Impact of Kampe Irrigation Dam on Farming Household Dietary Diversity in Kogi state, Nigeria

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A diverse range of foods has been shown to increase energy and micronutrients intake in the developing countries. It is widely asserted in the literature and development circles that farm household access to irrigation dam can provide a significant improvement of household's dietary diversity. This study set out to assess the role of Kampe irrigation dam on farm household dietary diversity in Kogi State, Nigeria. A total of 140 respondents were interviewed using structured questionnaire. A two stage sampling technique was utilized for the study. The respondents were divided into two stratum, namely irrigation beneficiary and irrigation non-beneficiary. A simple random sampling technique was used to draw respondents from the two strata and the collected data were analyzed with frequency counts, percentages, and Poisson regression analysis was used to identify the factors influencing farm household's dietary diversity score. A structured questionnaire with in-built 24-hour diet recall was use for data collection. A 12-food group model was used to evaluate diet diversity (DD). The results show that majority of the respondents (94.3 %) were married and mostly farmers (100 %). Overall, mean dietary diversity score (DDS) was 6.5, irrigation beneficiaries dietary diversity score was 7 on average and non-beneficiaries score was 6. Age of household head, household size, farm size, and income were all identified to contribute significantly to household dietary diversity score (DDS). In conclusion dietary diversity is fairly good for irrigation beneficiary compared to the overall average in the study area and efforts to improve nutritional status must address the issue of dietary diversity.

Keywords: Irrigation Dam, Household's Dietary, Kogi State

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1. Introduction

A diverse diet, rare among poor populations in developing countries, proves especially important for infants and young children who need essential micronutrients and energy for rapid physical and mental development (Andrew et al, 2010). Consuming diverse diets offers protection against chronic diseases and enhances the immune system in people living with HIV to combat AIDS opportunistic diseases (Susana et.al, 2010). Furthermore, while inverse relationships have been found between dietary diversity and chronic non-communicable diseases, it has a direct relationship with favorable nutritional status. It is not surprising that, eating a large variety of foods, across and within major food groups has been recommended in most dietary guidelines (Sanusi, 2010). Food security entails three important aspects (availability, access and utilization) in the relationship between man and food, necessary to ensure that nutrition plays its optimum role in human health. However, dietary diversity has been positively linked with these three pillars of food security (Opeyemi, 2013).There is also an association between dietary diversity and caloric availability measured at the individual level (John et. al., 2002).

Diet diversity reflects how varied the foods typically consumed by a household are and it predict nutrient adequacy better than those based on individual foods (Degye et al, 2013). Dietary diversity consists of the total number of foods or food groups that contribute to the overall diet of an individual over a reference period (FAO, 2007). Dietary diversity is defined as the number of individual food items or food groups consumed over a given period of time (Gina et. al., 2009). Dietary diversity in terms of food groups better predicts diet quality than that based on individual food items (Ruel, 2003). Indicators of dietary diversity, derived from the recall of the number of foods or food groups consumed over a given time period, have gained increased attention in both the nutrition and food security communities in recent years (Andrew et. al., 2010). Most often it is measured by counting the

number of food groups rather than food items consumed (Gina et al, 2009). The reference period can vary, but is most often the previous day or week (Gina et al, 2009).

Consequently, because conventional quantitative dietary assessment surveys are costly and cumbersome to conduct and analyze, there is great interest in using simple proxies of intake that can be measured quickly and easily and that validly reflect nutrient intake. This was the rationale for developing dietary diversity measurement tools as proxies of quantitative dietary intake (Gina, et al,2010).Dietary diversity indicators prove popular in part because the data are fairly easy to collect and are associated with dietary quality, energy intake, and food security (Andrew et al,2010). Households noted that irrigation scheme had significantly contributed to dietary diversity in two ways. First, there was increased production and availability of staple foods, vegetables and legumes. Secondly, the money realized from sales enabled household to buy other food products such as fish, meat, cooking oil which were not readily available in their households (LDSP, 2012). It is thought that irrigation can further improve beneficiaries dietary diversity " if households in the scheme diversity and deliberately increase production of lesser consumed crops such as fruits, legumes and oil seeds" (LDSP, 2012).

It is hypothesized during irrigation scheme proposal, that dietary diversification is considered as a key opportunity for scheme participants, for improved health and income generating opportunities. Lack of dietary diversity is one of the severe problems among poor populations in the resource limited countries. These populations tend to rely mostly on starchy staples, their diets are monotonous, and often include little or no animal products with few fresh fruits and vegetables (Ekesa et al, 2011). The study hypothesize that irrigation dam has positive effect on farm household's dietary diversity in the study area.

Studies that examined the linkage between dietary diversity and irrigation dams are very few. Even those studies that examined the impact of irrigation dam on food security are few, let alone those that researched into the impact of the role of irrigation dams on farm household's dietary diversity. As at the time of the commencement of this research, we are not aware of such studies for Nigeria, let alone in Kogi State, our study area. The absence of empirical studies on this important issue – irrigation dam and dietary diversity- has led to absence of concrete policies on irrigation and dietary diversity. It is believed that the knowledge that this kind of study can be useful for formulation of policies on effective utilization of irrigation dam to improve dietary diversity of farm households in the study area.

The study will try to answer two research questions namely: (i) what are the socio-economic characteristics of the farm households of both the irrigation beneficiaries and irrigation non-beneficiaries of the respondents in the study area Kogi State, Nigeria. (ii) Does irrigation dam contribute to dietary diversity of farm households in the study area? (iii) Identify the factors influencing farm household's dietary diversity score?

2. Materials and methods

2.1 Data and Sampling Techniques

This was a descriptive study to assess the role of Kampe irrigation dam on farm household's dietary diversity in Kogi State, Nigeria. Data were collected as part of the study of the variety of food intake of food list which represent the food groups within which the farm households consume. This study was carried out in Kogi State, Nigeria. The respondents for the study comprised of both irrigation dam project beneficiaries and the non-beneficiaries within the same catchment area in the study area, Kogi State, Nigeria.

A two stage sampling procedure was used for this study. The first stage involved the use of Stratified sampling technique; the population under study was divided into two strata; irrigation Beneficiaries and non-beneficiaries. From each stratum, simple random sampling technique was used to collect seventy irrigation beneficiaries and seventy non-beneficiaries completing the second stage. Data collection was carried out April 2013. The data was collected using well-structured questionnaire. The respondents were farming households in the study area; the samples were drawn from the project host community. The beneficiary list provided by the project resident head in the project site was used as the sampling frame while the community head list was used as the sampling frame for the irrigation non-beneficiary farm households. **S**tructured questionnaire was used to collect information used in this study. Data collected included the following: household composition, age, household size, highest educational level attained by head of the household, primary occupation of the household head, and estimated monthly income of the household head.

2.2 Analytical Method

2.2.1 Dietary Diversity Assessment

For dietary assessment, a 24-hour dietary recall was conducted to obtain information on farm household's food intake. It was conducted by trained enumerators at the home of the subjects and on the farm of a number of them. Respondents were asked

to recall all foods eaten/ taken in the previous twenty-four hours preceding the interview. A scale of twelve food groups was used in assessing the dietary diversity of subjects. Using information collected from the 24-hour dietary recall, the dietary diversity scores for individuals were derived using the FAO guidelines for measuring household and individual dietary diversity (FAO, 2005), and (Opeyemi,2013). The dietary diversity was assessed based on the number of food groups consumed over the immediate past 24 hours. A point was awarded to each food group consumed over the reference period, and the sums of all points were calculated for the dietary diversity score for each household. Dietary diversity was derived from the 12 food groups into; low, medium and high dietary diversity. Individual DDS were then judged based on their position on the scale.

All data collected were analyzed using statistical package for social sciences. Dietary Diversity Scores (DDS) for individuals farm households were derived using the transform and compute section of the SPSS as well as excel package. Dietary Diversity Scores from the irrigation beneficiary farm household and the irrigation non-beneficiary were compared using One-way ANOVA. The t-test was used to compare the mean DDS between irrigation beneficiary and irrigation non-beneficiary farm households. Poisson regression model (PRM) was used to identify the factors influencing the farm households' dietary diversity scores.

A scale of twelve food groups was used in assessing the dietary diversity of subjects. Using information collected from the 24-hour dietary recall, the dietary diversity scores for individuals were derived using the FAO guidelines for measuring household and individual dietary diversity (FAO,2005) also used by (Sanusi,2010) as well as (Animashaun,2012). A point was awarded to each food group consumed over the reference period, and the sums of all points were calculated for the dietary diversity score for each individual. Dietary Diversity terciles was derived from the 12 food groups into; low, medium and high dietary diversity terciles. Individual DDS will then be judged based on their position on the scale.

The following set of 12 food groups was used to calculate the HDDS;

a. Cereals,
b. Fish and seafood,
c. Root and tubers,
d. Pulses/legumes/nuts
e. Vegetables,
f. Milk and milk products,
g. Fruits,
h. Oil/fats and oil palm,
i. Meat and poultry offal
j. Sugar/honey,
k. Eggs,
l. Miscellaneous

Because the Dietary Diversity Score is a count data rather than continuous variables, a linear regression may not be appropriate in estimating its determinants. Counts data are non-normal and not continuous therefore, a linear regression may not be appropriate mode of estimation (Animashaun, 2012). In this case, a Poisson may be a more appropriate model to use. The Poisson Maximum Likelihood Estimator requires that the data be Poisson distributed with density function of PRM as given by (Animashaun, 2012):

$$F\left(yi/xi\right)=\frac{e^{-\lambda(x)}\lambda i(x)^{(y)}}{\Gamma(1+yi)} \quad \text{…….....…. 1}$$

Where λi = exp (α + X'β) and yi = 0,1…….i is the number/count food eaten by the household X = a vector of predictor variables

Following (animashaun, 2012) the expected number of the events, yi

E(yi/xi) = var[yi/xi] = λ = exp(α + X'β) …..... 2

For i = 1, 2,……..m

2.2.2 Determinants of Household Dietary Diversity

Based on the model above, the implicit functional form of the model estimated to examine the determinants of dietary diversity is specified as:

$Y = \alpha + \beta X_1 + \beta X_2 + \beta X_3 + \beta X_4 + \beta X_5 + e$ ..... …… 3

Where;

Y = count of diverse Food group eaten in Household in the past 24 hours

X_1 = Age of Household head (Numerical value),

X_2 = household size (Numerical value),

X_3 = Household farm size (ha),

X_4 = Annual household off farm income (Naira)

X_5 = Annual household farm income (Naira)

e = error term

α = constant

β = parameter coefficients to be estimated

3. Results and discussion

3.1 Socio-economic Characteristics of Respondents

The major socio-economic characteristics of the respondents covered in the survey were presented. These characteristics relate to the frequency distribution of heads of households by gender, age, years of formal education, and marital status. The distribution of the respondents according to their socioeconomic characteristics is as presented in table

1. Analysis of the socioeconomic characteristics of the farm households as shown in Table 1 indicates that irrigation farming is a male dominated enterprise in the study area. The modal age group of the farmers falls between ages 31-40 for both irrigation farmers and non-irrigation farmers. The overall modal age group of these farmers is 31-40 years with the lowest age group being 51-60 years of age. The results show that majority of the farmers are in their energetic years of age. The study further shows that most of the sampled farmers in the study were married (87.9%). The study further shows that most of the irrigation farmers had large family size; about 48.6% had between 1-5 household members, 38.6 % have 6-10 household members while the percentage was 60.0% and 38.6% respectively for irrigation non-beneficiary farm households. Overall, 54.3% have family size of 1-5 members. With regards to education, the study shows that all of the irrigation beneficiaries had primary and below education, 71 % of the irrigation non-beneficiary respondents had post primary school formal education. Most of the farmers practice farming at subsistence level, as an overall of 70.0% had farm size of 0.1-1.0 hectares. 27.1 % cultivated 1.1-2.0 hectares. 68.6% of the irrigation farmers cultivated between 0.1-1.0 hectares of land.

An overall of 52.1 % of the farmers had between 6-10 years farming experience, while only 12.1% had within 5 years of farming experience. Considering the fact that 76.0% of the farmers were not members of any cooperative society. All of the irrigation farmers were non-members of any cooperative society. The modal income group was N 51,000 – N 100,000 with an overall per cent 55.7%, irrigation beneficiary had an average annual income of ₦120,782, irrigation non-beneficiary average annual income ₦88,234 and the overall, annual income for the entire population was ₦104,513.

Table 1. Socio-economic Distribution of Respondents

Socio-economic indicators	Beneficiary households		Non beneficiary households		All households	
	Frequency	%	Frequency	%	Frequency	%
Gender						
Male	70	100	60	85.7	124	92.9
Female	0	0.0	10	14.3	16	7.1
Age						
20-30	18	25.7	13	18.6	31	22.1
31-40	27	38.6	24	34.3	51	36.4
41-50	10	14.3	22	31.4	32	22.9
51-60	15	21.4	7.1	15.7	26	18.6
Marital status						
Single	4	5.7	13	18.6	17	12.1
Married	66	94.3	57	81.4	123	87.9
Household size						
1-5	34	48.6	42	60.0	76	54.3
6-10	27	38.6	27	38.6	54	38.5
11-15	4	5.7	1	1.4	5	3.5
16-20	5	7.1	0	0.0	5	3.5
Education status						
Pry Sch & Below	70	100	20	28	82	58.6
SSCE/GCE	-	-	30	42.8	38	27.1
NCE/OND/Nursing	-	-	17	24.3	17	12.1
HND/University Graduate	-	-	3	4.3	3	2.1
Farm size						
0.1-1.0	48	68.6	49	70.0	98	70
1.1-2.0	18	25.7	21	30.0	38	27.1
>2	4	5.7	0.0	0.0	4	2.9

Source: Field Survey, 2013

Table 2. Socio- economic Distribution

Socio-economic indicators	Beneficiary household		Non beneficiary households		All household	
	Frequency	%	Frequency	%	Frequency	%
Experience						
1-5	13	18.6	4	5.7	17	12.1
6-10	46	65.7	27	38.6	73	52.1
11-15	11	15.7	23	32.9	34	24.3
16-20	-	-	13	18.5	13	9.3
>20	-	-	3	4.3	3	2.1
Cooperative membership						
Yes	-	-	33	47.1	33	23
No	70	100	37	52.9	107	76
Annual income						
1-50,000	4	5.7	5	7.1	9	6.43
51,000-100,000	29	41.4	49	70.0	78	55.7
101,000-150,000	23	32.9	10	14.2	33	23.6
151,000-200,000	9	12.8	5	7.1	14	10.0
>200,000	5	7.1	1	1.4	6	4.3

Source: Field Survey, 2013

3.2 Effect of irrigation Dam Project on Dietary Diversity

Table 3 presents result from the survey of 24 hour food recall of 12 food groups by households sampled. The table indicate the proportion of households in percentage consuming each food group as The results suggest that diet diversity, as measured by household consumption of the food groups, though not widely different when compared relatively, yet, irrigation beneficiaries consumes more of some of the food groups than irrigation non-beneficiary.

Table 3, showed the food consumption pattern of the households sampled, 75.7 % of the respondents consumed foods from cereal products. 62.9 % ate foods from fish and sea foods, 45.0 % ate root and tubers group, 50.7 % ate Pulses/Legumes/nuts, 62.9% ate vegetables, 56.4 % consumed milk and milk products, 62.1 % ate fruits, Oil and fats 88.6 %, meat products 52.1 %, sugar and honey products 55.7 %, egg 29.3 % and any food item outside the listed (1-11) was 7.1 %.

- Cereals, invariably rice and maize but occasionally sorghum, were consumed by all households in the study area during the period of the survey.
- Oil and fat products, were mostly consumed by many of the households, indicating the importance of this food component to their diet.
- Also green vegetables were normally consumed no more than as part of one meal a day by the irrigation beneficiaries as it is part of the main crops cultivated by them.
- About six of every 10 of the sampled households (60 percent) do consume fish and almost half (47 percent) also tasted meat during the period of the survey; the most common and essential sources of protein in the study area however is fish.
- Although a large proportion of the households consume green leafy vegetables (as noted above). It is however important to mention that only very few of the respondents consumed egg, which is considered as also very nutritive.
- The sampled households also consumed less milk and milk products. 47.1 % and 65.7 % for irrigation beneficiaries and non-beneficiaries respectively.

Table 4, showed the Dietary Diversity Scores (DDS) of individual respondents ranged from 2 to 10. The proportion of the subjects with the scores and in each of the three categories of low (1-4), medium/average (5-8) and high (9-12) shown in Table 5. The average DDS of the overall survey is 6.4857. The highest average Dietary Diversity Score was recorded for respondents from the irrigation beneficiary (6.9857).

Table 3. Percentage of consumption of food groups among Respondents

Food groups	Irrigation beneficiaries	Non beneficiaries	Total
Cereals	94.3	57.1	75.7
Fish and sea food	64.3	61.4	62.9
Root and tuber	51.4	38.6	45.0
Pulses /legumes/nuts	38.6	62.9	50.7
Vegetables	84.3	41.4	62.9
Milk and milk products	47.1	65.7	56.4
Fruits	68.6	55.7	62.1
Oil and fats	94.3	82.9	88.6
Meat and poultry	48.6	55.7	52.1
Sugar and honey	78.6	32.9	55.7
Eggs	18.6	40.0	29.3
Other food outside the list	10.0	4.3	7.1

Source: Field Survey, 2013

Table 4. Dietary Diversity Scores among the Respondents and Dietary Diversity Terciles

Dietary diversity scores	Beneficiary	Non beneficiary	All
1	0	0	0
2	0	1.4	0.7
3	0	0	0
4	1.4	7.1	4.3
5	1.4	18.6	10.0
6	22.9	38.6	30.7
7	48.5	31.4	40.1
8	22.9	2.9	0
9	2.9	2.9	12.9
10	0	0	0
Dietary Diversity Terciles			
Low (1-4)	1.4%	8.5%	5.0%
Medium (5-8)	97.6%	91.5%	93.6%
High (9-12)	1.0%	-	1.4%

Source: Field Survey, 2013

Table 5. Comparison of Dietary Diversity Scores of the Respondents.

	Number	Mean DDS	Minimum	Maximum
Irrigation beneficiaries	70	6.9857	4	9
Non beneficiaries	70	5.9857	2	8
All respondents	140	6.4857	2	9

Source: Field Survey, 2013

Table 6. Poisson determinants of household dietary diversity

Parameter variable	Coefficient	Std. error	Z
Age of household head	0.305*	0.145	2.105
Household size	-3.051**	1.326	-2.301
Household Farm size	16.149**	5.554	2.908
Household off farm income	-0.001**	0.000	-2.196
Household farm income	0.000	0.0004	1.000
Likelihood value	0.000		
Pearson Chi-square	0.000		

Source: Field survey, 2013: ***Significant at 1 %, **Significant at 5 %, * Significant at 10 %

3.3 Determinants of dietary diversity among irrigation beneficiaries

According to the parameter estimate Table 6, the age of irrigation beneficiary household head was positive and significant. This shows the higher the age of the respondent, the increase in the chances of their dietary diversity score. Household size of beneficiaries had a negative coefficient and significant at 5 %, this indicates that the higher the household size, the decrease in the chances of the dietary diversity. Household farm size was positive and significant at 5 %. This indicates that, the more the farm land available for cultivation the more the probability for crop diversity. Off-farm income was negative and significant at 5%.

The result showed that 1.4 % of the irrigation beneficiary respondents scored low, 97.6 % scored medium and 1.0 % scored high DDS. While 8.5 % of the irrigation non-beneficiary respondents scored low, 91.5 % scored high. It was noted that the mean DDS obtained in this study was at about the range of "average", therefore, more respondents are likely to have consumed between 5 to 7 food groups. The mean DDS for irrigation beneficiary respondents was 7 while that of irrigation non-beneficiary was 6 DDS. The minimum DDS for irrigation beneficiary respondents was 4 while the maximum was 9 in contrast with irrigation non-beneficiary respondents, 2 minimum and 8 maximum. More than 50% of the subjects scored 5 to 6 in their dietary diversity assessment. Although dietary diversity of populations has been reported to range from 2 to 9, different numbers of food groups and scoring systems have been employed in different countries to assess dietary diversity, making it difficult to compare DDS between countries. However, Styen et al, 2006; in a study to assess whether dietary diversity is a good indicator of dietary adequacy used 9 food groups to measure dietary diversity and obtained a mean DDS of 3.6. A mean DDS of 3.6 derived from 9 food groups is comparable to the 5.81 from 12 food groups in this study. It could be seen that the average number of food groups consumed by the subjects over the reference period is poor. Considering the importance of dietary diversity to nutrition and health, these results showed the need to mobilize efforts for ensuring that people have better access to and knowledge about adequate nutrition. Nutrition education and food aid are two effective programmes that have recorded success in bids to improve dietary diversity in populations (Sarrafzadegan et al, 2009; Lachat et al, 2009).Also location is very important for access to and intake of foods by individuals.

Finally, socio-economic status of farm households continues to have significant influence on food intake, hence nutritional status and health. Significant differences in DDS were observed in relation to Age of household head, family size, and household farm size, farm households' income and off-farm household incomes. These findings are consistent with previous reports (Bernal et al, 2003). The associations between these parameters and dietary diversity scores point to the firm relationship of socio-economic status on food intake.

4. Conclusion and Recommendations

The study begin with the hypothesis that irrigation dam would increase the beneficiary farm households dietary diversity. However, the result of the study showed that the irrigation beneficiary dietary diversity score (DDS) was 7 and 6 for non-beneficiary farm households. The result of the dietary diversity score for the study, haven been tested using t-test showed that the difference between the farm household dietary diversity score for the irrigation beneficiary and irrigation non-beneficiary households was not significant. In order to increase the level of significance of the impact of irrigation dam on farm household dietary diversity in the study area, this study makes the following recommendations. First, policy that could boost farm households income should be put in place as well as things that can help increase farm household off farm income should be encouraged. Second, enlightenment program on birth control measures and it importance should be embark upon in the study area. Finally, policy that will help to increase farmer farm size cultivated should be worked upon; this can include provision of farm input at very affordable price.

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