



Socio-Economic and Demographic Determinants of Dietary Diversity in Chamwino District, Tanzania

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Abstract: Researchers have determined the impact of socio-economic and demographic factors on dietary diversity using a simpler approach of twelve food groups. However, determining the influence of these factors based on an advanced procedure of weighted sum dietary diversity has not been done. The study on which this paper is based sought to analyse socio-economic and demographic determinants of dietary diversity in Chamwino District, Tanzania, with the specific objectives to a) determine dietary diversity and b) analyse the influence of socio-economic and demographic factors on dietary diversity in Chamwino District. Random sampling was used to select 400 households. The research was a cross-sectional one and was conducted using a questionnaire, focus group discussions and key informant interviews. Using weighted sum dietary diversity scores, it was found that 69.2% of the 400 sampled households had low dietary diversity. Household size, annual income per adult equivalent, education of household head, income-generating activities and land cultivated significantly influenced ($p \leq 0.05$) surveyed households' dietary diversity. It is concluded that most households in the study area consume low dietary diversity and that household size, annual income per adult equivalent, income-generating activities, education of household head, and land size cultivated are the major determinants of dietary diversity in the district. It is recommended that any intervention targeting at improving nutrition in Chamwino District should focus on promoting the consumption of a wide variety of food items at the household. Also, in order to improve dietary diversity in the district; family planning, income, income-generating activities, education of household head, and land size cultivated should be given high importance by government and other organisations dealing with food security.

Keywords: Socio-economic, demographic, dietary diversity, weighted sum dietary diversity, Tanzania

1. Introduction

Undernutrition and micronutrient malnutrition remain problems of significant magnitude in large parts of the developing world (Sibhatu, Krishna and Qaim, 2015). Improved nutrition requires not only better access to food for poor population segments, but also higher dietary quality and diversity (Sibhatu, Krishna and Qaim, 2015). Dietary diversity is defined as the number of food items consumed across and within food groups capable of ensuring adequate intake of essential nutrients that can promote good health (Abris *et al.*, 2018; Beatrice and Francis, 2018). According to Hoddinott (2002), dietary diversity is measured by summing up the number of different food items consumed by an individual over a specified time period. Hoddinott (2002) adds that it may be a simple arithmetic sum, the sum of the number of different food groups consumed, the sum of the number of different food items within a food group, or a weighted sum, whereby the additional weight is given to the frequency by which different food items are consumed. According to Kiboi *et al.* (2017), the nutrients essential for meeting nutritional requirements are not all usually found in a single food item; they are, however, present in a diet composed of a number of food items. According to Hu (2002), as cited by Abris *et al.* (2018), diverse diets have been shown to give protection against chronic diseases. Non-

diversified diets can have negative consequences on individual health, wellbeing, and development, as this kind of diet is not likely to meet micronutrient requirements. Dietary diversity is universally recognised as a key component of healthy diets (Abris *et al.*, 2018; Desta *et al.*, 2019). According to Mayèn *et al.* (2014) and Darmon and Drewnowski (2008), socio-economic and demographic factors have an impact on quantities and patterns of food intake; high socio-economic status and urban people generally consume more diverse food items compared to low socio-economic status and rural people. Impact of socioeconomic and demographic factors on health has widely been researched on, but the influence of socio-economic and demographic factors on dietary diversity has not widely been explored. Household dietary diversity can help identify vulnerable individuals from a socio-economic standpoint. Socio-economic factors (income, education, land cultivated, occupation and age) seem to be important determinants of dietary diversity and may, therefore, condition household dietary diversity (Zakaria and Laribick, 2014; Kiboi *et al.*, 2017). Other factors which may condition household dietary diversity are demographic factors (Darmon and Drewnowski, 2008). Socio-economic and demographic factors appear to have similar, although independent effects on dietary diversity (Darmon and Drewnowski, 2008). However, convincing empirical



evidence on the influence of socio-economic and demographic factors on dietary diversity remains to be established. Researchers have determined the impact of socio-demographic and economic factors on dietary diversity using a simpler approach of twelve food groups (see, for example, Taruvunga *et al.*, 2013 and Mbwana *et al.*, 2017). However, determining the influence of socio-economic and demographic factors on dietary diversity based on a weighted sum of dietary diversity scores, which reflects the frequency of consumption and not merely the number of different food items consumed, has not been done. Specifically, this paper sought to (i) determine dietary diversity and (ii) analyse the influence of socio-economic and demographic factors on dietary diversity in Chamwino District. The hypothesis that household size does not have a significant impact on dietary diversity was tested.

2.0 Theoretical Framework

This paper adopted the definition of dietary diversity that it is the number of food items consumed across and within food groups capable of ensuring adequate intake of essential nutrients that can promote good health (Abris *et al.*, 2018; Beatrice and Francis, 2018). In this paper, dietary diversity is measured using a weighted sum, whereby additional weights are given to the frequency by which different food items are consumed (Hoddinot, 2002). A household is said to consume high dietary diversity if the weighted sum score is 126.54 and above (Assenga and Kayunze, 2016). Dietary diversity of a household is influenced by demographic and socio-economic factors (Fig. 1). The demographic factors included in this paper are household size, age, and sex of the household head. Socio-economic factors, on the other hand, include education of household head in years, income-generating activities, total annual income per adult equivalent, acreage (land cultivated in hectares), marital status and main occupations of household heads. Both demographic and socio-economic factors influence dietary diversity which is the dependent variable.

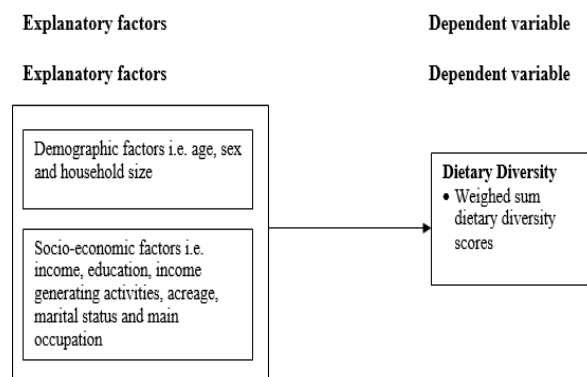


Figure 1: Conceptual framework of the paper

3.0 Methodology

3.1 Description of the Study Area

The study was conducted in Chamwino District, Dodoma Region, Tanzania. The district was selected since it had a

history of chronic food insecurity. Chronic food insecurity leads to chronic malnutrition which is reflected by stunting. Stunting reflects a failure to receive adequate nutrition over a long period of time. Mbwana *et al.* (2017) found that 41% of children under the age of five were stunted in the district in 2017. This level of stunting in the district was higher than the reported level of stunting at the national and Dodoma Region levels in 2015 which were 34% and 37%, respectively. Dodoma Region where Chamwino District is located has recurrent higher levels of stunting in Tanzania. According to URT (2015), the region was among 9 regions considered to have “very high” chronic malnutrition (stunting) exceeding the 40% threshold. These regions are Iringa, Njombe, Kagera, Dodoma, Ruvuma, Rukwa, Kigoma, Katavi, and Geita. In 2012, the district was among food-insecure districts in Tanzania (URT, 2012). The need for food aid from the government increased during the years 2009-14. Generally, food aid in tonnes for the above period was 93.8 (2009/10), 25 (2010/11), 53.8 (2011/12), 69 (2012/13) and 10 (2013/14) (DAICO of Chamwino District, personal communication, 2014).

3.2 Research Design, Sampling Procedures and Sample Size

A cross-sectional research design was used in this study. Cross-sectional designs can provide information that is useful for descriptive purposes as well as for determination of relationships between and among variables (Bailey, 1998). The sampling unit was a household since food scarcity is ultimately experienced at the household level (Maxwell, 1996). Chamwino District was selected purposively because of its history of chronic food insecurity. Three wards were purposively selected due to their history of receiving food aid from the government (District Agriculture, Irrigation and Co-operatives Officer (DAICO) of Chamwino District, personal communication, 2014) while six villages were selected purposively. These were Fufu Ward (Fufu and Suli Villages) and Idifu Ward (Idifu and Miganga Villages) where chronic food insecurity was relatively high and Membe Ward (Membe and Mlimwa Villages) where chronic food insecurity was relatively low. The respondents were selected randomly from the sampling frame which was established from the village registers by listing all households headed by male and female heads with children who were 7 to 17 years old. The sample size was 400 households. The formula for sample size determination by Cochran (1977) as cited by Bartlett, Kotrlik and Higgins (2001) was used to determine the sample size. The sample size was justified on the fact that “too large a sample implies a waste of resources, and too small a sample diminishes the utility of the results”. Therefore, the following formula was used to determine the reasonable sample size:

$n = \frac{Z^2 * p (1 - p)}{d^2}$ (Cochran, 1977, cited by Miezah *et al.* (2015), where:

d^2
 $n =$ sample size.



Z = a value on the abscissa of a standard normal distribution (from an assumption that the sample elements are normally distributed), which is 1.96 or approximately 2.0 and corresponds to a 95% confidence interval.

p = estimated variance in the population from which the sample is drawn, which is normally 0.5 for a population whose size is not known.

d = acceptable margin of error (or precision), whereby according to Krejcie and Morgan (1970) as cited by Bartlett *et al.* (2001), the general rule is that in social research d should be 5% for categorical data and 3% for continuous data. In this paper, 5% was used since substantial categorical data were collected.

Using a Z -value of 2.0, a p -value of 0.5, a q -value of 0.5, and a d -value of 0.05%, the sample size (n) was determined to be 400, i. e.

$$n = \frac{Z^2 * 0.5 (1 - 0.5)}{0.05^2} = (4 \times 0.25) / 0.0025 = 1 / 0.0025 = 400.$$

3.3 Data Collection

Primary data were collected using a questionnaire which was administered to household heads. The data collected included demographic and socio-economic factors such as sex of household head, marital status of household head, number of people living in a household, size of cultivated land, income-generating activities, income, age of household head and occupation of the household head. Data on household dietary diversity were collected using a dietary diversity questionnaire developed by Hoddinott (2002) whereby the determination of dietary diversity was done using the procedure described hereunder.

3.4 Determination of Dietary Diversity

In the study on which this paper is based, a weighted sum of dietary diversity was adopted. The person responsible for the preparation of food was asked to indicate different foodstuffs (e.g. maize, sorghum, vegetables) the family had eaten in the previous 30 days. The foodstuffs were location-specific, and food groups were developed from focused group discussions. Scoring on the basis of the tool presented in Appendix 1 was done using the following categories: 16-30 days in the previous month (score of 24) i.e. at least every other day; 4-15 days in the previous month (score of 10) i.e. once or twice a week; 1-3 days in the previous month (score of 3) and 0, i.e. not at all (score of 0). The dietary diversity index was achieved by calculation of the weighted sum adopted from Hoddinott (2002). The following weights were assigned: J: 24; S: 10; M: 3 and R: 0). These weights were summed up from each food item consumed by each individual household and used to calculate dietary diversity of a particular household, based on weighted sum dietary diversity scores. However, it is important to note that Hoddinott (2002) did not indicate the reasons for the use of the letters J, S, M, and R for weighting scores of dietary diversity. It is plausible that the letters were used for convenience in data coding and analysis. In this study, a household was said to have low dietary diversity if the weighted sum score was less than

126.54 and high dietary diversity if the weighted sum score was 126.54 and above. The cut-off of 126.54 was chosen because it was the mean weighted sum score in the sample. These cut-off points were established by Assenga and Kayunze (2016) when measuring food security based on dietary diversity using weighted sum dietary diversity score in Chamwino District.

3.5 Data Processing and Analysis

Quantitative data were analysed using IBM SPSS Statistics Version 20 Software and Microsoft Excel software to compute descriptive statistics, frequencies, percentages, statistical means, and standard deviations of individual variables. Besides, an inferential analysis was done to test the hypothesis of the paper. This hypothesis was tested using multiple linear regression analysis to test whether household size does not have a significant impact on dietary diversity. Variables were checked for normality because multiple linear regression assumes that variables have a normal distribution (Jason and Waters, 2002). Multiple linear regression was used to determine the effects of socio-economic and demographic factors on dietary diversity. The dependent variable, dietary diversity, was measured in terms of a weighted sum of dietary diversity scores.

Before entering variables in the linear regression model, normality of all scale-level measured variables was checked by computing their distribution curves and observing the curves visually to find whether any of them was skewed. Total annual household income per adult equivalent and land size cultivated were found to be skewed to the right; hence they were transformed into normal distributions using $\log_{10}$ transformation because that transformation function is recommended for transforming variables skewed to the right (Field, 2018). Other scale-level measured variables (weighted sum dietary diversity score, household size, age of household head, years of education of household head) were not transformed because they had normal distributions. Dummy variables which were entered in the linear regression model (sex of household head, income-generating activities, marital status of household head, and the main occupation of household head) were neither checked for normality nor transformed because doing so is not logical statistically.

Multicollinearity was checked by computing tolerances and variance inflation factors (VIF). According to Landau and Everitt (2004), tolerance values of more than 0.1 and VIF values of not more than 10 show that there is no multicollinearity. None of the tolerances or VIF value was less than 0.1 or greater than 10 respectively. Hence, there was no multicollinearity.

The multiple linear regression model that was used to determine the influence of socio-economic and demographic factors on dietary diversity in terms of weighted sum dietary diversity score was:

$$Y = B_1 X_1 + B_2 X_2 + B_3 X_3 + \dots + B_9 X_9 + e$$



Where:

Y= Weighted sum dietary diversity score (continuous variable)

a = Constant or intercept of the equation

b₁... b₉ = Regression coefficients,

e = Error term representing the proportion of the variance in the dependent variable that was unexplained by the regression equation.

X₁ = Household size (number of members),

X₂ = Sex of household head (Male = 1, Female = 0),

X₃ = Income generating activities (Yes = 1, No = 0),

X₄ = Education of household head (years of schooling),

X₅ = Total annual household income per adult equivalent,

X₆ = Acreage (land cultivated in hectares),

X₇ = Marital status of household head (Married = 1, Unmarried = 0),

X₈ = Main occupation of household head (Nonfarm = 1, Crop production = 0), and

X₉ = Age of household head (years).

3.6 Total Annual Household Income per Adult Equivalent (AE) Calculation

Net monetary values of all products produced and services provided by all household members over the previous 12 months were added up from the following household sources of income: products and services, salaries and wages, rentals, remittances and receipt in kind (Deaton, 1997). These were the households' sources of income which were used in this study. The amount of money obtained from those sources was divided by adjusted adult equivalent (AE) units of relevant households. According to Deaton (1997), to get better estimates of income, the survey must collect detailed data on all transactions, purchases of inputs, sales of output, and assets transactions, and do so for the whole range of economic activities among wage earners as well as among self-employed people (Deaton, 1997).

$$\text{Per Adult Income per person} = \frac{\text{Total income during year in household}}{\text{Adult equivalent unit at home}}$$

(Rahim *et al.*, 2011)

4.0 Findings and Discussion

4.1 Dietary Diversity of the Surveyed households

Many households (69.2%) ranked low on the measure of dietary diversity. This implies that many households were consuming limited dietary variety in the study area (Table 1).

Table 1: Dietary Diversity of the Surveyed Households (n = 400)

Dietary Diversity	Score ranges
High	126.54 and above
Low	Less than 126.54
Total	

Low dietary diversity could be due to low agricultural diversity in Chamwino District (Assenga and Kayunze, 2016), especially because the district is semi-arid, and the main way of getting food is through agriculture, including

livestock production. Low dietary diversity is a common feature of many developing countries (Labadarios, Steyn and Higgins, 2011).

4.2. Socioeconomic and demographic characteristics of the respondents

The average household size was 5.9 with the minimum and maximum sizes of 2 and 14. In terms of age, the minimum and maximum ages of the household heads were 19 and 91 years, respectively, while the average age was 46.1 years. Many (73%) of household heads had primary education. Eighty percent of household heads were male and married (78%). The average land cultivated in hectares was 2.55 with the maximum and minimum of 0.00 and 28 hectares, respectively. The main occupation of the household heads (98.5%) was crop production.

Table 2: Socioeconomic and demographic characteristics of the respondents (n = 400)

Characteristic	Frequency	Percent
Level of education of the household head		
No formal	97	24.2
Primary	292	73.0
Secondary	11	2.8
Sex of the household head		
Male	318	79.5
Female	82	20.5
Age of household head		
19 - 31	26	6.5
31 - 40	138	34.5
41 - 50	117	29.2
Above 50	119	29.8
Marital status of the household head		
Single	10	2.5
Married	312	78.0
Separated	44	11.0
Widow	33	8.2
Widower	1	0.2
Occupation of the household head		
Self-employed off farm	6	1.5
Crop production	394	98.5
Income-generating activities		
Yes	158	39.5
No	242	60.5

4.2 Socio-Economic and Demographic Determinants of dietary Diversity

Multiple linear regression was used to determine the influence of socio-economic and demographic variables on dietary diversity (weighted sum dietary diversity score) at the household level. The coefficient of determination, R², was 0.316 implying that the predictor variables explained 31.6% of the variation in the variance of the dependent variable that was dietary diversity in terms of weighted sum dietary



diversity scores. The other percent was contributed by other variables which were not included in the model (Gujarati, 2004; Field, 2018). For social sciences, such levels of coefficients of determination are reasonable, unlike in natural sciences where higher levels of R^2 are expected. Using linear regression analysis for determining the influence of socio-economic and demographic factors on weighted sum dietary diversity score household size, education of household head, income-generating activities, total annual household income per adult equivalent, and land cultivated in hectares were found to have significant influence (Table 3) on dietary diversity. The β -values tell us about the relationship between weighted sum dietary diversity scores and each predictor (Field, 2018). If the value is positive there is a positive relationship between the predictor variable and weighted sum dietary diversity score, whereas a negative coefficient represents a negative relationship (Field, 2018).

Land cultivated in hectares showed a positive significant influence ($\beta = 0.338$; $p \leq 0.001$) on dietary diversity (Table 3). This can be interpreted that an increase of 1 hectare of land cultivated, with all other predictor variables being held constant, caused an increase in weighted sum dietary diversity by 0.338 scores. This implies that the larger the land size cultivated the higher the dietary diversity.

Non-farm income-generating activities showed positive significant influence ($\beta = 0.211$; $p \leq 0.001$) on dietary diversity. Holding other predictors constant, households which were doing non-farm income-generating activities were found to consume higher dietary diversity by 0.211 scores compared to households which were not doing non-farm income-generating activities. This implies that the higher the household involvement in income-generating activities the higher the dietary diversity.

Household size showed negative and significant influence ($\beta = -0.099$; $p \leq 0.035$) on dietary diversity. This implies that an increase of 1 member of the household, all other predictor variables being held constant, caused a decrease in weighted sum dietary diversity by 0.099 scores. This implies that, as the household size gets larger, dietary diversity decreases. On the basis of the results, the hypothesis that household size does not have a significant impact on dietary diversity is rejected.

Years of schooling of the household head showed a positive and significant influence ($\beta = 0.122$; $p \leq 0.016$) on dietary diversity. This tells us that an increase of 1 year of schooling, all other predictor variables being held constant, caused an increase in weighted sum dietary diversity by 0.122 scores. This implies that the more the years of education of the household head, the higher the dietary diversity of the household.

Total annual household income per adult equivalent showed positive significant influence ($\beta = 0.190$; $p \leq 0.001$) on dietary diversity (Table 3), which means that an increase of TZS 1 with all other predictor variables held constant caused

an increase in weighted sum dietary diversity by 0.190 scores. This implies that the higher the household income, the higher the dietary diversity. This could be expected because increased income, other things being equal, means increased access to a wide variety of food.

Table 3: Socio-economic and Demographic determinants of dietary Diversity

Independent variables	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error				Tolerance	VIF
(Constant)	30.205	25.532		1.183	0.238		
Household size	-2.590	1.221	-0.099*	-0.121	0.035	0.869	1.151
Sex of household head (1 = Yes = 1, 0 = No)	-4.820	7.757	-0.044	-0.621	0.535	0.375	2.666
Income generating activities (1 = Yes, 0 = No)	18.945	4.055	0.211***	4.673	0.000	0.936	1.068
Education of household head (years)	1.753	0.723	0.122**	2.423	0.016	0.757	1.321
Total annual income per adult equivalent	18.290	4.659	0.190***	3.926	0.000	0.819	1.221
Land cultivated in hectare	50.524	7.512	0.338***	6.725	0.000	0.756	1.322
Marital status of household head (1 = Married, 0 = Unmarried)	2.703	7.692	0.026	0.351	0.726	0.359	2.783
Main occupation of household head (1 = non-farm, 0 = crop production)	28.981	16.102	0.080	1.800	0.073	0.960	1.041
Age of household head (years)	-0.054	0.180	-0.015	-0.303	0.762	0.773	1.294

Dependent variable: weighted sum dietary diversity score, $R = 0.563$, $R^2 = 0.316$, Adjusted $R^2 = 0.299$, F statistic = 18.4, Durbin-Watson = 1.882, ***significant at 0.1%, **significant at 1%, *significant at 5%.

5. Conclusions and Recommendations

Based on dietary diversity, it is concluded that many households in Chamwino District consume low dietary diversity. Therefore, there should be improved health promotion strategies to increase health outcomes. In particular, improvement highlighting more health food group options encourages dietary diversity within the home and enhances access to health education about food items for the whole family.

Based on the results whereby household size, income-generating activities, years of education of the household head, income and land cultivated had a significant influence on dietary diversity, it is concluded that these variables are the major determinants of dietary diversity in Chamwino District. Therefore, the following policy interventions are suggested for successful improvement in dietary diversity. Family planning needs to be intensified because large household size has a negative impact on dietary diversity. Policy interventions should focus more on education. Further, there is a need for promoting income-generating activities as alternative livelihood options in the study area to increase dietary diversity. Land reform plans that encourage land re-allocation should be supported in order to help households who do not own enough land for cultivation. Other policy interventions should focus on increasing household income.



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Appendix 1: Dietary Diversity. Indicate all the different food items that you have eaten in the last 30 days. Enter the following codes as indicated

Items	Frequency	Weight
	[1] 16 - 30 days in a month	24
	[2] 4 - 15 days in a month	10
	[3] 1 – 3 days in a month	3
	[4] days in a month	0
Cereals		
Maize		
Sorghum		
Rice		
Wheat		
Other cereals		
Tubers		
Sweet potatoes		
Taro		
Cassava		
Round potatoes		
Other tubers		
Vegetables		
Tomato		
Onion		
Carrot		
Cabbage		
Okra		
Leaf vegetables		
Legumes, nuts and other seeds		
Beans		
Cow peas		
Pigeon pea		
Groundnuts		
Fish		
Dried		
Smoked		

Items	Frequency	Weight
	[1] 16 - 30 days in a month	24
	[2] 4 - 15 days in a month	10
	[3] 1 – 3 days in a month	3
	[4] 0 days in a month	0
Fruits		
Bananas		
Mangoes		
Oranges		
Pawpaw		
Pineapple		
Baobab		
Other fruits		
Meat		
Beef		
Chicken		
Sheep/goat		
Other meat		
Pork		
Milk products		
Cow milk		
Goat milk		
Other items		
Sugar		
Honey		
Tea		
Salt		
Butter		