ajfand SCHOLARLY, PEER REVIEWED
AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
Volume 20 No. 5 September 2020
PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST
ISSN 1684 5374

Afr. J. Food Agric. Nutr. Dev. 2020; 20(5): 16325-16342 https://doi.org/10.18697/ajfand.93.19065

FACTORS INFLUENCING FOOD CONSUMPTION DIVERSITY AMONG FARMING HOUSEHOLDS IN SELECTED STATES IN SOUTHWESTERN NIGERIA

Egbetokun OA[1]* and GCG Fraser[1]

Olugbenga Egbetokun

*Corresponding author email: o.egbetokun@ru.ac.za

[1]I. A. R. & T., O.A.U., Ibadan and a Postdoctoral Research Fellow, Department of Economics and Economic History, Rhodes University, Grahamstown, South Africa

ajfand SCHOLARLY, PEER REVIEWED
AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
Volume 20 No. 5 September 2020
PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST
ISSN 1684 5374

ABSTRACT

The dietary practices of households have significant repercussions on the quality of life of its members. Dietary practice generally shows the types and variety of food intake and is extremely reliant on the socio-demographic characteristics. Dietary diversity has been positively associated with the four pillars of food security and all dietary guidelines propose consuming a large variety of foods, across and within major food groups. This paper focuses on the influence of socioeconomic factors on household-level food consumption diversity (FCD) in Nigeria. Since the majority of Nigerians (70 per cent) live in rural areas, an analysis of the food and nutrition security status of rural dwellers will provide a clear picture of what needs to be done to assure food security. A multi-stage sampling technique was employed for the selection of respondents from a random sample of households proportionate to the size of three states in the south-western agricultural zone of Nigeria, and primary data were collected using an interview guide. The analytical tools used were descriptive statistics, inferential statistics, mean food consumption diversity index and multinomial logit regression model. The results showed that there were significant differences in the socio-economic attributes of farming households in the area of study. Also, farming households (78.9%) in the south-west had a moderate level of FCD; only 8.2% of the farming households had high FCD level and the balance only having a poor FCD. Distance to market, access to information on price, household size, income and farm size were positively and significantly influencing FCD in the study area. However, expenditure on legumes decreases the ability of households to attain higher food consumption diversity in the study area. It is recommended that government should make food markets more accessible to farmers, disseminating information on prices of food through modern systems and educate farmers on productivity through extension services in order to generate more income to achieve high FCD.

Key words: Food Groups, Consumption Diversity, Farming Household, Diversity Index, Nigeria

ajfand SCHOLARLY, PEER REVIEWED AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT Volume 20 No. 5 September 2020 PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST ISSN 1684 5374

INTRODUCTION

Undernutrition and food insecurity are major problems faced by most developing countries [1]. In Nigeria, agriculture remains the hub of the economy, providing employment for over 90 per cent of the rural dwellers, who constitute about 70 per cent of the total population. However, Nigeria is still characterized by a high reliance on food imports. Malnutrition is widespread in the entire country and rural areas are especially vulnerable to chronic food shortages, malnutrition, unbalanced nutrition, erratic food supply, poor quality foods, high food costs, and even total lack of food. This phenomenon cuts across all age groups and categories of individuals in rural areas. There is a high level of malnutrition among adults and children in rural Nigeria. The figures differ according to geopolitical zones, with 56 per cent reported in a rural area of south-west and 84.3 per cent in 3 rural communities in the northern part of Nigeria. Nationally, among children, the overall prevalence of stunting, wasting, and underweight are 42.0 per cent, 9 per cent and 25 per cent, respectively.

Inconsistent food security results in inadequate dietary intake, which leads to malnutrition [2]. Malnutrition is the most serious consequence of food insecurity. Adult malnutrition results in lower productivity on farms and in the labour market. In women, it also results in foetal malnutrition and low birth weights. Foetal and infant undernutrition leads to lower cognitive development and poor schooling performance. For school-age children, nutritional deficiencies are responsible in part for poor school enrolment, absenteeism, early dropout, and poor classroom performance with consequent losses in productivity during adulthood [1, 3]. Nigeria's economy is the largest in Africa and is well-positioned to play a leading role in the global economy [4]. Despite strong economic growth over the last decade, poverty has remained significant, with increasing inequity and regional disparities. It is estimated that 69 per cent of Nigerians live below the relative poverty line (US$1.25 per day). The problem of food and nutrition security in Nigeria has not been adequately and critically analysed, despite various approaches to addressing the challenge. Since the majority of Nigerians (70 per cent) live in rural areas, an analysis of the food and nutrition security status of rural dwellers will provide a clear picture of what needs to be done to assure food security in Nigeria, with the attendant improvements in nutrition status when all the other necessary conditions, such as adequate health and care, are present.

Most people in rural areas are dependent on staple foods with little diversity, which increases the risk of insufficient intake of micronutrients [1]. The dietary practices of households in various communities have significant repercussions on the quality of life of its members. Dietary practice generally shows the types, variety and quality of food intake and is extremely reliant on the socio-demographic characteristics of the population in question. Knowledge of the individual food items consumed by a household, frequency of intake and their nutrient content helps to make general evaluations of the dietary practices of that household. Dietary diversity is one of the most frequently used indicators for the purposeful assessment of healthy dietary practices. Dietary diversity refers to a simple count of food groups that a household or an individual has consumed over the preceding period, usually 24 hours. Dietary diversity can be measured at the household or individual levels. At the household level, dietary diversity is generally

regarded as a measure of access to food, such as capability of a household to obtain an adequate quality and quantity of food to meet all household members' nutritional requirements for productive lives. At the individual level, it mirrors dietary quality, generally the micronutrient sufficiency of a diet [5]. Food security involves four important aspects of accessibility, availability, utilization and stability in the interaction between people and food, which is essential to ensure nutrients play their important role in maintaining a healthy human body. Dietary diversity has been positively associated with these four pillars of food security [6, 7]. Nearly all dietary guidelines propose consuming a large variety of foods, across and within major food groups [8, 9].

This is because it is linked with increased energy and nutrient intake, thus various improved health results including nutrient adequacy and anthropometric indices [10, 11]. Therefore, obtaining information about the household food consumption diversity in populations can serve as a simple but useful indicator of assessing household food security [6, 7, 12, 13]. The food consumption diversity of people in a region is determined by a variety of factors including past consumption behaviour of the community, traditional habits and the extent of technology-related with food production, processing, preparation and storage [14], season in question [15], agricultural biodiversity in the region and diversity of its farming systems [16], economic status of the population [17] and socio-demographic characteristics of households as well as availability and accessibility of services such as water supply and health [18, 19, 20, 21]. Therefore, in order to be healthy and active, rural dwellers need to have food in adequate quantity, quality and variety in order to meet recommended energy and nutrient requirements [22]. Variety in the diet implied choosing several different foods within any given food group, rather than eating the "same old thing" day after day [3]. This study aimed to examine determinants of household food consumption diversity in rural areas in the south-western geopolitical zone of Nigeria, with the objective of investigating the differences in food consumption diversity categories and a range of socio-demographic and economic factors that influence the consumption diversity practices. This is to provide reliable information to establish suitable intervention strategies and suggestions for actions aimed at improving consumption patterns and nutritional status of rural populations. The paper hypothesises that there are no differences in food consumption diversity among household socio-economic variables in the zone.

This research is based on the understanding that food and nutrition insecurity are major problems in developing countries. The framework focuses on the hypothesis of the causes and consequences of malnutrition [23], which informs the repercussion of current dietary patterns and nutrient intake on nutritional status. Nutritional status of household members may be predisposed by inadequate food consumption diversity. Nevertheless, household food consumption diversity apart from the fact that it can be used to assess household food security status, is influenced by other factors such as income, the area under cultivation and number of people in the household, food availability and accessibility, which may lead to monotonous food consumption. These factors may be further affected by individual factors such as age, gender and education level of the household head, to mention a few. The framework reflects on these associations as probable causes influencing food consumption diversity and, thus, household food security.

ajfand SCHOLARLY, PEER REVIEWED
AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
Volume 20 No. 5 September 2020
PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST
ISSN 1684 5374

RESEARCH METHODS

South-western Nigeria represents an agricultural zone spreading between Lat. 5^{o} and 9^{o} N and has a land area of 114,271 km^{2} representing 12% of the country's landmass. The agricultural south-western Nigeria zone comprises of 8 states, namely Delta, Edo, Ekiti, Lagos, Ogun, Ondo, Osun, and Oyo (State Agricultural Zones) (Agricultural Research Council of Nigeria (www.arcnigeria.org) [24]. It has a total estimated population of 27,581,992 [25]. The zone is characterized by a typical equatorial climate with distinct dry and wet seasons. The main growing season lasts up to 9 months with two peaks of rainfall in July and September. Rainfall ranges between 1200 mm in the northern areas of Ondo, Oyo and Osun states to nearly 2600 mm in the coastal areas of Lagos and Ogun states. Average zonal rainfall is 1480 mm with a monthly temperature range of 18-24^{o}C during the rainy season and 30-35^{o}C during the dry season.

Sampling technique

Multi-stage sampling was used in the selection of respondents in the study area. The first stage was the selection of three states using a random sampling technique, the second and last stages involved the use of proportionate sampling to arrive at the total sample used for the study.

The total sample size of respondents interviewed is given by proportion sample formula **[26]**:

$$S_{total} = \frac{N}{1+N(e^2)} \quad \text{.. (1)}$$

Where:
S_{total} = Total sample size of all respondents
N = Total population of farming household in the Southwest Agricultural Zone
e = Level of significance (Confidence Interval that is 95%)
The total farming household in south-western Nigeria is estimated as 1,788,384 [24]. Assuming a 95% confidence interval, equation (13) gives a total sample size of 400 for the study that is

$$\frac{1{,}788{,}384}{1+1{,}788{,}384(0.05)^2} = 400 \quad \text{.. (2)}$$

The sample size in each of the States is, however, determined by probability proportional to size given by

$$S_{state} = \frac{P_i}{P_t} n \quad \text{..(3)}$$

Where:
S_{State} = Sample size for a state *i*

ajfand SCHOLARLY, PEER REVIEWED AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT Volume 20 No. 5 September 2020 PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST ISSN 1684 5374

P_i = Population of farming households in State *i*

P_t = Total population of farming households in the selected states

n = the total sample size for the Study obtained above.

However, a total of 342 respondents (85.5%) with appropriate information were found useful for analysis.

Primary data were used for this study, which was collected using a structured questionnaire. The major food items consumed in Nigeria include maize, rice, beans, cassava, yam, plantain, vegetable/oil and meat/fish. However, information on the number of different food groups consumed was gathered rather than the number of different foods. Knowing that households consume, for example, an average of four different food groups implies that their diets offer some diversity in both macro and micronutrients. This is a more meaningful indicator than knowing that households consume four different foods, which might all be cereals. The U.N. Food and Agriculture Organization (FAO) classification, was adapted and the modified classification was used in the study (Table 1) [1, 27].

The analytical tools used were descriptive statistics, multinomial logit regression model and the mean food consumption diversity index. Descriptive statistics such as percentage and frequency were used to describe the household food consumption diversity. Mean food consumption diversity index was determined while multinomial logit regression was used to identify factors that determine food consumption diversity (FCD) levels of the households.

Dietary diversity strata

Cut-off points for measuring FCD were defined by creating strata [11, 28]. Relying on 6 food groups, FCD strata were made to establish the fraction of participating households as high, medium and low.

The mean FCD index is given as:

$$\text{Mean FCD index} = \frac{\sum_{1}^{j} dietary\ diversity\ scores}{Total\ food\ group\ (6)\ x\ Total\ number\ of\ households} \quad \ldots\ldots (4)$$

Dietary diversity score was measured as the total number of any items of the food groups consumed (assign 1 for consumed and 0 otherwise). This gives the score for each household; the scores are then divided by product of total food groups (6) and the number of members of the household to give the mean diversity index. The cut-off point could then be used to categorize FCD into thresholds [11, 28]. An increase in the average number of different food groups consumed provides a quantifiable measure of improved household food access. In general, any increase in household FCD reflects an improvement in the household's diet [11]. The food consumption diversity (FCD) mean index generated (0.58±0.06) was used to categorize the threshold of households having values between 0.1 – 0.50 as low FCD group, 0.51 – 0.64 as moderate FCD group and

0.65 – 1.0 as the high FCD group [11, 28]. This transformation was then computed into the multinomial regression model.

Multinomial Logit Regression Model

This model was used to determine the factors influencing farming households falling into different FCD statuses. A multinomial logit regression model is a form of regression model that is used when the dependent variable (regressand) is polychotomous and the independents (regressors) are of any type [29]. The advantage of multinomial logit is that it permits the analysis of decisions across more than two categories – allowing the determination of choice probabilities for different categories of FCD. Apart from the well-known drawbacks of Independence of Irrelevant Alternatives (IIA), this approach is more appropriate than the probit or logit models that have been conventionally used. Instead of having two dichotomous alternatives (0, 1) as in the multivariate logit or probit models, the multinomial logit has S possible states or categories – that is s = 1, 2, 3 ...S. [30]. In this analysis, the three categories that were considered are:

1. Households with high FCD (0.65 – 1.0)
2. Households with moderate FCD (0.51 – 0.64)
3. Households with low FCD (0.10 – 0.50)

Since the multinomial logit model does not treat these categories in any continuous order, it is different from ordered or sequential logit/probit models **[31]**. If there is a random sample of farmers, I = 1, 2, 3…N. Given three choice categories, s = 1, 2, 3, the multinomial logit model assigns probabilities P_{is} to events characterized as "ith household sth category". The vector of the characteristics of the household is denoted by z. To estimate this model there is a need to normalize in one category, which is referred to as the "reference state". The choice of base category (or reference state) is the best desirable among the household decisions in policy circles [32, 33]. Based on this, the reference state chosen for this study is the "household with high FCD" option that is the best desirable option.

The model can be specified as:

$$Y_0 = P_0 = \alpha_0 + \beta_{01}X_{01} + \beta_{02}X_{02} + \beta_{0n}X_{0n} + e_i \ldots\ldots\ldots\ldots\ldots\ldots(5)$$

$$Y_1 = P_1 = \alpha_1 + \beta_{11}X_{11} + \beta_{12}X_{12} + \beta_{1n}X_{1n} + e_i \ldots\ldots\ldots\ldots\ldots\ldots(6)$$

$$Y_2 = P_2 = \alpha_2 + \beta_{21}X_{21} + \beta_{22}X_{22} + \beta_{2n}X_{2n} + e_i \ldots\ldots\ldots\ldots\ldots\ldots(7)$$

The dependent variable Y is the household FCD status, which is 0 when the household is having high food diversity, 1 when food diversity is moderate and 2 when food diversity is low. The P_0, P_1 and P_2 represent the probability of having high, moderate and low food diversity respectively, which is discriminated by FCD index.

$X_1 \ldots X_n$ represent a vector of the explanatory variables, $\beta_1 \ldots \beta_n$ represent the parameter coefficients, e_i represents the independently distributed error term and $\alpha_o, \alpha_1, \alpha_2$ show the constant terms.

ajfand SCHOLARLY, PEER REVIEWED AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT Volume 20 No. 5 September 2020 PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST ISSN 1684 5374

The P_0 is the base with respect to other categories leading to

$$Log\frac{P_1}{P_0}=\alpha_{01}+\beta_{01}X_{01}+\ldots\ldots\ldots\ldots+\beta_nX_n+e_1\ldots\ldots\ldots\ldots\ldots(8)$$

$$Log\frac{P_2}{P_0}=\alpha_{02}+\beta_{02}X_{02}+\ldots\ldots\ldots\ldots+\beta_nX_n+e_1\ldots\ldots\ldots\ldots\ldots(9)$$

An iterative maximum likelihood algorithm was used to estimate the empirical models in order to obtain asymptotically efficient parameter estimates [34]. The log-likelihood function for the multinomial logit model is

$$1nL=\sum_i\sum_j d_{ij}InP_{ij}\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(10)$$

Where P_{ij} is the probability

$X_1\ldots.X_n$ are market and household characteristics

Variance Inflation Factor (VIF) was used to test for the presence of multi-collinearity. The test showed that there was no variable, except farm income, with a value higher than 10, which confirms the absence of multi-collinearity.

Market characteristics

X_1= distance of farm to the nearest market (km)
X_2 = access to price information (dummy: 1 if yes and 0 otherwise)
X_3 = access to information on product demand (dummy: 1 if yes and 0 otherwise)
X_4 = access to information on product availability (dummy: 1 if yes and 0 otherwise)

Household characteristics

X_5 = household size (number)
X_6 = sex of the household head (dummy: 1 if male and 0 otherwise)
X_7 = years of formal education of the household head (years)
X_8= marital status of the household head (Single=1, Married=2, Widow(er) =3, Divorced/Separated= 4)
X_9= farming experience of the household head (years)
X_{10} = age of the household head (years)
X_{11} = total income in a cropping season (naira)
X_{12} = farming income in a cropping season (naira)
X_{13} = farm size (ha)
X_{14} = share of expenditure on root and tuber
X_{15} = share of expenditure on cereals
X_{16} = share of expenditure on legumes
X_{17} = share of expenditure on fruits and vegetable
X_{18} = share of expenditure on fat and oil
X_{19} = access to extension agents (dummy: 1 if yes and 0 otherwise)

ajfand SCHOLARLY, PEER REVIEWED AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT Volume 20 No. 5 September 2020 PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST ISSN 1684 5374

RESULTS AND DISCUSSION

Socioeconomic characteristics and level of food consumption diversity

The result of the analysis of socioeconomic variables and different levels of food consumption diversity within each category are shown in Table 2. Most of the respondents were male (78.95%) and 69.01% were within the age range of 41-50 years. The average FCD of male-headed households was shown to be significantly higher ($p<0.01$) than that of the female-headed households. Household size was large, as 77% of the farmers had an average of 7 persons in their household. Nearly half the respondents in the study had a low level of education (52.63%) of which 38.3% had primary school education while 14.33% had no education, while 31.29% had secondary school education. Farm size was small as 56.43% of the respondents had farm size between 0.5 and 1.4 hectares. However, as farm size increased, there was a significant (at 5%) increase in FCD. Many of the respondents (75.73%) had access to extension services and FCD of respondents who have access to extension services were significantly higher ($p<0.01$) compared to those of farmers who had no access to extension services. Households with only farming activities (71%) had low farm income; however, when they engaged in some non-farm activities the total income increased, thereby having an impact on the FCD of the household. More than 43% of the respondents travelled over four kilometres to the nearest market. This implies that food accessibility was a challenge in the study area.

Food Diversity Status of Farming Households

Majority of the farmers (78.9%) had moderate FCD in the pooled data, followed by low (12.9%) and high (8.2%), respectively (Table 3). This implies that there is still much to be done in order to make farmers food and nutritionally secure. However, Ondo state had the highest percentage (13.2%) of farming households who had high FCD, while Oyo state had the highest percentage (26.2%) of farmers with low FCD.

Factors Influencing Food Consumption Diversity among Crop Farming Households

The likelihood-ratio was significant ($p<0.01$) in the pooled results in Table 4, suggesting the existence of a relationship between food diversity status and the suggested explanatory variables. In this section, eight significant variables that explained the probability of households falling into any of the food consumption diversity categories in the study area are discussed. However, farm income was dropped when tested for multicollinearity.

The marginal effect (ME) of the distance from home to the market had a positive and significant ($p < 0.01$) impact on FCD of the farming households. This implied that if a household could afford the cost of additional distance to access food market, it would increase the probability of having high FCD from moderate and low food consumption diversity. Access to price information on the various food items was significant ($p < 0.01$). The implication is that access to information on prices of food increases the likelihood of farming households from having moderate FCD to having high FCD. Access to information on product availability was positive and significant. This means that information on the availability of food items increased the likelihood of high FCD of farming households. This finding affirms that information, on the demand side, is key

to FCD as it allows the household to access alternative markets where food not available in the immediate locality could be sourced rather than being forgone [35, 36].

Household size was positive and significant at 1% in the pooled results indicating that there was an increased likelihood of having high FCD other than having moderate and low FCD, as the size of farming households increased. This is expected as there would be more family labour supply for farm activities, thus increase in farm output for market leading to higher income [37, 38, 39]. Surprisingly, the level of education of the head of household was significant and had a negative impact on FCD. This result is in line with similar studies [40] as well as contrary [41] to the study conducted in West Bengal that indicated that education did not significantly influence dietary diversity. This implied that low literacy level reduces the likelihood of farming households moving from low FCD to attaining higher FCD. The reason for this could be that there was generally a low level of education among the households in the study area. Low education increases the inability to appreciate the benefits of a diversified diet. Total income of the farming households was positive and significant with the FCD of the households. This implied that income increased the likelihood of households moving to high FCD from low FCD. The results agree with similar findings on the drivers of diet diversity and food consumption in Bangladesh [42].

Farm size was positive and significant (at 5%) in the pooled results. The positive sign implies that an increase in farm size increases the likelihood of households attaining high FCD rather than having moderate FCD. This finding is in consonance with similar studies [1, 43, 44, 45, 46]. Results of the studies conducted by these authors in Ethiopia and Kenya [40], which showed that farmers who had larger farms fared better nutritionally than farmers who cultivated small farmlands. Among the expenditure shares of food groups (items) in the pooled results, legume was the only food group significant and inversely related to the food diversity status of the households. This indicated that an increase in expenditure on legumes decreases the likelihood of farming households attaining higher food diversity. This was because it accounts for the largest share of expenditure and in consequence decreases the amounts spent on other food items. In getting the minimum required amount of legumes, considering its importance in the diet, a high cost is attached, thereby depriving households of having higher FCD. The results are similar to other studies [28] and in Colombia and Ecuador [47].

CONCLUSION

Factors positively influencing food diversity include distance to the market, which affects the varieties of food items consumed, and access to price information, which was viewed to increase the basket of food items consumed. Household size tends to increase family income, which in turn could probably lead to an increase in diverse food consumption within the household. Farmers' income and farm size were found to increase the diversity of food consumption in the study area. Expenditure on legumes decreased the ability of households to attain higher food diversity in the study area. Furthermore, a low level of education decreased farming households' FCD in the zone. Therefore, it is recommended that the State Government ensures more access to food markets by the farmers through provision of infrastructure. Dissemination of information

ajfand SCHOLARLY, PEER REVIEWED
AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
Volume 20 No. 5
September 2020
PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST
ISSN 1684 5374

on prices of food through modern systems should be carried out by the Federal, State and Local Governments. Farming households should be encouraged to enrol in schools by the Local Governments through establishment of adult education centres closer to rural areas. In addition, incentives such as free education and materials should be provided by the State Government to motivate rural farmers. Farming households should also be enlightened on the importance of consuming diversified food through various programmes, training, seminars and workshops organized by all the three tiers of Government.

As farm size increases, FCD increases. It is, therefore, recommended that the State Government should formulate a policy to develop farmers' productive capacities with the current landholding through the provision of extension services in order to produce more on the same space of land available, generate more income and thereby achieve high FCD. Finally, a policy instrument such as Multinomial Logit Model could be employed by the governments to inform programming and policy on food security in Africa.

ajfand SCHOLARLY, PEER REVIEWED AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT Volume 20 No. 5 September 2020 PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST ISSN 1684 5374

Table 1: Components of Each of the Selected Food Group

Food group	Composition (*Score 1 if any of the food item within a food group was consumed and 0 if the food item was not consumed*)
Tuber and root crops	Cassava tuber and other products (cassava flour, chips and Gari), yam tuber and other products (flour and chips), sweet potato, Irish potato, cocoyam
Cereal	Fresh maize, dry maize grain, maize flour, sorghum, rice, wheat grain and flour
Legume	Beans, soybean, groundnut
Fruit and vegetable	Banana, plantain, orange, mango, pawpaw, pineapple, apple, coconut, guava, chochorous, bitter leaf, pepper, onion, okra, tomato and eggplant
Animal protein	Beef, mutton, goat meat, pork, bush meat, chicken, fish (dry, fresh), crayfish, turkey and snail
Fats and oil	Palm oil and groundnut oil.

Source: Adapted [1, 27] and modified by the authors (2018)

ajfand SCHOLARLY, PEER REVIEWED AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT Volume 20 No. 5 September 2020 PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST ISSN 1684 5374

Table 2: Socioeconomic Analysis of Food Consumption Diversity (FCD) in south-western Nigeria

Variables		Food consumption diversity					
		Freq.	%	Mean	*T/F values	Standard deviation	FCD Level
Gender	Male	270	78.95	0.67	(-4.74)	0.4355	High
	Female	72	21.05	0.55		0.4942	Moderate
Age	< 30	7	2.05	0.34		0.4082	Low
	31-40	45	13.16	0.54	(9.98)	0.4572	Moderate
	41-50	236	69.01	0.59		0.3989	Moderate
	51-60	47	13.74	0.66		0.5398	High
	61 and above	7	2.05	0.65		0.4472	High
Household size	1-3 members	17	4.97	0.41		0.5072	Low
	4-6 members	152	44.44	0.55		0.3703	Moderate
	7-9 members	110	32.16	0.61	(3.69)	0.3243	Moderate
	10-12 members	49	14.33	0.66		0.4564	High
	12 and above	14	4.09	0.85		0.2773	High
Level of education	Informal edu.	49	14.33	0.62		0.5453	Moderate
	Pri. sch.	131	38.30	0.59		0.3692	Moderate
	Sec. sch.	107	31.29	0.61	(11.05)	0.5127	Moderate
	Tertiary	55	16.08	0.53		0.3655	Moderate
Farm size	0.5-1.4	193	56.43	0.59		0.4449	Moderate
	1.5-2.4	77	22.51	0.59	(-2.55)	0.4713	Moderate
	2.5-3.4	45	13.16	0.61		0.3827	Moderate
	Above 3.5	27	7.89	0.59		0.5871	Moderate
Access to extension service	Yes	259	75.73	0.68	(-3.31)	0.4519	High
	No	83	24.27	0.60		0.4656	Moderate
Total income	<30000	82	24.0	0.58		0.3806	Moderate
	31000 - 60000	136	39.8	0.69	(12.07)	0.5559	High
	61000 – 90000	27	7.9	0.66		0.4234	High
	91000 and above	97	28.4	0.72		0.5764	High
Farm income	<20000	246	71.9	0.52		0.2432	Moderate
	21000 - 40000	72	21.1	0.55	(11.02)	0.3703	Moderate
	41000 - 60000	24	7.0	0.57		0.3451	Moderate
Distance to market	<2	122	35.7	0.52		0.5201	Moderate
	2.1 - 4	71	20.8	0.53	(13.04)	0.4827	Moderate
	4.1 - 6	76	22.2	0.55		0.5234	Moderate
	6.1 and above	73	21.3	0.63		0.4423	High

*Test of significant difference of means within the group using T values for two groups and F otherwise
Source: Data analysis, 2018

ajfand SCHOLARLY, PEER REVIEWED AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT Volume 20 No. 5 September 2020 PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST ISSN 1684 5374

Table 3: Food Consumption Diversity (FCD) in the south-western Agricultural Zone, Nigeria

Food consumption diversity levels	States			
	Edo	Ondo	Oyo	Pooled
High	2 (1.5)	19 (13.2)	7 (11.5)	28 (8.2)
Moderate	118 (86.1)	114 (79.2)	38 (62.3)	270 (78.9)
Low	17 (12.4)	11 (7.6)	16 (26.2)	44 (12.9)

Note: Values in parenthesis are percentages of crop farmers in different FCD levels
Source: Data analysis, 2018

Table 4: Factors Influencing Food Consumption Diversity (Multinomial Logit Model)

Variables	Food consumption diversity levels in SW agricultural zone	
	P_1/P_0	P_2/P_0
Distance (X_1)	0.9652*** (2.50)	0.9751*** (2.52)
Access to price information (X_2)	1.0457*** (11.18)	0.3236 (0.03)
Access to information on product availability (X_4)	1.5935* (1.67)	1.3276 (1.16)
Household size (X_5)	0.7029*** (2.52)	0.9777*** (3.41)
Household head level of education (X_7)	0.5224 (0.13)	-2.5875*** (-2.58)
Total income (X_8)	-0.6127 (-0.18)	0.6277*** (3.19)
Farm size (X_{10})	9.4630** (2.01)	-8.1713 (-1.47)
expenditure on legumes (X_{13})	-2.6082 (-1.57)	-3.8382* (-2.23)
Cons	-0.2708 (-1.03)	-0.5140* (-1.90)
Diagnostic statistics	Number of observations = 308; LR chi2 (48) = -305.63 Prob > chi^2 =0.0000; Log likelihood = -39.8163 Pseudo R^2 = 0.1793	
Base categorical variable	P_1	P_2

Note: Values in parenthesis are t values, ***, **, * Significant at 1%, 5% and 10%, respectively
Source: Data analysis, 2018

REFERENCES

1. **Mbwana HA, Kinabo J, Lambert C and HK Biesalski** Determinants of household dietary practices in rural Tanzania: Implications for nutrition interventions. *Cogent Food and Agriculture.* 2016; **2**: 12-24.

2. **Akinyele IO** Ensuring Food and Nutrition Security in Rural Nigeria: An Assessment of the Challenges, Information Needs, and Analytical Capacity. Nigeria Strategy Support Program (NSSP)', IFPRI Background 2009: 007.

3. **Ajala CG and NT Meludu** Food Consumption Patterns of Adult Rural Dwellers in Oluyole Local Government Area of Oyo State. *Nigeria Journal of Agriculture and Social Research.* 2006; **6**: 84-96.

4. **World Bank.** Nigeria Country Overview. 2017. http://www.worldbank.org/en/country/nigeria/overview [November 2017].

5. **Burlingame B** Sustainable diets and biodiversity: Directions and solutions, research and action. FAO, Rome. 2011.

6. **Hillbrunner C and R Egan** Seasonality, Household food Security and nutritional Status in Dinajpur, Bangladesh. *Food and Nutrition Bulletin.* 2008; **29**: 221-31.

7. **Styen NP, Nel JH, Nantel G, Kennedy G and D Labadarios** Food Variety and Dietary Diversity Scores in children: are they good indicators of dietary adequacy. *Public Health Nutrition.* 2006; **9**: 644-650.

8. **Fogli-Cawley JJ, Dwyer JT, Saltzman E, Mccullough ML, Troy LM and PF Jacques** The 2005 dietary guidelines for Americans adherence index: Development and application. *The Journal of Nutrition.* 2006; **136**: 2908–2915.

9. **Jeanene J, Fogli C, Johanna TD, Edward S, Marjorie LM, Lisa MT and FJ Paul** The 2005 dietary guidelines for Americans Adherence Index: Development and Application. *The Journal of Nutrition.* 2006; **136**: 2908-2915.

10. **Bukania ZN, Mwangi M, Karanja RM, Mutisya R, Kombe Y, Kaduka LU and T Johns** Food insecurity and not dietary diversity is a predictor of nutrition status in children within semiarid agro-ecological zones in Eastern Kenya. *Journal of Nutrition and Metabolism.* 2014. DOI:10.1155/2014/907153

11. **Swindale A and P Bilinsky** Household Dietary Diversity Score (HDDS) for Measurement of Household Food Access: Indicator Guide No. 2. Food and Nutrition Technical Assistance Project. Washington, D. C. 2006.

12. **Vakili M, Abedi P, Sharifi M and M Hosseini** Dietary Diversity and Its Related Factors among Adolescents: A Survey in Ahvaz-Iran. *Global Journal of Health Science.* 2013; **5**: 181-186. DOI:10.5539/gjhs. v5n2p181

13. **Bernal RJ and AP Lorenzana** Dietary diversity and associated factors among beneficiaries of 77 childcare centres: Central Regional. *Venezuela.* 2003; **53**: 52-81.

14. **Keding GB, Schneider K and I Jordan** Production and processing of foods as core aspects of nutrition-sensitive agriculture and sustainable diets. *Food Security.* 2013; **5**: 825–846. DOI:10.1007/s12571-013-0312-6

15. **Kinabo J, Kamukama E and U Bukuku** Seasonal variation in physical activity patterns, energy expenditure and nutritional status of women in a rural village in Tanzania. *SAJCN* 2003; **16**: 96–102.

16. **Herforth A** Promotion of traditional African vegetables in Kenya and Tanzania: A case study of an intervention representing emerging imperatives in global nutrition. Unpublished PhD Thesis, Cornell University. 2010; 418.

17. **Taruvinga A, Muchenje V and A Mushunje** Determinants of rural household dietary diversity: The case of Amatole and Nyandeni districts, South Africa. *International Journal of Development and Sustainability*. 2013; **2**: 1–15.

18. **Chand S Malthusian** Theory of Population: Criticisms and Applicability. *Your Article Library* 2017. http://www.yourarticlelibrary.com/population/malthusian-theory-of-population-criticisms-and-applicability/10885. [Accessed November 29, 2018].

19. **Harley R Malthusian** Theory of Population Growth: Definition & Overview. 2017. http://www.study.com/academy/lesson/malthusian-theory-of-population-growth-definition-lesson-quiz.html. [Accessed November 29 2018].

20. **Oladimeji YU** Food Production Trend in Nigeria and Malthus Theory of Population: Empirical Evidence from Rice Production. *Nigerian Journal of Agriculture, Food and Environment.* 2017; **13**: 126-132.

21. **Seth T** Malthusian Theory of Population: Explained with its Criticism. 2017. http://www.economicsdiscussion.net/articles/malthusian-theory-of-population-explained-with-its-criticism/1521. [Accessed November 29, 2018].

22. **FAO.** Food-based dietary guidelines. Food and Agricultural Organization, Rome 2017.

23. **UNICEF.** The state of the world's children: Malnutrition causes, consequences and solutions. New York. 1998.

24. **Research-Extension-Farmers-Input-Linkage-System** (REFILS). Workshop Organized by the Institute of Agricultural Research and Training for Farmers and Stakeholders in South-Western Agricultural Zone, I.A.R.T. Moor Plantation, Ibadan, Nigeria. 2016.

25. **National Population Commission.** Federal Republic of Nigeria Official Gazette Population Census. 2006. https://www.nigerianstat.gov.ng/ [Accessed January 10, 2018].

26. **Bowley R** Social Statistics. New York, Macmillan Publishing Incorporation. 1977.

27. **Obayelu AE** Determinants of Household Food Security and Food Demand in the North Central Zone, Nigeria. Unpublished Ph.D Thesis, Department of Agricultural Economics, University of Ibadan, Ibadan, Oyo State. 2008.

28. **Ruel MT** Is Dietary Diversity as an 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. 2003.

29. **Gujarati DN** Basic Econometrics. McGraw-Hill Book Company, Singapore, Fourth Edition, 2003.

30. **Cramer JS** The Logit Model for Economists. London and New York, Edward Arnold. 1991.

31. **Amemiya T** Qualitative Response Models: A Survey. *J. of Econ. Lit.* 1981; **19**: 1483-1501.

32. **Grootaert C and H Patrinos** The Policy Analysis of Child Labour: A Comparative Study. St Martin's Press, New York. 1999.

33. **Jaccard J** Interaction Effects in Logistic Regression: Thousand and oaks. Quantitative Applications in the Social Sciences Series. Sage Publications, C. A. 2001; 135.

34. **Greene WH** LIMDEP Version 6.0 User's Manual and Reference Guide, New York Econometric Software, Incorporated. 1992.

35. **Nelson M, Zamasiya B, Makate C, Nyikahadzoi K and S Siziba** Factors influencing household food security among smallholder farmers in the Mudzi district of Zimbabwe. *Development Southern Africa.* 2014; **31**: 1-18.

36. **Stefan K, Kassie M and M Qaim** Farm production, market access and dietary diversity in Malawi. *Public Health Nutrition.* 2016; **20**: 325–335.

37. **Kumar A, Kumar P and PK Joshi** Food Consumption Pattern and Dietary Diversity in Nepal: Implications for Nutrition Security. *Indian Journal of Human Development.* 2017; **10**: 397–413. DOI: 10.1177/0973703017698899

38. **Olwande J and M Mathenge** Market Participation Poor Rural Households in Kenya. *Tegemeo Institute of Agricultural Policy and Development.* 2011; **4**: 38-45.

39. **Randela R, Alemu ZG and JA Groenewald** Factors Enhancing Market Participation by Small-Scale Cotton Farmers. *Agreckon Journal.* 2008; **47**: 451-469.

40. **Frohberg A** Local Perceptions Influencing the Consumption of a Diverse Diet in Vihiga County, Kenya. Unpublished Master's Dissertation, Ghent University. 2017.

41. **Mukherjee A, Paul S, Saha I, Som TK and G Ghose** Dietary Diversity and Its Determinants: A Community-Based Study among Adult Population of Durgapur, West Bengal. *Medicinal Journal.* 2018; **11**: 296-301.

42. **Hossain M, Jimi NA and MA Islam** Does Agriculture Promote Diet Diversity? A Bangladesh Study. LANSA Working Paper Series. 2016; **11**: 89 – 115.

43. **Ochieng J, Afari-Sefa V, Lukumay PJ and T Dubois** Determinants of dietary diversity and the potential role of men in improving household nutrition in Tanzania. *PLoS One*. 2017; **12**: 1- 18.

44. **Jaleta M, Gebremedhin B and D Hoekstra** Smallholder Commercialisation: Processes, Determinants and Impacts. Discussion Paper on Improving Productivity and Market Success (IPMS) of Ethiopian Farmers Project, ILRI (International Livestock Research Institute), Nairobi, Kenya. 2009; 55.

45. **Gabre-Madhin EZ, Dawit A and S Dejene** From Farmer to Market: Smallholder Commercialisation of Food Crops in Ethiopia. Draft ESSP Working Paper. 2007.

46. **Von Braun J and E Kennedy** The commercialisation of Agriculture, Economic Development and Nutrition'. John Hopkins Press, Baltimore, M. D. 1994.

47. **Vellema W, Desiere S and M D'Haese** Verifying Validity of the Household Dietary Diversity Score: An Application of Rasch Modelling. *Food and Nutrition Bulletin.* 2016; **37**: 27-41.