

Assessment of Dietary Diversity and Food Calorie Consumption among Rural Households in Kwara State, Nigeria

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ABSTRACT

The study assessed the factors that influence dietary diversity behaviour of rural households as well as the relationship between the dietary diversity and food calorie consumption among rural households in Kwara State, Nigeria. 120 rural households were selected using a three-stage sampling technique. Data were collected using structured questionnaire. The study adopted random utility model to fit the collected data, which were analysed using household Dietary Diversity Score [DDS], Analysis of Variance [ANOVA] test and Multinomial Logit Regression [MLR] technique. The result revealed that with reference to medium dietary diversity category, age, household income, gender and education level were the socioeconomic factors that are positively significant at $p < 0.01$, $p < 0.05$ and $p < 0.1$ levels to explain the dietary diversity attitude of the respondents. However, household size is negatively significant at $p < 0.01$ level, which express the variation of the dietary diversity of households with reference to medium dietary diversity. The food energy consumption (F-value, 183.15) is affected by rural households' decision of dietary diversity by at least 2245 kcal, which is above the recommended calorie for daily intake (1800 kcal). The findings of the study suggested that enlightenment campaigns on family planning, food-aid intervention and nutrition education could be strengthened to provide the recommendable dietary formula that improves human health status.

Key words: Dietary diversity, food calorie consumption, rural household, Regression

INTRODUCTION

A dietary diversity became a global concern in improving health conditions through the habit of food group consumption by adding health dimension to the issue of food calorie consumption. Access to nutritionally adequate and good quality diet is essential to human health, productivity and work output (Savy *et al.*, 2005). Diverse diets refer to a variety of foods from different food groups (vegetables, fruits, grains, and animal source foods), which provide a balance of nutrients that promote healthy growth and development. The increase in the variety of foods across and within food groups has the potential in ensuring adequate intake of essential nutrients to promote good health (Savy *et al.*, 2005). Similarly, Kennedy *et al.*, (2009) maintained that a diet, which is sufficiently diverse, could reflect nutrient adequacy as well as preventing the cases of food insecurity.

Food insecurity is the situation of having access to low quantity and under-quality of available food to be consumed by people, which deprive them of dietary needs and food preference for an active and healthy life. Low income distribution plays significant roles in the occurrence of food inaccessibility among people in the

developing countries. It is estimated that about 60% of the general populace, majority of which reside in rural areas, live on less than US\$1.25 per day (World Bank, 2013) while 80% of their daily income being spent on food consumption (Metu *et al.*, 2016). This means that income is imperative in making rural households to acquire nutritious food. Obviously, a single food cannot contain all the required nutrients and when the households' income per day is sufficient to demand food varieties, then the likelihood of meeting nutrient requirements and enhancing health is possible (Labadarios *et al.*, 2011). Also, the insecurity of diverse food consumption could result into malnutrition and skipping of nutritive meal, which is influenced by inadequate purchasing power and other financial constraints of demanding for food variety (Taruvinga, *et al.*, 2013).

Malnutrition is expressed in terms of inadequate food intake and poor diet quality. Consequently, frequent infections, morbidity and mortality of children and women especially in rural Africa can be renounced more easily from poor dietary intake (Lartey, 2004; Ajani, 2010). Lack of quality diet is a particularly severe problem among poor

developing world populations as their diets are predominantly based on starchy staples with little or no animal products and few fresh fruits and vegetables. Food consumption indicators with more food groups were more strongly associated with micronutrient adequacy for rural households including women (FAO, 2014). These plant-based diets tend to be low in a number of micronutrients, and the micronutrients they contain are often in a form that is not easily absorbed (Popkin, 1994). Notably, animal source foods are not energy-dense but they are an excellent source of high-quality and readily digested protein (Bernal and Lorenzana, 2003). It is therefore argued that given no regards to dietary energy consumption, only quality of diets that is correlated with dietary diversity would reduce malnutrition status (Azadbakht *et al.*, 2005; Steyn *et al.*, 2006).

Dietary diversification is a strategy that involves getting essential food nutrients from consuming a range of food-based items, which collectively work to maximize the availability of adequate amounts and greater variety of nutritious foods and improve health status and livelihood of the rural poor. In strengthening human nutrition in Nigeria, there are several interventions on ground to watch the dietary quality of households especially aged, women and children. For instance, the programmes like the Baby Friendly Hospital Initiative (1992), National Food and Nutrition Policy (NFNP) (1995), Community Management of Acute Malnutrition (CMAM) (2014), Home-grown School Feeding and Health Programme (2005), Roadmap to scaling up Nutrition in Nigeria (2012), State School Feeding Programmes and National Policy on Infant and Young Child Feeding (NPIYCF) (2005) were implemented to drive the scale up. Thereby, creating an enabling atmosphere in promoting optimal infant feeding practices, controlling micronutrient deficiency and anaemia through vitamin and minerals supplementation, food fortification and dietary diversification. For example, these have worked in the elimination of iodine deficiency through a salt iodization programme and development of vitamin A fortification flour (wheat/maize); sugar and vegetable oil by the Federal Ministry of Health (FMOH) (FMOH, 2014; Ogbo *et al.*, 2015).

Despite these efforts, the dietary diversity practices of households have dropped from 30 Dietary Diversity Score (DDS) in 2008 to 10 in 2013 and consequently revealing increase in the malnutrition level (Ogbo *et al.*, 2015). Inadequate knowledge about dietary diversity and food dietary quantity consumed could worsen malnutrition status and increase health problem, which is recognised with prominent levels of stunting, wasting and underweight of households. Although, the studies on dietary diversity had flooded the literature (Ajani, 2010; Taruvinga *et al.* 2013; Ogundari, 2013; Mahdis *et al.*, 2013; Hudu, 2014; Gathun *et al.*, 2015; Ogbo *et al.*, 2015;

Helen *et al.*, 2015), the dearth to understand the relationship between dietary diversity and dietary calorie consumption in among rural dwellers is elusive. The previous studies had focused on the socioeconomic determinants of dietary diversity among people of different sociological features such as women, adolescent girls, children and rural households in the developing countries. To the best of our knowledge, Ajani (2010), Ogundari (2013) and Ogbo *et al.* (2015), are the actual studies being done in Nigeria that focused on the state and determinants of demand for dietary diversity, but with little emphasis on dietary diversity and food calorie consumption relationship of the rural households. The constraint of low income among poor would introduce a trade-off between food calorie intake and dietary diversity attitude of rural households. Meanwhile, Ogundari (2013) noted that the inadequate diets of households, as well as demand for dietary diversity, are likely to be affected by different socio-economic characteristics including households' productivity across Nigeria. There might be changes in the determinants of dietary diversity, with the transition of government and instantaneous change in policies in Nigerian political system. The study therefore, determines the factor influencing dietary diversity behaviour of rural household and examines the food calorie consumption effect of the dietary diverse category among rural households. By understanding the relationship between dietary diversity and food calorie consumption among rural households, this study can be relevant in providing potential information for policy concerns in terms of scaling up a nutrition-enhancing intervention for promoting the health of less-privileges in the rural area.

METHODOLOGY

Study Area

This study was conducted in Kwara State, Nigeria. The State lies within the North Central geopolitical zone of Nigeria between latitudes 7°45' N and 9°30' N and longitudes 2°30' E and 6°25' E. It has a land area of about 32,500 square kilometres. The State is bounded in the north by Niger State, in the South by Osun and Ekiti States, in the East by Kogi State and in the West by Oyo State. Kwara State shares an international boundary with the Republic of Benin. According to the 2006 National Population Census figure, Kwara State has a total population of 2,371,089. This is made up of 1,220,581 males and 1,150,508 females (National Population Commission NPC, 2006). The topography of the State is mainly plain lands to slight gentle rolling. The annual rainfall and average temperature ranged between 1000 mm to 1500 mm and 25 to 35 °C, respectively (Kwara Agricultural Development Project KWADP, 1996; Akpenpuun & Busari 2013).

Sampling Procedure and Method of Data Collection

A three-stage sampling technique was used in selecting the households for this study. The first stage involved the random selection of 6 out of the 16 local government areas in Kwara State. The second stage contains 4 villages, which were randomly selected from each of the selected six local government areas. Using the households' sampling frame of the selected villages that was provided by the local government officials, there was a random selection of 5 household heads in each selected villages and data were sourced from 120 respondents in the study area. The data were collected using structured questionnaire with informal discussion and interview of the household members.

Method of Data Analysis

The data analysis adopted to meet the objectives of this study includes Descriptive statistics, Household Dietary Diversity Score (HDDS), Multinomial Logistic Regression Model and ANOVA Test. The ANOVA Test was used to examine the effect of dietary diversity attitude on the dietary calorie consumption. The dietary energy was calculated using the food consumption data collected from respondents and converted to Kilocalorie (kcal) with the standard from West African Food Conversion Table (FAO, 2012). The rejection of the null-hypothesis leads us to Honestly Significant Difference (HSD). The HSD is one of the furtherance tests of ANOVA test that helps in comparing pairs of treatment means (Thompson, 2005).

Household Dietary Diversity Score (HDDS)

Data on household dietary diversity was collected using 24-h. recall dietary intake. The information collected on dietary consumption was used to calculate a dietary diversity score (DDS). The DDS is defined as the number of different food groups consumed by family members over 24-h. Respondents were visited at their homes to source information for the survey. It was assumed that the women have good memory ability to of the foods eaten since most of them is involved in cooking household meals (Mirmiran *et al.* 2006). The 24-h recall was thus, validated based on methods described by Oldewage-Theron *et al.* (2008).

A list of meals, dishes and all food items and beverages consumed in the last 24-h were recorded. Although using 24-h recall period does not provide an indication of an individual's habitual diet, but it does provide an assessment of the diet at the population level and found useful to monitor progress or target interventions (Savy *et al.*, 2005). The 24-h recall period was used for this study as it is less subject to recall error, less cumbersome for the respondent and also conforms to the recall time period used in many dietary diversity studies (Ruel, 2003; Steyn *et al.*, 2006; Kennedy *et al.*, 2007; Arimond *et al.*, 2010).

Participants were asked for a full description of ingredients in mixed dishes including snacks and drinks.

For this study, the twelve food groups, recommended by United Nations Food and Agriculture Organization (FAO, 2007) were used to assess household DDS. The food diverse behaviour of households become obvious if the household consumed at least one food item from a particular food group for the past 24-h. In line with FAO guidelines for measuring household, individual dietary diversity was counted from the score allocated to each food in the food group (FAO, 2007). Following food variety score used by past study (Taruvunga *et al.* 2013), the household with DDS of ≤ 3 classifies as a low category in food groups. However, households that score 4 - 6 in the food groups would be regarded as medium dietary diverse category while those with ≥ 7 in food groups would be placed under high dietary diversity.

Multinomial Logistic Regression Model

This method of data analysis was used to determine the factors affecting the dietary diversity in the study area. The use of Multinomial logistic regression application in the study is based on the premise of the polychromous nature of the dependent variable. This model is given as:

$$Y = B_0 + B_1X_1 + B_2X_2 + \dots + B_iX_i + U_t$$

Where,

Y = Dietary Diversity Category (i.e. Low Dietary Diversity LDD, Medium Dietary Diversity MDD and High Dietary Diversity HDD)

B_0 and B_i are the estimated coefficient of the parameters $i = 1$ to 7

X_1 = Age (years)

X_2 = Household income (naira/day)

X_3 = Gender (Male =1, Female =0)

X_4 = Household size (Number)

X_5 = Education level (years)

X_6 = Access to credit (Yes =1, No =0)

X_7 = Primary income source (categorical)

U_t = Error term

RESULTS AND DISCUSSION

Socioeconomic Characteristics of the Household Heads

Table 1 indicates that 67.5% of the household heads respondents were male. Though females are in charge of making food ready to eat, the predominance of male in this study could be due to the role they played in enhancing nutrition through the provision of food expenditure. The age range between 40-60 years appeared to be prevalent having 65.9% of the respondents population. In order to comprehend the significance of diet to human health development among rural households, age becomes relevant in determining and promoting food

groups' consumption. Thus, this category of age range has the capability to earn more income to meet food needs. In further support of the significant age range, about 71% of the respondents are married (Table1). This implies that the married class of respondents would always fuel the spirit to work and earn more proceeds in fulfilling the probable dietary diversity decision of households. Moreso, the household size would be undoubtedly expected to be increased with the most of the respondents being married,

Table 1: Socioeconomic characteristics of the respondents (n= 120)

Socio-Economic	Frequency	Percentage
Gender		
Male	81	67.5
Female	39	32.5
Age		
Less than 40	24	20
40-60	79	65.9
Above 60	17	14
Marital		
Single	11	9.2
Married	85	70.83
Divorced	10	8.33
Widowed	14	11.7
Household		
1-5	43	35.8
6-12	69	57.2
>12	8	6.7
Education		
No formal	35	29.2
Formal	85	70.8
Primary		
Farming	39	32.5
Artisan	24	20.6
Trading	30	25
Civil servants	17	14.2
Others	10	8.3
Access to credit		
Yes	56	46.67
No	64	53.33
Source of credit		
Banks	9	16.07
Cooperative	14	25
Relatives	12	21.43
Money lender	14	25
Others	7	12.5

Source: Field Survey, 2016

for instance, 57% of the respondents have between 6-12 households. The position of household size would not only be affecting the dietary diversity decision of rural households but also their dietary calorie consumption. Also, 71% of the respondents had formal education, indicating that the formal education would serve as a key in exposing the rural households to identify and gather the appropriate foods to improve their health. As rural areas are also being known with different primary income sourced from occupation like farming, artisan, trading, civil servant, etc. had 32% of its respondents getting their income primarily from farming followed by trading (25%) and artisan (21%). Although, credit access has a great contribution to boosting the business of the respondents but the respondents have difficulty in accessing credit (53%), which might affect their income as well as the dietary consumption of the households. However, in Table1, some respondents still had access to credit (47%), bank (16%), cooperative society (25%), relatives (21%), and money-lender (25%).

Dietary Diversity Level and Dietary Calorie Consumption of Rural Households

Table 2 shows that 22.5% of the respondents with a score of ≤ 3 fall into low dietary diverse households and consumed average food calorie of 1596 kcal. It is also expressed that 51% of the respondents has the dietary diverse score of 4-6, making them to fall in the category of medium dietary diverse household that consumed up to 2421 kcal of dietary energy consumption (Table 2). On the final note, the high dietary diverse households are about 27% with the dietary diverse score of ≥ 7 who consumed the average of 2719 kcal of food energy consumption (Table 2). These findings are almost in line with the findings of Taruvunga *et al.* (2013) and Metu *et al.* (2016) that reported the increased minimum dietary energy requirement from 1710 kcal in 1992 to 1730 kcal in 2008. Contrarily, the results is stated to be far less than 1800 kcal (7500 KJ) regarded as average minimum daily energy requirement per person according to FAO recommendation (Hunger-FAO Portal, 2015). Metu *et al.*, (2016) further explained that the starchy food consumption has the larger portion in the current calories value with a little quantity being contributed by other food sources such as proteins, vitamins and minerals. Whereas, a minimum calorie of 1819 kcal was also recommended for daily intake per day according to the FAO, International Fund for Agricultural Development (IFAD) and World Food Programme (WFP) (2013). Thus, the dietary diverse households of this study such as the HDD category would not only be nutritionally sufficient but also affect the adequacy in energy consumption.

Table 2: Dietary Diversity and Energy Consumption

Dietary Diversity Category	Dietary Diversity Score	Food Calorie (Kcal)	Freq	Percentage
Low	≤3	1595.97	27	22.5
Medium	4-6	2420.64	61	50.8
High	≥7	2719.24	32	26.7
Mean		2245		

Source: Field Survey, 2016

This is affirmed by the mean value (2245 kcal) of food energy consumption that is affected by rural households' decision of dietary diversity, which is more than the recommended average calorie for daily intake (1800 kcal).

Factors Affecting the Dietary Diversity of Rural Households

Table 3 reveals the coefficients of explanatory variables together with their standard errors. The Chi² value is estimated as 0.31, which implies that at least one of the explanatory variables is significant to explain the variation of dietary diversity decision of respondents. The estimate of the pseudo R² (75.66%) measures the goodness of the fit of the regression model. About 75.66% of the variation in the dietary diversity is explained by the variation in the explanatory variables considered for this study. The regression result of the multinomial function fitted to the cross-section data shows that the MDD is regarded as based category. The result shows that the regression

coefficient of household head age is significantly positive at 10%. This indicated that the proportionate change of dietary diversity to the proportionate change in household age is less than unity. This implies that the 1% increase in household age explains 58% of the variation in LDD category with respect to MDD behaviour of the respondents. The regression coefficient of household income from the regression result in Table 3 is significantly negative for LDD and positive for HDD at 1% level. This indicates that the proportionate change dietary diversity of both LDD and HDD households to the proportionate change of household income is less than unity i.e. inelastic with respect to MDD. In terms of LDD households that is negatively significant, the 1% increase in income would result in 30% decrease in dietary diversity i.e. the LDD households incur less to meet dietary diversity habit no matter the increase in income of the households. Likewise, for the HDD households, 1% increase in income would lead to 32% increase in dietary diversity habit of the respondents. It is therefore, inferred that the households' income is important in compromising with dietary diversity behaviour. This finding is in conformity with Hudu (2014) who indicated that the use of household income is significant in predicting women's dietary diversity among Northern Ghanaian mothers. Also, increase in income of poorer households that makes meals more palatable have a positive effect in diversifying diet (Ruel, 2003). It is also found in Table 3 that the regression coefficient of gender for the HDD category is positively significant at 5% level. The estimate is greater than 1, showing that gender is elastic to explain dietary diversity by 1.02. This is confirming the contribution by the female households in the practice of dietary diversity.

Table 3: Factors affecting dietary diverse class of rural households

Variable	Low Dietary Diversity (LDD)			High Dietary Diversity (HDD)		
	Co-eff.	Std. error	P-value	Co-eff.	Std. error	P-value
X ₁	0.584*	0.038	0.084	-0.289	0.274	0.291
X ₂	-0.301***	0.09	0.001	0.320***	0.12	0.002
X ₃	-0.494	0.701	0.481	1.020**	0.511	0.045
X ₄	-0.393***	0.107	0	-0.043	0.104	0.681
X ₅	-0.471*	0.276	0.088	0.438**	0.211	0.038
X ₆	-0.253	0.663	0.702	-0.579	0.512	0.259
X ₇	0.04	0.241	0.867	-0.057	0.187	0.76
Constant	-3.175	1.887	0.092	-2.038	1.469	0.165
Based Category	Medium Dietary Diversity (MDD)					
Observation	120					
LR Chi ²	0.3054					
Pseudo R ²	75.66					

Source: Field Survey, 2016. Note: *, ** and *** indicates significant at 1%, 5%, and 10% level, respectively

The regression coefficient of household size is positively significant at 1% in LDD household category. This explains that the proportionate change in dietary diversity to the household size is less than unity. So the 39% decrease in dietary diversity in LDD category is influenced by 1% increase in household size. Finally, the regression coefficients of education level from both LDD and HDD regression function are negatively and positively significant, respectively. The proportionate change of dietary diversity to the education level in LDD and HDD functions is less than unity with respect to MDD category. The LDD behaviour has 47% decreases in dietary diversity caused by 1% increase in education level and the HDD has 44% increase in dietary diversity due to 1% increase in education level. The results indicate that for LDD households, the education level did not affect their dietary diversity. However, the education level become imperative factor stimulating more dietary diversity behaviour of rural households. This study is consistent with findings of Hoddinott and Yohannes (2002) while Ajani (2010) reported the educational levels, household size and income to be usually associated with food intake. Likewise, the socio-economic factors such as educational level, household size and income also remain the main determinants influencing food intake, nutritional status and health (Mahdis *et al.*, 2013; Ana-Lucia *et al.*, 2014; Helen *et al.*, 2015; Ogbo *et al.*, 2015). In contrary to this study, Ogundari (2013) found that the demand for less dietary diversity with more educated household head and household relied on home produced food.

Effect of Dietary Diversity on Dietary Calorie Consumption

Table 4 shows the result from ANOVA test and HSD or Turkey test, which reveals the effect of dietary diversity on dietary calorie consumption and compare the mean difference of dietary calorie in the pair of the dietary diverse category. The estimated F-value of ANOVA test (183.15) makes the null hypothesis being rejected (Table 4).

Table 4: Mean Difference Comparison of Dietary Calorie (kcal)

Matching Dietary Diversity Class	Mean Diff of Dietary Calorie	Std. Error	p-value
High – Medium	298.59	50.84	0
High – Low	1123.27	60.86	0
Medium – Low	824.68	53.84	0
F-value	183.15		

Significant Level = 5%

This concludes that the dietary diversity habit of respondents affects their dietary calorie consumption. Due to the rejection of our null-hypothesis, a mean difference of dietary calorie consumption for difference dietary diverse categories was compared using Turkey Test. It is revealed in Table 4 that for each pair of dietary diverse category compared, there is a significant difference in the dietary calorie consumption of respondents. Moreso, the mean difference of the dietary calorie consumption, while matching high with medium dietary diversity, is significant at 5% with approximately 299 kcal. In the matching of high with low dietary diversity class, the mean difference of dietary calorie consumption is widely reported up with 1123 kcal. This calorie disparity is reflected in indicator of complementary feeding such that the minimum acceptable diet is worsened and ineffective as the minimum dietary diversity fail to meet the nutrition requirements (Ogbo *et al.*, 2015). Also, Table 4 further shows that there exists a pair of medium to low dietary diverse categories having a significant mean difference of dietary calorie consumption with 825 kcal. From the mean difference estimates in the three categories, this study inferred that the more the rural households imbibe in the dietary diverse behaviour, the more their dietary calorie intake. This result is proving the authenticity of the study of Metu *et al.* (2016) that while aiming to achieve the sustainable food security in Nigeria through diet diversification, the calorie value cannot be attributed to only carbohydrate sources as earlier perceived to other food class.

CONCLUSION AND RECOMMENDATIONS

The study found that income, gender, education level and age are significant variables with respect to the MDD category contributing to dietary diversity attitude of rural households. However, household size might reduce the dietary diversity ability of the households. The study also revealed the F-value of 183.15 showing the significant relationship between the dietary diversity behaviour and dietary calorie consumption. The dietary diversity not only influences the health-enhancing nutrition but also influence the dietary energy consumption by at least 2245 kcal, which is above the daily-recommended calorie intake (1800 kcal). Thus, the dietary diversity behaviour would affect the popular impression of households going for quantity rather than quality in food consumption and this disturbed the health-enhanced feeding of rural households. Based on these findings, the following recommendations are suggested:

- Enlightenment campaigns through the community-based programme should be improved with the mandate of strengthening family planning programme among rural households and hence, ease food variety consumption.

- In order to reduce burden due to income constraint, food-aids intervention should be created to help the rural households to have improved health by diet diversification.

- The extension of nutrition education by health professionals, school teachers and other nutrition counselling experts using media nutrition programmes, pamphlet distribution and posters providing the right dietary combination that can promote health as well as calorie intake is required.

REFERENCES

- Ajani, S.R., (2010). An assessment of dietary diversity in six Nigerian States, *African Journal of Biomedical Resources* 13:161-167.
- Akpenpuun, T. D. and Busari, R. A. (2013) Impact of climate on tuber crops yield in Kwara State, Nigeria. *American International Journal of Contemporary Research* 3 (10): 52-57.
- Ana-Lucia M., Pedro M., Fred P., Pasca B., and Silvia S. (2014). Socioeconomic determinants of dietary patterns in low and middle-income countries: A systematic review. *American Journal of Clinical Nutrition* 100: 1520-1531.
- Arimond, M., Wiesmann, D., Becquey, E., Carriquiry, A., Daniels, M., Deitchler, M., Fanou-Fogny, N., Kennedy, G., Martin-Prevel, Y. and Torheim, L. E. (2010). Simple food group diversity indicators predict micronutrient adequacy of women's diets in 5 diverse, resource-poor settings. *Journal of Nutrition* 140 (11): 2079-2093.
- Azadbakht, L., Mirmiran, P. and Azizi, F. (2005). Dietary diversity Score is favorably associated with the metabolic syndrome in Tehranian adults. *International Journal of Obesity* 29 (11):1361 – 1367.
- Bernal, R.J. and Lorenzana, A.P. (2003), Dietary diversity and associated factors among beneficiaries of 77 child care Centers: Central Regional, Venezuela. *Archivos Latinoamericanos de Nutricion* 53:52-81.
- Food Agriculture Organization (FAO) (2007), Guidelines for measuring household and individual dietary diversity, Nutrition and Consumer Protection Division with support from the EC/FAO Food Security Information for Action Programme and the Food and Nutrition Technical Assistance (FANTA) Project, Rome, Italy.
- FAO, IFAD and WFP,—The state of food insecurity in the world: The multiple dimensions of food security, 2013, Rome, FAO.
- FAO., (2014). Introducing the Minimum Dietary Diversity–Women (MDD-W) Global Dietary Diversity Indicator for Women Washington, DC, July 15–16. Retrieved from http://www.fantaproject.org/sites/default/files/resouces/Introduce-MDD-W-indicator-brief-Sep2014_0.pdf.
- Federal Ministry of Health FMOH., (2014). National Strategic Plan of Action for Nutrition (2014-2019). Retrieved from <http://www.health.gov.ng/doc/NSPAN.pdf>.
- Gatahun E.A. and Abyu D.M., (2015) Dietary diversity feeding practice and determinants among children aged 6-23 months in Kemba-Woreda, Southern Ethiopia implication for public health intervention. *Journal of Nutrition and Food Science* S13: S13003. doi: 10.4172/2155-9600.1000S13003
- Helen H., Kishwar A., Abdul K., Sanjit S., Badrun N., Munir H., Leila Y., Anthony C., and Edward F. (2015). Socio-economic determinants of household food security and women's dietary diversity in Rural Bangladesh: A cross-sectional study. *Journal of Health Population and Nutrition* 33:2-12.
- Hoddinott, J. and Yohannes, Y. (2002). Dietary diversity as a food security indicator. Food Consumption and Nutrition Division Discussion Paper No. 136. International Food Policy Research Institute, Washington, D.C. In Kennedy, G. L., Pedro, M. R., Seghieri, C., Nantel, G. and Brouwer, I. (2007). Dietary diversity score is a useful indicator of micronutrient intake in non-breast-feeding Filipino children. *Journal of Nutrition* 137: 472–477.
- Hudu Z. and Dujin B. L. (2014). Socio-Economic determinants of dietary diversity among women of child bearing ages in Northern Ghana. *Food Science and Quality Management* 34:12-25.
- Hunger - FAO - Food and Agriculture Organization of the United Nations Portal (2015). The State of Food Insecurity in the World 2015 in Wikipedia's (2017). List of countries food energy intake https://en.wikipedia.org/wiki/List_of_countries_by_food_energy_intake.
- Kennedy, G. L., Pedro, M. R., Seghieri, C., Nantel, G. and Brouwer, I. (2007). Dietary diversity score is a useful indicator of micronutrient intake in non-breast-feeding Filipino children. *Journal of Nutrition* 137: 472–477.
- Kennedy, Gina, Nadia Fanou, Chiara Seghieri and Inge D. Brouwer (2009). Dietary Diversity as a Measure of the Micronutrient Adequacy of Women's Diets: Results from Bamako, Mali Site. Washington, DC: Food and Nutrition Technical Assistance II Project, FHI 360.
- Kwara State Agricultural Development Project (KWADP) Agronomic Survey Report for the year 1996.
- Labadarios, D., Steyn, N. P. and Nel, J. (2011). How diverse is the diet of adult South Africans South Africa?. *Journal of Nutrition* 10:33.
- Lartey, A. (2004), Maternal and Child nutrition in Sub-Saharan Africa: Challenges and Interventions, *The Proceedings of the Nutrition Society* 67(1):105-108.

- Mahdis V., Parvin A., Mehrdad S., and Mostafa H. (2013). Dietary diversity and its related factors among adolescents: A survey in Ahvaz-Iran. *Global Journal of Health Science* 5(2):181-186.
- Metu A.G., Okeyika K.O. and Maduka O.D. (2016). Achieving sustainable food security in Nigeria: Challenges and way forward. 3rd International Conference on African Development Issues (CU-ICADI 2016). Retrieved from <http://eprints.covenantuniversity.edu.ng/6653/1/icadi16pp182-187.pdf>.
- Mirmiran, P. and Azadbakht, L. (2004). Dietary diversity among food groups: an indicator of specific nutrient adequacy in Tehranian women. *Journal of the American College of Nutrition* 25: 354-361.
- National Population Commission, (2006). Estimated population figure, National Population Commission of Nigeria, Abuja.
- Ogbo, F. A. Andrew P., Idoko, J., Claudio F., and Agho K. E., (2015). Trends in complementary feeding indicators in Nigeria, 2003–2013. *Bio Medical Journal BMJ* 5 (10): 9-15.
- Ogundari K. (2013). 48-Determinants of the food-poverty states and the demand for dietary diversity in Nigeria. Contributed paper prepared for presentation at the 4th International Conference of the African Association of Agricultural Economist (AAAE), Cape-Town, Hammamet, Tunisia, 20-25 September, 2013. Retrieved from ageconsearch.umn.edu/bitstream/16302/2/kolawoleOgundari.pdf.
- Oldewage-Theron, W. and Kruger, R. (2008). Food variety and dietary diversity as indicators of the dietary adequacy and health status of an elderly population in Sharpeville, South Africa. *Journal of Nutrition* 27(1-2): 101-133.
- Popkin, B. M. (1996). A comparison of dietary trends among racial and socioeconomic groups in the United States. *England Journal of Medicine* 335:716-720.
- Ruel, M. T. (2003). Is dietary diversity an indicator of food security or dietary quality? A review of measurement issues and research needs. *Food and Nutrition Bulletin* 24: 231–232.
- Savy, M., Martin-Prevel, Y., Sawadogo P, Kameli Y, and Delpeuch F. (2005). Use of variety/diversity scores for dietary quality measurement: relation with nutritional status of women in a rural area in Burkina Faso. *European Journal of Clinical Nutrition* 59 (5):703-716.
- Steyn, N.P., Nel, J. H., Nantel, G., Kennedy, G. and Labadarios, D. (2006). Food variety and dietary diversity scores in children: are they good indicators of dietary adequacy? *Public Health Nutrition* 9 (5): 644-650.
- Taruvunga, A., Muchenje, V. and Mushunje, A. (2013), Determinants of rural household dietary diversity: The case of Amatole and Nyandeni districts, South Africa. *International Journal of Development and Sustainability* 2(4): 2233-2247.
- Thompson O.O. (2005). Essentials of Design and Analysis of Experiment. Published by Jehovah Lovelink Press, 31 Odi-olowo street Osogbo Osun State Nigeria. ISBN: 978-37990-4-5.
- World Bank (2013). World Development Report 2013: Jobs. Washington, DC; World Bank DOI: 10.1596/978-0-8213-9575-2.
