

**DETERMINANT OF HOUSEHOLD DIETARY DIVERSITY IN RURAL AND
URBAN TANZANIA: DOES HOUSEHOLD INCOME MATTER THE MOST?**

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**A DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF THE
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ABSTRACT

Recently, food security particularly in terms of nutrients availability has been topical reflected in food intake diversity. Thus, the study to analyze the determinant of household dietary diversity and analyze dietary diversity for rural and urban households in Tanzania was conducted. Specifically, the study intended to: compare the dietary diversity for rural, urban households and agro-ecological zones in Tanzania and lastly to determine the effect of income and other factors on dietary diversity in Tanzania. Using Panel data wave four, for 2014-2015 from the National Bureau of Statistics (NBS), the study adopted Descriptive Statistics, Food Consumption Score, Coping Strategy Index and Ordered Logit regression to accomplish the objectives. The dietary diversity was found to be more in rural areas than in urban area. Moreover, dietary diversity seems to be more dominant in Eastern and Lake Zone than the rest of the agro-ecological zones in Tanzania. Food Consumption Score suggest that, majority of Tanzanians belong to acceptance profile followed by borderline and poor profile, implying a high level of dietary diversity in Tanzania. The most consumed food was found to be cereals followed by vegetables, pulses, oil and sugar/sugar products. The results suggest that, household income, household size, cultivated plot and education were found to be significant and positively affecting dietary diversity while time spent on firewood and fetching water, livestock ownership and fishing activities were found to be significant but with negative effect in dietary diversity. Intake of less preferred food, reduce number of meals taken per day were the main coping strategies adopted by households. It is therefore recommended that, education should be provided, encourage household to participation in different economic activities in order to generate more income, ensuring availability of social services such as water and agricultural diversification will help to improve household dietary diversity.

DECLARATION

I, **Theresia Francis Assenga**, do hereby declare to the Senate of the Sokoine University of Agriculture that this dissertation is my original work, done within the period of registration and that it has neither been submitted nor being concurrently submitted for a higher degree award in any other Institution.

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The above declaration is confirmed by;

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Date

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Much as I have received all support, assistance and advises from others, I remain solely responsible for this work and its outcomes.

DEDICATION

I dedicate this dissertation to my beloved parents Drs, Mr. and Mrs. Assenga and my sister Getrude Tarimo for their tireless efforts in order to achieve my dream.

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LIST OF ACRONYMS

| | |
|-------|--|
| CSI | Coping Strategy Index |
| DD | Dietary Diversity |
| DHS | Demographic and Health Survey |
| FCS | Food Consumption Score |
| FWDDS | Frequency Weighted Dietary Diversity Score |
| NBS | National Bureau of Statistics |
| NCD | Non Communicable Disease |
| NPS | National Panel Survey |
| URT | United Republic of Tanzania |
| WFP | World Food Program |
| WHO | World Health Organization |

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background Information

Adequacy intake of food varieties is very essential to promote growth, improve immunity that helps to fight against diseases and provide energy to an individual. Intake of food varieties, has been suggested to be very important to human body as a major source of nutritional adequacy, developing hemoglobin concentrations as well as anthropometric indices (Taruvinga *et al.*, 2013). Despite its essentiality, the intake of food varieties is still insufficient globally and literature have suggested to be among the causes of Non-Communicable Diseases (NCD) that has lead 71% of global deaths. Some of non-communicable diseases that are due to poor food intake includes some cancers, diabetes, cardinal vascular and respiratory diseases (Branca *et al.*, 2019).

Moreover, insufficiency intake of food varieties leads to low labor productivity due to inadequacy body energy that act as a constrain for production as well as economic development (Kinabo *et al.*, 2016). However, this does not mean people should take too much food or too little because excessive consumption of a certain food lead to malnutrition, obesity, overweight and low availability of nutrients obtained from other food groups. Also, less utilization of a certain food leads to wasting, micronutrient deficiencies and stunting (Branca *et al.*, 2019).

In order to solve this problem, dietary diversity is an important approach. The word dietary diversity has been defined by Ruel (2003) as number of different food groups consumed by individual or household in a given reference period in order to attain all the required body nutrients. This includes intake of food varieties from seven food groups

namely: roots and tubers, grains (cereals), legumes and nuts, fruits and vegetables, dairy products, fish and meat (World Health Organization (WHO), 2019).

Despite its importance, general intake of food varieties from seven food groups is still low as some of food groups are excessively consumed while other such vegetables, fruits, pulses, legumes and nuts are consumed at low rate and this suggest a low dietary diversity (Branca *et al.*, 2019). Low dietary diversity has also been a challenge especially in African continent. As literature suggests Africa is one of the continents with agricultural food production potential but consumption of diverse food groups is still low (Ruel, 2003; Rakotoarisoa *et al.*, 2011). This problem is also persistence even in rural areas where most of agricultural activities are taking place and they are expected to consume what they produce but their level of dietary diversity is still low.

A study done by Taruvinga *et al.* (2013) show that most of rural households had low dietary diversity that has been attributed with low consumption of some food groups such as vegetables, eggs, fruits, meats and fish. Hence majority of the households were found to consume more condiments, sugar/sugar products, oils, potatoes and grains. Another study conducted by Kabwama *et al.* (2019) in Uganda and Keding *et al.* (2012) in Tanzania show that the level of dietary diversity is low in the two countries despite agricultural production potentiality existing in the two countries. Furthermore, a study done by Workicho *et al.* (2016) found low level of dietary diversity both in rural and urban household in Ethiopia. This was due to rare intake of animal products such as meat. Although consumption of fruits was high as well as tubers and oil.

In a developing country like Tanzania where most rural dwellers consume what they grow, one would expect household dietary diversity to be high in the food basket regions

(Kinabo *et al.*, 2016). However, demographic and health survey (DHS) data from Tanzania indicates that food basket regions are the most malnourished (URT, 2016). For household to attain dietary diversity income plays an important role as it enables household to have access to food varieties. However, studies have suggested mixed findings on the effect of income on dietary diversity as other factors were found to have more effect on dietary diversity compared to income (Workicho *et al.*, 2016; Hicks, 2018). It is the interest of this study to explore the determinant of household dietary diversity and assess if household income matters the most compare to other determinant of dietary diversity in Tanzania.

1.2 Problem Statement and Justification

Most of the developing countries such as Tanzania are facing the malnutrition problems that consists of over nutrition (overweight and obesity), undernutrition (wasting- low weight for height, underweight- low weight for age and stunting- low height for age) as well as micronutrient deficiency (insufficient minerals and vitamins). Presence of such problems has drawn attention to the government of Tanzania and other key stakeholders to consider malnutrition as one among challenges to deal with by improving the level of food security by 2030. Despite that Tanzania is endowed with varieties of food and food staff, yet the level of dietary diversity among Tanzanians is still low. This is due to high consumption of cereal foods 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 groups such as cereal implies low availability of micro and macronutrients as well as minerals. It also lowers the immunity for the children to fight against infection disease 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 can be a major source of nutrition deficient (McKevith, 2004; Ochieng *et al.*, 2017).

Generally, consumption of other food groups except for cereals has remained to be a challenge as literature shows that intake of some food groups such as fruits and vegetables, are below the recommended minimum intake of 400g per day that indicates low level of dietary diversity (Msambichaka *et al.*, 2018; Cochrane and D'Souza, 2015). The study by Ochieng *et al.* (2017) in Dodoma and Morogoro regions found that, majority of women and children had low dietary diversity due to low consumption of food obtained from animal sources.

The situation is said to be somehow different in some developed countries, as their level of dietary diversity tends to be relatively high due to high household income that leads to high accessibility to some food groups such as fruits and vegetable (Ruel, 2003). This is also supported by different studies that suggest income to be a major factor that enables household to attain dietary diversity (Prabhat and Begum, 2012; Taruvinga *et al.*, 2013; Doan, 2014; Powell *et al.*, 2017; Zhou *et al.*, 2019). While income has been considered an important for dietary diversity some studies suggest differently for instance Chen *et al.* (2012); Hicks (2018) reported that, income was not a constraint for individual or household to attain dietary diversity. Further, the results suggest that income affect dietary diversity negatively hence factors other than income play a major role towards dietary diversity.

Low dietary diversity has also been suggested to be a problem for the households located in rural areas despite larger percent of food produce and products are coming from rural area. A study done by Workicho *et al.* (2016) shows majority of the households in rural areas were found to have a low dietary diversity compared to urban households. However other study suggested households located in rural areas are more likely to attain higher dietary diversity compare to rural (Mukherjee *et al.*, 2018).

Based on the studies cited above, the effect of income and dietary diversity is still not clearly stated as some of the studies have suggested a positive effect of income to dietary diversity while others show other factors rather than income as major determinants of dietary diversity with income was found to have a negative effect on dietary diversity. Given this argument it was the question of the study to consider if household income matters the most in influencing dietary diversity compare to other determinant. This study intends to narrow the knowledge gap of the determinant of household dietary diversity and assess the effect of household income on dietary diversity. Further, the study intends to show dietary diversity differences in Tanzania between rural and urban as the literature did not provides conclusive explanations specifically to Tanzania context on dietary diversity differences between urban and rural households.

Findings of this study provides information's that helps policy makers to come up with the right policy to fight malnutrition and other nutrient deficiency diseases. The results can also be used to support implementation of the United Nation Sustainable Development goals number 2 that aimed to reduce food insecurity in order to solve malnutrition problems in Tanzania. Moreover, the study provides education and awareness to households on how to achieve nutrition quality including the importance of

eating varieties of foods that helps to reduce the rate of Non-Communicable Diseases that are due to poor dietary diversity.

1.3 Objectives

1.3.1 General objective

The general objective of the study is to analyze the effect of household income and other factors on household dietary diversity in Tanzania in order to inform policy and decision makers about the right policy intervention to combat nutrient deficiency diseases in the country as well as improving household food dietary diversity.

1.3.2 Specific objectives

Specifically, this study intended to:

- i. Compare dietary diversity for rural and urban households in Tanzania.
- ii. Compare dietary diversity for agro-ecological zones in Tanzania.
- ii. Determine the effect of income and other factors on food dietary diversity at household in Tanzania.

1.4 Hypothesis

With respect to the first, second and third objectives respectively, the following hypothesis were tested:

- i. There is no significant dietary diversity difference between rural and urban households in Tanzania.
- ii. There is no significant dietary diversity difference between agro-ecological zones in Tanzania.
- iii. The household income and other factors have had no significant effect on household dietary diversity in Tanzania.

1.5 Organization of the Dissertation

This study has been organized into 5 chapters. Second chapter is subdivided into three sections that includes conceptual framework, theoretical framework and empirical reviews (Household dietary diversity, dietary diversity metrics, income and dietary diversity for the cluster type (rural and urban) and determinant of household dietary diversity) by showing various literatures that are considered to be relevant to the study. Third chapter shows source of data, procedures that used to obtain sample (Sampling designing and procedures) as well as methods of data analysis that has been used to obtain results respectively to the objectives that include descriptive statistics, Food Consumption Score (FCS) and Ordered Logit Model. Fourth chapter provides results and discussion of the study while, fifth chapter presents conclusion, recommendation as well as policy implication of the study.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Theoretical Framework

Based on the nature of the study, the appropriate theory to be used was consumer theory. This theory explains how a rational consumer makes decisions on consumption based on preference, price and income. The theory assumes a consumer is rational as he/she has information about good/product and he/she is expected to consume goods that can maximize utility given a budget or income constraint (Levin and Milgrom, 2004). Among assumptions of consumer theory is monotonicity which assume consumer prefer more to less this means if a consumer is given two bundles of goods, and the first bundle (A) contains more varieties than the other (B), consumer will prefer the first bundle (A) to the other (B) (Shon, 2008). Based on monotonicity assumption, consumer will attain more utility by consuming bundle A to B as shown; $U(A) > U(B)$.

The applicability of the theory to this study is that households act as a consumption unit (consumers) and aimed to maximize utility. However, maximization of utility can be attained through consumption of food varieties from different food groups that enables household to attain a required level of dietary diversity. From monotonicity assumption, households must increase varieties of food in basket as they prefer more food varieties than less. Hence this enables them to maximize utility and attain a required level of food dietary diversity.

Increase in food consumed in the household food basket depends on the household income which enables them to access or be able to purchase food varieties. Furthermore, the level of dietary diversity attained by households is also influenced with other factors

such as education, household size, household head, education, age, employment, own a farm, own livestock's, marital status, time spent on water and firewood collection as well as household location.

2.2 Operationalization of Key Term

2.2.1 Dietary Diversity

The word dietary diversity has some times been used interchangeably with Dietary Adequacy or Dietary Variety and used as measure of Nutrition Adequacy (Ruel, 2003; Ali *et al.*, 2019). Dietary diversity is among indicators of food security, the word food security has been defined as ability to have physical and economic access to safe, nutritious and sufficient food in order to meet dietary needs as well as food preferences for a productive and health life (Jones *et al.*, 2013). In order to assess food security, three indicators must be considered that include food availability which implies, presence of food that can be used when needed; food access which means ability to purchase and obtain food for both poor and rich (income) households and; food utilization which means availability of all nutrients in a food eaten that include dietary diversity (Jones *et al.*, 2013; Mbwana *et al.*, 2016; Zhou *et al.*, 2019).

The word dietary diversity has been defined by different scholars Mbwana *et al.* (2016), defined dietary diversity as a simple count of food groups that individual or household consume over a given period usually 24 hours. Labadarios *et al.* (2011) and Mukherjee *et al.* (2018) defined as varieties of foods groups consumed in a given period. The recall period range from 24 hours to 15 days. In order to attain dietary diversity an individual or household must increase consumption of food groups as they are very important to promote good health because each food contains a unique nutrients. Food varieties that can be categorised as cereals and sugar are the major source of energy and carbohydrate

although protein obtained from cereals can not be termed as a high quality protein (McKevith, 2004; WFP, 2008; Potashova and Kovalenko, 2015).

Animal products that includes meat, fish and milk/milkproducts are the major source of quality protein as well as some minerals and vitamins (WFP, 2008). Pulses contain vitamins such as E and K, source of energy, fat and good protein compare to cereals (Ofuya and Akhidue, 2005). Intake of fruits and vegetables is very essential to human body because its acts as source of some minerals such as potassium that can be used to prevent kidney stone and bone loss, it also helps to prevent cancer, stroke, weight control, constipation (digestion system) and heart diseases (Amao, 2018). Studies have suggested that a high dietary diversity meal stands a higher chance of reducing chronic diseases (Non Communicable Disease) while a less diversify diet may lead to poor individual health (Ruel, 2003; Solomon *et al.*, 2017; Mukherjee *et al.*, 2018; Afshin *et al.*, 2019).

Given various definitions provided by different scholars, this study defines dietary diversity as number of food groups consumed by individual or household over a given reference period of 7 days. This definition reflect consumption behavior and habit of individual or household compared to 24 hours recall (WFP, 2008). In this study dietary diversity has been assessed at household level inorder to show the ability of a household to provide quantity and quality food that enables all household members to meet their nutritional requirements (Mbwana *et al.*, 2016). Moreover, household dietary diversity act as an indicator of food access while individual dietary diversity shows dietary quality (Taruvunga *et al.*, 2013).

2.2.2 Measuring Dietary Diversity (DD)

Dietary diversity can be measured by different methods, although Dietary Diversity Score (DDS) and Food Consumption Score (FCS) are the most common methods used. In this study FCS is used to measure household dietary diversity given that data are taken in 7 days as a reference period. FCS can also be known as Frequency Weighted Dietary Diversity Score (FWDDS), which is obtained from frequency consumption of different food groups that were consumed at individual or household level in a given 7 days as a recall before the survey.

The method has been modified to capture the weakness of DDS by capturing weights of different food groups, and dietary diversity has been estimated by considering food groups that are included within diet and consumption frequency of a certain food group (Wiesmann *et al.*, 2009). One advantage of this method is that, it shows individuals or household's food consumption habits due to the increase in recall period compare to DDS that consider a 24 hours as a recall period. A longer recall period that is more than 7 days can be a problem since it is hard for individual or household to remember a long recall (WFP, 2008). This study considers households to attain dietary diversity if they fall in a borderline (21.5 – 35) or acceptance level (>35) in Food Consumption Score (FCS). A household will not attain dietary diversity when FCS is below 21.5 (poor).

Some of the studies that used FCS in measuring dietary diversity includes the one done by Mushi (2019) that aimed to assess food security among farmers who adopted a new beans seed variety as well as non-adopters. Study done by Kennedy *et al.* (2010) used FCS in order to measure food security by comparing household DDS and FCS. Another study done by Ambaw *et al.* (2021) in North West Ethiopia used FCS to assess FCS level and associated factors among pregnant women who attended antenatal services. Most of

the pregnant women were found to attain a high FCS level (acceptance) that represents a high level of dietary diversity. Other studies that used FCS include Isaura *et al.* (2018); Ngosingosi (2018); Folahan *et al.* (2020).

2.3 Empirical Literature Review

2.3.1 Effect of household income on food dietary diversity

Income in the context of this study was considered as summation of all individuals incomes received by household over the given period of one year. The study used income rather than expenditure as proxy for household income in order to avoid correlation problem between income and expenditure. A study done by Nsabimana *et al.* (2020) use income in order to avoid correlation between expenditure and income especially when household is required to make consumption decisions in food and non-food as well as locating income to each specific food groups.

One among factors that cause inadequacy or adequacy dietary diversity is household income as literatures show its strong effect of on food intake. Income also enables households to have access to food varieties in order to be food secure as it has been suggested to be among the pillars of food security that is food access (Ruel, 2003; Mukherjee *et al.*, 2018). According to Prabhat and Begum (2012) quantity of food consumed and consumption frequency of a certain food is positively affected by income received. Study done by Zhou *et al.* (2019) show that income of the household is the major factors that can be used to determine household food security. Another study done by Annim and Frempong (2018) in Ghana suggested that income received by household as well as credit access have positively affected household nutritional status and dietary diversity. Study done by Taruvinga *et al.* (2013) found that income can influence household dietary diversity positively. Thus as income of household who lives in rural

area increase they are more likely to attain high dietary diversity. Similar results were obtained by Kiboi *et al.* (2017) in Kenya as income received per monthly was positively and significant influence dietary diversity especially to pregnant women.

However, some of the studies have shown that, income does not influence dietary diversity. For example, studies done by Chen *et al.* (2012) and Hicks (2018) found a negative effect of income on dietary intake hence as the income increase consumption of diversify food decrease. This means that low purchasing or consumption of a certain food group due to high price may not be the only reasons why people eat less diversify diet hence other factors except income were found to have more effect to dietary diversity. A study done by Muhammad *et al.* (2017) shows that, increase in household income may only lead to increase or decrease consumption of a certain food group. The study suggested that any increase in income lead to increase in fruits consumption and increased consumption of processed meat although intake of some food groups such as legumes is low.

2.3.2 Dietary diversity in rural and urban

Literature also provided inconclusive results in terms of dietary diversity between rural and urban as different studies shows rural households have more advantage in attaining food varieties compare to urban due to high food price compare to rural area. Also in rural area land is available that allows production of diverse crops and vegetables compared to the urban area, something that leads to high dietary diversity in rural areas (Mukherjee *et al.*, 2018). While some of the findings show urban households to have more income and therefore able to attain a high dietary diversity compare to rural households. Thus, for the households with high income in urban area were able to attain a high level of dietary diversity compare to the one in rural area (Warren *et al.*, 2015; Workicho *et al.*, 2016).

Similar results were also suggested by Khed (2018) as the effect of income was found to be significant to dietary diversity, meaning high the income the more food varieties can be accessed by individuals or households there by increasing food basket. Households located in urban area were found to have high dietary diversity compare to rural, and the reasons were due to high income as well as regular market. The higher level of diversity was attributed with high consumption of food varieties in urban compare to rural due to market access while rural is dominated with irregular market that cannot be accessed daily.

Another study done by Ajani (2010) in Nigeria found that rural households were more food diverse as they have an opportunity to adopt traditional foods that are found to be healthier and of good quality diet. However previous studies done in the same country have suggested urban households are more food diverse compare to rural. A study done by Bilal *et al.* (2016) in Ethiopia shows the level of dietary diversity to be low to both rural and urban although the level of diversity in urban was found to be worse compare to rural. The differences were due to unequal health education provision as rural areas are considered to lack health services hence more resources were located in rural compare to urban.

Based on this fact it is the interest of the study to show the effect of income on dietary diversity in Tanzania context in order to address the main study question that aim to assess if household income matter the most compare to other factors. Moreover, the study has analyzed the dietary diversity differences between rural and urban as previous studies did not provides a conclusive result on whether income influence dietary diversity as well as dietary diversity differences between rural and urban.

2.3.3 Determinant of dietary diversity

The study also tests the influence of other factors such as household size, household head, education, age, employment, own a farm, own livestock's, and marital status as studies suggested dietary diversity is not only influenced by income but other factors. Hence scholars have identified factors other than income that influencing dietary diversity as well as food security. These factors have been found to differ from one region to another as well as from one country to another (Zhou *et al.*, 2019).

Some of the studies includes the one done by Ali *et al.* (2019) on association of food security and other social economic factors with dietary diversity and nutrition statuses of children age 6-59 months in rural Bangladesh have shown the association between dietary diversity and social demographic factors. Among factors that were mentioned includes maternal education, mother age, education level, employment status, source of drinking water, household assets and income.

Another study by Zhou *et al.* (2019) in Pakistan on factors affecting household food security in rural Northern Hinterland of Pakistan reported gender, education, age, household size, remittance, unemployment, inflation, household assets that is land and livestock's, employment, distance from main road, credit, market access, flood, diseases, drought, food aid and food price are among household social economic characteristics that determinant of food security.

Similar study in Nigeria conducted by Kaoje *et al.* (2019) have also suggested income, farm size, inputs that facilitate farming activities, pest and diseases, education, age of household head, household size and marital status are the major determinant of household food security. The study is also related to Bocquier *et al.* (2015) that was done in France

which identified gender, age, household size, income, employment, and education as social economic characteristics that determine dietary quality.

A study done in Tanzania specifically in Dodoma and Morogoro regions by Mbwana *et al.* (2016) shows that area under cultivated, income, accessibility and availability, household size, age, gender of household head, level of illiteracy of a mother or care giver, employment status and distance to water source that is less than 30 minutes' walk are some of the factors that influencing household dietary diversity.

Another study done by Nabuuma *et al.* (2018) on dietary diversity among smallholder households in Bukoba District- Tanzania and Kiboga District- Uganda found that distance to market, ability of household to rent out land and age of a caregiver are the major factors influencing dietary diversity. A study done by Kiboi *et al.* (2017) in Kenya that examined the determinants of dietary diversity among pregnant women suggested that household assets, education, land ownership, morbidity and employment can influence dietary diversity.

Ochieng *et al.* (2017) on determinants of dietary diversity and the potential role of men in improving household nutrition in Tanzania that is in Dodoma - Bahi District and Mbeya - Mbarali District have reported different social economic factors that affect household dietary diversity. This includes level of education, gender of the household head, size of the land cultivated, nutrition training especially in food preparation, vegetable production, off farm income and access to credit. According to Khed (2018) factors such as food intake habit and market distance have a negative influence on dietary diversity while household size, milking animals, production diversity, education, non-farm income, food expenditure and age influence positively dietary diversity.

From the reviewed empirical studies, other than income factors have been reported to have a significant positive effect to dietary diversity. That includes education, time spent in collecting water, number of visiting to health centers especially during and after pregnancy, farm size or area cultivated, own livestock's nutrition training on food preparation, income, vegetable production and employment.

However, there is still a debate to some household social economic factors such as age, income, gender of the household head, household size as well as marital status as some of the study have reported to have a positive and negative influence on dietary diversity. Thus this study aims to fill the gap by analyzing various factors other than income that can influence household dietary diversity in Tanzania context.

CHAPTER THREE

3.0 METHODOLOGY

3.1 Data Source and Sampling Design

The study used the fourth wave (4) of the National Panel Survey (NPS) that was collected from October 2014 to November 2015 by National Bureau of Statistics (NBS). The first wave was collected between October 2008 and October 2009 with a sample size of 3 265, Second wave was collected between October 2010 and November 2011 with a sample size of 3 924. Third wave was collected between October 2012 and November 2013 with a sample size of 5 010 and the fourth wave was collected between October 2014 and November 2015 with a sample size of 3 352. The data for all the waves was done in such a way that, the data were collecting from the same population identified in the first wave in order to identify changes within the same population overtime. The dataset used was suitable for this kind of study since it contains household's information such as consumption (food and non-food), social economic characteristics, non- farm income generating activities as well as agricultural production information.

Data were collected through stratified, multistage cluster sample design and Population and Housing Census of 2012 was used as a sampling frame in order represents the entire population. During sample selection, 4 strata were formed thus, Dar es Salaam, other Urban areas in Mainland, Rural areas in Mainland and Zanzibar. Generally, the survey comprised of 860 originally selected households from 68 clusters from previous waves and 3 360 new households were interviewed that is equal to 420 clusters from the 2012 Population Households Census and the end 8 households were randomly selected from each cluster. Although, the survey ended up with 3 352 households as it was found that

one cluster in Dar es Salaam was no longer there due to various reasons such as some houses were demolished to allow road expansion.

The study used data that were collected from agricultural, livestock's and fishery sectors as well as at household level. The data provides key variables that were used in the study which include household's social economic characteristics and other variables such as income, household size, household head sex, education, household age, employment and marital status. Moreover, the study used household consumption data specifically household food consumption, so as to obtain information on food consumed by households in past seven days (week) in order to calculate the level of dietary diversity.

3.2 Conceptual Framework

In this study, household dietary diversity depends on varieties of food groups consumed by households. Households were considered to attain dietary diversity when fall in a borderline (21.5-35) and acceptance (>35) profile in Food Consumption Score and otherwise while income received by household was among factors influenced dietary diversity. Both agricultural and non-agricultural activities were the main source of the household income.

Figure 1 shows household received income from different sources. Income received enables household to fulfill their demands that is required at household level for both food and non-food. Thus, decisions must be made in order to allocate income on both food and non-food. Because households are assumed to be a rational consumer, amount of income located for food consumption has been distributed to different food groups so as to be able to buy more food varieties from different food groups in order to attain high dietary diversity. Through this, household will be regarded as food secure because they have

physical and economic access to safe, sufficient and nutritious food that enable them to meet daily dietary requirement (Jones *et al.*, 2013).

The level of dietary diversity depends on the influence of other factors such as household size, household head sex, education, age, employment, farm ownership, own livestock's, marital status, household location (rural, urban and agro-ecological zones), time spent on water and firewood collection. This factors may have a positive or negative affects on food choice and varieties of food groups consumed by household (Prabhat and Begum, 2012).

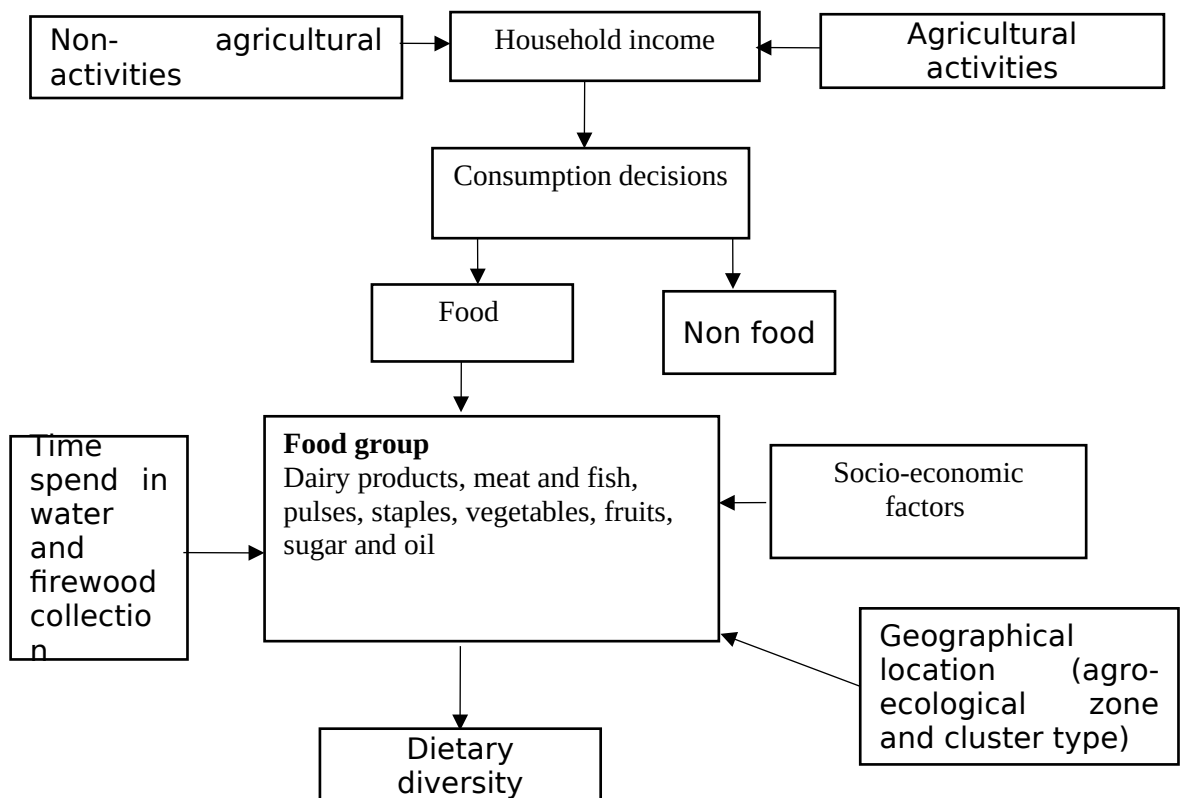


Figure 1: Conceptual Framework

Source: Modified from Nsabimana *et al.* (2020)

3.3 Methods of Data Analysis

3.3.1 Descriptive statistics

This involves use of measure of central tendency (mean, median and mode) and frequency (count, percent and frequency) in order to summarize and make simple interpretation of the data. In this study descriptive statistics was used to obtain results of the first and second objectives which aims to compare dietary diversity for cluster types (rural and urban) and agro-ecological zones. Through descriptive analysis the study was able to identify varieties of food group that are mostly consumed by households, summarization of household's social economic characteristics and other variables. Moreover, using a Chi-Square test the study was able to show dietary diversity differences in rural and urban as well as based on agro-ecological zones.

Other studies that used descriptive analysis includes the one done by Prabhat and Begum (2012) used a descriptive analysis and Chi-Square test in order to compare women with daily wage and monthly salaries payments with food consumption pattern as well as compare consumption pattern between women who are vegetarian and non-vegetarian. Similaly study done by Ajani (2010) used a Chi-Square to compare the level of dietary diversity and women social economic factors.

3.3.2 Dietary diversity metrics

3.3.2.1 Food Consumption Score (FCS)

In order to measure household dietary diversity a Food Consumption Score is used. This index can be used as a proxy indicator of household caloric availability (WFP, 2008). The method is used if food consumption data are recorded in a seven days as a reference period. In the current study households were asked to recall how many days in a week

they have consumed different food groups such as roots, tubers, plantain's, nuts and pulse, cereals, grains and cereals products, vegetables, meat, fish and animal products, fruits, milk and milk products, fats/oil, sugar and sugar products/ honey and spices/ condiments. In order to obtain the level of dietary diversity using Food Consumption Score (FCS) metric (Table 1), all foods were categorized in 9 food groups that is, cereals (staples), pulse, vegetables, fruits, meat and fish, oil, sugar and honey, milk and milk products and spices/ condiments.

Table 1: Food groups and their weights

| | Food items | Food groups | Weights |
|---|---|------------------------|----------------|
| 1 | Beef, goat, poultry, pork, eggs and fish | Meat and fish | 4 |
| 2 | Milk yogurt and other dairy | Milk and milk products | 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. | Cereals | 2 |
| 5 | Fruits | Fruits | 1 |
| 6 | Vegetables and leaves | Vegetables | 1 |
| 7 | Sugar and sugar products, honey | Sugar and honey | 0.5 |
| 8 | Oils, fats and butter | Oil | 0.5 |
| 9 | Tea, spices, salt, fish power, coffee, small amount of milk for tea. | Spices/ condiments | 0 |

Source: WFP (2008)

A number of days in a week that household consumed a given food were multiplied with food weight for each food groups so as to obtain a new weight for each food group. The weight of a food groups was given depends on the level of protein (quality protein), level of micronutrient and high energy obtain for a specific food groups for example protein obtained from animal source such as milk and meat. Some of the food groups such as

condiments (Weight=0), sugar/ sugar products and honey as well as fats/oil and butter were given small weight compare to other groups as they are consumed at a very low quantity. Hence when calculate Food Consumption Score condiments are excluded since they carry 0 weight. A new weight obtained from each food groups were summed in order to create a Food Consumption Score value for each household (Equation 1).

$$FCS = 4A_1 + 4A_2 + 3A_3 + 2A_4 + 1A_5 + 1A_6 + 0.5A_7 + 0.5A_8 + 0A_9 \dots \dots \dots (1)$$

Subscripts 1-9 = food groups A = frequency recalls from 7 days Number = food groups weights.

After obtain each household food consumption values, households were categorized in three profiles of Food Consumption Score that is household can be in a poor, borderline and acceptance level (Table 2). For a household who fall in a poor profile, it indicates a consumption of two food group in a week, four food group in a week for a borderline and more than four group for acceptance profile.

Table 2: Food consumption score profiles

| Food Consumption Score (FCS) | Profile |
|-------------------------------------|----------------|
| 0 – 21 | Poor |
| 21.5 – 35 | Borderline |
| > 35 | Acceptable |

Source: WFP (2008)

3.3.2.2 Coping Strategy Index (CSI)

CSI method can also be used as a measure of household food security. The method indicates various behaviors or a quickly responses and actions that are adopted by the household due to food shortage or lack of money to buy food (Maxwell and Caldwell, 2008). CSI mainly aims to answer a single question that provides answers on what

individuals or households do when they do not have enough food or money to buy food. Through the main question, the answers provided will represent different strategies that are adopted when such scenario occurs.

Different strategies that are adopted can have a long term impacts such strategies including selling of assets, while reducing portion size and eating less preferred food indicates a short term impacts. According to this method a household adopted strategies can be categorized into four groups, which are rationing strategies such as skipping the whole day without eating; decrease number of people in the household; increasing short term food availability that includes seed consumption, borrowing food from friends and relatives; harvesting premature crops as well as buy food on credit and dietary change by relying on less preferred foods.

The method uses 7 days as a recall period and that make easier for the households to remember. In order to answer the main question household must be asked; in a week or seven days, how many days they have adopted different strategies indicated in Table 3. This study used CSI to identify different actions that were adopted when household have no enough money to buy food or food shortage. It was important to identifying adopted strategies as they differ from one country to another. For example, strategy such as feeding working members in a household at the expenses of non-working members may not be a coping strategy in Tanzania but adopted in other countries. During the survey, households were asked if they have experienced or worried about food shortage during 7days. If “Yes”, households were required to provide more details by recalling how many days in a week they have adopted different strategies that are presented in Table 3. According to WFP (2003) different weight ranging from 1-4 can be assigned to each

strategy depend on the level of severe that is the most severity; strategy can be assigned a high weight and vice versa.

Table 3: Coping strategies index table

| Strategies | Weight |
|--|---------------|
| Rely on less preferred or less expensive food | 1 |
| Borrow food or rely on help from a friend or relatives | 2 |
| Limit varieties of food eaten | 3 |
| Limit portion size at meals time | 1 |
| Reduce number of meals eaten per day | 2 |
| Restrict consumption by adults for small children to eat | 2 |
| Go whole day and night without eating anything | 4 |

Source: Maxwell and Caldwell (2008)

In order to attain the Coping Strategy value, number of days of adopted strategy have been multiplied with the weight of a given strategy and added in order to obtain the final score that can be used to indicate whether a household is food secured or not (Equation 2). Final scores were categorized into three categories (Table 4) which represent the level of food security that is low (0-3), medium (4-9) and high (>10). The range of categories given is not constant and subjective. However, CSI indicates only food availability at household level but does not show the level of dietary diversity compare to FCS.

$$\sum \text{Weighted Score} = \text{Number of days} * \text{Severity Weight} \dots\dots\dots (2)$$

Table 4: CSI Levels

| CSI Levels | Range |
|-------------------|--------------|
| Low | 0-2 |
| Medium | 3-12 |
| High | >12 |

Source: Mutea et al. (2019)

Some of the studies that used CSI includes Akerele *et al.* (2013) in Nigeria that aimed to identify household coping strategies and food insecurity. A study done by Chagomoka *et al.* (2016) in Ghana used a CSI to analyze household behavior toward food insecurity specifically in rural and urban areas. Study done by Ngongi and Urassa (2014) in Tanzania used CSI to identify different coping strategies that were adopted by farmers.

3.3.2.3 Ordered Logit (Logit regression model)

Ordered logit model is also known as proportional odds model. It is as an extension of Binary model, allowing dependent variable to be categorized into more than two categories. Ordered Logit is used when the dependent variable has been classified in more than two categories that are arranged in order and their given values have meanings that differentiate one category from another. Other model such as Binary model can be used when dependent variable is based on two categories (dummy variables) this means value of one is given to show an observation is presence and zero if otherwise (Torres-Reyna, 2012).

Based on the third objective that aim to analyze the effect of income and other factors on food dietary diversity, in Tanzania an Ordered Logit model is used. This model is appropriate because dietary diversity as dependent variable has been categorized in ordered manner based on FCS level. According to FCS, dietary diversity has been categorized into “Poor”, “Borderline” and “Acceptance”. This means a household cannot belong to more than one category for example poor and borderline. The model is different from other model such as Multinomial Logit because it does consider the sequence of the outcome (Order matters). In this study the level of dietary diversity based on Food Consumption Score (FCS) was evaluated using following criteria’s:

$$DD=1(\text{ Poor }) \text{ If } FCS < 21 \dots\dots\dots (3)$$

$$DD=2 \text{ (Borderline) If } 21.5 < FCS < 35 \dots\dots\dots (4)$$

$$DD=3 \text{ (Acceptance) If } FCS > 35 \dots\dots\dots (5)$$

Thus, the Ordered Logistic regression equation was analyzed with other variables as shown in Table 5.

$$CPr_c = \frac{\exp(\alpha_c - \beta' X_i)}{1 + \exp(\alpha_c - \beta' X_i)} = \frac{1}{1 + \exp(-\alpha_c + \beta' X_i)} \dots\dots\dots (6)$$

$$\beta' X_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \dots\dots\dots + \beta_{13} X_{13} \dots\dots\dots (7)$$

Where: B_0, \dots, B_{13} Coefficients to be estimated X_1, \dots, X_{13}

α_c = Categories (Poor, borderline and acceptance)

CPr_c = Cumulative probability for the categories

Other determinants can have a positive or negative influence on household dietary diversity (Taruvunga, 2013). This brings a need to predict outcome of some of the variables that have been used in this study as indicated in Table 5.

Table 5: Description of variables used in estimation of Order Logit Model

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

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 Households Social Economic Characteristics

This subsection presents social economics characteristics and other variables of the sampled household that were included in the analysis. In this study, the variables included were captured at household level (Table 6). Some of the variables that were considered include age of the household head, sex of the household head, household composition structure, education, marital status, household income, farm size, number of meals per day, time spent in searching for water and firewood. Household income was captured by summing income earned by household in a year from agricultural and non - agricultural activities. In terms of household food consumption frequency, seven days' recall was used as reference period and dietary diversity was measured by using Food Consumption Score (FCS).

It was observed that 28% of the households were female headed while 72% were male headed households (Table 6). This shows that most of the households are in patrilineal society that are guided by male as the head of the household while few are matrilineal guided by female as the head of the households. The sex of the household head, has a major implication in decision making specifically in consumption for both food and non-food. About 78% of the household's head have attended school while 22% never attended school (Table 6). In this study a household were considered to be educated if they have ability to read and write either English, Kiswahili or both. Thus about 76% of the households were able to read and write while 24% were not able to read and write. However, most of the households have completed primary education as their highest level of education (47%) followed by Ordinary Level and some courses (13%), Advance Level

and some courses (1%) as well as Diploma and Universities level education (4%). Further on marital status, about 59% of the household's heads were married while 11% living together, 7% separated, divorced (4%) and widower or widow (12%) and 7% never married (Table 6). Consideration of marital status is very important as it has an effect in financial status of the households and decision making (Powell *et al.*, 2017). In this study household's heads who are separated, divorced, living together as well as widower or widow were also considered as single.

The average household composition structure consists of 5 members while the highest is 33 members and minimum is 1 member (Table 6). Large household size represents high productivity due to availability of manpower. The results also revealed that the number of meals taken per day differs from adults and children in the households. Generally, on average adults takes three meals per day while children take four meals per day (Table 6).

It is important to consider household major source of water and fuel energy used as they can be used during food preparation, but also they suggest time taken by household to access them. As reported in Table 6 that, major fuels used by household for cooking are firewood (61%), charcoal (32%), paraffin (3%) and gas (3%). For the households who use firewood as a major fuel for cooking, on average spend 3 hours to collect fire wood with maximum of 8 hours and minimum of 1 hour. Household accessibility to some of social services such as water has also implication in food intake at household level. The study has identified different sources that household depends on in order to obtain water for cooking and other domestic activities during rain and dry seasons. Some of the sources identified by households include piped water (53.3%), rain water collection (16%), surface water (35%), tube well (17%) and unprotected dug well (21%) as the main source of water (Table 6). Some of the sources were not located nearby, making household to

spend on average 27 minutes in order to get water to use in the household with a minimum of 6 minutes and the maximum of 280 minutes (Table 6). The mean age of the household head is 44 years old while the maximum age is 100 years and minimum age was 16 years (Table 6). This suggests that, most of the households interviewed were at productive age, an indication of activeness in economic activities in order to earn income.

The results also show that, on average, household earned about 5 063 000TZS per year while a minimum household income was found to be about 342 000 TZS and maximum of about 62 900 000 TZS. Availability of land is very essential for agricultural purpose and can also allow crop diversification, thus for the households who own farm, a mean farm size is 5.5 acres and the maximum is 251 acres (Table 6).

Table 6: Descriptive analysis of variables

| Variables | Description | Percent | Variables | Description | Percent | Variables | Mean | Standard Deviation | Min | Max |
|---------------------------|---------------------------|---------|---|-----------------------------|---------|--|-------|--------------------|-----|--------|
| Sex of the Household head | Female | 28 | Fuel used for cooking | Firewood | 61 | Age | 44 | 15 | 16 | 100 |
| | Male | 72 | | Charcoal | 32 | HH Size (No. HH members) | 5 | 3 | 1 | 33 |
| | Attended formal education | 78 | | Paraffin | 3 | Household Income (“000” TZS) | 5 063 | 9 043 | 342 | 62 900 |
| | Never attended | 22 | | Gas | 3 | Farm Size (Acres) | 5.5 | 11.4 | 1.3 | 251 |
| | Ability to read and write | 76 | | Other (such as electricity) | 1 | No. Meals a day (Adult) | 3 | 0.5 | 1 | 4 |
| Education | Cannot read and write | 24 | Sources of drink water during dry and rain season | Pipes water | 53. | No. Meals a day (Children) | 4 | 2 | 1 | 11 |
| | Primary education | 49 | | Rain collection | 16 | Time spent in fetching water (minutes) | 26 | 31 | 6 | 280 |
| | O level + some courses | 13 | | Surface water | 35 | Time spent in collecting firewood (hrs.) | 3 | 2 | 1 | 6 |
| | A level + some courses | 1 | | Tube well | 17 | | | | | |
| | Diploma + University | 4 | | Unprotected dug wells | 21 | | | | | |
| | Married | 59 | | | | | | | | |
| | Living together | 11 | | | | | | | | |
| Marital status | Separated | 7 | | | | | | | | |
| | Divorced | 4 | | | | | | | | |

| | |
|----------|----|
| Widow/er | 12 |
| Single | 7 |

4.2 Household Dietary Diversity in Tanzania

Food groups that are mostly consumed by households in Tanzania

In order to analyze dietary diversity, it was important to identify common food groups that are consumed by households in order to be aware of varieties of food contained in household's food baskets. Hence a descriptive analysis was used to identify common food groups consumed by household.

Table 7: Food groups consumed

| Food Groups | Percent |
|------------------------|----------------|
| Cereals | 97 |
| Pulse | 83 |
| Vegetables | 95 |
| Meat and Fish | 88 |
| Fruits | 60 |
| Milk and Milk Products | 65 |
| Oil | 89 |
| Sugar and Honey | 81 |
| Spices and condiments | 94 |

Thus, from Table 7, the results show that cereals (97%) were the most food group consumed by households in a given reference period of 7 days. Other food groups such as vegetables were also highly consumed (95%) followed by fats/oil (89%), meat, fish and animal products (88%), pulse (83%) and sugar/honey (81%). Some food groups such as fruits and milk/milk products were consumed at low rate, that is, 60% and 65% respectively. Generally, the household diet is mainly dominated by cereals, vegetables, meat, fish and animal products, pulse and less utilization of fruits as well as milk/ milk products. Intake of milk is very important as they are source of Vitamin A, good quality protein and micronutrients while fruits also contain micronutrients and they have low fats (World Food Programme (WFP), 2008).

High consumption of cereals and pulses compare to other food groups may be due to the availability across many regions, something that tend to push prices down resulting in high demand in line with principles of economics of demand and supply. Insufficient consumption of fruits and milk/milk products is due to low availability as majority of fruits are available seasonally while low consumption of milk maybe due to high price.

The results are in line with that of Tanzania Comprehensive food security and assessment report of 2017 as it shows 97% of the household depends on cereals in order to meet their food's needs. Further, the report shows that consumption of protein from animal source is still less utilized. Study done by Kinabo *et al.* (2017) in Morogoro Region reported a low intake of protein from animal source due to inadequate consumption of milk and milk products. The study also shows that cereal was most consumed especially maize products such as stiff porridge (Ugali) and rice. Low intake of food groups was due to consumption habit of the household to consume specific food groups, low feeding frequency as well as poor food preparation and cooking.

Similar studies done by Mukherjee *et al.* (2018); Ochieng *et al.* (2017); Bellows *et al.* (2020) reported that cereals were the most food group consumed as well as oil. However, the level of dietary diversity was low due to less consumption of meat, fish, eggs and fruits. Study done by Ntwenya *et al.* (2015) shows that the level of fibers as well as fat intake is still low in most of Tanzanians food basket.

In order to show household dietary diversity, FCS is used with the reference to the three profiles, poor, borderline and acceptance. The analysis involves identifying a profile that had high percent and low percent of the households as indicated in Table 8. Generally, based on FCS, the level of dietary diversity is high as a large percent of the households'

falls in acceptance level that is 89%, relative to the borderline 9% and poor 2%. This shows that, most of the households attains a minimum dietary diversity, meaning that, consumption of more than four food groups in a given seven days as a reference period. The results may also imply existence of high level of food security among households. For the households under poor profile indicate intake of less than four food groups, specifically high consumption of cereals and vegetables in seven days and this means they are food insecure.

Table 8: Food Consumption Score (FCS) levels with percentages

| FCS Profile | Percentage (%) |
|--------------------|-----------------------|
| Acceptance | 89 |
| Borderline | 9 |
| Poor | 2 |

4.3 Dietary diversity between rural and urban

A Chi-Square test was used in order to test dietary diversity differences between Cluster type that is rural and urban. The results suggest that there is association between Cluster type (rural and urban) and Food Consumption Score levels as rural cluster (80%) are more food diversifies compare to urban (20%) cluster (Table 10). Thus, there is significant difference ($p < 0.01$) in level of dietary diversity between rural and urban. This means that for the households who lives in rural areas have a high chance to attain a high dietary diversity compare to the households who lives in urban.

High dietary diversity in rural areas is due to production of food varieties as most of agricultural production activities take places in rural compare to urban. What is observed in these results suggest that, what is produced in the farm is also consumed at a household level instead of taking everything that is produced to the market for sale. It could as well

be availability of farm areas in the rural areas, allowing crops diversification and livestock keeping that makes food more available and at a bit cheaper prices compared to the urban areas. As suggested in Table 9, there is a high rate of participation in agricultural activities for rural households both cultivation of crops and livestock keeping that provides more chance for rural to attain high diversity compare to urban households. It is undeniable fact as well that, most of rural households are involved in subsistence agricultural practices hence they produce enough for home consumption and less for commercial purposes.

The results are similar to the study done by Mukherjee *et al.* (2018) in India as the study reported that, large percent of rural households have high Dietary Diversity Score compare to households in urban area. The reasons provided behind the observation by Mukherjee *et al.* (2018) were due to the low food price in rural area as there is enough area for agricultural activities and high availability of food in rural compare to Urban. However, these results are inconsistent with the one by Warren *et al.* (2015) who argued that, as most of households who lives in urban areas were found to attain high dietary diversity as the Dietary Diversity Score was 6.8. Similar results were obtained by Khed (2018) as households located in rural area were found to attain low dietary diversity compare to urban. The study also considered urban household to attain high diversity due to high income and present of regular market. This study argues that, for rural household existence, low food price is an opportunity parameter to attain diversity. With low food prices, households would be able to buy varieties of food staff by spending little amount of the income they earn compare to urban.

Table 9: Rural and Urban participation in agricultural activities

| Agricultural activities | Cluster type | Percent (Yes) | Percent (No) |
|--------------------------------|---------------------|----------------------|---------------------|
| Plot cultivated | Rural | 87 | 13 |
| | Urban | 25 | 75 |
| Livestock ownership | Rural | 58 | 42 |
| | Urban | 15 | 85 |

Dietary diversity across agro-ecological zones in Tanzania

It was also important to take consideration of agro-ecological zones when analyzing household's dietary diversity as they differ in terms of climates as well as nature of the soil. This can also have implications in different economic activities undertaken in different agro- ecological zones. Thus, in order to achieve this objective a Chi-Square test was used to test dietary diversity differences as well as to analyze level of dietary diversity based of FCS level based on agro-ecological zones.

The results, show that the level of dietary diversity varies across agro- ecological zones, (Table 10). Eastern zone and Lake zone have many households falling under acceptance and borderline level in FCS compare to Central zones and Northern Zones. This could be contributed by climatic factors such that in Central zone the nature of the soil may not supports agricultural diversification thus there is a probability that these regions import some foods from other nearby regions and some times the price of food is high. High dietary diversity in Lake and Eastern zone is due to the existences of large business cities such as Mwanza and Dar es Salaam that create market for both food and non-food items due to high demand. Furthermore, presents of regions that are among the main producers of food products such as Mwanza and Morogoro contributes to high diversity due to food availability.

Study done Mbwana *et al.* (2016) in Dodoma and Morogoro regions in Tanzania show that Dodoma experience one season rainfall per annum and most foods are imported with three times of the original food price. In case of Northern zone, the farming systems and climate and nature of the soil support production of different food agricultural products thus the low level of dietary diversity in this zone maybe attributed to business activities in which they sell a large percentage of what they produced and less remain for home or household consumptions. This means what is produced is not the same as what goes on the plate.

Table 10: Cluster type and agro-ecological zones 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 | | |
| Agro-ecological Zone | Eastern | 13 | 15 | 26 | 133.79 | 0.00*** |
| | Central | 4 | 9 | 3 | | |
| | Lake | 27 | 24 | 21 | | |
| | Northern | 5 | 5 | 9 | | |
| | Western | 6 | 10 | 7 | | |
| | Southern | 12 | 16 | 6 | | |
| | Southern Highland | 12 | 19 | 12 | | |

Note: * implies significance at $p < 0.01$ probability level.**

4.4 The Effect of Household Income and Other Factors on Dietary Diversity in Tanzania

4.4.1 Effect of household income on food dietary diversity in Tanzania

In this study income was estimated by summing income received by households in a year from different sources such as livestock and fishing activities, agricultural production activities as well as non-agricultural activities (Trade and business, pensions, wages and salaries, financial assistances and remittance). In order to handle outlier problem due to variation of income, Winsorization method was used by replacing the lowest values with 10 percentiles and 99 percentiles with the highest values. This method is more robust compare to other methods such as Trimming as it does not allow loss of information from other variables that maybe removed due to presents of outlier problem (Chambers *et al.*, 2000; VandenBosch, 2000). In order to confirm the effect of household income on food dietary diversity, an Ordered Logit model was used with dependent variable of FCS Levels that is poor, borderline and acceptance. Since a model cannot be run by one independent variable other household's variables were also included.

Given the results from econometric analysis, household income was found to be significant ($P < 0.01$) and positively affecting household dietary diversity (Table 14). This provides enough evidence that with high household income the more likely for household to be in acceptance or borderline level in FCS (high dietary diversity). This suggests that as household income increase there is high probability of households to consume varieties of food groups as it increase household purchasing power and attain dietary diversity.

The results are in line with the findings reported by Kiboi *et al.* (2017), in which household income was found to be positive and significant to dietary diversity both in household level and to pregnant women. Through income, household is able to purchase

more food varieties that helps to attain high dietary diversity. Study done by Ajani, (2010) in Nigeria found that, income influences positively dietary diversity especially to poor households because its enables them to have access of food varieties. These result are similar to those of Taruvinga *et al.* (2013); Estruk and Oren, (2014); Bocquier *et al.* (2015); Zhou *et al.* (2019) which show a positive effect of household income on dietary diversity as well as food security.

Despite most of the households being in acceptance level in FCS still income was the major problem to some households. Statistical analysis results show that about 32.4% of the household had experience food shock that had been due to low income while about 67.6% had enough food given a recall period of seven days (Table 11).

Table 11: Food shortage in a week

| Food shortage during seven days | Percentages |
|--|--------------------|
| Enough food | 67.6 |
| No enough food | 32.4 |

In some instances, due to the low availability of food in the respective household, the household may be forced to adopt some strategies in order to cope with a given situation at hand (Figure 2). Some of the coping strategies adopted include intake of less preferred foods (27.7%), reduce number of meals eaten per day (19.9%), limit varieties of food eaten (14.8), borrow food or rely on help from a friend or relatives (10.6%), limit portion of size at meal time (13.3), no intake of food for the whole day (3.2%), and restrict consumption by adults in order to allow children to eat (6.7%).

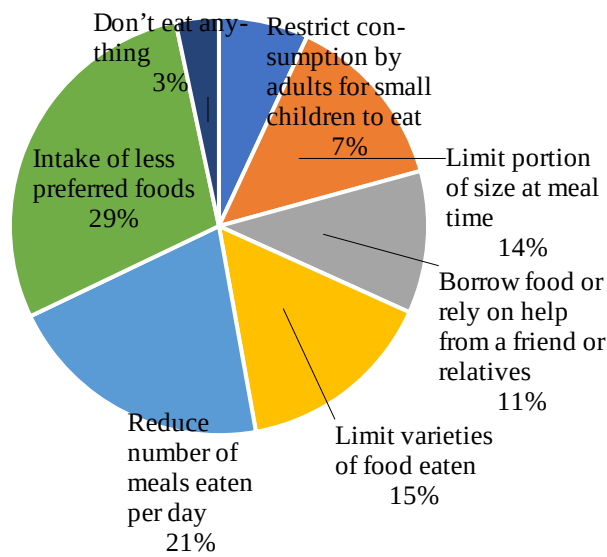


Figure 2: Coping strategies

Using Coping Strategy Index (CSI), majority of the households were found to be food secure (67%) that indicates low coping strategy level (0-2). 15% were food insecure but in a medium level. This indicate a short term impact of food shortage due to coping strategy that they adopt such as eating less preferred food and limit food varieties (Table 12). While 18% falls in a high level of food insecurity, this implies a long impact of food shortage hence household may decide to adopt long term strategy such as borrow food from friends and relatives, limit portion size, reduce number of meals and skipping the whole day without eating (Table 12).

Table 12: Coping Strategy index levels with percentages

| CSI Levels | Percentages |
|------------|-------------|
| Low | 67 |
| Medium | 15 |
| High | 18 |

The results of this study are in line with the study done by Akerele *et al.* (2013) in South West Nigeria as the study suggested that most of adopted strategies include eating less preferred food, reducing portion size and eating less expensive. Also the study suggested that the level of food insecurity decline with an increase in household income and education level. In Ghana, consumption of seeds, purchasing food on credit, sending children to eat in relatives or neighbors and skipping the whole day without eating were the coping strategies in urban areas. While limit portion size, eating less preferred food, intake of immature crops, looking for temporary employments, hunting, sale of animals, firewood and charcoal were common in urban and rural areas (Chagomoka *et al.*, 2016).

The coping strategies for food insecurity were also similar to the study reported by Ngongi and Urassa (2014) in Kahama, Tanzania as most of the farmers were found to eat less preferred food as the most adopted strategy although other strategies such as food purchase on credit, borrow food from friends and relatives, eating seed stocks and reducing portion size were also adopted.

Households were also asked if they had experienced any food problem in a given 12 months from 2013 to 2015 (Table 13). About 37% of the households had claimed to have experienced food shortage in a given 12 months while 63% had sufficient food. This implies that the level of food security is quietly satisfactory.

Table 13: Food shortage experience in 12 months

| Food shortage experience | Percentage % |
|---------------------------------|---------------------|
| Experience food shortage | 37 |
| Never experienced food shortage | 63 |

However, for the households that experienced food shortage, it was documented that the major cause of the said food shortage during these years (2013, 2014 and 2015) was the lack of money in those years 36%, 51% and 51% respectively (Table 14). Low intake of food due to lack of money or any resources represent food insecurity (Hunger) (Jones *et al.*, 2013). Other causes of the food shortage stemmed from inadequacy of household food stocks due to lack of farm inputs (8%, 12 and 7%), food in the market was very expensive (8%, 12% and 7%) and inadequate household stocks due to drought/ poor rain (28%, 6% and 7%) respectively.

Table 14: Causes of food shortage between 2013-2015 in percentage

| Causes | Years | | |
|---|--------------|-------------|-------------|
| | 2013 | 2014 | 2015 |
| Inadequate household stocks due to drought/ poor rain | 28 | 6 | 7 |
| Inadequate household food stocks due to crop pest damage | 2 | 2 | 3 |
| Inadequate household food stocks due to small land size | 8 | 8 | 3 |
| Inadequate household food stocks due to lack of farm inputs | 9 | 10 | 8 |
| Food in the market was very expensive | 8 | 12 | 7 |
| Unable to reach the market due to high transportation cost | 0 | 0 | 0 |
| No food in the market | 1 | 1 | 3 |
| Floods/water logging/hailstorm | 2 | 1 | 2 |
| No money | 36 | 51 | 51 |
| Other | 7 | 9 | 15 |

Table 15: Determinant of dietary diversity in Tanzania

| Variable | Coefficients and Standard Errors | P>z | Variable | Coefficients and Standard Errors | P>z |
|---|---|---------------|-----------------------------|---|---------------|
| Time spend in fetching water | -0.0057 (0.0017) | 0.001 *** | Household Size | 0.1401 (0.2641) | 0.000*** |
| Age of the Household Head | -0.005 (0.0037) | 0.179 | Livestock ownership | -0.4921 (0.1306) | 0.000*** |
| Time spend on finding cooking energy | -0.1032 (0.0406) | 0.011* | Fishing Activities | -1.4459 (0.7273) | 0.047* |
| Employment | -0.1737 (0.1721) | 0.313 | Plot Cultivated | 0.5126 (0.1799) | 0.004*** |
| Marital Status | 0.4366 (0.1387) | 0.753 | Gender of Household Head | 0.3262 (0.1453) | 0.822 |
| Farm Size | 0.0016 (0.0068) | 0.811 | Education | 0.5631 (0.1317) | 0.000*** |
| Household Income | 3.87E-08 (1.43E-08) | 0.007*** | Cluster type | 0.6268 (0.1699) | 0.000*** |

Note: ***, ** and * implies significance at $p < 0.01$, $p < 0.05$ and $p < 0.1$ probability levels, respectively and Standard Error in

parentheses.

4.4.2 Effect of Other Factors to Household Dietary Diversity in Tanzania

While household income was found to be positive and significant to dietary diversity, other factors were also found to have an implication towards dietary diversity. Some of the factors were found to be positive while other factors were found to be negative to household food dietary diversity (Table 15).

The econometric analysis results suggest (Table 15) that, household head education is positive and significant ($P < 0.01$) in influencing the household food dietary diversity. This implies that as the household head is educated the more likely to attain high level of dietary diversity. Availability of education to household enables them to have knowledge on the importance of intake of nutrition foods and this can also have an implication in food choice. Through education household can acquire knowledge and skills that may shape the way they generate income that can be used to purchase food varieties. Moreover, the more household members are educated, there is high probability of the household to increase food expenditure on nutritional foods compare to the households with no education (Taruvunga *et al.*, 2013; Ochieng *et al.*, 2017).

Similar results were also obtained from the study done by Kiboi *et al.* (2017) as education was found to be positively and significant to improve pregnant women dietary diversity. One among the reason that was pointed out is education enabled them to obtain appropriate information as well as improving their feeding practices. Moreover, household education helps in making choices on best food varieties, food preparation methods and processing (Kinabo *et al.*, 2016; Solomon *et al.*, 2017). Studies done by Zhou *et al.* (2019); Obayelu and Osho (2020); Estruk and Oren (2014) show that educated households were more likely to get a good paying job that enable them to earn enough money to buy varieties of foods.

Plot cultivated was found to be positive and significant ($P < 0.01$) to household dietary diversity. This implies that for the household who cultivate any plot the probability of attain dietary diversity is likely to be higher compare to those who did not cultivate any plot. Cultivated plot provide a great opportunity for households to grow varieties of food groups and reduce cost of buying foods in the market and this enables households to attain high dietary diversity. Furthermore, amount of income that was saved can be used to buy other food groups such as meat and fish that household don't produce. These findings consistent with the studies done by Taruvinga *et al.* (2013); Harris-Fry *et al.* (2014); Zhou *et al.* (2019), and Cordero-Ahiman *et al.* (2021) as they found that households who own assets both land, crop and home garden were more likely to attain high dietary diversity as well as to be food secured, therefore availability of such household's assets enable them to grow their own food.

Livestock's ownership was found to be negative and significant at $P < 0.01$ to household dietary diversity. Given econometric analysis results, this study suggests that for the households who own livestock are more likely to attain low dietary diversity compare to the households who don't own livestock's. 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 to livestock's owner maybe due to inadequacy consumption of other food groups as household maybe specialized in livestock keeping and forgone crop production. Hence attainment of dietary diversity is the function of different food groups and not a single food group.

Results are in line with the study done by Kinabo *et al.* (2016) among farming households in Morogoro Region in Tanzania which show that the level of dietary diversity among household was low. Among the reasons given was low intake of protein from animal

source as livestock's such as low consumption chickens and eggs were aimed for sales. Most of the chickens were consumed in holidays and when there was a guest. This implies that as household own more livestock's has is a great chance of the household to attain low dietary diversity as they keep livestock's for selling. However, these results contradict with study done by Taruvinga *et al.* (2013); Harris-Fry *et al.* (2015); Kiboi *et al.* (2017) as households who own livestock were more likely to attain dietary diversity because livestock ownership enables household to attain both micro and macronutrients as they can be source of foods such as milk, meat and eggs. Moreover, livestock such as chickens are easy to keep. Another study done Workicho *et al.* (2016) suggested that households who owned livestock were found to attain high dietary diversity as its enables them to generate income that can be used for consumption of other food groups.

Furthermore, fishing activities was found to be significant ($P < 0.05$) and negative to household dietary diversity. These implies that for the households who were involved in fishing activities were more likely to attain a low dietary diversity compare to the households who did not involve themselves in fishing activities. From these results, it suggests that there is a probability that a small percent of some of the catch were used for household consumption and remained were disposed for sell and through this made the household to attain low dietary diversity.

Household family size was also found to be positive and significant at $P < 0.01$ to dietary diversity. These implies that as household members increase it is more likely to attain high dietary diversity. This can be due to availability of labor force that increase productivity and enable increase of income from multiple sources. The results are similar to the studies reported by Harris-Fry *et al.* (2015) and Cordero-Ahiman *et al.* (2021) as it was found that as family size increase the level of dietary diversity increases. According

to the study done by Workicho *et al.* (2016), they found that, households who had more than four family members had attained high dietary diversity. Hence as household's size increase lead to availability of labor that helps to increase production. However, large family size sometimes can lead to food insecurity due to increase of number of dependent such as young children (Estruk and Oren, 2014; Kaoje *et al.*, 2019). A study done by Zhou *et al.* (2019) found the level of household food insecurity increases with an increase of household composition structure.

Another factor that was found to be significant is time spent by households in fetching water as its very important during food preparation. The time that household use in fetching water was found to be negative and significant at $P < 0.01$ to household dietary diversity. This implies that as household spend more time during water collection, the likelihood to attain low dietary diversity. The reasons behind are low availability of water 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 results were reported by Mbwana *et al.* (2016) household who spend more than 60 minutes' walk from home to water sources were found to have low dietary diversity compare to the households who spend less than 60 minutes.

Time spent in searching for firewood was also found to be significant at $P < 0.05$ but negative related to household dietary diversity. This results suggest that as households spent more time in searching for cooking energy such as firewood, the more likely to attaining low dietary diversity. This can influence household to consume food away from home, reduce number of meals consumed as more time is spend in searching for cooking energy such as firewoods and consume less preferred food that take less time during preparation such as porridge.

CHAPTER FIVE

5.0 SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Summary

The study intended to analyze determinant of household dietary diversity in rural and urban and the effect of household income to dietary diversity in Tanzania. Specifically, the study compared dietary diversity for the rural, urban households and agro-ecological zones as well as analyzed the effect of household income and other determinant of food dietary diversity in Tanzania.

The results show that majority of the household heads are male (71%) compare to female (28%) with average age of 44 years. About 76% of the households can read and write either English, Kiswahili or both, this indicates that majority of the households heads are educated and this provides an opportunity for household to be employed. On average, the household composition structure contains 5 members, minimum of 1 member and maximum of 33 members. Thus the larger the household size the more labor as well as availability of income from different sources.

Household income was obtained by adding all income received by households from both Agricultural and Non-Agricultural activities. The mean income received by households in a year was found to be 5 063 TZS (000) and the maximum income received in a year was 62 900 TZS (000). Moreover on average households spend 3 hours to collect firewoods and 26 mins to fetch water.

In terms of household dietary diversity, some of the households were found to be in acceptance level (89%), 9% borderline and 2% in poor. This suggests that most of the

households had attained atleast a minmum level of dietary diversity that is intake of atleast four food groups in a given reference period of seven days. Cereals (97%) was the most consumed food groups followed by vegetables (95%), oils (89%), meat, fish and animal products (88%), pulse (83%) and sugar and honey (81%) while fruits (60% and milk products (65%) were not consumed frequently compare to other food groups.

Regarding clusters analysis, agro-ecological zones and dietary diversity (Food Consupntion Score level) the Chi-Square test results provides enough eveidence that their is significant difference at 1% between dietary diversity, Cluster type and agro-ecological zone. Most of rural area have plenty land to cultivate varieties of food crops as well as food price maybe low compare to urban areas. Moreover some agro-ecological zones such as Eastern zone and Lake zone have soil potential to support agricultural activities compare to Central zone. This provides a great room to reject given hypotheses as the dietary diversity was found to be different in rural and urban as well as based on the agro-ecological zones.

Intake of less preferred food, reduce number of meals taken per day, limit varieties of food, borrow food from friends and relatives, limit portion size, skipping the whole day without eating and restricts adult from consumption in order for children to eat, were the main coping strategies adopted in the study sample. The level of food security was suggested to be high as majority of the households were found in low level of coping strategy index implying availability of food.

The econometric analysis results suggested a Chi-Square of 224.44 at 1% level of significant. Hence we reject the stated hypothesis as household income and other factors were also found to have an effect to dietary diversity. From the estimated econometric

model, it was found that, household income, hours spent in fetching water, hours spent in collecting firewoods, household size, livestock ownerships, fishing activities, plot cultivation and education were found to be significant to household dietary diversity.

5.2 Conclusions

From the general objective, this study concludes that most of the households have attained a minimum dietary diversity although for the households who live in rural and some of the agro-ecological zones that support agricultural production have a greater chance to attain dietary diversity compared to the households located in urban and zones such as Central zone that does not support diversification of agricultural production.

Based on the results obtained from the third objective it is right to suggest that household dietary diversity is strongly influenced by household income, household size, plot cultivated and education as they have a positive implication to dietary diversity. While time spent in fetching water, time spent in firewood, livestock ownership and fishing activities were suggested to have a negative effect to household food dietary diversity.

5.3 Recommendations

Based on the findings and discussion of this study the following are the recommendations: Firstly, education and awareness creation to households on the importance of intake of variety of food groups and importance of dietary diversity is useful. As the results suggest that some of the food groups were taken at a low rate compared to other food groups. Moreover, education and awareness will help to improve households' eating style and increase consumption of food at household level as the results show that household dietary diversity is mainly dominated by cereals; hence consumption of more cereals compared to other food groups may be due to eating habits. Creating nutritional awareness

to some zones that are agricultural potential but with low level of dietary diversity as a large percent of the produced are taken to the market and less are consumed at home. Education and awareness should also target food preparation as well as food choice in the localities.

Secondly, in order to improve dietary diversity in urban households, improvement of infrastructure is necessary so as to make easier transportation of food varieties from rural to urban areas and ensure availability of food varieties. As the study show a significant differences between dietary diversity and cluster type at 1% hence households located in urban have a high probability to attain low dietary diversity compare to rural. Low dietary diversity in urban maybe attributed to high food price due to inadequate infrastructure that make transportation cost to be high and lead to low availability of food varieties.

Third, encourage household to participate in different economic activities both agricultural and non-agricultural so as to obtain income that can be used for both food and non-food expenditure. As the regression results suggest, household income is positive and significant related to household dietary diversity and it implies that an increase in household income can lead to improvement of household dietary diversity. Moreover, income will enable access of food at household level as the study found a major cause of food shortage was due to lack of income (Money). Proper policies should emerge in order to safeguard households during food shortage such as introduction of food programmes that provide food assistance during food shortage.

Fourth, provision of household social services such as water near residential areas will improve household dietary diversity by cutting the time needed to search for clear water. The results suggest that as households spent more time in searching for water the more

likely to attain low dietary diversity. In order to solve this problem construction of different source of water near households in order to obtain water within a short time is necessary.

Further more encouraging agricultural diversification so that to obtain varieties of food help to improve household dietary diversity rather than specializing in production of a single food group.

5.4 Policy Implication

This study have different policy implications; Firstly: Introduction and strenghtern effectiveness of different programs such as fruits and milk campaign and other foods that are consumed rarel in order to create awareness. As the findings suggest a low intake of fruits and milk/milk products hence adding more efforts the existing programs and introducing new programs that aim to educate households on the important of such food groups is very important.

Secondly: Considering agro-ecological zones differences when making nutritional policies is very important as some of the zones have more advantage in term of agricultural potential compared to others. Third: construction of good infrastructure in rural area such as roads so as to ensure availabilty of food varities in urban area and reduce transportation cost that have an implication in food prices. As the findings suggest urban households have a high chance to attain low dietary diversity, which maybe due to high food prices. Thus improvement of infrastructure will reduce unccessary costs that are incurred in the entire value chain that are due to poor infrastructure.

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