Eastern and Southern Africa Journal of agricultural Economics & Development Vol. 12 No. 2 (2022)

Dietary Diversity for Rural and Urban Households in Tanzania

Assenga, T.F[1]* and Mishili F.J.[1]

Abstract

Food Security in terms of food access and nutrition has become paramount in food security discussions. Dietary diversity therefore surfaces as key ingredient to bring and speed the discussion of food access and nutrition. The aim of this study was to analyze the level of dietary diversity for the rural and urban households in Tanzania. Specifically, the study has assessed the dietary diversity differences between rural and urban and analyzed determinants of dietary diversity for the rural and urban households, using the fourth wave of the 2014/2015 panel data from the National Bureau of Statistics (NBS). Statistical, Food Consumption Scores, and econometrics analyses were used to estimate the differences between the rural and urban food diversity. The results show that rural households have high dietary diversity compared to urban households. due to participation in various agricultural activities such as crop cultivation. Household education, households' size and time spent in water collection were the main determinant for both rural and urban dietary diversity. Other factors such as plot cultivation, fishing activities, livestock keeping, time spent in firewood collection and household age were found to influence rural household dietary diversity while marital status was found to influence urban dietary diversity. To improve household dietary diversity, the study recommends that the government should increase investment in infrastructure such as roads to make easy transportation of food varieties. Provision of social services such as water is important for facilitating dietary diversification.

Key words: *Dietary Diversity, Food Consumption Score, Rural and Urban households.*

1 Introduction

Most of the developing countries are facing malnutrition challenges that consists of micronutrient deficiency, over and under nutrition. Presence of such challenges has attracted a glut of policy attention that culminated food security into international agenda. Governments and International food organizations world over advocated for attainment of food and nutrition security by

[1] Department of Agricultural Economics and Agribusiness, Sokoine University of Agriculture, Morogoro, Tanzania.
*Corresponding Author: assengatheresiaf@gmail.com

2030. To this effect, individuals and households are encouraged through different programs and campaigns to consume varieties of food groups to attain dietary diversity that helps to address malnutrition. Dietary diversity is the number of different food groups consumed by individual or household in a given period (Ruel, 2003). Tanzania is producing varieties of food crops; however, the level of dietary diversity among Tanzanians leaves a lot to be desired. Generally, Tanzanians consume high amount of cereals compared to other food groups such as fruits and vegetables, meat, fish and poultry products that are very important to the body as they are the major source of nutrients (Ochieng *et al*., 2017; Powell *et al.,* 2017).

High consumption of specific food group such as cereals foods implies low availability of micro and macronutrients as well as minerals. It also lowers immunity for the children to fight against infectious diseases if substituted too early due to inappropriate breast feeding (Mbwana *et al*., 2016). However, high intake of cereals has been shown to be a major source of energy, vitamin E, Vitamin B, carbohydrate, and protein but if not consumed with other food groups, cereals can be a major source of nutrition deficiency (McKevith, 2004 and Ochieng *et al*., 2017).

The literature shows that consumption of food groups other than cereals remain a challenge. For example, consumption of fruits and vegetables is below the recommended minimum intake of 400g per day. This is largely attributable to lack of dietary diversity (Msambichaka *et al.,* 2018; Cochrane and D'Souza, 2015). According to Ochieng *et al*. (2017), majority of women and children have low dietary diversity due to low consumption of fruits, vegetables, and animals.

Low dietary diversity is emerging as a rural phenomenon even though larger percent of food products are produced in rural area. Warren *et al*. (2015); Khed (2018); Workicho *et al.* (2016) show that majority of the households in rural areas have low dietary diversity compared. This is contrary to Ajani (2010); and Mukherjee *et al.* (2018) who found that rural areas are more likely to attain dietary diversity than urban areas. This paucity is the concern of the study at hand. In similar context, this study compares the level of dietary diversity between rural and urban households in selected regions of Tanzania. We assess the dietary diversity difference between rural and urban areas and analyze the determinant of household dietary diversity for rural and urban area in Tanzania. With these objectives, we hypothesize that,

1. There are no significant dietary diversity differences between rural and urban households and
2. Education, household size and time spent in water collection significantly influence dietary diversity for the rural and urban households.

The remainder of this paper continue as follow: After this background, section two presents the methodology of the study where data sources, sampling strategy, and data analysis are specified. After the methodology, section three present and discusses the study findings of the study. Finally, we present in section four conclusion and recommendations.

2 Methodology

2.1 Data Source and Sampling Design

The study used the fourth wave of the 2014/2015 panel data from the National Bureau of Statistics (NBS). National Panel Survey data were suitable for the study as it contains households' information such as consumption of food and non-food products, social economic characteristics, agricultural production, and fishing activities. Data were collected through stratified, multistage cluster sampling. The Population and Housing Census of 2012 was used as a sampling frame to select a sample that represents the entire population. The total number of rural households included in this study is 1,978 out of which 1,366 are urban households.

2.2 Methods of Data Analysis

2.2.1 Statistical analysis

Statistical analysis was employed to analyze dietary diversity differences between rural and urban area and Chi-Square test was used to check the significance of the difference.

2.2.2 Food Consumption Score (FCS)

Food Consumption Scores were used to measure household dietary diversity. This metric was used because food consumption data were recorded in seven days as a reference period. During the survey, households were asked to recall how many days in a week they have consumed different food groups indicated in Table 1. To obtain the level of dietary diversity using FCS, all foods were categorized in 8 food groups.

Table 1: Food Groups and their weights

S/N	**Food items**	**Food groups**	**Weights**
1	Beef, goat, poultry, pork, eggs and fish	Meat and fish	4
2	Milk yogurt and other diary	Milk	4
3	Beans, Peas, groundnuts, and cashew nuts	Pulses	3
4	Maize, maize porridge, rice, sorghum, millet pasta, bread and other cereals, Cassava, potatoes and sweet potatoes, other tubers, plantains.	Staples (cereals)	2
5	Fruits	Fruits	1
6	Vegetables and leaves	Vegetables	1
7	Sugar and sugar products, honey	Sugar	0.5
8	Oils, fats and butter	Oil	0.5

Number of days in a week that household consumed a given food were multiplied with food weight for each food groups to obtain a new weight for each food group. The weight of a food groups was given based on the level of protein, level of micronutrient and high energy obtained from a specific food group. For example, protein obtained from animal source such as milk and meat were given a high weight compared to protein obtained from the cereals and pulses. A new weight obtained from each food groups were summed to create an FCS value for each household (Equation 1).

$$FCS = A_1 4_1 + A_2 4_2 + A_3 3_3 + A_4 2_4 + A_5 1_5 + A_6 1_6 + A_7 0.5_7 + A_8 0.5_8 \ldots\ldots\ldots (1)$$

Where;

Subscripts 1-8 = food groups; A = frequency recalls from 7 days; Number =Food group weight.

After obtaining each household food consumption values, households were categorized in three profiles of Food Consumption Score namely poor, borderline and acceptance (Table 2).

Table 2: Food Consumption Score Profiles

Food consumption score (FCS)	**Profile**
0-21	Poor
21.5-35	Borderline
>35	Acceptable

2.2.3 Econometric analysis

To address the second hypothesis, an Ordered Logit Model was used to analyze the determinants of food dietary diversity for rural and urban households in Tanzania. This model is appropriate because dietary diversity as dependent variable has been categorized in an ordered manner based on FCS level. As indicated in Table 2, dietary diversity has been categorized into “Poor”, “Borderline” and “Acceptance” According to Wooldridge, (2003); Torres-Reyna (2012) the outcomes of the level of dietary diversity based on FCS can be expressively presented in the following criteria:

$$DD = 0\ (\text{"Poor"})\ If\ FCS < 21 \ldots\ldots (2)$$

$$DD = 1(\text{"Borderline"})\ If\ 21.5 < FCS < 35 \ldots\ldots (3)$$

$$DD = 2(\text{"Acceptance"})\ If\ FCS > 35 \ldots\ldots (4)$$

In equation 5 and 6, the Ordered Logistic regression was analyzed with other variables as shown in Appendix 3.

$$CPr_c = \frac{\exp(\alpha_c - \beta' X_i)}{1 + exp\,(\alpha_c - \beta' X_i)} = \frac{1}{1 + exp(-\alpha_c + B' X_i)} \ldots\ldots (5)$$

$$\beta' X_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \cdots \ldots + \beta_n X_n \ldots\ldots (6)$$

Where: $B_{0\ldots\ldots n} = Coeffiecients\ to\ be\ estimated$ $X_{1\ldots\ldots n}$

α_c = Categories (Poor, borderline and acceptance)

CPr_c = Cumulative probability for the categories

3 Results and Discussion

3.1 Description of Social Economic and other Variables for Rural and Urban Households

Findings of social economic characteristics and other variables of the sampled household that were included in the analysis are presented in Table 3. In this study, the variables included were captured at household level and a separate descriptive analysis was done for rural and urban households.

Descriptive results suggest that about 59% of households were rural and 41% were urban households. Majority of the household head were male for both rural (73%) and urban (70%) while few households are headed by females Table 3. Sex of the household head has a major implication in decision making specifically in consumption both food and non-food products. In term of education, the study considered household to be educated if they have ability to read and write either in English, Kiswahili, or both. Thus, the results suggest that majority of urban household were educated (89%) compared to rural households (71%). A large difference between rural and urban education is due to unequal distribution of social services such as schools. These findings are not uncommon because majority of schools are in urban compared to rural areas. This gives more opportunity for urban households to have access to such services compared to rural households. Further, results show that majority of the households in both rural (96%) and urban areas (89%) are married and only few are single. Consideration of marital status is very important as it influences financial status of the households and decision making (Table 4).

The average household size in rural areas is 5 members with the maximum of 33 members while in urban areas the household size is 4 members for with the maximum of 17 members (Table 4). Larger household size in rural areas is attributable to lack of family planning education and availability of affordable food for feeding the family. Large household size in rural areas is considered a potential source of labour for agricultural productivity. The average age of rural household member is 46 years while the mean age of urban household member is 42 years.

Table 3: Description of variables used in estimation of Ordered Logit Model

Variable	Description	Unit of measurement	Expected signs	Variables	Description (Dummy)	Expected signs
Farm size	Continuous	Acres	+/-	Sex of household head	1= Male 0=Female	+/-
Household age	Continuous	Number of years	+/-	Education	1= Education 0=No education	+
Household size	Continuous	Number of members of a household	+	Employment	1= Employed 0= Not employed	+
Time spent in fetching water	Continuous	Minutes	-	Marital status	1= Married 0= not married	+/-
Time spent in collecting firewood	Continuous	Hours	-	Cultivated plot	1= Yes 0= No	+
				Fishing activities	1= Yes 0= No	+
				Own livestock's	1=Own livestock's 0= No livestock's	+

It is important to consider household major source fuel energy as it can be used during food preparation and suggest time taken by household to access. As reported in Table 8, major fuels used by rural household for cooking were firewood (89%), charcoal (9%) and paraffin (0.5%). While 65.5% of the urban households use charcoal, 19 % use firewood 7% use gas and 6.2% use paraffin. For the households using firewood in rural and urban areas, an average of 3 hours were spent in collecting firewood with maximum of 7 hours and minimum of 1 hour. Household accessibility to some of social services such as water can also have an implication on food intake at household level. Some of the sources were not located nearby making households spend 31 minutes on average for getting water to use in the household with a minimum of 6 minutes and the maximum of 280 minutes for rural households. For the urban households, an average of 23 minutes were used for fetching water with a maximum of 240 minutes and minimum of 6 minutes (Table 4).

Variables	Rural				Urban				Variable	Rural	Urban
	Min	Max	SD	Mean	Min	Max	SD	Mean		Percent	Percent
Time spent in collecting firewood (hours)	1	7	2	3	1	7	2	3	Marital status	96	89
Time spent in water collection (mins)	6	280	34	31	6	240	23	16	Education	71	89
Household size	1	33	3	5	1	17	2	4	Household head sex	73 (Male) 27 (Female)	70 (Male) 30 (Female)
Household age	18	100	16	46	16	100	14	42	Households	59	41

Table 4: Descriptive Analysis of Variables

3.2 Dietary Diversity Differences in Rural and Urban Households

A Chi-Square test was used to test dietary diversity differences between rural and urban areas. The results suggest that there is association between Cluster type (rural and urban areas) and FCS levels as 80% of the rural cluster was more food diversified compared to 20% of the urban cluster (Table 5). Thus, there is significant difference ($p<0.01$) in the level of dietary diversity between rural and urban areas. This means that the rural households were found to have a high chance of attaining a high dietary diversity compared to urban households.

Table 5: Cluster type (Urban and Rural) in relation to Food Consumption Score (FCS)

Variables	Category	FCS Level%			Pearson Chi Square	Significant
		Poor	Borderline	Acceptance		
Cluster Type	Rural	74	80	43	69.11	0.00***
	Urban	26	20	57		

High dietary diversity in rural areas is attributable to production of food varieties as most of agricultural production activities take places in rural compared to urban. These findings suggest that part of the rural household farm produce is consumed at home. instead of taking everything that is to the market for sale. High dietary diversity in rural areas could also be attributable to availability of adequate land that allow crops diversification and livestock keeping. As shown in Table 6, there is a high rate of participation in agricultural activities for rural households in terms of crop production and livestock keeping. This provides more chance for rural households to attain high diversity compared to urban households. Admittedly, most of rural households are involved in subsistence agricultural practices, hence they produce enough for home consumption.

Table 6: Rural and Urban participation in agricultural activities

Agricultural activities	Cluster type	Percent (Yes)	Percent (No)
Plot cultivated	Rural	87	13
	Urban	25	75
Livestock	Rural	58	42

ownership	Urban	15	85

These findings are similar to those by Mukherjee *et al.* (2018) who found that large percent of rural households have high dietary diversity score compared to households in urban area. Mukherjee *et al.* (2018) associated their findings with low food price in rural area as there is enough area for agricultural activities and high availability of food in rural areas compared to urban. However, these findings are inconsistent with the ones by Warren *et al.* (2015) who found that urban households have more diversified diets. Similar findings were recorded by Khed (2018) as households located in rural area were found to attain low dietary diversity compared to urban households. Overall, studies that found high dietary diversity in urban household associated the findings with high income and presence of regular market. This study argues that for rural household existence, low food price is an opportune parameter to attain diversity. With low food prices, households would be able to buy varieties of food by spending little amount of their income compared to urban household.

3.3 Determinant of Dietary Diversity for Rural and Urban Households

For the analysis of the determinants of Dietary Diversity, independent variables that were included are household education, household size, household age, time spent in water and firewood collection, livestock's ownership, fishing activities, cultivated plot, marital status, sex of the household head and farm size along with the dependent variable that is dietary diversity based on the level of Food Consumption Scores. Findings on the relationship of these variables are found in Table 7.

Household education was found to be significant ($P<0.05$ and $P<0.01$) and positively affect dietary diversity in both rural and urban households. This suggests that household with educated members are more likely to attain high dietary diversity. Education enables household to have knowledge in selection of nutritious foods and get employment to generate income that can be used to fulfill household basic needs such as food hence. For the household located in rural areas education helps to increase agricultural productivity using improved seeds and better farming technology that led to the increase in quantity and quality of the produced food, hence food security. These findings are similar to Ngongi and Urassa (2014) as households with education were

found to be more food secure due to accumulation of income from both farm and non-farm activities.

Household size was found to be significant (P<0.1 and P< 0.01) and positively affect household dietary diversity in rural and urban areas. This means that as the number of household members increase, the household is more likely to attain high dietary diversity. The larger household size implies availability of family labor for production and increased output level. It also implies an accumulation of income from multiple sources. However, Ngongi, and Urassa (2014) show that, as household size increase there is an increase in level of food insecurity since majority of the household members depend on the income obtained from household head.

Time spent in water collection was found to be significant (P<0.05) and positively affect dietary diversity in rural and urban areas. This implies that as household spent more time in water collection the more likely it were for the household to attain low dietary diversity. This is because inadequate water supply can force household to consume specific food groups such as porridge that need little water during food preparation as well as skipping meals (reducing feeding frequency) as more time is spent in water collection and less time in food preparation. Similar findings were reported by Mbwana *et al.* (2016).

Table 7: Determinant of household dietary diversity for rural and urban Tanzania

Rural variable	Coefficients and standard error	P>|Z|	Urban Variable	Coefficients and standard errors	P>|Z|
Household age	-0.088 (0.004)	0.035**	Marital status	0.983 (0.326)	0.003***
Time spent in collecting firewood	-0.110 (0.043)	0.010**	Household size	0.119 (0.061)	0.052*
Household size	0.143 (0.028)	0.000***	Time spent in fetching water	-0.013 (0.004)	0.002***
Plot cultivated	0.884 (0.266)	0.001***	Education	0.697 (0.330)	0.035**
Time spent in fetching water	-0.005 (0.003)	0.009***			
Education	0.620 (0.139)	0.000***			
Livestock ownership	-0.551 (0.139)	0.000***			
Fishing activities	-1.235 (0.743)	0.093*			

p<0.1probability levels, respectively and Standard Error in parentheses

Household marital status was found to be positive and significant (P<0.01) to urban household dietary diversity. This means that for the households who are married in urban area they are more likely to attain a high dietary diversity compare to single households. High dietary diversity is due to combination of income from different sources that enables afford food and non food expenditures. Further more, most of married households care for one another's health including eating habit and selection of nutritional food. These findings are similar to Powell *et al.* (2017).

Time spent on finding firewood was also found to be significant at P<0.05 but negatively related to rural household dietary diversity. These findings suggest that as households spent more time in finding cooking energy such as fire wood the more likely it were for the household to attaining low dietary diversity. This can influence household to reduce number of meals consumed as more time is spent in finding cooking energy and consume less prefered food that take less time during preparation.

Livestock ownership and fishing activities were found to be significant (P<0.01and P<0.1) and affect negatively rural dietary diversity. These findings suggest that the households owning livestock and involved in fishing activities in rural are likely to attain low dietary diversity compared to households without livestock and fishing activities. This is probably due to a large percent of the livestock that are kept by households maybe for business rather than home consumption. Moreover, low dietary diversity maybe due to inadequate consumption of other food groups as household maybe specialized in livestock keeping or fishing instead of crop production. These findings are in line with Kinabo *et al.* (2016) who suggested that the level of dietary diversity among households is low due to insufficient intake of protein from animals such as chickens.

Plot cultivated was found to be positive and significant (P<0.01) to rural household dietary diversity. This implies that farming households are likely to attain a high dietary diversity compared to households that do not farm. Cultivated plot provide a great opportunity for households to grow varieties of food groups and reduce cost of buying foods in the market. Furthermore, the amount of income that is saved can be used to buy other food groups such as meat and fish that households don't produce. These findings are consistent with those of Taruvinga *et al.* (2013); Harris-Fry *et al.* (2014); Zhou *et al.* (2019) and Cordero-Ahiman *et*

al. (2021) who found that households with assets such as land and crops, are likely to attain high dietary diversity.

Table 8: Major source of cooking energy for rural and urban.

Fuel sources	Urban percent	Rural percent
Firewood	19	89
Paraffin	6.2	0.5
Electricity	0.7	0.2
Gas	7	0.3
Charcoal	65.5	9
Other	1.6	0.6

Household age was found to be significant and negatively related to dietary diversity for rural households. These finding imply that the more the age of the household member, the more likely the household will have low dietary diversity. Increase in age of the household member lead to decline in capacity of the household member to participate in different activities such as crop cultivation as the working hours are reduced. Reduction of working hours leads to low income and low productivity hence low dietary diversity (Huluka and Wondimagegnhu, 2019).

4 Conclusion and Recommendation

4.1 Conclusion

The study intended to analyze dietary diversity for the rural and urban household. Using Food Consumption Score metrics and Chi-Square test, this study fail to accept the stated hypotheses as the findings suggested food diversification to rural households than urban households.

The results provided enough evidence that their is significant difference at 1% in the level of dietary diversity between cluster type (rural and urban). Thus, rural households were found to attain a high dietary diversity compared to urban households. High rural dietary diversity may be attributed to high participation of agricultural activities such as livestock keeping and crop cultivation.

The findings of statistic analyses suggested a Chi-Square of 29.6 and 118.5 for rural and urban respectively at 1% level of significancy. Therefore, we fail to accept the second hypothesis. However marital status was found to be significant to urban dietary diversity while time spent in firewood collection, plot cultivated, livestocks ownership, household age, fishing activities were found to affect rural household dietary diversity.

4.2 Recommendation

Based on the findings and discussion, this study recommends that in order to improve dietary diversity to urban households, improvement of infrastructure is necessary to easy transportation of food varieties from rural to urban areas to ensure availability of food varieties in urban areas. This recommendation is proposed as the study show that urban households have a high probability of attaining low dietary diversity compared to rural households. As indicated in section 3, low dietary diversity in urban may be attributed to high food price due to inadequate infrastructure for transportation varieties of agrifood products. Furthermore, we emphasize agricultural diversification to obtain food varieties from different food groups rather than specialization in a certain agricultural activity such as livestock keeping.

Provision of household social services such as water near residential areas will improve household dietary diversity by cutting the time needed for searching for clean water. The findings suggest that as households spend more time in searching for water, they are likely to attain low dietary diversity. To address this problem, construction of different source of water should be located near rural and urban households in order to obtain water within a short time.

Reference

Ajani, S. (2010). An Assessment of Dietary Diversity in Six Nigerian States. *African Journal of Biomedical Research* 13(3): 161-167.

Ajani, S. (2010). An Assessment of Dietary Diversity in Six Nigerian States. *African Journal of Biomedical Research* 13(3): 161-167.

Bocquier, A., Vieux, F., Lioret, S., Dubuisson, C., Caillavet, F. and Darmon, N. (2015). Socio-economic Characteristics, Living Conditions and Diet Quality are Associated with Food Insecurity in France. *Public Health Nutrition* 18(16): 2952-2961.

Cochrane, N. and D'Souza, A. (2015). *Measuring Access to Food in Tanzania: A Food Basket Approach.* EIB-135, U.S. Department of Agriculture, Economic Research Service, February 2015. 34pp.

Cordero-Ahiman, O.V., Vanegas, J.L., Franco-Crespo, C., Beltrán-Romero, P. and Quinde-Lituma, M.E. (2021). Factors that Determine the Dietary Diversity Score in Rural Households: The Case of the Paute River Basin of Azuay Province, Ecuador. *International Journal of Environmental Research and Public Health* 18(4): 1-16.

Estruk, O. and Oren, M. (2014). Impact of Household Socio-economic Factors on Food Security: Case of Adana, Turkey. *Pakistan Journal of Nutrition* 13(1): 1-6.

Harris-Fry, H., Azad, K., Kuddus, A., Shaha, S., Nahar, B., Hossen, M. and Fottrell, E. (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(1): 1-12.

Khed, V. (2018). *Nutritional Status and Dietary Diversity of Households in Vijayapura District of Karnataka*. University of Agricultural Science, Bengaluru, Department of Agricultural Economics, India. 24pp.

Kiboi, W., Kimiywe, J. and Chege, P. (2017). Determinants of Dietary Diversity among Pregnant Women in Laikipia County, Kenya: A Cross-sectional Study. *Bio-Med Central Nutrition* 3(1): 1-8.

Kinabo, J., Mamiro, P., Dawkins, N., Bundala, N., Mwanri, A., Majili, Z. and Msuya, J. (2016). Food Intake and Dietary Diversity of Farming Households in Morogoro Region, Tanzania. *African Journal of Food, Agriculture, Nutrition and Development* 16(4): 11295-11309.

Mbwana, H.A., Kinabo, J., Lambert, C. and Biesalski, H.K. (2016). Determinants of Household Dietary Practices in Rural Tanzania: Implications for Nutrition Interventions. *Cogent Food & Agriculture* 2(1): 1-13.

McKevith, B. (2004). Nutritional Aspects of Cereals. *Nutrition Bulletin* 29(2): 111-142.

Msambichaka, B., Eze, I.C., Abdul, R., Abdulla, S., Klatser, P., Tanner, M. and Probst-Hensch, N. (2018). Insufficient Fruit and Vegetable Intake in a Low-and Middle-income Setting: A

Population-based Survey in Semi-urban Tanzania. *Nutrients* 10(2): 1-16.

Mukherjee, A., Paul, S., Saha, I., Som, T.K. and Ghose, G. (2018). Dietary Diversity and its Determinants: A Community-based Study among Adult Population of Durgapur, West Bengal. *Medical Journal of Dr. DY Patil Vidyapeeth 11*(4), 11: 296-301.

Ngongi, A.M. and Urassa, K. (2014). Farm Household's Food Production and Households' Food Security Status: A Case of Kahama District, Tanzania. *Tanzania Journal of Agricultural Sciences* 13(2): 40-58.

Huluka, A.T. and Wondimagegnhu, B.A. (2019). Determinants of household Dietary Diversity in the Yayo Biosphere Reserve of Ethiopia: An Empirical Analysis using Sustainable Livelihood Framework. *Cogent Food and Agriculture*, *5*(1), 1690829.

Ochieng, J., Afari-Sefa, V., Lukumay, P.J. and Dubois, T. (2017). Determinants of Dietary Diversity and the Potential Role of Men in Improving Household Nutrition in Tanzania. *Plos One* 12(12): 1-18.

Powell, B., Kerr, R. B., Young, S. L. and Johns, T. (2017). The Determinants of Dietary Diversity and Nutrition: Ethno Nutrition Knowledge of Local People in the East Usambara Mountains, Tanzania. *Journal of Ethno Biology and Ethno Medicine* 13(1): 1-12.

Ruel, M.T. (2003). Operationalizing Dietary Diversity: A Review of Measurement Issues and Research Priorities. *The Journal of Nutrition* 133(11): 3911S-3926S.

Taruvinga, 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.

Torres-Reyna, O. (2012). Getting Started in Logit and Ordered Logit Regression. Princeton University, [http://dss.princeton.edu/training/Logit.Pdf] site visited on 11/07/2021.

Warren, E., Hawkesworth, S. and Knai, C. (2015). Investigating the Association between Urban Agriculture and Food Security, Dietary Diversity, and Nutritional Status: A Systematic Literature Review. *Food Policy* 53: 54-66.

Wooldridge, J.M. and Econometrics, I. (2003). A Modern Approach. *Mason: Thomson South-Western*.

Workicho, A., Belachew, T., Feyissa, G.T., Wondafrash, B., Lachat, C., Verstraeten, R. and Kolsteren, P. (2016). Household Dietary Diversity and Animal Source Food Consumption in Ethiopia: Evidence from the 2011 Welfare Monitoring Survey. BioMed Central Public Health 16(1): 1-11.

World Food Programme (2008). Food Consumption Analysis: Calculation and Use of the Food Consumption Score in Food Security Analysis. United Nations Vulnerability Analysis and Mapping Branch. 24pp.

Zhou, D., Shah, T., Ali, S., Ahmad, W., Din, I.U. and Ilyas, A. (2019). Factors Affecting Household Food Security in Rural Northern Hinterland of Pakistan. *Journal of the Saudi Society of Agricultural Sciences* 18(2): 201-210.