is feared that the population figure might significantly rise due to a number of factors: Akinyele (2009) reported that, there are overwhelmingly large proportion of Nigerians who are food insecure that spread across both urban and rural communities, though most of the food insecure are found in the rural areas. It is based on this that Nigeria and G77 developing countries and China in the 1996 General Assembly Meeting called for an urgent

action to address the global food crisis that threatened millions of people. Nigeria identified climate change, severe floods, desertification and drought as the major causes of frequent food shortages being experienced in the region.

2 Literature Review

Food insecurity issue almost affects every country of the world but empirical evidences on food insecurity in the developed and developing countries show that food insecurity differs in degree, intensity and importance. Even the most developed countries have faced household food security related problems. In industrialized countries, approximately 5–15% of families experience food insecurity, that is insufficient access to ‘‘sufficient, safe, and nutritious food that meets individuals’ dietary needs and preferences for an active and healthy life’’ (FAO, 2003; M. Bashir, Schilizzi, & Pandit, 2012). Even the United State, which is considered as the largest and biggest economy had 12% of its households to be food insecure for at least some times during the year, and the prevalence of food insecurity with hunger rose from 3.5 percent to 3.9 percent in 2003 and 2004 respectively ((Nord et al. 2004). Furthermore, Nnakwe (2008) found that 24.3%, 12.2% and 12.2% of the U.S families were food insecure without hunger, food insecure with moderate hunger and food insecure with severe hunger among low-income families respectively. Food insecurity in the context developed nations has been defined as “their inability to obtain sufficient, nutritious, personally acceptable food through normal food channels or the uncertainty that one will be able to do so” Davis, *et al* in ((McIntyre et al. 1999). Reports from the National Population Health Survey (NPHS) estimated that 10% of Canadians experienced food insecurity with children being the most likely affected age group in a household (McIntyre et al., 1999). Booth & Smith (2001) also reported 5% of the Australian population to be food insecure.

Looking at the food security situation in Nigeria, many empirical studies indicated an alarming dimension that attracts an urgent attention. A considerable amount of literature has been published on food security in the country. These studies include; Idrisa, Gwary, & Shehu (2008) analyzed the food security status among 120 farming households in Jere Local Government Area of Borno State. The incidence of food insecurity was found to be higher among households within the age of 40-49 years, but the depth and severity were higher in the age group of household 50 years and above. More so, large family size, low-income level and low level of education were identified as having a negative impact on food security among farming Households in Jere LGA. Arene & Anyaeji (2010) estimated food security among households in Nsuka metropolis Nigeria using binary logistic regression and identified income and age of the household to be the major determinants of food security. Oluwatayo (2009) presents an account on the contribution of cooperatives in food security in Ekiti State, Nigeria. He uses probit regression model and found that household members belonging to a cooperative are more food secure than non-cooperators.

Dauda (2010) examines the interrelationship between women’s status and household food security coping strategies in the metropolitan area of Lagos state, Nigeria; she identified marital status, income, education and occupation to be significant indicators of food security status. In another major study by Bamire (2010) using discriminant technique and probit regression model in analyzing the effects of land use factors on food security among rural households in the dry savannah zone of Nigeria, shows that 75% of the households were food insecure and spending 30% of their income on food. His study reveals that; farm size, use of land improvement techniques, age, membership of the association and access to extension services as the important determinants and predictors of food security.

Most of these existing studies focused on assessing food security at a particular region of the country and failed to cover the whole country. The incidence, depth and severity of food insecurity across different geopolitical zones and some important socio-economic variables in the two major seasons in the country has not been adequately addressed by the earlier studies. Against the above background, this research was undertaken to access the food insecurity situation among the rural households in rural Nigeria. This study has provided a comparative analysis at the national level between hungry period (post-planting) and food abundance period (post-harvesting) has contributed in the existing niche in the literature. The rest of the paper is organized as follows: The next section presents the methodology adopted; Section three presents and discusses the empirical results. Section four concludes.

3. Methodology

3.1 Establishing Food Poverty Line

Greer &Thorbecke (1986) defined food poverty as a condition of lacking the resources necessary to acquire a nutritionally adequate diet, which can be measured in term of food calories or monetary value of the calories. No official food poverty line was established in Nigeria as a country (Canagarajan, Ngwafon & Thomas, 1997) . In this study, however, based on the 2120 kcal recommend for Nigeria by (FAO/WB/UNU 2001), PPP $0.87 purchasing power parity, and current (₦ 158.50) Nigerian Naira to US dollar exchange rate, a food poverty line is developed. A food poverty threshold of ₦50, 331.67 equivalent to $ 317.55 per annum was arrived at as the

cost of purchasing the recommended daily allowances (RDA) of an adult equivalent for a healthy life in rural Nigeria. Using a real per capita expenditure does not control for possible differences in consumption behaviour among individual household members, especially between children and adults, and males and females. To take care of these consumption differentials between household groups, this study adjusts food expenditure of the households. This will take care of individual household members food needs according to their sex and age; hence, FAO equivalent weight scales of 0.8 were assigned to adult female and 0.5 to a child.

$$Y=\sum_c \sum_{ij} - R^C \geq O^C \quad (1)$$

Where Y = Food security status of i^{th} household (Y=1 food secure household, food insecure=0)

$\sum_{ij}$ = Cost of calorie consumption (purchased and self-produce food)

RC = Recommended calorie consumption

$$Y = \sum \beta_{ij} Z_i + \varepsilon \quad (2)$$

A well-known FGT poverty index satisfies both monotonicity and transfer axioms as against crude index obtain through head count ratios which violates both the monotonicity and the transfer axioms.

$$P_\propto = \frac{1}{N} \sum_{i=1}^{Q} \left(\frac{Z-Yi}{Z}\right)^\alpha \quad (3)$$

Where α which is a parameter that measures the incidence, depth and severity of food insecurity respectively, with the values of 0, 1 and 2 are indicators of food poverty aversion by the household.

N= Total number of households

Q= the number of food insecure households

Z= Cut off between food secure and food insecure households representing a food poverty line or threshold which was estimated at ₦138 monetary equivalent of required daily allowances RDAs.

y_i= the measure of per adult equivalent food expenditure of i^{th} households.

The head count ratio denoted by (H) measures the percentage of the population that is food insecure. The first measure of food insecurity situation commonly used is the headcount ratio. The major drawbacks of this method are that it is crude and tends to violate the basic axioms of monotonicity and transfer. It is also insensitive to the distribution of income among poor as rightly mentioned by (Sen 1976).

It is given as;

$$H = \frac{M}{N} \quad (4)$$

Where; M represents the number of food insecure households,

N is the sample population being studied.

The Food Insecurity Gap of n household is given as:

$$FIG_n = \frac{TRC_n TCC_n}{TCR_n} \quad (5)$$

Where FIG*n* is given as the Food Insecurity Gap of the n^{th} household, TCR*n* is the total calorie requirement for the n^{th} insecure household

Food poverty gap: This shows the extent to which individuals fall below poverty or the food poverty line Sen (2009). The main advantage of this poverty measure is that there is no discontinuity in the poverty line. However, its major limitation is that it may not capture the differences in the severity of poverty among food poor.

TCC*n* is the total calorie consumed by the n^{th} insecure household.

$$\sum 1 = n \frac{\frac{TCR_n TCC_n}{TCRn}}{FIH} \quad (7)$$

Therefore, the total food insecurity gap is given as:

Where, *TFIG* = Total Food Insecurity Gap, which indicates the depth of food

Insecurity among the food insecure households and n = Number of food insecure households.

The Squared Food Insecurity Gap, which indicates the severity of food insecurity among households is given as:

$$\sum \frac{(FIGn)2}{FIH} \quad (8)$$

Where, SFIG = Squared Food Insecurity Gap, indicates the severity of food insecurity among the food insecure households in a given study area. The squared Food poverty gap addresses the problem of inequality among the food poor which poverty gap failed to tackle. This index reflects the actual severity of food poverty and its distribution among the food poor households or individuals.

4. Results and Discussion

Looking at the socio-economic profile of the households Table 1, it can be observed that approximately about 62% of the household heads fall within the age bracket of 30-50 years while only very few (4.49%) were above 70 years of age in post-planting. The percentage within this age group was reported to be a little bit lower in post-

harvest period where about 56% of the households fall between 30-50 years of age. The mean age of the households was 51 years, meaning that, the majority of the sample household were in the active working age group. However, male headed majority of the households about 86.64%, while the female was heading only 13.46% of the households and the percentages are just similar in both post-planting and post-harvesting rounds. This implies that majority of the households were headed by males, which is very common in the African set up. The finding further shows that 82.93% are married in post-harvesting season, which is just marginally different the post-plating visit with about 81.88% female headed households, this implies that married households are expected to have more labour available to use in farm and non-farm enterprise as such are expected to be more food secure than unmarried, widow and divorced counterparts.

Table 1 Descriptive Statistics of Socio-economic Characteristics and Geo-political Location of the Households

	Post Planting		Post Harvesting	
Variable	**N**	**Percentage**	**N**	**Percentage**
Age				
≤30	370	10.94	375	11.16
31-40	782	23.19	765	22.77
41-50	784	23.25	778	23.15
51-60	644	19.11	648	19.29
61-70	463	13.75	643	19.14
≥70	329	9.76	151	4.49
Total	**3372**	**100**	**3365**	**100**
Gender			3360	
Male	2932	86.75	2913	86.64
Female	`448	13.25	449	13.46
Total	**3380**	**100**	**3362**	**100**
Marital Status				
Married	2765	81.88	2935	82.93
Never married	93	2.75	96	2.71
Divorced	101	2.99	82	2.32
Widow	418	12.38	426	12.04
Total	**3377**	**100**	**3539**	**100**
Literacy				
Literate	1863	55.20	1871	55.65
Non-literate	1512	44.80	1491	44.35
Total	**3375**	**100**	**3362**	**100**
Occupation				
Farming	2427	66.64	1295	64.23
Non-farming	1215	33.36	721	35.77
Total	**3642**	**100**	**2016**	**100**
Household Size				
1-5	1690	50.07	1977	52.15
6-10	1392	41.24	1489	39.28
11-15	268	7.94	298	7.86
>16	25	0.74	27	0.71
Total	**3375**	**100**	**3791**	**100**
Region				
North Central	580	17.16	577	17.17
North East	660	19.53	664	19.76
North West	730	21.60	741	22.05
South East	590	17.46	593	17.65
South South	560	16.57	539	16.04
South West	260	7.69	248	7.38
Total	**3380**	**100**	**3360**	**100**

Source: Author's calculation, 2014

In terms of literacy rate, the results indicate that 55.65% of the respondents were literates in the two rounds of the survey, meaning that they can read and write in any language. The literacy ratio, reported in this study is within the range of national average of (61.3% national average, 72.3% for male and 50.4% for female) as reported by (CIA, 2010). Furthermore, as expected 66.64% of the households were engaged in farming during the post-planting round of visit, the trend is almost similar in post-harvesting where 64.23% of the respondents were farming households. This is very close to the national average of (70%) labour force employed by agriculture as reported by (CIA 2013).

4.1 Examining the Spatial and Temporal Food Insecurity in Rural Nigeria

To measure the incidence, extent and degree of food insecurity, the well-known Foster, Greer and Thorbeck

(FGT) formula satisfies that the axioms of transfer and monotonicity axiom was employed. The ∝ is the parameter for the measurement of food poverty in a given population. ∝ =0 measures head count, ∝= 0 measures the depth of food insecurity and ∝=2 is the food insecurity squared of food insecure households. The situation when the ∝= 0 yields a distribution of individual food poverty levels in which each poor person has poverty level 1; the average across the entire population is simply the headcount ratio poor. The situation when α= 1 that is the normalized gap g_i as a poor person's food poverty level, thereby differentiating among the poor; the average becomes the poverty gap measure. The case where ∝=2 squares the normalized food poverty gap and thus weights the gaps by the gaps; this yields the squared gap measure α= 2. As α tends to infinity, the condition of the poorest poor are becoming worse of. The parameter ∝ is an indicator of "poverty aversion". The results summary of incidence, depth and severity of food insecurity in rural Nigeria, according to six geopolitical zones are presented in (Table 2).

Table 2 Incidence, Depth and Severity of Food Insecurity in Rural Nigeria

Region	Post-planting				Post-harvesting			
Region	N	Incidence α=0	Depth α=1	Severity α=2	N	Incidence α=0	Depth α=1	Severity α=2
National	1680	46.36	0.43	1.11 (0.001)	1626	42.78	0.348	7.45 (0.002)
North Central	312	47.93	0.44	1.85 (0.005)	277	42.75	0.36	4.58 (0.0046)
North East	390	56.28	0.48	5.91 (0.005)	354	50.14	0.36	3.60 (0.004)
North West	445	57.30	0.42	3.98	359	45.56	0.35	3.34 (0.0003)
South East	403	63.36	0.44	4.97 (0.004)	304	42.52	0.36	4.15 (0.004)
South South	243	41.54	0.41	6.93 (0.010)	162	28.22	0.36	8.00 (0.008)
South West	151	53.36	0.37	9.12 (0.009)	170	46.07	0.34	6.60 (0.007)

Source: Author's calculations 2014

Head count describes the percentage of sample households whose per capita income or food consumption is below predetermine subsistence level recommended daily allowances (RDAs). At the national level, the incidence of food insecurity as indicated by head count was 46.36 and 42.76 for post-planting and post-harvesting period respectively. This implies that 46.36% and 42.76% of rural households were not able to meet their daily recommended daily allowance (RDAs) which is 2120 kcal valued at ₦137.50 per adult per day. On average, a food insecure individual in a particular household will require ₦47.96 and ₦26.80 daily food expenditure to exit food insecurity in post-planting and post-harvesting seasons respectively. Furthermore, the estimated values of the food insecurity gap were 0.43 and 0.35 for post-planting and post-harvesting respectively. This shows that 43% and 35% of food insecure households are below the recommended calorie requirement or are below food the poverty line during post-planting and post-harvesting periods, respectively. Finally, the severity of food insecure households was 1.11 and 7.45 for post-planting and post-planting periods. This means that 1.11% of the households in post-planting are most food insecure groups in rural Nigeria as against 7.45 in post-harvest season.

Disaggregating rural household by zones revealed that in Southeast is having the number of food insecure (63.36%), followed by North-West (57.30%) and Northeast (56.28%) during post-planting. The households would require additional annual food expenditure of ₦18, 153.58 to come back to food security level. This finding is in agreement with (Adepoju & Adejare 2013) who recorded 56% of households in the North-Eastern Nigeria to be food insecure during post-planting season. In the case of the post-harvesting season, households in the Northeast (50.14), South-West (46.07) and North-West (45.56) had the highest incidence of food poverty in rural Nigeria. On average, the two regions would require ₦17, 641.31 and ₦17, 863.21 respectively, to exit food poverty. This implies that these food insecure households are subsisting on less than RDAs calorie.

Looking at the depth of food poverty, per adult equivalent food poverty insecurity gap during post-planting was estimated to be highest in the North-East (48), North-Central (44) and South-East (44), this shows that these regions are having the highest level of food inequality (see Table 2). These results therefore, indicate that, the food insecure households are short of recommended calorie intake by 48%, 44% and 44% for Northeast, North-Central and Southeast respectively. This could be attributable to the low percentage of processed food consumption of 15% and 11% as reported by Akinyele (2009). While in the post-harvesting period, the highest ratio of households subsisting below the recommended calorie intake are found in the North-Central, North-East, South-East and South-South with (36%) for each zone and the least ratio of the food insecurity depth a similar

trend was observed in the North-West and South-West with 34% and 35% respectively. The least ratio of food insecurity as can be seen, could be an indication of high food expenditure in the region of (24% and 23%) as reported by (Akinyele 2009) for the South-East and South-South respectively as reported. This result alludes that South-East and South-South would require ₦8, 873.33 and ₦7, 986.45 respectively, to exit food insecurity. In terms of severity, South-South, South-West and North-Central have the highest ratios of food poverty of 8%, 6.6% and 4.58% respectively. North-East and North-West had the least severity of food insecure households.

The high incidence of food insecurity in the Northern part of the country could partly be attributed to the 2009/2010 widespread flooding, which displaced many settlements along the banks of river Niger, and Benue. (Watts 1983; Corbett 1988) buttressed that drought, flood and conflicts are often cited in the literature as the common causes of famine in Africa, although there are usually many factors that are to be blamed. For example, 1973/74 food crisis in Northern Nigeria was due to the early 1970s Sahelian drought. Another major contributing factor to the food insecurity in the Northern Nigeria, in the civil insecurity relating to *Boko Haram* inseguence in North-East especially in Borno, Yobe and Adamawa Food insecurity conditions in Borno and Yobe that are epicentre of the *Boko Haram* civil insurgence may worsen and food crisis is envisaged (FEWS NET, 2012 and USAID, 2013).

The low ratio of the incidence of food security experienced during the post-harvest season compared to the post-planting period is expected due to the fact that, food harvest improves annually after August in most parts of Nigeria. This is due to the fact that, harvest of cereals, tubers and pulses and food become more available in addition to the stability of food prices. On the issue of food insecurity in some southern regions, for example, in the oil rich South-South, the issue can be linked to the incessant insecurity due to kidnapping, oil bunkering and armed robbery. The insecurity problems usually hamper the normal inflows of food and negatively affect many agricultural and commercial activities.

Further disaggregation of the food security status according to selected socio-economic variables of the households revealed many interesting findings between post-planting and post-harvest seasons. The socio-economic variables considered are gender, marital status, educational level, age, occupation and household size. The results presented in Table 3 revealed that, food insecurity differs across socio-economic characteristics of the household. With respect to the gender of the head of the household, male headed household is less food insecure with $\propto=0$ (0.43), $\propto=1$ (0.42) and $\propto=2$ (0.18) food security situation indices as compared with their female counterparts $\propto=0$ (0.49), $\propto=1$ (0.43) and $\propto=2$ (0.19) respectively or the same period.

Table 3 Food Security Profile of the Household on Some Selected Variables

Variable	Post-planting Incidence $\propto=0$	Depth $\propto=1$	Severity $\propto=2$	Post-harvesting Incidence $\propto=0$	Depth $\propto=1$	Incidence $\propto=0$
Gender						
Male	0.43	0.42	0.18	0.43	0.35	0.13
Female	0.49	0.43	0.19	0.47	0.36	0.14
Marital Status						
Married	0.61	0.33	0.13	0.59	0.34	0.14
Never married	0.34	0.18	0.12	0.24	0.16	0.03
Divorce	0.60	0.34	0.16	0.68	0.42	0.17
Widow	0.71	0.31	0.14	0.61	0.32	0.11
Occupation						
Farming Only	0.69	0.41	0.13	0.35	0.32	0.10
Non-farming	0.54	0.30	0.11	0.65	0.36	0.13
Educational level						
No formal education	0.72	0.45	0.19	0.62	0.37	0.13
Basic	0.61	0.43	0.15	0.57	0.35	0.12
Secondary	0.57	0.34	0.14	0.51	0.32	0.11
Tertiary	0.50	0.41	0.13	0.42	0.31	0.10
Household Size						
≤5	0.44	0.30	0.10	0.32	0.21	0.09
6-10	0.62	0.35	0.13	0.58	0.32	0.10
11-15	0.68	0.34	0.17	0.63	0.33	0.13
≥16	0.74	0.36	0.18	0.71	0.39	0.13
Age						
31-40	0.45	0.28	0.09	0.34	0.18	0.09
41-50	0.55	0.20	0.10	0.48	0.29	0.11
51-60	0.63	0.26	0.13	0.57	0.33	0.13
61-70	0.70	0.37	0.15	0.67	0.41	0.15
≥70	0.75	0.35	0.18	0.70	0.44	0.17

Source: Author calculations, 2014

The analysis of the food insecurity situation in rural Nigeria, buttressed that male head households are more food secure than their female counterparts. The indices of incidence, depth and severity of food insecurity for male were (43%), (0.42) and (0.18) and (43%), (0.35) and (0.13) during post-planting and post-harvest respectively. While that of female household heads was (49%), (0.42) and (0.18) and (47%), (0.36) and (0.14) for $\propto=0$, $\propto=1$ and $\propto=2$ for post-planting periods respectively. This implies that, male require a slightly lower amount food expenditure (₦17, 651.64, ₦16, 735.50) to exit food insecurity as compared to their female headed households who need (₦17, 818.64, ₦17, 127.89) for post-planting and post-harvesting seasons respectively. This means that on the average male headed households would require (₦16,835) to exit food insecurity, while the female headed households would require (₦17,386) to exit food poverty in post-harvesting period. This implies that the food security situation among male-headed households is better than that of female-headed households. This is expected, because male-headed households have more access to productive assets such as land, credit and other farm inputs than their female counterparts do. This is in-line with Ajani (2008) who argued that women are often marginalized in their families and communities and have suffered from lack of access to credit, land, education, decision making, power and right to work.

The food security indices by the marital status of the respondents between post-planting and post-harvest periods almost followed similar scenario. The distribution of the household heads by marital status shows that, households headed by widow are the most food insecure. The breakdown of food insecurity indices for the widow household head during post-planting revealed the incidence (71%), depth (0.31) and severity (0.14). This means that, on average widow headed households require (₦21, 153.89) to exit food insecurity. The least food insecurity status was reported among the unmarried headed households with a food insecurity incidence index of (34%), depth (0.18) and severity (0.12). Contrary to a priori expectation, the household heads that are married have highest indices of food insecurity next only to a widow household head. The food insecurity indices show the incidence of (61%), depth (0.33) and severity (0.13) for the married household heads (see table 3). The high food insecurity among the married households as compared to unmarried households could be attributable to larger household size and high dependency ratio for married households.

Table 3 further provides the highlights of the occupational distribution of the households. Based on the primary occupation, the incidence (69%), depth (0.41) and severity (0.13) in post-plating period was reported for household whose primary occupation is farming only. This is expected, as subsistence agricultural practices of the majority of farmers in rural Nigeria is characterized by the use of low level technology, poor access to credit and extension services such agriculture alone has not been able to meet the livelihood requirements of most farming households. This finding contradicts Titus & Adetokunbo (2007) who reported highest incidence, depth and severity of food insecurity among traders in South-Western Nigeria. However, in the post-harvest period, the farming households are found to be more food secure than non-farming households with an incidence (35%), depth (0.32) and severity (0.10) as compared to 0.65, 0.36 for households who combined farming with non-farm activities. The households that diversified their portfolios into multiple income generating activities besides farming are likely to be more food secure than those that rely on farming as the only source of income. This assertion holds only during post-harvesting season in the case of rural Nigeria. Diversified income sources by a particular household means an increase the household's purchasing power, hence, the likelihood of being food secure. This is in agreement with Asogwa, Okwoche, & Umeh (2012) who found that households with relatively more diverse sources of farm income tended to have a lower probability being poor than those with relatively less diverse enterprises and income sources, given other factors.

The result shows that household heads with no formal education had the highest incidence of food insecurity of (72% and 62%) for post-planting and post-harvest seasons respectively. While the depth (0.45) and severity (0.37) were also highest among the households with no formal education in the post-planting, the trend is similar in the post-harvest period. The incidence of food insecurity was found to be lower among the household heads with tertiary education (50% and 42%) as compared to highest (67% and 57%) for households with no formal education respectively for post-planting and post-harvesting seasons.

Furthermore, the depth and severity of food insecurity among the households with only basic education were (0.43) and (0.15 and 0.35 and 0.12) for post-planting and post-planting season respectively. Conversely, the depth and severity of food insecurity among the household heads with a tertiary education is better, which were (0.51 and 0.10) in post-harvest period. However, the depth of food insecurity worsens to (0.41 and 0.13) in post-planting season. This implies education as a social capital impact positively to the households' ability to take good and well-informed production and nutrition decisions and enhance food security by improving household food accessibility (Goni, 2011 and Titus & Adetukumbo, 2007).

Disaggregating the respondents by household size revealed that, the incidence, depth and severity of food increases with increase in the household size. The incidence, depth and severity of food insecurity increase from (44%, 0.30 and 0.10) (74%, 0.36 and 0.18) for households with less than five (5) members and greater or equals to 16 members respectively, in the post-planting season. However, in the case of the post-harvesting period, incidence, depth and severity of food insecurity were only (32%, 0.21 and 0.09). This means an increase

in household size would increase the probability of the incidence, depth and severity of food insecurity in the study area, and vice versa. The food insecurity (within the household size less than or equals to 5) worsens to (71%, 0.39 and 0.13) for incidence, depth and severity respectively. This scenario shows that, the food insecurity situation is better in post-harvest period due to the reasons mentioned earlier. The household size has been shown to have a negative relationship with food security and food intake (Amaza et al. 2008).

The worsening the food security situation with an increased in household size, may be due to the fact that, larger number of less productive adults (e.g. old and unemployed) and children in a household. The higher ratio of unproductive members the household constitutes a burden on the active members in meeting the cost of minimum calorie for the household, hence the high probability or intensity of food insecurity and vice versa (Hassan & Babu, 1991 and Omonona, Adetokunbo, & Titus, 2007). On the other hand, households with smaller sizes would have least burden on the amount of food that particular household would require and therefore the probability of becoming food secure is high as compared to households with larger family sizes. It is obvious that, food requirement increase with the number of persons that feed in the households.

Based on age group, it can be seen that food insecurity indices increased with increase in age of the household heads in rural Nigeria for both post-planting and post-harvesting periods. The food insecurity incidence rose from (45%) and (0.34) to (75%) and (70%) for the household heads between the ages 31-40 years and greater or equal to 70 years in post-plating and post-harvest seasons respectively. The depth and severity of food insecurity also followed the same pattern in the two periods. The depth of food insecurity increased from $\propto$=1 (0.28) and $\propto$=1 (0.37) to $\propto$=1 (0.18) and $\propto$=1 (0.41) for household heads between the ages of 31-40 and 61 to 70 years of post-planting and post-harvest seasons respectively. The depth of food insecurity later declined to $\propto$=1 (0.35) when the age increased to over 70 years in post-planting, however, the trend in post-harvest kept increasing in the same pattern. On the other hand, the severity of food insecurity also increases with increase in age of the household heads from (0.09) and (0.18) to (0.09) and (0.19) for households between the ages of 31-40 years and ages greater than 70 years of age in post-planting and post-harvest periods respectively. This shows that $\propto$=0, $\propto$=1 and $\propto$=2 also differs between the two seasons.

This implies that household heads in post-planting periods have higher incidence, depth and severity of food insecurity than during the post-harvest period. The result revealed that, given other factors, the households within youthful age (31-50 years) are less food insecure. This is expected, as household heads within this age group constituted the most economically active and productive labour force. Hence, productivity is expected to be high. The decrease in the depth of food insecurity of household heads 70 years may be due to additional income from their grown up economically active adult members of the household and possibly decrease in economically inactive members in the household. This finding contradicts the life cycle hypothesis assumption that older households have a probability of being food secure. The possible explanation to this is the productivity among this age cohort is very low, the income is assumed to decrease due to the retirement of the working groups. For households that are mainly engaged in farming and other income generating enterprises, energy to cultivate land or operate the business is less. This is in agreement with Babatunde, Omotesho, & Sholotan (2007) who asserted that younger households are more food secure than their older counterpart does. This is due to the fact that, productivity decreases with increase in age (Tijani & Ndukwe, 2012).

5. Conclusion

Food security at the national level is just necessary but not sufficient condition to guarantee food access at the household or individual level. This study has shown that, regardless of location and socio-economic characteristics almost two third (66.7%) of the households in Nigeria has farming as their primary occupation. The differences in food insecurity differ exists due temporal and spatial differences in rural Nigeria as well as other socio-economic characteristics of the households. The study reveals the existence of transitory food security based on the temporal rather than the chronic food shortages, the severity of which is more during post-planting season. High food prices and recurrence of droughts were viewed as the key causes of food shortages in the rural Nigeria as shown by this study. However, as a result of unavailability of needed inputs such as high quality seeds, organic and mineral fertilizers needed to replenish depleted soils and ineffective marketing and extension systems, the study revealed that farming households are the most food insecure in the study area. The study recommends a public policy initiative targeting agriculture and non-farm activities would influence positively on the food security and general welfare of the rural poor. Since rural households in Nigeria are heavily dependent on agriculture and agriculture related activities, the initiatives that seek to increase agricultural productivity through the adoption of improved modern technologies such as improved seeds, pesticides, herbicides, fertilizers are the right step in ensuring food availability for the households. Providing such infrastructure such as roads will provide an efficient distribution channel for the trading of agricultural products and enhance farm input supply at affordable prices, thereby increasing availability and accessibility of food to rural households. In the same vein, access road, electricity and portable water will encourage households to participate in non-farm sector activities especially during the labour slack periods.

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