

**DOI: 10.18697/ajfand.76.16045****FOOD INTAKE AND DIETARY DIVERSITY OF FARMING HOUSEHOLDS  
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## ABSTRACT

The Tanzanian economy depends heavily on agriculture and hence human labor provides much of the power needed for farming activities. This study was carried out to determine the diversity and dietary adequacy of farming households in four selected districts of Morogoro region in Tanzania. Adult household members from 140 households participated in the study. A 24-hour dietary recall, dietary diversity score and frequency of food consumption tools were used to assess and quantify nutrient intake and adequacy of consumed diets in farming households. Tanzania food composition tables were used to compute estimates of the energy intake, macro and micronutrients consumed by farming households. Analysis was done using SPSS version 18 and Microsoft excel version 10. Cereal food group was consumed in relatively large quantities compared to other food groups in the surveyed households. The contribution of cereal group to energy intake was 75-82%, protein 8-16% and fat 9-14%. Stiff porridge made of maize flour was the mostly consumed cereal dish followed by rice. The mean intake of energy per day was inadequate; the intake of energy for men was 1402 kcal/day while for female was 1347 kcal/day meeting only 52% and 72%, respectively of the recommended energy intake. Generally, the consumption of protein from the animal sources was significantly low in all districts. Ninety-nine percent of the households rarely consumed eggs; 83% rarely consumed meat and poultry. Consumption of milk and milk products was inadequate as 92% of the households indicated that they rarely consumed these products. The intake of fat was also low by 53% compared to the recommended intake for adults. The intake of iron, zinc, and calcium was 40, 53 and 64%, respectively, which was not sufficient to meet daily requirements. Low intake of nutrients was generally attributed to inadequate food intake due to low feeding frequency, poorly diversified diets and sub-optimal practices in food preparation and cooking. The results from surveyed areas indicated that all districts are rich in terms of bio-diversity and food availability, nevertheless the consumption of these foods in the study communities was inadequate with regards to quantity and quality. This situation compromises nutritional status and pre-disposes farming households to diseases and infections hence affects work output, labor productivity and wealth generation. Educating farmers on the importance of consuming diversified and adequate diets from different food groups will improve their nutrition situation and stimulate more production hence increased agricultural productivity.

**Key words:** Dietary adequacy, Dietary diversity, Nutrition status, Tanzania farming households



## INTRODUCTION

Human labor provides much of the power needed for economic productivity and development in Tanzania. High prevalence of protein, energy and micronutrient malnutrition compromises health status and affects labor productivity and economic development [1]. Farmers are the ones who produce food crops not only for household consumption but also for national economic development. Their nutritional status depends on what kind of foods they consume. Different food groups contain different nutrients that our body needs for active and healthy life. Nutrient adequacy of an individual is determined by the contribution of each nutrient in the diets and the extent to which particular nutrients meet the needs of an individual. Certainly, if the individual's nutritional needs are not met, a person will be at risk of micro and macronutrients deficiencies [2]. There is no single food that can supply the required and adequate nutrients to consumers except human milk during infancy [3]. High quality diets depend upon diet diversity and contributes nutrient adequacy in adults [4].

Dietary diversity is a qualitative measure of household access to a variety of food groups and is estimated from the number of food groups consumed over a given time period [5]. The lack of dietary diversity impacts the lives of many adults and children in sub-Saharan Africa [5-7]. Only 55.5% of households in rural Tanzania (Kilosa) consumed legumes/vegetables with their main meal of stiff porridge, made from refined and processed maize flour [8]. Furthermore, only 1.0% of that population served stiff porridge with meat. Foods of animal origin such as meat/meat products, fish, poultry and fruits are rarely consumed. Therefore, the impact from low dietary diversity leads to serious health implications for women of childbearing age and older children; but this could apply to all members of the household including school-age children [9]. Diets (cereals and vegetables) quality was also observed among rural women of Kongwa, Muheza, Singida districts in the northern and central districts of Tanzania [10]. Savy and his colleagues observed a similar trend in Burkina Faso among rural women with a diet consisting largely of cereals and vegetables with fish sometimes added [7].

In developing countries, dietary inadequacy and lack of diversity constitute a common problem associated with low socioeconomic status, poor levels of education, lack of understanding of the role of food in health, and acute poverty [11]. This study examined the dietary adequacy and diversity of nutrients from diets consumed by farming households in Morogoro region, Tanzania.

## METHODOLOGY

### Description of study area

The study, which mainly involved farming households cultivating a variety of crops for subsistence and sale, was carried out over a six-month period from March 2014 to July 2014 in Morogoro urban, Kilosa, Gairo and Kilombero Districts in Morogoro region, Tanzania. The sites involved were Ifakara Secondary, Machipi valley and FDC farm in Kilombero district; Chakwale, Masenge and Mamiwa in Gairo district; Mvumi A, Mvumi B, Lumbiji Tandika and Lumbiji Chamwino in Kilosa district and Fungafunga site in Morogoro municipality.



### Study design, subjects and approval

A cross-sectional design was employed to collect information on food consumption in different households. This was a subsample of a larger study that involved soils and crops sampling from farmers' fields. Farmers who participated in soil and crop sampling were purposively included in the study. The study also randomly selected other farming households residing nearby the purposively sampled households. A total of 140 farming households were chosen proportionate to size in the soil and crop sampling sites in different districts of Morogoro region. The survey was done when farmers had harvested their crops from the fields. This was a good time to observe how the farmers behave with regards to their food intake and diversity. Permission to conduct this study was obtained from Sokoine University Research and Post Graduate Studies Committee. Since participation in this study was voluntary, the researchers explained to the farmers about the study and farmers verbally consented to participate in the study on the day of interview.

### 24-Hour Dietary Recall

A 24-hour dietary recall, which is a retrospective assessment method, was used to determine the amounts of foods taken by interviewed subjects in farming households. The individuals were asked to recount all foods and beverages they consumed during a 24-hour period between the time they woke up the previous day to the time they woke up on the day of interview. The interviews were conducted at the homestead of interviewees. Portion sizes of either raw foods or cooked foods such as solids and fluids used by households were taken and measured by standard equipment [12]. The 24-hour dietary recall method aided to determine adequacy with regards to macro and micronutrient intake in foods consumed by household members. The foods that have been recalled provided information on the variety or diversity of the foods consumed by individuals in a household. The 24-hour diet recalls were taken for two non-consecutive days by interviewing households without prior announcement regarding the date of interview. This was to ensure that households were not making any alteration to their habitual diet during the study period.

### Household dietary diversity score

Household Dietary Diversity Scores (HDDS) were estimated using information collected from the 24-hour dietary recall [13]. Foods consumed in the past 24 hours were grouped into one of the 12 food groups. These are 'Cereals, roots and tubers, vegetables, fruits, meat and meat products, eggs, fish, legumes, milk, oils and fat, sugar, spices and condiments'. Consumption of a particular food group scored 1, and if a group was not consumed a score of 0 was given depending on the nutrient composition in the Tanzanian food composition tables [14]. A single point was awarded to each of the food group consumed over the past 24 hours. The points awarded were added giving a maximum score of 12 points for the households who consumed all food groups. Household Dietary Diversity Scores was defined as a total count of different food groups consumed in the past 24 hours. Further categorization into low, medium and high dietary diversity was done. The score was based on the assumption that different food groups provide a different set of nutrients so an individual who consumed foods from various food groups, was assured diversity in nutrient intake.



### **The food frequency questionnaire (FFQ)**

Information on frequency of consumption of different food items was obtained from the consumed food during 24-hour dietary recall interview. The respondents were asked about their usual frequency of consumption of each food item mentioned in a 24-hour dietary recall form. The frequency of consumption from the surveyed households was then categorized in a defined period of time such as per day, week, and month or rare [15].

### **Preparation, cooking and consumption practices**

Information about food preparation, cooking methods and consumption was also collected. The information collected included descriptions of the preparation and cooking methods. In addition, observations on actual food preparation and cooking practices were carried out to identify and understand practices that influence or limit the adequacy of consumed diets in the area. Twenty households, 4 from each district, were opportunistically observed for a single preparation and cooking episode. The interviewers were also observing and recording household food consumption practices by using a checklist.

### **Data analysis**

Data obtained were entered and subjected to statistical analysis using Microsoft Excel Software (Microsoft office, 2010) in conjunction with Statistical Package and Service Solutions (SPSS Inc.) computer software version 18. Comparisons between actual and recommended levels of food intake were calculated by estimating nutrient intake from a variety of foods consumed by individual farmers using data from the Tanzania food composition tables [14].

## **RESULTS**

### **Farmers' characteristics**

In the surveyed villages, a total of 140 farming household members with a mean age of 38 years were interviewed, majority being female (57%). Most of respondents were between the ages of 18 and 80. The mean age for women was 37 years ( $\pm 12.2$ ) and mean age for men was 39.8 years ( $\pm 11.8$ ). The mean household size was five, subsistence farming was more predominant in the area where more than three quarters of households used hand hoe for farming activities. Major food crops grown in the area were maize (Kilombero, Gairo and Kilosa), beans (Gairo and Kilosa) and rice (Kilombero). Vegetables such as amaranth, pumpkin leaves, Chinese cabbage and sweet potato leaves were grown in Morogoro municipality and Kilombero.

### **Dietary diversity score**

The results from surveyed areas indicated that all districts were rich in terms of biodiversity and food availability (Table 1). However, this was not reflected in consumption of different food groups available. About 12% of the households consumed food items from 1-3 food groups, 64% from 4-6 food groups and 24% from seven or more food groups. Mean HDDS was five, cereals being the most frequently consumed food group by all households and eggs being the least consumed food (1.0% of the households)



followed by milk products and meat. Fruits were not regarded as a compulsory part of the meal in the majority of households visited; only 26% of households consumed fruits.

### Frequency of consumption

All the visited households consumed cereals at different frequencies in a week and 69% of the surveyed households consumed cereals every day in a week. Stiff porridge made of maize-meal (*ugali*) was the most frequently consumed cereal followed by rice (Table 2). Consumption of milk and its products was sub-optimal, about 8% of the population consumed this food. In addition, 17% of the surveyed farming households consumed meat/poultry/offal and only 1% of the households consumed eggs once a week.

### Nutrient adequacy

Energy intake was inadequate in all the surveyed districts (Table 3). Equally, intake of proteins and fats was also low compared to the recommended level of intake for adult males and females. Carbohydrates mainly from the cereal food group contributed the highest proportion (68%) of energy intake compared to other sources such as proteins (9.5%) and fat (22.4%) for both males and females. Therefore, intake of carbohydrates was slightly higher than the recommended intake; but protein and fat were much lower than the recommended intake. In addition, the intake of micronutrients such as iron (40%), zinc (53%) and calcium (65%) percentage of recommended daily allowance (RDA) was inadequate. Many households could not reach the required adequacy. However, for households in Kilombero district intake of calcium was far more than or equal to the recommended level (1015 mg for males and 804 mg for females). The percentage adequacy for most nutrients was below 100%. Energy intake ranged from 49 to 76%; protein 25 to 37% and fats 38 to 61% (Table 4). Micronutrients intake was also inadequate in most of the areas surveyed.

### Preparation, cooking and consumption practices

Food preparation and cooking practices have profound effect on nutrient contents and quality of food consumed. The study revealed some habitual poor practices on food preparation and cooking on the surveyed households. Some of the noted practices include de-hulling and soaking of maize cereals for making flour that is used for cooking stiff porridge; this was commonly practiced in Kilosa. Other practices included washing of vegetables after cutting/ chopping, discarding water after boiling vegetables such as amaranth, Chinese cabbage and pumpkin leaves. These practices were commonly observed at Fungafunga site in Morogoro Municipality. In all the surveyed areas *magadi* soda was added when cooking the vegetable called jute mallow (*mlenda*) for tenderization, reducing sliminess and for taste improvement. It was also noted that the majority of households consumed large portions of cereal-based dishes disproportionate to relish servings. Furthermore, intra household food distribution did not consider requirements and ability to eat. This was considered not appropriate because children ate from the same pot with other members of the household without adequate supervision by adults.



## DISCUSSION

Good nutrition is fundamental to health and to the prevention of diseases as well as for general wellbeing and productivity. Quality of diets is a pre-requisite for an individual to attain optimal nutritional status and it is achieved through consumption of foods from different food groups in compliance with individual nutrient requirements. The surveyed districts have diverse varieties of foods, which are locally available and suitable for consumption. Nevertheless, household members lack knowledge on how best they can combine locally available foods to create energy and nutrient dense diets.

In the present study the cereal food group was frequently consumed, stiff porridge made of maize flour being the most consumed cereal dish followed by rice. There is limited consumption of foods from other starchy foods such as potatoes, cassava and yams or even other cereals such as sorghum and wheat. This implies that there is too much emphasis on maize to the extent that when there is maize crop failure in a particular season, households suffer significant food availability challenges. Similar findings were made by Rathnayake *et al.* [16], who observed that poor dietary diversity is particularly a significant problem among poor populations in the developing world as their diets are based on mostly starchy staples. In addition, carbohydrate was the single major contributor of energy to food consumed by households as compared to other food groups. Energy should be represented in correct proportions from all three sources of macronutrients: carbohydrate (50%), protein (20%) and fat (30%). The imbalance of one macronutrient will compromise the overall contribution of energy and nutrients needed by the body [17]. In the present study, it was observed that nearly all households in the study population consumed less energy and protein compared to the recommended levels. Considering that these are farming communities, chronic energy inadequacy compromises nutritional status of household members and lowers labor productivity in agricultural production. Low protein consumption was caused by inadequate intake of protein rich foods such as meat and dairy products. For example, frequency of eating eggs was low compared to all other food groups because most households responded by saying '*Chickens are reared and the eggs we get from chickens are sold and not consumed*'. It is clear from this statement that there are other reasons for growing crops or raising livestock and in most cases it is not consumption. Chickens are eaten when there is an important guest or on holidays otherwise they are sold to pay for school fees, to buy exercise books or for medical drugs and to meet other special household requirements. This situation compromises the current efforts towards reduction of Protein Energy Malnutrition in the region.

Consumption of micronutrients was also sub-optimal, due to limited consumption of micronutrient rich foods. Many households indicated that they consumed vegetables but usually the amounts were too small to contribute significantly to micronutrient intake. Inadequate intake of micronutrients reduces the ability of the body to build its defense system against diseases and infections. In this regard, the body is pre-disposed to diseases and infection, hence affects work output and labor productivity as well as economic status of the household due to high health care budget. This observation corroborates the high prevalence of anaemia in the study areas [1]. Findings from the same study, HDDS data showed that 70% of surveyed population consumed vegetables but the frequency of



consumption was not satisfactory. On average, majority of households consumed vegetables 1-3 times a week. A similar situation was observed on fruit consumption pattern where the mean diversity score was 5, close to the acceptable minimum score. However, despite the acceptable diversity, the amounts of food that are consumed from each food group are usually too little to be able to provide adequate nutrients. Low frequency of consumption of fruits was attributed to traditional eating habits in that many households do not consider fruits as part of the meal. In addition, seasonal variation of food production could be a contributing factor. This is an indication that there is minimum ability (knowledge, skills and financial resources) of the households to preserve these foods and to produce them during off season. Other researchers pointed out that performance of dietary diversity is improved when a minimum intake for each food group is considered [16]. In order for an individual to achieve nutrient adequacy from the diets, it is important to consider not only diversification of the diet but also the amount and frequency of food consumption of different food groups [1]. If attempts to improve the nutrient intake through diet diversification and improvement of the cooking and food preparation skills are not implemented, malnutrition will continue to be a major concern in Morogoro region.

Inappropriate food preparation, cooking and consumption practices were also noted as a challenge in the surveyed households. Dehulling and soaking of cereals (maize) as well as washing of chopped vegetables have been shown to cause the loss of important vitamins and minerals that are eliminated with the discarded soaking water [18]. Water-soluble vitamins such as vitamin C and B can easily be leached when vegetables and cereals are soaked in water; this reduces significantly the vitamin contents of soaked vegetables and cereals. Traditional cooking methods lead to 90% loss of Vitamin C (ascorbic acid) in the leaves and 50 – 60% is lost in cooking water [19]. It was also noted that all the surveyed households added sodium bicarbonate (*magadi* soda) when cooking jute mallow (*mlenda*), spinach and pumpkin leaves for tenderization and taste improvement of the vegetables. Addition of bicarbonate to beans reduces bioavailability of iron and zinc by 37% and 24%, respectively [20]. These practices have profound impact on the quality and quantity of nutrients, hence affect adequacy of diets in meeting nutrient requirements of consumers. Portion serving sizes were observed as a common challenge as majority of households consumed large portions of cereal based dishes in disproportion to relish servings. This compromises the possibility and benefit of including different food groups to achieve a balanced diet, hence leading to dietary inadequacies.

Inadequacies of nutrients consumed from different foods in the surveyed districts were mainly attributed by insufficient food intake, low feeding frequency and poorly diversified diets, but the underlying factor is limited understanding among the general population and more specifically households surveyed of the contribution of different food groups to nutrient requirements and general health. Inadequate nutrient intake leads to poor nutritional status of farmers, consequently, reducing working capacity and output in the fields which could significantly hamper farmers' wealth generation capabilities.





## CONCLUSION

The diet of rural Tanzanian farmers is inadequate and insufficiently diversified, with majority of the households eating less than six food groups. Although cereal staples and fat were consumed in almost all households, the diets were not adequate to meet energy intake let alone other nutrients. Promotion of diversified diets and consumption of recommended amount should be advocated to improve the nutrition situation of the Tanzanian rural farmers. Therefore, the primary intervention strategy should be to promote diversified and sustainable livelihoods by educating farmers on the importance of consuming diversified and adequate diets from different food groups. In order to achieve adequate levels of intake there is a need to address the issue of food preparation, processing, and combination of various types of locally available food sources, which were also found to be inappropriate. Furthermore, the influence of seasonality and other factors affecting dietary diversity and adequacy should be explored further.

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**Table 1: Consumption of different food groups by farming households**

<b>Food group</b>	<b>Dietary Diversity Score: Percent of households consuming each food group</b>
Cereals (wheat products, rice, maize and sorghum)	100
Roots and tubers (potatoes, yams, banana and cassava)	22
Vegetables	72
Fruits	26
Meat and meat products	17
Eggs	1.4
Fish	40
Legumes	40
Milk	7.9
Oil and fats	91
Sugar	63
Others (spices and condiments)	60

**Table 2: Frequency of consumption of different food groups by farmers in the surveyed areas per week**

Frequency of consumption	Food Groups										
	Days /week	Cereals	Roots & tubers	Vegetables	Fruits	Meat Poultry Offals	Eggs	Fish & sea foods	Pulses legumes	Milk & milk products	Oils/Fats
	%										
1	1.4	3.6	15	8.6	9.3	1.4	7.1	11.4	1.4	4.3	6.4
2	1.4	6.4	20.7	7.1	2.9		11.4	12.9	1.4	12.9	4.3
3	8.6	7.1	17.9	4.3	3.6		8.6	8.6	1.4	25.7	10.7
4	7.1	2.1	7.1	2.1	0.7		4.3	2.9		15	6.4
5	10.7	0.7	2.9	0.7	0.7		1.4	1.4		6.4	2.1
6	2.1	2.9	0.7	0.7			7.1	0.7		2.1	
7	68.6		7.1	2.9				1.4	3.6	23.6	32.1
Rarely		77.1	28.6	73.6	82.9	98.6	60	60.7	92.1	10	37.9

**Table 3: Average nutrient intake from foods consumed by farmers in surveyed areas in relation to the recommended daily intake<sup>1</sup>**

District	Sex	Energy (Kcal/day)	Protein (g)	Fat (g)	CHO (g)	Iron (mg)	Zinc (mg)	Calcium (mg)
<b>Recommended Intake</b>	<b>Male</b>	<b>2600</b>	<b>130</b>	<b>87</b>	<b>325</b>	<b>45</b>	<b>12</b>	<b>800</b>
<b>Recommended intake</b>	<b>Female</b>	<b>1800</b>	<b>90</b>	<b>60</b>	<b>225</b>	<b>21</b>	<b>12</b>	<b>800</b>
Kilombero	Male	1656.6	33.1	33.1	306.6	10.0	7.7	1015.3
	Female	1368.5	34.9	36.4	225.5	8.4	6.5	804.1
Gairo	Male	1255.3	35.6	42.1	183.5	17.6	5.7	174.3
	Female	1340.3	33.1	34.2	225.1	12.6	5.7	557.0
Kilosa	Male	1652.9	38.5	36.9	291.7	13.2	7.5	404.6
	Female	1368.1	26.6	40.7	223.8	17.0	8.9	351.6
Morogoro Municipal	Male	1043.8	27.5	24.9	177.4	6.7	4.7	465.6
	Female	1094.2	25.2	19.5	204.4	6.6	4.2	364.0
	Male	1402.2	33.7	34.3	239.8	11.9	6.4	515.0
	Female	1292.7	29.9	32.7	219.7	11.1	6.3	519.2
	Overall average	1347.5	31.8	33.5	229.7	11.5	6.3	517.1

<sup>1</sup>Source: [21]

CHO-Carbohydrates

**Table 4: Nutrient intake adequacy from foods consumed by farmers in surveyed areas: Percent of the recommended daily intake**

District	Sex	Energy	Protein	Fat	CHO	Iron	Zinc	Calcium
Kilombero	M	63.7	25.5	38.0	94.3	22.2	64.1	126.9
	F	76.0	38.7	60.6	100.2	39.9	53.9	100.5
Gairo	M	48.3	27.4	48.4	56.5	39.1	47.5	21.8
	F	74.5	36.8	57.0	100.0	59.8	47.8	69.6
Kilosa	M	63.6	29.6	42.4	89.7	29.4	62.1	50.6
	F	76.0	29.5	67.9	99.5	80.9	73.9	43.9
Morogoro Municipal	M	40.1	21.2	28.6	54.6	14.9	38.8	58.2
	F	60.8	28.0	32.5	90.9	31.5	34.7	45.5
Overall	M	53.9	25.9	39.4	73.8	26.4	53.1	64.4
Overall	F	71.8	33.3	54.5	97.6	53.0	52.6	64.9
	Overall average	62.9	29.6	46.9	85.7	39.7	52.8	64.6

CHO-Carbohydrates

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