
LIVELIHOOD DIVERSIFICATION STRATEGIES AND FOOD INSECURITY STATUS OF RURAL FARMING HOUSEHOLDS IN NORTH-EASTERN NIGERIA

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ABSTRACT

The study examined the effects of households' livelihood diversification strategies on food insecurity in rural North-eastern Nigeria. In order to realise the objectives of the study, primary data were obtained from 444 farmers with the aid of structured questionnaire. Descriptive statistics, Tobit regression model, Cost of Calorie Function and ANOVA were used to analyse the data. The findings showed that farmers adopted five livelihood strategies of which Cropping, Poultry and Livestock Keeping (CPL) was predominant, accounting for 37.39% of respondents. However, 7.43% of the households practising Cropping, Fishing, Livestock keeping and Off-farm (CFLO) had the highest surplus and least shortfall indices of 0.75 and 0.20 respectively; implying that food secure households in this category exceeded daily RDA of 2250kcal of energy/adult equivalent/day by 75%; but food insecure households fell short of same by 20%. Head count ratio indicated that 58% and 42% of individuals in this category are food secure and food insecure respectively. Thus, a significant relationship between households' food insecurity and livelihood diversification strategies is established.

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Introduction

World Food Summit (1996) defined food security as 'a situation when all people at all times have both physical and economic access to sufficient food to meet their dietary needs for a productive and healthy life'. Within the context of this definition, four distinct variables are central to the attainment of food security which include, food

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availability and access to food (short-term dimension of food security), sustainability of access to food (long-term dimension) and food utilization. These four dimensions are pointer to the complexity of the concept of food security. At one level the concern is with national food security, which is the ability of countries to produce or import adequate food all year round to meet their requirements for both public and private distribution; while at another level, the concern is more about food security among individuals, and households. Food insecurity or lack of access to nutritionally adequate diet in a household or country exists in two forms, namely, chronic and transitory food insecurity. According to Gautam and Anderson (2016), chronic food insecurity exists when food supplies are persistently insufficient to ensure adequate nutrients for all individuals while transitory food insecurity exists when there is a temporary decline in access due to perturbations such as instability in food production, food price variations and income shortfalls (Oluwatayo, 2009; Tantu, Gamebo, Sheno and Kabalo, 2017). National food security is distinguishable from household food security, for aggregate food supply from domestic sources or import or both are a prerequisite but not a sufficient condition (Idachaba, 2006). In other words, adequate food availability in Nigeria on per capita basis does not necessarily translate into adequate food for all citizens. Food security at household level is a subset of national food security and it requires that all individuals and households have access to sufficient food either by producing it themselves or purchasing it by generating sufficient income to demand for it ideally through livelihood diversification strategies. Despite Nigeria's food-producing potential characterized by her vast agricultural endowment, food insecurity remains a very serious problem. This finds expression in the country's colossal annual food importation bill varying from N=113.63 billion in 2002 to ₦348 billion in 2007. This figure got increased to a humongous N=1.31 trillion in 2010. In 2011 the figure got reduced to a whopping N=1.1trillion which got further reduced to still a staggering N=0.648 trillion in 2012 (The Nation, 2011; Ships and Ports, 2013). At the World Food Summit of 1999, Nigeria alongside 185 other countries of the world made a commitment to reduce the number of chronically undernourished persons by half in the year 2015 (Ashagidigbi and Yusuf, 2013). In Nigeria, the rate of increase in poverty is alarming. Statistics from the National Bureau of Statistics have shown that poverty incidence in Nigeria had risen from 54.4% in 2004 to 69% in 2010. Giving an estimated population figure of 163 million, this translates into 113 million Nigerians living below the poverty line, with an estimated 94% of them living in the rural areas (National Bureau of Statistics, 2010). By implication, a large percentage of Nigerians and still a larger percentage of Nigerian rural dwellers are food insecure because they are poor. Therefore, in order to formulate effective policies aimed at ensuring sustainable food security a comprehensive study of factors that determine rural households' food insecurity becomes imperative (Hoang and Pham, 2014; Amao and Ayantoye, 2015); Mada and Menza, 2015). Besides, identifying those who are food insecure as target groups and having a better understanding of the factors engendering food insecurity are critical to designing efficient and effective food security programs (Mutenje *et al*, 2010). The study thus addressed the following research questions; what are the

livelihood diversification strategies and food security profile of households? What are the determinants of livelihood diversification strategies among households? What is the food security status of households? And what is the linkage between livelihood diversification strategies and food security in the study area?

A number of interrelated factors have made this study necessary. Following the World Food Conference in 1974, the concept of food insecurity has evolved, developed, and has become multi-faceted and diversified. The main focus has shifted from global and national to household and individual food insecurity and from food availability to food accessibility and sustainability of accessibility. This trend informs the current strategy of the Nigerian Government in ensuring food security and elimination of hunger through sustainability of accessibility to food among the rural populace. Therefore, this study which is focused on household livelihood diversification strategies and food insecurity in rural North-eastern Nigeria is consistent with current government food security focus. Livelihood constitutes household's capability, assets and economic activities to secure basic needs (Loison, 2015). The accompanying increase in poverty levels has compelled residents of rural economies to embark on livelihood diversification strategies including on-farm, (crop, fisheries and livestock) and off-farm activities or market and non-market activities to mitigate risks inherent in unpredictable agro-climatic and politico-economic circumstances (Ifeoma and Agwu, 2014; Glory and Nsikak-Abasi, 2017; Asfaw, Simane, Hassen and Bantider, 2017). Agricultural insurance is a veritable instrument to mitigate the multitudinous risks farmers are exposed to in the agricultural production process. However, this has remained underdeveloped in Nigeria given the hazardous nature of agricultural production, particularly amongst smallholder farmers who are subject to severe resource and credit constraints. The significance of agricultural insurance in reducing production risks in agriculture has been reported by Vojinovic, Zarkovic and Arambasic-Camprag (2015) in Serbia; although still underdeveloped, the great potentials for crops insurance are accentuated. The inability of small scale farmers to take premium for crops insurance has made livelihood diversification strategies the most viable coping and risk reduction alternatives accessible to farmers in the study area. Livelihood diversification centres on a portfolio of diverse activities to achieve robust livelihood outcomes to fall back on in the face of unexpected shocks. It is a rational response by households to lack of opportunities for specialization which was considered not the most desirable option. Recent studies have, however, indicated that rather than promoting specialization within existing portfolios, upgrading them to augmenting income could be more realistic and relevant for poverty reduction (Babatunde and Qaim, 2010; Alkaakahol and Aye, 2014). Accordingly, an investigation of the livelihood portfolio of rural households in relation to the diverse decisions which they take with a view to enhancing their livelihood when faced with pressure on scarce available resources was made. The essence was to have an insight into both the asset status and livelihood diversification profile in order to assist in knowing areas to which social protection/safety nets could be directed.

There are limited data on household livelihood diversification strategies and food insecurity changes over time in Nigeria. This is due to lack of available panel data to capture such a trend over time. As a result, the study of chronic food insecurity and its determinants has not been in-depth in Nigeria. Even though results of previous studies have identified factors affecting food security, available evidence points to the fact that there is still much to be learnt through the pursuit of more analysis to increase the understanding of the dynamics of household food insecurity, in terms of changes over time and over space. According to Olayemi, (1998), in as much as food insecurity problems are dynamic, changing in scope and nature over various phases of economic development, research on the subject has to be on a sustained basis. As such, this study on household livelihood diversification strategies and household food insecurity is expected to fill some of the existing knowledge gap by using empirical data to examine the food insecurity status of households in the North eastern part of Nigeria and identify the influence of livelihood diversification strategies variables on households' food insecurity.

A number of studies have been carried out in developing countries on rural livelihood diversification strategies and household food security. Tantu, Gamebo, Sheno and Kabalo (2017) in a study of household food insecurity and associated factors among households in southern Ethiopia found single household head with greater than two dependent members, households headed by daily labourers and low monthly food expenditure had negative and significant effects on household food insecurity. The authors recommended implementation of policies and programmes to stabilize food markets as well as livelihood diversification strategies that will provide opportunities for urban households to improve their income and reduce food insecurity.

In a study of household livelihood strategies and poverty reduction in Nepal, Khatiwada, et. al., (2017), collected primary data from 453 households from three villages which were analysed based on sustainable livelihood framework. The results indicated that only 13% of the sample diversified their livelihood into commercial farming while majority of the respondents diversified their income into non-farm sources which were more beneficial and aided in poverty reduction than commercial agriculture. In spite of the effects of non-farm livelihood strategies in improving the well-being of the poor, the study found that they are not as effective in mitigating household food security as market-oriented agro-enterprises. The authors advocated supporting poor farming households to embrace market-oriented farm and off-farm vocational activities through improved access to credit, markets and vocational skills to enhance food security and reduce household poverty.

In order to examine the impact of livelihood diversification strategies on household well-being, in Humla, Nepal, Gautam and Andersen (2016) collected data from 313 rural households in three villages with proportional allocation to the size of the three major ethnic groups in the area. The findings imply some level of uniformity in the number of livelihood activities adopted by households, though their effects on household overall well-being are diverse. The results further showed that well-being may not have a direct

link with livelihood diversification per se but rather on a households' involvement in 'high return sectors' such as trade in Non-Timber Forest Products (NTFP) or salaried employment. Due to the poor financial standing of rural households many are unable to garner the social and economic resources required to participate in these highly profitable livelihood activities. Therefore, agro-based livelihood strategies such as improved farming system, diversification into high-value crops, high-yielding and short duration crops as well as pest and disease tolerant varieties of food crops should be promoted to cater for the needs of the vulnerable rural households.

Research has also shown that though on-farm livelihood diversification activities help to reduce the adverse impact of both short-term and long-term shocks on farmers yield and income, livelihood diversification beyond farm-based enterprises will play significant role in reducing poverty and enhancing food security. Using data drawn randomly from a cross-section of 384 rural households in North Central Ethiopia, Asfaw, et. al., (2017) studied the determinants of non-farm livelihood diversification. The results indicated that relying on on-farm agricultural enterprises alone will make the goal of achieving food security and improving the welfare of smallholder subsistence farmers difficult. They therefore recommended the creation and re-invigoration of rural based institutions such as co-operative societies, farmers training centres as well as effective agricultural extension programme to integrate non-farm livelihood activities into the overall livelihood diversification strategies in order to achieve the overall goal of reducing rural poverty and improving food security among rural households.

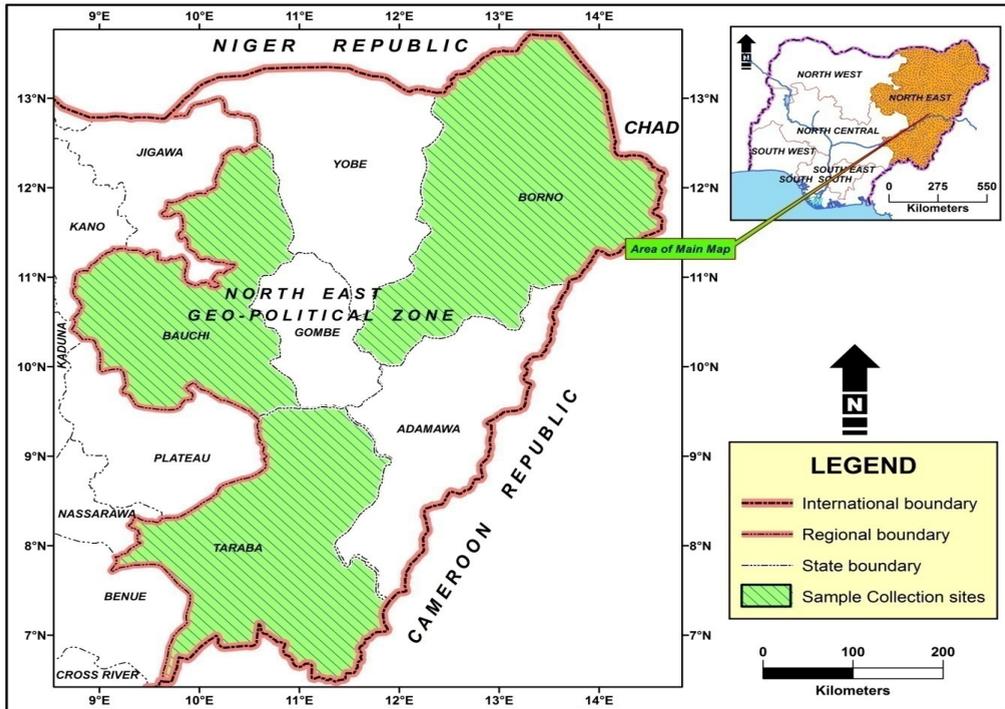
Materials and Methods

The Study Area and Data Collection

The study was carried out in the North East geopolitical zone of Nigeria (Fig. 1). It comprises of six (6) states, namely: Adamawa, Bauchi, Borno, Gombe, Taraba and Yobe. The area lies between latitudes 7° 30" and 14° North of the equator and between longitudes 9° and 15° East of the Greenwich Meridian. It shares boundaries with Cameroon and Chad Republic to the east; Benue, Plateau and Taraba States to the South; Jigawa and Kano states to the West and Niger Republic to the North. The number of inhabitants of the area was put at 18,971,965 based on the 2006 Census (Federal Republic of Nigeria, 2007). Its projected population by 2013, using 3.5% growth rate, is 24,137,639. The mean annual rainfall in the area ranges from 260mm around Nguru (Borno State) to about 1400mm around Sugu (Adamawa State), while mean annual temperature ranges from 20°C to 40°C (Shehu, 2013). The cropping season in the study area lasts between two months in the Northern part to about 5.5 months in the Southern part. Major crops grown include rice, maize, millet, sorghum, cowpea, cotton, groundnut, yam, potato, cassava and water melon (Oganuga, 2006). Artisan, bakery, blacksmithing, mechanic, bricklaying, charcoal burning, vulcanizing, driving, security, clergy, African ethno-medical practices, carpentry as well as fishing, poultry and livestock husbandry are practiced in the study area. Table 1 shows a breakdown of respondents as reflected by the number of questionnaire per state, the number of Local Government Areas and

villages involved in the study. The study was targeted at the rural populace with a view to extrapolating their socioeconomic characteristics as captured by the independent variables to urban agriculture. In the first round of the survey, 450 rural respondents were sampled. In the second round of the survey, only 444 respondents were able to return their completed questionnaire. The remaining were either wrongly completed or their owners were dead.

Figure 1: Map of North-East Geopolitical Zone Showing Sampled States



Source: Bureau for Land and Survey, Jalingo, Taraba State, 2012

Table 1: Distribution of Questionnaire by Sampled States in Rural North-eastern Nigeria

Sampled States	No. of sampled LGAs	No. of sampled villages	Copies of questionnaires administered	Copies of questionnaires retrieved	Mean Response rate
Bauchi	5	25	150	148	98.67
Borno	6	30	180	177	
Taraba	4	20	120	119	
Total	15	75	450	444	

Source: Field Survey, 2017

Conceptual Framework

In order to address household food insecurity, the Foster, Greer and Thorbecke (FGT) food energy intake method was used to generate food insecurity indices and, hence, food insecurity line to guide in identifying both the food secure and food insecure respondents (Ravallion and Bidani 1994; Aigbokhan, 2000; Okurat *et al*, 2002). The study adopted this method due to its simplicity and ease of computation as follows:

The Value of food (F_{*j}) per adult equivalent consumed by each household, which is equal to the sum of the value of purchased food (V_{*j}) and the value of donated food to the household or own production consumed (C_{*j}) was determined as follows.

$$F_{*j} = V_{*j} + C_{*j} \dots \dots \dots (1)$$

$$\text{But } V_{*j} = D_{ij} P_{ij}$$

Where,

V_{*j} = value of purchased food consumed by the j th household

D_{ij} = the quantity of i th food item purchased by j th household.

P_{ij} = the local price paid by the j th household for the i th food item consumption.

But,

$$C_{*j} = M_{*ij} P_{ij} \dots \dots \dots (2)$$

The adult equivalent H_j for each household was obtained by converting household size on the basis of age, sex and activity levels into adult equivalent scale calculated by World Health Organization. Total value of food consumed per adult equivalent (F_{*j}) was derived by dividing the total value of food consumed by household adult equivalent:

$$F_{*j} = \frac{F_j}{H_j} \dots \dots \dots (3)$$

Where,

F_j = Total value of food consumed by j th household

H_j = Adult equivalent for j th household

F_{*j} = Total value of food consumed per adult equivalent,

The different types and quantities of foods consumed by the different households were converted to calories (C_j) using the caloric equivalents table.

A regression model was fitted to estimate parameters (a) and (b) to be used in determining food insecurity threshold (line)

$$\ln F_{*j} = a + bC_j \dots \dots \dots (4)$$

Where,

F^*j = Total food expenditure per adult equivalent by household j

C_j = Total calorie consumption per adult equivalent by household j

a and b are parameters to be estimated

The food insecurity line, Z , which is the estimated cost of acquiring the caloric recommended daily allowance (RDA), was estimated as follows:

$$Z = e^{(a+bR)} \dots\dots\dots(5)$$

Where Z = food insecurity threshold.

R = recommended daily allowance of calories per adult equivalent of 2250 Kcal (WHO, 1985).

Determinants of Food Insecurity in the Study Area

Tobit regression model was used to determine the factors influencing food insecurity among households in the study area. The model which is as expressed in equation (6) following McDonald and Moffit, (1980) as adopted by Omonona, (2001) as follows:

$$V_{i^*} = \beta T X_i + e_i \dots\dots\dots(6)$$

$$V_i = 0 \text{ if } V_{i^*} \leq 0$$

$$V_i = V_{i^*} \text{ if } V_{i^*} > 0$$

$$i = 1, 2, 3, \dots\dots\dots n.$$

Where,

V_{i^*} = Limited dependent variable which expresses the depth of household food insecurity defined as;

$$(Z - Y_i) / Z \text{ and}$$

Z = Food insecurity line

X_i = vectors of independent variables

bT = vectors of parameters to be estimated

Y_i = per adult equivalent food expenditure

e_i = Independently distributed error term

The above method was used to determine the food secure and food insecure households in the study area. However, the extent of household livelihood diversification (HLD) among respondents was measured using Herfindal index (HI) of concentration, given

as follows:

$$HI = \sum_{i=1}^n P_i^2 \dots\dots\dots(7)$$

$$\text{But } P_i = \frac{A_i}{\sum_{i=1}^n A_i} \dots\dots\dots(8)$$

Combining (7) and (8),

$$HI = \sum_{i=1}^n \left(\frac{A_i}{\sum_{i=1}^n A_i} \right)^2 \dots\dots\dots(9)$$

Where,

P_i = proportion of enterprise in household livelihood strategies

A_i = share of farm revenue from enterprise i practiced by the respondent.

$\sum_{i=1}^n A_i$ = Total revenue from all enterprises engaged in by household

$i = 1, 2, 3 \dots, n$

n = number of enterprises owned by the respondent.

Therefore, household livelihood diversification (HLD) is given as;

$$HDL = 1 - \sum_{i=1}^n \left(\frac{A_i}{\sum_{i=1}^n A_i} \right)^2 \dots\dots\dots(10)$$

Results and Discussion

Household Livelihood Diversification Strategies of Respondents

The study identified five different livelihood diversification strategies adopted by farming households in the study area as adapted from Agbola (2014) (Table 2).

Table 2: Distribution of Households by Diversification Strategies

Livelihood Diversification Strategies	Number of Households	Percentage (%)
Cropping only (C).	95	21.40
Cropping and off-farm only (CO).	115	25.90
Cropping, poultry and livestock production only (CPL).	166	37.39
Cropping, fishing, livestock production and off-farm only (CFLO).	33	7.43
Cropping, poultry, livestock production and off-farm only (CPLO).	35	7.88
	444	100

Source: Field Survey, 2017

As shown in Table 2, about 37.39 % of the farming households derived their livelihood from a combination of cropping, poultry and livestock production (CPL) strategy, while 21.40 %, 25.90 %, 7.43 % and 7.88 % of respondents were engaged in cropping (C) only; cropping and off-farming (CO); cropping, fishing, livestock production and off-farming (CFLO); and cropping, poultry, livestock production and off-farming (CPLO) strategies respectively.

Construction of Food Poverty Line

Per adult equivalent household expenditure was computed as the sum total of per adult equivalent household expenditure on purchased food items, value of received food and own produce consumption on the basis of prevailing local market prices (Amao and Ayantoye (2017). By so doing, a relative food poverty line was constructed based on the Mean Monthly Expenditure on Food Items per Adult Equivalent (MMEFIPAE = N=14, 144.19 of sampled respondents (Oni and Fashogbon (2013). Food secure and food insecure categories were then established using the (N=9429.46) food poverty line so generated. Accordingly, households that spent less than two thirds of the MMEFIPAE were classified as food insecure while those that spent two thirds or more of the MMEFIPAE were classified as food secure (Omonona and Adetokumbo, 2007). Based on the result of the analysis, the area could be said to be food insecure as about 44% of the sampled households were unable to meet the basic minimum requirements (Table 3) of 2250 kcal of energy per adult equivalent per day in food intake; with an average food expenditure of N=198.85 per day per adult equivalent which fell below the cost of recommended calorie per adult equivalent per day of N=302.18. About 56% of the sampled households were food secure, with an average food expenditure of N=526.00 per adult equivalent per day which is over and above the cost of recommended calorie per adult equivalent per day of N=304.18 (Table 4). This implies that about 56% of these households were subsisting either

Table 3: Regression Results for Food Insecurity Thresholds

$\ln F_{i,j} = a + bC_j$
$\ln F_{i,j} = 9.1495 - 0.00000092C_j$
$Z = e^{(a+bR)}$
R = 2250 (Daily Recommended Dietary Allowance- DRDA).
e = 2.71828
Hence, $Z = 2.71828^{(9.1495+0.00000092(2250))} = N=9429.46$ per month
Daily recommended calorie intake (R) = 2250 kcal.
Food insecurity line (Z):
Cost of daily recommended calorie intake per adult equivalent per day = N=304.18
Cost of daily recommended calorie intake per adult equivalent per month = N=9429.46

Source: Field Survey, 2017.

on or above the daily recommended dietary requirement of 2250 kcal of energy per adult equivalent per day. The table also showed a head count ratio of 0.56 and 0.44 for the food secure and food insecure households respectively. However, the shortfall/surplus indices which symbolize the extent of deviation from the food insecurity line revealed that food secure households exceeded the daily recommended

Table 4: Food Poverty Lines for the Study Area

Indices	Food Poverty Status	
	Food secure	Food insecure
Percentage of households	56.00	44.00
Average household size (Adult equivalent)	7.21	12.20
Food Poverty lines (Z):		
Mean	1.64	0.62
Std Dev.	0.43	0.79
Shortfall/Surplus index (P)	0.64	-0.38
Average per adult equivalent food expenditure Per day (₺)	526.00	198.85
Calorie availability(kcal/adult equivalent/day)	3690.02	1394.98
Head count ratio (H)	0.56	0.44

Source: Field Survey, 2017.

calorie intake by 64% while food insecure households fell short of the recommended dietary requirement by 38%. Table 5 presents a profile of food insecurity of households by their livelihood diversification strategies. It indicates that households that derived livelihood through a combination of cropping, fishing, livestock and off-farm (CFLO) activities ranked best compared to all other categories.

Table 5: Household Food Security and Diversification Strategies

L/hood Category	Ranking	Household Status	Percentage H/holds (%)	Shortfall/Surplus Index	Head count Ratio	FI(Z)Index (mean)	PerAEFood Exp.PerDay (N=)	PerAE Calorie Availability PerDay (Kcal)	Average Adult Equivalent Size
A	1 st	FI	3.15	-0.2	0.42	0.80	256.59	1800.04	7.18
		FS	4.28	0.75	0.58	1.75	561.28	3937.52	6.30
B	2 nd	FI	3.38	-0.32	0.43	0.68	218.10	1530.03	9.12
		FS	4.50	0.68	0.57	1.68	538.83	3780.03	8.21
C	3 rd	FI	11.49	-0.37	0.44	0.63	202.06	1417.50	9.47
		FS	14.41	0.64	0.56	1.64	526.00	3690.02	6.1
D	4 th	FI	16.89	-0.41	0.45	0.59	189.23	1327.50	9.51
		FS	20.50	0.62	0.55	1.62	519.59	3645.05	8.11
E	5 th	FI	9.91	-0.45	0.46	0.55	176.40	1237.49	10.8
		FS	11.49	0.60	0.54	1.60	513.17	3600.01	7.3

FI = Food Insecure; FS = Food Secure, AE = Adult Equivalent
A = Cropping, Fishing, Livestock and Off-farm (CFLO) activities.

- B = Cropping, Poultry, Livestock and Off-farm (CPLO) activities.
- C = Cropping and Off-farm (CO) activities.
- D = Cropping, Poultry and Livestock (CPL) enterprises.
- E = Cropping (C) only.

Source: Field Survey, 2017

Households that were involved in CFLO were better off with the highest surplus index of 0.75 and the least shortfall index of 0.20, implying that food secure households in this group exceeded the daily recommended dietary allowance of 2250kcal of energy per adult equivalent per day by 75% while the food insecure households fell short of the recommended calorie intake by 20%. The head count ratio revealed that 58% of individuals in this group were food secure while 42% were food insecure. The same explanation goes for the second, third, fourth and fifth categories respectively. The chi-square test in Table 6 shows that food insecurity is statistically related with livelihood diversification strategies of farmers at the 1% level of significance.

Conclusion

The study examined livelihood diversification strategies and food insecurity status among farming households in rural North-eastern, Nigeria. It revealed, on the basis of the food insecurity line, that there was a high level of food insecurity (44%) in the study area. Furthermore, diverse aspects of the rural populace characteristics

Table 6: Test Statistics

Test	Livelihood Strategies	Food Insecurity Status
Chi-square	149.94	196.31
Df	4	10
Asymp. Sig	0.00	0.00

Source: Field Survey, 2017.

captured by the different variables were instrumental to the high level of food insecurity found in the area. However, since non-farm activities (trading, African ethno-medical practice, bricklaying, soap making, food hawking, blacksmithing, charcoal burning, fuel selling, vulcanizing and carpentry) were found to support food security strategies, diversification into such non-farm activities is key to tackling food insecurity problems (Tantu, et. al., 2017; Khatiwada, et. al., 2017; Asfaw, et. al., 2017). To this end, it is recommended that policy options (with support from relevant NGOs) be directed at the education of farmers in this regard and, hence, their empowerment in not only promoting and sustaining same to ensure sustainability of accessibility to food, but also orienting their general outlook on farming (both on-farm and off-farm) towards urban agriculture.

Conflict of interests

We, the authors do not find any conflict of interests as regards the conception of the study, and preparation of the manuscript for publication.

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