

## **ANALYSIS OF FOOD SAFETY PRACTICES AND DIETARY DIVERSITY AMONG FARMING HOUSEHOLDS IN DEKINA LOCAL GOVERNMENT AREA OF KOGI STATE, NIGERIA**

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### **ABSTRACT**

*The study analysed the food safety practices and dietary diversity among farming households in Dekina Local Government Area, Kogi State of Nigeria. The three major districts (Okura, Dekina and Biraidu) in Dekina LGA Kogi State of Nigeria were chosen. A multistage random sampling was used in selecting 120 farmers' respondents and data were obtained with the aid of a well-structured questionnaire and interview schedule. The data obtained were analyzed using simple descriptive statistics, mean score from likert type of scale, dietary diversity score and multinomial logistic regression model. Result from the finding showed a mean age of 44 years. The food safety knowledge of the respondent showed mean score of 3.1 this implied that respondents prefer cleaning kitchen with bleach agent. The dietary diversity category of the food groups, were analyzed with the use of dietary diversity score, which revealed that 5.8% of the respondents with a score of  $\leq 4$  fall into low dietary diverse households. It is also expressed that 41.7% of the respondents has the dietary diverse score of 5-7, making them to fall in the category of medium dietary diverse household of dietary foods consumption. Also, the high dietary diverse households are 52.5% with the dietary diverse score of  $\geq 8$  of food consumption. With reference to low and medium dietary diversity category, gender is the socioeconomic factors that are positively significant at  $p < 1.5$  and  $p < 0.00$  respectively, to explain the dietary diversity attitude of the respondents. The findings of the study suggested that enlightenment campaigns on food safety and nutrition education could be strengthened to provide the recommendable dietary formula and food safety practices that improve human health status in Dekina Local Government Area, Kogi State of Nigeria.*

**Key words:** Food, Safety, Practices, Dietary, Diversity, Farming households

### **1. INTRODUCTION**

Food security is a situation in which all household members have both economic and physical access to enough, safe and nutritious foods to meet their needs, so that they do not live in hunger or fear of starvation; food security entails three important aspects (availability, access and utilization) in the relationship between man and food, critical to ensure that nutrition plays its optimum role in human health (Ajani, 2010). Interestingly, dietary diversity has been positively linked with these three pillars of food security (Bernal *et al.*, 2003; Styen *et al.*, 2006; Hillbruner and Egan, 2008). Eating a large variety of foods, across and within major food groups has

therefore been recommended in most dietary guidelines (Jeanene *et al.*, 2006), since it is associated with a number of improved outcomes such as nutrient adequacy, anthropometric indices and improved haemoglobin concentrations (Swindale and Bilinsky, 2005). Food safety practices during food preparation, handling and storage creates the conditions that allows the proliferation and transmission of disease causing organisms such as bacteria, viruses and other food-borne pathogens (Fielding *et al.*, 2001).

Dietary diversity is recognized as an important contribution to the micronutrient status of individuals. Ruel (2002) noted that lack of dietary diversity is a challenge for rural communities in developing countries. Their diets are by default defined on starchy staples with inadequate animal products, fresh fruits and vegetables (Ruel *et al.*, 2004). However there is still very limited information on the connection between dietary diversity and food safety knowledge especially in areas where food availability is low (Ruel, 2003). Experience with the use of dietary diversity to measure dietary quality and food safety practices in such situation is scanty; food availability in Dekina L.G.A, Kogi State of Nigeria is often poor and unpredictable due to frequent change in the weather and seasonality. Several authors therefore argue that, quality of diets is directly correlated to dietary diversity and inversely related to malnutrition (Azadbakht *et al.*, 2005; Styen *et al.*, 2006).

As rightly suggested by Rashid *et al.*, (2006) a large number of studies seem to be focusing on determinants of dietary energy consumption (or dietary quantity), at the expense of dietary quality and diversity. Need therefore arises to also focus on assessment of food safety knowledge and dietary diversity given the fact that a safe diet is normally rare in rural communities from developing countries is critically important for infants and young children in terms of supply of micronutrients and safe food for physical and mental growth (Torlesse *et al.*, 2003; Pan-American Health Organization and WHO, 2003; Ruel *et al.*, 2004).

In view of the above, this study aimed to assess food safety practices and dietary diversity among farming households in Dekina Local Government Area of Kogi State, Nigeria; the specific objectives of this study are to:

- i. describe the socioeconomics characteristic of farming household in the study area;
- ii. identify the food safety practices among farming households in the study area;
- iii. ascertain food safety knowledge of farming household in the study area;
- iv. examine the dietary diversity of farming household in the study area;
- v. determine the factors that affect the dietary diversity category among farming households in the study area.

## **2. METHODOLOGY**

The study was carried out in Dekina Local Government Area of Kogi State, Nigeria. It comprises of three districts; Dekina, Biraidu and Okura constituting of twelve electoral wards, namely; Dekina, Abocho, Anyigba, Odu 1, Odu 2, Egume, Okura, Iyale, Oganenigu, Emewe, Ojikpadala And Ogbabede.

A multistage random sampling technique was used for the study. Firstly, the three major districts (Okura, Dekina and Biraidu) were selected. Secondly, two (2) communities were randomly selected from each of the three districts, making 6 communities in total. Thirdly, twenty (20) farming households were randomly selected from each of the 6 communities. A total of 120

respondents were used for the study. The primary data for this study was obtained through the use of structured questionnaire. For the socio economic characteristics, food safety practices, food safety knowledge, dietary diversity and to determine the factors affecting dietary of farming households, descriptive and inferential statistical tools such as mean, frequency distribution tables, percentages, 4-Likert scale and multinomial logistic regression analysis were employed. Likert Scale Type of Scale.

The four point Likert type is specified as follows:

Opinion		point
Strongly agree (SA)	4	
Agree (A)		3
Disagree (D)	2	
Strongly Disagree (SD)		1

### **Dietary Diversity Score**

Household Dietary Diversity Score (HDDS) = Sum (A + B + C + ... + n)

The average household dietary diversity for the population of the study can be calculated as follows;

$$\text{Average HDD} = \frac{\text{sum (HDDS)}}{\text{Total number of Household Survey}}$$

### **Multinomial Logistic Regression Model**

This method of data analysis was used to determine the factors affecting the dietary diversity of the farming households in the study area. 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<sub>0</sub> and B<sub>i</sub> are the estimated coefficient of the parameters, i = 1 to 8

X<sub>1</sub>= Age

X<sub>2</sub> = Gender

X<sub>3</sub> = Marital status

X<sub>4</sub> = Household size

X<sub>5</sub> = Educational level

X<sub>6</sub> = Farm size

X<sub>7</sub> = Access to credit

X<sub>8</sub> = Farming experience

U<sub>t</sub>= Error term

### 3. RESULTS AND DISCUSSION

#### 3.1 Socioeconomic Characteristics of the Farming Households

**Table 1: Distribution of Respondents According to Socioeconomic Characteristics**

Socioeconomic characteristics	Frequency	Percentage	Mean
<b>Age</b>			
25-35	35	29.2	
36-45	31	25.8	
46-55	25	20.8	
56 Above	29	24.2	44.8 years
<b>Total</b>	<b>120</b>	<b>100</b>	
<b>Gender</b>			
Male	61	50.8	Male
Female	59	49.2	
<b>Total</b>	<b>120</b>	<b>100</b>	
<b>Marital status</b>			
Single	10	8.3	
Married	92	76.7	
Divorce	4	3.3	Married
Widow	6	5.0	
Widower	8	6.7	
<b>Total</b>	<b>120</b>	<b>100</b>	
<b>Household size</b>			
1-5	50	41.7	
6-10	60	50.0	
11-15	10	8.3	
16 Above	0	0.0	6.2 Members
<b>Total</b>	<b>120</b>	<b>100</b>	
<b>Educational level</b>			
No formal education	75	62.5	
Primary education	12	10.0	
Secondary education	30	25.0	No formal education
Tertiary education	3	2.5	
<b>Total</b>	<b>120</b>	<b>100</b>	
<b>Major occupation</b>			
<b>Farming experience</b>			
1-15	92	76.7	
16-30	16	13.3	
31-45	11	9.2	
46 Above	1	0.8	17.8 Years
<b>Total</b>	<b>120</b>	<b>100</b>	
<b>Farm size</b>			
0.1-2	76	63.3	
2.1-4	42	35.0	
4.1-6	2	1.7	
Above 6.1	0	0.0	2.2 Hectare
<b>Total</b>	<b>120</b>	<b>100</b>	

*Source:* Computed from Field Survey, 2019

Table 1 shows that 50.8% 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 25-35 years appeared to be prevalent having 29.2% 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 76.7% of the respondents are married. This implies that the married class of the respondents would always fuel the spirit to work and earn more proceeds in fulfilling the probable dietary diversity decision of households. More so, the household size would be undoubtedly expected to be increased with the most of the respondents being married, for instance, 50.0% of the respondents have between 6-10 households. The position of household size would not only be affecting the dietary diversity decision of rural households but also their food safety practices and knowledge. Also, 62.5% of the respondents had no formal education, indicating that the non-formal education would serve as a key constrain for the rural households not to identify and gather the appropriate foods to improve their health; results revealed that, most of the household had no formal education. Kruger *et al.* (2005) reported that, education attainment can lead to acquisition of a different lifestyle which may have either positively or negatively impact on dietary diversity and food safety knowledge.

### **3.2 Food Safety Practices among Farming Households**

The findings obtained in Table 2 shows that the respondent believe in seeking for information concerning food safety practices from health profession or health magazines and newspapers with mean score of 3.6. Respondents disclosed that information concerning food safety practice from health profession or health magazines and newspapers could serve as a means of improving their food safety practices. Food safety training will lead to an improvement in food safety if the knowledge impacted reflects a positive change in behavior (Seaman and Eves, 2006).

This findings obtained in the study area showed that respondents strongly agreed to the statement; eat food in a clean environment with the mean score of 3.3, the respondents knew quite alright that there is need to eat food in a clean environment in order to avoid food borne diseases. The research work obtained the 3.1 mean score which implies that respondents ensure that food is not exposed to personal sweat, sneezing, and coughing; as personal hygiene of household is important to good food handling practice. Household must maintain a high degree of personal cleanliness when receiving, preserving, cooking, processing, packaging, transporting or disposing of food (WHO, 2015). The people believe that food exposure to personal sweat, sneezing, and coughing could impose to food borne diseases when such food is consumed.

**Table 2: Food Safety Practice of Farming Household**

Variables	Strongly agreed(SA)	Agreed (A)	Disagreed (D)	Strongly disagreed(SD)	Mean score
Seek for information concerning food safety practices from health profession or health magazines and newspapers.	80	32	6	2	3.6
Wash hand with soap and water after using the toilet.	64	46	7	3	3.4
Access to clean water will help ensure food safety.	64	38	12	6	3.3
Separate raw food from ready-to-eat or cooked food.	36	61	11	12	3.0
Eat food in a clean environment.	61	41	12	6	3.3
Ensuring that food is not exposed to personal sweat, sneezing, and coughing.	51	48	13	8	3.1
Avoid use of the same working surface and equipment for both raw and cooked food.	36	52	20	12	2.9
Wash plate with uncontaminated clean water.	51	37	19	12	3.0
Tasting food to see if it is still good should be discouraged.	30	38	30	22	2.6
Read articles on food safety practices.	38	54	21	7	3.0
Spoilt food item should be properly disposed.	56	41	13	10	3.2
There is need to always consider the safety of food for storage.	43	56	12	9	3.1
Eat any food without washing hands.	25	17	32	46	2.2
Check expiring date of any food items before purchasing.	62	36	9	13	3.2
Taste or dish out food with hand.	20	23	44	33	2.3

**Source:** Computed from Field Survey, 2019

Respondents in the study area strongly disagreed that to eat any food without washing hands with mean score 2.2; they believe that when one eat food without washing hands, is expose to food borne diseases, that is, improper hand washing is known to be the main cause of food borne illness, household should wash their hands by applying soap and using warm water, scrubbing thoroughly, rinsing and then drying using paper towels or a drying device (Robert *et al.*, 2008). Washing hands before eating food could free them of food borne diseases.

The research found that respondents believe that taste or dish out food with hand with the mean score of 2.3 which indicates that the respondents disagreed with the item, it made it known that tasting food with hand is not hygiene and could likely lead to food borne diseases. No bare hand contact of ready-to-eat foods, households must maintain a high degree of personal cleanliness and restrain hair as necessary, U.S Food and Drug Administration (USFDA 2012).

### 3.3 Food Safety Knowledge of Farming Household

The food safety knowledge of farming households in the study area is presented in Table 3.

**Table 3: Food Safety Knowledge of Farming Household**

Variables	Strongly agreed (SA)	Agreed (A)	Disagreed (D)	Strongly disagreed (SD)	Mean score
Cook food should be thoroughly reheated when cold	64	42	9	5	3.4
Classes about home food safety can help learn more	34	72	12	2	3.2
Left over are safe to eat until they smell bad	21	29	44	26	2.4
It okay to thaw meat on the counter	23	41	39	17	2.6
Cleaning kitchen with bleach kills bacteria	45	44	25	6	3.1
Cooked food must be kept away from raw food	28	70	19	3	3.0
Infants and young children are more vulnerable to food safety threats	50	44	17	9	3.1
Diarrhea, stomach pains, typhoid fever, vomiting are symptoms of food borne diseases	46	48	20	6	3.1
I don't need to wash fruit or vegetables if am going to peel them	19	30	42	29	2.3
Raw egg are healthy and very nutritious	35	58	20	7	3.0
Food borne illnesses are minor and temporary	24	61	26	9	2.8
Washing food (meat, seafood ) will rid them of bacteria	49	39	25	7	3.1
Pay attention to expiry date during food purchase	56	50	10	4	3.3
Food item should be well preserved especially against cockroaches, rodent, insect, etc	54	49	12	5	3.3
No touching hair, face, nose when preparing food	48	48	17	7	3.1

**Source:** Computed from Field Survey, 2019

Table 3 shows that the respondents strongly agreed that cook food should be thoroughly reheated when cold as a way of preventing food borne diseases (mean score = 3.4). Knowledge about food safety is one of the strategies aimed at preventing food borne illness. This includes knowledge about personal hygiene, cross contamination, temperature and time control, cleaning and sanitizing, glove use (USFDA 2012). The respondents also agreed that classes about home food safety can help learn more in relation to food safety knowledge of the people. Food safety training will lead to an improvement in food safety if the knowledge impacted reflects a positive change in behavior (Seaman and Eves, 2006).

Respondents in the study area agreed that it is okay to thaw meat on the counter with mean score 2.6; they believe that thawing meat on the counter would have no health effect on them when consumed. The research work obtained the 3.1 mean score which implies that respondents prefer cleaning kitchen with bleach agent as the respondents strongly agreed that the use of bleaching agent for cleaning kitchen kills bacteria. Without washing hands and kitchen tools, diseases may easily spread. Since cross- contamination is a major cause of food poisoning and can transfer bacteria from one food item to other foods, it is crucial to be aware of how it spreads so as to know how to prevent it (WHO, 2010).

The findings obtained shows that respondents believed that diarrhea, stomach pains, typhoid fever, vomiting are symptoms of food borne diseases with mean score of 3.1, which implies that the respondents strongly agreed to it that diarrhea, stomach pains, typhoid fever, vomiting are symptoms of food borne diseases. The mean score of 2.3, indicate that the respondents don't need to wash fruit or vegetables if there are going to peel them, this finding disagreed that fruit or vegetables need not to be was before peeling. Globally, much of the known burden of food borne disease comes from consumption of fresh, perishable foods sold in informal markets of developing countries, where a lack of storage, washing and cooling facilities can jeopardize food safety (Roesel *et al*, Grace, *et al* 2015).

The respondents in the study area agreed that raw egg are healthy and very nutritious with the mean score of 3.0, they believe that raw egg are healthy and very nutritious when consume. The findings obtained shows that respondent believed that food item should be well preserved especially against cockroaches, rodent, insect, etc with the mean score of 3.3, which implies that the respondents strongly agreed to preserved food item especially against cockroaches, rodent, insect, respondent disclosed that preservation of food item could reduce food borne diseases. They tend to adopt the Knowledge, Attitudes, and Practices (KAP) model which has substantial limitations (Griffith, 2000).

### **3.4 Dietary Diversity of farming Households**

The proportion of households who consumed food from each food group in the previous 24 hours (Table 4) revealed that root and tuber crops, cereals, oil and fats constituted the food group consumed by most respondents with respective percentage 93.3%, 88.3% and 85.0%; furthermore sweets, legumes, flesh meats and condiment constituted the food group consumed by most respondents with respective percentages 74.2%, 68.3%, 67.5% and 54.2% households. Over 25.8% of the households in the findings consumed eggs (fried and boiled fish) whereas about 27.5% of all the households consumed milk and milk product. The research work find out that households consumed 27.5% of fruits. Over 28.3% of the households in the findings consumed fish (fresh and smoked frozen fish) whereas about 34.2% of all the households consumed vegetable. These findings are consistent with the observation that lack of diversity is a particularly severe problem among populations in the developing world where diets are based predominantly on staples and often include only a few animal products at most and only seasonal fruits and vegetables (Arimond, Ruel., 2004).

**Table 4: Percentage of Food Groups Consumed**

Food group	Frequency *	Percentage
Cereals	106	88.3
Roots And Tubers	112	93.3
Vegetables	41	34.2
Fruits	33	27.5
Flesh Meats And Organ Meat	81	67.5
Eggs	31	25.8
Fish And Seafood	34	28.3
Legumes, Nuts And Seeds	82	68.3
Milk And Milk Products	33	27.5
Oils And Fats	102	85.0
Sweets	89	74.2
Condiments, Beverages	65	54.2

**Source:** Computed from Field Survey, 2019 \* = Multiple response

These findings concur with those of other researchers that poor households subsist on monotonous staple-based diets and lack access to nutritious foods such as fruits, vegetables, animal-source foods (such as fish, meat, eggs, and dairy products), or wild foods of high nutrient content (Ruel, 2003). Lack of diversity in the diet is strongly associated with inadequate intake and risks of deficiencies of essential micronutrients such as vitamin A, iron, and zinc, International Food Policy Research Institute (IFPRI, 2011). Micronutrient deficiencies have far-reaching health and nutrition consequences in both the short and the long term (United Nations Children's Fund and Micronutrient Initiative 2004). These deficiencies affect the survival, health, development, and well-being of those afflicted. Children and women of reproductive age are especially vulnerable because they have particularly high micronutrient requirements (Black *et al.*, 2008). The limited access to nutritious food in the study area could be attributed to limited availability of nutritious foods, economic constraints and lack of knowledge and information (IFPRI, 2011).

Table 5 shows that 5.8% of the respondents with a score of  $\leq 4$  fall into low dietary diverse households. It is also expressed that 41.7% of the respondents has the dietary diverse score of 5-7, making them to fall in the category of medium dietary diverse household of dietary foods consumption. Also, the high dietary diverse households are 52.5% with the dietary diverse score of  $\geq 8$  of food consumption. These findings are almost in line with the findings of Tarvinga *et al.*, (2013) and Metu *et al.*, (2016) that reported the increased minimum dietary food requirement in 1992 to 2008. Dietary intake of more than five food groups per day, as was the case in this study indicated adequate intake of micronutrients in the body (Gina *et al.*, 2007). 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 5: Dietary Diversity Category of the food group of Farming Households**

Dietary Category	Diversity Score	Diversity	Frequency	Percentage
Low	≤ 4		7	5.8
Medium	5 – 7		50	41.7
High	≥ 8		63	52.5
<b>Total</b>			<b>120</b>	<b>100</b>

*Source:* Computed from Field Survey, 2019

### 3.5 Factors Affecting Dietary Diversity among Farming Households

Table 6 reveals the coefficients of explanatory variables together with their standard errors on factors affecting dietary diversity among farming households.

**Table 6: Factors Affecting Dietary Diversity among Farming Households**

Variable	Low Dietary Diversity (LDD)			Medium Dietary Diversity (MDD)		
	Co-eff.	Std. error	P-value	Co-eff.	Std. error	P-value
X <sub>1</sub> (Age)	0.007	0.056	0.894	-0.028	0.029	0.337
X <sub>2</sub> (Gender)	-1.649	0.676	0.015**	-1.550	0.415	0.000***
X <sub>3</sub> (M_status)	-1.180	1.053	0.262	-0.233	0.631	0.712
X <sub>4</sub> (HH_size)	0.359	0.222	0.106	0.261	0.125	0.037
X <sub>5</sub> (Edu_level)	0.616	0.992	0.535	-0.413	0.540	0.445
X <sub>6</sub> (Farm_size)	-0.430	0.447	0.336	-0.139	0.225	0.538
X <sub>7</sub> (Access_credit)	0.042	0.956	0.965	-0.666	0.526	0.206
X <sub>8</sub> (Farming_exp.)	-0.043	0.053	0.414	-0.000	0.001	0.824
Constant	-1.254	2.768	0.650	1.844	1.452	0.204
<b>Based Category</b>	High Dietary Diversity (HDD)					
Observation	120					
LR Chi <sup>2</sup> (16)	46.53					
Prob>chi <sup>2</sup>	0.0001					
Pseudo R <sup>2</sup>	0.2193					

The Chi<sup>2</sup> value is estimated as 46.53 which imply 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 R<sup>2</sup> (21.93%) measures the goodness of fit of the regression model. About 21.93% 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 HDD is regarded as based category. The result shows that the p-value of households' gender is significantly negative at 5%. This indicated that the proportionate change of dietary diversity to the proportionate change in gender is less than unity. This implies that the 5% increase in households' gender explains 1.5% of the variation in LDD category with respect to HDD behaviour of the respondents. It is also found in Table 4.5 that the p-value of gender for the MDD category is negatively significant at 10% level. The estimate is less than 1, showing that gender is inelastic to explain dietary diversity by 0.000. This is confirming the contribution by the female households in the practice of dietary diversity.

The proportionate change of dietary diversity to the gender in LDD and MDD functions is less than unity with respect to HDD category. However, the gender becomes imperative factor stimulating more dietary diversity behaviour of rural households. This Study is consistent with findings of Hoddinott and Yohannes (2002), and Ajani (2010) when they reported that educational levels, gender, 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 in studies by (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.

#### **4. Conclusion and recommendations**

The study examined the assess food safety knowledge and dietary diversity among farming households in Dekina Local Government, Kogi State of Nigeria It can be concluded from the findings that rural households in Dekina Local Government Area of Kogi State, Nigeria consumed an average of four to five food groups the previous day. However, the diet consumed is low in dietary variety as the commonly consumed food groups were spices and condiments, oil and fat, roots and tubers, cereals and fish. Eggs, milk, meat, fruits, and vegetables were the least consumed. Consequently, access to food safety knowledge and dietary diversity remained a challenge in the region. Based on the research findings, it is recommended that;

1. Workshops and seminars should be organized to update the stake holders with relevant information to enable them to update households' knowledge from time to time.
2. Dietary diversity, diet quality and healthy eating practices need to be given first priority in the community.
3. Farming households should be encouraged to eat healthier and nutrient dense foods from different food groups such as fruits, vegetables, and or non-refined grains (complex carbohydrate)
4. Food aids intervention should be created to help the rural households to have improved health by diet diversification.

#### **REFERENCES**

- Ajani, S.R. (2010), "An Assessment of Dietary Diversity in Six Nigerian States", *Afr. J. Biomed. Res*, Vol. 13, pp. 161 -167.
- 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, Ruel MT., (2004). Dietary diversity is associated with child nutritional status:Evidence from 11 demographic and health surveys. *J. Nutr.* 2004;134:2579-2585.

- 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*, Vol. 29 No. 11, pp. 1361 – 7.
- Bernal, R.J. and Lorenzana, A.P. (2003), “Dietary diversity and associated factors among beneficiaries of 77 child care Centers: Central Regional”, *Venezuela*, Vol. 53, pp. 52-81.
- Black RE, Allen LH, Bhuttam ZA, Caulfield LE, De Onis M, Ezatti M. (2008). Maternal and child undernutrition: Global and regional exposures and health consequences. *Lancet*. 2008;371:243 260.
- Egan, M.B., Raats, M.M., Grubb, S.M., Eves A., Eves A., Lumbers, M.L.,and Dean M.S., (2007). A review of food safety and hygiene training studies in the commercial sector. *Food Control* (18):1180-90.
- Fielding J. E, Aguirre. A and Palaiologos .E (2001). Effectiveness of altered incentives in a food safety inspection program.2001;32(3):239–244.doi:10.1006/pmed.2000.0796. [[PubMed](#)][[CrossRef](#)][[Google Scholar](#)].
- Gana, L., Regina, P. M., Chiara S. C., Nante, G. and Inge, B. I. (2007). Dietary Diversity Score Is a Useful Indicator of Micronutrient Intake in Non-Breast-Feeding Filipino Children. *American Society for Nutrition. Journal of Nutrition* 137 (2): 472 – 477.
- Grace, D., Food Safety in Low and Middle Income countries. *International Journal of Environmental Research and Public Health*, 2015. 12(9):10490-10507.
- 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.
- Hillbrunner, C. and Egan, R., (2008), “Seasonality, Household food Security and nutritional Status in Dinajpur, Bangladesh”, *Food and Nutrition Bulletin*, Vol. 29 No. 3, pp. 221-31.
- Hoddinott, J. and Yohannes, Y. (2002). Dietary diversity as a food security indicator.FANTA 2002, Washington DC. (available at <http://www.aed.org/Health/upload/dietarydiversity.pdf>).
- IFPRI/ World Bank (2011) *From Agriculture to Nutrition: Pathways, Synergies and Outcomes*. Washington DC: Agriculture and Rural Development Department, The World Bank.

- Jeanene, J., Fogli, C., Johanna, T.D., Edward, S., Marjorie, L.M., Lisa, M.T. and Paul, F.J. (2006), "The 2005 dietary guidelines for Americans Adherence Index: Development and Application", *Journal of Nutrition*, Vol. 136, pp. 2908-2915.
- Kruger, H. S., Puoane, T., Senekal, M. and van der Merwe, M. T. (2005). Obesity in South Africa: challenges for government and health professionals. *Public Health Nutrition* 8(5): 491-500.
- 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(CUICADI 2016)*. Retrieved from [http://eprints.covenantuniversity.edu.ng/6653/1/icadi\\_16pp182-187.pdf](http://eprints.covenantuniversity.edu.ng/6653/1/icadi_16pp182-187.pdf).
- 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 Economists (AAAE), Cape-Town, Hammamet, Tunisia, 20-25 September, 2013. Retrieved from [ageconsearch.umn.edu/bitstream/16302/2kolawole Ogundari.pdf](http://ageconsearch.umn.edu/bitstream/16302/2kolawole%20Ogundari.pdf).
- Pan-American Health Organization and WHO. (2003), "Guiding principles for complementary feeding of the breastfed child", Washington, DC: PAHO/WHO; 2003.
- Rashid, D.A., Smith, L and Rahman, T. (2006), "Determinants of dietary quality: evidence from Bangladesh", American Agricultural Economics Association Annual Meeting; 2006 July 23–26; Long Beach, CA, available at: <http://ageconsearch.umn.edu/bitstream/21326/1/sp06ra11.pdf> (accessed April 2013).
- Robert, K; R; B; B, Barret, A.D., Howels A.D., Chanklin, C.W., Pilling, V., and Brannon, L.A. (2008). Food Safety training and food service employees' knowledge and behavior food prof. *Trends* 28:252 – 260.
- Roesel, K., Grace, D., (eds). Food safety and informal markets- animal products in sub-Saharan Africa. 2015. Routledge Taylor and Francis Group, earthscan from Routledge, ILRI.

- Ruel, M. (2002). "Is Dietary Diversity as Indicator of Food Security or Dietary Quality? A review of measurement and research needs", FCND Discussion Paper No. 140. *International Food Policy Research Institute, Washington D.C.*
- Ruel, M., Minot, N. and Smith, L. (2004), "Patterns and determinants of fruit and vegetable demand in developing countries: a multi-country comparison", Paper prepared for the Joint WHO/FAO Workshop on Fruit and Vegetables for Health. Kobe, Japan, September 1-3, 2004.
- Ruel, M.T. (2003) Is dietary diversity an indicator of food security or dietary quality? A review of measurements issues and research needs. *Food and Nutrition Bulletin* 24: 231-234.
- Seaman, P., and Eves, A. (2006). Perceptions of hygiene training amongst food handlers, managers and training providers - A qualitative study. *Food Control*, July, 21(7), 10371041. Guildford Surrey: School of Management, University of Surrey.
- Styen, 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*, Vol. 9 No. 5, pp. 644-50.
- Swindale, A. and Bilinsky, P. (2005), "Household Dietary diversity Score (HDDS) for Measurement of Household food Access: Indicator Guide, Food and Nutrition Technical Assistance", *The Journal of Nutrition*, Vol. 138 No. 12, pp. 2448-53.
- 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.
- Torlesse, H., Kiess, L. and Bloem, M.W. (2003), "Association of household rice expenditure with child nutritional status indicates a role for macroeconomic food policy in combating malnutrition", *J Nutr*, Vol. 133, pp. 1320-5.
- U.S Food and Drug Administration (FDA). (2012). Safe Food Handling: What You Need to Know. Retrieved from <http://www.fda.gov/food/resourcesforyou/consumers/ucm255180.htm>.
- World Health Organization [WHO], (2010). Initiative to estimate the Global Burden of Food borne Diseases: Information and publications. Retrieved June 26, 2010, from [http://www.who.int/foodsafety/foodborne\\_disease/ferg/en/index\\_7.htm](http://www.who.int/foodsafety/foodborne_disease/ferg/en/index_7.htm)

World Health Organization [WHO], (2011). Initiative to estimate the Global Burden of Food borne Diseases: Information and publications. Retrieved June 26, 2011, from [http://www.who.int/foodsafety/foodborne disease/ferg/en/index 7.htm](http://www.who.int/foodsafety/foodborne%20disease/ferg/en/index%207.htm).

World Health Organization of the United Nations, (2013). Global Strategy on Diet, Physical Activity and Health. Part 3 Measurement. Geneva. 168pp.