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A Hub of Food Amid of Nutrition Insecurities: Exploring Food and Nutrition Situations in Rural Areas of Tanzania

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Abstract

A cross sectional study was conducted and involved 351 households from two regions where participants were mother/caregiver-child pairs. This paper discloses the challenges and opportunities of food and nutrition situations in the areas using lessons from Morogoro and Dodoma regions, Tanzania. Data were collected through an inventory food production questionnaire, focus group discussions, observation and documentation on preparation, cooking and consumption practices. The study revealed several opportunities regarding food and nutrition situations including; availability of arable land for cultivation of diverse crops, ownership of arable land by 75% of study population, and diverse crop production, where about 80% of households cultivate 2-3 food crops. In addition, existence of manpower for agriculture production was evidenced by household composition of more than 3 adults capable of participating in agriculture production. Seasonal availability of fresh produce such as fruits and vegetables was also among the opportunities noted. Despite the documented opportunities, 82% of households participated in subsistence farming and depended on rain fed agriculture, this led to low productivity per acre and seasonal scarcity of foods. Poor nutrition status of children and women coupled by frequent illnesses was noted. Prevalence of stunting was 40.5% and underweight was 14.5%, prevalence of overweight for women was also high in the villages. Furthermore, limited skills on food preparations and sub-optimal dietary practices such as low dietary diversity, low consumption of fruits and animal source foods prevailed in the areas. The importance of addressing the challenges is highlighted including promoting diversified and sustainable agriculture by educating farmers on the importance of producing, consuming and sustaining diversified diets. Also, increasing nutrition awareness on the importance of good nutrition for economic development and productive life.

Keywords: *Food security, nutrition situations, rural farming, rural*

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Introduction

Tanzania's rural population is experiencing high prevalence of under-nutrition and an increase of overweight and obesity (MoHCDGEC *et al.*, 2016; MoHCDGEC *et al.*, 2018). It is also facing additional challenges of food insecurity and undiversified agriculture despite of having good climatic conditions that support crop biodiversity (Brown, 2007; FAO, 2012). Rural areas have much

potential in terms of agriculture production, the rural land is diverse topographically and it is capable of producing different crops within the same or different agro-ecological climates (WFP, 2013). Human capital is also high in rural areas, according to the demographic and socio-economic profile of Tanzania, the majority of the population (70%) live in rural areas (URT, 2014). However, the agriculture practices in place have not helped the numerous rural populations to access and sustain agricultural production and food availability throughout the year.

Agriculture in rural areas is tied with a number of hurdles, including, low productivity, inadequate mechanisation and unreliable rainfall. In addition, subsistence farming is predominant in rural areas and crop production is mainly involving the use of hand hoe, and less yield seeds varieties (Lana *et al.,* 2017; Mutabazi *et al.,* 2015). Agriculture production outputs have been accomplished by accessing more arable lands instead of improving on farm productivity by using adequate inputs such as high yield seeds, drought tolerant crop varieties, inappropriate agricultural practices have made rural farmers to become vulnerable to weather shocks, land degradation and food insecurity (CAADP, 2013; Mutabazi, 2013; World-Bank, 2015). This has a profound impact in food availability, accessibility and ultimately nutrition status of the rural communities.

Tanzanian agriculture sector has put its emphasis on increasing agriculture productivity, especially on cereal food crops (FAO, 2013; URT, 2019). The emphasis on adequate production of cereal staples has made the country to attain surplus in-terms of cereals crops production (URT, 2019). While excess production of cereals can only avail caloric sufficiency, adequate production and utilization of livestock products, legumes, fruits and vegetables remains central to good nutrition. The issue of access to these micro nutrient-dense foods has become a major challenge for many individuals living in rural communities. Typical diets in rural households are monotonous and less diversified (Kinabo, 2011). They consist of mainly cereal or root staple crops, and little of proteins, micronutrient rich vegetables and fruits. Several factors have been reported to contribute to the situation, these include; cost, seasonal availability, inadequate nutrition knowledge and perception that fruits and vegetables are not considered household priorities when income is not sufficient to meet the needs of a quality diet (Kinabo, 2011; Fanzo, 2013).

Despite the mentioned opportunities, the rural land itself is diverse, with a large representation of different crops with different agro-ecological climates. This makes it suitable for cultivation of different crop varieties (Fanzo 2013; Bukania *et al.,* 2014). However, rural areas are home to some of the most nutritionally insecure people in the country, compounded with food insecurity, under-nutrition and diseases. It is also the place where about 70 percent of the poor, hungry and undernourished people live (CAADP, 2013). Any efforts invested in rural area will not only serve this population, but also will ensure food security, optimal nutrition, economic growth and will reduce rural-urban inequalities.

Researches on determinants of food and nutrition situations in rural areas have not attempted to link the challenges and opportunities of food and nutrition situations in rural areas in the context food and nutrition security. This paper attempts to present opportunities and challenges on food and nutrition situations in a rural context. The paper unpacks the contribution of rural life in improving both food and nutrition situations in Tanzania.

Methodology

Description of study area

The study involved four villages of Morogoro and Dodoma region. Two of them are in the sub humid Morogoro region and two in the semi-arid Dodoma region. The two regions have diverse environmental and socio-economic conditions for investigating some of causative factors for food and nutrition insecurity thus allowing for the transfer of results to other regions in Tanzania. In Morogoro region, Kilosa district was selected, the villages selected were Changarawe and Ilakala, these represented the sub humid climate in Kilosa, the food systems are more

varied mainly relying on sorghum, maize, legumes, rice, and horticulture and livestock. Morogoro region receives two rainfall seasons with an average of 600-800mm per annum. In Dodoma region, Chamwino district was selected and Ilolo and Idifu villages represented the semi-arid climate. The villages are characterized by a long dry season starting late April to early December, and a short single wet season starting December to mid-April. The average rainfall is 500mm annually. Food crops grown are maize, sorghum, millet, cassava and cowpeas (Mutabazi, 2013).

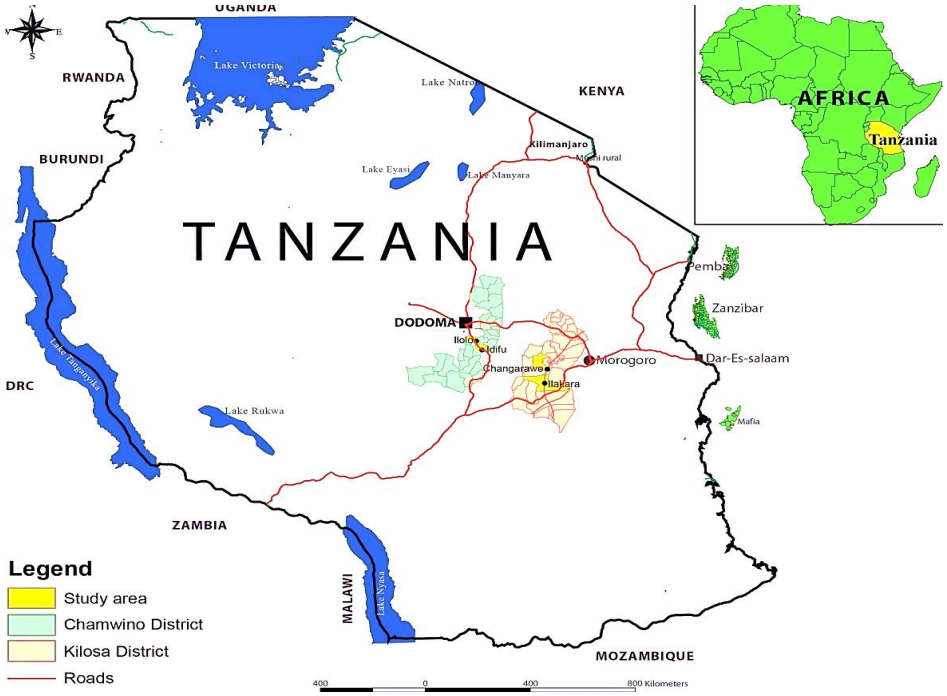

Figure 1. A map of Tanzania showing the study regions, districts and villages

Sampling of households

A cross-sectional research design was employed to collect information on socio-economic data, food production, consumption and nutrition status in different households of the studied villages. This paper used a sub-sample from larger study of Trans-SEC project that involved a total of 600 households. A cluster sampling technique was used to select 351 households with children below five years of age. The technique was applied because the study involved two heterogeneous districts (Dodoma and Morogoro) with different climates (semi-arid and semi-humid) and different agro-ecological patterns. The population in the participating villages was divided into groups (or clusters) and a simple random sample of the groups was selected. The elements in each cluster were then sampled proportionate to population size in a given village. The selected representative sample size enabled statistically valid conclusions. The participants were the mother/caregiver-child pair. Interviews were done to mothers/caregivers only and measurements were taken from mother/caregivers and children. Household heads and spouses were informed of purpose, objectives and activities of the study. The consent was sought from household representatives to participate in the study.

Methods of data collection

Inventory food production questionnaire

A checklist of itemized key points for discussion was developed to collect information on type of food crops produced in the studied villages, uses

of the produced food crops, challenges encountered and existing opportunities. The information was collected from farmers, extension officers and village leaders.

Anthropometric measurements

Anthropometric assessments were done to assess nutrition status of children under five years of age and their mothers/ caregivers; the parameters of interest were height, weight and age. These were collected in order to assess indicators of nutrition status for children (stunting, underweight and wasting). For caregivers' weight and height were measured in order to compute their BMI status. A questionnaire was used to collect demographic and socioeconomic information. The age of the children was obtained from their parents and verified from their clinic cards where available. The height (in cm) and weight (in kg) of 351 children and their caregivers in the sampled households were measured. The weight was measured to the nearest 0.01 kg or 10 g using a SECA electronic bathroom scale. For children below two years or who could not stand on their own, their weight was measured using a SECA scale with a tare facility. Both children and their caregivers were in minimal clothing and without footwear when measurements were taken. Height was measured using a stadiometer. The measurements were taken while the subject was standing without shoes, on a horizontal flat plane attached to the base of the stadiometer with heels together; and stretched upwards to a full extent and the head in the Frankfurt plane. Recumbent length was measured on children below the age of 24 months.

Focus group discussions (FGDs)

A checklist of guided questions for discussion was developed focusing on the aspects of food production preparations, consumption, existing challenges and opportunities. The groups consisted of 5 -10 individuals these were farmers, extension officers and village leaders. The FGD sessions were planned with the help of ARI-partners in each of the two locations – Morogoro and Dodoma. Agriculture Research Institute (ARI) partners helped with introduction of the project to the District Executive Directors (DED) who oversees governance and development issues in the district.

Observation and documentation

The information about food preparation and cooking methods was also collected. Observations and focus group discussions were used to identify and understand practices in the context of food preparation, cooking and consumption in the visited households. Twenty households from each district were opportunistically observed for a single preparation and cooking episode. The interviewers were also observing and documenting household food consumption practices by using a checklist for observation. The information collected included descriptions of the preparation and cooking and consumption practices.

Data analysis

Data obtained were entered and subjected to statistical analysis using SPSS software version 17 (SPSS Inc., Chicago, IL, USA) to compute measures of central tendency and descriptive statistics including frequencies and percentages. Furthermore, ENA for SMART 2011 (www.nutrisurvey.de/ena2011/) was used to compute indicators for nutrition status by converting the anthropometric measurements into z-scores of weight for age (WAZ), height for age (HAZ) and weight for height (WHZ), and compared with the WHO guidelines and standards, which were used to define stunting, underweight, wasting in children.

Results

Household's characteristics

A total of 351 households were reached during the household survey. Male headed households were the majority (87%) whereas only about 12% of the households were headed by females. The mean age of caregivers was years (41.6±12.6) and mean age of children was (3.6±1.52) years. Average range of household size was 5-7 members, about 50% of children in the surveyed area are below five years. At household level, about 87 % of male were head of households and they are involved in decision making of different

household matters. Majority of the surveyed population about 95% were farmers and farming is their main source of employment (Table 1). Subsistence farming was more predominant in the area where more than three quarters of households used hand hoe for farming activities.

Table1: Demographic characteristics of households (n = 351)

	Changarawe N= 100	**Ilakala** N= 101	**Ilolo** N= 50	**Idifu** N= 100
Mean age of caregiver (SD)	42.9 ±13.4	38.5 ±10.3	38.1±9.5	45.3±14.2
Male	90	95	80	83
Female	10	5	20	17
Marital status of household head (%)				
Married-monogamous	75	65	66	77
Married-polygamous	4	21	8	5
Co-habitation	7	1	8	1
Widowed	7	3	8	11
Divorced	5	6	8	3
Single	2	4	2	3
Level of literacy (%)				
Not able to read and write	35	29	36	58
Can read and write to some extent	11	36	34	14
Can read and write	54	35	30	28
Education level of respondent (%)				
No education	33	30	28	61
Primary education	60	65	70	38
Secondary education	7	3	2	0
Adult Education	0	2	0	1
Occupation of respondent (%)				
Farmer	95	97	92	96
Employed formal sector	1	0	0	0
Self employed	0	2	4	2
Other	4	1	4	2
Total number of people living in the household (%)				
2 to 5	57	56	48	40
6 to 8	38	38	42	53
9 to 13	5	6	10	7

Food production

The finding revealed that over 80 % of the population produces food, followed by purchasing (11%). Majority of the population relied mainly on agriculture production as a source of their staple foods. Other means of obtaining foods in households included collection of wild foods accounted for 7%. Different crops were grown in the villages, about 95% of crop production was under a rain fed system as irrigation was not a common practice in the surveyed villages. The major staple crop

grown in Dodoma was millet and in Morogoro the major staple crops grown were maize and rice. Shortage of food appears to be a common problem in the area. It starts 4 months after harvest, from November, to February subsistence farming was more predominant in the area where more than three quarters of households used hand hoe for farming activities.

Food production in Dodoma (Idifu and Ilolo)

Pearl millet is the main staple food in this village and was grown by all households. The crop occupied 70% of the village land and each household grew an average of 3 acres. Average yield in optimal production is 700-800 kg/acre while in years with inadequate production yields range from 60-600 kg/acre. Pearl millet is utilized mostly for food and small amount for making local brew. Other crops include sorghum, bambara nuts, groundnuts, sunflower, pigeon peas, cowpeas, cassava, grapes, rozella and indigenous vegetables. Simsim and paddy are newly introduced crops. Livestock keeping was also noted in the areas, example of these livestock include cattle, goats, and pigs.

Food production in Morogoro (Ilakala and Changarawe)

In Morogoro rural, maize and paddy were the main food staples about 50 percent of these crops are commercialized and used as a source of household income. Simsim is also produced as a cash crop, it is normally prepared and processed as seeds or oil for selling. About 76% of farmers reported that simsim crop is highly profitable hence the crop is for selling and not for domestic consumption. Other food crops are shown in the Figure 2.

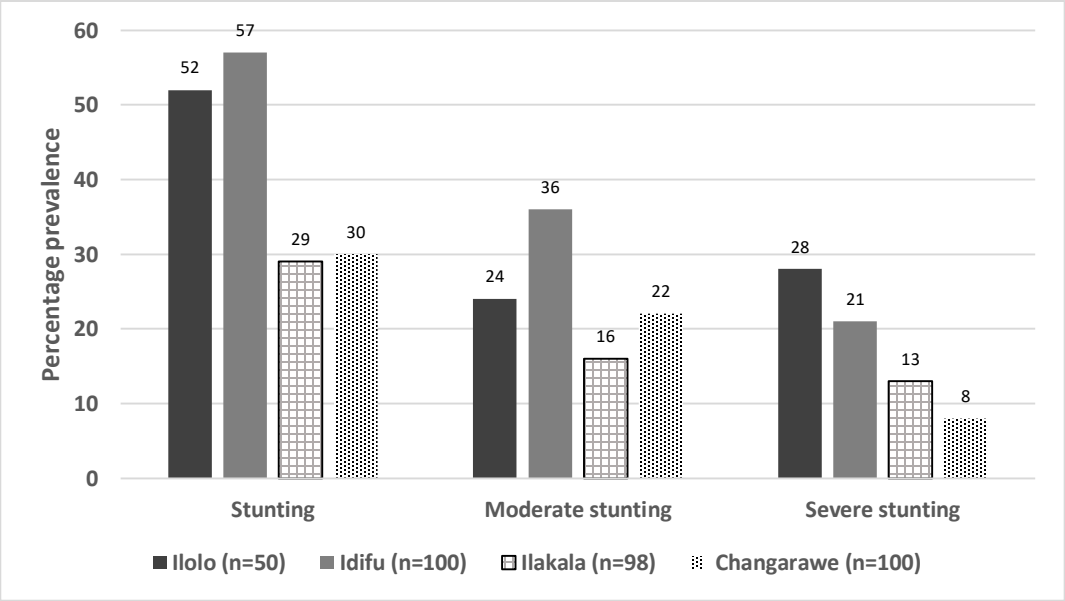

Figure 2. Prevalence of stunting in the four villages

Food availability and accessibility

Food availability is still a challenge in all of the four villages; however, the magnitude differs from one village to another. Among the challenges noted, was food scarcity during dry (lean) season. The shortage of foods starts 4 months after harvest, from November to February. In these months about 65% of surveyed households reported to experience food unavailability in their localities. The major reported reasons for food unavailability were seasonal food shortage and inadequate agricultural productivity due to subsistence farming. Other challenges were income poverty and marketing factors such as price of food items, these factors affect economic accessibility and

household's purchasing power. In Dodoma 71% reported to not being able to access food because of the marketing price while in Morogoro it accounted for 52%. The population is still dependent on food purchases and collection of wild food (11% and 7% respectively) for fulfilling basic food requirements. The crops produced are mainly staples therefore most of the times households need to purchase relishes (e.g. vegetables, sardines, beans etc.) as a complement for staple foods consumed. An average daily cost of diet per households in all four villages is 1,875/= Tanzanian shillings (TAS), (equivalent to 0.94 USD) this creates an additional challenge to the households because majority of them need to save money in order to cater for daily dietary needs. Household food production is the major source of food availability within the households; still 48% of households need to sell some of their produced food crops in order to cater for households' basic needs. For households that run of food shortage, selling of labor is the survival strategy by most of relatively poorer households as a coping strategy during food shortage periods.

Food consumption patterns

The results from surveyed areas showed that different food groups are available in all of the surveyed areas. However, this was not reflected in consumption of different food groups available. Cereals was the most frequently consumed food group by all households and eggs being the least consumed food (1.5% of the households) followed by milk products and meat which accounted for 4% of all the surveyed households (Table 2). Generally, the consumption of fruits was not adequate in the majority of households visited only 7% of households consumed fruits. In addition, vegetable consumption was also low in all two districts of Dodoma it accounted for 40% of the surveyed population. 69% of households reported to change their food consumption pattern during harvesting and lean season. The frequency and number of meals is reduced from three per day to once per day during the critical food shortages.

Table 2. Consumption of different food groups and Dietary Diversity Score (DDS) among Dodoma and Morogoro villages

Food group	Percent of DDS: Morogoro rural	Percent of DDS: Dodoma rural
Cereals (wheat products, rice, maize and sorghum)	100	100
Roots and tubers (potatoes, yams, cassava)	9	7
Vegetables	81	40
Fruits	9.5	5
Meat and meat products	3.5	5
Eggs	2	1
Fish	9	8
Legumes	31	26.5
Milk	3.5	5
Oil and fats	94.5	45
Sugar	95	83
Others (spices and condiments)	98	93.5

Preparation, cooking and consumption practices

Depending on the season, preparation, cooking and consumption practices of the surveyed population tend to differ. During harvesting season especially in Morogoro rural, de-hulling and soaking of maize cereal is the common practice by majority of the households. During food shortage maize is not de-husked before milling. The whole grains are milled in order to maintain the volume not for reason that whole

grain flours are healthy and nutrient-rich. The meals are also cut from three per day to one during the critical food shortages. It was also noted that during harvesting seasons in Dodoma rural, part of the produced pearl millet is utilized mostly for making local brew. Other reported practices were; washing of vegetables after cutting/ slicing, discarding water after boiling and overcooking vegetables for more than 20 minutes. These vegetables were amaranth, chinese and pumpkin leaves. These practices were commonly observed at Kilosa villages. In addition, in all four villages, caregivers added magadi soda when cooking mlenda (jute mallow) for tenderization and taste enhancement. Furthermore, the culture of saving bigger portion of food and relish to household heads was observed as a challenge in the areas. It was revealed during group discussion that, in both Dodoma and Morogoro women and children eat last after serving the household's head first.

Nutrition situation

Table 3 represents general nutrition situation in the four villages. Nutrition status of children was calculated based on three indicators, which are; stunting, wasting and underweight. The indices for nutritional status were converted into z-scores of weight for age (WAZ), height for age (HAZ) and weight for height (WHZ), and compared with the WHO guidelines for defining the severity of nutrition condition (WHO 2006). Results from all villages indicated that prevalence of stunting was 40.5%, underweight 14.7% and wasting was 2.9% as shown in Table 3;

Table 3. General situation of nutrition status of under-five children in four villages

Under nutrition status	**All child population n = 348**
Prevalence of stunting (height-for-age z-scores) (<-2 z-score)	40.5 % (9.7 - 81.3 95% C.I.)
Prevalence of moderate stunting (<-2 z-score and >=-3 z-score)	24.7 % (9.7 - 50.0 95% C.I.)
Prevalence of severe stunting (<-3 z-score)	15.8 % (2.9 - 54.1 95% C.I.)
Prevalence of underweight (weight-for-age z-scores) (<-2 z-score)	14.7 % (10.3 - 20.5 95% C.I.)
Prevalence of moderate underweight (<-2 z-score and >=-3 z-score)	12.1 % (9.8 - 14.7 95% C.I.)
Prevalence of severe underweight (<-3 z-score)	2.6 % (0.9 - 7.1 95% C.I.)
Prevalence of wasting (weight-for-height z-scores) (<-2 z-score)	2.9 % (0.5 - 14.1 95% C.I.)
Prevalence of moderate wasting (<-2 z-score and >=-3 z-score)	2.6 % (0.5 - 13.4 95% C.I.)
Prevalence of severe wasting (<-3 z-score)	0.3 % (0.0 - 9.4 95% C.I.)

Stunting

Stunting is an indicator of height for age; the results indicated that overall prevalence of stunting in all villages was 40.5%. The higher prevalence level of stunting was noted in Idifu village (57%) followed by Ilolo village (52%). The high level of stunting is associated with poor socioeconomic conditions and increased risk of frequent and early exposure to adverse conditions such as illness and/or inappropriate feeding practices.

Wasting

Wasting is an indicator of weight for height, wasting indicates a recent and severe process of weight loss, which is often associated with acute starvation and/or severe disease. On the severity index, prevalence between 10-14% is regarded as serious, and above or equals 15% as critical. The prevalence of 2.9% wasting in the surveyed population is within the acceptable range.

Underweight

Underweight is an indicator of weight for age it reflects body mass relative to chronological age. It is influenced by both the height of the child (height-for-age) and his or her weight (weight-for-height)**.** The results from the surveyed four villages indicated that 14.7% are underweight, however in Dodoma underweight was more prevalent accounted for 17% in both villages. This is high level given by the WHO (16%). Presence of underweight in a population implies multiple existences of stunting and underweight conditions.

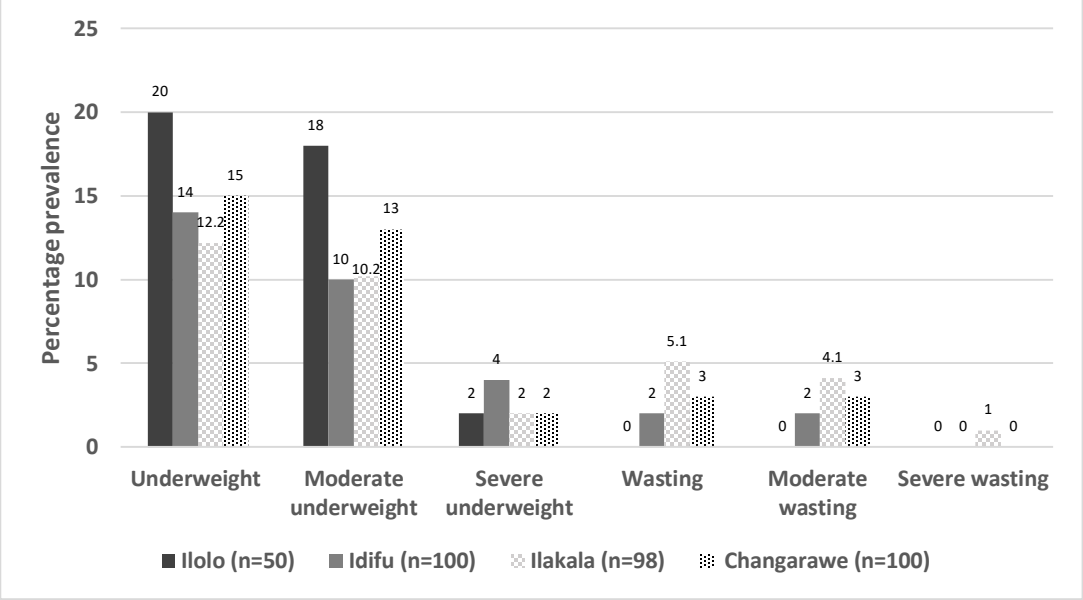

Figure 3. Prevalence of underweight and wasting for children in the four villages

Status of overweight and obesity for women in the four villages

Figure 4, indicates prevalence status of overweight and obesity for women in the villages, the prevalence of overweight was almost 2 times higher compared to underweight in the studied villages

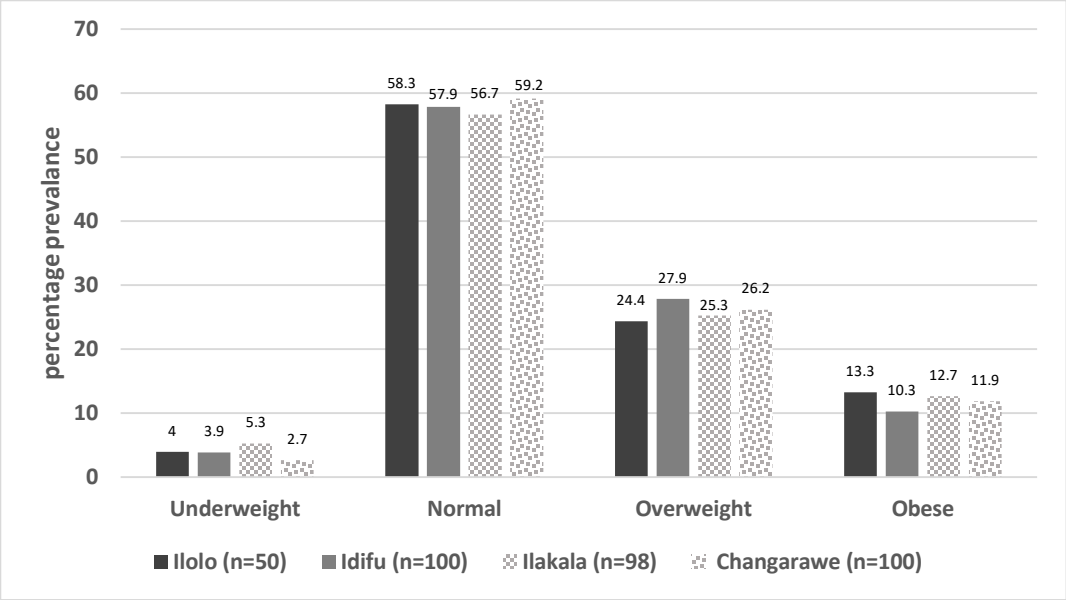

Figure 4. BMI status of adults female caregivers/Mothers in the four villages

Quality of human Labor for agriculture production

Results from key informants' interviews and focus group discussions, revealed that agriculture production in the surveyed area, depends totally on human labor. It involves the use of hand hoe for production of crops hence the quality of human labor is very important for participating in agriculture production. Officials from village health centers pointed out that among the common diseases and conditions reported by their clients is and Malaria, HIV and malnutrition especially underweight in adults and children. Prevalence of diseases and conditions in these population have negative impact on health and nutrition status of people, consequently affect quality of human labor, hence compromises agriculture production activities.

Discussion

This section describes the major challenges and opportunities regarding food and nutrition situations found in this study, the challenges and opportunities have been categorized into the area of food production, food availability, food accessibility, consumption pattern, processing, nutrition status and quality of human labour.

Food production

The findings indicated that different foods were produced at the study areas at a subsistence level. Similar finding made by S.F (2010) and WFP (2013) who reported that agriculture is a means of food production and a major source of livelihood for the majority of rural communities in the country. The authors further narrated that, agriculture practices in place have not helped the numerous rural populations to access and sustain agriculture production and food availability throughout the year. Small-scale subsistence farming for food production was a major activity for the majority of rural households in Morogoro and Dodoma. There is a need to empower rural farming households with appropriate agriculture technology and adequate knowledge on good agronomic practices in order to sustain food availability and consumption in the regions. Morogoro's and Dodoma's natural land resource base, sufficient underground water and good climatic conditions are conducive for expansion and diversification of both crop and livestock production. The main crops cultivated include rice, cassava, sweet potatoes, bananas, plantains, yams and legumes. Cereals such as sorghum, maize and millet are also grown on a small scale.

For many years, the Tanzanian agriculture sector has put its emphasis in increase agriculture

production, while food availability and utilization are the prerequisite for good nutrition. The issue of access to micronutrients rich foods has become a major challenge for many individuals living in rural communities. It was observed that most diets, in rural households are monotonous and less diversified. It consists mainly cereal or root staple crops, and little of animal source proteins, micronutrient rich vegetables and fruits. In addition it was further noted that other factors which contributed to inaccessibility of these foods are cost, seasonal availability, and perception that fruits and vegetables are not considered household priorities when income is not sufficient to meet the needs of a quality diet (Kearney, 2010; Hillocks, 2011).

The situation of agriculture production found in the surveyed villages has also been documented in literatures that, households which are not producing enough varieties of food crops, tend to rely on monotonous diets and low nutritional quality diets. These diets generally constitute a large proportion of starchy foods, which include cereals and tubers and are low in vegetables, fruits and animal protein (FAO, 2011; FAO, 2012; M'Kaibi, 2015). These diets tend to be inadequate of micronutrients, and the thus resulting in deficiencies (FAO, 2012; M'Kaibi, 2015). All these challenges need to be addressed by educating the rural households on the importance of including nutrition in agriculture production.

Food Consumption pattern

Generally, consumption of proteins from animal sources such as meat, milk and eggs were not adequate, this was also followed by inadequate consumption of micronutrient rich food groups such as fruits and vegetables by majority of the surveyed households. Insufficient consumption animal source foods have implications on the deficiencies of proteins and micronutrients thus compromises with nutrients requirements in both adults and children. On other hand less consumption of fruits and vegetables lead to poor micronutrient status in the body (Sunderland, 2011; Keding *et al.,* 2012). Inadequate intake of micronutrient reduces the ability of the body to mount the immune response against diseases and infections. In this regard the body is pre-disposed to diseases and infections hence affects work output, labor productivity and economic status of the household (Shils, 2006; Fanzo, 2013). It has been reported from literatures that low frequency of consumption of fruits is 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 be able to preserve these foods and to produce them during off-season (Hillocks, 2011; Keding *et al.,* 2012; WFP, 2013; FAO, 2014).

Starchy staple was the single major contributor of energy to food consumed by all of the surveyed rural households as compared to other food groups. It has been indicated by literatures that energy should be represented in correct proportion from all three sources of macronutrients, i.e. 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. Considering the mentioned scenarios, the majority of rural communities are prone to protein energy malnutrition.

Food availability and accessibility

The results from surveyed areas showed that different food crops are available in all of the surveyed areas; however, this was not reflected in consumption of different food groups available. Economic accessibility of food was reported as a barrier for consumption of diversified diet by majority of households. This further corresponds to the study done by Kearney (2010) and Shills (2006) who reported that people in developing countries are often consume monotonous diets, not because of the choice but because of the economic factors including price of foods (Shils, 2006; Kearney, 2010). In this study it was noted that despite of having low production of food crops in most households, some of food crops are sold to cater for basic needs of households.

In Morogoro rural, maize is the main food staple about 50% of it is commercialized and used as a source of household income. Simsim is also

produced as a cash crop it is normally prepared and processed as seeds or oil for selling. Farmers reported that simsim crop is highly profitable hence the crop is for selling and not for domestic consumption. The question that is still remained unclear is to whether the amount of money received after selling food crops is translated into improvement of household's nutrition status or not. Food shortage was also reported by majority of the household both Dodoma and Morogoro. Shortage of foods starts 4 months after harvesting; from November, December, January and February. This is a challenge and it calls for urgent need of empowering rural community on sustainable means of agriculture production and consumption

Preparation, cooking and consumption practices
Inappropriate nutrition practices were also noted as a challenge in the surveyed households. Dehulling and soaking of cereals (Maize) have been shown to cause the loss of important vitamins and minerals that are eliminated during dehulling and soaking process. Water-soluble vitamins such as vitamin B can easily be leached when cereals are soaked in water, this reduces significantly the vitamin contents of a soaked cereals. In addition, the practice of making local brew by using cereals is known to be a significant contributor to food insecurity among rural families. This practice not only affects food availability but also expose households to nutrition insecurity and vulnerability (FAO, 2011; Keding *et al.,* 2012). Appropriate vegetable preparation and cooking; has remained a challenge to the surveyed households. Caregivers who are mainly involved in food preparations and cooking reported to have inadequate skills on appropriate vegetable preparation and cooking. Caregivers reported from the focus group discussion that, it is a common practice both in Dodoma and Morogoro to expose vegetables to the sunlight for at least 30 minutes before cooking in order to dry them, they also excessively slicing vegetables and soak them prior to cooking and they do cook vegetables for long time. They overcook them, destroying the taste, appearance and many essential micronutrients such as vitamins A, B and C (Mbwana eta al., 2016; Shils 2006). In addition, poor intra-household's food distribution hampers the efforts of reducing malnutrition in the households; it is culturally acceptable to serve household head first with bigger portion without prioritizing vulnerable groups such as children.

Nutrition status
The study indicated that, the most prevailed form of malnutrition in the studied rural communities is under-nutrition in child hood and overweight for women. Under-nutrition can take several forms including hunger and micronutrient deficiencies. In most of the surveyed households the measures taken to reduce the levels of hunger has traditionally placed the emphasis on the quantity of food, and refers to ensuring a minimum caloric intake is met. In addition, it was noted that, the households preferred largely on starchy staples to meet their hunger needs and no other food groups. This has implications on poor nutrition status of the rural households as they eat in order to fill their stomach and not to meet their body nutrition needs. Malnutrition among children is a critical problem because its effects are long lasting and go beyond child-hood. The study indicated that stunting was the most prevailed form of under-nutrition with unacceptable prevalence in all of the studied population. Stunting has both short- and long-term consequences. A stunted child as compared to non- stunted child is physically, emotionally and intellectually less productive and suffer more from chronic illnesses and disabilities (TFNC, 2014). Several studies indicated that the prevalence of under-nutrition was higher in the rural area compared to urban area (S.F, 2010; NBS, 2011; TFNC, 2012; WFP 2013). On other hand, overweight in women was almost twice higher as compared to underweight in women. Similar observation was made by (Mendez *et al.,* 2005) who reported that, in developing countries, the prevalence of overweight has exceeded that of in underweight in more than half of the countries studied. The demographics and health survey of Tanzania indicated an increase of overweight and obesity both rural and urban areas of the country. Hence, there is a need to further explore other dimensions and contributing factors despite of having rich biodiversity and enormous opportunities in the rural communities.

Quality of human labour for agriculture production

It has been documented that quality of human labour is necessary for attaining of adequate food security. If nutrition status is compromised, people will not be able to participate in crop production. In addition households' income and savings are directed to health care cost hence and caregivers has to reduce or stop agriculture production activities in order to attend a sick individual within the household (Kinabo 2011; WFP 2013). This will consequently not only reduce household money but also compromise agriculture production activities. This study revealed that Malaria, HIV and Malnutrition are prevalent in the area, this poses a challenge in agriculture production. Diseases and malnutrition perpetuate the cycle of poverty and reduces production capacity in most of rural households. This subsequently results into reduction of working capacity, poor production and inadequate economic development.

Conclusion

The findings of the study entail that rural areas have got several opportunities such as arable land, good climatic conditions, adequate human labour and existence of agro-biodiversity. All these opportunities are surpassed with existence of inadequate nutrition knowledge on the optimal utilization of available food to meet nutritional requirements. Furthermore, sub-optimal preparation and cooking practices coupled with poor agronomic practices, food insecurity, poverty and diseases exacerbate nutrition situations. These have contributed to the persistence of malnutrition in the areas. The pre-requisite for attainment of food security and good nutrition status in rural areas is to address issues of knowledge gaps, sustainable food supply by diversifying farming systems in order to increase potential access of the households to adequate and diversified diets. It is also important to promote appropriate and improved technologies for home preservation and drying of vegetables and fruits. This will reduce seasonal scarcity of fresh produce hence ensure adequate supply of micronutrient-rich foods in rural areas. All these will be possible if rural people will be empowered with health and nutrition education in order to translate agriculture production into adequate consumption and to be able to sustain the livelihood of rural communities. It is now high time for Tanzanian government to start investing in human capital by improving health and nutrition status of human labour for attainment of food and nutrition security. Furthermore, it is necessary to explore more on drivers and barriers for attainment of food and nutrition security in rural communities.

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