EATING BEHAVIORS AND DIETARY DIVERSITY AMONG ADULTS IN MOROGORO URBAN, RURAL AND MVOMERO DISTRICTS

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A DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF THE MASTERS OF SCIENCE IN HUMAN NUTRITION OF SOKOINE UNIVERSITY OF AGRICULTURE. MOROGORO, TANZANIA.

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ABSTRACT

Lack of dietary diversity is a serious health problem in developing countries because diets are dominantly starchy staples. This study aimed at assessing healthy eating behaviors and dietary diversity among people living in Morogoro urban, rural and Mvomero districts. A cross sectional study was conducted to assess eating behaviors and dietary diversity in 150 households. Dietary diversity was assessed by using un-quantified validated 24 hours recall method. Anthropometric measurements of children under the age of five years (n = 102) were taken. Data was analyzed using SPSS for windows version 21 and WHOAnthroPlus. Results showed that, rural households had a lower average dietary diversity score per day (6.56 ± 1.73 units of dietary diversity score per day) than urban (8.38 ± 1.65 units of dietary diversity score per day) and periuban (7.72 ± 1.43 units of dietary diversity score per day) households. Dietary diversity was significantly different ($P < 0.05$) among households of different socio-economic status. Among all study households, 41.7 % (n = 63) had no knowledge about the effects of poor dietary diversity while 37.3 % (n = 56) had no knowledge about the roles played by vegetable and fruits in reducing the risks of non-communicable diseases. Nutritional status of the children under the age of five years, were negatively associated with high dietary diversity scores. It was concluded from this study that, living in rural areas increased the risk of becoming undernourished compared to living in urban and periurban areas. Despite socio-economic challenges in urban areas, people living in urban settings were more informed and had better access to diverse food varieties in all seasons. Awareness programmes should be conducted to the rural communities to equip them with appropriate nutritional knowledge about food groups, healthy eating and dietary diversity.

DECLARATION

I, Titus Herbert Mkemwa, do hereby declare to the Senate of Sokoine University of Agriculture that this dissertation is my own original work done within the period of registration and that it has neither been submitted nor being concurrently submitted in any other institution.

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(Supervisor)

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DEDICATION

I dedicate this work to my beloved parents, my father Rev. Herbert Amon Mkemwa and my late mother Anna Mkemwa for laying the foundation of my education. I also dedicate this work to my uncles Elias Fredrick Kissamo, David Fredrick Kissamo, Herman Fredrick Kissamo, Godfrey Fredrick Kissamo and Arnold Fredrick Kissamo for supporting my education and shaping me to the way I am now.

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LIST OF ABBREVIATIONS

DDS	Dietary Diversity Scores
DES	Dietary Energy Supply
FAO	Food and Agriculture Organization
FVS	Food Variety Scores
GIS	Geographical Information System
GPS	Geographical Position System
HDDS	Household Dietary Diversity Score
HSD	Honestly Significant Difference
IDDS	Individual Dietary Diversity Scores
kg	Kilogram
m	Metre
MDGs	Millennium Development Goals
NBS	National Bureau of Statistics
REPOA	Research on Poverty Alleviation
SPSS	Statistical Package for Social Sciences
TPHC	Tanzania Population and Housing Census
UNDES	United Nations Department of Economics and Social Affairs
URT	United Republic of Tanzania
USA	United States of America
WHO	World Health Organization

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background Information

A diet, which is sufficiently diverse, reflects nutrient adequacy (Kennedy *et al.,* 2009). This is because there is no single food, which contains all nutrients required for optimal health. The more variety of foods across and within food groups included in a daily diet the greater the likelihood of meeting nutrient requirements (WHO, 2010). Monotonous diets, based mainly on starchy foods such as maize and bread, have been closely associated with food and nutrition insecurity (Foote *et al.,* 2009). According to Foote *et al.* (2009) dietary diversity is an outcome measure of food security at the individual or household level. Food security is defined as access by all people at all times, to enough food and nutrients for an active healthy life (USDA, 2011).

Lack of dietary diversity is a particularly serious problem among poor populations in the developing world, because their diets are predominantly based on starchy staples, and often include little or no animal products and few fresh fruits and vegetables. Nutrition transition that most of the developing countries are undergoing is introducing important changes that greatly increase the risks for diet – related non – communicable diseases (Wahlqvist *et al.,* 2012). The concept of dietary diversity has been shown to have effects across the nutrition spectrum from under-nutrition to over-nutrition, depending on the way an individual or households diversify their diet (Foote *et al.,* 2009).

Meals consumed at the households reflect food varieties, which have a great impact on the nutritional status of the household members (Mirmiran *et al.,* 2006). There is a consistent positive association between households dietary diversity, children nutritional status and

per capita income, suggesting that household dietary diversity could be a useful indicator of food security and children nutritional status (Mirmiran *et al.,* 2006).

1.2 Problem Statement

About 44 % of Tanzanians consume too few calories and undiversified diet, with 71 % of all energy obtained from starchy staples (FAO, 2010a). Despite under-nutrition being a major concern in developing countries, diet related metabolic problems such as diabetics, cardiovascular diseases, hypertension among others, have emerged as alarming public health problems (Caballero and Rubinstein, 2009). Tanzania, among other developing countries in Sub-Saharan African, is facing both under-nutrition and over-nutrition challenges. Under-nutrition has been associated with undiversified diet (FAO 2010a). Overweight and obesity have been associated with diets that may have diversity, but of poorly selected food items such as high fat and high sugar foods. That is the reason why dietary diversity has showed to go along with healthy eating behaviours, involving careful selection of food items that can support good health.

Approximately 16 % of Tanzanian children aged zero to 59 months have low weight for their age, but in Morogoro Region, 18.8 % of children under the age of five years have low weight for their ages (NBS, 2012). A study by Nyaruhucha *et al.* (2004) showed that prevalence of overweight and obesity among adults was 25 % in Morogoro. The study also reported that 30 % of males and 26 % females living in institutions had low Body Mass Index while 39 % of males and 23 % of females living at home with families (not institution) had low Body Mass Index. The causes of under-nutrition were low dietary diversity and poor food choices. According to NBS (2012), low dietary diversity in Tanzanian households negatively affects the nutritional status of children especially those under the age of five years.

1.3 Justification of the Study

Diversified diet is necessity for achievement of balanced nutrient intake for optimal health, mental well-being, satisfaction and enjoyment. Morogoro Region is among the five regions earmarked as the national granary for the production of cereals in the national grain reserve program. However, initiatives done by the Government and other stakeholders such as USAID, UNICEF, CARE INTERNATIONAL and WORLD VISION, have not succeeded in eradicating under-nutrition in Morogoro Region, and the problem of under-nutrition is still rising (NBS, 2012).

Numerous studies based on individual dietary diversity have been cited looking at the eating habits at individual level using multiple pass and quantified 24-hrs recalls (Arimond *et al.,* 2010; Arimond and Ruel, 2004; Kennedy *et al.,* 2007). These studies do not provide assessment of dietary diversity at the population level (Albala *et al.,* 2011). In Tanzania, healthy eating and dietary diversity at the household level are not yet clearly characterised since macro and micro - nutrient deficiencies still remain a major public health problem (NBS, 2012). Still, there is a gap on how households dietary diversity as a measure of food security and proxy indicator of children nutritional status has been evaluated at population level (NBS, 2012). This study was designed to assess household dietary diversity using a non-quantified 24 hours recall method in urban, periurban and rural settings of Morogoro and Mvomero Districts.

1.4 Objectives of the Study

1.4.1 General objective

To assess eating behaviours and dietary diversity among adults in urban, periurban and rural households of Morogoro and Mvomero Districts.

1.4.2 Specific objectives

i. To determine the major food groups consumed at the household level based on a 24 hours recall method.

ii. To determine the usual food groups consumed at the household level using household dietary diversity scores.

iii. To assess nutrition awareness on healthy eating and dietary diversity.

iv. To determine the nutritional status of children under the age of five years using anthropometric measurements and investigate its association with dietary diversity.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Importance of Dietary Diversity

Dietary diversity reflects access to a variety of foods in the diet, and is the proxy to individual nutritional adequacy as the quality of the diet does improve with consumption of greater food diversity (Hudson, 2011). The association of dietary diversity to longevity and reduced rates of chronic degenerative diseases such as cardiovascular disease, diabetes and cancers for men and women was shown in previous work by Kant *et al.* (2010). In Kenya, dietary diversity has been linked to improved anthropometry in children aged one to three years (Onyango *et al.,* 2012).

2.2 Dietary Diversity at the Household Level

Under-nutrition can occur despite increased food availability and higher incomes for a number of reasons, including poor maternal and child feeding practices as well as inequitable food allocation within households. Other causes of under-nutrition include inadequate sanitation, poor or non-existent health services, and lack of access to safe, potable water (Steyn *et al.,* 2011). In addition to these, a leading cause of persistent under-nutrition is poor dietary diversity, that is, poor diversity of foods in the diet.

Poor dietary diversity can occur in a variety of contexts, including those where food availability is good and purchasing power is sufficient. It is typically expressed as a monotonous diet that is too high in carbohydrates and too low in protein and micronutrients. Intake of monotonous foods is common in many parts of the developing world, even among households, which can afford to eat better.

This type of diet, which is high in starch but low in protein, fat and micronutrients, will result in under-nutrition even if dietary energy supply is adequate. Stunting, nutrition-related anaemia, iron, zinc and vitamin A deficiencies are examples of hidden under-nutrition that can occur in individuals who are consuming enough total energy but not enough macro-and micro-nutrient-rich foods such as meat, fish, eggs, dairy, legumes, fruits and vegetables. In less secure households, where income and dietary energy supply are low, under-nutrition resulting from inadequate caloric intake may be exacerbated by poor dietary diversity. In both cases, increasing consumption of nutrient-rich foods is a key to improved nutritional status.

2.3 Healthy Eating

Healthy eating means consuming the right quantities of foods from all food groups in order to lead a healthy life (Rah *et al.,* 2010). The crucial part of healthy eating is a balanced diet. A balanced diet or a good diet means, consuming foods in the right quantities from the five main food groups namely, whole grains, fruit and vegetables, protein, diary, fat and sugar. A good diet must include several food groups because one single group cannot provide all nutrients that human body needs for good health. Healthy eating is one of the best practices that someone can do to prevent and control many health problems, such as heart diseases, high blood pressure, type 2 diabetes and cancers (WHO, 2013).

In addition to the quality of the foods consumed the quantity matters when considering good eating habits. Taking in the same number of calories as you burn ensures that your weight remains steady over time. Conversely, consuming more calories than you burn, results in weight gain as the body converts extra calories to fat tissue.

When fat tissue is accumulated, it increases the risk of developing one or more health problems, including heart disease, hypertension, respiratory issues, diabetes and cancers. A healthy meal plan without excess calories helps a consumer to feel not only good but can also prolong one's life. Healthy eating is influenced by various factors which affect individual food intake and hence, the nutritional status. Factors like marketing, cultural aspects, family economy, nutrition knowledge and emotions, influence what and how much a person can eat (Murphy and Allen, 2012).

2.4 Assessment of Household Dietary Diversity

Dietary diversity scores are used to asses food varieties consumed at the household level or by an individual. This is a method, which involves counting the food groups eaten by household members or an individual over the preceding 24 hours recall. Calculation of the scores is slightly different in household and individual levels (Johns and Eyzaguirre, 2010).

Using one 24 hour recall period does not provide an indication of an individual's habitual diet, but it does provide an assessment of the diet at the population level and can be used to monitor progress on target interventions (Albala *et al.,* 2011). The recall period of one 24-hour which was chosen by Food and Agriculture Organization (FAO, 2009) of the United Nations is less subjected to recall error, less cumbersome for the respondent and also conforms to the recall time period used in many dietary diversity studies (Arimond e*t al.,* 2010). Moreover, analysis of dietary diversity data based on one 24 hours recall period is easier than with longer recall periods.

2.5 Dietary Diversity and Household Socio-economic and Food Security Status

Few studies have specifically addressed the association between dietary diversity and socio-economic status. Intuitively, it seems plausible that people would tend to diversify

their diet more as their income increases, mainly due to greater variety diets generally more palatable and more pleasant (Hatløy *et al.,* 2000).

As households diversify their diet, they tend to increase their consumption of prestigious, non-staple foods rather than increasing variety within the category of staple foods. A study in Mali by Hatløy *et al.* (2000) also tested the association between household dietary diversity and socio-economic status. The study showed that, household dietary diversity increased with socio-economic status regardless of the households' location. However, a large difference was found in dietary diversity between urban and rural households, whereby urban households had a consistently higher dietary diversity than rural households were, even in the lowest socio-economic status group in urban areas there was higher dietary diversity than the highest socio-economic group in rural households.

The association between household dietary diversity and socio-economic factors is also suggested in other studies (Hatløy *et al.,* 2001). In Southern Peru, household dietary diversity was found to be higher in urban compared to rural areas (Leatherman, 2011). Within urban areas, poorer households also consumed less diverse diets compared to wealthier households, and the differences were mainly due to their lower intake of meals containing meat, dairy products and vegetables.

2.6 Dietary Diversity and Children Nutritional Status

Household dietary diversity is a good proxy indicator for children's nutritional status (Onyango *et al.,* 2009). Studies in Mali and Kenya documented strong associations between household dietary diversity and children's nutritional status (Onyango *et al.,* 2009; Hatløy *et al.,* 2000). In urban areas of Mali, lower dietary diversity scores were associated with twice the risk of being stunted and underweight (Kant *et al.,* 2000).

In Kenya, dietary diversity measured by the number of individual foods consumed in one 24 hours recall was significantly associated with nutritional status indicators namely Weight-for-age Z-scores (WAZ), Weight-for-height Z-scores (WHZ), Height-for-age Z-scores (HAZ) and mid-upper arm circumference among 12 to 36 months old children (Onyango *et al.,* 2009). The association between dietary diversity and growth is largely confounded by socioeconomic factors because dietary diversity is strongly associated with household socioeconomic characteristics (Onyango *et al.,* 2009).

2.7 Reference Period

There is no simple answer to the question regarding the optimal recall period to assess dietary diversity. As for all dietary assessment methods, this depends on the magnitude of day to day variability and recall error, and on whether the indicator is to be used at the individual or the household level.

At the household level, FAO, (2010b) uses a reference period of previous 24 hours recall. Using one 24 hours recall period does not provide an indication of an individual's habitual diet, but it does provide an assessment of the diet at the population level and can be useful to monitor progress or target interventions. The recall period of one 24 hours recall was chosen by FAO (2010b), as it takes less time and also less tedious for the respondent. Rather than having to say yes or no to each food, it actively involves the respondent in the interview process.

It facilitates consideration of the ingredients used in mixed dishes, it is less subject to recall error, less cumbersome for the respondent and also conforms to the recall time period used in many household dietary diversity studies (Kennedy *et al.,* 2007**;** Ruel, and

Garrett, 2010; Steyn *et al.,* 2011; Arimond *et al.,* 2010). Moreover, analysis of dietary diversity data based on a 24 hours recall period is easier than with longer recall periods.

2.8 Food or Food Group Diversity

The question of whether individual foods or food groups should be used to define dietary diversity has been addressed in a number of studies that compared both types of indicators. There is no international consensus on which food groups to include in the scores. Results of new research could justify changing the groups proposed in these guidelines. A study in Mali (Kennedy *et al.,* 2009) and Vietnam (Snowdon *et al.,* 2010) compared a household food variety score using one 24 hours recall with a food group indicator and found that both indicators were significantly associated with nutrient adequacy. The study by Kennedy *et al.* (2009), however, demonstrated that, food group diversity was a stronger predictor of dietary quality than the simple count of individual food items.

The proposed numbers of food groups to be included in the household dietary diversity score is based on the food groups proposed by FAO (2010b). The household dietary diversity scores is calculated based upon different numbers of food groups because the scores are used for different purposes. The household dietary diversity scores is meant to provide an indication of household economic access to food, thus items that require household resources to obtain, such as condiments, sugar and sugary foods and beverages, are included in the score. Individual scores are meant to reflect the nutritional quality of the diet. Twelve (12) food groups namely as cereals, white roots and tubers, vitamin A rich vegetables and tubers, dark green leafy vegetables and other vegetables, vitamin A rich fruits and other fruits, flesh meats and organ meat, eggs, fish and seafood, legumes, nuts and oil seeds, milk and milk products, oils and fats, sweets, and spices and condiments and beverages are proposed for the household dietary diversity scores. The

nine food groups including starchy staples, dark green leafy vegetables, other vitamin A rich fruits and vegetables, other fruits and vegetables, organ meat, meat and fish, eggs, legumes, nuts and seeds, milk and milk products ,are proposed for the individual dietary diversity scores (FAO, 2010b).

2.9 Scoring System

Dietary diversity indicators are usually constructed by summing up the number of foods or food groups (FAO, 2013). In developed countries, scoring systems sometimes include consideration of the number of portions of specific food groups in line with dietary guidelines (FAO, 2010b).

2.10 Cut-off Values

According to FAO (2013), the mean score of food groups should be consumed by at least 50 % of household members. Households, which consumed $\leq$ 3 food groups, had a low dietary diversity, and the households which consumed 4 and 5 food groups had medium dietary diversity, while the households which consumed $\geq$ 6 food groups had high dietary diversity. All households dietary scores should be within the range of 0 – 12 (FAO, 2013). Dietary intake of more than five food groups per day, predicts adequate intake of micronutrients in the body (Gina *et al.,* 2007).

Tanzania Food and Nutrition Centre (2011) highlighted that, the standard healthy eating is the consumption of three meals per day, which consist of five food groups namely:

i. Cereals, green bananas, roots and tubers group examples maize, rice, millet, cassava, taro, white potatoes, yams and sweet potatoes, pulses and nuts.
ii. Protein-source group examples beans, peas, nuts, meats, fish, eggs, milk, sardines and insects.

iii. Fruits group such as pawpaw, mango, orange, pineapple.

iv. Vegetables group including amaranth, sweet potato leaves, okra, pumpkins and tomatoes.

v. Honey, fats and oil group for extra energy such as sugar, honey, coconut, sunflower, corn and palm oil. Also two snacks a day are needed to ensure supply of all nutrients the body needs to stay strong and fight infection (TFNC, 2011).

There are no established cut-off points in terms of number of food groups to indicate adequate or inadequate dietary diversity for the household dietary diversity scores and individual dietary diversity scores. It is recommended to use the mean score or distribution of scores for analytical purposes and to set programme targets for interventions or goals. In addition to calculating mean dietary diversity scores, it is also important to know which food groups are predominately consumed at different levels of the scores (Snowdon *et al.,* 2010). This provides information on the foods that are eaten by those with the lowest dietary diversity, and which foods are added by those with a higher scores.

CHAPTER THREE

3.0 METHODOLOGY

3.1 Description of the Study Area

Morogoro Region is located about 190 km West of Dar es Salaam. It is situated on the slopes of Uluguru mountains and covers an area of 260 sq. km (UN-HABITAT, 2012). It lies at the crossings of longitudes 37.6 612 East of the Greenwich Meridian and latitude 6.82 102 South of Equator. The region covers an area of 19 056 sq. km with a total population of 2 218 492 in a share of 1 093 302 males and 1 125 110 females with an average households size of 4.4 persons (NBS, 2012).

Administratively, the region is divided into eight districts namely; Morogoro Municipality, Morogoro Rural District, Kilosa District, Ulanga District, Mvomero District, Kilombero District, and Gairo District. A satellite picture taken in Morogoro indicated that, the GIS taken for this study covered urban, periurban up to rural areas of the following districts; Morogoro Municipality, Morogoro rural and Mvomero districts.

Morogoro Municipality has a population of 315 866 on the ratio of 52.15 % women (164 166) and 47.85 % men (151 170), and the population growth rate is 4.7 % per annum. The following wards were covered in this study; Boma, Mji Mkuu, Mwembesongo, Sabasaba, Sultan Area, Uwanja wa Ndege, Uwanja wa Taifa, Kihonda Magorofani, Mafisa, Tungi, Mkundi, Mindu and Kingo (NBS, 2012). Morogoro rural district has a population of 286 248 in a ratio of 140 824 and 145 424 males and females, respectively, with household size of 4.2 persons. The following wards from Morogoro rural District were involved in the study; Kasanga, Kisaki, Mikese, and Mkambarani (NBS, 2012).

Mvomero District has a population of 312 109 in a ratio of 154 843 (males) and 157 266 (female) with household size of 4.3 persons. The following wards in Mvemoro District were involved in the study namely, Mzumbe and Mlali (NBS, 2012).

About 10 % of the current population in the study area, were civil servants employed by public and public institutions and industries while 50 % of the population were involved in agricultural activities (UN-HABITAT, 2012). The main cash crop grown in the study area was sisal while food crops grown include maize, rice, vegetables and fruits. The main income-generating activities include livestock keeping, mining, charcoal making petty and businesses. The average per capital income is estimated to be 130 000 Tanzanian shillings annually (UN-HABITAT, 2012). The main ethnic groups in the study areas are Waluguru, Wasagara, Wakaguru, Wandamba and Wapogoro.

The average daily temperature is $30^{o}C \pm 5^{o}C$. Normally, the highest temperature occurs in November, December and January during which the maximum temperature is $33^{o}C \pm 3^{o}C$ and the minimum temperature are in June, July and August when the mean temperature drops down to $16^{o}C \pm 5^{o}C$. The mean relative humidity is 66 % and drops down to 37 % during dry season. The average annual rainfall ranges from 821 mm to 1 505 mm. March to May is the time for long rainfall whereas short rains start during harvesting period, October to December (NBS, 2012).

3.2 Study Design

A cross-sectional design was used in this study. A cross-sectional design aims at determining the frequency (or level) of a particular attribute, such as a specific exposure, disease or any other health-related event, in a defined population at a particular point in time (Albala *et al.,* 2011).

According to Kothari (2009), a cross-sectional design is considered favourable because it is inexpensive in term of time, flexibilities, minimizes bias, and maximizes reliability.

3.3 Sampling Frame

The study population included all people who usually prepare foods (cooks) in the households. These were either parents or guardians or households maids or boys. Sick respondents or people receiving special diet during the interview were excluded from this study. Likewise, all households that refused to participate in the study were excluded.

3.4 Sampling Techniques

A geographical information system (GIS) and stratified random sampling techniques were used to randomly identify the households considering, urban, periurban and rural settings. Based on roads infrastructure and building density, GIS was used to create grid cells (strata) of which, sampled households were obtained randomly and given identification (ID) number as TZ_MORO_001, TZ_MORO_002, up to TZ_MORO_150.

The household ID was loaded into geographical position system device (GARMIN. eTrex 10, Garmin International, 2012. USA). In each setting (urban, periurban and rural) ten (10) grid cells were created (25 m by 25 m), and in each grid cell, five (5) households were randomly selected to make 150 households (Table 1). According to Marsland *et al*. (2009), in case the identified house was a guesthouse, hotel, or a non-residential house, a researcher could have a right to select the house nearby his or her left side towards north direction without exceeding the radius of 25 metre length and 25 metre width.

Table 1: Sampling technique

Location	Grid Cells (strata)	Households	Sample size (n)
Urban	10	5	50
Periurban	10	5	50
Rural	10	5	50
Total			150

3.5 Sample Size

Sample size was determined by using the statistical power analysis (Chow *et al.,* 2003) using the following equation:

$N = Z^2 * P (1-p) / d^2$

Whereby:

N = estimated sample size (when population is greater than 10 000)

d = degree of accuracy desired (precision level) (acceptable error 0.05 or 5 %)

P = prevalence of underweight children who are under five years (18.8 % underweight in Morogoro) (NBS, 2012).

Z = standard normal deviate set at 1.96, which corresponds to 95 % confidence interval

After substituting those values in the equation and dividing by the average household size (4.4 person) in Morogoro Region, (NBS, 2012), the sample size was 150 households inclusive of 10 % to cover for non – response that may occur (Fisher *et al.,* 1991).

3.6 Data Collection

3.6.1 Construction of the questionnaire

A structured questionnaire was constructed (Appendix 5). The Questionnaire had three sections. Section I solicited information on households socio-economic and demographic characteristics of the respondents, Section II solicited information on under-five children.

Section III assessed the meal composition based on previous 24 hours recall while Section IV assessed respondent nutrition awareness on healthy eating and dietary diversity.

3.6.2 Training of the enumerators

Eleven enumerators were trained on how to ask questions, how to record the responses and how to use the equipment to collect the anthropometric measurements.

3.6.3 Pretesting of the questionnaire

Before data collection, the questionnaire and other equipment were pre-tested in Chamwino ward. After pretesting, necessary changes were incorporated in the Questionnaire before the final administration.

3.6.4 Administration of the questionnaire

The questionnaire was administered to the subjects by face to face interview through home visits during the morning hours of the day.

3.7 Measurements Taken

Physical measurements of the subjects were taken once at the baseline survey. The biomarker for household dietary diversity was the nutrition improvement of children under the age of five years, including weight and height.

3.7.1 Height

For children less than two years of age, recumbent length was measured (lying down on the flat board). The board was positioned on a hard flat surface, and with the mother's help, the child was placed on the board facing upward with the head facing towards the fixed end and the body paralleling to the long axis of the board. Child's knees were

pressed onto the board so that the legs were straight and the toes pointing directly upwards, then the movable footboard was brought to rest firmly against the heels and measurement was taken and recorded to the nearest 0.1m.

For children above two years of age, stadiometer was placed against a wall firmly for measuring height. Subjects were asked to stand straight with the head positioned such that the Frankfurt plane was horizontal, feet together, knees straight and heels, buttocks and shoulder blades in contact with the vertical surface of the stadiometer. Hands were hanging loosely with palms facing the thighs. The movable headboard was then lowered until it touched the crown of the head and measurement was read and recorded to the nearest 0.1m**.**

3.7.2 Weight

The SECA weighing scale was used for both children who could stand themselves and those who could not, and were helped by their mothers or caregivers. The scale was placed on a hard flat surface ensuring that the display window was blank. Thereafter, the scale was turned on and given time (5 seconds) to adjust to zero. Children above two years were asked to step on the scale and stand still to allow weight to be displayed. Then the measurement was read and recorded to the nearest 0.1kg. For those children below two years, the mothers or caregivers stood on the scale without the baby. The scale was zeroed with the mother or caregiver on it. Then the child was given to the mother or caregiver. Then the measurement was read and recorded to the nearest 0.1kg. Each subject was weighed with minimum clothing and or with no footwear. Age and sex were also recorded.

3.8 Data Analysis

The collected data was entered into the statistical program (Statistical Package for Social Sciences - SPSS) version 21 (SPSS, Inc, Chicago, IL, USA) for analysis. According to FAO (2010b), to create twelve household dietary diversity score, some food groups mentioned by a household were aggregated. Vitamin A rich vegetables and tubers, dark green leafy vegetables and other vegetables were aggregated as vegetables group. Organ meats and fresh meat were aggregated as meat group and the fruit group was a combination of vitamin A rich fruits and other fruits. The other nine groups were; cereal, roots and tubers, eggs, fish and other sea foods, legumes, nuts and seeds, milk and milk products, oils and fats, sweets, and spices, condiments and beverages.

A one score was given to each household that consumed a specific group within twelve food groups. A zero score was given to a household that did not consume a specific group. Sums of scores were calculated for each household. Sums of scores of household dietary diversity in each group were expressed as food groups consumed per day. The frequencies of food consumption within the twelve food groups were expressed as consumption times per day. According to FAO (2013), a household dietary diversity of ≤ 3 food groups consumed per day reflected low dietary diversity and poor food security. A household dietary diversity score of four and five food groups per day was regarded as a medium dietary diversity while a household dietary diversity score of > 6 food groups per day were regarded as high dietary diversity. Multivariate regression analysis was conducted to examine the differences in food consumption within the twelve food groups.

Anthropometric indices of weight for age Z - scores, weight for height Z - scores and height for age Z - scores were determined by using WHO Anthro plus version 3.2.2, (2010) and compared with WHO reference population (WHO, 2006). Linear regression on

nutrition indices of children was also conducted to examine the association between household dietary diversity and children nutritional status.

3.9 Ethics and Confidentiality

Permission was sought from the Sokoine University of Agriculture and from Morogoro Municipality and Mvomero District healthy authorities to conduct the study in the districts. The objectives of this study were explained to the household heads during household survey to create awareness about the study. Those households, which affirmed their willingness to participate in the study, signed a consent form. Confidentiality of the respondents was ensured and each household had its own identification number. Subjects were free to participate in the study without any fear of retribution.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 Socio-economic and Demographic Characteristics of the Respondents

4.1.1 Sex of adult respondents

The results showed that, 33.6 %, 33.6 % and 32.9 % were female subjects in urban, peri urban and rural households, respectively (Table 2). These women were the ones who were mostly involved in meal preparation at their households. None of the male in urban and periurban settings was involved in meal preparation. This observation was similar to that reported at national level where 90 % of meals preparation in the households was done by females especially in rural areas (URT, 2013). In most African societies, meal preparation is a responsibility charged to females and remains as a social role for women at the household level (Onyango *et al.,* 2012).

A person preparing meals in the household can influence the eating behavior and dietary diversity at the household. Findings by Maletnlema (2002) showed that, whenever females were engaged in meal preparations in the household, most of the household members would like to consume the meals rather than taking meals outside the home. Findings of this study suggest that, since female were mostly involved in meal preparation than males; majority of the family members in the studied households consumed foods prepared at the households and not outside their households. This implies that, collective return to the home-cooked meal may offer significant health and social advantages than outside cooked meal.

Table 2: Socio-economic and demographic characteristics of the respondents

Categories	Variable	Location						Total	
		Urban		Periurban		Rural			
		n	%	n	%	N	%	n	%
Sex (adults)	Males	0	0.0	0	0.0	1	2.0	1	0.7
	Females	50	100	50	100	49	98.0	149	99.3
Sex (children)	Males	14	40.0	16	53.3	14	37.8	44	43.1
	Females	21	60.0	14	46.7	23	62.2	58	56.9
Age (month) : children	12 – 24	11	31.4	7	23.3	13	35.1	31	30.4
	25 – 36	11	31.4	7	23.3	10	27.0	28	27.5
	37 – 48	7	20.0	12	40.0	8	21.6	27	26.5
	49 – 60	6	17.1	4	13.3	6	16.2	16	15.7
Age (year) : adult	18 – 25	16	32.0	13	26.0	14	28.0	43	28.7
	26 – 33	18	36.0	14	28.0	18	36.0	50	33.3
	34 – 41	12	24.0	14	28.0	13	26.0	39	26.0
	42 – 49	4	8.0	8	16.0	4	8.0	16	10.7
	50 – 57	0	0.0	1	2.0	1	2.0	2	1.3
Education	Informal	1	2.0	2	4.0	17	34.0	20	13.3
	Primary	31	62.0	39	78.0	33	66.0	103	68.7
	Secondary	1	2.0	6	12.0	0	0.0	7	4.7
	College and above	3	6.0	3	6.0	0	0.0	6	4.0
Occupation	Farmers	0	0.0	18	36.0	45	90.0	63	42.0
	Formal	10	20.0	8	16.0	0	0.0	18	12.0
	Informal	18	36.0	12	24.0	4	8.0	34	22.7
	Non-employed	22	44.0	12	24.0	1	2.0	35	23.3
Family size	1 – 2	10	20.0	8	16.0	11	22.0	29	19.3
	3 – 4	35	70.0	40	80.0	34	68.0	109	72.7
	5 – 6	3	6.0	1	2.0	4	8.0	8	5.3
	7 +	2	4.0	1	2.0	1	2.0	4	2.7
Family purchasing per day (Tsh)	1 000 – 4 500	10	20.0	23	46.0	42	84.0	75	50.0
	5 000 – 9 500	22	44.0	11	22.0	5	10.0	38	25.3
	10 000+	18	36.0	16	32.0	3	6.0	37	24.7

4.1.2 Sex and age of the studied children

The results indicated that, 13.7 %, 14 % and 15.7 % of the children in urban, periurban and rural households, respectively, were boys while 20 %, 13.7 % and 23 % of the children in urban, periurban and rural households, respectively, were females. The data also showed that, 10.8 %, 6.9 % and 12.7 % of the children in urban, periurban and rural households, respectively, were aged 12 - 24 months. Only 5.9 %, 3.9 % and 5.9 % of the children in urban, periurban and rural households, respectively, were aged 9 - 60 months (Table 2). Based on these results, most of the children were above twelve months implying that they had attained the age for consuming foods prepared at the households.

4.1.3 Age of adults respondents

Most of the studied adults 33.3 % (n = 50) were aged 26 – 33 years whereas 28.7 % (n = 43) were aged 18 – 25 years. Results also indicated that, adults aged 34 – 41; 42 – 49 and 50 – 57 years, respectively, were 26 %; 10.7 % and 1.3 %. Urban households had 32 % (n = 16) of adults aged 18 – 25 years whereas rural and periurban areas had 28 % and 26 %, of adults aged 18 – 25 years (Table 2). This study revealed that, only few women of the older age, such as 50 years and above, were engaged in meal preparation at the households. Therefore, many of the women engaged in meal preparation at the households had ages below fifty years. It was also found that, in rural and periurban households, older women were also responsible in meal preparation, whereas in urban households, the older women were not engaged in meal preparation at their households. Young adult (those below 50 years age) is the social group whose diet is influenced by various factors such as tight job schedule, likes and dislikes, and lifestyle behaviours which are the risk factors for development of diabetes and cardiovascular diseases. Young adults eat different food varieties from various food groups than other age groups but socio – economic factors

limit their food choices and eating behaviors and put them at risk of developing non – communicable disease such as type 2 diabetes (Mokhtar *et al.,* 2000).

4.1.4 Education level

Table 2 shows that, 62 % (n = 31) of the subjects in urban households had attained primary education level whereas the percent of primary graduates in periurban and rural households was 78 % (n = 23) and 66 % (n = 24) respectively. The percent of the subjects who had attained higher education level in urban and periurban areas were similar (6 %). Results also showed that, two percent of the respondents in urban households did not attend any formal school. Likewise, four percent and thirty four percent of the periurban and rural households, respectively, did not attend any formal school. This implied that, most of the subjects in urban (98 %; n = 34), periurban (96 %; n = 29) and rural (66 %; n = 24) households had attained formal education and were thus literate. Results of this study therefore indicated that, the proportion of subjects who had attained college education level in rural households was lower than the subjects from urban and periurban households.

The study found that illiterate rate was higher in the rural households than urban and periurban areas (Table 2). Education level is an important social factor that affects food selection, healthy eating and food diversity at the household. In this study, majority of the parents/guardians or care providers had only primary school education while only a handful had attained secondary and higher education levels (Table 2). According to Mselle *et al.* (2013), parents/guardians or care providers who had attained even the primary education level were more articulate in addressing nutrition, food selection and health problems of their families than their uneducated peers. Educated parents/guardians or care

providers had better understanding of nutrition, food choices and feeding practices for their family members (Mselle *et al*., 2013).

4.1.5 Occupation of the subjects

Farming was a dominant sector that employed many people in periurban and rural households compared to the urban setting. The results presented in Table 2 show that, 42 % (n = 63) of the studied respondents were farmers. The percentage of the farmers in periurban households was 36 % (n = 18) whereas in rural settings was 90 % (n = 45). None of the respondents in urban setting engaged with farming activities. The percentage of people employed in the formal sector was 12 % (n = 18) for all of the studied respondents. Twenty percent of the formally employed persons were in urban households while sixteen percent and zero percent of the formally employed persons lived in periurban and rural households, respectively. There was a higher percentage of people employed in informal sector in urban 36 % (n = 18) than periurban 24 % (n = 12) and rural 8 % (n = 4) households.

The rate of unemployment in urban, periurban and rural settings combined together was 23.3 % (n = 35). Only few (2 %) of the unemployed persons lived in rural households while 44 % and 24 % of the unemployed persons were in urban and periurban households, respectively. The findings indicated that, despite many people in urban and periurban settings been employed in formal sector than their counterparts in rural area, the rate of unemployment in urban and periurban settings was also considerably higher than in rural settings. Occupations of the respondents affect health eating and dietary diversity (Sakamaki, 2005). Employed people have greater chance on dietary diversity, food selection and access of nutrition information but due to various socio – economic factors like tight schedule and sedentary lifestyles in urban areas they change their dietary pattern

and junk foods have become popular foods across most towns and cities. Urban people are at greater risk of developing non – communicable diseases than rural people.

4.1.6 Household size

Results presented on Table 2 show that, 92 % (n = 138) of the studied households had an average family size of less than five persons. Only 2.7 % (n = 4) of the studied households had a family size of more than seven members and 5.3 % (n = 8) of the studied households had an average family size of 5 – 6 persons. Large family sizes were notable in rural areas than in urban or periurban settings. The average household size observed in this study was similar to that reported in the Tanzania Population and Housing Census (NBS, 2012). According to NBS (2012), the average household size in Morogoro region was four persons. The average household size observed in this study was however lower than the typical household size at the national level that was five persons (NBS, 2012). Large family size; especially in urban settings has a negative implication in household dietary diversity (Arganin *et al.,* 2012). According to Arganin *et al. (*2012), large family sizes were associated with lower dietary diversity, poor food security and poor food selection at the household.

4.1.7 Households purchasing power

The results showed that 20 % (n = 10) of the urban households spent an average of 1 000 – 4 500 Tanzanian Shillings per day for purchasing foods. Forty-six percent (n = 23) and 84 % (n = 42) of the periurban and rural households, respectively spent an average of 1 000 to 4 500 Tanzanian Shillings per day for purchasing foods. The data also showed that, 44 % (n = 22), 22 % (n = 11) and 10 % (n = 5) of the urban, periurban and rural households, respectively, spent an average of 5 000 to 9 000 Tanzanian Shillings per day for purchasing households foods. Only 36 % (n = 18), 32 % (n = 16) and 6 % (n = 3) of the

urban, periurban and rural households, respectively, spent more than 9 000 Tanzanian Shillings per day for purchasing foods for the households.

The findings showed that, households in rural areas did not spend much money for purchasing foods, compared to urban and periurban households. High expenditure on foods by the urban households could be due to higher food prices in urban areas compared to the periurban and rural areas, as most of the foods consumed in the rural and periurban households are obtained from their own farms. This implies that, in low food supply season rural people are at a greater risk of insufficient food supply.

4.2 Frequency of Food Consumption

This was based on counting the frequencies of consumption of individual food items within the twelve food groups namely cereals; roots and tubers; vegetables; fruits; meats; eggs; fish and sea foods; legumes; sweets, nuts and seeds; milk and milk products; oils and fats; and spices, condiments and beverages (Table 3). Overall, 78 different individual food varieties were consumed in all study households. On average, food items consumed by a household per day were 18 ± 8; 15 ± 6 and 12 ± 3 units of dietary diversity per day in urban, periurban and rural households, respectively. This indicated that, urban and periurban households consumed many food varieties than their counterparts in rural households. It was also noted that, the urban households consumed more food varieties than the periurban households. Another study reported that, households that consumed many food items had also high dietary diversity and good household food security (Leatherman, 2011).

Table 3: Frequencies of food groups consumption per day in the studied households

Type	Location									Total n	Mean ± SD	X^2	F	*P*
	Urban			Periurban			Rural							
	n	%	Means ± SD	n	%	Means ± SD	n	%	Means ± SD					
Cereal	149	34.2	2.98 ± 1.04	152	34.9	3.04 ± 1.18	135	31.0	2.70 ± 0.89	436	2.91 ± 1.03	1.65	1.56	0.21
Eggs	4	80.0	0.80 ± 0.27	1	20.0	0.20 ± 0.41	0	0.0	0.00 ± 0.00	5	0.03 ± 0.18	0.09	2.73	0.07
Fish and other sea foods	31	38.3	3.16 ± 1.04	30	37.0	3.42 ± 1.03	20	24.7	2.96 ± 0.86	81	0.54 ± 0.71	0.74	1.47	0.11
Legumes, nuts and seeds	94	36.0	0.86 ± 0.27	93	35.6	0.68 ± 0.71	74	28.4	0.70 ± 0.95	99	0.75 ± 0.88	0.49	0.62	0.54
Meat	23	56.1	0.46 ± 0.65	14	34.1	0.28 ± 0.53	4	9.8	0.46 ± 0.65	41	0.27 ± 0.54	1.81	6.61	0.00*
Milk and milk product	10	45.5	0.20 ± 0.40	8	36.4	0.16 ± 0.42	4	18.2	0.80 ± 0.53	22	0.15 ± 0.39	0.19	1.23	0.30
Oil, fats and nuts	116	37.2	2.10 ± 0.84	102	32.7	2.02 ± 0.42	94	30.1	1.86 ± 0.57	312	1.99 ± 0.64	0.75	1.85	0.16
Fruits	248	37.0	0.88 ± 1.06	222	33.1	6.44 ± 0.64	200	29.9	0.72 ± 1.31	670	0.68 ± 1.05	2.48	2.28	0.11
Spices, condiments and beverages	196	38.0	3.16 ± 1.04	190	36.8	3.42 ± 1.03	130	25.2	2.96 ± 0.85	516	3.18 ± 0.99	2.66	2.78	0.07
Sweets	88	35.6	1.60 ± 0.76	89	36.0	1.76 ± 0.77	70	28.3	1.54 ± 0.89	247	1.63 ± 0.81	0.65	1.00	0.37
Vegetables	54	47.8	5.24 ± 2.45	46	40.7	6.26 ± 1.65	13	11.5	6.22 ± 1.65	113	5.27 ± 2.07	43.29	11.52	0.00*
Roots and tubers	15	35.7	0.30 ± 0.58	10	23.8	0.34 ± 0.59	17	40.5	0.72 ± 1.31	42	0.28 ± 0.53	0.26	0.92	0.40

Mean values for food groups with asterisks were significantly different at $P < 0.05$

Urban households had a higher frequency of food groups consumption compared to periurban and rural households. The results also showed that, there were many individual food items consumed from vegetables than any other food group (Table 3). The average frequencies of consumption of vegetables per day were higher (5.27 ± 2.07 units of dietary diversity per day) followed by spices, condiments and beverages (3.18 ± 0.99 units of dietary diversity per day), cereals (2.91 ± 1.03 units of dietary diversity per day) and oil, fats and nuts (1.99 ± 0.64 units of dietary diversity per day). The lowest frequency of food consumption per day was for eggs (0.03 ± 0.18 units of dietary diversity per day) (Table 3).

The results also showed that, periurban households had the highest consumption of vegetables per day compared to the rural and urban households. Rural households on the other hand consumed more vegetables than the urban households. The average frequencies of dietary intake of spices and condiments per day were lower in rural areas (2.96 ± 0.85 units of dietary diversity per day) than periurban areas (3.42 ± 1.03 units of dietary diversity per day) and urban (3.16 ± 1.04 units of dietary diversity per day) households (Table 3). The average frequencies of dietary intake of cereals per day in periurban households were (3.04 ± 1.18 units of dietary diversity per day), urban (2.98 ± 1.04 units of dietary diversity per day) and rural (2.70 ± 0.89 units of dietary diversity per day). The periurban households therefore, had the highest consumption of cereals than the rural households, which implies that their energy intake is higher than rural households. Cereals are carbohydrate source foods which is essential to supply fuel to the body. Rural people had low intake of this food group which implies that, there had energy deficiency due to low scores in this food group. Similar study on energy intake by Ranil *et al.* (2013) shows that, inadequate intake of energy source foods lower the glucose level in the body.

Despite the fact that, the majority in rural households kept animals, consumption of animal protein was low. In rural, periurban and urban households, consumption of protein derived from animal sources was 12 %, 23 % and 37 % households, respectively. In rural Tanzania, 38 % of the households keep animals mainly for selling but not for the household consumption (MAFS, 2004). Households in rural areas rely on monotonous carbohydrate based foods (Rah *et al.,* 2010). Consumption of animal protein is also low (Rah *et al.,*2010; leaving them not only with protein deficiency but also energy deficiency (Kennedy *et al.,* 2007) which is mostly leveled in under-five children (Fernandez *et al.,* 2001). Low consumption of animal protein (Steyn, 2006) and plant and animal protein (Chee *et al.,* 2009) was also reported in rural South Africa and rural Malaysia, respectively. According to Steyn (2006), minority of the rural respondents consumed chicken, beef and eggs. The study also found that, majority of food items consumed were monotonous-carbohydrate based food (Steyn, 2006)**.** Monotonous carbohydrates based-diet that lacks protein and other macro and micro-nutrients, is a poor quality diet (Drewnowski *et al.,* 2009) because, it increases health problems (Wolever and Mehling, 2003; Popkin, 2001) including prevalence of diabetes (Mirmiran *et al.,* 2006; Foote *et al.,* 2009) and incidences of cancers (Fernandez *et al.,* 2001).

4.3 Comparison of Food Consumption based on Location

A significance difference ($P < 0.05$) in meat and vegetables consumptions was observed among locals (Table 3). The Tukay Honestly Significant Difference (HSD) test was performed to investigate the differences in food items among localities (Table 4). Results of the HSD indicated that, there were significance differences ($P < 0.05$) in the consumption of meat in between rural and urban households. It was however revealed that, no significant difference was observed in meat consumption between the urban and periurban households.

The results further indicated that, no significant difference was observed in meat consumption (P > 0.05) between rural and periurban households. Consumption of vegetables was found to be significantly different ($P < 0.05$) between urban and periurban households. It was also significantly different ($P < 0.05$) between rural households and periurban households. The results however indicated that, no significant difference was observed ($P > 0.05$) in vegetable consumption among rural and periurban households (Table 4). Low intake of vegetables indicates the chance of vitamins and minerals deficiency, which highly affect the children and pregnancy women whose demand for vegetables is high compared to other age groups. To prevent vitamins and minerals deficiencies consumption of vegetables should be encouraged for better health (Ranil, *et al.,* 2013).

4.4 Household Dietary Diversity Score

The household dietary diversity score (HDDS) consisted of a simple count of single food within the twelve food groups namely:

i. Cereals
ii. Roots and tubers
iii. Vegetables
iv. Fruits
v. Meals
vi. Eggs
vii. Fish and sea foods
viii. Legumes, nuts and seeds
ix. Sweets
x. Milk and milk products
xi. Oils and fats and
xii. Spices, condiments and beverages.

In the scores of twelve food groups of the household dietary diversity per day, urban households had the highest scores (8.38 ± 1.65 units of dietary diversity per day) compared to rural (7.72 ± 1.44 units of dietary diversity per day) and periurban (6.56 ± 1.72 units of dietary diversity per day) households (Table 5).

In urban households, the minimum consumed food groups per day were five. Rural households consumed a minimum of three food groups per day (Table 5). These results implied that, dietary diversity in rural households was low compared to periurban and urban households. Results also showed that, urban households had higher dietary diversity compared to periurban households. Consumption of food groups were significant different among localities ($P < 0.05$) (Table 5).

Table 4: Tukay Honestly Significant Difference test on comparison of food consumption frequency

Food group	Location		Mean differences	*P*-value
Meat	Urban	Rural	0.380	0.001*
		Periurban	0.180	0.201
	Rural	Urban	-0.380	0.001*
		Periurban	-0.200	0.139
	Periurban	Urban	-0.180	0.201
		Rural	0.200	0.139
Vegetables	Urban	Rural	0.88	0.064
		Periurban	-.980	0.034*
	Rural	Urban	-0.88	0.064*
		Periurban	-1.860	0.000*
	Periurban	Urban	.980	0.034*
		Rural	1.860	0.000*

Mean values for food groups with astericks were significantly different at $P < 0.05$

4.5 Consumption of Food Groups

4.5.1 Cereals

Cereals were a common food group consumed by all households. The most consumed cereals were maize (maize meal), wheat (as chapatti and buns) and rice. This implied that, the diet was predominantly based on cereals. Observation from this study was similar to that reported at national level, where more than 60 % of the predominant diets in Tanzania were reported to be cereal-based (NBS, 2011), with low energy and nutrient density (URT, 2010). Another study in Sri Lanka also found the same results where cereal based foods were the predominant consumed diets (Wolever and Mehling, 2003). Consumption of entire carbohydrate is linked to increased risk of diabetes (Mohan *et al.,* 2009). Wolever, and Mehling (2003) recommended that, dietary intake of carbohydrate-based food should be minimal, since diets predominantly based on carbohydrate foods raise plasma glucose, triglycerides and non-esterified fatty acids leading to insulin resistance.

Table 5: Location and the household dietary diversity

Location	Measure of household dietary diversity (HDDS) (n = 150)				F	Df	*P*
	Mean	Standard deviation	Minimum	Maximum			
Urban	8.38	1.65	5	12			
Periurban	7.72	1.44	5	11	16.326	2	0.00
Rural	6.56	1.72	3	12			

4.5.2 Roots and tubers

The group of white roots and tubers included white potatoes, yam and cassava. These were consumed in the form of flour or in cooked form. Others were sweet potatoes, pumpkin and Irish (round) potatoes. Urban households had higher average HDDS (0.48 ± 0.50 units of dietary diversity per day) for roots and tubers than periurban and rural households. Periurban households also had higher average HDDS for this food group compared to

rural households. The differences in consumption of roots and tubers among localities were not significant ($P > 0.05$) (Table 6). This is also a carbohydrate rich food source urban households had high scores which implies that, they get sufficient energy than rural people. This is also confirmed by the study done by Davy *et al.* (2006) which showed that, energy from different carbohydrates food sources like yams maintain the glucose level and provide energy to the body.

4.5.3 Vitamin A rich vegetables, dark green leafy

The study findings indicated that, consumption of vitamin A rich vegetables, dark green leafy and other vegetables among localities was significantly different ($P < 0.05$). Rural households had the lowest average score on of HDD per day in consumption of vitamin A rich vegetables, dark green leafy vegetables and other vegetables (Table 6). Periurban households had higher average dietary diversity score per day than urban households. Children and lactating women have higher demands of vitamin A than any age group, the risk vitamin A deficiency is high in rural areas than urban and periurban areas. Rural households had low scores in consumption of vitamin A rich foods like carrots, and dark green leafy vegetables, implies that they are in risk of vitamins deficiency especially vitamin A, which is crucial for child growth. This observation echoed the report by the Ministry of Agriculture and Food Security in Tanzania (2012) that, 65 % of vegetables harvested in rural areas are not consumed by the rural people but are transported to urban areas.

4.5.4 Vitamin A rich fruits

Table 6 shows that, the consumption of vitamin A rich fruits and other fruits in urban, periurban and rural households was significantly different ($P < 0.05$). Results indicated further that; dietary intake of this food group in urban households was more than two

times that of rural households. Urban household also had higher consumption of vitamin A rich fruits than their periurban counterparts did. Findings of this study were in line with those reported in rural Madagascar by Sharma (2003). According to Sharma (2003), despite high production and availability of fruits in rural communities, consumption of vitamin A rich fruits was only 10 % while in urban households consumption rate was as high as 50 %. Finding by Wolever and Mehling, (2003), also found that, fruits consumption among rural population in Sri Lanka were also low compared to consumption in urban population. It is also shows that, rural households has low scores in this food group, due to this, chances of developing micro – nutrients deficiency is higher than their counterparts in urban households.

4.5.5 Flesh, organ meats and eggs

The results (Table 6) showed that, consumption of flesh meats and organ meats among urban, periurban and rural households was significantly different ($P < 0.05$). Dietary intake of this group in urban households was more than twice the amount consumed in rural households. Eggs were consumed in the form of fast food fried potatoes. According to Ngasongwa (2007), urban households consume fast foods more often than the rural households due to occupation and time constraints, which make urban households to rely on a simple potato-eggs meal. Urban people are at higher risk of developing non – communicable diseases like type two diabetes. This finding is similar with that reported by Foot *et al.* (2009) that, relying on simple foods, including the fast fried foods had been reported to cause overweight and obesity.

Table 6: Household food diversity scores for the most common food groups

Good group	Location									Total			
	Urban			Periurban			Rural						
	Household dietary diversity score (HDDS)												
	N	%	Mean ± SD	n	%	Mean ± SD	n	%	Mean ± SD	Mean ± SD	$(X)^2$	F	*P*
Cereals	50	100	1.00 ± 0.00	50	100	1.00 ± 0.00	50	100	1.00± 0.00	1.00 ± 0.00	0.00	-	-
Roots and tubers	22	44	0.48 ± 0.50	21	42	0.42 ± 0.50	15	30	0.30 ± 0.46	0.40 ± 0.49	0.420	1.756	0.176
Vitamin A rich vegetables and dark green leafy vegetables	45	90	0.90 ± 0.30	50	100	1.00 ± 0.00	35	70	0.70 ± 0.46	0.87 ± 0.34	1.167	11.433	0.000*
Vitamin A rich fruits and other fruits	27	54	0.54 ± 0.50	22	44	0.44 ± 0.50	13	26	0.26 ± 0.44	0.41 ± 0.49	1.007	4.307	0.015*
Flesh meats and organ meat	24	48	0.48 ± 0.50	17	34	0.34 ± 0.48	9	18	0.18 ± 0.39	0.33 ± 0.47	1.127	5.329	0.006*
Eggs	11	22	0.22 ±	7	14	0.14 ±	5	10	0.10 ±	0.15 ±	0.187	1.437	0.241
Fish and other sea foods	32	64	0.64 ± 0.48	31	62	0.62 ± 0.49	22	44	0.44 ± 0.50	0.57 ± 0.50	0.607	2.504	0.085
Legumes, nuts and seeds	39	78	0.78 ± 0.42	38	76	0.76 ± 0.43	34	68	0.70 ± 0.46	0.75 ± 0.44	0.087	0.452	0.637
Milk and milk products	15	30	0.30 ± 0.46	7	14	0.14 ± 0.35	7	14	0.14 ± 0.35	0.19 ± 0.40	0.427	2.783	0.065
Oils and fats	50	100	1.00 ± 0.00	49	98	0.98 ± 0.14	45	90	0.90 ± 0.30	0.96 ± 0.20	0.140	3.755	0.026*
Sweets	49	98	0.98 ± 0.14	44	88	0.88 ± 0.33	41	82	0.82 ± 0.39	0.89 ± 0.31	0.327	3.521	0.032*
Spices, condiments and beverages	50	100	1.00 ± 0.00	50	100	1.00 ± 0.00	49	98	1.00 ± 0.00	1.00 ± 0.00	0.000	-	-

Mean values for food groups with astericks were significantly different at *P < 0.05*

4.5.6 Fish and other seafood

The rates of consumption of fish and other sea foods in urban households was higher 64 % (n = 32) than in periurban 62 % (n = 31) and rural (44 % (n = 22) households (Table 6). The results showed that, dietary intake of this food group among rural, periurban and urban households was not significantly different ($P > 0.05$). A similar result was also reported by Amélie *et al.* (2012). According to Amélie *et al.* (2012), people in urban areas of Zanzibar had more diverse diet and were eating more protein foods from sea sources than in rural areas. Fish and sea foods are good sources of high quality protein, vitamins and minerals such as iron, zinc and selenium (Sharma, 2003). Low dietary intake of proteins from animal sources could lead to poor growth and development of body tissues and organs (Amélie *et al.,* 2012).

4. 5.7 Legumes, nuts and seeds

This study indicated that, the most frequently consumed foods in this food group were common beans, cowpeas, soybeans and pigeon peas. The common bean was the major legume consumed by subjects in all localities. Consumption of legume as a source of protein was higher than consumption of animal protein sources (Table 6). Dietary intake of protein from legumes and lentils was higher in urban than periurban and rural households. However, the consumption level were not significantly different ($P < 0.05$) (Table 6). Low consumption of this food group limits the intake of plant protein, B vitamins and dietary fibre which are required for growth and development, especially in children and women of reproductive age. This observation is similar to the report by Nyaruhucha *et al*. (2004) who reported that, high consumption of common beans and cowpeas in rural areas was attributed to the fact that, they are cheap and readily available compared to animal source of protein.

4.5.8 Milk and milk products

This study showed that, there was significant difference in consumption of milk and milk products among localities ($P < 0.05$) (Table 6). Consumption of milk and milk products was higher in urban households than rural and periurban households. It was also noted from this study that, consumption of milk and milk products in urban was more than twice the amount consumed in rural and periurban households. Milk is an expensive food item. The amount which households in urban areas can consume is dependent on income levels. For pastoral societies, milk is a basic item in the diet and the consumption of milk and milk products is more frequently and not dependent on absolute per capital income (Kurwijila, 2000).

For them, milk is for home consumption first, while selling is done only when there is surplus above the family's dietary needs. Low score for rural people implies that, they are greater chance of calcium, vitamin D and protein deficiency which is essential for growth and development especially for children. Children and women of reproductive age in rural areas are the most vulnerable since, their nutritional requirement is higher than other age groups.

4.5.9 Oils and fats

Consumption of oil and fat was significantly different among localities ($P < 0.05$) with urban households having a higher dietary intake of this food group than rural and periurban households (Table 6). The results indicated that, the average consumption of oil/fats in urban households exceeded the amount consumed in periurban by two percent. Results indicated further that, consumption of oil fats in urban households exceeded that of rural households by 10 %. Rising income levels affect purchasing power among urban compare to rural people. High fats foods such as animal products have high proportion of

saturated fatty, which is associated with cardiovascular disease. Urban people have high chance of developing non - communicable diseases such as cardiovascular diseases due to selection of unhealthy foods. Similar observation on intake of fats was observed by Mohan *et al.* (2009) who reported that, excessive use of plant and animal based fats elevate the blood lipids thereby increasing the risk of heart diseases and other illnesses.

4.5.10 Sweets

Sugar was the most frequently reported sweet that was consumed during breakfast as flavoring agent for tea/coffee.

Others included in this group were sweetened juice drinks, cakes and honey. Like the dietary diversity score of vegetables, fruits, meat and oil consumption of sweets among rural, periurban and urban households was significantly different ($P < 0.05$), with urban households having higher dietary intake of sweets than rural and periurban households (Table 6). This food group is a source of energy to the body. Consumption of sweets such as sugar, honey, cakes and sweetened soda, are associated with increased energy to the body, this influenced by high income to urban people that enabled to purchase these sweets. Rural households had low dietary scores on sweets group than the urban households. This implied that, sweets are not a priority food group to rural people, despite of their low purchasing.

4.5.11 Spices, condiments and beverages

This study showed that, in this food group, iodated salt, black peppers, coffee, tea and alcoholic beverages were most frequently consumed in all households. In most households, foods found in this category constituted an important ingredient for the daily meal. For example, iodated salt was an important ingredient in many of the cooked foods

such as green vegetables, which were hardly eaten without it. Results in Table 6 shows that, consumption of cooked vegetables with iodated salt was higher than any other items in the group of spices, condiments and beverages. Iodine is an important micro – nutrient for normal growth and development especially for pregnant women and children under the age of five years. This study confirms that, the risk of iodine deficiency is very low or none since all households in urban, periurban and rural take iodated salts.

4.6 Comparisons and Strengths of Differences for Consumption of Food Groups among Localities

4.6.1 Vitamin A rich vegetables, tubers and dark green leafy vegetables

Results of the post hoc analysis are presented in Table 7. Results showed that, consumption of food varieties in this group varied significantly ($P < 0.05$) among urban and rural households. The results also indicated that, there were significant differences in consumption ($P < 0.05$) between rural and periurban households.

However, dietary intake of this group among urban and periurban households was not significant different ($P > 0.05$) (Table 7). On the health aspects urban people affected by the market price since most of the foods in this food group they buy it, so for the poor urban people and town dwellers they had risk of deficiency of Vitamin A from plant sources, which negatively affect proper vision and normal growth especially to children under the age of five years and women of reproductive age.

4.6.2 Vitamin A rich fruits

The household dietary score for this food group, varied significantly ($P < 0.05$) among urban and rural households. Statistical analysis indicated that, there was no significant

difference ($P > 0.05$) in the fruits score among urban and periurban households. Likewise, the analysis further showed that, no significant differences ($P = 0.154$) in fruits score among rural and periurban households. This food group provides a source of vitamin A to the body. Consumption of foods like ripe mangoes and papaya are associated with increase in pro-vitamin A. Low dietary scores observed in rural households, suggests that, households in rural areas had a higher risk of developing vitamin A deficiency. This in turn may adversely affect the health of children and lactating mothers.

4.6.3 Meat

Consumption of meat in urban and rural households varied significantly ($P = 0.004$). No significant difference ($P > 0.05$) in meat consumption was observed among urban and periurban households (Table 7). The study also revealed that, there were no statistical differences ($P > 0.05$) in meat consumption between rural and periurban households. Meat group is the most common protein food source that had high score in the urban households. This could be due to high income that enabled the people to purchase the expensive animal protein. Rural households had low dietary scores on meat group than the urban households. This implied that, people living in rural areas had low purchasing power and could not afford the expensive meat.

Table 7: Tukay Honestly Significant Difference on dietary diversity

Dependent variable	Independent variable		Mean difference between location	Std. error	*P*-value
Food group	**Location**				
	1= Urban 2 = Rural	**2 = Rural 3 = Periurban**			
Vegetables	**1**	**2**	**0.200**	**0.064**	**0.006***
		3	**-0.100**	**0.064**	**0.264**
	2	**3**	**0.300**	**0.064**	**0.000***
Fruits	**1**	**2**	**0.280**	**0.097**	**0.012***
		3	**0.100**	**0.097**	**0.557**
	2	**3**	**-0.180**	**0.097**	**0.154**
Meat	**1**	**2**	**0.300**	**0.092**	**0.004***
		3	**0.140**	**0.092**	**0.283**
	2	**3**	**-0.160**	**0.092**	**0.194**
Fat and oil	**1**	**2**	**0.100**	**0.039**	**0.028***
		3	**0.020**	**0.039**	**0.863**
	2	**3**	**-0.080**	**0.039**	**0.099**
Sweets	**1**	**2**	**0.160**	**0.061**	**0.026***
		3	**0.100**	**0.061**	**0.232**
	2	**3**	**-0.060**	**0.061**	**0.588**

Mean values for food groups with astericks were significantly different at P < 0.05

4.6.4 Fats and oil

Post hoc analysis of fat and oil consumption scores indicated that, significant difference existed (P = 0.028) in fat and oil consumption among rural and urban households. However, no significant difference in consumption of oil and fat was noted among the rural and periurban households. Similarly, No significant difference (P > 0.05) was observed between urban and periurban households (Table 7). Fat promote uptake of fat-soluble vitamins (A, D, E and K) and impart a feeling of satiety and satisfaction and thus, delay the onset of hunger. Therefore, insufficient intake of fat, could lead to nutrition

deficiency of fat-soluble vitamins and consequently affect the growth and development of the body. However, fat should be consumed in moderation.

4.6.5 Sweets

Variation in the average score for this food category was significantly differentl (P = 0.028) among urban and rural households. However, no significant variation (P > 0.05) was found among urban and periurban households (Table 7).

4.7 Awareness on Healthy Eating and Dietary Diversity

4.7.1 Balance diet

A diet that contains proper proportions of carbohydrates, fats, proteins, vitamins, minerals, and water needed for maintaining good health is a balanced diet (Ali *et al.,* 2009). Data presented in Table 8 shows that, 46.7 % (n = 70) of the respondents in the three settings had no knowledge about balanced diet. Proportional of the subjects who had no knowledge about balanced diet varied among localities. The majority of the subjects in rural area (78 %; n = 39) had no knowledge about balanced diet while 34 % (n = 17) of their counterparts in urban and 28 % (n = 14) of the periurban subjects did not know balanced diet.

Eight percent of the subjects in the rural area defined balanced diet as a diet either rich in protein such as fish, meat or diet without any fat. Neither the urban nor periurban subjects associated a balanced diet with protein rich foods or a diet without fat (Table 8). Based on the results of this study, rural households lacked accurate information on nutrition. Nutrition aspects go along with knowledge and awarenence to ensure proper selection of foods for good health. Lack of correct information on food choices and selection, negatively affects the health eating behaviors and consequently affects dietary intake. Nutrition education was lower among rural subjects than their urban peers. Information on

health eating and eating behaviour was limited for both rural and urban settings. Undernutrition problems in rural areas may be caused by lack of correct nutrition information (REPOA, 2004).

Table 8: Nutrition knowledge of people in urban, periurban and rural settings

Awareness	Variable	Urban (n = 50)		Periurban (n = 50)		Rural (n = 50)		Total (n = 150)	
		n	%	N	%	n	%	n	%
Balance diet	Diet rich in food varieties	33	66.0	36	72.0	11	22.0	80	53.3
	Diet rich in protein foods	1	2.0	1	2.0	3	6.0	5	3.3
	Diet without fat or oil	0	0.0	0	0.0	1	2.0	1	0.7
	Diet rich in carbohydrate foods	0	0.0	0	0.0	1	2.0	1	0.7
Effects of poor dietary Diversity	Diabetes	15	30.0	10	22.0	5	10.0	30	20.0
	Cancer	0	0.0	1	2.0	2	4.0	3	2.0
	Heart diseases	11	22.0	9	18.0	5	10.0	25	16.7
	Overweight	34	68.0	31	62.0	24	48.0	89	59.3
Consumption of fruits and vegetable enhances Satiety	Yes	28	56.0	34	68.0	32	64.0	94	62.7
	No	22	44.0	16	32.0	18	36.0	56	37.3
Consumption of vegetable reduces risks to diseases	Yes	35	70.0	34	68.0	32	64.0	101	67.3
	No	15	30.0	16	32.0	18	36.0	49	32.7
Excess consumption of saturated fats and sugar increases risks to diseases	Yes	44	88.0	38	76.0	31	62.0	113	75.3
	No	6	12.0	12	24.0	29	58.0	47	31.3

Lack of nutrition information results into poor dietary eating practices (Charles, 2001) that instigate to inadequate nutrients intake among rural people (REPOA, 2004; Styne *et al.,* 2011). Inadequate nutrients intake in children has been reported to have a profound effect on children's ability to pay attention and learn in school (Charles, 2001; Alderman *et al.,* 2005).

4.7.2 Health consequences of poor dietary diversity

Poor dietary diversity is associated with various health problems including overweight or obesity, CVDs and other non-communicable diseases. The known consequences of poor dietary diversity in the three settings were overweight (59.3 %), diabetes (20 %), heart disease (16.7 %) and cancer (2 %). Overweight was much known by majority 68 % (n = 34) in urban area while in periurban area was 62 % (n = 31) while rural setting was 48 % (n = 24) (Table 8). Diabetes that was another disease associated with poor dietary diversity was known mostly in urban areas but less known in periurban or rural households.

4.7.3 Satiety reduction through vegetable and fruits consumption

According to Tetens *et al.* (2009), consumption of fruits and vegetables limits energy intake by increasing the post-prandial satiety and therefore decreasing the subsequent hunger. Table 8 data show that, 62.7 % (n = 94) of the subjects in the three settings were knowledgeable that, fruits consumption enhances satiety. Approximately 67.3 % (n = 100) of the subjects in the three settings knew that consumption of vegetables could enhance fullness. Many subjects 68 % (n = 34) in periurban areas were aware that, consumption of fruits and vegetables enhances satiety while 56 % (n = 28) of the urban and 64 % (n = 32) of the rural households had a similar knowledge.

4.7.4 Excessive intake of saturated fats and sugar

Many national and international food-based dietary guidelines recommend reduction in the consumption of saturated fats and sugar in order to protect the body against chronic diseases such as cardiovascular diseases and certain types of cancers (He *et al.,* 2004). More than three quarters 75.3 % (n = 113) of the studied subjects had knowledge about the health effects of excessive intake of fats and sugar (Table 8). Many subjects 88% (n = 44)

in urban areas had knowledge that, saturated fats should be taken in a limited amounts and excessive intake of saturated fats could results in fatal health problems. Subjects in rural areas 62 % (n = 31) were less knowledgeable about the effects of saturated fats and sugar intake on health.

4.8 Nutritional Status of Children

4.8.1 Weight-for-age z-score (WAZ)

The weight for age- Z – scores of the studied children (n = 102) is presented in Table 9. In all settings, 28.4 % (n = 29) had low weight for their age. The results showed further that, about 10 % (n = 10) of the children in periurban households were moderately underweight (< - 2 to > -3 SD) while 13.5 % (n = 5) of the studied children in rural households were also moderately underweight. Prevalence of severely underweight children (< -3 SD) in rural, urban and periurban households was 24.3 % (n = 9), 5.7 % (n = 2) and 16 % (n = 5), respectively. The nutritional status of children varied significantly ($P < 0.05$) among households of different dietary diversity (Table 9).

Table 9: Nutritional status of the studied children

Index	SD Score	Location						Total (n = 102)	
		Periurban (n = 30)		Urban (n = 35)		Rural (n = 37)		n	%
		N	%	n	%	n	%		
WAZ	Severely underweight < - 3	5	16.7	2	5.7	9	24.3	16	15.7
	Moderately underweight < - 2 - > -3	3	10.0	5	14.3	5	13.5	13	12.7
	Mild underweight - 1 - > -2	7	23.3	5	14.3	7	23.3	19	18.6
	Normal weight for age < -1 – +2	15	50.0	22	62.9	15	40.5	52	51.0
	Overweight > +2	0	0.0	1	2.9	1	2.7	2	2.0
HAZ	Severely stunted < -3	0	0.0	0	0.0	1	2.7	1	1.0
	Moderately stunted < - 2 - > -3	3	8.6	2	6.7	2	8.1	8	7.8
	Mild stunted -1 - > -2	2	5.7	2	6.7	6	16.2	10	9.8
	Normal height for age < -1 – +2	18	60.0	17	56.7	21	56.8	55	54.9
WHZ	Severely wasted < -3	1	2.9	2	6.7	1	2.7	4	3.9
	Moderately wasted < - 2 - > -3	0	0.0	1	3.3	5	13.5	6	5.9
	Mild wasted -1 - > -2	13	37.1	5	16.7	4	10.8	22	21.6
	Normal weight for height < -1 – +2	21	60.0	22	73.3	27	73.0	70	68.6

WAZ = Weight for Age Z – Scores, HAZ = Height for Age Z – Scores, WHZ = Weight for Height Z – Scores

The results also showed that, dietary diversity varied significantly ($P < 0.05$) among households of different socio-economic levels (Table 10). The results showed further that, weight for-age of children varied significantly among household (Table 11). Less weight-for-age among the under-five children was significantly higher ($P < 0.001$) among households who consumed less than three food groups per day compared to those households that consumed more than three food groups per day in the preceding 24 hours (Table 12). The findings of this study suggested that, the more the households diversified

their diets in the preceding 24 hours, the less likelihood their children would become under-weight (Appendix 2).

Table 10: Household dietary diversity, children nutritional status and household income

Variable	X^2	df	*P*
Nutritional status	16.893	2	0.004
Household income	173.14	38	0.000

4.8.2 Height-for-age z-score (HAZ)

The prevalence of stunting (< -2 to < -3 SD) among children aged 12 – 59 months was 8.8 % (n = 9) in all study households (Table 9). Low height-for age (< -2 to < -3 SD) among the studied children was 6.7 % (n = 2), 10.8 % (n = 4) and 8.6 % (n = 3) in urban, rural and periurban households, respectively (Table 9). Height-for-age of children was significantly different ($P < 0.05$) among households of different dietary diversity (Table 11). The result of multivariate logistic regression showed that, children whose households diversified less than three food varieties per day were significantly ($P < 0.05$) stunted, and the odds ratio was four times more than those consumed more than three food groups per day (Table 12).

Table 11: Differences in nutritional status of children and household dietary diversity

Variable	X^2	Df	*P*
Weight-for-height z- scores (WHZ)	188.32	182	0.534
Height-for-age z scores (HAZ)	165.00	167	0.032
Weight-for-age z scores (WAZ)	146.26	180	0.024

4.8.3 Weight-for-height- z score (WHZ)

The prevalence of low weight for height among all studied children was 9.8 % (n = 10) Prevalence of wasting among children in rural setting was higher than urban and periurban settings. The results indicated that, urban households had more (10 %; n = 3) wasted children than periurban (2.9 %; n = 1) households (Table 9). The results showed further that, 2.9 % (n = 1) of the children in periurban areas were severely wasted while 6.7 % (n = 2) and 2.7 % (n = 1) of children in urban and rural households, respectively, were also severely wasted (Table 9). Results of multivariate logistic regression analysis indicated that, prevalence of wasting in children among households that consumed different food varieties in the preceding 24 hours was not significantly different ($P > 0.05$) (Table 11).

Table 12: Multivariate logistic regression model for the association between under-nutritional among children and household dietary diversity scores

Status	Consumption of food groups					
	< 3		**4 – 5**		**≥ 6**	
	Exp. (β)	*P*	*Exp. (β)*	*P*	*Exp. (β)*	*P*
Stunted	4.269	0.042*	6.478	0.682	6.956	0.163
Wasted	14.365	0.345	12.417	0.067	13.783	0.564
Underweight	45.411	0.000*	17.276	3.670	12.673	3.957

4.9 Limitations of the Study

i. This study used a single 24 hours recall method to obtain usual intake in all households. However, multiple dietary recalls during weekdays and weekends could have provided a better picture of the habitual dietary intake diet in the households.

ii. It was not easy to distinguish healthy and unhealthy food items/food group. These counting systems were assigned equal values for every food item irrespective of

the health outcome (such as fruits and sweets). No recommendation was given for optimal level to judge the health benefits group. it was thus difficult to the health benefits of the various consumers- excess or intake of various food groups.

iii. The study tried to measure the diversity of the food groups but did not measure the diversity within food groups. Most Tanzania dishes are mixed in nature, which causes considerable practical limitations for food item groupings.

CHAPTER FIVE

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusion

Regardless of the rural households being the primary source of food production, majority of the rural households had lower dietary diversity compared to urban and periurban households, leading to overall poor nutritional status among rural children compared to urban and periurban peers. The low dietary diversity could be caused by low knowledge about healthy eating among rural people. Animal protein was hardly consumed in the study households, particularly in rural areas. Plant protein was the major sources of protein in the studied households. Majority of the respondents in rural households were not knowledgeable about the health consequences of poor dietary diversity compared to their counterparts in urban and periurban households. Rural households had higher rate of under nutrition compared to urban and periurban households. Stunting, wasting and underweight among under-five children were negatively associated with higher dietary diversity score in the households. Therefore, the more households diversify their diet, the less likely that their children would be undernourished. It was concluded from this study that, living in rural areas increased the risk of becoming undernourished compared to living in urban and periurban areas. Despite socio-economic challenges in urban areas, people living in urban areas had better access to nutrition information and diverse food varieties in all seasons.

5.2 Recommendations

i. Based on this study, since the rural communities have adequate food varieties, but seemed to have lower consumption of diversified diets compared to their counterparts in urban and periurban areas; awareness programmes should be conducted among the

rural communities to equip them with appropriate nutrition knowledge about healthy eating. Conducting nutritional advocacy and publicity to rural people will not only increase their dietary diversification but also help to reduce the rate of under nutrition among children under the age of five years.

ii. Further studies should be conducted to investigate the association between under-nutrition among adults and household dietary diversity scores.

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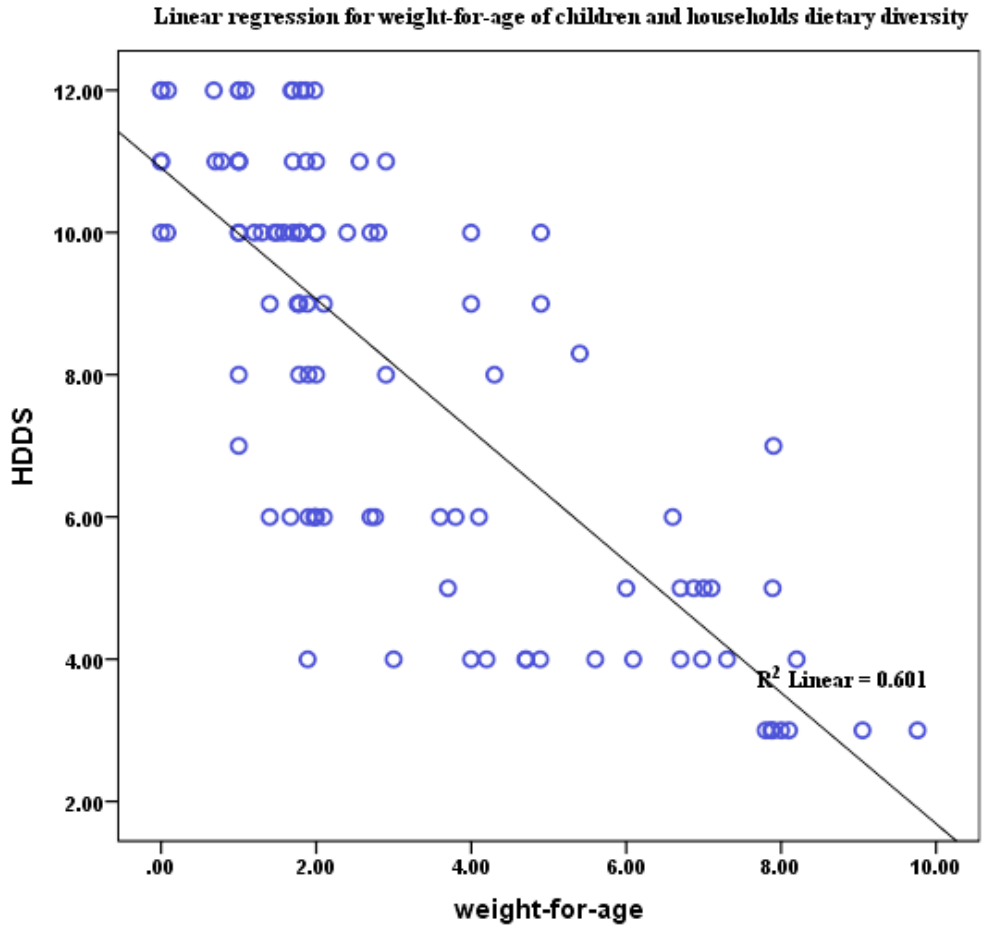
APPENDICES

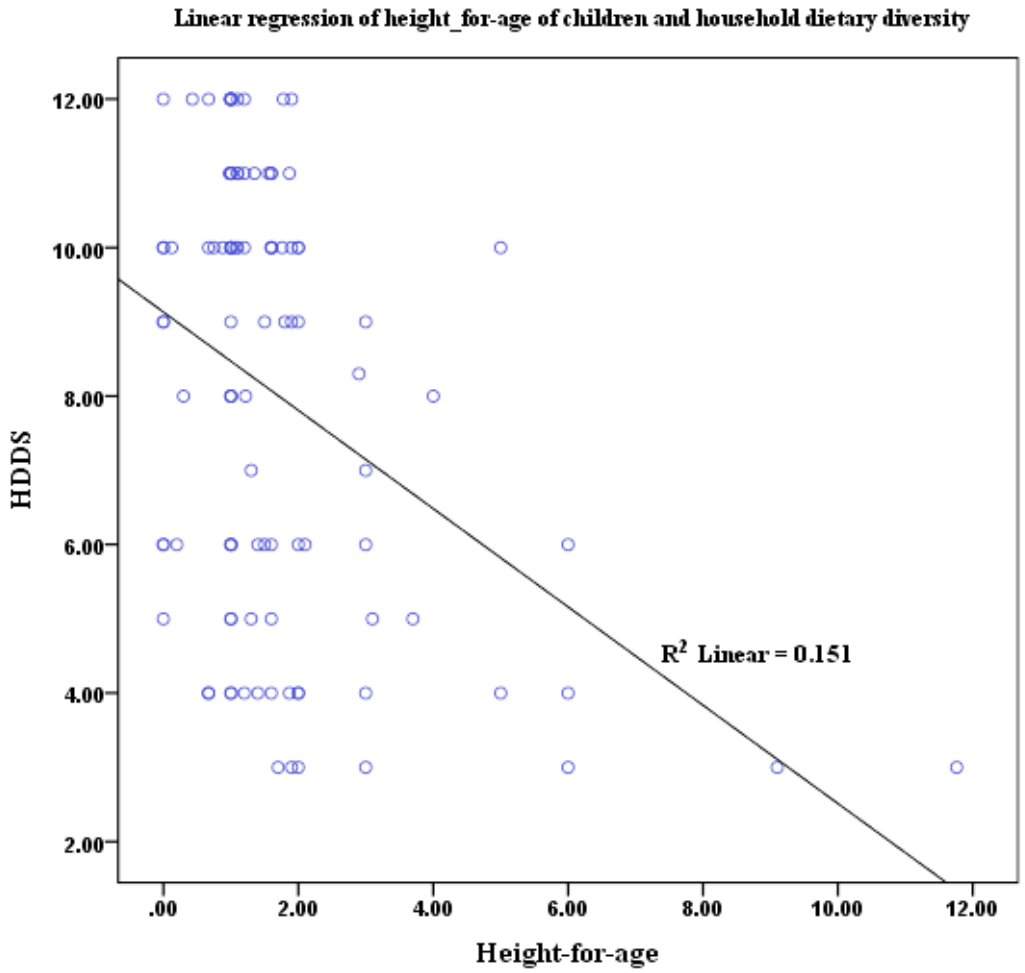
Appendix 1: Households that lived in agricultural activities

Variable	Categories	Location							
		Urban		Per-urban		Rural		Total	
		N	%	n	%	n	%	n	%
Owning land		20	40.0	32	64.0	45	90.0	97	64.7
Cultivating	Cereals	16	32.0	23	46.0	39	78.0	78	52.0
crops	Roots	4	8.0	6	12.0	10	20.0	20	13.3
	Vegetables	3	6.0	6	12.0	9	18.0	18	12.0
	Fruits	0	0.0	2	4.0	2	4.0	4	2.7
Animal keeping	Cows/ goats	1	2.0	4	8.0	9	18.0	14	9.3
	Chicken	11	22.0	20	40.0	22	44.0	53	35.3

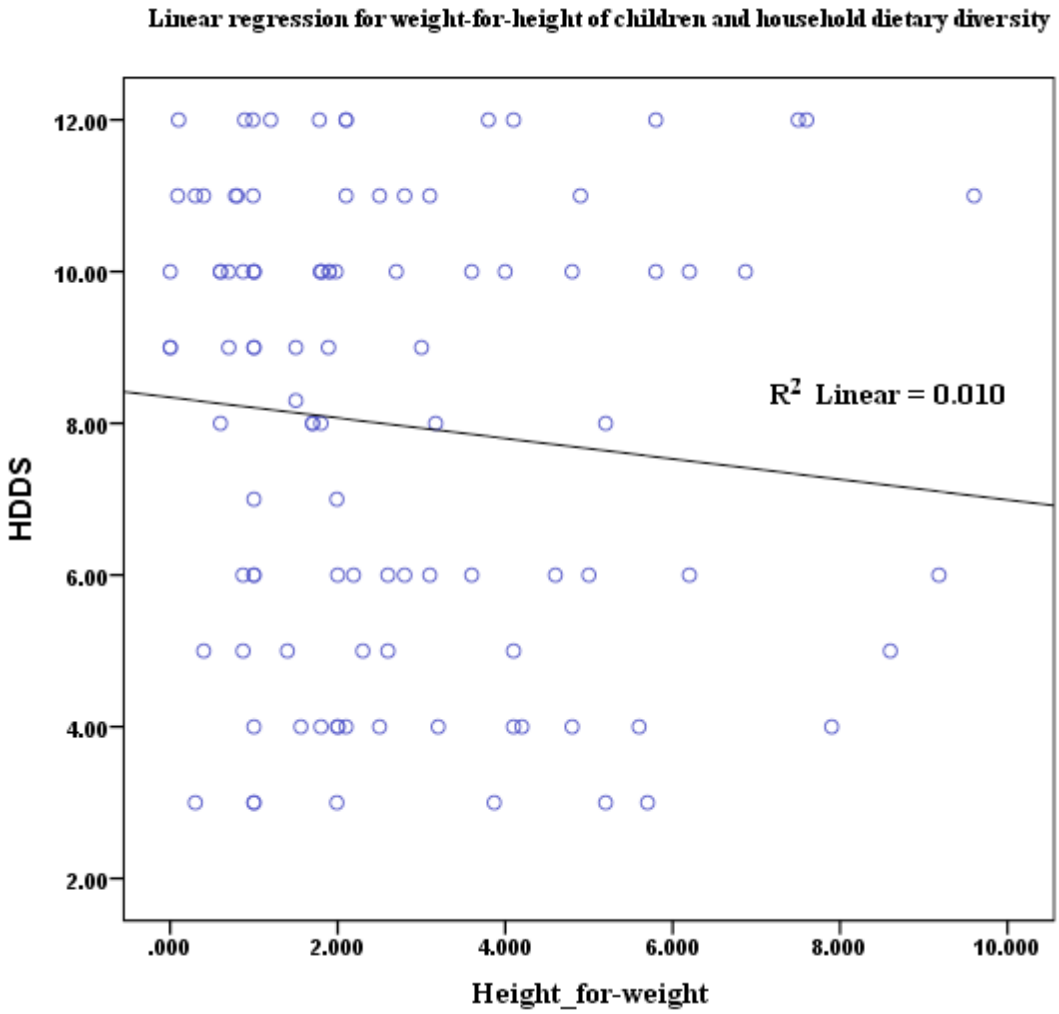
Appendix 2: Linear regression of weight-for-age of children and households dietary diversity



Appendix 3: Linear regression of height-for-age of children and household dietary diversity



Appendix 4: Linear regression of height-for-age of children and household dietary diversity



Appendix 5: Questionnaire

A structured questionnaire used for assessment of eating behaviors and dietary diversity among adults in Morogoro urban, periurban and rural districts.

Instructions: Please fill in the blanks/box or circle the letter bearing the correct answer (s) where applicable, otherwise, instructed.

SECTION I

Household's Socio-economic and Demographic Characteristics

1.	**Date of interview**	**1.**
2.	**Location**	**2.**
3.	**Sampling ID**	**3.**
4.	**Ward name**	**4.**

5. Sex of interviewee: [Male] [Female]

6. Age of interviewee (years) ☐

7. Highest education attained by an interviewee
(cycle the applicable answer)

a) Non-schooled
b) Primary
c) Secondary
d) College and above

8. Occupation of an interviewee
(cycle the applicable answer)

a) Famer
b) Formal
c) Informal
d) Non-employed

9. How many are you in this household? ☐

10. How much amount of money does your household spend for food purchases p ☐

11. Is there under-five child in this household?
(If yes go to Section II, if no go to Section III)

a) Yes
b) No

SECTION II

Information on Under-Five Children

12. What is a child's name? _____

13. How old is (child's name) _____ months

(Ask the mother to give you with the clinic card to confirm the date of birth of a child)

14. Sex of a child

a) Male

b) Female

15. Weight of a child: (*Record in kilogram*_____

16. Height of a child: (*Record in centimetres*_____

SECTION III

Assessment of the Meal Composition Based on a Previous 24-hour Recall

Please describe the foods (meals and snacks) that were eaten during the previous day. Start with the first foods or drinks taken during morning. Write down all foods and drinks mentioned. When composite dishes are mentioned, ask for the list of ingredients composed the meal, and when the respondent has finished, probe for meals and snacks not mentioned.

Breakfast	Snack	Lunch	Snack	Dinner	Snack

Dietary Diversity Scores of the Food Groups

Household Dietary Diversity Score (HDDS) include foods eaten by any member of within the household. It excludes foods purchased and eaten outside the home. When the respondent recall is complete fill in the food groups based on the information recorded above. For any food groups not mentioned, ask the respondent if a food item from this group was consumed (Put 1 if any of the food items were consumed and 0 if were not consumed).

No	Food Group	Example Of Food Items	Yes=1 No =0
1	Cereals	corn/maize, rice, wheat, sorghum, millet or any other grains or foods made from these (e.g. bread, noodles, porridge or other grain products) + insert local foods e.g. ugali, nshima, porridge or pastes	
2	Roots and tubers	white potatoes, white yam, white cassava, or other foods made from roots	
3	Vitamin A rich vegetables and tubers , dark green leafy vegetables and other vegetables	Pumpkin, carrot, squash, or sweet potatoes that are orange inside + other locally available vitamin A rich vegetables (e.g. red sweet pepper).Dark green/leafy vegetables, including wild forms + locally available vitamin A rich leaves such as amaranth, cassava leaves, kale, spinach. other vegetables (e.g. tomato, onion, eggplant) + other locally available vegetables	
4	Vitamin A rich fruits and other fruits	ripe mango, cantaloupe, apricot (fresh or dried), ripe papaya, dried peach, and 100% fruit juice made from	

		these + other locally available vitamin A rich fruits. other fruits, including wild fruits and 100% fruit juice made from these	
5	**Flesh meats and organ meat**	**Liver, kidney, heart or other organ meats or blood-based foods. beef, pork, lamb, goat, rabbit, game, chicken, duck, other birds, insects**	
6	**Eggs**	**eggs from chicken, duck, guinea fowl or any other egg**	
7	**Fish and seafoods**	**fresh or dried fish or shellfish**	
8	**Legumes, nuts and seeds**	**dried beans, dried peas, lentils, nuts, seeds or foods made from these (eg. hummus, peanut butter)**	
9	**Milk and milk products**	**milk, cheese, yogurt or other milk products**	
10	**Oils and fats**	**oil, fats or butter added to food or used for cooking**	
11	**Sweets**	**sugar, honey, sweetened soda or sweetened juice drinks, sugary foods such as chocolates, candies, cookies and cakes**	
12	**Spices, condiments, beverages**	**spices (black pepper, salt), condiments (soy sauce, hot sauce), coffee, tea, alcoholic beverages**	

SECTION IV

Nutritional Awareness on Healthy Eating and Dietary Diversity

17. Are you aware of the term "balance diet"

a) Yes
b) No

18. Which of the following is balance diet?

(Cycle that is applicable)

a) A diet rich in different food varieties from several food groups at a proportional quantity
b) A diet rich in protein foods; like fish, meat and eggs
c) A diet without any fat or oil
d) A diet rich in carbohydrate foods

19. Do you understand that poor dietary diversity can result into health problems*? (If yes, answer question 20 and 21, if no go to question 22)*

a) Yes
b) No

20. Among the followings health problems, which category is the result of poor dietary diversity?

(Cycle all that are applicable)

a) Diabetes
b) Cancer
c) Overweight
d) Heart diseases
e) Others

21. Are you aware that saturated fats (e.g. animal fats), refined sugars and salts should be taken in limited amount in your daily dietary intake?

a) Yes
b) No

22. Does your household own farm land?

(If yes, answer question 23, if no go to question 24)

a) Yes
b) No

23. Which crops do your household cultivates?
Mention them _____

24. Are there any animal kept?

a) Yes

b) No

25. If yes in question 24 above, mention the kept animals. _____

Thank you very much for your time, participation and cooperation in this research