

**UNDERSTANDING DRIVERS OF DIET CHANGE AND FOOD CHOICE  
AMONG PASTORALIST SOCIETIES IN HANDENI AND MVOMERO  
DISTRICTS, TANZANIA**

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**A DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF THE  
REQUIREMENTS FOR THE DEGREE OF MASTER OF HUMAN NUTRITION  
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## ABSTRACT

Pastoralism is a livelihood system more prone to environmental, economic, social and political threat and pressures. Outcomes of these effects have implications on gender roles, responsibilities, lifestyles, and activities. This study elucidated the influences of shifting pastoralism livelihood strategies on the changes in socio-cultural, gender norms, food choice and dietary pattern in six randomly selected villages of Handeni and Mvomero districts, Tanzania. A total of 436 respondents participated in a cross-sectional study design and provided dietary information through household interviews, key informant interviews and focus group discussions. MAXQDA software (12.3.1) analysed qualitative data and Statistical Package for Service Solutions (SPSS, 20) and STATA (11.2) computed frequency, percentages and binary logistic regression. Livestock keeping and crops cultivation were the primary livelihood systems in the study area. Food valuation, food choices and food habits were influenced by, nutrition, and economic values as well as social and cultural perceptions. Statistically significant differences were observed in the consumption pattern of various foods between dry and wet seasons. These variations of food consumption were found due to the availability and accessibility of foods. Such foods includes; orange fleshed sweet potato  $P=0.002$ ; maize ( $P=0.002$ ); green kidney beans ( $P=0.002$ ); fresh lung fish ( $P=0.001$ ); jute leaves ( $P=0.001$ ), spider plant leaves ( $P=0.008$ ) and nightshade leaves ( $P=0.000$ ). Animal and animal products such as meat and milk were the main source of food in pastoral communities but their consumption also varied ( $P=0.001$ ). The study concludes that the major drivers of diet change and food choice include; livelihood diversification, food valuation (social and cultural inheritance, age, gender, economic status, ethnicity and beliefs), school interaction, livelihood systems, availability and accessibility of foods. It was therefore recommended that, nutrition education, communication and counseling focused on addressing unwarranted beliefs and norms regarding food consumption should be provided in order to improve pastoral household nutrition status.

## DECLARATION

I Lulu Shaabani Ngume 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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**LIST OF ABBREVIATIONS AND ACRONYMS**

CHD	Coronary Heart Disease
CI	Confidence Interval
DDS	Department of Development Studies
DFC	Drivers of Food Choice
DFID	Department for International Development
DGAC	Dietary Guidelines Advisory Committee
EFSA	European Food Safety Authority
FAO	Food and Agriculture Organization
FEWSNET	Famine Early Warning Systems Network
FGD	Focus Group Discussion
FSNAU	Food Security and Nutrition Analysis Unit
HH	Household Interview
ILO	International Labour Organization
ILRI	International Livestock Research Institute
IUCN	International Union for Conservation of Nature
KII	Key Informant Interview
NIMR	National Institute for Medical Research
SPSS	Statistical Package for Service Solutions
TFNC	Tanzania Food and Nutrition Centre
UK	United Kingdom
URT	United Republic of Tanzania
USA	United States of America
VEO	Village Executive Officer
TZS	Tanzania Shillings

## CHAPTER ONE

### 1.0 INTRODUCTION

Pastoralism in Tanzania is a livelihood system characterized by large herds of indigenous breeds of animals that are reared mainly for subsistence with occasional trading. It is an extensive system with low input and outputs (IUCN, 2015). Animals depend entirely on natural resources such as land, water, pasture and human labour. In East Africa especially Tanzanian pastoralists commonly practised mobile pastoralism which refers to the fixed based settlement and mobile herd camps. This is when the animals are moved seasonally by certain members of the household, usually young men/adolescent boys but children and women often stay behind at a fixed household with some milk cows, calves, and small stock (Flintan *et al.*, 2011). This practice is highly influenced by the changes in land use and tenures allocated to people within the communities although some few societies such as Datoga people are still considered as nomadic pastoralist due to their shifting of the entire family with the animals from place to place without having permanent settlement (Sellen, 2003; Flintan *et al.*, 2011; Msuya, 2015).

Pastoralists' forms of life are often different or more like the same compared to non-pastoral societies. According to Ahmed (2014), most of East African pastoralists practiced patrilineal descent, where men make important decisions such as the sale of animals, own animals and have a sense of bravery. Women are regarded as food givers, as they normally control nearly all aspects related to milk, from milking to processing, bartering/selling and intra-household allocation, therefore responsible for providing sustenance to children and elders. They contribute in the herding of cattle especially

young cattle (calves), goats and sheep, performing domestic chores and have low economic and decision making power regarding the animal sales (Holtzman, 2002).

Generally livelihood is a set of economic activities, involving self-employment and/or wage-employment by using one's endowments (human and material) to generate adequate resources of cash and non-cash for meeting the requirements of self and the household, usually carried out repeatedly and as such become a way of life (Chambers and Conway, 1991). Livelihood security depends upon a number of activities and strategies, e.g. wage employment, which includes local and non-local (working as a hired herder, farm worker, and migrant labourer), social pension, remittances from household members working in urban areas, unpaid domestic and farm labour, livestock keeping, selling of livestock products, rental property ownership and sales, and farming of either subsistence and/or commercial (Little *et al.*, 2001).

Additionally, livelihood diversification pursue any income-earning activities and strategies undertaken by households to generate income hence attempt to reduce its vulnerability by having more than one livelihood activity (Mengistu, 2015). In a diversified household livelihood, if one productive activity does not provide enough, or fails completely, there are other sources of livelihood that help household from time to time, to live a comfortable existence in the society.

In the food domain, values have been studied in relation to food consumption patterns and food related attitudes. It can indeed play an important role in explaining differences in attitudes and perception of people towards food choice. Values have been described as abstract and enduring concepts that guide or explain attitudes, norms, beliefs and behaviour also it examines all influencing factors that predictive power in analyzing

attitudes and preferences. Values can provide important information to better understand human behaviour because they are limited in number and temporally stable (Saher *et al.*, 2006; Kihlberg and Risvik, 2007; Klein *et al.*, 2011).

### **1.1 Problem Statement**

Pastoral communities derived their diets from livestock, consuming products such as milk, meat and blood which contribute a substantial proportion of dietary energy, protein and micronutrients but now have deviated to staple food consumption such as maize products (Ianotti and Lesogorol, 2014). The lifestyle and livelihood shifts that accompany sedentary and nomadic strategies have substantial implications for gender roles and responsibilities that are likely to influence diet choices which ultimately affect nutrition and health of pastoral individuals (Flintan *et al.*, 2011).

Extreme climate events and changing weather patterns, and the resulting influences on food security, are spurring shifts in livelihoods among pastoralist communities (Toutain *et al.*, 2012). In addition to pressure associated with climate change, pastoralists face political, economic and social pressures, for example, land use policies that limit access to key grazing areas, and increased human population growth and settlements that provide new livelihoods and lifestyle opportunities both have differing impacts on men and women (Flintan *et al.*, 2011). Changes in livelihood strategies that involve incorporation of more beef animals, such as bull or oxen, in herd structures often result in increased quantities of milk diverted to calf fattening and hence reduced milk for human consumption. This in turn has negative consequences on pastoralists' diets and hence on their health, especially for women as they usually reduce milk consumption to compensate with maize based meal (Flintan, 2008).

The growing demand for animals as sources of foods is likely to present new opportunities for economic growth among pastoralists. However, such opportunities may have unintended consequences for diets by causing more products to be sold instead of used for consumption which affects the pastoral diets (Nsiima *et al.*, 2012). With emerging markets, women lose control of milk, its allocation for household consumption and income from milk sales. Increasingly, milk products that usually went to children and other household members is diverted to sales and replaced with less nutritious, starchy foods, such as maize meal (McPeak *et al.*, 2012). Moreover, the goal of men to increase livestock sales also affects nutritional status of household members.

The lifestyle and livelihood shifts that accompany sedentary and nomadic strategies have substantial implications for gender roles and responsibilities that are likely to influence diet choices which ultimately affect nutrition and health (Flintan *et al.*, 2011). However majority of the pastoralists lack nutritional knowledge about food consumption pattern especially on dietary related diseases (cardiovascular disease) and overweight/obesity; also they are not aware of nutrition related issues such as proper food production, preparation, storage, preservation, and diversification to maintain dietary quality (McPeak *et al.*, 2012).

## **1.2 Justification of the Study**

There are multiple, incremental options, including livelihood diversification, that, when adapted to local contexts and circumstances, can increase probabilities to improve livelihoods such as, cultivation, livestock keeping, small business and casual labour. However, various pressures, including poor policies, agricultural encroachment, population pressure and climatic change are recent risk phenomena that shape current livelihood diversification patterns. Different levels of risk might have both positive and

negative impacts on food choice and household consumption pattern that is associated with varied livelihood options and social groups including female/male, young/old, and better-off/poor households. These might have influence on short and/or long term livelihood outcomes. Whereas for the individuals who their primary livelihood depends only on the livestock keeping consider animals as major source of income; other individuals who depend on both crop and livestock keeping, consider crops and animals as their source of income however these individuals may also practice petty business.. All these contribute much to financial scenario of the community but access to other forms of income and to assets strengthens the distribution of resources within the household.

The concept of livelihood diversification (strategy) has become central to development policies, programs and practices that improve pastoral living conditions specifically on nutrition. Majority of pastoral households faced with challenges affecting livestock productions have diversified into other livelihoods that can be supported by environmental conditions (McCabe *et al.*, 2010). Some pastoralists engage in seasonal crop farming where climatic conditions are favorable (Mengistu, 2015), while others stock more of certain livestock species that are believed to be resistant to drought and diseases. Shifting livelihoods and lifestyles may cause changes in the social and cultural values of food hence had an implications on pastoralists' diets, which were based on milk and other animal products contributed to substantial proportion of dietary energy, protein and micronutrients but now have changed to more staple foods consumption such as maize meal which are richer in carbohydrates (Flintan *et al.*, 2011; Ianotti and Lesogorol, 2014).

This study aimed at understanding drivers of food choice and diet changes among pastoralists as influenced by economic, political and social situation. The evidence

generated through this study can be used by policy/advocacy and program planners to develop sustainable economic and policy diversification. Also it will generate basic knowledge on the evolution of food consumption and utilization patterns as it identifies and characterizes the different dietary habits that exist in the pastoralist societies.

Therefore, this study sought to explain the impacts of livelihood diversification on food choice and the contribution of social identities food valuation and food choice among pastoral communities and describe how shifting livelihood strategies among Tanzania pastoralists influence changes in socio-cultural and gender norms, food access and food valuation and explain the intersections of these effects on food choice and seasonal dietary pattern of various types of pastoralists.

### **1.3 Study Objectives**

#### **1.3.1 Overall objective**

The overall objective of this study was to elucidate the influences of shifting livelihood strategies on the changes in socio-cultural, gender norms, food choice and dietary pattern among Tanzanian pastoralists in Handeni and Mvomero districts.

#### **1.3.2 Specific objectives**

- i) To examine the impacts of livelihood diversification on food choice among pastoralists.
- ii) To assess the contribution of social identities to food valuation and food choice among pastoral communities.
- iii) To assess seasonal dietary pattern of pastoral communities.

### **1.3.3 Research questions**

- i) What are the livelihood diversification strategies and what drives the diversification on food choice among pastoralists?
- ii) What is the contribution of social identities to food valuation and food choice among pastoral communities?
- iii) How do the dietary patterns vary across agricultural seasons among the pastoral communities?

## CHAPTER TWO

### 2.0 LITERATURE REVIEW

#### 2.1 Shifting of Pastoralist Livelihood Systems

Over the past thirty years, East African pastoralist societies (Kenya, Tanzania, and Uganda) have faced large challenges to their economies and traditional ways of life due to the increasing changes in population growth, livestock economy, loss of herding lands to farmers, out-migration by poor pastoralists, and dis-locations brought about by drought. In the savanna regions of southern Kenya and Tanzania, Maasai and other groups have lost land to expanding farming populations, private ranches, wheat estates, and the expansion of tourist game parks (Odhiambo, 2006; Fratkin, 2008).

These problems are intense to the extent that more pastoral individuals have responding to the social, political, and economic challenges with increased economic diversification including agro-pastoralism, wage labor, and increased market integration. These changes result in increased social and economic stratification, urban migration, and diminished nutrition for women and children (Fratkin, 2008).

To adjust from these challenges pastoral way of life has changed. Some traditionally nomadic societies, some families have become more or less sedentary which refers to the pronounced pattern of migrations that usually take them to cool highland valleys in the summer and warmer lowland valleys in the winter. In both locations (highland and lowland valleys), pastoralist have regular encampments or stable village often with permanent houses example Sukuma, Gogo and Pare when the opportunity arises, while others continue with their nomadic livelihood strategies or a combination (Odhiambo, 2006; Flintan *et al.*, 2011; Gustafson *et al.*, 2015).

However, both nomadic and sedentary pastoral communities, women are still responsible for food procurement, preparation and allocation, thus preserving food culture. The control of milk by women is neither an absolute nor a fixed norm, as varying patterns of control and cooperation exist in relation to emerging market opportunities. Sedentary pastoral livelihood changes gender roles such as control of food, milk and milk income hence changes in women's domestic routines, child care practices and availability of animal products. Also the changes provides new opportunity to women including integration into small farming, vegetables and milk selling or wage labourers (Flintan *et al.*, 2011).

## **2.2 Definition of Terminologies**

All pastoralist societies can be accurately described as following either a nomadic or transhumance way of life where;

- i. Nomadic pastoralism is when the entire family moves with the animals several times during the year and there is no fixed settlement (Morton and Meadows, 2011).
- ii. Transhumance pastoralism is when members of the family or the entire family and their herds migrate usually once per year (usually dry season) on the same route to the same pastures each year and then return to the same fixed place each year (Gustafson *et al.*, 2015). Transhumances usually last about 3-4 months and are common in West Africa but are very uncommon in East Africa.

## **2.3 Food Choice and its Consequences in Pastoral Societies**

Food choice involves selection of foods for consumption, which results from the competing, reinforcing and interacting influences of social, environmental and economic

influences (Barker, 2010). In the East African context such as Tanzania, nutritional status and diet quality are poorer among agro-pastoral women and children compared to their nomadic counterparts (Ionotti and Lasogorol, 2014). It can be caused by several factors such as cultural, availability of food, taste, nutrition aspects in terms of health eating, reducing of weight and eating food contain a specific nutrient because of its deficiency in the body. Illness can also cause the selection of food to an individual due to loss of appetite and/or some complications such as diarrhea and vomiting. Furthermore purchasing decision has high influences to food choice within the household. All these factors may have positive and negative consequences in pastoral diets as people tend to consume foods based on their option available.

#### **2.4 Food Value in Pastoral Communities**

Food valuation refers to how food is perceived and/or valued within the society (Lu, 2012). Food can be used to identify individual's gender, age group, tribe and income status. The value of food in society is often greater than its contributions to income, nutrition or health, but in some areas food has multiple additional values such as inherent social and cultural appreciation, which may be more important motivators of diet choice than health and nutrition (Weaver *et al.*, 2015). Shifting in livelihoods and lifestyles may underlie changes in the social and cultural values of food for pastoral communities as due to the inter-ethnicity people tend to adopt foreign attitudes and behaviours toward foods which ultimately have high influence to the change of diet and food choices (Sadler and Catley, 2009; Ahmed, 2014; Weaver *et al.*, 2015).

#### **2.5 Pastoral Diets**

Pastoralists rely on their herds for daily subsistence. Pastoralist diets consist of milk, meat, and blood obtained from their animals, and cereals either grown or obtained from trading their animals. Milk and milk products account for 60 to 65 percent of the dietary

energy of Maasai, Turkana and Rendille, consumed mainly in wet seasons, while meat usually from goats and sheep, blood tapped from living animals together with cereals are consumed as the dry season sets in and milk yields diminish (Sellen, 2003).

The consumption of these food groups tend to provide necessary nutrients needed within the body. And for the pastoralist high consumption of dairy products, meat and cereals helps them to obtain different nutrients including carbohydrate, (protein and fat), and minerals. These nutrients are specifically divided into macronutrient and micronutrients.

### **2.5.1 Carbohydrates**

Foods which are abundant in carbohydrate include whole grains such as maize, rice, pasta, cassava and varieties of breads, potatoes, cakes and biscuits. These foods provide energy in the body also contain high sugar, fat and sodium where all these nutrients are needed in the body (FAO, 2008a; Te Morenga *et al.*, 2013). However a high consumption of added sugars has been ultimately associated with various conditions, such as obesity, risk factors for coronary heart disease (CHD), diabetes and metabolic syndrome (Te Morenga *et al.*, 2013).

### **2.5.2 Protein and fat**

Generally dairy products such as yogurt, cheese, ghee, fermented milk and fresh milk and meat tend to provide protein within the body. Milk is produced and consumed throughout the year but also these rely on the household income level (FAO, 2008a; Ogello *et al.*, 2013). Poor households milk an average of two to seven cows, middle class households have around ten to twenty milk cows and better-off households milking around thirty cows. All the milk produced is consumed except for small amounts are sold by households living near the trading centres. However, animal meat usually to

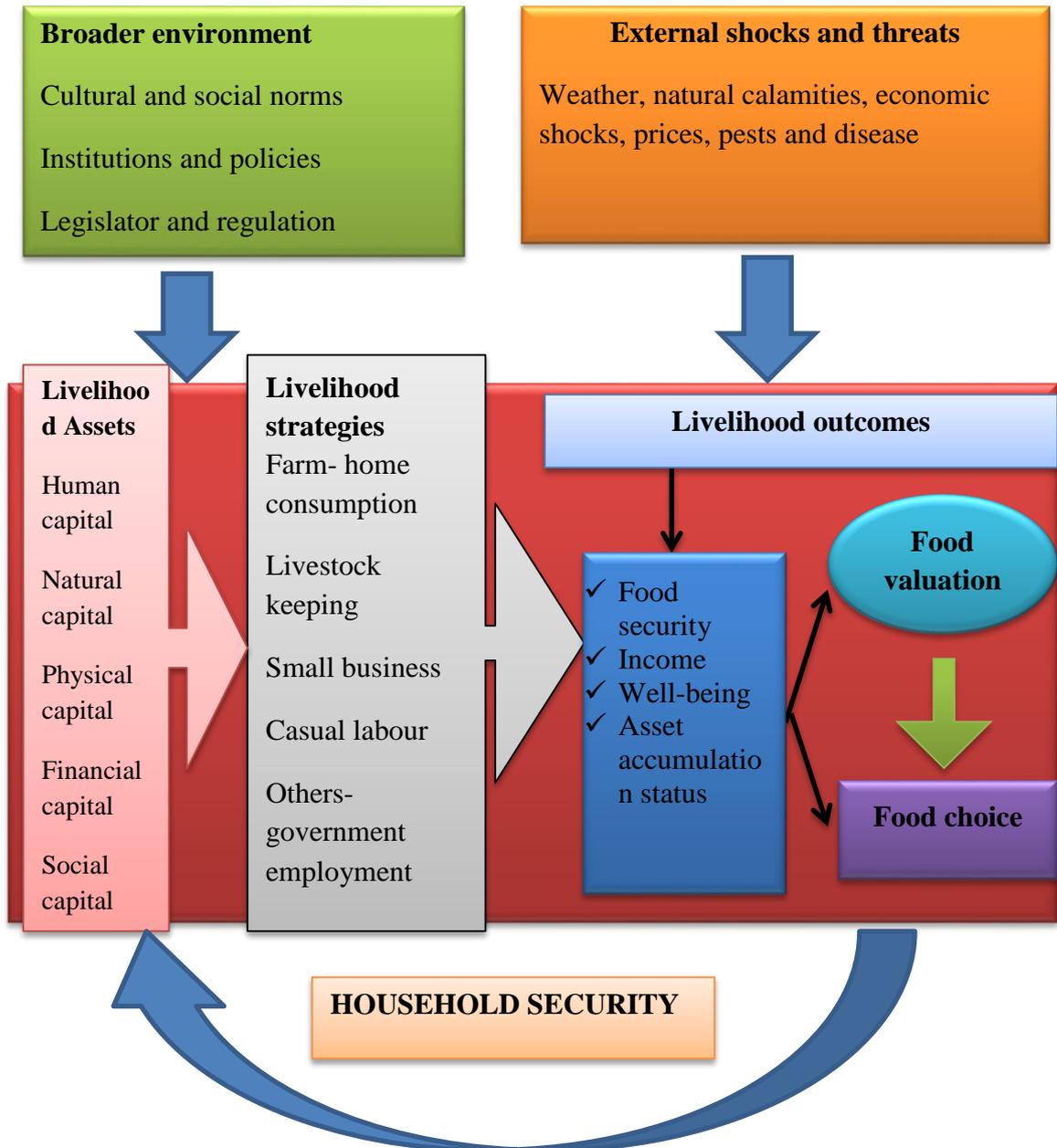
pastoralist acts as an essential part of the diet and is important for good health as they are rich in fat where the fat nutrients provide the medium for the absorption of fat-soluble vitamins (FAO, 2015). They are also primary contributors to overall energy intake in the human body (Bradford Dietitians, 2013). Fat can be categorized in three types saturated and trans-fat in which unsaturated fat is considered to be good compared to saturated fat (FAO, 2008a).

### **2.5.3 Minerals**

Calcium and iron minerals are more present in the milk and animal meat. Calcium is essential for healthy functioning of bones and teeth. Children require this nutrient for their rapid growth while elders require calcium for the prevention of bone depletion/disintegration (FAO, 2015). However, iron is also essential nutrient within the body as it a major component of hemoglobin, found in red blood cells and requirements are high within the body especially for children due to their growth demands. The little presence of iron in the diet may cause anaemia (FAO, 2008a; Barker, 2010).

## **2.6 Conceptual Framework of the Study**

This study has adopted the sustainable livelihood framework from UK Department for International Development (DFID, 2000), as an explicit and simplified representation of reality with the variables used to interpret evidence and solve problems to successfully act in changing household livelihoods. Frameworks are at a level of complexity between an assets, livelihood strategies and livelihood outcomes as shown in Figure 1. Where all are major life tasks that raising household survival as they are strongly influenced by broader environment and external shocks and threats. In livelihood diversification, a common framework facilitates experimentation by making explicit the variables involved hence defines household situation.



**Figure 1: Conceptual framework describing factors influencing household livelihood security**

## **CHAPTER THREE**

### **3.0 METHODOLOGY**

#### **3.1 Study Area**

The study was conducted in Handeni and Mvomero districts which were among the districts under the MoreMilkiT project. The MoreMilkiT project was the project initiated by the International Livestock Research Institute (ILRI) in 2014 with the goal of promoting inclusive growth and reduced poverty and vulnerability among dairy-dependent livelihoods in rural areas of Handeni, Kilosa, Mvomero and Lushoto in Tanzania. In this study however, only six villages whose livestock management systems were either sedentary or migratory were randomly selected from the two Districts. These villages included Manyinga, Kambala and Mela in Mvomero District and, in Handeni District the villages selected were Masatu, Kibaya and Konje.

According to URT (2013), Mvomero District climatically is characterized by a dry tropical climate of the semi-arid type. The mean annual temperature of the District is 25°C where annual rainfall ranges from 800 mm in low-lying areas to about 1300 mm in high altitude areas. In Handeni District climatically undulating with scattered hinge rising and upland areas mainly towards the western parts of the district without coastline and the terrain, which lies between 600-1200 meters above sea level. Most of the district has the coastal type of climate which is generally characterized by high temperatures and humidity. Average temperatures vary from 27°C to 30°C and it is cooler during June and September and hottest between December and March. It has two rain seasons, the short rains fall from October to December, and the long rains from mid-March to June while dry season is between July and September (URT, 2013).

Generally, the main economic activities are crop farming and livestock keeping. Major crops cultivated in Mvomero district are maize, rice and sugar cane and in Handeni district are maize and sisal. Other crops cultivated in both districts include beans, cowpeas, cassava, bananas, sweet potatoes and finger millet. In addition other economic activities practiced in the areas are small business/shop, charcoal making and fishing (URT, 2013). Fig. 2 shows the map of Mvomero and Handeni Districts which shows the areas where this study was conducted.

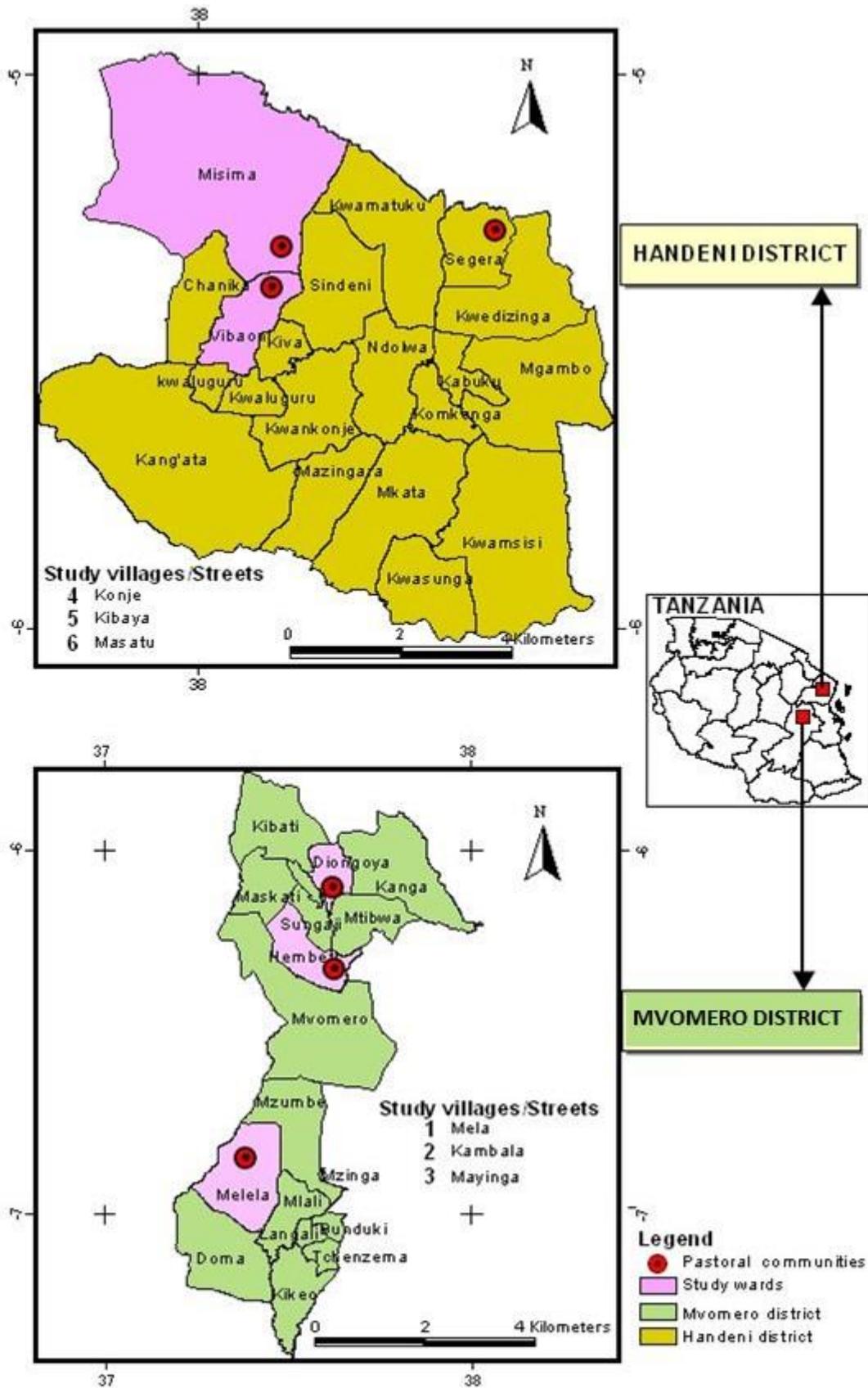


Figure 2: Map of Mvomero and Handeni districts showing the study areas

### **3.2 Study Population**

The target groups for this study were pastoralists from the pastoral communities which were previously involved in the MoreMilkiT project.

### **3.3 Research Design**

A cross-sectional research design was used to study factors that influence food choice. The nature of the study varied based on the gathering and analysing information, where livelihood and food valuation data were collected once during February to March 2017. A repeated cross-sectional study was applied in the gathering and analysing of the information where data were collected once in the two different periods due to seasonality (heavy/ long rainy season and dry season) for determine seasonal dietary pattern.

#### **3.3.1 Sample size and sampling**

A total of 436 respondents were selected in this study whereas different approaches of data collection such as focus group discussions (FGDs), key informants (KII) and household interviews were triangulated in an attempt to gain more insights about the parameters selected for the study. In this case, different techniques and criteria were used to select participants for each of the data collection approaches employed during the study.

#### **3.3.2 Description of participants**

Focus group discussion (FGDs), ten participants were purposively selected from the village register with the help of the village chairperson and Village Executive Officer (VEO). The FGD participants were stratified into different groups based on their gender (age and sex were the basic criteria for selection. Therefore, the FGDs were organized into six main groups namely youths male, youth female, elder male, elder female above 60 years, and women of reproductive age (pregnant or with children below 5 years) and

adult males (both age range from 26 – 45 years). The selection process was based on proportional to size sampling procedure in which participants were chosen from the existing tribes according to the number of members for each tribe in relation to the total population in the village. Existing tribes were Maasai, Zigua, Pare, Iraqw (Mbulu), Kinga, Nguu, Waarusha, Chagga and Kaguru. This study therefore presumed that tribal differences depict cultural ideologies that determine variations in the livelihood strategies existing in the area and dietary patterns (Table 1).

**Table 1: Distribution of participants by data collection method**

<b>Method</b>	<b>No. of Groups</b>	<b>No. of Respondents per Group</b>	<b>No. of Villages</b>	<b>District</b>	<b>Total estimated no. of Respondents</b>	<b>Actual no. of Respondents interviewed</b>
Focus group discussion*	6	10	6	2	<b>360</b>	<b>360</b>
Key informant interview*	8	1	6	2	<b>48</b>	<b>36</b>
Household survey**	1	10	6	2	<b>60</b>	<b>40</b>
<b>Total</b>	<b>15</b>	<b>21</b>	<b>18</b>	<b>2</b>	<b>468</b>	<b>436</b>

**Note \*\*:** The same number of respondent was interviewed for the first and second round of the food list household survey

**\*:** KII's and FGD's data were only conducted once

Participants for the Key Informant Interviews (KIIs) were purposively selected based on the kind of information that was needed for the study. The Key informants interviewed included government workers e.g. Livestock, agriculture and nutrition/health officers at district level, influential male and female persons, religious leaders based on main or dominating religions, Village Chairperson, Village Health Worker, Village Executive Officer (VEO), Community Development Officer, as well as the Ward or Village level Extension Officers for livestock, agriculture, health and community development (Table 1).

Respondents for the household surveys were selected from the list of the MoreMilkiT project recipients with the help of the village project leader and about ten female respondents were selected in each of the six villages summing up to 60 respondents (Table 1).

### **3.4 Pretesting Questionnaire**

Pretesting of the questionnaires and checklist was carried out in one village in Mvomero District with similar research criteria but which was not involved in the actual data collection. The procedure was useful in tools adjustment and clarity for the actual work. This was done prior to the actual data collection.

### **3.5 Data Collection**

Both quantitative and qualitative data were collected. Different data collection tools were used for each of the respective approaches as detailed below:

#### **3.5.1 Qualitative data**

A semi-structured in-depth interview with the aid of voice recorder and note summary was used. It consisted of several key questions that helped to define the areas that were explored, but also allowed the interviewer or interviewee to diverge in order to pursue an idea or response in more detail (Britten, 1999). Data collected through voice were transcribed to form transcripts (words records) that captured directly the discussion/dialogues in Focus group discussions, key informant interviews and household interviews. The information was used to answer objective (i) which aimed at examining the impacts of livelihood diversification on food choice among pastoralist. In this case the all the respondents were asked to mention the main and substitute livelihood systems from which they earn their income and those which are generally practiced in their communities. Respondents were also asked to mention the type of

livelihood system that are no longer practised and why. In addressing objective (ii) which aimed at assessing the contribution of social identities to food valuation and food choice among pastoral communities, questions were asked only in the focus group discussions. Participants were given food picture cards and told to group the foods as they perceived that fitted their best description. After grouping these foods, the interviewer asked them to list foods based on the categories such as healthy, unhealthy, wealthy and for the poor.

#### **3.5.1.1 Focus group discussion**

A checklist of questions (Appendix 3) was used to guide discussions aimed at getting deeper understanding and additional insight of topics such as typical diet patterns in the communities based on source and deviations (example by life-stage, culture, taboos and preferences), valuation and prioritization of foods (economic identification of “important”, “convenient”, “healthy”, “prestigious” and “non-prestigious” foods), social and well-being consequences of achieving or not achieving categories of consumption household roles (responsibilities and decision-making on production, sale, preparation, consumption of foods). Composition of the discussion includes group participants, moderator and note takers. The moderator and the note taker, with the help of village leader, organised an appropriate and conducive environment for discussion such as school classroom or village office. The moderator and note taker introduced themselves and the purpose of the discussion, then asked for the participants consent to participate in the discussion while being recorded by voice recorders. Grounds were set such that participants and the moderators were assured of confidentiality, respects among the participant’s views and equal/free chance of participation in the discussion. After setting the ground rules, the moderator asked questions to the participants and allowed the discussion to start while the note taker was observing the participants body gesture and

jotting down the key points. The recorded files were transferred to the computer for the compilation with other files before transcription and translation for the analysis.

### **3.5.1.2 Key informant interviews**

A semi-structured interview schedule was administered to knowledgeable participant (section 3.3.2) in the community at district/ward/village level. The aim was to collect information from a wide range of people based on food and nutrition, health, lifestyle, roles and responsibilities of the community members. Participants were selected based on their titles in the community and experience/knowledge with the community. Before the interview started the interviewer made self-introduction and explained to the participant the purpose of the interview, then sought permission to start the discussion and recording of the conversation by a voice recorder. Following the consent by the key informant the interviewer was started the recorder and asked questions guided by the interview checklist (Appendix 2). The recorded file was then transferred to the computer for transcription and translation for the analysis.

### **3.5.1.3 Household survey**

Information was collected from women (mothers) whose households were in the MoreMilkiT project by using a structured questionnaire. The appointment was setup between the interviewer and the respondent where the interview was conducted at the respondent's home. During the set date of the interview, the interviewer was introduced him/herself to the respondent and asked for the consent to interview the respondent and recording the data. After the respondent consent the interviewer set the ground for the discussion by switching on the recorder and started administering the questionnaire (Appendix 1). The interview took maximum one hour and at the end on the interview,

data were saved in the recorder. The recorded files were transferred to the computer for the compilation with other files before transcription and translation for the analysis.

### **3.5.2 Quantitative data**

#### **Data on food consumption**

Data on food consumption in pastoral community included type of food, frequency and groups of food consumed were collected twice at one point in-time during dry season and rain season using the cross-sectional research design from households using food list questionnaire. The food list had fourteen food groups where each food group had between 2 to 31 food items with four columns, the responses included were usually, often, rarely and never. The focus was on women at the household level as they usually responsible for food preparations. The first round of data collection started from February to March 2017 and the second round was in September to October 2017. The design was preferable since it is the recommended design for descriptive studies intending to analyse the association between and among variables to provide a snapshot of ideas, opinions and information necessary for the intended purposes (Sikira and Urassa, 2015).

### **3.6 Data Analysis**

#### **3.6.1 Qualitative data analysis**

Objective (i) and (ii) contribution of social identities food valuation and food choice data were analysed by MAXQDA version 12.3.1 software, voice records collected from focus group discussion, key informant and household interviews were transcribed verbatim and translated followed by formation of code book for result categorization and analysis. The code book contained all the key points obtained in the field based on the specific topic of concern with regard to the objectives. These key points assisted in analysing the data in the software as it categorizes the results based on the colors

selected. MAXQDA software analysed the data in-form of colored graphical tables for the interpretation.

### **3.6.2 Quantitative data analysis**

Objective number three of this study which aimed at “assessing the seasonal dietary patterns in pastoral communities” was coded and partly analysed by using the Statistical Package for Service Solution (SPSS) version 20 through which descriptive statistics such as frequency and percentages of foods consumed in the dry and wet seasons were computed under the cross tabulations function. The other part of analysis for this objective was performed in STATA version 11.2 where the binary logistic regression was run to determine whether there were any significant variations in the consumption patterns of different food varieties and by-products across the seasons of the year. In such case, “seasons of the year” was treated as an independent variable (and it was coded as 1=Dry season and 2=Wet season) whereas, “food consumption” was treated as the dependent variable. However, before the data were modeled into binary logistic regression, “food consumption” which was previously coded into four levels (1= usually consumed, 2=Often consumed, 3=rarely consumed and 4=never consumed) was recoded into two levels in order to meet one of the basic requirements of the binary logistic regression that requires the dependent variable to have binary responses. In that case, 1 and 2 were coded as “1” and renamed as “Consumed” while 3 and 4 were coded as “0” and renamed as “Not consumed”. Furthermore, imperative noting that, during analysis, some of the cases were automatically dropped or omitted from the model for different reasons including due to the problem of collinearity or because the independent variable predicts failure perfectly.

### **3.7 Ethical Consideration**

This study was initiated only after receiving ethical written approval from National Institute for Medical Research (NIMR), Emory University IRB, Sokoine University of

Agriculture and permission letter from the district authorities, Village Executive Officers (VEO) and/or village chairpersons. Details of the study were explained to the villagers who are members of the MoreMilkiT project, before commencement of data collection. The research project was awarded a reference approval code number NIMR/HQ/R.8a/Vol. IX/2387 from National Institute for Medical Research (Appendix 4).

## **CHAPTER FOUR**

### **4.0 RESULTS**

This chapter presents the major findings emanating from the study related to understanding drivers of diet change and food choice among pastoralist societies in Handeni and Mvomero districts, Tanzania. The results are therefore presented in three main sections: The first section on the impacts of livelihood diversification on food choice among pastoralists, the second section presents the contribution of social identities to food valuation and food choice, and the third section is on the seasonal dietary patterns of pastoralist, in the two districts.

#### **4.1 Demographic Characteristics of Respondents**

The findings on socio-demographic characteristics as presented in Table 2 reveal that majority of participants are Maasai with 45% followed by 23% of Zigua and 20% for Pare. However, Hehe, Muha, Arusha and Mbulu had less than 10% of participant involved in the study. The results further show that, the age group participated in greater number are adult with 38% followed by elders by 36%.

**Table 2: Demographic characteristics of the studied population**

Demographic Information	MVOMERO						HANDENI						Total
	Kambala		Mela		Manyinga		Masatu		Kibaya		Konje		%
	n	%	n	%	n	%	n	%	n	%	n	%	
<b>Ethnicity</b>													
Zigua	0	0.0	0	0.0	1	0.23	40	9.17	28	6.42	31	7.11	22.93
Maasai	60	13.8	70	16.06	2	0.46	0	0.0	2	0.46	60	13.76	44.54
Pare	0	0.0	0	0.0	35	8.03	20	4.59	23	5.27	10	2.29	20.18
Chagga	0	0.0	0	0.0	6	1.38	8	1.83	0	0.0	1	0.23	3.44
Mbulu	0	0.0	0	0.0	1	0.23	0	0.0	15	3.44	8	1.83	5.5
Hehe	2	0.46	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0.46
Muha	0	0.0	0	0.0	1	0.23	0	0.0	0	0.0	0	0.0	0.23
Arusha	0	0.0	0	0.0	0	0.0	6	1.38	4	0.92	2	0.46	2.26
<b>Total</b>	<b>62</b>	<b>14.26</b>	<b>70</b>	<b>16.06</b>	<b>46</b>	<b>10.56</b>	<b>74</b>	<b>16.97</b>	<b>72</b>	<b>16.51</b>	<b>112</b>	<b>25.68</b>	<b>100.0</b>
<b>Age categories</b>													
Youth ( 14-25)	20	4.59	20	4.59	20	4.59	20	4.59	20	4.59	20	4.59	27.54
Adults (35-45)	29	6.65	24	5.50	25	5.73	26	5.96	24	5.50	32	7.34	36.71
Elders (>60)	26	5.96	26	5.96	25	5.73	25	5.73	26	5.96	28	6.42	35.75
<b>Total</b>	<b>75</b>	<b>17.2</b>	<b>70</b>	<b>16.05</b>	<b>70</b>	<b>16.05</b>	<b>71</b>	<b>16.28</b>	<b>70</b>	<b>16.05</b>	<b>80</b>	<b>18.35</b>	<b>100.0</b>

## 4.2 Impacts of Livelihood Diversification on Food Choice among Pastoralists

### 4.2.1 Livelihood systems

The primary livelihood activities for most of the people in the study area were livestock keeping and crop cultivation (Table 3). However, people were also engaged in other livelihood systems such as small business, casual labour and salaried employments as part of their livelihood strategies. The extent to which different livelihood systems were practised varied from one village to the other in both Handeni and Mvomero districts. Nevertheless, results show a holistic picture that livestock keeping is one of the most practised livelihoods in all villages in the study areas as reported by 100% of the interviewed respondents from Kambala, Kibaya, Mela, Manyinga, Masatu and Konje villages.

**Table 3: Distribution of livelihood systems in the pastoral communities**

Livelihood Activity	Villages						Overall% (n=40)
	Kambala	Mela	Manyinga	Masatu	Kibaya	Konje	
	<b>Percentages (%)</b>						
Cultivation	86	67	100	100	100	100	92
Livestock keeping	100	100	100	100	100	100	100
Small business	0	33	33	40	50	80	39
Casual labourer	14	50	50	100	33	40	48
Salaried employment	0	0	0	20	17	10	8
Changing livelihoods	0	33	33	20	17	10	19

\*: Household interviews (2017)

During the focus group discussions in Kambala, one of the participants was quoted saying,

*“We do not have many businesses to do here, so most of us just depend on livestock keeping”* (A participant from adult men group, 2017).

Similar implications were also drawn during the discussions with participants in Konje, Manyinga, Masatu, Kibaya and Mela where most of the participants highlighted

livestock keeping as a major source of income to the majority of people in the communities. One FGD participant in Konje village said,

*“Livestock keeping is the main income source to most of us and we engage in this activity throughout the year, to us this is a sustainable project”* (A participant from elder men group, 2017).

Concurrently, some of the participants went a little further to explain the complexities they face in their struggle to provide for their families through livestock keeping. While responding to a question posed during a FGD in Konje one of the participants said,

*“Our cattles lack enough pasture and water especially during the dry season. When this happens we are compelled to sell them at low prices sometimes even as low as 30 000 Tanzanian shillings per a matured cow. At the same time, the sack of maize which is equivalent to 100 kilograms is sold at 150 000 TZS when there is critical food shortage. So in order to get one bag of maize, we have no choice but to sell almost five to six cows or fourteen goats ”* (A participant from adult men group, 2017).

In addition , one of the participants during a discussion with adult males in Kambala highlighted about the frequent fluctuation of livestock prices in the livestock auction markets; said,

*“We normally depend on the money we get by selling cattle in the regular livestock auctions, but because the prices vary a lot from one auction to the next sometimes a person may become hard up thus prompted to borrow food and other provisions from the nearby shops to feed the family. So due to low cattle prices even when you sell a cow, the money you get ends up in settling the debts that you have in the shops, so you go back to square one”*.

Crop cultivation was also reported as one of the widely practiced livelihood system by about 92% of all the respondents interviewed in the study area but the extent to which this livelihood system was practiced varied from one village to the other. Lower proportions in comparison to other villages were reported in Kambala and Mela where 86% and 67% of the respondents, respectively reported cultivation as another livelihood system from which they obtain their income. Such variations in the proportion of people who engage in crops cultivation in one village versus the other might be attributed to different factors ranging from environmental related factors to socio-cultural norms and belief.

During focus group discussions, it was also observed that apart from being used as one of the main mechanisms for ensuring that the household is always food secure, other people also depended on crops cultivation to get income for fulfilling other non-food expenses such as building houses, paying school fees and for making contributions to other family or community members. In one of the FGDs conducted in Masatu village, a respondent from women of reproductive age group said,

*“Agriculture is our main activity; we grow maize, rice, pigeon peas, okra, sweet potatoes, pumpkin leaves, eggplants, jackfruits, hares lettuce, mangoes and cassava which are sometimes sold for cash”.*

Another participant during a discussion in Kambala jumped in saying,

*“Despite the fact that there are those who do petty business, salaried jobs or employed themselves by riding motorbikes, farming is our main occupation, most of us depend on the rain seasons to farm so as to get food for the family”* (A participant from women of reproductive age group, 2017).

Furthermore, other livelihood systems such as casual labour and small business were also reported in varying proportions; where by 48% of the respondents were sometimes

engaged in casual labour and 39% have small businesses to supplement the incomes accrued from their main livelihoods. In most cases small business acts as a supplementary livelihood for most of the people in the villages visited. It normally helps to secure household's financial condition especially when weather conditions become unfavorable for agriculture or livestock keeping. Apparently, findings from the focus group discussions also applauded the fact that small business and casual labour are dependable livelihood systems in all the villages visited during the study. While contributing to some of the topics posed in a focus group discussion in Kambala, one respondent said,

*“Though we mostly rely on livestock husbandry for food and income, there are these petty businesses that normally women do such as trading sugar, soap and cooking food for selling during the auction days, others do sell edible oil and petroleum to get money for fulfilling other needs”* (A participant from adult men group, 2017).

Most of the women in the Maasai community were previously just housewives hence they were not used to these types of activities; but as the pressures of climate change and acculturation increases it is reported that nowadays it is common to see women on the auction days selling different products.

Moreover, further discussions with participants from other villages also revealed that not only do people in the study area depend on trading different products but there are also those who sell what they produce on their own farms or homestead. A FGD respondent from reproductive women group in Masatu village said,

*“Most of the men and women in this community engage in charcoal production and selling firewood. There are also those who grow green vegetables and sell on the streets to get money for their families”*.

Remarks of this nature were also vivid in other villages such as Kambala where one participant from the elder men group said,

*“In most cases people in this community rely on selling excess milk from their own cows but this year the situation has been different because it has not rained so the cattle have ran out of feeds and they are producing very little amount of milk thus our income has considerably gone down, if we face a bigger problem at this time we will have to sell a goat or cow. It has become very difficult to rely on livestock alone so nowadays we are also doing some small business but they are also so small to make us just rely on them as our main activities”.*

In Manyinga, a respondent from elder women focus group discussion also asserted that,

*“Apart from crop cultivation and livestock keeping, other people are also involved in charcoal making, selling of concrete and pots”.*

Most of the participants reported that with regards to business items such as charcoal, concrete and pots selling, there are those people who trade these products and sell them in the auctions and/or weekly markets for profit. However, there are those who make these products and sell them to get money for purchasing food and other small purchases (soap and body lotions) for the family. So basically, sometimes people use small business as a resiliency strategy while others also regard it as an alternative livelihood system.

Similarly, during the focus group discussions conducted in Masatu the participants observed that sometimes people tend to accrue their incomes by engaging in paid labour activities such as working on other people's farms where they normally do farm activities such as clearing farm lands, tilling the soil, weeding and harvesting or help

during other postharvest processes. In other occasions people are employed to tend other people's livestock and get paid some money. In Manyinga village where there is a large sugarcane plantation, people have also been offering their labour and get paid. As one respondent from Masatu acknowledges,

*“Casual labour has been helpful to some of the families especially during tough/hard times when these families run out of options to support their families”* (A participant from adult men group, 2017).

It was further reported that, 19% of the participants have the tendency of changing from one type of livelihood to another from time to time as the strategy used in their community to support their living (Table 3). Only a small proportion of the respondents (8%) mentioned formal salaried employment as one of the dependable livelihood systems in the study area.

Findings from the focus group discussions also complement what has been observed from the households' interviews. In the FGDs it was observed that, the involvement of some people in activities such as self-employment, waged and salaried employment including teachers, doctors, and other civil servants was also an important livelihood system for some people in the study area. The focus group results further indicated that the practice of these other livelihood activities is high in Manyinga, Masatu and Konje but low in Mela, Kibaya and Kambala.

Further findings from the focus group discussions illustrated that in all the villages visited in the study area, some of the people accrued their incomes from multiple livelihood activities while others tended to substitute one livelihood activity with the other depending on the weather conditions, changes in productivity, changes in market

conditions or/and other socio-cultural dynamics which therefore permits or obscure some of the livelihood activities to flourish. In one of the FGDs conducted in Kambala, one respondent asserted that,

*“It was not common to find people who engage in business or other activities not related to livestock keeping in the pastoralist communities but due to the changes in the government policies most of the pastoralists have changed their ways of living, we were not used to doing petty business in the past but we are trying to learn now”*  
(A participant from elder men group, 2017).

Another participant from the same group also emphasised,

*“Nowadays, most of the Maasai people are engaging in agriculture, this happens because the weather is no longer conducive for livestock keeping only. We could only live on meat and milk alone without resorting to any other economic activities but that is not the case now, we are compelled to farm and do other activities in order to afford the daily meals because we also need hard food stuff”.*

Similarly, another respondent during the discussions in Masatu village said,

*“When we were still young, we used to pick mangoes free of charge from anybody's mango tree in the neighborhood, but nowadays mangoes are sold at the price of two hundred shillings at the local market. That is to say, mangoes have nowadays become a valuable commodity no longer available for free. The same change has also occurred on vegetables, which were previously obtained freely. For this reason everybody needs to work to get money for purchasing family's necessities”* (A participant from adult men group, 2017).

A focus group discussion 's participant in Konje added that,

*“due to food shortage, women are nowadays involved in charcoal making, something which was not there in the past”* (A participant from women of reproductive age group, 2017).

Generally, shifting from one livelihood system to another was reportedly as something that people would do either permanently or temporarily for personal reasons or due to other external shocks and threats.

#### **4.2.2 Gender role and livelihood systems**

Gender roles are cultural and personal. They determine how males and females should think, speak, dress, act and interact within the context of the society. Therefore, gender schemas are deeply embedded cognitive frameworks regarding what defines masculine and feminine roles in the pastoral communities. In this study, it was generally noted that, different gender groups engage in different roles or sometimes sharing some roles depending on their livelihoods and social set up for a particular activity.

In households where livestock keeping was practiced, it was reported during the FGDs that, activities such as cattle herding (calves and goat) and milking were done mostly by women and female youth. Activities such as cattle selling, cattle raring and watering were normally under the men’s domain with the help of youth males. One of the respondents in the adult women group said,

*“When the cattle have gone to Ronjo (a place where pasture and water normally found) we usually remain with the calves and goats which are usually not grazed with the other herd. So, in the morning we allow the herd that is left at home to graze around in the nearby places and we bring them back home in the afternoon. Sometimes however, we are obliged to practice stall feeding for those calves and lactating cows left at home in cases where feeds are scarce. When the cattle are back*

*from 'Ronjo' in rain season women are also the ones who make sure that all the animals get safely to the shed. In that case, a woman has to inspect the herd and whenever she detects any problem she will have to report it to the husband to find a solution for the problem”.*

Similarly, another participant from the adult men group said,

*“The task of raiding cattle when shifting to transhumance during the dry season is done by men. The task of rearing the cattle in the grazing field is mostly the youth male domain. Approximately, seventy percent of young boys are involved in this activity compared to adult men, animal selling is however the domain of adult men. They are the ones who make final decisions even when the wife is involved during the process. The men are also the ones who take the cattle to the market and make all the bargaining for the price with the buyer”.*

Gender roles in the households that are engaged in crops cultivation highly depends on the type of activities conducted. During the period of farm preparations, activities such as tilling the land are performed by both men and women. Planting and weeding are done by women in most cases. The role of harvesting is also carried out by either men or women or both depending on the type of the crop. Men participate mostly in harvesting crops that are meant for commercial purposes or in some instances in maize harvesting but there are crops which are normally treated as feminine crops including beans, cowpeas and green gram. These crops are placed on women's domain because they are normally grown in small quantities than maize.

From the discussions with the study participants, it was eminent that there were some dynamics towards gender roles which are suspected to be influenced by education,

changes in economic systems and inter-ethnicity. Such observation was vivid through the words of one of the respondents during KII's who said,

*“Women had a lot of duties during the past few years in our community, including looking for vegetables and other relish. They also had to look for food and taking maize to milling machines. Most of the men were reluctant to do these types of chores with a belief that they are feminine roles. But nowadays most men have been educated and have thus become responsible for their families. It is a common thing for instance for a man to buy meat or vegetables for the family and sometimes help in undertaking some of the domestic roles”* (quotation from an Influential person “a male”, 2017).

In additionally, another participant from the focus group discussion said in Mela village,

*“Most men did not engage themselves in any income generating activities in the past, they mostly relied on the crops grown by women to feed the family. Sometimes women had to look for casual labour and earn some money to sustain the family. Nowadays men have changed a lot, they have started working so as to produce something for the family and this is due to the changes in economic conditions where one has to work really hard to earn some income. If we don't work hard, hunger will kill us”* (A participant from adult men group, 2017).

These dynamics have also encouraged the practices of alternative livelihoods including small businesses such as petty/trading of agro or non-agro products, casual labour and salaried/waged employments. As it was noted earlier, due to complexities that are inherent in the struggle for economic wellbeing people tend to find substitute activities to sustain their needs. For example, in the past women in pastoral societies were not

allowed to engage in some of the productive activities. But nowadays things have changed; women are involved in charcoal making, fruits/food vending, cloth business and farming with one goal of earning income to support their families. At the same time, men also conduct the same activities. One of the participants from the elder men group from Konje village clarified,

*“ .....Women nowadays are taking milk to the market and on their way back home they purchase vegetables and prepare food for the children. Other women own small shops such as kiosk where they buy different products from the market and resell them to the village members. These kinds of activities were never allowed in the past”.*

#### **4.2.3 The influence of livelihood systems on eating habits**

Eating habits in this study, focused on food distribution, food frequency, number of meals and the type of food consumed in the households of the pastoralists. In particular, the linkages between eating habits and the livelihood systems can be elucidated in this particular case through different arguments put forth by the pastoralists contacted during the study. It was generally observed that, different livelihood strategies that the pastoralists use to put food on the table have varying results and considerable impacts on the eating habits of the referred households. Livelihood systems in one way or the other tend to increase the availability and accessibility of food if the underlying factors such as government policies, socio-economic and climatic conditions remain favorable. This eventually influences the change in the distribution of food among individuals in terms of proportions, the number of meals, the type and frequency of food consumed within the household.

One of the participants from the adult men group, asserted that,

*“We farmers become very relaxed during the harvesting period because we do not have to struggle too much to bring food on the table because food is highly available during this time”.*

Similarly, another participant from the adult women group claimed that,

*“During rainy season it’s the period when our families especially children become very healthy because of high availability of milk”.*

So basically, for those households whose livelihood activities are related to crops cultivation and livestock keeping, they tend to have abundant food supply during the periods when production is high. However, when production levels go down for whatsoever reasons, the costs for obtaining food tend to increase and hence food availability in the household becomes a problem especially for the poor resourced households.

Coping mechanisms include resorting to alternative livelihood systems such as casual labour and small business to cater for the household’s food requirements. It was further observed that, while some of the people in the pastoral communities use the alternative livelihood systems as a means to basic food requirements mainly during the hard times; there are those who use alternative livelihoods as a means to enrich their dietary intake on a regular basis. For instance, one of the participants from the adult men group observed that,

*“We usually consider casual labour as a supplementary livelihood system from which we get money to provide for the family especially during the difficult periods when our main livelihoods have low productivity. We really struggle during such periods so the little we get is only used to obtain food for the family. Doing casual*

*labour is a very tough job with a low pay that normally varies. You may for instance get 10 000 TZS today but tomorrow become even less. This also affects the way we eat because if you get less cash you also end up buying less food. For example, as a bread earner of the family, I may bring rice and meat for the children in the days that I have sufficient amount of money but for the other days when I don't have money I will only afford a kilogram of maize flour, where the mother will use to prepare porridge for the children”.*

### **4.3 Contribution of Social Identities to Food Valuation and Food Choice**

#### **4.3.1 Food valuation**

Food plays an important role in intercultural encounters as food choices establish boundaries and borders across societies. Food can identify individuals by gender, age group, tribe, income status and as a nation. The value of food in society is often greater than its contributions to income, nutrition or health, but in some areas food has multiple additional values such as inherent social and cultural appreciation, which may be more important motivators of diet choice than health and nutrition (Weaver *et al.*, 2015).

##### **4.3.1.1 Identification of healthy and unhealthy foods by pastoral communities**

The food we eat gives our bodies the nutrients to function properly when prepared and handled safely whereas the excess intake or less intake of food gives the body wrong instructions hence causes over-consumption or under-nutrition (DGAC, 2015). In most cases, healthy foods are natural foods without artificial ingredients which people buy because they consider them to be good for them. Normally, such foods are produced and marketed to provide human health effects beyond a normal healthy diet required for human nutrition.

**a) Healthy foods in the context of the pastoral communities**

As illustrated in Table 4, the study participants from the group of female's youth identified foods by categorizing them according to the perceived food groups, nutritional meals and food texture. Similar experiences were also observed from the other groups where elderly men and adult men identified food by categorizing into nutritional meals. Elder women, adult women (women of reproductive age groups) and youth males identified healthy foods randomly without aligning them into any specific categories.

**Table 4: Gendered identification of healthy foods in the pastoral communities**

<b>Gender Group</b>	<b>Healthy Foods</b>	<b>Food Group</b>	<b>Example</b>	<b>Reason</b>
<b>Youth Male</b>	Maize, milk, animal fats, cow blood, cow liver, okra, carrots, amaranth, groundnuts, pumpkin leaves, spinach, bananas, tomatoes, cassava, eggs and Fish	N/A	N/A	-Not aware
<b>Youth Female</b>	Maize, cassava, sorghum, yams, bananas, soursop, pawpaw, oranges, meat, sunflower oil, rice, fresh milk, fish, eggs, groundnuts, green vegetables and millet	Vegetables  Texture  Nutritional Meals	-amaranth leaves, cabbage, fried/fresh fish, pumpkin and sweet potato leaves and spinach <b>Slippery vegetables</b> -okra, amaranth, african eggplant, hare's lettuce, jute leaves and sweet potatoes leaves <b>Wheat foods</b> -bun, biscuits, chapatti, bread, rice bun, pasta, chips and crisp <b>Carbohydrates foods</b> - maize, cassava, sorghum and yams <b>Vitamin foods</b> -fruits and green vegetables	-Learned at schools
<b>Adult Men</b>	Cow blood, animal fats, meats, green vegetables, potatoes, cassava, fruits such as oranges, avocado, eggs, natural fresh juice and fish	Nutritional Meals	<b>Carbohydrates foods</b> - sorghum , rice, millet, maize, cassava meal, round potatoes, orange, yellow and white sweet potatoes, <b>Vitamin foods</b> -bananas, avocados, oranges, amaranth, spinach, kale, cowpea and pumpkin leaves, hare's lettuce, carrots and cabbage <b>Protein foods</b> -fresh milk and fermented milk, meat, ghee, liver, chicken meat, eggs, beans <b>Minerals</b> -fish, sardines, milk	-Learned from the community healthy seminars - Heard from other people from different ethnicity
<b>Adult Women</b>	Sweet potatoes, unhulled maize, pawpaw, avocado, eggs, green vegetables, meat, milk, sardines, fish and tomatoes	N/A	N/A	-Not aware
<b>Elder Men</b>	Fish, meat, beans, eggs, groundnuts, milk, buttered milk, , fish, unhulled maize, green vegetables, bananas, carrots, millets and fruits	Nutritional Meals	<b>Vitamin</b> -milk contains calcium, carrot contains vitamin A	-Traditional knowledge
<b>Elder Women</b>	Cow meat, ripe bananas, fish, beans, sweat potatoes, fruits such as oranges, mangoes , green vegetables and unhulled maize	N/A	N/A	-Not aware

Note: N/A – Not Applicable

The foods presented in this sub-section are regarded as the most important foods by the study participants whereas one of the participants from the adult men group while stressing on the importance of these foods said,

*“....Some of these foods is very important that they are used to heal infections and diseases amongst the people. For example, a malaria patient with water shortage in the body is normally advised to eat oranges whereas a poor sighted person is advised to eat amaranth so as to improve sight”*. In the same essence, a participant from the adult women group asserted that, *“....we also drinks milk because it contains calcium which makes the body bones strong”*.

Nevertheless, some of the participants mentioned certain foods based on their perceived functions within the body, including the consumption of fruits such as oranges and watermelon which were associated with increasing quantity of water in the body, vegetables such as amaranth, jute mallow, spinach, kale, sweet potato leaves and beans are associated with boosting blood volume and body protection. Furthermore, foods such as, beef, fish, milk, eggs, cow blood, sardines, prawns, fried and fresh fish, chicken, goat, intestines meat, and *soup* are among the foods associated with building and strengthening of bones. Other participants added by mentioning fruits such as mangoes, oranges, watermelon, pineapples, passion fruits, ripe bananas, sour-sop, pawpaw, avocado and guava as important fruits for protecting and strengthening the body, increase blood levels and preserving memories.

#### **b) Unhealthy foods in the context of the pastoralists communities**

Beverages such as soda, black tea, alcohol, processed cooking oils and animal fats were considered to be unhealthy (Table 5). The main reason given by the participants, was that some of these foods contain chemicals which tend to cause cancer and other cardiac

diseases as emphasised by the participants from the adult women/men and youth female groups that,

*“Most of the people say that, soda is made with a lot of chemicals and that is not good for the body, also drinks such as yoghurt are also not healthy because yoghurt is just fermented overnight. Also, other drinks such as black tea do not add any healthy value to the body”.*

Other participants from the same groups also contended that all the foods which are prepared by adding industrial cooking oil have side effects in the body. While contributing to one of the questions posed during the discussion with the adult men, one of the participants said, *“...ordinary cooking oil is not good for health as it can cause high blood pressure”.*

**Table 5: Gendered identification of unhealthy foods in the pastoral communities**

<b>Gender Groups</b>	<b>Unhealthy Foods</b>	<b>Reason</b>
Youth Male	Soda, cooking oils, alcohol beverages	-Contains chemicals
Youth Female	Processed juice, animal fats, cooking oils example korie oil, fried potatoes (chips) and black tea	-Contain chemicals -Increases the risk of cardiovascular diseases such as diabetes and high blood pressure
Adult men	Soda, cooking oil and black tea	-Contain chemicals
Adult women	Alcohol, animal fat, cooking oil and black tea	-Increases diseases such as heart disease
Elder men	Animal fat, buttered milk, red meat, alcohol beverages, soda and cooking oil.	-Increase weight - Contain chemicals as they are made from the industries
Elder women	Black tea and cooking oil	-Not aware

The consumption of certain foods is usually acquainted to the diet consumed by certain ethnic groups. For example, Maasai people described their diet based on the age groups with the knowledge that wrong consumption may cause a certain health problem to the individual. Such restrictions that are accustomed towards the consumption of certain

foods are mostly associated with the existing cultural taboos and beliefs about foods in a referred community. One of the participants from the elder men group in Mela village observed that,

*“...young women who are on the reproductive age are not advised to eat cow's intestines because when they eat that the infant's umbilical cord will have some problems or it can wrap itself around the neck of the fetus which can be dangerous to the life of the fetus”.*

#### **4.3.1.2 Foods identified by their nutritional value**

Nutritional value refers to an indication of the contribution of a food to the nutrient content of the diet. This value depends on the quantity of a food which is digested and absorbed and the amounts of the essential nutrients such as protein, fat, carbohydrate, minerals and vitamins which it contains. The nutrient value of food can be affected by the soil and other growing conditions, handling and storage, as well as processing (EFSA, 2017).

Pastoralists from both districts were able to identify foods based on their nutrient content. However, there were some slight misidentifications and specifications of actual amounts of nutrients content present in the specified foods. Majority of the respondents from all the groups, identified/ grouped foods by their nutritional content as mentioned in the Table 6.

**Table 6: Categorization of foods based on nutrient present**

<b>Nutrient</b>	<b>Type of food</b>
Carbohydrates	Irish potatoes, sweet potatoes, <i>pilau</i> , bananas, maize porridge, cassava stiff porridge, rice, maize stiff porridge, sorghum stiff porridge, plantain, white sweet potatoes, yellow sweet potatoes, snacks, sugar canes, baobab nuts, boiled maize, rice buns, pasta, fermented milk, chips and crips
Vitamin	Papaya, ripe bananas, sour-sop, avocado, jackfruit, pineapple, watermelon, tamarind, mangoes, oranges, passion fruits, baobab nuts, avocado, jackfruits, oranges, chutney, sugarcanes, amaranth leaves, african eggplant, hares lettuce, sweet potatoes leaves, pumpkin leaves, kale, cabbage, jute leaves, okra, sweet peppers and carrots
Protein	Cow intestines and stomach, sardines, prawn, eggs, cow blood, meat, goat meat, chicken, roasted and fried fish, tea with milk and black tea, pigeon peas, beans, cowpeas, groundnuts and green grams

In the process of identifying food groups some of the participants from these groups had different opinions towards nutrients present in foods. For example, some respondents from the elder women and youth male groups mentioned vegetable salads, tomatoes, spinach, pumpkin leaves, green pepper, amaranth leaves, sweet potato leaves, jute mallow, okra, hares lettuce, cabbage, coconut, carrots with the consideration that they are rich in protein. Other participants were able to mention foods which are rich in minerals and vitamins by identifying food such as *milk and carrot* are specifically containing calcium and vitamin A respectively.

#### **4.3.1.3 Foods identified based on their economic value**

##### **Food availability and accessibility**

Food availability is when all people have sufficient quantities of food available on a consistent basis. It is determined by food production and food trade (Burchi and De

Muro, 2016). Food accessibility refers to the access by individuals to adequate resources for acquiring appropriate foods for a nutritious diet. It addresses whether the households or individuals have enough resources to acquire appropriate quantity of quality foods, thus, it encompasses their income, expenditure and buying capacity (Swaminathan and Bhavani, 2013).

Maize was mentioned by most of the participants in both districts as the staple food crop in the area. Majority of them during the discussions said “...*maize is the main crop that people cultivate here so it is the main food consumed in this area*”. Although, some of the participants mentioned that cowpeas and beans are also produced in their areas but they are seasonal and are produced in less quantities.

Milk consumption was also reported in both districts but its availability is normally high during heavy rain seasons (March to June) when there is high amount of pasture but declines during the dry season when fodder becomes scarce especially in October. One of the participants from adult men group asserted that, “*Stiff porridge, rice, meat and milk are available in our community and because they have enough nutrients people tend to consume these foods a lot*”.

#### **4.2.1.4 Foods identification based on sociological elements**

##### **i) Cultural effects**

Culture consists of the beliefs, behaviours, objects, and other characteristics common to the members of a particular group or society (Torelli and Rodas, 2017). In this study culture was one of the factors that determines the value of food because it influences food interpretation.

Findings show that nutrition information can be incongruent with the cultural norms of food enjoyment distinctively associated with tribe identities. During the discussions with

the stratified groups (age and sex) in both Handeni and Mvomero districts, the tribes identified were Zigua, Iraqw (Mbulu), Maasai, Pare, Chagga, Kaguru, Ngu, Kinga, Meru, Sukuma, Nyamwezi, Hehe and Waarusha. These tribes have different social and cultural norms and practices based on their beliefs, which influence certain behaviours towards food valuation. Some of the participants asserted that there are some foods such as beans and sardines which are not eaten by certain age groups or people with certain conditions. In particular, one of the participants in the elder women group (Iraqw (Mbulu) ethnicity) insisted that,

*“...beans and sardines are not eaten by breastfeeding women, because sardines have small bones and beans produce gas in the stomach, this can be dangerous to a breastfeeding mother”.*

However another participant from adult men group in Zigua ethnicity went an extra mile to stress that food like cow’s blood are only consumed by the Maasai people. He was quoted saying,

*“...Whereas cow’s blood is not eaten or drunk in other tribes but rather regarded as waste but in Maasai ethnicity cow’s blood is culturally consumed and regarded as very important food which increases blood level in the body”.*

In the same essence, other animal products like milk are not allowed to be consumed by some groups of people such as pregnant women in the Maasai society until she delivers, milk is only encouraged to women after delivery as it is considered to be nutritious for both the mother and the child. Also some foods such as meat and milk are consumed and regarded as important foods in special occasions such as traditional ceremonies (men circumcision) in the Maasai tribe. One of the participants from the elder men group of the Maasai ethnicity said,

*“To us milk and meat are the main foods that we eat in the wilderness and are normally mixed with traditional medicine for strengthening the body”.*

## ii) Social status and the role of foods

Social status refers to the relative rank or hierarchy based upon honor or prestige that an individual holds includes attendant rights, duties, and lifestyle (Sedikide and Guinote, 2018). It can either be status of an individual or status of the food.

Findings presented in Table 7 show that, all the participants valued food based on the economic status towards the type of foods, whereas foods group were grouped by participants based on the perceived differences between the high class (rich) and low class (poor) people.

**Table 7: Categorization of foods based on social-economic status**

<b>Gender Groups</b>	<b>Wealthy</b>	<b>Poor</b>
Youth Male	Rice, <i>pilau</i> , chips, snacks, meat, chicken, coffee, soda, birian and tea	Unhulled maize, african eggplants, jute mallow, hare's lettuce, okra, sardines, cassava flour, mushroom and sorghum flour
Youth Female	Goat and cow meat, rice, spaghetti, <i>pilau</i> , chapatti, chips, milk, fruits (soursop, avocado), coconut, beer and soda	Maize porridge, stiff porridge with beans or tomato and onion stew, local cereal beverage ( <i>togwa</i> ), jute mallow, groundnuts and hare's lettuce
Adult Men	Cow meat, milk, chicken, chips, rice, bananas, chapattis, pasta, crips, biscuit and birian	Sardines, beans, stiff porridge, black tea, cassava, sorghum, jute mallow, hare's lettuce and local /wild vegetables
Adult Women	Bananas, rice, cow meat, milk products example ghee, chips, pasta, <i>pilau</i> , goat meat, vegetables example spinach, kale and cabbage	Cassava flour, black tea, jute mallow, stewed maize flour with onion and tomatoes ( <i>kididio</i> ), hare's lettuce, beans and small fried fish
Elder Men	Rice, <i>pilau</i> , cow meat, chips, chapatti, birian, pork, beer, soda, bananas, chicken and fruit example water melon	Cassava porridge, okra, jute mallow, maize mixed with beans and wild vegetables
Elder Women	Cow meat, pasta, chips, cooked green bananas cooked, avocados, goat meat, <i>pilau</i> , eggs, chicken, chapatti, rice, milk tea and milk products example ghee	Sardines, beans, small fried fish, cassava porridge, okra, black tea, hare's lettuce, jute mallow, sorghum flour, boiled maize and mangoes

Note: Wealthy – High class or rich people  
 Poor – Low class people

Animal products such as meat, milk and ghee, rice, pancakes and soda were mostly regarded as foods for the high-class people thus some of the low class people rarely consumed it. Green leafy vegetables especially jute mallow leaves, hare's lettuce and other local/wild green vegetables were considered as foods for the low class people although most of the people had positive thought towards them. One of the participants during the FGDs with the adult women group said,

*“In our community, there are some people who think that eating vegetables as part of diet is a sign of poverty, though most vegetables have very important nutrients necessary for our bodies. For example admitting to someone that you are using cassava meal you become afraid that he will see you as a very low class person. Similarly, for those who eats maize meal, normally unprocessed/unrefined maize meal "dona" is sold at lower prices than the refined maize flour hence in most cases a person who consumes “dona” is more likely to be rated as a low class person than the one who consumes refined maize flour”.*

Moreover other foods such as sardines, black tea, cassava, sorghum and maize based foods are also valued as foods for low class (poor) people with the reason that their easily available and accessible and highly consumed by low class (poor) people more than high class (rich) people as said by one participant from the youth female group.

Furthermore, other factors such as the number of meals consumed, frequency of food consumption and food preparation were also used to categorize households based on economic status where some of participants from youth male group quoted saying,

*“The consumption of monotonous food example maize porridge here shows that an individual is poor”.* Another participant also added that, *“people who do not eat different varieties of foods are also considered poor in our communities”.*

The method of food preparation associate with values of food in relation to individual status, especially when people perceived that the use of certain spices, coconut and cooking oil tend to justify the economic status of an individual. A participant from the adult women group added by saying,

*“Normally low class (poor) people are eating foods which are only boiled without adding any cooking oil or prepared milk mixed with maize flour without spices and/or condiments added such as tomatoes, onions, cardamom while high class (rich) people are eating frequently fried foods such as chips and preparing their foods with coconuts and different spices”.*

Foods are also valued due to their perceived role, based on certain group status including pregnant and lactating women and sick individuals with the expectation that these foods improves their conditions. One of the participants from elder women group for instance said,

*“As for the Pare the flour that is prepared from a combination of cassava and bananas is mainly used for pregnant mothers or those who have delivered so as to build that woman's health and bring her back to normal, but after that they do not use it again”.* Another participant from adult women group also said, *“lactating women in Iraqw (Mbulu) tribe are given animal fat and roasted/fried/boiled meat for about three month by their husband”.*

These foods are considered as high energy and nutritional foods, which are assumed to support the recovery of energy and blood lost during pregnancy and delivery.

### **iii) Attitude and beliefs**

Attitude refers to a lasting group of feelings, beliefs and behaviour tendencies directed towards specific foods (Perloff, 2016). It usually describes what we think is the proper way of doing something and can change easily and frequently. Beliefs are ideas based

on our previous experiences and convictions and may not necessarily be based on logic or fact, nevertheless beliefs often serve as a frame of reference through which we interpret our world (Minton and Khale, 2014; Primmer, 2018).

In this study there were variations across the groups even though some groups had related attitudes and beliefs towards similar foods consumed. Foods such as stiff porridge that most of the people prefer is believed to be healthier and to provide more energy than rice as one of the participants from adult men group said,

*“...stiff porridge gives more energy compared to rice. For instance when you take rice for supper you will be hungry when you wake up contrary to when you take stiff porridge. So I can say stiff porridge builds the body”.*

Furthermore, some of the respondents believed that, the use of cooking oil and dehulled maize is not healthy so they prefer foods without cooking oil such as un-dehulled maize meal or jute mallow. It was alerted by one participant from adult women group that,

*“...foods such as maize meal or leaf jute mallow raw, are very good for diet that you don't have to use oil which in most cases has some negative effects to human health. Nonetheless, we are advised that we should not use maize flour that has been processed from cracked maize with the husks removed, we should use whole maize for nutrition purposes”.*

In addition, another participant from the same group provided some scientific aspects towards the consumption of certain foods by saying,

*“Here we have porridge which is mixed with ghee, it is basically nutritious as compared to black tea as we are advised not to take black tea but to use porridge or a certain type of plants known as lemon grass. We also have drinks such as juice,*

*where we are normally advised to use natural juice because the artificial ones have many chemicals”.*

In the same accord another participant from the youth female group said,

*“When it comes to biscuits we are also advised not to use it extensively as they are bad for teeth. We are also advised that, when preparing foods like chips we should use cooking oils which are cholesterol free such as sunflower oil because other un-recommended oils may cause heart problems”.*

Apparently, some of the people in these communities believe that the monotonous consumption of particular foods have negative impact in the body hence encourage themselves to diversify food consumption for good health. This was clearly denoted in the words of one of the participants in the adult men’s group, who said,

*“...people say if you want to be healthy you must change food and not to eat the same food for a long time. You have to change and mix with fruits and vegetables so as to have variety of nutrients”.*

Other participants in elder women group also supported the belief that consumption of cooking oil may cause heart diseases and agreed that the consumption of ghee reduces the effects. Through the words of one of the participants, it was stressed that,

*“...when you use ghee or cow’s oil for cooking vegetables you will not experience any health effects. For example if you eat cheese, cow’s oil or honey with meat, you can walk or run distances without showing any fatigue, side effects or tiredness. But it is vice versa if you use other cooking oils”.*

#### **4.4 Assessment of Dietary Patterns in Pastoral Communities**

##### **Food consumption patterns between the districts**

Both Mvomero and Handeni districts have access to different food groups although the consumption of these foods differs according to season. Fourteen food groups were

assessed in both districts. All foods which their percentage consumption distribution exceed 50% were categorized as highly consumed food and less than 50% were categorized as low consumed foods.

**i) Cereals**

Consumption of cereal and cereal by-products was generally high in the study area. Some of the cereals whose consumption were reported by a larger proportion of the studied population include, dry de-hulled and locally processed maize flour which was consumed by 86% of the people in dry season and 81% in the wet season, white rice was consumed by 81% in dry and 84% in the wet, dry un-hulled and locally processed maize flour was consumed by 77% in dry and 63% in the wet season whereas chapatti was consumed by 72% in the dry and 65% of the people in wet season (Table 8). The subsequent regression analysis revealed that, some of the cereals such as “white bread loaf, whole wheat bread loaf, wheat flour bread, dry de-hulled locally processed maize flour, maize cracked, white maize flour refined, and sorghum flour” were more likely to be consumed in one of the seasons during the year, with some being consumed in the dry and others in the wet season with the P-values of 0.001, 0.023, 0.014, 0.012, 0.001, 0.034 and 0.018 respectively. Only “Green white maize, dry maize and white rice” had high odds to be consumed in both seasons with the odds ratio of 5.47, 4.27, and 1.24 respectively.

**Table 8: Percentage distribution for the consumption of cereals in the dry and wet season (n=20)**

Cereals	Mvomero								Handeni				Overall	Odds Ratio	P-value	Confidence Interval (CI=95%)		
	Kambala		Mela		Consumed Percentages (%)				Kibaya		Konje							
	Dry	Wet	Dry	Wet	Manyinga	Masatu	Dry	Wet	Dry	Wet	Dry	Wet						
Bread (Loaf_ white)	43	0	29	0	29	0	13	0	19	0	69	0	30	26	.08	0.001 <sup>a</sup>	.02	.35
Bread (Loaf_ whole wheat)	0	0	0	100	100	0	9	0	9	0	82	0	15	2	.09	0.023 <sup>a</sup>	.01	.71
Bread, wheat flour	46	0	15	0	39	0	26	0	26	0	48	0	46	3	.41	0.014 <sup>a</sup>	.20	.84
Brown rice	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-
Bulrush Millet	50	0	25	0	25	0	0	0	0	0	100	0	12	0	-	-	-	-
Chapatti	48	38	20	19	32	43	29	21	23	37	48	42	72	65	.71	0.358 <sup>b</sup>	.35	1.46
Finger Millet	60	30	10	10	30	60	15	33	25	46	60	21	39	31	.71	0.336 <sup>b</sup>	.35	1.43
Lentils flour	0	0	0	0	0	100	0	0	0	0	0	0	0	2	-	-	-	-
Maize flour ( dry de-hulled_ Locally processed )	52	31	29	35	19	35	25	20	31	40	44	40	86	81	.34	0.012 <sup>a</sup>	.15	.79
Maize flour ( dry un-hulled_ Locally processed)	56	42	22	47	22	11	18	38	30	38	52	25	77	63	-	-	-	-
Maize ( green_ yellow)	50	33	25	0	25	67	0	20	18	40	82	40	14	13	.90	0.837 <sup>b</sup>	.34	2.40
Maize (cracked)	56	42	33	50	11	8	14	27	32	36	55	36	51	37	.30	0.001 <sup>a</sup>	.15	.63
Maize (green_ white)	55	32	36	37	9	32	13	30	25	35	63	35	35	69	5.47	0.000 <sup>a</sup>	2.21	13.53
Maize (dried)	43	35	24	31	33	35	24	24	24	41	52	35	59	8	4.27	0.000 <sup>a</sup>	2.09	8.73
Maize (White flour_ refined)	36	50	36	50	27	0	12	0	29	0	59	100	40	19	.43	0.034 <sup>a</sup>	.20	.94
Pasta (wheat_ dry)	40	0	20	40	40	60	21	31	26	62	53	8	37	29	.69	0.312 <sup>b</sup>	.34	1.41
Rice (white)	59	33	21	30	21	37	27	0	29	0	44	0	81	84	1.24	0.634 <sup>b</sup>	.51	2.99
Sorghum flour	50	0	50	33	0	67	0	20	18	20	82	60	17	7	.08	0.018 <sup>a</sup>	.01	.65
Wheat flour ( all purpose)	62	43	15	14	23	43	22	0	17	67	61	33	46	16	.22	0.000 <sup>a</sup>	.34	2.40
Wheat grain (whole)	0	33	0	33	0	33	0	33	0	33	0	33	0	7	-	-	-	-

Note: <sup>a</sup> Represents a statistically significant difference between cases

<sup>b</sup> Represents a non-significant difference between cases

**ii) Roots and Tubers**

Generally, highly consumed roots and tubers in the study area during the dry and wet season were, raw cassava tuber consumed by 77% of the population in both seasons, round potato was consumed by 73% in dry and 55% in wet season and white sweet potato which was consumed by 68% of the people in dry and 65% in wet season (Table 9). Further analysis of the binary logistic regression (logit) denotes a statistically significant difference in the consumption of roots and tubers between the dry and wet season whereas, some of the foods including “fried potato strips and orange sweet potato” were more likely to be consumed in the wet season ( $P=0.000$ , and  $0.002$  respectively). Round potato ( $P=0.000$ ), yams ( $P=0.004$ ), and orange sweet potato ( $P=0.002$ ), were more likely to be consumed in the dry season. However, the consumption of “raw and dried cassava tuber” was high for both seasons with the odds ratio of 1.03 and 2.65 respectively.

**Table 9: Percentage distribution of roots and tubers consumption between dry and wet season (n=12)**

Roots and Tubers	Mvomero								Handeni				Overall	Odds ratio	P-value	Confidence Interval (CI=95%)		
	Kambala		Mela		Consumed Percentages (%)				Kibaya		Konje							
	Dry	Wet	Dry	Wet	Manyinga	Masatu	Dry	Wet	Dry	Wet	Dry	Wet						
Potato Strips (fried)	0	20	0	40	0	40	0	0	0	25	0	75	0	15	.08	0.000 <sup>a</sup>	.02	.27
Yam	47	11	20	22	33	67	14	20	33	20	52	60	46	23	.34	0.004 <sup>a</sup>	.16	.72
Cassava tuber (raw)	44	30	22	20	33	50	27	36	27	43	46	21	77	77	1.03	0.945 <sup>b</sup>	.46	2.28
Cassava tuber (dried)	33	47	0	21	67	32	8	35	17	35	75	31	19	39	2.65	0.012 <sup>a</sup>	1.24	5.67
Turnip (cooked)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-
Turnip (raw)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-
Cassava flour	56	0	11	0	33	100	25	14	13	43	63	43	32	19	.46	0.060 <sup>b</sup>	.20	1.02
Round Potato	50	30	19	40	31	30	29	7	23	43	52	50	73	55	.06	0.000 <sup>a</sup>	.03	.15
Taro	50	50	33	25	17	25	0	33	8	67	92	0	23	11	.42	0.076 <sup>b</sup>	.16	1.09
White sweet potato	44	47	22	32	35	21	20	19	27	48	53	33	68	65	.86	0.669 <sup>b</sup>	.42	1.74
Yellow sweet potato	0	39	0	31	0	31	0	17	0	25	0	58	0	40	1.52	0.240 <sup>b</sup>	.76	3.06
Orange sweet potato	20	20	30	40	50	40	11	0	32	0	58	100	37	8	.25	0.002 <sup>a</sup>	.10	.60

Note: <sup>a</sup> Represents a statistically significant difference between cases

<sup>b</sup> Represents a non-significant difference between cases

**iii) Legumes, Nuts and Seeds**

The most consumed legumes, nuts and seed foods in the study area include, dried and green kidney beans which were respectively consumed by 97% and 63% in the dry season and about 90% and 36% in the wet season, dried and green cowpeas, which were consumed respectively by 77% and 73% in the dry season while in the wet season were consumed by 76% and 60% respectively, shelled dried groundnuts which were consumed by 58% in dry season and 26% during the wet season, and bean mung which was consumed by 59% in dry season and 53% in the wet (Table 10). The regression analysis pinpoints a significant statistical difference in the consumption of some of the legumes, nuts and seed foods between the dry and the wet season such that, foods like dried green gram ( $P=0.043$ ), groundnuts ( $P=0.000$ ), cashew nuts ( $P=0.019$ ), green kidney beans ( $P=0.002$ ), dried Bambara nuts ( $P=0.011$ ), whole dried sesame seeds ( $P=0.002$ ), were more likely to be consumed in the dry season.

**Table 10: Percentage distribution of legumes, nuts and seeds consumption between dry and wet season (n=14)**

Legumes, Nuts and Seeds	Mvomero								Handeni				Overall %	Odds Ratio	P-value	Confidence Interval (CI=95%)		
	Kambala		Mela		Consumed Percentages (%)				Kibaya		Konje							
	Dry	Wet	Dry	Wet	Manyinga	Masatu	Dry	Wet	Dry	Wet	Dry	Wet						
Bean mung	43	0	29	10	29	50	24	40	28	17	48	44	59	53	.65	0.213 <sup>b</sup>	.33	1.28
Green gram (dried)	0	0	100	0	0	0	0	100	10	0	90	0	12	3	.20	0.043 <sup>a</sup>	.04	.95
Groundnut (shelled_ dried)	47	0	16	30	37	20	23	50	19	33	58	17	58	26	.28	0.000 <sup>a</sup>	.14	.57
Cashew nut	50	0	0	50	50	50	18	0	0	0	82	0	19	5	.21	0.019 <sup>a</sup>	.06	.78
Cowpea (dried)	22	0	28	42	50	21	50	37	21	25	29	43	77	76	.94	0.877 <sup>b</sup>	.43	2.06
Cowpea (green)	46	0	23	36	31	21	26	43	26	22	48	44	73	60	.55	0.095 <sup>b</sup>	.27	1.11
kidney Beans (green)	41	0	27	0	32	60	26	40	26	6	48	47	63	36	.33	0.002 <sup>a</sup>	.16	.65
kidney Bean (dried)	50	0	24	32	27	36	24	32	29	25	48	39	97	90	.25	0.093 <sup>b</sup>	.05	1.26
Pigeon peas (green)	46	0	8	27	46	18	24	55	24	22	52	56	44	32	.62	0.173 <sup>b</sup>	.31	1.24
Pigeon peas (dried)	40	0	13	40	47	20	25	40	25	25	50	25	45	29	.50	0.060 <sup>b</sup>	.25	1.02
Soybean (dried)	67	0	33	0	0	33	8	67	23	33	69	33	21	19	.93	0.865 <sup>b</sup>	.40	2.15
Bambara nut (dried)	33	0	33	50	33	50	17	0	0	0	83	0	19	3	.14	0.011 <sup>a</sup>	.03	.64
Pumpkin seed (dried)	47	0	20	33	33	22	18	44	23	53	59	24	47	42	.80	0.516 <sup>b</sup>	.41	1.57
Sesame seeds (whole dried)	25	0	13	0	63	0	17	100	22	25	61	25	33	10	.21	0.002 <sup>a</sup>	.08	.56

Note: <sup>a</sup> Represents a statistically significant difference between cases

<sup>b</sup> Represents a non-significant difference between cases

**iv) Fish and Sea Foods**

Fish and other sea foods are the foods which were not commonly consumed in the study area in both the dry and wet season. Nevertheless, the dried small fish were consumed by 64% in dry season and about 56% in the wet season (Table 11). Results from the regression analysis (CI=95%) showed a statistically significant difference between the consumption of various sea foods including, “fresh lung fish (P=0.001), fried lung fish (P=0.019), dried Nile perch (P=0.006), smoked lung fish and sardines (both at P=0.000) which were more likely to be consumed in the wet season. Similarly, fresh tilapia fish (P=0.004), and smoked salted tilapia fish (odds ratio= 1.86) were more likely to be consumed in the dry season.

**Table 11: Percentage distribution of fish and sea foods consumption between dry and wet season (n=15)**

Fish and Sea Foods	Mvomero								Handeni				Overall	Odds Ratio	P-value	Confidence Interval (CI=95%)		
	Consumed Percentages (%)								Kibaya	Konje	Dry	Wet						
	Kambala		Mela		Manyinga		Masatu											
Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet					
Fish small (dried)	19	31	0	0	58	69	0	41	0	32	25	27	64	56	-	-	-	-
Fish small (fried)	0	43	0	21	0	36	0	17	0	21	0	63	0	49	-	-	-	-
Lung fish (fresh)	0	33	0	22	0	44	0	11	0	21	0	68	0	36	.23	0.001 <sup>a</sup>	.09	.57
Lung fish (fried)	33	22	11	0	56	78	11	0	26	100	63	0	36	24	.39	0.019 <sup>a</sup>	.17	.86
Lung fish (smoked)	0	0	0	0	0	100	0	0	0	100	0	0	0	5	.08	0.000 <sup>a</sup>	.02	.28
Nile perch (fresh)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-
Nile perch (fried)	0	0	0	0	0	0	0	13	0	0	0	67	0	26	-	-	-	-
Nile perch (dried)	0	0	0	0	0	0	0	14	0	21	0	64	0	23	.17	0.006 <sup>a</sup>	.05	.61
Prawn (dried_large)	0	0	0	0	0	0	0	18	0	0	0	82	0	17	.34	0.076 <sup>b</sup>	.11	1.12
Prawn (dried_small)	0	0	0	0	22	0	14	0	21	0	64	0	23	0	-	-	-	-
Prawn (fresh_large)	0	0	0	0	0	0	18	0	0	0	82	0	17	0	-	-	-	-
Sardines	0	0	0	0	0	100	0	50	0	38	0	13	0	19	.13	0.000 <sup>a</sup>	.06	.29
Tilapia fish (fried)	0	0	0	0	0	0	0	0	0	33	0	67	0	5	.83	0.596 <sup>b</sup>	.43	1.63
Tilapia fish (fresh)	18	0	18	0	64	100	0	71	0	29	0	0	41	18	.31	0.004 <sup>a</sup>	.14	.68
Tilapia fish (smoked_salted)	0	36	0	18	0	46	0	0	0	24	0	57	41	0	1.86	0.071 <sup>b</sup>	.95	3.66

Note: <sup>a</sup> Represents a statistically significant difference between cases

<sup>b</sup> Represents a non-significant difference between cases

### v) Eggs

A statistical significant difference ( $P=0.019$ ) in the consumption of eggs between the dry and wet season was observed whereby, whole local chicken eggs were consumed by 67% of the study participants in dry season and 47% in the wet season. Moreover, exotic chicken eggs were consumed by 29% in the dry and 5% in the wet season ( $P=0.002$ ). Duck eggs were consumed in the dry season by 24% of the interviewed participants and 2% in the wet season ( $P=0.004$ ) (Table 12).

**Table 12: Percentage distribution of eggs consumption between dry and wet season (n=3)**

Eggs	Mvomero						Handeni						Overall	Odds Ratio	P-value	Confidence Interval (CI=95%)	
	Consumed Percentages (%)																
	Kambala		Mela		Manyinga		Masatu		Kibaya		Konje						
Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet				
Chicken eggs (whole-local)	40	31	25	23	35	46	22	19	28	25	50	56	67	47	.44	0.019 <sup>a</sup>	.22 .87
Duck eggs	25	0	25	0	50	0	27	100	13	0	60	0	24	2	.04	0.002 <sup>a</sup>	.01 .30
Chicken eggs (layers)	25	0	25	0	50	100	13	100	20	0	67	0	29	5	.16	0.004 <sup>a</sup>	.04 .56

Note: <sup>a</sup> Represents a statistically significant difference between cases

<sup>b</sup> Represents a non-significant difference between cases

### vi) Fruits

The proportions to which different varieties of fruits were consumed in the dry and wet season are presented in Table 13. Mangoes and oranges were highly consumed in dry season by 83% and 85% of the studied respondents, respectively. In the wet season these fruits were consumed by 89% and 82%, respectively. Furthermore, many other fruits were also consumed in varying proportions in the dry and wet season. Such fruits included, large ripe bananas consumed by 72% in dry season and 58% in wet season,

tamarind consumed by 59% in dry and 58% in wet season, and jackfruits consumed by 56% in dry and 52% in wet season. Nonetheless, when the consumption of different fruits was regressed against seasons of the year at a confidence interval of 95%, a significant statistical difference was observed. Most of the fruits such as, apple (P=0.004), avocado pulp, ripe sugar banana, unripe papaya, ripe papaya, watermelon fruit and sour-sop (at P=0.000 respectively), loquat (P=0.007), passion fruit (P=0.002), granadilla purple passion fruit and pineapple (both at P=0.001) were more likely to be consumed in the dry season. Various fruits such as mangoes and tangerine however, had higher odds (1.57 and 1.07 respectively) of being consumed in both seasons.

**Table 13: Percentage distribution of fruits consumption between dry and wet season (n=27)**

Fruits	Mvomero						Handeni						Overall	Odds Ratio	P-value	Confidence Interval (CI=95%)		
	Consumed Percentages (%)																	
	Kambala		Mela		Manyinga		Masatu		Kibaya		Konje							Dry
Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet					
Apple	39	0	35	0	26	0	8	0	17	0	75	100	24	2	.05	0.004 <sup>a</sup>	.01	.39
Apple juice (canned or bottled)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-
Avocado pulp	41	11	29	11	29	78	26	33	26	33	48	33	54	19	.21	0.000 <sup>a</sup>	.10	.44
Banana (large_ripe)	52	31	16	19	32	50	23	30	14	35	52	35	72	58	.54	0.091 <sup>b</sup>	.27	1.10
Banana (large_unripe)	47	29	11	29	42	43	21	21	29	36	50	43	34	45	-	-	-	-
Banana (sugar_ripe)	53	50	21	25	26	25	17	30	29	30	54	40	55	23	.24	0.000 <sup>a</sup>	.11	.50
Baobab fruit	43	50	43	40	14	10	16	29	36	50	48	21	55	38	.51	0.060 <sup>b</sup>	.26	1.01
Cherimoya (custard apple or sweetsop)	20	0	30	0	50	100	14	33	14	33	71	33	23	13	.49	0.129 <sup>b</sup>	.20	1.23
Coconut whole	47	0	23	0	30	0	20	0	33	0	47	0	68	0	.70	0.311 <sup>b</sup>	.35	1.40
Guava fruit	0	0	11	50	33	50	28	33	24	38	48	29	56	47	.64	0.187 <sup>b</sup>	.33	1.25
Jackfruit	50	18	50	9	0	72	16	38	24	36	60	24	56	52	.82	0.572 <sup>b</sup>	.42	1.61
Lemon	0	52	0	21	0	26	0	21	0	30	0	49	76	0	-	-	-	-
Loquat	43	0	27	0	30	0	9	0	0	100	90	0	22	0	.06	0.007 <sup>a</sup>	.01	.46
Mango	45	36	26	32	29	32	20	27	29	40	51	33	83	89	1.57	0.369 <sup>b</sup>	.59	4.21
Orange	50	37	27	32	23	32	17	31	29	38	54	31	85	82	.84	0.709 <sup>b</sup>	.34	2.07
Orange juice	0	33	0	67	0	0	0	33	0	0	0	67	0	10	-	-	-	-
Papaya (unripe)	33	33	42	67	25	0	21	25	27	50	52	25	73	11	.04	0.000 <sup>a</sup>	.02	.11
Papaya fruit (ripe)	53	40	16	40	32	20	21	40	30	33	49	27	75	32	.18	0.000 <sup>a</sup>	.08	.36
Passion fruit	25	0	50	33	25	67	7	67	21	0	71	33	33	10	.21	0.002 <sup>a</sup>	.08	.56
Passion fruit (granadilla purple)	43	0	21	0	36	0	7	0	21	50	71	50	28	3	.08	0.001 <sup>a</sup>	.02	.38
Pears	0	0	0	0	0	100	0	0	0	40	0	60	0	10	.65	0.428 <sup>b</sup>	.23	1.88
Pineapple	47	30	21	20	32	50	20	25	24	38	56	38	59	29	.28	0.001 <sup>a</sup>	.14	.58
Plum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-
Sour sop	43	0	24	0	33	0	21	0	21	100	58	0	37	5	.09	0.000 <sup>a</sup>	.02	.30
Tamarind	39	39	33	50	28	11	21	0	31	56	48	44	59	58	.90	0.764 <sup>b</sup>	.46	1.77
Tangerine	42	30	21	20	37	50	25	33	25	39	50	28	28	45	1.07	0.852 <sup>b</sup>	.54	2.09
Watermelon fruit	0	29	25	14	75	57	27	25	27	38	46	38	56	24	.25	0.000 <sup>a</sup>	.12	.51

Note: <sup>a</sup> Represents a statistically significant difference between cases

<sup>b</sup> Represents a non-significant difference between cases

**vii) Vegetables**

Except for the vegetables such as eggplants, and pumpkins which were more likely to be consumed in the wet season (87%, and 81% respectively), most of the other vegetables in the study area including blackjack leaves, turnip greens, hares lettuce, cassava leaves, kale, swiss-chard leaves and nightshade leaves (at  $P=0.000$  respectively), green or white cabbage ( $P=0.003$ ), raw carrot ( $P=0.002$ ), jute leaves ( $P=0.001$ ), onion leaves ( $P=0.004$ ) and spider plant leaves ( $P=0.008$ ) were more likely to be consumed by most people during the dry season (Table 14). Regression results further suggest that, other vegetables such as red ripe tomato and raw lettuce had high odds of being consumed in both seasons in comparison to other vegetables examined.

**Table 14: Percentage distribution of vegetables consumption between dry and wet season (n=31)**

Vegetables	Mvomero								Handeni				Overall	Odds Ratio	P-value	Confidence Interval (CI=95%)		
	Consumed Percentages (%)								Kibaya		Konje							
	Kambala		Mela		Manyinga		Masatu		Dry	Wet	Dry	Wet					Dry	Wet
African eggplant	35	48	35	24	31	28	32	28	36	31	32	42	83	77	.69	0.380 <sup>b</sup>	.30	1.59
Amaranth leaves	23	51	42	26	35	23	35	24	31	29	35	46	97	89	.21	0.060 <sup>b</sup>	.04	1.03
Blackjack leaves	0	22	78	39	22	39	0	18	0	29	0	54	59	19	.17	0.000 <sup>a</sup>	.08	.36
Cabbage (green or white)	11	47	44	28	44	25	31	23	35	30	35	46	91	71	.24	0.003 <sup>a</sup>	.09	.62
Carrot (raw)	23	56	31	20	46	24	35	27	29	27	35	46	74	48	.32	0.002 <sup>a</sup>	.16	.66
Cassava leaves	50	22	33	26	17	52	17	22	17	26	67	52	60	29	.25	0.000 <sup>a</sup>	.12	.52
Chinese mustard (greens)	0	48	0	23	0	29	0	24	0	26	0	50	0	78	.77	0.602 <sup>b</sup>	.29	2.07
Cowpeas leaves	33	52	33	22	33	26	29	27	33	32	38	41	51	68	1.45	0.400 <sup>b</sup>	.61	3.44
Cucumber	0	23	0	54	0	23	0	31	0	15	0	54	0	42	-	-	-	-
Eggplant	29	42	43	21	29	37	27	26	35	30	39	44	59	87	4.70	0.000 <sup>a</sup>	1.97	11.20
Greens leaves (wild)	0	32	0	39	0	29	0	35	0	31	0	35	0	97	-	-	-	-
Hares lettuce	0	32	56	32	44	36	0	17	0	27	0	57	67	36	.28	0.000 <sup>a</sup>	.14	.55
Jute leaf	32	46	42	27	26	27	26	18	39	32	35	50	91	68	.21	0.001 <sup>a</sup>	.08	.53
Kale	8	55	58	20	33	25	0	19	0	26	0	56	60	27	.25	0.000 <sup>a</sup>	.12	.51
Lettuce (raw)	13	50	38	50	50	0	0	0	0	10	0	90	15	23	1.60	0.279 <sup>b</sup>	.68	3.78
Nightshade leaves	8	40	31	24	62	36	0	23	0	32	0	45	72	40	.27	0.000 <sup>a</sup>	.13	.54
Okra	37	50	37	20	26	30	35	24	31	29	35	47	87	86	.87	0.771 <sup>b</sup>	.33	2.28
Onion leaves	100	38	0	38	0	25	0	0	100	31	0	69	26	7	.19	0.004 <sup>a</sup>	.06	.58
Onion tuber	31	50	38	24	31	27	0	24	0	29	0	48	97	100	-	-	-	-
Pepper (sweet green _raw)	19	44	38	28	44	23	42	23	32	32	26	45	72	57	.51	0.060 <sup>b</sup>	.25	1.03
Pepper _hot	62	0	23	0	15	0	15	0	39	0	55	0	42	0	-	-	-	-
Pumpkin	26	48	44	24	30	28	30	19	35	31	35	50	73	81	5.34	0.004 <sup>a</sup>	1.73	16.54
Pumpkin leaves	36	48	36	26	29	26	33	21	33	29	33	50	89	94	.54	0.203 <sup>b</sup>	.21	1.39
Spider Plant leaves	10	39	60	31	30	31	0	13	0	30	0	57	46	24	.37	0.008 <sup>a</sup>	.18	.77
Sweet potato leaves	30	47	40	27	30	27	36	25	29	28	36	48	95	94	.78	0.738 <sup>b</sup>	.19	3.27
Swiss chard	33	41	42	31	25	28	0	23	0	29	0	49	82	31	.09	0.000 <sup>a</sup>	.04	.20
Tomato (red ripe _raw)	49	23	24	54	27	23	24	31	27	15	49	43	95	84	3.30	0.292 <sup>b</sup>	.36	30.28
Turnip greens	0	50	50	28	50	22	0	17	0	33	0	50	54	15	.15	0.000 <sup>a</sup>	.06	.34

Note: <sup>a</sup> Represents a statistically significant difference between cases

<sup>b</sup> Represents a non-significant difference between cases

**viii) Milk and Dairy Products**

Generally, dairy products such as butter milk, cow milk whole powdered, fresh-non-fortified cow's milk, and locally fermented milk were highly consumed by many people in the study area (Table 15). However, results from the logistic regression show that, the consumption of fresh non-fortified cow's milk varied significantly from the wet to the dry season. About 63% of the participants consumed fresh non-fortified cow's milk in wet season and 28% of the participants consumed it in the dry season ( $P=0.000$ ). Similarly, the consumption of powdered non-fat cow's milk varied significantly ( $P=0.031$ ) between the seasons whereas about 15% of the people consumed powdered non-fat cow's milk in dry season while none of the participants consumed it in the wet. Moreover, fortified powdered milk had high odds of being consumed in the dry season (Odds ratio=7.12) but no statistical significant difference was found in its consumption pattern across the seasons.

**Table 15: Percentage distribution of milk and dairy products consumption between dry and wet season (n=10)**

Dairy Products	Mvomero						Handeni						Overall	Odds Ratio	P-value	Confidence Interval (CI=95%)		
	Kambala		Mela		Manyinga		Masatu		Kibaya		Konje							
	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet						
Butter milk	64	30	0	70	36	0	19	0	29	50	52	50	41	26	.50	0.061 <sup>b</sup>	.24	1.03
Cow milk (powdered_ whole)	0	9	0	9	0	82	0	0	0	0	0	0	0	61	-	-	-	-
Cow milk (UHT)	0	0	0	100	0	0	0	67	0	33	0	0	14	7	.42	0.156 <sup>b</sup>	.13	1.39
Cow milk (fresh and non-fortified)	51	35	26	35	23	30	0	25	28	25	48	50	28	63	.02	0.000 <sup>a</sup>	.00	.05
Cow milk (powdered_ nonfat)	0	0	0	0	0	0	0	0	18	0	82	0	15	0	.18	0.031 <sup>a</sup>	.04	.85
Cow milk (powdered_ whole)	0	0	0	100	0	0	0	0	0	0	0	100	15	3	-	-	-	-
Fermented milk (local)	0	59	0	22	0	19	0	21	0	27	0	53	0	78	-	-	-	-
Goat milk (fresh)	83	36	17	64	0	0	21	0	26	83	53	17	32	27	-	-	-	-
Milk (powder_ fortified)	67	0	0	0	33	0	17	0	0	0	83	0	19	0	7.12	0.000 <sup>a</sup>	3.32	15.28
Yoghurt (industrial)	0	0	0	0	0	0	8	0	8	0	83	0	19	0	-	-	-	-

Note: <sup>a</sup> Represents a statistically significant difference between cases

<sup>b</sup> Represents a non-significant difference between cases

**ix) Meat and Meat Products**

Similar results were also found using a logistic regression model (logit) where a significant statistical difference was found in the consumption of beef intestines and stomach, beef kidney, beef liver, local chicken meat, goat hooves, goat intestines and stomach, goat kidney, goats' liver, and goat meat (at  $P=0.000$  respectively), duck meat ( $P=0.004$ ), lean or boneless pork meat and broiler chicken meat (both at  $P=0.008$ ) and mutton meat ( $P=0.007$ ) between dry and wet season (Table 16). Consumption of meat and related products in the study area was found to be high especially during the dry season and seem to be rarely consumed in the wet season. Furthermore, about 85% of the people in the study area consume beef meat during the dry season but none of them consumed beef meat in the wet season.

**Table 16: Percentage distribution of meat and meat products consumption between the dry and wet season (n=25)**

Meats/Meat Products	Mvomero								Handeni				Overall %	Odds Ratio	P-value	Confidence Interval (CI=95%)		
	Consumed Percentages (%)								Kibaya	Konje	Dry	Wet						
	Kambala		Mela		Manyinga		Masatu											
	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet										
Beef meat	52	0	21	0	28	0	0	0	0	0	46	0	85	0	.07	0.000 <sup>a</sup>	.03	.17
Beef intestines and stomach	52	46	24	23	24	31	25	14	29	43	46	43	63	32	.28	0.000 <sup>a</sup>	.14	.57
Beef kidney	57	0	29	0	14	0	0	21	33	21	67	58	74	16	.06	0.000 <sup>a</sup>	.02	.14
Beef lean	58	0	33	0	8	0	17	0	50	0	33	0	29	0	-	-	-	-
Beef liver	56	40	17	40	28	20	29	50	29	25	43	25	59	15	.12	0.000 <sup>a</sup>	.051	.27
Beef meat (lean and/or boneless)	44	0	44	0	11	0	0	0	50	0	50	0	13	0	-	-	-	-
Beef meat (low-fat and/or boneless)	50	0	50	0	0	0	25	0	25	0	50	0	21	0	-	-	-	-
Beef medium-fat	54	0	23	0	23	0	0	0	50	0	50	0	31	0	-	-	-	-
Chicken feet	0	50	0	0	0	50	14	0	7	67	79	33	26	11	.37	0.037 <sup>a</sup>	.14	.94
Chicken liver	33	50	33	0	33	50	17	17	8	33	0	50	23	19	.80	0.594 <sup>b</sup>	.35	1.82
Chicken meat (broiler)	0	0	0	0	0	100	17	0	8	0	0	0	21	2	.06	0.008 <sup>a</sup>	.01	.49
Chicken meat (local)	44	53	22	21	33	29	25	19	38	26	38	56	59	27	.26	0.000 <sup>a</sup>	.13	.54
Duck meat	17	100	17	0	67	0	15	0	15	0	69	0	24	2	.05	0.004 <sup>a</sup>	.01	.39
Goat hooves	67	0	13	0	0	0	67	0	13	50	0	50	46	3	.04	0.000 <sup>a</sup>	.01	.17
Goat intestines and stomach	0	42	14	33	36	25	0	22	24	33	45	44	65	34	.27	0.000 <sup>a</sup>	.13	.55
Goat kidney	0	0	0	17	0	33	0	29	100	0	0	46	59	2	.01	0.000 <sup>a</sup>	.00	.09
Goat liver	52	0	22	0	26	0	27	0	0	0	43	0	68	0	.05	0.000 <sup>a</sup>	.02	.13
Goat meat	62	0	31	0	8	0	27	27	46	27	27	46	74	39	.22	0.000 <sup>a</sup>	.11	.45
Mutton meat	57	73	29	27	14	0	0	0	0	33	0	67	50	16	.38	0.007 <sup>a</sup>	.19	.77
Pork (high-fat)	0	0	0	0	100	0	0	0	0	0	100	0	0	8	-	-	-	-
Pork intestines and stomach	0	0	0	0	100	0	0	0	0	0	0	0	11	3	.26	0.089 <sup>b</sup>	.053	1.23
Pork meat (lean and/or boneless)	67	0	0	0	100	0	0	0	15	0	100	0	21	3	.13	0.008 <sup>a</sup>	.029	.59
Rabbit	0	0	0	0	0	0	0	0	0	0	0	0	14	0	.00	-	-	-
Sausage	0	0	0	0	0	0	0	0	0	0	0	0	0	0	.00	-	-	-
Wild meat	0	0	0	0	0	0	0	0	100	0	0	0	0	2	.00	-	-	-

Note: <sup>a</sup> Represents a statistically significant difference between cases

<sup>b</sup> Represents a non-significant difference between cases

**x) Fats/Oils**

Consumption of fats and oils has been observed in the study area where the consumption patterns were more inclined to the dry season with sunflower being consumed by about 83% in the dry season and 32% in the wet season ( $P=0.000$ ) (Table 17). A significant statistical difference ( $P=0.002$ ) was observed in the consumption of sesame oil which was consumed by 28% of the studied participants in the dry season and 2% in the wet season. In particular, all the other fat and oil foods regressed in this study were more likely to be consumed in the dry season except for the fresh palm oil which was more likely to be consumed in the wet season by 44% of the people and only 28% in the dry season (Odds ratio=1.96).

**Table 17: Percentage distribution of fats and oils consumption between the dry and wet season (n=10)**

Fats/Oils	Mvomero								Handeni				Overall	Odds Ratio	P-value	Confidence Interval (CI=95%)		
	Kambala		Mela		Manyinga		Masatu		Kibaya		Konje							
	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet						
Animal fat	64	40	14	60	21	0	22	0	35	44	44	56	47	39	.70	0.302 <sup>b</sup>	.36	1.38
Corn oil	50	0	50	0	0	0	0	0	0	0	100	0	17	0	-	-	-	-
Margarine	55	0	18	0	27	0	21	0	26	100	53	0	38	2	-	-	-	-
Palm oil (fresh)	29	47	43	35	29	18	7	10	33	10	60	80	28	44	1.96	0.060 <sup>b</sup>	.97	3.97
Palm oil (kernel)	50	0	50	0	0	0	0	0	10	0	90	0	15	0	-	-	-	-
Palm oil (red)	100	0	0	0	0	0	0	75	0	25	100	0	14	0	.42	0.156 <sup>b</sup>	.13	1.39
Sesame oil	50	0	33	0	17	0	13	0	25	0	63	100	28	2	.04	0.002 <sup>a</sup>	.01	.32
Sunflower oil	53	33	17	33	30	33	29	0	23	50	49	50	83	32	.10	0.000 <sup>a</sup>	.04	.21
Vegetable fat (white fortified)	56	0	33	0	11	0	5	0	43	0	52	0	38	0	.76	0.447 <sup>b</sup>	.38	1.54
Vegetable fat (white unfortified)	0	50	0	33	0	17	0	12	0	29	0	59	30	0	-	-	-	-

Note: <sup>a</sup> Represents a statistically significant difference between cases

<sup>b</sup> Represents a non-significant difference between cases

**xi) Sugar and Sweets**

Among the sugar and sweets consumed by the people in the study area, brown sugar was found to be one of the most consumed items whereas in the dry season it was consumed by 97% and in the wet season consumed by 100% of those involved in this study. Further analysis with logistic regression (logit) noted a statistically significant difference between the consumption of the sugary items such as candy chocolate (P=0.037), chewing gum (P=0.001), sweet biscuits (0.000), hard candy (P=0.000), cookie (P=0.000), honey (P=0.000) and sugarcane whole (P=0.026) in the dry and the wet season. Except for the sugared baked wheat dough (*konaifa*) and deep fried wheat dough which had higher odds of being consumed in the wet season (Odds ratio=3.90 and 1.02 respectively), most of the other sugary items were more likely to be consumed in the dry season (Table 18).

**Table 18: Percentage distribution of sugar and sweets consumption between the dry and wet season (n=16)**

Sugar and Sweets	Mvomero								Handeni				Overall %	Odds Ratio	P-value	Confidence Interval (CI=95%)		
	Kambala		Mela		Consumed Percentages (%)				Kibaya		Konje							
	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet						
Biscuit (sweet)	48	43	24	14	28	43	21	13	25	47	54	40	68	36	.26	0.000 <sup>a</sup>	.07	.34
Candy (hard)	25	67	25	0	50	33	55	18	20	18	25	64	62	23	.18	0.000 <sup>a</sup>	.09	.39
Candy chocolate	50	50	17	0	33	50	21	0	14	60	64	40	26	11	.37	0.037 <sup>a</sup>	.14	.94
Chewing gum	52	57	24	0	24	43	22	15	26	46	52	39	62	32	.30	0.001 <sup>a</sup>	.15	.60
Cookie	47	100	21	0	32	0	25	0	25	0	50	0	55	2	.01	0.000 <sup>a</sup>	.00	.10
Glucose	0	100	0	0	0	0	0	0	0	0	0	0	0	2	-	-	-	-
Half cakes	0	60	0	20	0	20	0	28	0	24	0	48	0	51	-	-	-	-
Honey	44	33	28	33	28	33	21	50	31	50	48	0	60	19	.16	0.000 <sup>a</sup>	.07	.34
Molasses (cane sugar)	50	0	29	0	21	0	16	0	21	0	63	0	42	0	-	-	-	-
Queen cakes	60	0	20	0	20	0	19	0	13	0	69	0	33	0	-	-	-	-
Sugar (Brown)	45	48	12	26	59	26	20	23	21	28	9	50	91	100	-	-	-	-
Sugar (white)	55	0	36	0	9	0	14	0	14	0	71	0	32	0	-	-	-	-
Sugarcane juice	40	0	20	0	40	0	20	0	20	0	60	0	32	0	-	-	-	-
Sugarcane (whole)	50	15	19	8	31	77	23	19	26	43	52	38	73	55	.45	0.026 <sup>a</sup>	.22	.91
Sugared baked wheat-dough ( <i>kona</i> )	0	37	0	32	0	32	0	27	0	46	0	27	0	66	3.90	0.000 <sup>a</sup>	1.93	7.91
Wheat dough/ deep (fried)	47	36	28	28	25	36	22	33	30	37	49	30	86	89	1.02	0.963 <sup>b</sup>	.36	2.93

Note: <sup>a</sup> Represents a statistically significant difference between cases

<sup>b</sup> Represents a non-significant difference between cases

**xii) Condiments**

About 95% of the respondents contacted during this study reported that they normally consume iodized salt during the wet season but only 92% said that they consume iodized salt during the dry season. Table 19 further illustrates that, the consumption of other condiments including raw ginger root, and lemon is high during the wet season (69% and 76% respectively) than in the dry season (67% and 62% respectively). A further logistic analysis conversely depicts that, some of the condiments including, bouillon mix ( $P=0.040$ ), cinnamon ground ( $P=0.028$ ), cocoa powder ( $P=0.030$ ), raw garlic ( $P=0.003$ ), curry powder ( $P=0.000$ ), black ground or whole kernel peppercorn ( $P=0.000$ ), non-iodized salt ( $P=0.001$ ) and mix ground spices ( $P=0.001$ ) were more likely to be consumed in the dry season. Other condiments such as lemon, raw ginger root and iodized salt generally had higher odds of being consumed throughout the year regardless of the season.

**Table 19: Percentage distribution of condiments consumption between dry and wet season (n=16)**

Condiments	Mvomero						Handeni						Overall	Odds Ratio	P-value	Confidence Interval (CI=95%)		
	Kambala		Mela		Manyinga		Masatu		Kibaya		Konje							
	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet						
Baking powder	40	46	20	15	40	39	19	25	33	50	48	25	40	27	.57	0.129 <sup>b</sup>	.28	1.18
Baking soda	0	33	0	17	0	50	0	100	0	0	0	0	0	11	.00	-	-	-
Bouillon mix ( <i>Royco</i> )	67	0	33	0	0	100	10	0	0	50	90	50	17	5	.25	0.040 <sup>a</sup>	.07	.94
Cardamom	67	50	13	10	20	40	25	42	15	32	60	26	45	47	1.08	0.822 <sup>b</sup>	.55	2.11
Chill (green_raw)	50	23	25	46	25	31	21	30	21	20	58	50	45	37	.72	0.354 <sup>b</sup>	.37	1.43
Chill (red_raw)	50	23	29	39	21	39	12	0	24	80	65	20	40	29	.62	0.188 <sup>b</sup>	.30	1.26
Cinnamon ground	44	63	25	25	31	13	29	50	19	30	52	20	47	29	.45	0.028 <sup>a</sup>	.22	.92
Cocoa (powdered)	50	0	50	0	0	0	0	0	0	100	100	0	14	2	.10	0.030 <sup>a</sup>	.01	.80
Curry powder	44	0	22	0	33	0	13	33	19	33	69	33	32	5	.11	0.000 <sup>a</sup>	.03	.38
Garlic (raw)	41	56	29	22	29	22	30	20	15	60	55	20	47	23	.32	0.003 <sup>a</sup>	.15	.68
Ginger root (raw)	48	42	22	37	30	21	24	38	28	38	48	25	67	69	1.13	0.735 <sup>b</sup>	.55	2.32
Lemon	44	36	22	18	35	46	26	40	26	32	48	28	62	76	1.52	0.281 <sup>b</sup>	.71	3.28
Peppercorn (black ground or whole_kernel)	35	33	35	33	29	33	19	44	24	44	57	11	49	19	.25	0.000 <sup>a</sup>	.12	.55
Salt (iodized)	53	35	19	35	28	31	25	30	25	40	50	30	92	95	1.64	0.498 <sup>b</sup>	.39	6.83
Salt (non-iodized)	53	38	24	38	24	25	22	50	37	40	41	10	56	29	.32	0.001 <sup>a</sup>	.16	.64
Spices (mix_ground)	36	100	27	0	36	0	26	75	26	25	47	0	39	11	.20	0.001 <sup>a</sup>	.08	.51

Note: <sup>a</sup> Represents a statistically significant difference between cases

<sup>b</sup> Represents a non-significant difference between cases

**xiii) Beverages**

Despite the fact that there are some beverages which were not consumed at all including beverage mix powder, beverage blackcurrant/syrup/ribena, it was found that some other beverages such as black tea leaf, dry tea leaves and carbonated non-alcoholic beverage were highly consumed in the dry season by 92%, 89% and 64% respectively. Contrarily, brewed black tea was highly consumed in the wet season by 95% but less consumed in dry season at 0% (Table 20). In particular, regression results show a significant statistical difference in the consumption of beverages such as commercial beer ( $P=0.018$ ), local brew/grains beer ( $P=0.014$ ), carbonated non-alcoholic beverage ( $P=0.001$ ), instant coffee ( $P=0.004$ ), dry coffee ground ( $P=0.003$ ), and sweetened colored juice (0.000) between the dry and the wet season. In addition, beverages such as, leaf black tea, chamomile tea and lemongrass tea had higher odds (Odds ratio=1.64, 1.09 and 15.71 respectively) of being consumed in the dry season as compared to other beverages.

**Table 20: Percentage distribution of beverages consumption between the dry and wet season (n=20)**

Beverages	Mvomero				Handeni								Overall	Odds Ratio	P-value	Confidence Interval (CI=95%)		
	Consumed Percentages (%)																	
	Kambala		Mela		Manyinga		Masatu		Kibaya		Konje						Dry	Wet
Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet					
Beer (local brew_molasses)	0	0	0	0	100	0	10	0	0	0	90	0	14	0	-	-	-	-
Beer (commercial)	0	100	0	0	100	0	0	8	0	17	0	75	16	2	<b>0.08</b>	0.018 <sup>a</sup>	.01	.65
Beer (local brew_grains)	0	0	0	50	100	50	0	8	0	8	0	83	17	2	<b>0.07</b>	0.014 <sup>a</sup>	.01	.59
Beer (local brew_honey)	50	0	0	0	50	0	9	0	0	0	91	0	17	0	-	-	-	-
Beverage (carbonated nonalcoholic)	47	46	27	27	27	27	29	29	43	29	29	43	64	36	<b>0.31</b>	0.001 <sup>a</sup>	.15	.62
Beverage (Mix_bottled liquid)	50	0	25	0	25	0	0	0	10	0	90	0	13	0	-	-	-	-
Beverage (mix-powder)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-
Beverage blackcurrant (syrup/ribena)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-
Black tea (leaf)	48	0	23	0	29	0	24	0	29	0	46	0	92	0	<b>1.64</b>	0.498 <sup>b</sup>	.39	6.83
Black tea (brewed)	0	37	0	30	0	33	0	31	0	38	0	31	0	95	-	-	-	-
Chamomile tea	36	20	18	10	46	70	20	50	30	31	50	19	38	42	<b>1.09</b>	0.793 <sup>b</sup>	.56	2.16
Chocolate mix (powdered/milo)	50	0	25	100	25	0	0	0	0	100	100	0	12	3	<b>0.26</b>	0.089 <sup>b</sup>	.05	1.23
Coconut water	40	0	30	0	30	0	26	0	16	0	60	0	37	0	-	-	-	-
Coffee (instant)	0	50	0	0	0	50	100	20	0	20	0	60	24	2	<b>0.05</b>	0.004 <sup>a</sup>	.01	.39
Coffee ground (dry)	0	25	0	0	0	75	0	19	100	19	0	63	26	2	<b>0.05</b>	0.003 <sup>a</sup>	.01	.37
Lemongrass tea	44	0	0	0	56	0	24	0	18	0	59	0	33	0	<b>15.71</b>	0.000 <sup>a</sup>	6.28	39.30
Local partially fermented cereal drink (sugar added)	0	20	67	60	33	20	0	14	100	14	0	71	24	11	<b>0.40</b>	0.053 <sup>a</sup>	.15	1.01
Orange juice	58	0	17	0	25	0	19	0	24	0	57	0	42	0	-	-	-	-
Sweetened colored juice (flavored drink)	50	44	25	22	25	33	0	25	100	33	0	42	54	8	<b>0.08</b>	0.000 <sup>a</sup>	.03	.21
Tea leaves (dry)	36	0	32	0	32	0	33	0	33	0	33	0	89	0	-	-	-	-

Note: <sup>a</sup> Represents a statistically significant difference between cases

<sup>b</sup> Represents a non-significant difference between cases

**xiv) Complementary Foods**

Infant foods are not commonly consumed in Mvomero and Handeni districts. Only 24% of the study participants reported to have consumed infant cereal /cerelac in dry season and 2% in wet season while only 14% have consumed infant formula/ lactogen in the dry season and none have used it in the wet (Table 21).

**Table 21: Percentage distribution of complimentary foods consumption between the dry and wet season (n=2)**

Complementary Foods	Mvomero								Handeni				Overall	Odds Ratio	P-value	Confidence Interval (CI=95%)		
	Consumed Percentages (%)								Kibaya	Konje	Dry	Wet						
	Kambala		Mela		Manyinga		Masatu											
Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet					
Infant cereal (cerelac)	0	80	0	0	100	20	31	21	38	7	31	71	24	2	0.05	0.004 <sup>a</sup>	0.01	0.39
Infant formula (Lactogen)	100	0	0	0	0	0	10	0	0	0	90	0	14	0	-	-	-	-

Note: <sup>a</sup> Represents a statistically significant difference between cases

<sup>b</sup> Represents a non-significant difference between cases

## **CHAPTER FIVE**

### **5.0 DISCUSSION**

#### **5.1 Preamble**

This chapter presents discussion for the findings of the study conducted in Mvomero and Handeni districts. This section is organized according to the research objectives and the main areas for discussion are impacts of livelihood diversification on food choice, contribution of social identities to food valuation and food choice, and assessment of seasonal dietary patterns in pastoral communities.

Livelihood diversification, social identities of foods and food valuation are the cornerstone factors of food choice that determine household dietary patterns. Other broad range of interacting factors including environmental associates such as threats/shock, income and culture have indirect impact to food choice although speed up the cause.

#### **5.2 Impacts of Livelihood Diversification on Pastoralists' Food Choice**

##### **5.2.1 Livelihood systems existing among pastoral communities**

The presence of livelihood systems diversification was observed among the pastoral societies even though the pace of progress was not very well pronounced. Among all the identified livelihood systems in the study area include livestock keeping, crop cultivation, casual labour, small business and wage/salary employment only livestock keeping and crop cultivation were highlighted as the main livelihood systems. In fact, findings of this nature, relate to what was observed by Dong *et al.* (2011), that economic activities based on cattle, goats, sheep, and poultry play an important role in pastoralist economy. However, due to different pressures such as increasing need to

build alternative livelihood strategies around livestock production and trade (Homewood, 2010; Little and McPeak, 2014), the pastoralists are prompted to establish new engagements. Such gradual lifestyle changes among the pastoral communities are also linked to other factors such as political issues, conflicts and financial breakdown (McCabe, 2010; Wakhungu *et al.*, 2014; Morton and Meadows, 2011).

These livelihood transitions are always inevitable in many societies and are mediated via changes in climate or vice versa changes caused by other drivers including immigration, conflicts for natural resources, and changing economies (Rufino *et al.*, 2013). Hence, a new trend of economic activities that divert from livestock keeping and crops cultivation or even the shift from livestock keeping to crops cultivation and/or vice versa among the pastoral communities. Mela village was one of the villages originally inhabited by exclusive pastoralists because one of the reasons for its establishment was to cater for sufficient grazing land (Mhangwa, 2013). However, recently as illustrated in the results section, other livelihood activities including, small business, and casual labour were also moderately practiced and in most cases they were used as resiliency strategies when livestock keeping and/or cultivation are not performing well.

In addition, most of these supplementary activities especially casual labour are normally done during the local seasonal agriculture periods which are deemed to be labour intensive periods. For the livestock keepers, however, labour intensive periods are usually during the dry season where extra labour is needed to support in raiding livestock in search for pasture and water. In particular, many resources are required by to sustain the households during such periods and so income diversification becomes a very important strategy to them (FSNAU, 2016). But according to Little *et al.*, 2001;

Homewood *et al.*, 2012; ILO, 2013 and Yoonyoung *et al.* (2014), livelihood diversification works more for the low income households as their only mechanism of ensuring household food security while the high income pastoralists uses supplementary activities such as petty/trade or businesses as an alternative source of income whenever necessary. The low income status has caused pastoralist to fail to maintain a pastoral livelihood thus they have turned into other environmentally destructive activities such as charcoal making, which can compete with and impact on the sustainability of pastoralism itself due to its influence on weather pattern (Little and McPeak, 2014).

### **5.2.2 Gender role and livelihood systems**

Gender determines the different roles that adult men/women, youths and the elderly play in pastoral society, as well as the power relations in the households. As observed in the present study, each gender groups have their specific roles to play depending on their livelihoods and social set up for that activity. Men as heads of the household usually assume the role of making final decisions regarding most of the tasks executed in the households except for those tasks which are exclusively on the woman's domain. And customary households apply rules and regulations on a day-to-day basis that so many variations exist such as knowledge, ownership rights and ideas brought by the traditional and cultural beliefs (Kassam, 2012).

However in pastoral communities both men and women have vital roles in the continuation and adaptation of pastoral systems. Women play a central role as livestock keepers, natural resource managers, income generators, and service providers, tasks which, by themselves, are influenced by gendered norms, values, and relations (Flintan *et al.*, 2011).

In spite of women's contribution to pastoral life, they have only limited access to, and control over, key productive resources such as livestock and land. They also have limited access to healthcare, education, family planning, and reproductive health (Ridgewel *et al.*, 2007). Moreover, the fundamental role of pastoral women in agriculture and livestock production has been systematically ignored and undervalued (Dejene *et al.*, 2005).

Despite of all these challenges waged against women in the pastoral communities, still women are the most dependable group in the society in assuring that families have all the needs. Their community's role is more crucial in recent times where inter-ethnicity, climate change and variability have affected gender roles among the pastoral communities (Yi *et al.*, 2012). These effects tend to differ between men and women due to the different magnitude of the impact on the allocation of tasks and time which varies between men and women (Mubaya *et al.*, 2010). For example, during dry seasons water become scarce in many pastoral communities hence women needed to spend more time fetching water in far areas and this reduces the time for food production and preparation as well as participation in income generating activities and child care. So in order to balance these situation, both women and men need to create the best coping and adaptation strategies which favors both gender equally (Mollel and Porokwa, 2014).

### **5.2.3 The influence of livelihood systems on eating habits**

Generally, the eating habits are more likely to be affected by the climatic changes which have unique connection with the livelihood systems within the communities. The climatic changes have causes multiple higher risks in the pastoral communities which exacerbating drivers of food insecurity. These changes disproportionately affects

the poorest and most food insecure through a combination of decreasing crop production, and changes in the frequency and intensity of climate-related hazards, all of which may result in more humanitarian and food security crises (FAO, 2008b; Gornall *et al.*, 2010). These changes affect the different dimensions of food security in many ways. The availability of food can be affected through variations in yields especially in key producing areas due to increasing temperatures as well as changes in the quantity of arable land and water available for agriculture (Abrha, 2015). Changes in production, in turn, can affect the ability of households to access food and as such impact on dietary diversity (FAO, 2015). Moreover, these changes, directly impact livelihoods systems that depend on climate-sensitive activities, such as rain-fed agriculture and livestock rearing and indirectly affects casual labour and small business because of their independency (Krishnamurthy *et al.*, 2013). Most of the casual works and small business in pastoral communities come from the land and the livestock owned and the interference of climatic change may affect the system negatively.

### **5.3 Contribution of Social Identities to Food Valuation and Food Choice**

#### **5.3.1 Healthy and unhealthy foods identification**

##### **5.3.1.1 Healthy foods**

Majority of the participants in each FGD were able to identify healthy foods based on their general perspectives and claimed to consume them frequently. Such findings imply that, the level of health awareness about the kind of foods consumed in the households of the pastoralists is satisfactory. However, other factors including self-efficacy during food preparation, strategies to overcome access barriers to foods and the shifting social norms around certain healthy foods may still be debatable in the promotion of healthy consumption in the community. The increase of knowledge/

awareness towards healthy foods itself is very important but insufficient to behavioural change in maintaining a healthy society.

Normally from the argument raised in the FGD healthy foods tend to provide nutrients which support the body's functions. This observation concurs with the observations made by König *et al.* (2018) that, a good diet includes sufficient calories and adequate protein, fat and carbohydrates, as well as vitamins and minerals such as vitamin D and calcium. According to FAO (2008a) animal based foods like milk tend to have an additional advantage of being good sources of protein and other micronutrients (calcium) that are important for bone and general health. FAO further reports that, fruits and vegetables provide vitamins and minerals for proper body growth and development and helps in prevention of diseases. These nutrients are needed in very small (micro) but in a specific amount regarding the age group/status of an individual, but they are essential for health and well-being. These micronutrients work together with the macronutrients we consumed such as carbohydrates, protein and fats in the provision of energy, build and maintain tissues and to regulate all of the body's processes (Vergnaud *et al.*, 2012). Vitamins and minerals are needed to help the body perform specific functions that promote growth, reproduction, and help maintain health and life. Our bodies require a number of different vitamins and minerals, each of which have a specific function in the body and must be supplied in different, sufficient amounts (Blumberg *et al.*, 2010).

### **5.3.1.2 Unhealthy foods**

Unhealthy foods may be referred to as any food that is not regarded as being conducive to maintaining health. It was clear through the present study that the knowledge about unhealthy foods is still insufficient among respondents in both Mvomero and Handeni

districts. Despite the fact that few of them were able to say that some of the foods may cause heart diseases and high blood pressure, it was only in the case of processed drinks that the respondents were able to describe them as unhealthy because they are highly associated with different health problems including cancer due to the presence of chemical contents. In most cases foods such as cooking oils were termed as unhealthy foods by the participants without being able to clearly justify how. Scientifically, some of the cooking oils tend to have high amount of bad cholesterol which are associated with degenerative diseases include cardiac diseases, diabetes and obesity (Wei *et al.*, 2016).

The consumption of processed foods including soft drinks are discouraged due to their high content of caloric which increases body weight without the consumer getting proper nutrition (Vergnaud *et al.*, 2012). The excess sugar consumed always is linked to insulin resistance, high triglycerides, increased levels of the harmful cholesterol and increased fat accumulation in the liver and abdominal cavity (Gunnars, 2017). And the processed drinks were mentioned as among unhealthy foods due to the chemicals present which explained a certain level of awareness regarding the associated problems of consuming high amount of processed foods.

### **5.3.2 Nutritional value**

In both districts, the communities were aware of the nutrient composition present in the foods consumed though with a moderate accuracy rate as there were some misidentifications for various types of foods. The nutrient groups identified by the communities were carbohydrate, protein, vitamin and mineral based foods. These results indicated that little is known among the individuals within the communities based on the categorization food nutrients specifically during the elaboration of carrots and milk in the prevention of eyes blindness and bone strengthening.

Generally the accessibility and availability of foods can promote or constrain the healthy eating (Applanaidu *et al.*, 2014) despite the level of nutrition knowledge of the individuals (Tang *et al.*, 2014; EFSA, 2017). And according to Gaskins *et al.* (2007); Lin *et al.* (2010) and Dressler, (2012), these parameters have a significant influence on food choices thus their absence may result to poor diet quality which emerge as a major modifiable risk factor for different health problems.

The availability and easily accessibility of nutritious food in the community that meet people's dietary needs with the high nutritional knowledge tend to widen food preferences for an active and healthy life, and determination of household's food security (FAO, 2008b; Boratyn'ska and Tofiq, 2016). For example from the adult men group discussions it was obvious that people who produced maize tended to consume more *ugali* than other foods, and for those who keep cattle consumed more animal based products such as milk especially during wet season when milk production is high.

### **5.3.3 Sociological element**

#### **5.3.3.1 Cultural effects**

Foods usually evolve from human culture, and human biological phenomena with significant sociocultural values that are an integral concept in human values. People especially in rural areas are bound to their culture hence it shapes their physical behaviours towards the surroundings including food selection and consumption patterns which transfer from generation to generation (Lu, 2012; Know, 2017).

In the present study, it was clear that food choices are influenced by the cultural norms, for example some of the eating habits such as food distribution/allocation and

preparation are relied more on the status of certain groups which are influenced by physiological factors (pregnancy/delivery/breastfeeding), age (elder, youth, children) and sex/gender (men, women). In Iraqw (Mbulu) societies the goat meat is culturally prepared for a delivered woman as the sign of appreciation from the husband and helped to regain back their energy. Preparation, allocation and procurement of milk generally involves women hence preserve their food culture (Holtzman, 2002).

In addition, when food choice transposed outside its traditional settings, in the context of economic decision-making still to other pastoral people selection of foods seem to provide culinary variety and a sense of adventure (Jingfeng, 2013; Barrena *et al.*, 2015). Many people care much on their food choice to the extent that their own utility is affected by the attributes of the ethnic food. This was also observed during the discussion when some of the participants from the Maasai ethnicity when given the picture cards for the identification of food groups and further explanation of their health benefits some of them threw away fish cards when showing to be irritated from it.

Moreover the choices and/or selection of foods are usually attached to geographic origin of the product, cultural identification and fulfillment of the family duty as observed in the present study that individuals lived in Mvomero district consumed rice several times than individuals lived in Handeni district where maize is highly produced. People normally consume what they perceived to be culturally acceptable to their societies where these societies act as a media which emic and etic values are learnt and adopted example in Maasai societies culturally, livestock and their products, such as milk, blood, and hides, are valued as main foods (Sadler and Catley, 2009; Ahmed, 2014).

### 5.3.3.2 Social status and role

A social identity includes status and roles that influence psychological valuation of rewarding experiences, drawing on evidence from behaviour and the brain (Cameron *et al.*, 2015). In the examination of influences of identity across the domains of food valuation people tend to identify themselves in three main groups' including by income level (rich and poor), ethnic group and physiological status based on the consumed foods. For example, meat based meals are valued as foods for rich people simply because their price is very expensive that low income people usually fail to achieve compared to a bunch of green leafy vegetables which is usually sold at TZS 200 or sometimes individuals may obtain it locally free from the farm.

Social groups within the societies normally lead individuals in the extension of self-concepts which are associated with positive evaluation and preferred welfare of their in-groups (Turner *et al.*, 1994). However people can shift the group-level categorization between representing themselves as individuals or as members of any one of these groups due to the multiple social identities, such as race, political affiliation, and occupation (Brewer and Gardner, 1996). Generally as depicted from the findings some of the food types and their allocations are identified usually based on age grades and sex of an individual for example in Maasai ethnicity the cow intestines and stomach are normally recognized as foods for women where beef liver are for elder women and the neck are for adult men. This is because customary social groups often leads people to favor their own groups in terms of allocation and distribution of foods (Iyer and Wright, 2016) whereby men are usually given the lion's portion, children and women are given poor foods or animal cuts. Consequently, diets within the households differ between males and females. Women generally ate low quality foods than male and elder family members hence given them inferiority food perceptions.

Furthermore, education, migration and intermarriages have observed in the present study as the contributing factors to social identifications which conquer with the observation from Correll and Park (2005) that, social identification represents an important source of social motivation within communities by providing opportunities for social interaction and psychological benefits such as self-esteem from the adoption of the certain behaviours. These sources of social motivation, social identities broadly shape social evaluation and decision-making through self-categorization and social comparison by providing a sense of individual's belonging hence reduced uncertainty of how to act within the society (Hogg, 2000; Srinivasan *et al.*, 2013; Van Bavel *et al.*, 2014; Packer and Van Bavel, 2015).

### **5.3.3.3 Attitude and beliefs**

Positive attitudes/beliefs refers to a state of mind that envisions and expects favorable results and the vice versa of negative attitude/beliefs. Positive and negative attitudes/beliefs towards foods vary from one individual to another in relation to the ethnicity which conceptualizing with the socio-cultural integration that aid a great deal with the perpetuating on the adoption of food consumption (Srinivasan *et al.*, 2013). For example in Maasai ethnicity, the consumption of some foods such as chicken, fish and eggs is still not acceptable to some individuals especially elders while for others consume them due to the influence and attachment of ridged attitudes/beliefs. Moreover, these believes and attitudes are connected with gender issues as to some pastoral communities people usually behave according to the attitude/believes which are abided to their traditions and norms that are found within the society hence affects their food consumption pattern. For example, in Maasai tradition it is believed that meat is naturally powerful so the *Moran* consumed a lot of meat to acquire the power they need for protection of themselves and their communities. However, when slaughtering an animals no woman is allowed to see the meat that is consumed by

*Morans* especially the pregnant women because women are culturally regarded as weak creatures thus if they see the *Moran's* meat it is believed to loses its natural strength and so according to their traditions *Moran* are not supposed to consume any meals that are regarded as weak. If a *Moran* consumes weak meals, he will be as weak as a woman.

It was also observed that some of the attitudes and beliefs are influenced by the availability and accessibility of the particular foods. In Handeni and Mvomero districts, pastoralists have changed their diets because of some food scarcity which have been caused by the changes of weather conditions. Maize based meals are highly consumed in these areas despite pastoral beliefs that nutritious foods are only drawn from animal source foods. Nevertheless the majorities have changed; they no longer adhere to these beliefs and attitudes; therefore access and consume diversified foods. Moreover maize meals is believed to be the main dish while other foods are less appreciated to some of the ethnic groups (Ohna *et al.*, 2012), for example Zigua people from Handeni believed that *Ugali* is the very important meal hence encourage the growth of Maize crop, and the in absence of maize within the household it is considered food insecure.

#### **5.4 Dietary Patterns in Pastoral Communities**

Pastoral communities exhibited a varied pattern of consumption for varieties of foods. In particular, the variations in the dietary patterns could be attributed to issues of food availability, accessibility and stability. In spite of the existence of different sources of food, most of the people obtained their foods from their own crops and livestock farms such as maize, beans, sweet potatoes, cassava, meat and milk, and some of them including rice, bananas and tomatoes are partly purchased while other foods like local green vegetables and wild fruits are obtained from the wild. From whichever source that the people in the study area obtained their foods, they were more likely to be

affected by seasonality as some of the foods were more available in one season and less in the other season depending on climatic conditions. Some of the foods such as local green vegetables (hare's lettuce, nightshades, jute leaves), milk, pumpkin and ripe plantain, were more available in the wet season and less available during dry season and vice versa. According to Chege and Muthamia (2016), the availability of food at the household level determines the number of meals consumed per day and its quantity and quality, which eventually translates to nutrients intake. During dry seasons where normally food production is low, households change their normal food consumption patterns and adopt coping mechanisms for survival. Some of them tend to reduce the number of meals consumed while others only reduce the quantity or consume only one food type monotonously especially if its availability is easy in comparison to other type of foods for example the consumption of *Kididio* (little amount of milk mixed with maize flour) due to the scarcity of milk and local green vegetables in dry seasons. As observed in this study, this has considerable impacts on the nutritional status of the household especially for the children and lactating women because of their special dietary requirements.

It was also noted that, is some occasions people from the pastoral communities would sell part of their excess farm produce including milk, livestock or crops to obtain cash in order to purchase other foods such as rice, green gram, round potatoes, white breads and cooking oil of their preference thus ensuring a highly-diversified diet in the household. This strategy was prominently reported during the wet season where climatic conditions are favorable for crop production in agrarian communities and there are enough pastures for livestock keepers hence resulting to high yields for consumption and commercial purposes. During the dry seasons however, where food production is significantly low and households have limited financial resources for

purchasing foods from the market; households' low purchasing power coincides with limited food availability and high food prices in the market hence culminating household's food security (Cervantes-Godoy and Dewbre, 2010; Chege *et al.*, 2015).

Apparently, part of the results also indicated that, while some of the foods were reportedly available only for one season throughout the year, there were few foods that were available in both the wet and dry season including tomatoes, onions, lemon, ginger roots, sugar and sunflower oil. This implied that, poor resourced pastoral households had limited food options especially when their postharvest food reserves are finished. In that case, they would be prompted to consume only one or two varieties of foods such as *Ugali* and more likely to reduce the amount and/or number of meals. This scenario when the accessibility and allocation of food in the household are disrupted, it puts the health status of the household members especially children at risk of nutrient adequacy. Similar observation were also presented by Swift (1981) where it was noted that, the body weight of the people examined in most agricultural groups, tended to be maximal shortly after the end of the harvest, but decreased by 2 to 5 kilograms during pre-harvest cultivation. Whereas among pastoralists, the weight is lowest during the hot, dry season when the milk supply from animals is lowest.

The use of complimentary foods was very low. Minimal consumption of infant formulas can generally be explained by various arguments. Most of the people in the pastoral communities are lacking adequate knowledge about the use of infant formulas or that the costs for obtaining such foods are higher than most of the people can afford. In addition, it could be that most of the breastfeeding women in the study area are aware about the importance and are practicing exclusive breastfeeding thus eliminating the need for infant formula and related supplements that are in most cases used when

breastfeeding is not a viable option. Moreover, the fact that, these complimentary foods were mostly consumed during the dry season compared to the wet season could be linked to food availability which is usually not a problem during the wet season (Coppock *et al.*, 1986; Oiyee *et al.*, 2006) but it is indeed in the dry season where, Na *et al.* (2016) clarified that during the shortage periods, breastfeeding women fail to adhere to dietary requirements as the result, breastfeeding women may end up getting less than the required milk to breastfeed their children.

### **5.5 Limitations of the Study**

1. Though the ideal study design for the study of this nature would have been the longitudinal design as it allows tracing behavioural changes for each of the individual cases being examined over an extended period of time; this study used cross sectional study design. The main limitations for not using the longitudinal design were due to financial and time constraints.
2. Initially this study intended to interview an estimated total of 468 respondents but until the end of the study period only 436 respondents were interviewed thus there was a gap of about 32 respondents. The expected sample size was not met due to different reasons including death and migration where some of the MoreMilkiT project participants selected as respondents had shifted to other places away from the study area; hence there was no possibility of interviewing them.

## CHAPTER SIX

### 6.0 CONCLUSION AND RECOMMENDATIONS

#### 6.1 Conclusion

The present study aimed at understanding drivers of diet change and food choice among pastoralist societies in Handeni and Mvomero districts in Tanzania. The major drivers of diet change and food choices among the pastoral communities included:

Livelihood diversification, such as livestock keeping, crop cultivation, salary/wage employment and small business that people were engaged in brought variation on the accessibility of food. Diversified activities resulted to a shift in the food choices among the pastoralists based on impacts of economic, environment, social and political pressures of their livelihood systems.

Food valuation based on inherent social and cultural values related to food, perceived importance, age, gender, economic status, ethnicity and beliefs influences the pastoral diets and food choices. These variations usually occurred from one population group (youth, adults and elders) to another because of age category and traditional beliefs/myths/taboo. The value of food however influenced by the education and intermarriage exposures which were more withheld by youth and adult than elders.

School interaction among children who are enrolled in boarding and day schools brought new ideas at home about food consumption pattern as some of the behaviours were learned and adopted through inter-ethnicity interactions in schools.

Availability and accessibility of food was affected by the seasonality. Foods such as milk, animal source foods and vegetables were more available in the wet season and

less available during dry season. This implied that community members were exposed to episodes of adequate and inadequate intake of vital nutrients such as protein, vitamin and minerals.

Pastoral livelihood system is affected by climate change which reduces the level of productivity and nutrient intake among pastoral communities. Changes of these livelihood strategies due to seasonal variations influenced by the shortage of pasture affected women and children's diet who remain at home when youths and some adult men migrated with animals to distant areas in search of pasture and water. Drivers of food choice determine the quantity and quality of food consumption in the household, nutrients intake and nutritional status of the household members.

## **6.2 Recommendations**

On the basis of the empirical findings presented in this dissertation, the following recommendations can be made;

- i. Nutrition education, communication and counseling should focus on addressing unwarranted beliefs and norms regarding food consumption to improve pastoral household nutrition status.
- ii. Stockholders working with pastoral communities should continue to address socio-cultural and environmental factors influencing food availability and accessibility in order to improve food choice and consumption.
- iii. More information should be provided in these communities to create awareness regarding food, composition and consumption.

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## APPENDICES

### Appendix 1: Guide for Semi-structured In-depth Interview for Households

**Primary respondent should be woman >30 years if possible; where multiple women exist choose the most senior / highest status woman who is responsible for food preparation in the household**

#### Introduction

*Hello my name is \_\_\_\_\_. I am working with Sokoine University in Morogoro, the International Livestock Research Institute in Nairobi and Emory University in the USA on a research study. The research is trying to understand how diets are changing in your communities and households and what is driving these changes specifically for the cattle keeping communities in Tanga and Morogoro. We would like to ask you questions about changes in your community over the last years and how these changes have affected the community including food availability and diet, health and nutrition, gender roles and poverty and livelihoods. We are trying to understand how changes in the community are affecting community members' and household diets. This information will be used to help us and others identify ways to help community and household members improve their diets, nutrition and health. As part of this research we are speaking to community members and selected household members like you.*

*I will be taking notes but I would also like to record this discussion so I don't miss anything. All the information you give will be kept confidential. Neither your name nor any of the things you tell us will be shared with anyone outside our team in a way that can identify you. Your participation is completely your choice and there is no penalty to you if you choose not to participate. Also, you are free to not answer questions you do not wish to answer and you may stop at any time. Your cooperation is greatly appreciated, as it will help us to understand the food choices and nutritional and health status of members of your household and of this community. If you decide to participate I would expect this interview to take about an hour.*

*Would you agree to participate in this study? YES / NO*

*Do you agree to this interview being recorded? YES/ NO*

**INTRODUCTORY QUESTIONS:**

Hello – thank you for taking some time to talk with us. As we indicated earlier we are very interested to understand how diets are changing in communities in this area, especially for those whom livestock keeping is important. But before we begin we would be interested in hearing a bit more about you and your family

1. I am interested to know, how long have you lived in this community?
  - a. *If arrived within past 5 years* → Where were you living before you arrived in this community? Why did you move? What changes have you seen in this community since arriving?
  - b. *If more than 10 years* → I am sure you have seen many changes in this community over the years? In your opinion, what have been the biggest changes in this community? [follow up → to identify changes in livelihood strategies, gender roles, conflict]
    - a. What do you think have caused these changes?

**I. LIVELIHOODS AND CHANGES OVER SEASONS:**

2. How has your herd changed since we visited you in August? [*probe to identify loss / gain*];
  - a. What are the reasons for these changes?
3. I would now like to know more about how your household manages its herd in the different seasons. First, please tell me the different seasons that you have here? [*identify names of seasons and months of the year they occur*]
4. How does your household graze and water the herd over the different seasons? [*follow up to identify → whether they are mobile and when and for how long during the year they are mobile; where they graze and water cattle in the different seasons; do they use fodder / ololili?*]
  - a. *Follow up* → Who is responsible for the different activities during the different seasons?
  - b. *If mobile* → How does the household organize itself when it is time to take the cattle to the other grazing / watering areas? *follow up to identify* → Who goes with cattle to grazing lands? Who remains at the main settlement)? How is this decided? Which, if any animals are left

behind at the main settlement? How do you decide which animals remain behind? Who ultimately decides? How do those who remain behind support themselves? How does this period affect those who remain behind?

5. What other types of work, if any, do the different members of this family do to support the household? [*follow up to identify → who does what work and how work differs over the different seasons; make sure respondent includes her/himself*]

**II. DIETS and FOOD SOURCING** [*Interviewer will repeat questions 6-10 for each of the different seasons specified previously, taking special care to capture diets of those who remain behind when cattle and household members are away for grazing*]

So, as we said, we would like to learn more about the diets of households in this community.

6. To help us get started, could you please describe the meals your household usually takes during this season / X season.
- a. *Follow up to identify* → how many meals? What is typically consumed for the different meals? Probe → foods and beverages and how foods are prepared – i.e. boiled, fried, roasted, etc.].
  - b. If these foods are difficult to obtain what alternatives are there?
  - c. *Follow up to identify* → Do all eat from a common pot or do some have own plate?
  - d. *Follow up to identify* → Who is served first, next, last?
  - e. *Follow up to identify* → Are there foods prioritized or reserved for specific household members? What foods are prioritized for which household members? *Probe on meat, milk*
7. During this season / season X, where does your household obtain the different foods and drinks they consume?
- a. *Follow up to identify* → Which foods are from the household's own production i.e. gardening / animal-rearing? Which are bought? Which are gathered wild? Which are from food aid?

- b. *If wild foods* → Who is responsible for gathering wild foods? How much time is spent during a week gathering wild food?
  - c. **10 stone activity** (*place 10 stones / beans / beads in front of participant and probe using the sources of food from previous question*) → if these 10 stones represented all of your food, how many stones would you say is the food produced by your household; how much is bought; from food aid? how much is through bartering; how much is through gathering.
  - d. How does your household store these foods during this season?
8. Of the foods you produce during this season, how does the family decide what to keep and what to sell?
9. Of the foods you buy during this season, how does the family decide what to buy and how much?
- a. [follow up to identify → Who decides what food is bought? Who buys the different foods?
  - b. During this season, where do you prefer to buy your foods [which markets]? Why?

***After finishing review of questions 6-9 over each season summarize the patterns you are hearing and note the differences across the seasons in terms of how the diets change, then ask →***

10. When is it most difficult to obtain and prepare the foods you want? [*probe to identify which foods are wanted more regularly*]
- a. What makes it difficult during these times? [*follow up to identify role of food availability, food price, and time available for food preparation*]
11. When is it easiest to obtain and prepare the foods you want?
- a. What makes it easy? [*follow up to identify role of food availability, food price, and time available for food preparation*]
12. Throughout the seasons do some members of the household eat differently than others, by that I mean they eat different foods or eat more or less often than others?
- a. *Follow up to identify* → who eats differently and how

b. *Follow up* → Why do they eat differently?

13. *Follow up for those not mentioned* → If there were a pregnant/ breastfeeding woman / very young child [less than 24 months] in the household how would their diet differ from others in the household? [probe foods they eat more of / foods they eat less of; probe animal source foods – meat, milk, eggs]

a. *Why do the diets of* [pregnant / breastfeeding woman / very young child [less than 24 months] *differ in this way?*

### III. CHANGE IN DIETS OVER TIME

14. Thinking back to when you were much younger how would you say the diets of your tribe have changed over time? [*follow up to identify changes in consumption of staples, milk, meats, blood, vegetables, foods grown (crops) versus foods gathered*]?

a. *Follow up to identify* → how have foods for special occasions have changed such as marriage, circumcision, funeral, coming of age ect.

b. *Follow up to identify* → Which foods does your tribe consume more of now compared to in the past?

c. *Follow up to identify* → Which do they consume less of now compared to in the past?

15. What do you think are the reasons for this change?

a. *follow up to identify -*→ changes in livelihoods, herd composition, gender roles, preferences, intermarriage, migration, loss of knowledge in growing / gathering / preparing]

16. How do you think these changes have affected your tribe?

i. *Probe to identify* → both perceived positive and negative effects

ii. *probe to identify* → effects on the health of women, men, young children, elders?

iii. *Probe to identify other effects* → social interactions / relationships

#### IV. MARKETS AND HUB INVOLVMENT

**Thank you for this I would now like to talk a bit about the markets you use.**

17. Who in the household sells in the markets? [follow up to identify → what is sold by whom]
  - a. Which markets do you sell in [probe distance to markets]?
  - b. Why do you sell in these?
  
18. *If the respondent sells in the market ask*, how do you spend the money you earn from selling [xx item].
  - a. If you earn a bit more than usual, what would you do with extra money?  
Probe → Would buy something for yourself, what would you buy?  
Why?
  - b. If you make less money than usual how does that change what you do with the money?
  - c. *If others sell in the market --* what do they do with the money that is earned?
    - i. If they had earned a bit more than usual what would they do with the extra money? Probe for all who sell – ie. men, youth, elder women / elder men
  
19. We've talked a great deal about changes in your tribe and in this community. I would now like you to think back to before the MOREMilk / ILRI project. What changes in your community have you seen or heard about that you would say are a result of the MOREMilk/ILRI project?
  - a. Follow up to identify → changes in herd management, markets, gender roles, milk availability, income from milk / animal sales, relationships between value chain actors
  
20. What changes in your household have you seen as a result of the MOREMILK/ILRI project?
  - a. Follow up to identify → diets, milk availability at household level; milk consumption by household members; money available for spending on food?

Thank you for taking this time with us. We have one more quick set of questions but before we begin can you let me know your age? Thank you – this last section I will record on this piece of paper so I can now turn off the recorder.

**COMPLETE ONE PER HOUSEHOLD INTERVIEWED/TURN OFF RECORDER**

HHID: \_\_\_\_\_ Name of head of household: \_\_\_\_\_

Respondent name: \_\_\_\_\_

Respondent gender: M F

Respondent age: \_\_\_\_\_

Respondent tribe: \_\_\_\_\_

Date of interview: \_\_\_\_\_

Interviewer: \_\_\_\_\_

21. I would now like ask you about specific foods and how often your household eats these foods of dishes made from these foods over the course of a year. I have a long list of foods and will ask you to tell me, when these foods are in season, whether you eat these foods several times a week (usually), a few times a month (often), a few times a year (rarely) or never

Local Name	English Name	Usually	Often	Rarely	Never
<b>Cereals, breads</b>					
Mkate	Bread, with wheat flour				
Chapati	Chapati with wheat flour				
Mkate wa unga uliokobolewa	Bread, loaf, white				
Mkate wa ngano isiyokobolewa	Bread, loaf, whole wheat				
Mahindi yasiyokobolewa	Maize, cracked (dehulled), raw				
Unga wa mahindi wa Kiwandani (industrially packaged)	Maize, white, flour, refined, 85% extract				
Unga Sembe	Maize, flour, dry, dehulled, locally processed				
Unga wa mahindi wa Dona	Maize, flour, dry, whole / unhulled, locally processed				
Mahindi makavu	Maize, dried, raw				
Mahindi mabichi (raw, white)	Maize, green (white), raw				
Mahindi mabichi (raw, yellow)	Maize, green (yellow), raw				
Uwele	Millet, bulrush				

Local Name	English Name	Usually	Often	Rarely	Never
Ulezi	Millet, finger				
Tambi (pasta)	Pasta (Spaghetti/noodles), wheat, dry				
Mchele wa kahawia	Rice, brown, raw				
Mchele	Rice, white, raw				
Unga wa mtama	Sorghum, flour				
Unga wa ngano	Wheat, flour, all purpose, 72% extract				
<b>Roots, Tubers</b>					
Viazi mviringo vibichi	Potato, english, raw				
Viazi vikuu vibichi	Taro, raw				
Magimbi mabichi	Yam, raw				
Unga wa muhogo	Cassava, flour				
Mihogo mibichi	Cassava, tuber, raw, fresh				
Mihogo iliyokaushwa	Cassava, tuber, dried				
Viazi vitamu (white) vibichi	Sweet potato, white flesh, raw				
Viazi vitamu, chungwa	Sweet potato, orange, raw				
Viazi vitamu njano vilivyopikwa	Sweet potato, yellow, raw				
Matoke	Banana, large, unripe (cooking banana)				
<b>Beans, Peas, Nuts</b>					
Maharage makavu	Bean, kidney, dried, raw				
Maharage Mabichi	Bean, kidney, green, raw				
Choroko (green grams)	Bean, mung, raw				
Koroshu	Cashew nut				
Kunde mbichi	Cowpea, green, uncooked				
Kunde kavu	Cowpea, dried, uncooked				
Dengu	Lentils (also called Chickpeas), dried, raw				
Mbaazi mbichi	Pigeon pea, green				
Mbaazi kavu	Pigeon pea, raw, dried				
Soya	Soybean, dried, raw				
Karanga	Groundnut, shelled, dried, raw				
Njugu Mawe	Bambara Nuts, dried				
Unga wa dengu	lentil, flour				
Ufuta	Sesame, dried				
Mbegu za maboga	pumpkin, seed, dried				
<b>Meats</b>					
Utumbo	Beef, intestines and stomach, raw				
Nyama	Beef, meat, raw				
Nyama, Maini mbichi	Beef, liver, raw				
Maharage makavu	Beef, kidney, raw				

Local Name	English Name	Usually	Often	Rarely	Never
Kuku wa kienyeji	Chicken, local raw, whole				
Kuku wa nyama	Chicken, broiler, raw, whole				
Maini/utumbo wa kuku	Chicken, liver (and / or other organs)				
Miguu ya kuku	chicken, feet				
Nyama ya mbuzi	Goat, meat, raw				
Maini ya mbuzi	Goat, liver				
Figo za mbuzi	Goat, kidney				
Utumbo wa mbuzi	Goat, intestines				
Makanyagio/miguu ya mbuzi	Goat, hooves				
Nyama ya kondoo	Mutton, meat raw				
Nyama ya nguruwe	Pork, meat raw				
Utumbo wa nguruwe	Pork, intestines and stomach, raw				
Sungura	Rabbit, raw				
Bata	Duck, raw				
<b>Fish, seafood</b>					
Dagaa wakavu	Fish, small, dried				
Dagaa wa kukaanga	Fish, small, fried				
Kambale wabichi	Lung fish, fresh				
Kambale wa kukaanga	Lung fish, fried				
Kambale wa kubanikwa	Lung fish, smoked, dried				
Perege wabichi	Tilapia, fresh				
Perege wa kukaanga	Tilapia, fried				
Perege wa kukausha kwa moshi/chumvi.	Tilapia, smoked/salted				
Sangara wabichi	Nile perch, fresh				
Sangara kukaanga	Nile perch, fried				
Sangara kukausha	Nile perch, dried				
Kamba wabichi	Prawn, fresh, large				
Kamba wakavu	Prawn, dried, large				
Uduvi	prawn, dried, small				
<b>Eggs</b>					
Mayai ya kuku wa kienyeji	Egg, chicken, local				
Mayai ya kuku wa kisasa	Egg, chicken, layers				
Mayai ya bata	Egg, duck				
<b>Dairy</b>					
Maziwa wa ngombe	Milk, cow, fresh,				
Maziwa ya mbuzi	Milk, goat				
Maziwa ya unga (yasiyo na mafuta)	Milk, cow, powdered, nonfat				
Maziwa ya unga (whole fat)	Milk, cow, powdered, whole				
Maziwa ya pakiti	Milk, cow, UHT				
Maziwa ya unga	Milk, powder, fortified				

Local Name	English Name	Usually	Often	Rarely	Never
ulioongezwa virutubisho					
Mtindi wa kiwandani	Yogurt, industrial				
Maziwa mgando	Fermented milk, local				
<b>Vegetables</b>					
Kabichi (kijani au nyeupe)	Cabbage, green or white, raw				
Spinachi	Swiss chard				
Sukuma wiki	Kale, raw or cooked				
Figiri	Turnip greens				
Chainizi	Chinese mustard greens				
Kisamvu	Cassava, leaves				
Majani ya kunde	Cowpea, leaves				
Mgagani	Spider plant, leaves				
Mchungu	Hares lettuce				
Matembele	Sweet potato, leaves				
Mchicha	Leaf, amaranth, raw				
Majani ya Kitunguu	Onion, leaves				
Majani mashona nguo	Blackjack, leaves				
Mlenda	Leaf, jute, raw				
Mnavu	Nightshade, leaves				
Majani ya maboga	Pumpkin, leaves				
Majani ya magimbi	Taro, leaves				
Vitunguu	Onion tuber				
Boga	Pumpkin, raw				
Biringanya	Eggplant, raw				
Nyanya Chungu	African eggplant, raw				
Ndizi mzuzu	Plantain, ripe, raw				
Ndizi mbichi	Plantain, unripe, raw				
Karoti	Carrot, raw				
Bamia	Okra, raw				
Lettusi	Lettuce, raw				
Pilipili hoho	Pepper, sweet, green, raw				
Pilipili kali	Pepper, hot				
Nyanya	Tomato, red, ripe, raw				
<i>Any <b>vegetables</b> that I have not mentioned that are eaten? indicate name, source (gathered, market, home production) and frequency in columns below</i>					
Name (local)	Source				
<b>Fruits</b>					
Ndizi kisukari	Banana, small, sweet				
Ndizi za kuiva	Banana, large, ripe				
Pera	Guava				
Tikiti maji	Watermelon				
Matopetope	Cherimoya (custard apple, sweetsop))				
Stafeli	Soursop				
Nanasi	Pineapple				

Local Name	English Name	Usually	Often	Rarely	Never
Fenesi	Jackfruit				
Sambia	Loquat				
Embe	Mango				
Chungwa	Orange				
papai	Papaya, ripe or unripe				
Pasheni	Passion fruit				
Pasheni	Passion fruit, granadilla, purple				
Chenza	Tangerine				
Parachichi	Avocado, pulp				
Ukwaju	Tamarind				
Ubuyu	Baobab fruit				
Epo	Apple				
Nazi	Coconut, whole				
Chungwa	Orange				
Papai	Papaya, fruit, ripe				
Limao	Lemon				
<i>Any <b>fruits</b> that I have not mentioned – indicate name, source (gathered, market, home production) and frequency in columns below</i>					
Name (local)	Source				
<b>Fats, oils</b>					
Mafuta ya wanyama	Fat, animal				
Kimbo - Mafuta ya kiwandani yaliyoongezwa virutubishao	Fat, vegetable, white, fortified				
Kimbo - Mafuta ya kiwandani yasiyoongezwa virutubishao	Fat, vegetable, white, unfortified				
Siagi ya Mkate	Margarine				
Mafuata ya alizeti	Oil, sunflower				
Mafuata ya ufuta	Oil, sesame				
Mafuta ya mahindi	Oil, corn				
Siagi	Butter, from cow's milk				
Mafuata ya Mawese mekundu	Oil, palm, red				
Mafuta ya mawese yaliyosafishwa	Oil, palm, flesh				
Mafuta ya mawese sugars and sweets	Oil, palm, kernel				
Halfkeki	Half cakes (no egg)				
Keki	Queen cakes				
Chokolade	Candy, chocolate				
Pipi Ngumu	Candy, hard				
Bublish, big G	Chewing gum				
Biscuti	Cookie				
Juice ya Miwa	Sugar cane, juice				
Muwa	Sugar cane, whole				
Mandazi (african donut)	Wheat, dough, deep fried				

Local Name	English Name	Usually	Often	Rarely	Never
Biscuit	Biscuit, sweet, packaged				
Asali	Honey				
Sukari Guru	Molasses				
Sukari nyeupe	Sugar, white				
Sukari	Sugar, brown				
<b>Condiments</b>					
Magadi soda	Baking powder				
Kyoko	Bouillon mix				
Iiki	Cardamom				
Pilipili za kijani/Mbuzi	Chilli, green, raw				
Pilipili nyekundu	Chilli, red, raw				
Kokoa	Cocoa, powdered				
Binzari	Curry powder				
Glucose	Glucose powder				
Chumvi ya Madini	Salt, iodized				
Chumvi ya isiyo na Madini	Salt, non- iodized				
Vitunguu swaumu	Garlic, raw				
Madalasini	Cinnamon, ground				
Malimao	Lemon				
Tangawizi	Ginger, root, raw				
Pilipili manga	Peppercorn, black, ground or whole kernel				
Viungo Mchanganyiko	Spices, mix, ground				
<b>Beverages</b>					
Bia	Beer, commercial				
Pombe za kienyeji	Beer, local brew, grains]				
Pombe ya Asali	Beer, local brew, honey				
Pombe ya miwa	Beer, local brew, molasses				
Pombe mchanyiko	Beverage mix, bottled liquid				
Fruto	Beverage, blackcurrant syrup, ribena				
Soda,	Beverage, carbonated, non-alcoholic				
Juisi	Sweetened colored juice flavored drinks				
Majani ya chai	Black tea, leaf				
Mchachai	Chamomile, tea				
Majani ya mchai chai	Lemongrass tea				
Milo	Chocolate mix, powdered, milo				
Kahawa	Coffee, ground, dry				
Kahawa iliyotayari	Coffee, instant				
Togwa	local partially fermented cereal drink, sugar added				
Madafu	Coconut, water				
Juisi ya Chungwa	Orange, juice				

Local Name	English Name	Usually	Often	Rarely	Never
Mchanganyiko wa chakula cha mtoto cha nafaka	Infant cereal				
Mchanganyiko wa chakula cha mtoto (maziwa)	Infant formula				
<b>Prepared Snacks</b>					
Chips	Potato, strips, fried				
Crisps	Crisps and other packaged savory snacks				
Kake za viazi	Potato pancakes				
Bagia	Bajhia				
Kitumbua	Kitumbua, snack like andazi, made from rice				
Soseji	Sausage				
Sambusa	Samosa				
Udongo	Soil				
<i>Any <b>snacks</b> that I have not mentioned that are eaten? indicate name, source (market, home production) and frequency in columns below</i>					
<i>Name</i>	<i>Source</i>				
<i>Any <b>other foods</b> that I have not mentioned that are eaten? Indicate name, source (market, home production) and frequency in columns below</i>					
<i>Name</i>	<i>Source</i>				

## **Appendix 2: Guide for Key Informant Interviews**

*Hello my name is \_\_\_\_\_. I am working with Sokoine University in Morogor, the International Livestock Research Institute in Nairobi and Emory University in the USA on a research study. The purpose of this study is to learn about cattle-keeping communities in Tanga and Morogoro Today we would like to ask you questions about changes in your community over the last years and how these changes have affected the community including food availability and diet, health and nutrition, gender roles and poverty and livelihoods. We are trying to understand how changes in the community are affecting community members' diets. This information will be used to help us and others identify ways to help community members have good diets, nutrition and health. As part of this research we are speaking to community members and also community leaders such as yourself from this and five other communities in Tanga and Morogoro.*

*I will be taking notes but I would also like to record this discussion so I don't miss anything. All the information you give will be kept confidential. Neither your name nor any of the things you tell us will be shared with anyone outside our team in a way that can identify you. Your participation is completely your choice. You do not have to participate if you do not want to. There is no penalty to you if you choose not to participate. Also, you are free to not answer questions you do not wish to answer and you may stop at any time. Your cooperation is greatly appreciated, as it will help us to understand the food choices and nutritional and health status of members of your community. If you decide to participate I would expect this interview to take about an hour.*

*Would you agree to participate in this study? YES / NO*

*Do you agree to this interview being recorded? YES/ NO*

### **I. General Background**

How long have you been a {position} in this community? What did you do before you came here in this position?

1. Since you've started working as a [position] what important changes (if any) have you observed in this community?

*Follow up depending on leaders' occupation →*

- a) How have markets changes?

- b) How have livelihoods / activities required as means of living changed?
  - c) How have the roles and responsibilities of women and men changed?
  - d) **For all**, Probe positive changes, negative changes
2. What do you think are the main drivers of these changes?
  3. How do you think these changes have affected the community?  
*Follow up depending on response* → In what ways have these changes specifically affected women and children?
  4. *Follow up depending on response* → What have been the impacts of these changes on the nutrition and health of community members?

## II. Poverty and Wealth

1. What are all the characteristics that would describe a very wealthy (better-off) person within this community?
  - a. *Follow up* → *livelihoods / economic strategies; assets as well as cultural and social characteristics;*
  - b. *Follow up* → *probe on diets and food preferences:*
2. What are all the characteristics that would describe a middle wealthy person within this community?
  - a. *Follow up* → *livelihoods / economic strategies; assets as well as cultural and social characteristics;*
  - b. *Follow up* → *probe on diets and food preferences:*
3. What are all the characteristics that would describe a poor person within this community?
  - a. *Follow up* → *livelihoods / economic strategies; assets as well as cultural and social characteristics;*
  - b. *Follow up* → *probe on diets and food preferences:*
4. [*Using 10 stones*], Here I have 10 stones, lets imagine that these represent all the members of {community X};
  - (a)As best as you can tell, how many stones represent the proportion of very wealthy/better-off households in your community (from 0 to 10)

(b) As best as you can tell, how many stones represent the proportion of middle wealthy households in your community (from 0 to 10)

(b) As best as you can tell, how many stones represent the proportion of poor households in your community (from 0 to 10)

5. How have these numbers changed since you've been in this position?
6. What are the reasons why some households are more/ better-off in your area?
7. What are the reasons why these households are poor in your area? [*Probe which type of households –i.e. head of household (female, widow, youth, elderly), landless/livestockless people, families with many children, without jobs, living in remote areas, etc.*]

### **III Food Security**

1. Are any seasons or months of the year when some households are more likely to experience food shortages? If yes, when do such times of hunger occur?
2. Which types of households are most vulnerable to food shortages? Follow up if needed → What makes them vulnerable [*Probe-if the respondent hesitates, suggest which type of head of household (female, widow, youth, elderly), landless/livestockless people, families with many children, without jobs, living in remote areas, etc.*]
3. Within a households, which members are more likely to be exposed to / harmed by hunger and food insecurity? [*Probe- young women, widow, youth, elderly, very young children*]? Follow up → Why are these members more likely to be exposed?
4. What year was the most recent severe food shortage? What was the cause of this shortage?
5. What did people do to cope with the food shortages during that period? [*Probe: Practices such as increased livestock sales, off-farm employment, or reduction of consumption and number of daily meals taken*]

- a. What type of outside assistance if any did households in this community receive during the most recent time of widespread hunger and food insecurity? What was received and who provided?
6. During the most recent food shortage, what happened in the local markets? [*Probe: Changes in supply of food, increased livestock sales, price fluctuation, etc.*]
    - a. *Follow up* → how did this compare to previous periods of food shortage?
  7. How often do serious food shortages occur in this community? Has this increased or decreased since you began working in this position?
    - a. *Follow up* → how have families' coping strategies to food shortages changed since you have been in this position?
    - b. *Follow up* → what do you think are the reasons for these changes?
  8. What are the biggest current threats to hunger and food security in this community?
    - a. *Follow up if water not mentioned* → How big of a threat are water issues to hunger and food security in this community? [*probe for reasons*]
    - b. What are the main constraints concerning water faced by the people in your community?
  9. What do you think can be done to reduce food shortages and hunger in the community? [*probe on water*]
  10. What is currently being done within the community to enhance the food security or health and nutrition of community members? *Probe* → who is doing what activities?

### **Changes in food systems**

1. Since you have been a [XXX] how have diets in this community changed?
    - a. *Follow up* → What are some foods community members now eat more of?
    - b. *Follow up* → What are some foods they eat less?
- [*if not mentioned probe: animal source foods -- how has consumption of animal-sourced foods changed [probe: milk, meat, eggs, fish];*]

2. How has the preparation of foods changed in the households [*probe – frying versus boiling; cooking foods that take less time*]? Are there foods that households no longer prepare [depend on vendors to prepare]
3. What do you think has caused these changes in diets
  - a. *probe changes in types of foods and changes in preparation methods*
  - b. *potential probes → climate change, limited accessed to land / water; mobility of people, importation of foods from marriages; TV/radio advertising making food more appealing, availability, affordability, and/or fewer doing own production*]?
4. What do you feel has been the nutrition and health impacts of these changes in diets?
  - a. Follow up if not mentioned -- What do you think the nutritional and health impacts of these diet changes have been specifically for women?
  - b. Specifically for children 24 months or younger?
5. What would you say are the biggest threats to poor nutrition and health in this community today?

**Women’s Empowerment (decision-making focus)**

1. How are major decisions usually made by households in this community (*probe for process → i.e. sit down discuss / man only decides / woman only decides, etc.*)
 

*Then follow up specifically about food →*

  - a. What kinds of decisions about the household does a wife typically make on her own? Which does she make in partnership with her family?
  - b. What kinds of decisions about the household does the husband typically make on his own? Which does he make in partnership with her family?
  - c. How much say do women have in deciding what foods (crops / animal products) are sold in the markets or retained at home?
  - d. How much say do women have in deciding when to slaughter animals for meat?
  - e. How much say do women have in what foods are bought in the markets? (*probe different foods – staples, vegetables, meat / eggs / milk*)

2. If women had more say in household decision making how would that affect the health and nutrition of the household – [*Probe if not mentioned– her own health and nutrition / child health and nutrition*]
3. If she had more say about the foods that are kept for home consumption or bought in the markets how would that affect the health and nutrition of her household? [*Probe if not mentioned– her own health and nutrition / child health and nutrition*]
4. How has women’s involvement in household decision making changed since you first started this role? What are the reasons for these changes?
5. What constraints are there for women to have more say in decision making?
6. What would help women have more say in decision-making? [*probe if not mentioned → own income, inheritance, dowries, education, access to land, credit other resources etc.*]
7. Thank you, we have reached the end of our interview. Do you have anything else you would like us to know about your community?

### **Appendix 3: Guide for Focus Group Discussion**

Introduction (5 min):

Hello all. My name is [*say facilitator's name*] and this is [*note taker and translator*]. We are working with Sokoine University in Morogoro, International Livestock Research Institute in Nairobi and Emory University in Atlanta USA. As we mentioned with each of you earlier, we are asking you to participate in this discussion for a research project. The research is trying to understand how diets are changing in your communities and what is driving these changes. We are asking your community to participate because you have been recently involved with ILRI. We believe the findings from these discussions will assist local government and organizations develop more effective programs with this community and others related to nutrition, health and community development.

The discussion will last about [*1.5 hour for elders / youth; 2 hours for adult men/women*]. We will provide you with a tea break and small token of our appreciation for participating. If you need to excuse yourself at any time during the course of the discussion, please feel free to do so. Your participation in the discussion is completely voluntary. You may leave at any time and you can choose not to answer questions you do not wish to answer.

With your permission we would like to record this discussion on this recorder so that we don't miss anything. We will also take notes. No one else except members of our team will listen to the recording or see the notes. All information that you will provide will be kept confidential by us. Your name and other facts that might point to you will not appear when we write about or present the findings from our discussion. We will not use your name or any other information that can identify you in the reports that we write.

We ask that you respect one another's privacy and not repeat what you hear during the discussion to others outside of this group. We cannot guarantee that what you say will not be repeated by others participating in this group and so you do not need to share your own personal experiences if you do not wish to.

Do you have any questions about what I've discussed so far? [*Answer questions if there are any – be prepared with MoreMilkiT findings if they ask*]

With all of this information, would you like to participate in this discussion today? [*Wait for confirmation that they consent to participation*].

Do I have your permission to record this discussion? *[Wait for confirmation that they consent to being recorded].*

### **I. Introductions and Community Change (10 min)**

1. Before we get started we would like to know a bit more about you – lets go around and please say your name and how long you have lived in this community.
2. Since you all were younger what major changes have you seen in this community?
  - a. *If not mentioned, follow up* → how have livelihoods changed? [what people do to support their households]; how have men and women's roles changed?
3. How have these changes affected the community?
  - a. *If not mentioned, follow up* → how have changes affected children; how have they affected women?

*If elders or youth then skip to part III.*

### **II. Seasonal and gender division of labor and household activities [TO BE DONE ONLY WITH MEN/ WOMEN GROUPS – NOT ELDERS / YOUTH] 30 min**

#### **Seasonal Calendar**

**Objective:** (i) To explore how seasonal variations affect the labor burdens and time allocation and how this has changed over time. **Time:** 40 minutes

**Materials:** flip chart and markers, recorder, notebook and pen for note taker, seeds or stones

**Facilitator note:** Reference the below table for structuring your seasonal calendar but fill it in with what the participants say. Develop the calendar on the flipchart paper on the ground or in front of the group. The facilitator will write up what the participants say.

*Facilitator: Before we start talking more about food I would like to know a bit more about this community and how the work and activities you do change over the season. To help us with this I am going to draw out a calendar that we can fill in together.*

1. So, first can you tell me what are the seasons in this community and when do they occur? [indicate on calendar] What about special events / holidays / festivals -- When are they?
2. Great! Now what are the main livelihoods in this community, by that I mean the primary way households support themselves?

So [X, Y and Z are the main livelihoods] let's start with X [write it on the calendar]-- what are all of the activities that people do for that livelihood [list them off as they are named]; what about livelihood Y, what are the major activities people do for Y [list them as named], and what are the activities that people do for Z. What are some other common ways people make income or support their families that we have not mentioned? {list but don't probe on specific activities}

3. Thank you --I would like for us to indicate when these different activities occur throughout the year and who participates in them. Let's start with the first activity listed for [livelihood X) *[For those that done all year, ask the participants to indicate when work is heaviest for that activity and when it is lightest]*.
  - a. When is this activity done? When is work heaviest / lightest for this activity
  - a. Who is primarily responsible for doing activity X -- men, women, both equally, children, elders? Indicate on calendar; if it changes throughout the year then indicate that on the calendar with symbols
4. Now let's talk about household tasks -- what are the various household activities that are done that are important for the household [probe -- fetching water, firewood; cooking; building / repairing structures; cooking, laundry, caring for children --*indicate on calendar]*.
  - a. Is the amount of time spent on these different activities the same throughout the year or does it change over the seasons? What increases / decreases and when? *[Indicate when on calendar]*
  - b. Who does these activities? [men, women, elders, children, some combination]? If depends on season, probe how.

5. Thinking about all of the activities that are done throughout the year, when is there more time for leisure activities? When is there less or no time for leisure?

**See detailed example of seasonal livelihoods calendar and gender division of labor table in facilitator manual**

	Months of the year												Division of Labor by Gender / Age			
	J	F	M	A	M	J	J	A	S	O	N	D	Women	Men	Children	Elders
Seasons																
Special events																
Main																
Livelihood(s)																
Livelihood																
Activities																
Other																
Livelihoods																
Household tasks																

**III. TYPICAL DIET PATTERNS IN COMMUNITY (15 MIN)**

4. I would now like to know more about diets in this community. How would you all describe the diets of [women/ men] your age in this community? [*allow to free describe with some clarification probes before following up with categories below*]
- Have them identify foods and drinks that most [men/women] their age take nearly every day [staples, vegetables, beans/meats, milk, tea, snacks; probe preparation method – boiled, fried, dried, etc. as relevant];
  - Foods and drinks taken several times a week, but not every day [probe snacks; special dishes, preparation methods]?
  - Foods or drinks taken only a few times a month or only during specific seasons [probe snacks, preparation method, special dishes, meats /fish / eggs]?
  - Foods or drinks that are rarely or never taken. Why are these foods rarely taken foods?
5. So if I am hearing your right, [*summarize diet pattern*]. How would you say the diets of [men/women] your age differ from other groups in the community?

- a. *If not mentioned, follow up* → Are there foods [men/women] your age eat that other groups in the community don't eat? [*probe different gender groups, different age groups / different tribes, etc.*]
- b. Why do you think they don't eat those foods?
- c. *If not mentioned, follow up* → Are there foods that others typically eat that [men/women] your age don't generally eat? [*probe different gender groups, different age groups / different tribes, etc.*]
- d. Why do you all generally not eat these foods?
- e. What are other reasons for these differences?

#### **IV. FOOD SOURCING (5-10 min)**

6. For all of these foods we have discussed, which foods do most people in the community obtain by buying?
  - a. Which do they produce at home for themselves?
  - b. Which do they barter / trade for?
  - c. Which do they gather from the wild?

#### **V. CHANGES IN DIETS OVER TIME (10 min)**

4. Now I would like to think back to when you were much younger --how have diets in this community changed since then?
  - a. *If not mentioned, follow up* → Which foods or drinks are taken more now than in the past? *Probe food types and preparation method*
  - b. *If not mentioned, follow up* → Which foods or drinks are not taken as much now as in the past? *Probe food types and preparation method*
  - c. What do you all think have caused these changes?
    - II. Probe on changes in types of foods / drinks taken
    - III. Probe on changes in ways foods are prepared – boiled, fried
  - d. Which foods from the past do men/women your age wish you could have more of? Why are you unable to eat these as much as you would like?

## VI. FOOD VALUATION (35 min)

### **Pile Sorting Food Valuation**

**Objective:** (i) To understand the different values ascribed to specific foods Time: 30 minutes

**Materials:** two sets of labeled, color pictures of foods / meals; recorder, notebook and pen for note taker

**Facilitator note:**

I would now like us to do an exercise about different foods. I have here a set of picture cards with foods, drinks and meals on them. I will ask you a series of questions about the foods and ask you to sort the cards into piles.

1. First how would you group these foods –put them into categories that make sense to you. [Debrief about how they grouped their foods and why they put those foods together]
2. Which of these foods and drinks can be found in this community and which are not commonly found?
3. Which of these are important to have at social events such as weddings, birth celebrations, coming of age ceremonies, funerals, tribal meetings [probe reasons why different foods are at different events]
4. Now, of these foods and drinks – which would do people say are good for the health / for the body?
  - a. Follow up → why do people say these are good for health? What do these foods do for the body?
  - b. Which are not good for the body→ why do people say these are good for the body / not good for the body]
  - c. Are there foods or drinks that certain groups of people should not or cannot take? For example young infants, pregnant women; breastfeeding women, elders? Why are these foods not taken? → Why should they not take these?
5. Which of these foods, if they were consumed in front of others such as neighbors / friends would cause people to think you were of high status?
  - a. Which foods would cause people to think you might be of low status?

6. Which foods are considered to be more convenient– meaning they require less time, fuel or water for cooking – and those that are less convenient?
7. We have talked about different characteristics of foods that are available in this community such as healthy, convenient, high status → when people are choosing what foods to buy what do you think they prioritize most – the cost of the food, the convenience, the healthfulness, or the status the food might bring?
  - a. Follow up → how might this differ by gender or age of the buyer?

Thank you very much – this has been a very interesting conversation. Before we close do you have anything to add to our discussion about diets in this community or how diets have changed over the years?

Do you have any questions for us?

**Appendix 4: Approval Letter from NIMR**

**THE UNITED REPUBLIC  
OF TANZANIA**



National Institute for Medical Research  
3 Barack Obama Drive  
P.O. Box 9653  
11101 Dar es Salaam  
Tel: 255 22 2121400  
Fax: 255 22 2121360  
Email: [headquarters@nimr.or.tz](mailto:headquarters@nimr.or.tz)

Ministry of Health, Community  
Development Gender, Elderly & Childre  
6 Samora Machel Avenue  
P.O. Box 9083  
11478 Dar es Salaam  
Tel: 255 22 2120262-7  
Fax: 255 22 2110986

NIMR/HQ/R.8a/Vol. IX/2387

10\* January 2017

Prof Joyce Kinabo,  
SUA, College of Agriculture,  
Department of Food Science Technology, Nutrition and Consumer Sciences  
P.O. Box 3006 MOROGORO.

**CLEARANCE CERTIFICATE FOR CONDUCTING  
MEDICAL RESEARCH IN TANZANIA**

This is to certify that the research entitled: Understanding the Drivers of Diet Change and Food Choice Among Tanzanian Pastoralist to Inform Policy and Practice (Kinabo *et al*), has been granted ethical clearance to be conducted in Tanzania.

The Principal Investigator of the study must ensure that the following conditions are fulfilled:

1. Progress report is submitted to the Ministry of Health, Community Development, Gender, Elderly & Children and the National Institute for Medical Research, Regional and District Medical Officers after every six months.
2. Permission to publish the results is obtained from National Institute for Medical Research.
3. Copies of final publications are made available to the Ministry of Health, Community Development, Gender, Elderly & Children and the National Institute for Medical Research.
4. Any researcher, who contravenes or fails to comply with these conditions, shall be guilty of an offence and shall be liable on conviction to a fine. NIMR Act No. 23 of 1979, PART III Section 10(2).
5. Site: Kilosa, in Morogoro and Handeni, in Tanga.

Approval is for one year: 10<sup>th</sup> January 2017 to 09<sup>th</sup> January 2018.

Name: Prof Yuri us Daud Mgaya

Signature  
CHAIRPERSON  
MEDICAL RESEARCH  
COORDINATING COMMITTEE

Name: Prof. Muhammad Bukari Kambi

Signature  
CHIEF MEDICAL OFFICER  
MINISTRY OF HEALTH, COMMUNITY  
DEVELOPMENT, GENDER, ELDERLY  
&CHILDREN

CC: RMO Tonga, Morogoro  
DED  
DMO