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Measurement and determinants of rural food poverty in Nigeria: recent evidence from general household survey panel

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Abstract

This paper examines food security determinants among rural farming households in Nigeria. A total of 3380 households from General Household Survey-panel data that adopt the World Bank Living Standard Measurement Survey (LSMS) technique was used for this study. The impacts of household characteristics, household endowments and activity related characteristics were explored using logistic regression analysis. Based on the Food and Agriculture Organization FAO recommended minimum 2120 kcal daily per adult equivalent was valued at (N138) equivalent and USD 0.87 food poverty threshold of per annum was derived for rural Nigeria. This threshold is the cost for purchasing recommended daily food allowances (RDA) of an adult equivalent for healthy life in rural Nigeria. The results of the study revealed that age of the household head, tertiary education, farm size, household size, value of livestock holdings, total remittances received by the household, participation in nonfarm enterprise and access to formal credit have significant impact on food security. 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 extra time into non-farm income generating activities due to high demand for labour for farm operations.

Introduction

It is an indisputable fact that, food is one of the most necessities of life. Food is important for healthy growth and productive life of individuals. Food security became fundamental to the developmental policies in Nigeria. It is in view of this, that, eradicating hunger and poverty have become the key policy agenda of Nigerian governments. Nigeria as in the case of many developing countries is faced with a major challenge of feeding its ever-increasing human population, which currently stood at 167 million according to National Population Commission (NPC, 2012). Consequently, successive governments in Nigeria, in their bids to attain food security, increase productivity, generate employment and increase farm incomes a number of programs and policies were launched. Some of these programs include; National Accelerated Food Production Program (NAFPP) launched in 1972 targeted to increase productivity of smallholder producers. Operation Feed the Nation (OFN) 1976-1979 and Green Revolution (GR) were aimed at improving agricultural production. River Basin Development Authority (RBDAs) geared towards developing irrigation farming, was also launched in 1979. Directorate of Food Road and Rural Infrastructure (DFRRI) and Community Banking and National Agricultural and Community Development Bank (NAACB) were also established to take charge of rural development and rural financing respectively. Other recent programs specifically geared towards food security include National Economic Empowerment Development Strategies (NEEDS) and National Food Security Program (NFSP) launched in 2004 and 2008 respectively. The major setback faced by most of these programs is lack of continuity from one regime to another; many of the programs suffer neglects due to change in government. Despite all these huge programs and policies, the large segment of the Nigerian population subsisting on inadequate nutrition keeps on increasing by the day.

Concept of food security gain prominence during the 1974 first world food conference. However, food right was recognized since the 1948 Universal Declaration of Human Rights (UDHR). Later in 1996, during the 67th General Assembly Meeting in Rome, Food and Agricultural Organization reaffirms the declaration that access to safe and nutritious food as the right of everyone. During this meeting, Nigeria and G77 developing countries and China called for

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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 experience in the region.

Recent development in the global food security literature showed that in 2001, 687 people in the world suffered from hunger majority of whom are from South Asia and Africa (Kakwani, 2007). More recently, FAO (2012) reported that nearly 870 million people were suffering from chronic undernourishment majority whom are in developing countries. Nigerian being an agriculturally endowed nation whose GDP is heavenly driven by agriculture, yet imports substantial quantities of food to cater for domestic demand. For instance, (CBN, 2008) reported food import bills and live animals to stood at N147.38b, N260.33b in 2005, N293.07 and N299.48b in 2004, 2005, 2007 2008 respectively. These figures are clear indicators of huge deficiencies in food supply from domestic production.

An overview on the determinants of food security

There is a body of literature pertaining to the determinants of food security in South Asia and Sub-Saharan Africa including Nigeria. In a related study by Ihab *et al.* (2012) reported a significant impact between food security and socio-demographic variables for each medical outcome study short form SF-36 scale among a cross-section of low-income households in Malaysia. Despite being one of the leading producers of agricultural commodities in the world Pakistan has up to 26% of its population undernourished (Bashir *et al.*, 2012) using a logistic model further reported that, monthly income; livestock assets and education of the respondents to have a positive and significant impact food security of rural Pakistani households. While the joint family systems and family size has a negative impact. Kabbani (2005) assessed food security among households reports that female headed households and young adult household heads are more food insecure than their male counterparts. Households with high educational attainments were also less food insecure among agricultural households in Yemen. More recent studies by Mensah *et al.* (2013) a logistic regression was used to examine the determinants of household food security in Sekyere-Afram plain Ghana. Hence points out that household size, farm size, off-farm income, credit access and marital status as having significant influence on food security among households with expected sign on the variables.

Much has been written on food security in Nigeria; recent studies indicated an alarming rate of food insecurity that attracts an urgent attention. Idrisa, *et al.* (2008) analyses the food security status among 120 farming households in Jere Local Government Area (LGA) of Borno State and reported the incidence of food insecurity to be higher among households within the age bracket (40-49) years but the depth and severity were higher in the age group of household 50 years and above. Large family size, low-income level and low level of education were identified to have a negative impact on food security among farming households in Jere LGA of Kaduna State Nigeria. In a related study, Arene and Anyaeji (2010) examined food security among households in Nsuka metropolis Nigeria using binary logistic regression; they identified that income and age of the households head as the major determinants of food security. Oluwatayo (2009) reported an account of the contribution of cooperatives on food security in Ekiti State, Nigeria using probit regression model the study concludes that household members belonging to a cooperative are more food secure than non-members. Dauda (2010) examines interrelationship between women's status and household food security coping strategies in metropolitan area of Lagos state Nigeria, Dauda 2010, 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 models, result shows that 75% of the households in the study area are food insecure. This study also reveals that; farm size, use of land improvement techniques, age, membership of the association and access to extension services as the significant determinants and predictors of food security.

The problem of food security in Nigeria has not been adequately and critically analysed, despite various approaches at addressing the challenge (Akinyele, 2009). Furthermore, dearth of national survey that provides data sets for the comprehensive analysis of food and nutrition security in Nigeria is absent. Hence, very little is known about food security in Nigeria at national level. Most of the researches done on food security in Nigeria to date are limited to a particular locality or region. To bridge the existing knowledge gap, the current study used 2010/2011 general household survey-panel (GHS-panel) data to examine food security determinants in rural Nigeria. The remaining part of the paper is organized as follows: The previous section provides brief overview of the determinants of food security in Africa, including Nigeria while section three describes the methodology used, section four presents and discusses the results and section five concludes

the paper.

Methodology

In this study, we modeled household food security under the framework of Agricultural Household Models (AHMs) as proposed by (Singh *et al*., 1986). Singh and Becker, 1965 earlier provides a theory that dealt with the allocation of time by household in the production processes. The AHM model treats farms or agricultural households as producers and consumers as against the traditional micro-economic theory that dealt with two separately. Most households in developing countries produce partly for own-consumption and sale part to cater for other needs. Farm households also purchase farm input such as fertilizer from a competitive market in which they are price takers and therefore can be affected by any change in government policy. AHM captures theoretically in a consistent fashion empirical application of the consequences of policy interventions (Singh *et al*., 1986). AHM application covered a wide range of policy issues in several countries of the world, including India, Indonesia, Japan, Republic of Korea, Malaysia, Nigeria, Senegal, Sierra Leone, Taiwan, and Thailand (Singh *et al*., 1986).

Establishing food poverty index

Greer and Thorbecke (1986) defined food poverty as a condition of lacking the resources necessary to acquire a nutritionally adequate diet, which can be measured in terms of food calories or monetary value of the calories. When the food poverty line has been defined for a particular area, all the individual or households below the line are considered as food poor, subsisting on inadequate nutrition. No official food poverty line was established in Nigeria as a country (Canagarajan *et al*., 1997). 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 we make adjustments to food expenditure of the households. This will take care of individual household members according to their sex and age food needs; hence FAO equivalent weight scales of 0.8 were assigned to adult female and 0.5 for child. Based on FAO recommended 2120 kcal minimum daily threshold for active and healthy life was valued at N138 equivalent to 0.87 USD. This is the cost of buying a recommended daily allowances (RDA) of an adult equivalent for healthy life in rural Nigeria.

Cost of Calorie

Several methods were used for establishing food poverty line. In this study, (COC) was chosen for its operational advantages, simplicity, less data requirement and yielding values that are very close to the actual calorie (Asogwa and Umeh, 2012). Classification of households into two categorical measures of food security was achieved through calculating the ratio between food expenditure on calorie consumed and recommended daily calorie consumption. For a particular household to be food secure the ratio must be equal to or greater than zero.

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

Where Y = Food security status of ith household (Y=1 food secure household, food insecure=0)

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

RC = Recommended calorie consumption

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

Where Z_i is the vector for household endowments agriculture related characteristics of ith households and ε is an error term.

Logit regression model, which gives maximum likelihood estimators, was directly applied to equation 3, which is given as:

$$ln\left[\frac{p}{1-p}\right] = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \varepsilon \quad \text{..........} (3)$$

Where P is the probability of households being food secure or otherwise

β_{0s} Intercept

$\beta 1$ to βn are the estimated Parameters, where P is the probability of households being food secure or otherwise.

Dataset and variables

This study considered household to be a group of people who usually slept in the same dwelling and share their meal together (NBS, 2012). A representative sample of 3380 rural households was used to examine determinants of food security in Nigerian rural households. The general household survey was conducted in 2010 and 2011 by the National Bureau of statistics (NBS), in collaboration with the Federal Ministry of Agriculture and Rural Development (FMA and RD), the National Food Reserve Agency (NFRA), the Bill and Melinda Gates foundation (BMGF) and World Bank (WB). The survey was the first of its kind in Nigeria to collect panel data on households, their characteristic, welfare

Table 1. Definition of variables used in the model

Variable	Expected relationship	Definition
Food security		Food security=1 if food secure, =0 otherwise
Household Characteristics		
Age	(-)	Age of household head (in years)
Gender	(+/-)	1 if household headed by male, 0 otherwise
Educational level (basic)	(+/-)	Primary and Secondary levels of education attained by household head
Educational level (Tertiary)	(+)	College and University levels of education attained by household heads
Household Endowments		
Farm size	(+)	Total land owned by a particular household (in hectares)
Value of livestock holdings	(+)	Total value of livestock holdings owned by households (₦)
Household size	(-)	Number of people in a particular household
Remittances	(+)	The amount of money received from migrant household members in (₦)
Activity Variables		
Diversified	(+)	1 if household Participations in non-farm enterprise NFE (Petty trade, mechanics, transportation, wage activity etc.), 0 otherwise
Undiversified	(-/+)	1 if a particular households solely depends on farming for a livelihood, 0 otherwise
Access to formal credit	(+)	1 if a particular household has access to formal credit (1), 0 = otherwise

and agricultural activities. The other countries where similar research was conducted are: Ethiopia, Uganda, Tanzania, Malawi, Niger and Mali (National Bureau of Statistics, 2012).

Results and Discussion

Table 1 presents definitions of variables used in the analysis. The left hand side variable is categorical limited depended variable taking value of 1 and 0. The independent variables were grouped into household characteristics, households' endowments and activity related variables. When the dependent variable is limited such as food security, the best estimation technique to adopt is maximum likelihood (MLE) method. In limited dependent variable, response probabilities are strictly restricted to values between one and zero. Table 2 presents maximum likelihood parameter estimates and odds ratios which explain probability households being of food secure in rural Nigeria. An econometric analysis of the determinants food security shows that almost all the variables have hypothesized signs and statistically significant effects on the dependent variable (food security) in a post-planting season. Age of the household head, tertiary education, farm size, household size, value of livestock holdings, total remittance receive by household, diversified households, undiversified households and access to formal credit had significant impact on food security. While in the post harvesting season, only five out of the eleven variables are statistically significant. They are, age of the household head, and farm size, household size, diversified households and access to formal credit. To correct for heteroskedasticity and multiple observation, problem, robust standard errors command available in the STATA software package was used. Model significance and predictive efficiency was 85.3% and it has passed a commonly used Hosmer and Lesmershow (H-L) test of goodness of fit with insignificant (P>0.05) hence null hypothesis of goodness of fit was accepted.

Age

Age of the household head has a negative sign that shows an inverse and highly significant (P>001) relationship with food security in both post planting and post harvesting seasons. The odds ratios indicated that an increase in age of household head by one year would decrease the probability of households becoming food secure by 1.35 and 0.98 percent in post planting and post harvesting season respectively. It implies that, older household heads are less likely to be food secure than younger household heads. This is expected as increase in age goes with a commensurate increase in household size, hence an additional responsibility and having many mouths to feed. This finding is consistent with other studies (Huffman and Jensen, 2003; Yen *et al.*, 2008; Bashir *et al*., 2012; Asogwa and Umeh, 2012).

Tertiary education

Education up to tertiary level had positive and highly significant (p>0.001) impact on food security. Household heads with education up to tertiary level (16 and above years of schooling) are more likely to be food secure than those with lower educational levels in post-planting period, while the impact was

Table 2. Food security determinants among rural households in Nigeria

Post planting				Post harvesting		
Explanatory Variable	B	Odd Ratios	Z-statistics	B	Odd Ratios	Z-statistics
Household Characteristics						
Age	-0.0107 (0.003)	0.990	-3.93***	-0.010 (0.003)	0.990	-3.71***
Gender	-0.0498 (0.175)	0.953	-0.27	0.2992 (0.280)	1.349	1.42
Basic Education	0.0483 (0.082)	1.053	0.61	-0.196 (0.191)	0.823	-0.84
Tertiary Education	0.771 (0.309)	2.153	5.47***	0.053 (0.704)	1.055	0.07
Households Endowments						
Farm size	0.104 (0.029)	1.111	4.18***	-0.116 (0.052)	0.890	-1.98**
Household size	-0.699 (0.060)	0.502	-10.54***	-0.174 (0.014)	0.840	-11.36***
Value of Livestock holdings	8.460 (0.007)	1.006	2.04**	-8.710 (6.050)	1.000	-0.18
Remittances	0.000 (5.230)	1.001	4.21***	2.200 (3.420)	1.000	0.88
Activity Variables						
Diversified households	0.322 (0.106)	1.371	4.16***	0.210 (0.102)	1.233	0.011**
Undiversified households	-0.313 (0.0684)	0.720	-3.41***	-0.1510 (0.088)	0.853	0.122
Access to formal credit	0.567 (0.398)	1.756	2.51**	1.002 (0.711)	2.724	3.77***
Constant	1.3013 (0.274)		4.76***	2.843 (0.4107)		6.92***
Log likelihood = -305.261				Log likelihood = -2017.710		
Pseudo R2 = 0.079				Pseudo R2 = 0.084		
Prob > chi2 = 0.0000				Prob > chi2 = 0.0000		

***significant at 1%, ***significant at 5% and *significant at 10%
Figures in parenthesis are the robust standard Errors

not significant during post-harvesting. The result shows that one additional year of schooling above secondary level has direct effects of the increase in food security by 22.88 percent. Additional years of schooling of household head increase the food security status of that household holding other factors constant. The result is consistent with current literature examples (Amaza et al., 2008; Oluwatayo *et al*., 2009). The incidence of food insecurity decreases with the level of education in Lagos state, households with tertiary education are having the lowest food insecurity incidence (Omonona *et al.*, 2007). This is quite interesting, as expected tertiary educational level should positively affect the income and consumption levels of the entire family based on the consumer theory. However, the relationship between food security and tertiary education is positive but not significant. This could be because most households with tertiary education are civil servants; hence, their food security status is less affected by the season of the year.

Farm size

Land is probably one of the most important factors in crop and livestock small-holder production system in rural Nigeria. With large farm size, farmer can increase or diversify the scale of his production of a given commodity. Farm size has a positive and significant (p>0.001) relationship with food security in rural Nigeria during post planting while the relationship is negative in post harvesting. It expounds that probability of a household being food secure increase by 11.10 percent when an area under cultivation is increased by one hectare. This outcome is consistent with Asogwa and Umeh (2012), who reported that households with large farm sizes tends to be efficient in resource use and adopts mechanization more than small farm size holders. The low likelihood of being food insecure among small farm holders could be linked to pressure on land due to a traditional tenure system where land holding keeps shrinking farm households. This shows the extent to which household size and farm size are linked in rural Nigeria.

Household size

Quite interesting is the significant and negative relationship between household size and food security in rural Nigeria. As expected, households with larger family size (children and old age) are more vulnerable to food insecurity than those with smaller size. The inverse relationship between the household size and food security implies that, an increase in the household size by one member will decrease the

probability of that house becoming a food security by 49.8 percent in post planting. However, in the post-harvest period, the likelihood of becoming food insecure is just about 16 percent. As expected, an increase in the household size by a member especially juveniles and old aged implies a decrease in per head income and food available for consumption of that particular household being depleted. This is quite true especially in smallholder subsistence rural farming communities, where production could hardly match with domestic food demands of household, this could concomitantly result into a vicious food insecurity situation (Mensah *et al.*, 2013).

Value of livestock holdings

Livestock accounts for a major source of income, food, manure farm labour, fuel, and served as a source of prestige in rural Nigeria. It also accounts for over 30% of agricultural gross domestic product (GDP) and 2.88 percent of national GDP (NBS, 2012). Livestock value has positive and statistically significant p>0.05 influence on food security in rural Nigeria during the post planting period. While in the post harvesting season, the impact was not very significant and it has an unexpected inverse relationship with food security. In other words, the higher the number of animal holdings a household has holding other factors constant the more food secure they are. This implies that an increase in livestock value by N1000 (6.30 USD) will increase the probability of rural households becoming food secure by factor 0.6 percent in post planting ceteris paribus. Ownership of livestock assets is considered one of the strategies for income diversification in rural crop-livestock farming system against crop failure and transitory economic shocks. Livestock assets could be sold in case of needs to cushion the effects of the adverse shocks. Inequality in asset ownership (particularly size and type of land ownership, livestock holding), human capital (e.g. number of adult members and educational level) as well as other forms of capital can affect the food production and access to off-farm income, which can enhance the ability of households to acquire food other than their own production (Maharjan and Khatri-Chheri, 2006).

Remittance

The coefficient of the total remittance is positive and significant at (p>0.01) level, meaning that total remittance exhibits a positive relationship with food security of the households in the study area. This indicates that, for a unit increase in remittance, the probability of household becoming food secure will also increase by 0.6 percent factor during post planting season. Transfer of remittance by a household member(s) that migrated either within Nigeria or abroad will increase the income as well as consumption levels of that particular household. However, the coefficient of remittance was not significant in explaining food security of households in the study area even at the 10 percent level during post-harvesting season. This is because most of the households that migrated to the southern part of the country from north retuned home no remittance transfer.

Diversified households

Diversification means simultaneous integration of other income generating activities with farming for enhancement of livelihood of farm families. The income generated from these activities is used to purchase additional food to augment domestic food produce. The coefficient of diversified households was positive and significant at p>0.01 (post planting) and p>0.05 in (post harvesting), implying that there is positive relationship between income diversification and food security in both post planting and post harvesting seasons. Diversified households are those engaged in nonfarm enterprise income activities (NFIA) such as petty trading, transportation, mechanic, bricklaying, transportation etc. Diversified households are more likely to be food secure than undiversified households. In terms of the magnitude, diversified households during post planting are having a high probability of becoming food more secure by 37.1 percent than during post harvesting by only 23.33 percent. This is an interesting result, as diversified households are expected to have more income, hence opportunity to modernize their agricultural production through the adoption of modern farming practice. Income so realize in NFIA can be reinvested into farming, thereby making the food more readily available for their households. The findings of the current study are consisted with (Barret *et al*., 2001) who asserted that engagement into NFIA as a path-ways out of the vicious cycle of food insecurity in sub-Saharan Africa. In the same vein, (Owusu *et al.*, 2011) reported that participation in non-farm work helped raised households income and thereby increasing their likelihood of being food security.

Access to formal credit

Another important and interesting finding is strong and positive impact of access to formal credit on the food security situation in the study area. Access to formal credit is highly significant at p>0.01 with expected signs in both post planting

and post harvesting seasons. The farming families who have access to formal credit stands higher probability of being more secure than those without access to formal credit by a factor (75.6 percent) and (72.4 percent) in post-planting and post-harvesting seasons respectively. This is quite expected, because households that have access to credit are more likely to expand and diversify their business, adopt new farming technologies and purchase improved farm inputs. This shows that borrowing money for productive purposes by peasant farmers is crucial in boosting their productivity. This will consequently give high yields and better return in agribusiness.

Conclusion

This paper examined determinants of food security in rural Nigeria using newly available General household-panel data. Logistic regression that follows cumulative distribution was used to examine determinants of food security. The results also revealed that, various factors such as household characteristics (age, gender, basic and tertiary education), household endowments (farm size, household size, value of livestock holdings, total remittances) and activity variables (diversified, undiversified and access to formal credit) came into play to determine the food security of rural households in Nigeria. Household's endowments also play a key role in determining food security status of rural Nigeria. The study recommends policies that ensure better access to formal credit through micro credit financing and encourage establishment of non-farm enterprises to increase rural household income and food expenditure. Efforts directed toward education, especially at tertiary level and land reform policies are very important for increasing food security in rural Nigeria.

References

Akinyele, I. O. 2009. Ensuring food and nutrition security in Rural Nigeria: an assessment of the challenges, information needs, and analytical capacity. Abuja, Nigeria.

Amazon, P. S., Adejobi, A. O. and Fregene, T. 2008. Measurement and determinants of food insecurity in northeast Nigeria: some empirical policy guidelines. Journal of Food Agriculture and Environment 6(2): 92–96.

Arene, C. J. and Anyaeji, M. R. 2010. Determinants of food security among households in Nsukka Metropolis of Enugu State, Nigeria. Pakistan Journal of Social Sciences 30(1): 9–16.

Asogwa, B. C. and Umeh, J. C. 2012. Food insecurity determinants among rural farm households in Nigeria. Proceeding of International Conference on Ecology, Agriculture and Chemical Engineering (ICEACS'2012).Thailand: Phuket.

Bamire, A. S. 2010. Effects of tenure and land use factors on food security among rural households in the dry Savannas of Nigeria. African Journal of Food, Agriculture, Nutrition and Development 10(1): 1982-2000.

Barrett, C. B., Reardon, T. and Webb, P. 2001. Nonfarm income diversification and household livelihood strategies in rural Africa: concepts, dynamics, and policy implications 26(4): 315–331.

Bashir, M. K. and Schilizzi, S. 2013. Determinants of rural household food security: a comparative analysis of African and Asian studies. Journal of the science of food and agriculture 93: 1251–1258.

Bashir, M., Schilizzi, S. and Pandit, R. 2012. The Determinants of rural household food security in the Punjab, Pakistan: an econometric analysis 1: 1-30.

Canagarajan, S., Ngwafon, J. and Thomas, S. 1997. The evolution of poverty and welfare in Nigeria, shared equally by different. The World Bank Policy Working Paper: 1-100.

CBN. 2008. The Central Bank of Nigeria in partnership with Alliance for a Green Revolution in Africa (AGRA): conceptual issues, operations and prospects for food security in Nigeria 48: 181–192.

Dauda, R. O. S. 2010. Women's status, household food security and coping strategies in Nigeria: a survey based analysis. Pakistan Journal of Social Sciences 7(3): 262–268.

FAO. 2012. The state of food insecurity in the world 2012 key messages. Rome.

FAO/WB/UNU. 2001. Human energy requirements 10: 1–103.

Huffman, S. K. and Jensen, H. H. 2003. Do food assistance programs improve household food security? recent evidence from the United States. Centre for Agricultural and Rural and Rural Development, IOWA State University, Ames Iowa 50011-1070 USA. Working paper 03wp335.

Idrisa, Y. L., Gwary, M. M. and Shehu, H. 2008. Analysis of food security status among farming households in Jere Local Government of Borno State, Nigeria. Journal Tropical Agriculture Food Environ 7(3): 199–205.

Ihab, A. N., Rohana, A. J., Manan, W. M. W., Suriati, W. N. W. and Zalilah, M. S. 2012. Association of household food insecurity and adverse health outcomes among mothers in low-income households: a cross-sectional study of a rural sample in Malaysia. International Journal of Collaborative Research on Internal Medicine and Public Health 4(12): 1971–1987.

Greer, J and E. Thorbeke. 1986. A methodology for measuring food poverty applied to Kenya. Journal of Development Economics 24: 59–74.

Kabbani, N. and Y. W. 2005. Survey results on hunger and food insecurity in Yemen. Proceedings of the 11th Annual Conference of the Economic Research Forum

for Arab Countries, Iran JEL 132(55): 1–20.
Kakwani, N. 2007. New Global Poverty Counts. Asian Development Review 24(2): 17–36.
Maharjan, K.L. and Khatri, C. A. 2006. Household food security in rural areas of Nepal: relationship between Socio-economic characteristics and food security status, Australia: 1–15.
Mensah, O; James, A. and Tuffour, T. 2013. Determinants of household food security in the Sekyere-Afram Plains District of Ghana. Global Advanced Research Journal of Agricultural Science 2(1): 34–40.
National Bureau of Statistics (NBS). 2012. General Household Survey – Panel. Abuja, Nigeria.
National Bureau of Statistics (NBS). 2012. The Presidency Gross Domestic Product for Nigeria. Abuja, Nigeria.
Nwajiuba, C. 2012. Nigeria's Agriculture and Food Security Challenges. Agriculture and Food Security. 12.
Oluwatayo, I. B. 2009. Towards assuring household food security in rural Nigeria: have cooperatives got any place. Journal of Agricultural Economics and Rural Development 2(1): 52–60.
Omonona, T., Adetokunbo, G. and Titus, B. 2007. An analysis of food security situation among Nigerian Urban households: evidence from Lagos State, Nigeria. Journal of Central European Agriculture 8(3): 397–406.
Owusu, V., Abdulai, A. and Abdul-Rahman, S. 2011. Non-farm work and food security among farm households in Northern Ghana. Food Policy 36(2): 108–118.
Singh, I., Squire, L. and Strauss, J. 1986. A survey of agricultural household models: recent findings and policy implications. The World Bank Economic Review 1(1): 149–179.
Sultana, A. and Kiani, A. 2011. Determinants of food security at household level in Pakistan. African Journal of Business Management 5(34): 12972–12979.
World Health Organization (WHO). 1985. Energy and protein requirements:. WHO Technical Report Series 724. Geneva.
Yen, S. T., Andrews, M., Chen, Z. and Eastwood, D. B. 2008. Food stamp program participation and food insecurity: an instrumental variables approach. American Journal of Agricultural Economics 90(1): 117–132.