FOOD SECURITY IN THE SEMI-ARID MACHAKOS COUNTY: A CASE STUDY OF MWALA SUB-COUNTY

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DECLARATION

I understand that plagiarism is an offence and I declare therefore that this research thesis is my original work and has not been presented to any other institution for any other award

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DEDICATION

This thesis is dedicated to my husband Stephen Ndolo Kilika and our sons Daniel and Ezra.

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ACRONYMS

AE	Adult Equivalents
AWSC	African Women's Studies Centre
CBOs	Community Based Organizations
DFID	Department for International Development
FAO	Food and Agricultural Organization
FGDs	Focus Group Discussions
FNS	Food and Nutrition Security
GOK	Government of Kenya
HFS	Household Food Security
HH	Household
IARCs	International Agricultural Research Centres
IFIs	International Financial Institutions
KFSSG	Kenya Food Security Steering Group
NARES	National Agricultural Research and Extension Systems
NGOs	Non-Governmental Organizations
OLS	Ordinary Least Square
ROK	Republic of Kenya
SSA	Sub-Saharan African
TEEAL	The Essential Electronic Agricultural Library
USAID	United States Agency for International Development
VIF	Variance Inflation Factor
WFP	World Food Program
WHO	World Health Organization

ABSTRACT

Ensuring food security is a global significant challenge despite struggles to increase agricultural productivity, food distribution and identify appropriate policy interventions to cub food shortage. The recent recurrent incidences of food deficit in Kenya have placed the nation among the 20 most food insecure countries in the world. Food insecurity in the country is a prevalent issue since approximately 84% the country's landmass is covered by arid and semi-arid land. Achieving sustainable food security in these regions is a major challenge. The sub-county of Mwala is located within the semi-arid marginal agricultural zone of the south-eastern and coastal lowlands. The zone is often drought prone, exposing its households to occasional chronic and recurrent acute food insecurity. To alleviate food insecurity in Mwala Sub-county, the study examined the level and knowledge of food security in Mwala sub-country and the factors that affect availability, access, utilization and stability of food and nutrition. The study examined how socio-economic, natural and physical factors influence food security and their impact on alleviation of food and nutritional deficits. The research approach involved exploratory, descriptive and participatory research designs. Purposive and simple random sampling methods were used to select four locations and a sample size of 84 farmers groups. The data was subjected to descriptive analysis using SPPS Version 21 and the relationship between variables determined using Multiple Linear Regression Analysis. A binomial logit model was employed to assess the factors affecting awareness of food security. The study showed that gender, education, and income of the households were the main determinants of food security awareness. The status of food security amongst residents of Mwala sub-county is very low as depicted by a 98% response. Only 2% of the respondents evaluated food security status in their households as food secure. Additionally, the model summary shows that 76.3% of variation in food security can be explained by the three predictors namely; natural factors, socio- economic factors and physical factors. This implies that the remaining 23.7% of the variation in food security could be accounted for by other factors not included in this study. These findings provide policy insights on key areas of intervention with respect to uptake of food security in the Sub-county, County and ultimately the country at large.

<div align="center">**CHAPTER ONE**</div>

INTRODUCTION

1.1. Background Information

Food security remains a significant challenge despite global struggles to identify and implement appropriate policy interventions which include increasing agricultural production and improvement of food distribution (FAO, 2014). All over the world food crisis and on-going chronic and acute food insecurity problems clearly demonstrate that numerous people are becoming susceptible to political, climatic and economic shocks that threaten food and nutritional availability, access, utilization and stability (FAO, 2014).

Like other Sub-Saharan African (SSA) countries, the prevalent food insecurity in Kenya is attributed to a number of factors including socio-economic, physical and natural, high rate of post-harvest food losses, unstable food prices and limited household income (Wambua *et al.,* 2014; Icheria, 2015). The recent recurrent incidences of food deficit in Kenya has made it one of the 20 most food insecure countries in the world (Icheria, 2015). Over the years there has been a continual decline in crop and livestock diversity, increasing vulnerability of smallholder farmers to food insecurity (Achonga *et al.,* 2015).

A growing recognition that a lot of factors affect food security in arid and semi-arid regions of the country has been on the rise (Wambua *et al.,* 2014). Approximately 84% of Kenya's landmass is arid and semi-arid land, hence not suitable for rain-fed agriculture (ROK, 2010). The Sub-county of Mwala in Machakos County is located within the semi-arid marginal agricultural zone of the south-eastern and coastal lowlands with a population of 163,032 people, 7,150 registered farmers and 275 farmers' groups. The region is typically characterized by unevenly distributed rainfall of between 500-1250mm per annum (GOK, 2009), where most the farmers practice subsistence farming. Consequently, the zone is often drought prone, exposing households to occasional chronic and recurrent acute food insecurity. At the same time, livestock production in the sub-country is limited to drought tolerant indigenous livestock breeds which have a low productivity capacity (KFSSG, 2008).

Amwata *et al.,* (2016) established that in Makueni County, vulnerability of households to food insecurity is determined by land size, household size, rainfall and access to climate information, herd size, off-farm employment and gender of the household head. Mganga *et al.,* (2015) reiterate that female-headed households were more vulnerable to food insecurity than male-headed households because of low access to resources for food production and purchases.

To achieve sustainable food security in the semi-arid regions of the country is one of the main challenges facing both the county and national governments at large (FAO, 2013). This challenge is extremely intricate, requiring consideration of not just food availability and access but also the ability to be utilized and its stability. To enhance food security in any region, there is need to create awareness on the concept of food not just being available, but accessible in a form that satisfies the dietary needs of the people while ensuring the stability of its access (Bartfeld and Wang, 2006). Since there are numerous factors that affect the achievement of food availability, access, utility and stability, making the smallholder famers aware of such factors and how they affect food security will empower them to focus on not just increased productivity but also ensuring their households are food secure (Adams *et al*., 2010).

The country's food sustainability is perceived to lay in the availability and accessibility of maize, a central indicator of food security (Wambua *et al.,* 2014). According to Muchena *et al.,* (1988), maize crop can grow in a wide range of soils that enables maize cultivation in almost all agro-ecological zones. Empirical evidence reveals that two out of every three farmers grow maize (Kibaara, 2005), exuberating the food insecurity issue even further due to overreliance to one crop.

1.2. Food Security in Kenya

Food is one of the basic needs of human life (FAO, 2014). Therefore, the methods of acquiring it have preoccupied people for a very long time and were the major focus during the early times of human existence (FAO, 2013). The issues related to food security have, therefore, attracted the attention of researchers worldwide due to its importance for human health and survival (FAO, 2014). According to FAO (2013), an

estimate of over 10 million people are food insecure and about 3.2 million are drought affected residents in the marginal areas who live on food relief, making the achievement of national food security a key objective of the agricultural sector in Kenya.

Food security in this case is defined as "a situation in which all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food which meets their dietary needs and food preferences for an active and healthy life" (KFSSG, 2008; ROK, 2008). Food security is influenced by two determinants; a physical and a temporal determinant. The physical determinant is the food flow which include; availability, accessibility and utilization (FAO, 2014). Food availability is guaranteed when people have excess of their immediate requirements. Access is ensured when all households and all individuals within those households have sufficient resources to obtain appropriate foods for a nutritious diet. Adequate utilization is the ability of the human body to ingest and metabolize food. In most cases, utilization is only discussed from a biological perspective (FAO, 2014).

Kenya has been facing severe food insecurity problems depicted by a high proportion of the population having no access to food in the right amounts and quality. The country has undergone a succession of poor rainy seasons, with the last good rainy season pattern experienced in 2013 (FAO, 2013). In the marginal agricultural areas, the number of food insecure households has risen, primarily due to the October to December 2014 short rains being well below average (FAO, 2013). The current food insecurity problems in the country are attributed to several factors including the frequent droughts in most parts of the country, high costs of domestic food production due to high costs of inputs especially fertilizer, high global food prices and low purchasing power for large proportion of the population due to high level of poverty (FSR, 2012). Failure to achieve food security translates to food insecurity as a result of declining nutritional status and health of the public (FAO, 2013). Nutritional insecurity is characterized by energy and protein deficit and currently almost 50% of families' experience energy and protein deficit (FOA, 2014).

1.3. Food Security Situation in Mwala Sub-County

Mwala Sub-county is within a marginal agricultural livelihood zone that covers the south-eastern and coastal lowlands (USAID, 2010). The production seasons are characterized by poorly distributed rainfall ranging between 500-1250mm per year (GOK, 2009). The zone is often drought prone and the March to May long rains are often unreliable (USAID, 2010). The short rains are the most productive and account for approximately 70% of the food output (GOK, 2001). The general pattern of food security in Mwala Sub-county is characterized by considerable seasonal fluctuations which contribute to unstable levels of food products commonly grown such as maize, beans, pigeon peas, millet and sorghum. Lack of food diversity in the Sub country contributes to food insecurity as majority of the locals rely on cereals particularly, maize as their staple food and rarely modify their meals to include other traditional and contemporary foods (GOK, 2009).

Different agronomic factors contribute to the poor production experienced in the region. The prolonged droughts and low agricultural productivity have often exacerbated the country's food security situation with increased reliance on food relief. Low levels of maize production often leave many households with low access to required foods, thus remaining under-fed during times of poor harvest (GOK, 2001). Maize accounts for approximately 70% of the food produced, which is higher than even more drought resistant crops like sorghum, millets and green grams.

Lack of adequate local and national strategic food reserves, high post-harvest loses and lack of effective control of crops and livestock diseases has often compounded the food security problem. Income structure of the households in the sub-county indicate that about 40% earnings are derived from crop sales, 30% from livestock, 30% from off-farm activities including money sent from earnings by household members working away (GOK, 2009). Households have small storage facilities and household heads often sell available food immediately after harvest to meet other food and non-food obligations. Livestock production is limited by low productive capacity of the indigenous breeds that are able to tolerate drought conditions (KFSSG, 2008).

1.4. Statement of the Problem

There has been widespread food insecurity in Kenya, an indication that the proposed measures and interventions of food insecurity mitigation have not been successful, calling for different approaches. Issues related to food security have attracted the attention of researchers worldwide due to its importance for human health and survival. While most studies have been directed on factors that influence food security, limited work has been focused on the knowledge and level of understanding of what food security means especially among the rural poor. The widespread household food insecurity in Kenya's arid and semiarid regions calls for review of ineffective interventions since 51% of the rural households are still food insecure compared to 38% in the urban areas (AWSC, 2014). Although most of the rural population has been directing their concerns about food security on the ability to secure adequate food supplies, food availability does not guarantee its access and utility (Icheria, 2015).

The degree of food security knowledge of smallholder farmers has not been explored as a way to winning the fight against food insecurity while identifying other factors that contribute to food insecurity. Without the proper knowledge of what food security is, most households members would not understand the impact of food insecurity factors to their own food security situation or the level of food insecurity they are exposed to. There is need to promote the awareness of food security concept among the smallholder farmers while enlightening them on the factors that cause food insecurity. It is essential to make them aware that food availability, though elemental in ensuring food security, does not guarantee its access especially to the rural poor households. For households and individuals to be food secure, food at their access must be adequate both in quantity and quality, which translates to active healthy life for every individual (AWSC, 2014). This study addressed food insecurity issues in Mwala sub-county from the mind-set of smallholder farmers to the factors that affect food security. The study further assessed the extent to which natural, physical and socio-economic factors have influenced food security in the study area.

1.5. Justification of the Study

Lately, there has been a fairly vigorous discourse about the food crisis that has hit many parts of the world, including Kenya (AWSC, 2014). Many studies on food security have been addressing the issue of food crisis by strengthening food security at the level of national, community and households (Icheria, 2015). The widespread food insecurity in Kenya is an indication that the proposed measures and interventions of eradicating food insecurity have not been successful calling for different approaches. The study by Kimani and Kombo (2010) shows that the concept of food security from the consumers' perspective is best understood with the members of the household in mind.

Empowering the smallholder farmers to understand what being food secure means, is adorning them with the capacity to identify factors that threaten their food security while at the same time developing strategies to curb the food insecurity issue within their household. To mitigate food insecurity among the communities there is an urgent need for thorough assessment of the level and knowledge of food availability, access, utility and sustainability. Food needs vary from region to region and among countries within regions of the world. This means that approaches to food security have to be tailored to each situation.

The study tried to address food insecurity issue in Mwala Sub-county from the mind-set of the smallholder famers to the factors that affect food security. The study further assessed the extent to which natural and physical factors have influenced food security. The recommendations from the study were added on to the existing interventions since food insecurity can only be addressed with multifaceted approaches. Kaloi *et al*., (2005) notes that this knowledge can assist smallholder farmers, policy makers, researchers and other stakeholders to take the necessary measures and ensure food security in the Sub-County.

1.6. General Objective

The primary purpose of this study was to examine the level and knowledge of food security and the factors that affect it among smallholder farmers in Mwala Sub-county, Machakos County in Kenya.

1.6.1. Specific Objectives

The specific objectives are:

i.   To assess the level of awareness of components of food security among the small scale farmers.

ii. To investigate how socio-economic factors influence food security in Mwala Sub-county

iii. To examine the extent to which natural and physical factors influence food security in Mwala Sub-county.

1.7. Research Questions

i.   What is the level of awareness of small holder farmers on components of food security in Mwala Sub-county?

ii. How do socio-economic factors influence food security in Mwala Sub-county?

iii. How do natural and physical factors influence food security in Mwala Sub-county?

1.8. Limitations

The study was confined to Mwala Sub-county in Machakos County Kenya. The focus was on the level of knowledge on food security among the smallholder farmers in the Sub-country and the factors that affect food security. Although numerous factors have been identified that are responsible for the food insecurity situation in Kenya, this study was limited to the socio-economic. Whereas researchers in different regions have also identified various efforts by smallholder farmers in mitigating food insecurity, the study was limited to identifying the extent to which physical and natural factors influence food security in the study area and give recommendations.

1.9. Assumptions

The study was based on the following assumptions:

i. Past food security interventions have had some positive impact on food security.

ii. Households faced the same prices for food, irrespective of their location in the county.

iii. The socio-economic and natural environments in other arid and semi-arid counties in Kenya are significantly similar to those in the study area. Any observed effects could be generalized to the dry land region.

1.10. Definition of Terms

i. **Climate variability:** in this study refers to alterations in the earth's weather, including variations in temperature, wind patterns and rainfall.

ii. **Governance:** is used to refer to a process of policy and enforcement of regulations and standards relating to food security in this study.

iii. **Household:** Here refers to a unit of people living together and eating from the same pot.

iv. **Markets**: in this study, refer to avenues for buying and selling of food.

v. **Food security:** refers to when all people at all times have access to sufficient, safe, nutritious food to maintain a healthy and active life (in this study).

vi. **Food insecurity:** is the state of, or risk of, being unable to provide food (to oneself, a family, a nation, etc.) (FAO, 2001). Food insecurity as a situation exists when members of a household have an inadequate diet for part or all of the year or face the possibility of an inadequate diet in the future. Hunger is the uneasy or painful sensation caused by a lack of food (Phillips and Taylor, 1990).

vii. **Farmer:** a farmer is a person engaged in agriculture, raising living organisms for food or raw materials.

viii. **Farmers' demographic characteristics:** is the data about farmers' population, age, gender and income

ix. **Farmland size:** Size in acres of household land under cultivation

x. **Farm size:** Size in acres of the entire household land holding

xi.   **Small-scale farmers:** Farmers whose agricultural orientation is mainly subsistence and cultivate land not exceeding 10 acres (Icheria, 2012).

1.11.   Organization of the Thesis

The study is organized into six chapters. Chapter one provides details on the background of the study, statement of the problem, purpose of the study, objectives of the study, research questions, limitations, and delimitations, assumptions of the study and definition of terms used.

Chapter Two offers a review of the relevant literature on the determinants of food security, theoretical and conceptual framework.

Chapter Three covers research methodology that is applied to source data. In this section the procedures and techniques which were used in the collection, processing and analysis of data are explained. Specifically, the following subsections are included; research design, target population, data collection instruments, data collection procedures, pre-testing of research instrument, operationalization of the variables and finally data analysis.

Chapter Four presents the results of the descriptive and regression analysis and the presentation of study findings.

Chapter Five provides a discussion of the results in relation to the expected outcomes, and testing of hypothesis. This is followed by chapter six which contain a summary of the findings, conclusions and recommendations for policy interventions from this study. References and appendices follow thereafter.

CHAPTER TWO

LITERATURE REVIEW

Studies on food security have mainly focused on food production as the main approach of securing food (Nyariki, 1997). Some governments advocate for the expansion of farming systems to produce enough for households to be food secure (Gladwin *et al*., 2001). On the other hand, others have focused their attention on the contributions of root and tuber crops such as sweet potato and cassava to food security (Allemann *et al*., 2004). Their main emphasis in the fight against food insecurity has been the importance of improving food security under conditions of climatic change (Droogers, 2003).

The degree of vulnerability to food insecurity depends on the nature of the risk and a household's resilience to it. A household's resilience often depends on how well it can re-organize and adapt; which further depends on the demographic characteristics, assets and livelihood strategies (Nyariki *et al*., 2002; D'Haese *et al*., 2005). The food security risk factors in the dry lands include natural shocks such as climate (drought) and natural resource degradation (soil, forests, water) which expose households to fluctuation in food production (European Commission, 2000; Nyariki *et al*., 2002). But the effect of climate change reflected in worsening aridity remains the most daunting (Tiffen, 2002). The high risk of food insecurity has contributed to the collapse of agro – pastoral systems and reduced income generating activities thus eroding the purchasing power of the rural households (Wambua and Kithia, 2014).

Nguluu *et al.,* (2014) described the farming systems that exist in the dry-lands of Kenya and offers suggestions for improvement and sustainable use of dry-land biodiversity to enhance food security. These includes; intercropping and sole cropping farming systems (especially the newly developed varieties) for the long term sustainability of agro diversity and food security which would in turn conserve the environment.

2.1. Theoretical Framework

To analyse the reason why food insecurity is still prevalent in the arid and semiarid areas in Kenya despite international action and attempts by the government to eradicate it, several theories were chosen. The theory of neoliberalism belongs to the branch of international relation theories and the theory of dependency is one of the development theories. Other theories of food security used were the Entitlement theory, Malthusian and Anti-Malthusian approach to food security. The Malthusian theory contends that population increase causes food scarcity while and Anti-Malthusian claim that an increase in population causes increase in food production (Kayunze, 2008). This was done consciously with an attempt to have more comprehensive analysis and by combining several, could have better overview from national and international levels.

2.2. Neoliberalism Theory

Neoliberalism has been chosen because it provides an explanation and reasons behind the agricultural market liberalization, which had an immense impact on the Kenyan market and consequently on the food security in Kenya. Neoliberalism is the theory of political economic tradition advocating that the prosperity of a human is best achieved by liberation of his entrepreneurial opportunities that are bounded by institutional framework. The government should only create and maintain institutional framework designed for free trade. The rapid growth in power of newly established International Financial Institutions (IFI) and the capital centralization alongside, the structural crisis within the central economies led to the unfavourable impacts on the exports. What is more, the drop of primary commodity prices deepened the degradation there. The three main characteristics of neoliberalism are privatization, deregulation and disengagement of the state in areas of social provision. Neoliberalism is able to explain how re-regulating markets via state-led policies benefits dominant classes and the poorest ones become even poorer with no access to food and other goods. In general, theory focuses on the importance of institutions and their imposed norms.

2.3. Dependency Theory

Dependency theory analyses the relationship between the developed economies and developing ones, the exploitation of the periphery by the advanced ones. The theory focuses on the impacts of unequal relationship between the two parts. Dependency is described as the integration of periphery in the global system by which underdeveloped countries and former colonies are economically profited from which has led to their underdevelopment (Soete, 1981). Thus, the theory explains the underdevelopment as a particular situation where the group of disadvantaged countries is conditioned by the growth of dominant ones. The main statement of the theory is that the international exchange and foreign investments inflict negative effects in the social welfare of the recipient countries (Jenkins and Scanlan, 2001). Overall, dependency theory has a focus point on unequal, exploitative and dependent relations between the First World and the Third World.

2.4. The Entitlement Approach to Food Security

The entitlement approach to hunger discusses the ability of people to command food through the legal means available in the society. Entitlements are defined as the set of alternative commodity bundles that a person can command in a society using the totality of rights and opportunities that he or she faces (Young *et al.,* 2001). Sen's (1981) entitlement theory forms the conceptual basis of approaches of all agencies to assessing food security. Sen, (1981) introduced the idea of food security as a demand concern, where it is viewed in terms of entitlements, which influence capacity to access food. In this regard, the ability of households to access food either through production, purchase or transfers becomes important in defining household food security. Hence, household food security is a function of the availability of food within the country and the level of household resources that are necessary to produce or purchase food as well as other basic needs. Sen explained that famines occur not because there is not enough food, but because people do not have access to enough food. Of course the availability of food near to the household is a prerequisite of food security. Availability is influenced by factors such as community's proximity to centers of production and supply or market forces, restrictions on trade and international policies that affect food supplies. All of these are key to food security

analysis. Sen's work was none the less a radical break through, before him the availability of food was thought to be the overriding determinant of famine (cite).

According to Sen (Year), people's exchange entitlements to their livelihood sources reflect their ability to acquire food. Famine occurs when a large number of people suffer a complete collapse in their exchange entitlements (Sen, 1981). From the recent experience especially in Africa the association between violence and famine is so close that no widely applicable famine can disregard the role of violence and the way some resources like food are illegally acquired by some groups at the expense of others (de Waal, 1990; Macrae and Zwi, 1994). In Sen's work the violent access of food by one group removes another exchange entitlements (cite).

Entitlement theory has been criticised on two further counts. First it implies a straight forward sequence of entitlement failure leading to hunger and then to malnutrition, starvation and death. Second it implies that people's actions are largely determined by their need to consume food (de Waal, 1990). An important extension to entitlement theory focuses on the role of investments in determining household vulnerability to food insecurity. When households are able to generate a surplus over and above their basic food requirements, the excess resources are diverted into assets of different kinds which can be drawn upon when they face crisis (Swift, 1989). In such circumstance we may relate food security to the idea of vulnerability to poor resource endowments of households, focusing more clearly on the risk where avoidance becomes central to attaining food security.

2.5. Malthusian and Anti-Malthusian Theory

Malthusian and Anti-Malthusian theories take two contentious positions in relation to food availability and population growth. According to Dyson, (1996) cited by Kayunze *et al*., (2007), argue that food insecurity is caused by having too many people compared to the amount of food produced. Population increases in a geometrical manner and food production increases only in an arithmetical ratio. This means that a strong and constantly operating check on population from the difficulty

of subsistence is a necessity. However, other Anti-Malthusians argue that there can never be too many people in a country.

Expansion of food production like it was during the green revolution of Asia in the 1970s as a result of improved agricultural technology is difficult today because of the environmental changes which have left farmers with few options to improve food crop output. Demands for irrigation water, the use of additional fertilizers on currently available crop varieties has little or no yields increase. While Malthusians are pessimistic and argue that in future there will be too little food for the increasing population, Anti-Malthusians comments that improved agricultural technology will increase food production (Kayunze *et al.,* 2009).

All these theories and concepts were considered to explain the ineffectiveness of Kenyan policies. After the theoretical considerations, however, it was decided that only the neoliberalism and dependency theories were appropriate since they together are capable of providing the answer to the issue in question.

2.6. Knowledge on Food Security

The concept of food security is recent in origin and it has been defined in many ways by many researchers (WFP, 2012; DFID 2004). DFID (2004) highlights that early thinking linked hunger and food insecurity to reduced food availability. Hunger and particularly famine, appeared to be a result of an acute food shortage, which could be best addressed through steps to increase the production and distribution of food. Later, the explanations in terms of failures of 'entitlement', that is the inability of individuals to access the food they need due to poverty was linked to food security. Concerns about food security were previously directed more at the national and international level, and concerned the ability of countries to secure adequate food supplies. Only later did the level of analysis shift to include a focus on food security at local level, even down to households and individuals (WFP, 2012).

Most of the rural households understand food security as having sufficient availability of food though, majority of them still experience hidden hunger which refers to

persons whose food is insufficient to meet the FAO/WHO recommended allowance of 2,250 calories per person per day (ROK, 2008). The causes of food insecurity are complex and improving agricultural performance has proved to be less important than tackling the underlying poverty that remains the fundamental cause of hunger and food insecurity (DFID, 2004). As the saying goes 'poverty is in the mind', addressing the understanding of smallholder famers about food security could be a mile towards achieving food security coupled with other strategies. Whereas various definitions on food security exist, it is important to establish whether the concept is understood at the local level.

2.7. Factors that Affect Food Security

Food security is affected by a complexity of factors. These include unstable social and political environments that preclude sustainable economic growth, war and civil strife, macroeconomic imbalances in trade, natural resource constraints, poor human resource base, gender inequality, inadequate education, poor health, natural disasters such as floods and locust infestation and the absence of good governance (Haile *et al.,* 2005). All these factors contribute to either insufficient national food availability or insufficient access to food by households and individuals.

Food insecure households are not always hungry because their villages or counties produce less but because several factors affect food productivity and storage. Studies by Below *et al.*, (2012), Wambua, (2008) and Tiffen, (1994) reveal that physical and natural factors such as drought, performance and distribution of rainfall, soils, temperature, crops and livestock diseases, and pests contribute significantly to food insecurity in the marginalized areas. The areas have experienced climate changes due to human impact as well as social–economic transformation which have negatively affected rural livelihood systems (Wambua *et al.,* 2014).

The major cause of food insecurity in the arid and semiarid areas is attributed to physical, natural and human factors (Mutiso, 2015). There is growing recognition that socio-economic factors such as poor agricultural practices, levels of household incomes and expenditure patterns, prevalent food and non-food prices, marketing

practices and conflict have compounded to the precarious food insecurity situation among the marginalized smallholder farmers households (Wambua *et al*., 2014; Kinyua, 2004). Other underlying factors include adoption rates in growing drought tolerant crops, use of uncertified seeds, access to farm inputs and poor post-harvest food management. Female headed household are more at risk of food insecurity due to limited access to land ownership and other valuable assets (Mulandi, 2007). Lack of land and other resources such as livestock, money and good shelter needed to facilitate farming activities were identified as the major contributing factors to food insecurity (Wambua *et al*., 2014).

The identified food insecurity problems can be attributed to several factors that include:

i.   Climatic factors, including the frequent droughts in most parts of the country.

ii.   High costs of domestic food production due to high costs of inputs especially fertilizer.

iii.   Internal displacement of a large number of farmers, especially those in the high potential agricultural areas.

iv.   High global food prices associated to low purchasing power for large proportion of the population due to high level of poverty.

As a result, more than 10 million (almost a third of the population) persons are chronically food insecure (ROK 2010; FAO 2011; ROK 2008).

2.8. Dimensions of Food Security

These are also referred to as Food security Components. Common to most definitions of food security are the elements of availability, access, utilization and stability or sustainability (FAO 2011).

2.8.1. Food Availability

In this context, availability refers to the physical existence of food, be it from own production or from the markets. On national level food availability is a function of the combination of domestic food stocks, commercial food imports, food aid, and

domestic food production, as well as the underlying determinants of each of these factors. Use of the term availability is often confusing, since it can refer to food supplies available at both the household level and at a more aggregate (regional or national) level. However, the term is applied most commonly in reference to food supplies at the regional or national level (Riely *et al.,* 1999).

Food availability is achieved when a sufficient amount of food is constantly available for all members of society. This kind of food can be obtained through household production, local production, storage, imports or food aids. Food availability is a function of the combination of domestic food stocks, commercial food imports, food aid, and domestic food production, as well as the underlying determinants of each of these factors.

2.8.2. Food Access

Access emphasizes on having sufficient resources to obtain appropriate foods for a nutritious diet. It is the way different people obtain the available food. Normally, we access food through a combination of home production, stocks, purchase, barter, gifts, borrowing or food aid. Food access is ensured when communities and households and all individuals within them have adequate resources, such as money, to obtain appropriate foods for a nutritious diet (Riely *et al.* 1999). Access depends normally on; income available to the household, the distribution of income within the household, the price of food, and other factors worth mentioning are individuals' access to market, social and institutional entitlement/rights (ibid).

2.8.3. Food Utilization

Utilization has a socio-economic and a biological aspect. If sufficient and nutritious food is both available and accessible the household has to make decisions concerning what food is being consumed (demanded) and how the food is allocated within the household. In households where distribution is unequal, even if the measured aggregate access is sufficient some individuals may suffer from food deficiency leading to diet related diseases.

2.8.4. Food Stability

Stability or sustainability refers to the temporal dimension of nutrition security (i.e. the time frame over which food security is being considered). In much of the food security literature, a distinction is drawn between chronic food insecurity—the inability to meet food needs on an ongoing basis—and transitory food insecurity when the inability to meet food needs is of a temporary nature (Maxwell and Frankenberger, 1992)

2.9   Conceptual Framework

The study is based on the 2009 Wold Food Program (WFP) conceptual framework of food and nutrition security (WFP, 2009). The conceptual framework uses basic causes of food insecurity, the underlying causes, factors that lead to the impact and the outcome of the impact as indicators of food insecurity. There are three key concepts in the framework; Livelihoods, Food security and Nutrition security. The framework analyses the basic causes or structural factors that establish the context in which food insecurity exists, the underlying causes in relation to the characteristics of the individuals that make them more or less susceptible to food insecurity, the factors that lead to malnutrition and death. This framework allows for formulation of hypotheses on probable local effects of crisis. It allows for review of secondary information and discussions with key informants, aids in identifying most factors that most likely affect FNS in the study and pinpoint possible linkages among factors affecting FNS in the study area (WFP, 2009).

Food security is influenced by food flow as the physical determinant which includes; availability, accessibility and utilization. Availability is achieved if adequate food is available at people's disposal. Access is ensured when all households and all individuals within those households have sufficient resources to obtain appropriate foods for a nutritious diet. Adequate utilization is the ability of the human body to ingest and metabolize food. In most cases, utilization is only discussed from a biological perspective (FAO, 2014).

Nutrition security is based on nutritious and safe diets, an adequate biological and social environment, a proper health care to avoid diseases ensure adequate utilization of food (FAO, 2014). The inclusion of smallholder farmers' knowledge and understanding of food security concept and factors that affect it is explored on the basis of food security (availability, access and utilization), nutrition security and livelihood as conceptualized in Figure 1.1.
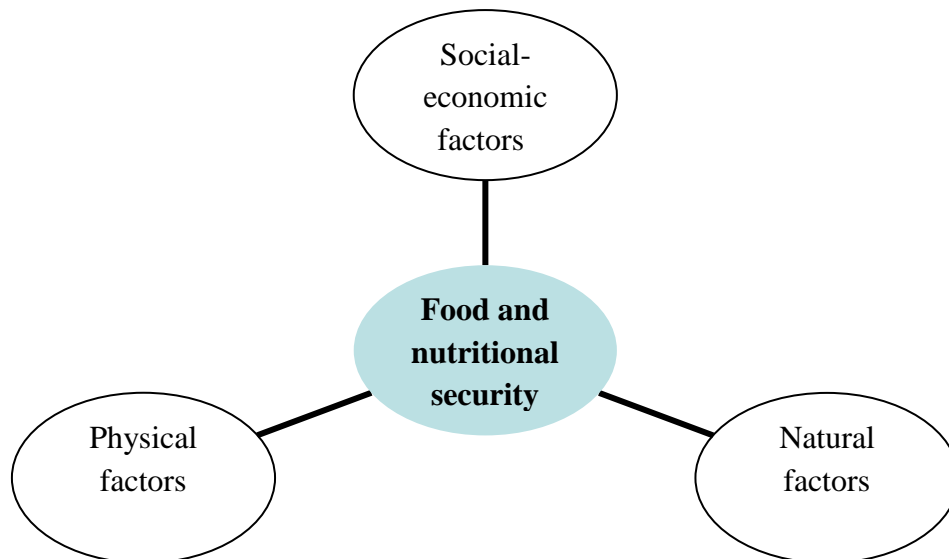
Figure 0.1 Conceptual framework of food and nutrition security

Figure 2.1 is presented to simplify the interactive effects of the study variables of the WFP Conceptual Framework of Food and Nutrition Security. The independent variables here represent the causes or the determinants of food security. It is these

variables that are tested to see if they have a significant influence on the dependent variable, food security. The factors are Natural factors (climate change), Socio-Economic (governance), Physical factors (access to market), demographic factors (gender, population) and level of awareness (knowledge). The dependent variable here is food security. There is also extraneous variable or the moderating factors. The moderating factors include economic status and political stability.

Socio-economic factors
- Agricultural practices
- Levels of households incomes
- Expenditure patterns
- Food and non-food average prices
- Marketing practices
- Access to markets
- Conflicts
- Governance

Demographic Factors
- Age
- Gender
- Marital Status
- Occupation
- Highest level of education

Natural Factors
- Climate variation (weather changes)
- Drought
- Floods

Physical Factors
- Land Use
- Land size
- Land productivity
- Distance to the market)

Level of Awareness
- Knowledge on food security
- Type of farming methods
- Farmers Group
- Type of farmer

Food Security
- Food Reserves
- Number of meals per day
- Source of food

Independent Variables   **Dependent Variable**

Figure 0.2: Simplified Conceptual Framework

CHAPTER THREE

METHODOLOGY

3.1. Research Design

To adequately respond to the research questions a research approach involving exploratory, descriptive and participatory research designs was utilized. Exploratory case study research provided information on the level and knowledge of food security among the smallholder farmers while descriptive research gave a logical description of the different farmers groups under investigation, the socio-economic, natural and physical factors that influence food security. The descriptive case study and participatory research were further used to establish the extent to which the different factors influence food security in the sub-county.

3.2. Research Site and Rationale

This study was conducted in four locations in Mwala Sub-county, a medium potential livelihood zone within Machakos County in Kenya. Mwala sub-county has 15 locations that cover an area of 852.9 Km^2 with a population of 89,211 people (Kenya National Bureau of Statistics, 2013). The sub-county is located 1000 to 1600 m above sea level within the semi-arid marginal agricultural zone of the south-eastern and coastal lowlands. It is typically characterized by bimodal unevenly distributed rainfall ranging between 500-1250mm per annum (GOK, 2012; USAID 2010). Rainfall is scarce and erratic making the Sub-county of Mwala often prone to drought mainly due to unreliability of the March to May long rains. Much of the productivity that is close to 70% of the food output takes place during the short rains in October to December while the long rains occur in March to May (GOK, 2009). The short rains normally deliver more rain and are more reliable than the long rains (GOK, 2009). At the same time livestock production is constrained by poor productive capacity of the local breeds which have the ability to tolerate and resist drought conditions (KFSSG, 2008). Among many factors that affect food security, study locations selected (Mbiuni, Muusini, Mwala and Kabaa.) have contrasting production patterns, agricultural activities and socio-economic differences (FAO, 2013).

3.3. Target Population

Mwala Sub-county has population density of 160 persons per square Kilometre, a population of 163,032 people. The Sub-county has 15 locations and 58 sub-locations, highest number of administrative units compared to other sub-counties within Machakos Country. From the sub-county's population, 7,150 of them are registered farmers who have formed 300 farmers' groups (Kenya National Bureau of Statistics, 2013). A sample of smallholder farmer was drawn from the farmers' groups within four purposively selected locations; Mbiuni, Muusini, Mwala and Kabaa, in the sub-county.

3.4. Sample Size

A sample size of 86 farmers' groups was used where 21 farmers' groups from each of the four locations represented the small-scale farmers in Mwala Sub-county. The sample was selected using a multistage sampling method.

The sample size was determined according Magnani (1999) using the following formula;

$$n = D \left[\frac{\left(Z_\alpha + Z_\beta \right)^2 * \left(sd_1^2 + sd_2^2 \right)}{\left(X_2 - X_1 \right)} \right] \quad\text{................................... (1)}$$

Where;

$n = $ *required minimum sample size per survey round or comparison group*

$D = $ *design effect for cluster surveys (use default value of 2)*

$X_1 = $ *the estimated level of an indicator at the time of the first survey or for the control area*

$X_2 = $ *the expected level of the indicator either at some future date or for the project area such that the quantity* $\left(X_2 - X_1 \right)$ *is the size of the magnitude of change or comparison − group differences it is desired to be able to detect*

sd_1 *and* $sd_2 = $ *expected standard deviations for the indicators for the respective survey rounds or comparison groups being compared*

$$Z_{\alpha} = \textit{the z-score corresponding to the degree of confidence with which it is}$$
$$\textit{desired to be able to conclude that an observed change of size } (X_2 - X_1)$$
$$\textit{would not have occurred by chance } (\textit{statistical significance}), \textit{ and}$$
$$Z_{\beta} = \textit{the z-score corresponding to the degree of confidence with which it is desired}$$
$$\textit{to be certain of detecting a change of size } (X_2 - X_1) \textit{ if one actually occurred}$$
$$(\textit{statistical power}).$$

Applying formula 1, we obtain;

$$n = 2\left[(1.645 + 0.840)^2 * (10212 + 12252) / (2,040 - 1,440)^2\right]$$
$$= 2\left[(6.175)(2,543,066) / (600)^2\right]$$
$$= 2[15,705,432 / 360,000] = 2(43.6262) = 86$$

3.5. Sampling Procedure

Multistage sampling strategy was used to get the sample size of 86 farmers' groups. Purposive sampling was used to select 4 out of 15 locations within the sub-county, while simple random sampling was used to select a sample size of 21 farmers' groups from each of the location.

A sampling frame (list of households) was obtained for each farmers group. Respondents were randomly selected from each farmer's group using simple random sampling method for which the starting point was chosen at random that is the first i^{th} household was selected randomly in each farmers' group. Thereafter, the subsequent households were selected at regular intervals which was obtained by dividing the total population of each location by 21.

3.6. Measurement of Variables

3.6.1. Independent Variables

The independent variables here represent the causes or the determinants of food security. These variables that were tested to see if they had a significant influence on food security. The factors included, natural factors, socio-economic factors, physical factors and level of awareness (knowledge) on food security. The dependent variable

here was food security. The extraneous variable or the moderating factors included economic status and political stability.

Based on the reviewed literatures, some of the common predictors that were expected to have influence on farmers' food security in the study area were;

1. **Age of head of household (AGE)**: Age is a continuous variable and measured in years. Older people have relatively richer experiences of the social and physical environments as well as greater experience of farming activities (Haile *et al.,* 2005). That is, when heads get higher age, they are expected to have stable economy in farming. Moreover, older household heads are expected to have better access to land than younger heads, because younger men either have to wait for land redistribution, or have to share land with their families. Therefore, the expected effect of age on household food security would be positive for older household heads and negative for comparatively younger household heads.

2. **Sex of head of the household (SEX)**: Sex of the household is a dummy variable. Female headed households, according to Adugna and Wogayehu (2011), have higher probability of being food insecure. Hence, in this study sex also is expected to have relation with the household food security status. Male headed households are expected to be more food secure that female headed households.

3. **Marital status of the household head (MAS):** This is a discrete variable and it determines the household food security status. The study made by Adekoyo (2009) in Oyo state of Nigeria found that households headed by married individuals were found to be food secure and households headed by unmarried households heads were found to be food insecure. However, widowed and divorced female headed households, according to Adugna and Wogayehu (2011), were highly positioned to be food insecure. Thus, the same result would be expected in his study.

4. **Household size (AE)**: The size of the household is a continuous variable and measured in household adult equivalents. Thus, increasing family size in turn adult equivalent, according to reviewed literatures, tends to exert more pressure on household consumption than the labour it contributes to production (Adugna,

2011). Thus, increase in the household adult equivalent would have a negative correlation with household food security status.

5. **Educational level of head of household (EDUC):** Formal education is a variable which could impact positively on household ability to take good and well-informed production and nutritional status decisions (Babatunde *et al*., 2007). Based on Amaza *et al*. (2006), the higher the educational level of household head, the more food secure the household is expected to be. Therefore, the same relation would also be expected in this study.

6. **Farm land size of a household (FLSZ)**: Farm land size is the total farm land cultivated by the household measured in hectares. According to Haile, Alemu and Kudhlande (2005) and Babatunde *et al.* (2007), food production can be increased extensively through expansion of areas under cultivation. It was thus expected that households with larger farm size to have more likelihood to being food secure than those with smaller farm size. As a continuous variable, the expected effect of farm land size on household food security was positive.

Table 0.1: Summary of Variables

Independent variable	Expected sign	Variable description	Type of variable
Age of HH head	+	Age of the household head, measured in years.	Continuous
Sex of HH head	+	Sex of the household head, 0 for female and 1 for male that means it is dummy variable.	Dummy
Marital status	+	Marital status of the household head, 0 for divorced and widowed and, 1 for married.	Discrete
HH size in AE	_	Number of household/family members who live under the same household, measured in AE.	Continuous
Education level	+	Education level of the head of the	Discrete

		household, where 0= None; 1= Primary, 2 =Secondary, 3 = Tertiary.	
Land holding size	+	Size of crop land, measured in hectares.	Continuous

The independent variables are measured using certain indicators as follows:

i. Natural Factors such as Climate change; the indicators include weather changes and types of weather. These indicators are assessed to determine their effect on farms and livestock and on food security.

ii. Socio-economic factors such as governance; the indicators are awareness of food security as human rights component, activities ensuring food security. These factors are tested on their influence to on food security.

iii. Physical factors such as access to market; the indicators are distance to the no of kilometres to the market and food prices. The effect of these variables on food security is also determined in the study.

iv. Human factors such as land use; the indicators include size of land and land used for food production and land productivity in relation to the ideal expected yields. These indicators are tested to reveal their influence on food security, the study's dependent variable measured using the indicators of food availability, accessibility and productivity.

v. The level of awareness on food security; the indicators include knowledge on food security, type of farmer (smallscale vs. largescale) and type of farming methods employed. These factors are examined and their influence on food security determined.

3.6.2. Dependent Variable

The dependent variable in this study was food security. The food security status could be determined based on the 2100 kcals per adult equivalent per a day. Thus, it was a bivariate taking the value 1 for food secured households and 0 for food insecure households. If the household consumed less than this minimum amount of energy, it was food insecure and if the household consumed more than the threshold level, the

household was concluded as food secure. This variable was used for binary logistic regression.

There were 3 domains of the independent variable as adapted from WFP's (2005) household food consumption approach. They are household food security, vulnerability to household food insecurity and household food insecurity.

3.7. Operationalization of Variables

The operational of variables describes the independent and dependent variables measurement indicators of the study as shown in the table 3.2;

Table 0.2: Operationalization of Variables

Objectives	Independent Variables	Measurement of indicators	Measurement scale	Tools of Analysis
To assess the level of awareness of food security among the small scale farmers in Mwala Sub-county	Awareness	Knowledge on food security, type of farmer and type of farming methods employed	Ordinal scale	Mean, frequencies, mode, Standard deviation and Multiple regression analysis
To investigate how socio-economic factors influence food security in Mwala Sub-county.	Socio-economic factors	Awareness of food security as human rights component, activities ensuring food security such as governance, marketing practices,	Ordinal scale	Mean, frequencies, mode, Standard deviation and Multiple regression analysis

		expenditure patterns, income levels		
To examine the extent to which natural and physical factors influence food security in Mwala Sub-county.	Natural and physical factors	weather changes and types of weather, distance to the market and food prices	Ordinal scale	Mean, frequencies, mode, Standard deviation and Multiple regression analysis
	Dependent variables			
The primary purpose of this study was to examine the level and knowledge of food security and the factors that affect it among smallholder farmers in Mwala Sub-county, Machakos County in Kenya.	Food security	Adequate food Reserves, Number of meals per day, Source of food	Ordinal scale	Mean, frequencies, mode, Standard deviation and Multiple regression analysis

3.8. Data Collection Method

Primary data, both qualitative and quantitative was collected from various stakeholders. Secondary data was obtained from searches in libraries; offline databases e.g. The Essential Electronic Agricultural Library (TEEAL) and the internet (online databases and websites).

3.8.1. Questionnaire

The present study used semi structured questionnaires to collect primary data. Two selected assistants from the local area were engaged to ensure local customs were respected. A rapport had been created between the assistants and the community. These assistants had been selected since they had worked with social development projects in the area for the past five years. This made access to accurate information easy. Having worked in the area enhanced the phenomenon of talking with community during discussions rather than talking to the community as Okeyo (2015) advises.

Three weeks were taken to explain the objectives of the study to the community, adequate time was spent explaining the objectives and enough chance given to the community for seeking clarification. To minimize biases, information was filtered, notes taken and later used to enrich the questionnaire. The questionnaire used had specific questions with limited answers creating a possibility to get the quantitative data that could be analysed statistically.

Semi structured questions assisted in generating in-depth and explanatory qualitative information. This method allows flexibility, follow up to original questions and pursuing of new lines of questioning, two-way interaction and facilitates exchange of information between the interviewer and interviewee making the atmosphere more relaxed. The use of both closed-ended questionnaires and semi-structured questions is necessary in order to get as much information as possible from the community members (Okeyo, 2015).

3.8.2. Focus Group Discussions

Focus Group Discussions (FGDs) were also used to allow probing. The FGDs were used as a qualitative research technique for mapping out systems and answer questions of "why" and "how", especially concerning the data collected from the questionnaire interview. Where information was not clear from the questionnaires the discussion clarified how the natural factors (climate change) affected the daily living of the community for instance. The discussants were in groups of 5 - 10. The

meetings took between 2 - 3 hours and were done in all the four locations with the permission of the area administrator (chief).

3.8.3. Key Informants

Key informants interviews were used with people who had vast experience and knowledge and could provide extensive insight into bio-sociocultural aspects of the community. The representative from the county agricultural office and agricultural extension officer were purposively selected as key informants since they possessed vital information concerning household food security as well as agricultural aspects. Interviews were conducted with the two officers to get insights on household food security. Information concerning land use such as sizes of farmlands, food production, drought resistant crops cultivated in the area, was obtained from the agricultural extension officer. The researcher booked appointments with key informants and informed them of that the study was for academic purposes prior to conducting the interviews.

3.9. Instrument Validity

Farmers were asked through questionnaires and interviews to identify indicators of food security and what they understand by the term food security. They were asked to score between the social-economic, physical and natural factors, which contribute significantly to food insecurity.

The first objective was to a large extent implemented using brainstorming with structured questionnaires and face-to face interviews with the farmers' groups. The second and third objectives involved collecting information from the stake holders in the four locations through interviewing key informants that included researchers from National Agricultural Research and Extension Systems (NARES) and International Agricultural Research Centres (IARCs), extension agents, NGOs, agro-dealers, Community Based Organizations (CBOs) and farmers. The interviews entailed the use of semi structured questionnaires and face-to-face interviews. Additionally, secondary data and the use of prior knowledge was also applied for these two objectives.

3.10. Reliability of the Instrument

Reliability refers to the degree to which scores obtained with an instrument are consistent measures (Kothari, 2008). To test the reliability of the instruments, the study used test-retest technique. Test-retest reliability is measured by administering a test twice at two different points in time. According to Okeyo (2015) reliability is also checked by comparing farmers' responses with those of other farmers and sources. Cooper and Schindler (2001) explain reliability of research as determining whether the research truly measures that which it was intended to measure or how truthful the research results are. Pre-test study is thus conducted to detect weakness in design and instrumentation and to provide accurate data for selection of a sample.

Pre-test was used to improve the questionnaire, semi-structured questions and interviews and test for reliability of the instruments. The study dealt with experts and farmers from different locations of Mwala sub-county who were issued with the questionnaires. The experts were required to assess if the questionnaires helped in assessing the food security issue and the factors affecting it. Farmers who participated in the pre-test study were not involved in the main study. Pre-testing was carried out in 28 farmers' groups to make 10% of the total number of the 275 farmers involved in the study.

According to Orodho (2003) the number in the pre-test should be 10% of the entire sample. Cronbach's alpha was used to determine the internal consistency of items in the questionnaire to gauge its reliability. Data reliability plays an important role towards generalization of the gathered data to reflect the true characteristics of the study problem (Klein and Ford, 2003). The analysis tested the internal consistency of the instruments by computing Cronbach's alpha to determine the reliability of the instrument. Cronbach's Alpha is a reliable coefficient that indicates how well items are positively related to one another. A Cronbach's alpha coefficient of 0.712 was taken as acceptable reliability. According to Cronbach (1957) a coefficient of between $0.7 \leq \alpha < 0.9$ is taken to be good while that of $\alpha \geq 0.9$ is taken to be excellent (George, 2003).

3.11. Pre-test Results

The coefficient of the data gathered from the pre-test study was computed with the assistance of Statistical Package for Social Sciences (SPSS) version 21. The average Cronbach's Alpha value for the pre-test was 0.712 as shown in table 3.3, meaning the items under each variable, were consistent.

Table 0.3: Reliability Test

Variable	Cronbach's Alpha	No of Items
Natural factors	.780	3
Socio-economic factors	.883	4
Physical factors	.563	4
Food security	.623	5
Average Cronbach's Alpha for all variables	.712	**16**

Source: Author computations from field data, 2019

3.12. Data Processing and Analysis

Data analysis is the process of evaluating data using analytical and logical reasoning to examine each component of the data provided. SPSS version 21.0 was used to generate descriptive statistics including frequency counts and percentages. The relationship between the variables for example the level of farmers' knowledge on food security, social economic, physical and natural factors were determined using Multiple Linear Regression Analysis on the SPSS software.

For this study descriptive, multiple linear and logistic regression analyses were used to answer the specific objectives. The descriptive analysis involved computation of means, standard deviation, percentages, and frequency of distribution for objective number two. For objective one, a binary logistic regression analysis was employed to indicate the likelihood of the independent variables being associated with food security or insecurity.

3.13. Model Specification 1

Multiple Linear Regression analysis was adopted to establish the relationships between the dependent and independent variables as described in equation 2.

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \varepsilon \quad \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \quad (2)$$

Where;

$Y =$ Food Security

$\beta_0 =$ Constant

$\beta 1, \beta_2, \& \beta_3 =$ Coefficients

$X_1 =$ Natural Factors

$X_2 =$ Social Economic Factors

$X_3 =$ Physical Factors

$\varepsilon =$ Residual Error

3.14. Model Specification 2

Modeling the determinants of the level of knowledge on food security at household levels seems to comprise different methodologies and techniques. It includes the different techniques from ordinary least square to discrete choice models. It is unwise to use OLS regression when confronted with a binary dependent variable. The main difficulty occurs with regression model when the researcher wishes to use a binary variable as dependent variable. The variable does not follow normal distribution. Rather, it is distributed as a binomial random variable. Connecting a regression line to data points reveals the hetroscedasticity problem in linear relationship between dependent and independent variable. Moreover, if an estimated OLS regression model is carried out, the residuals are not normally distributed.

Therefore, using OLS regression on data with a binary dependent variable violates at least two assumptions that underlie this model. There are two alternative regression models that are used most often when dealing with a binary dependent variable: Logistic regression and Probit regression. The discrete choice model has a number of

attractive features as compare to regression approach. The most important feature of the discrete model approach is that it gives probabilistic estimates for the different status of food security while regression approach does not have this particular feature. It means that in regression analysis one cannot make any probability statement about the effects of different explanatory variables on food security.

Owing to the marginal effects and the interrelationship of the level of farmers' knowledge on food security and the level of awareness of food security, the farmer's level of knowledge on food security is modelled separately. A binary logit model was employed in assessing determinants of farmer knowledge about food security. The logit model was preferred owing to the fact that the dependent variable is discrete in nature. According to Green and Hensher (2009), the logistic distribution is better in applied research over the probit model because of computational complexity arising from lack of a closed form for the normal cumulative density function on which the probit model is based. With level of knowledge as the dependent variable, farmers who were aware were identified and assigned the value of $F = 1$ and 0 otherwise. The logit model is specified as:

$$F = \alpha_0 + \alpha_1 t_1 + \alpha_2 t_2 + \alpha_3 t_3 + \alpha_4 t_4 + \alpha_5 t_5 + \alpha_6 t_6 \quad \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \quad (3)$$

Where

$F = $ Level of farmer's knowledge on food security

$\alpha_0 = $ Constant

$\alpha_1, \alpha_2, \alpha_3, \alpha_4, \alpha_5 \ \& \ \alpha_6 = $ Coefficients

$t_1 = $ Farm size

$t_2 = $ Gender

$t_3 = $ Education

$t_4 = $ Income

$t_5 = $ Farmers Group

$t_6 = $ Type of Farmer

The *a priori* expectation of the probability of a household becoming food secure is stated as:

i.   **Age of household head:** The age of household head is expected to impact on his or her labour supply for food production. Young and energetic household heads are expected to cultivate larger farms compared to the older and weaker household head. It also determines the ability to seek and obtain off farm Jobs and income which younger household heads can do better. Arene and Anyaeji (2010) on the other hand, found older household heads to be more food secure than the younger household heads. Hence the expected effects of age of household head on food security could be positive or negative.

ii. **Sex of household head:** Sex of household head looks at the role played by the individuals in providing households needs including acquisition of food. Female headed households have higher dependency ratios which hinder household capacity to allocate labour to on-farm or other income generating activities. Also female headed household tend to be older and have fewer years of education than male heads of household (FAO, 2012). The expected effect of this variable is positive.

iii. **Household size:** The size of household determines the food security status of the households. It is expected that as the household size increases, the probability of food security decreases. This could mean that as the household size increases there is larger number of people to be taken care of by the same source of income. Hence the effect of the variable is negative.

iv. **Income of Household:** This refers to the sum of earnings of household from both off-farm and on farm sources (Babatunde *et al.,* 2007). The more household head earns income the greater the chances of being food secure. The income is expected to increase household's food production and access to more quantity and quality food. The expected effect of this variable on food security is positive.

v.   **Education of Household Head:** Education is expected to have positive influence on household food security. As the level of education increases, the percentage of food secure households increases. This is expected because with

increase in the level of education, individuals will be able to adopt more modern farm technologies on their farms thus improving their productivity and again have access to better job opportunities in the labour market. The expected effect of this variable on food security is positive.

vi. **Land Size:** Land size is the total area of land cultivated to food and cash crops by households measured in hectares. The larger the farm size of the household, the higher the expected level of food production, it is therefore, expected of a household with a larger farm size to be more food secure than a household with a smaller farm size. Hence the expected effect on food security is positive.

vii. **Farmers' Group:** Farmers' groups is the potential of a farmer to belong to a farmers group or a cooperative the society within the Sub-county. The higher the chances of belonging to a farmers' group the higher the ability to access government support such as seeds, training or credit facilities. Hence the expected effect on food security is positive.

viii. **Farmer Type:** Farmer type refers to either small scale farmer or large scale farmer. Farmer type is expected to have positive or negative influence on household food security. A large scale farmer is expected to have higher impact on food security since he/she cultivates large tracts of land, hence maximum production. A small scale farmer is prone to food insecurity since the food production is also small. Membership to social and development group like Merry-go-round, farmers' savings and credit cooperative organization (SACCO) were relatively higher among large scale farmers.

Table 3.4 depicts the Variables, Description and expected signs for the determinants of level of awareness of food security. The table presents six variables that were used to determine level of awareness. Among the variables used were size of land (LANDSIZE), gender of the household (GENDER), education level of the farmer (EDUC), income of the farmer (INCOME), Farmers Group (FARMERGP), and type of the farmer (FARMTYPE). Gender refers to the roles played by both men and women in the society. It was therefore expected that gender could have a significant effect in terms of knowledge about food security. Further, education level of the

household was thought to have influence on awareness. Finally, average monthly income was included because it was expected that it could explain awareness and alternative risk mitigation strategies on food security. The table 3.4 presented indicates the description and expected signs for the variables.

Table 0.4: Variables, Description and Expected Signs

Variable	Description	Expected sign
LANDSIZE	Size of land in acres [1 = large scale, 0 = small scale]]	±
GENDER	Household gender [1 = male, 0 = female]	+
EDUC	Education level of the household [1 = high educ, 0 = low educ]	+
INCOME	Monthly income of the household [1 = High income, 0 = low income]	+
FARMERGP	Membership to a development group [1 = Yes, 0 =otherwise]	+
TYPEFARM	Type of farmer either small or large scale [1 = large scale, 0 = otherwise]	±

Source: Author computations from field data, 2019

Following Greene (1993), the probability that farmer i is aware of food security can be modelled as:

$$\Pr{ob} = \left[Fi_j = 1 \right] = \frac{e^{\left(\beta' x_i \right)}}{1 + e^{\left(\beta' x_i \right)}} = \Lambda\left(\beta' x_i \right) \quad \text{...} \quad (4)$$

The subscripts i and j denote farmer awareness/knowledge where those who are aware are assigned a value of 1 and 0 for otherwise. It should be noted that equation (3) above represents the reduced form of the binomial logit model, where the x_i row vector of explanatory variables for the ith farmer and the non-observed $\varepsilon i's$ are assumed to follow a distribution of logistic probability with a density function:

$$G'(\beta' x_i) = \Lambda(\beta' x_i)\left[1 - \Lambda(\beta' x_i)\right] \text{..} \quad (5)$$

The probability that farmer i is aware of food security is empirically estimated by the model as:

$$\Pr[F_i = 1] = X_i \beta_i + \varepsilon_i \quad \text{.. (6)}$$

Where X represents a vector of socio-demographic characteristics that influence farmers awareness of food security, β_i is a vector of parameters to be estimated while ε_i stochastic random term. The study also estimated marginal effects. According to Otieno (2013), marginal effects measures instantaneous effects change in explanatory variable on the predicted probability under the assumption that all other explanatory variables are held constant. Thus, marginal effects are computed as follows:

$$\beta_m = \left[\frac{\partial(\beta_i X_i + \varepsilon_i)}{\partial \beta_i X_i} \right] \beta_i \quad \text{... (7)}$$

For continuous explanatory variables.

In terms of dummy variables, equation (5) becomes

$$\beta_m = \Pr[F_i = 1] - \Pr[F_i = 0] \quad \text{.. (8)}$$

CHAPTER FOUR

RESULTS

4.1. Introduction

This chapter presents analysed data that comprises of general information of the respondents, food security, natural factors, socio-economic factors and physical factors which are thought to affect food security awareness.

4.2. Response Rate

Orodho (2003) defines response rate as the extent to which the final data sets includes all sample members and is calculated as the number of respondents with whom interviews are completed and divided by the total number of respondents in the entire sample including non-respondents. The study targeted 84 respondents from Mwala sub-county. However, 60 questionnaires were filled correctly and returned. This translates to 71.4% response rate (Table 4.1). A response rate of above 50% is adequate for analysis (Babie, 2002) thus a response rate of 71.4 % in this study was considered good and adequate for analysis.

Table 0.1: Response Rate

Category	Frequency	Percentage
Response	60	71.4
Non response	14	28.6
Total	**84**	**100.0**

Source: Author computations from field data, 2019

4.3. Requisite Tests

4.3.1. Sampling Adequacy: Kaiser-Meyer-Olkin (KMO) and Bartlett's Test

Factorability is a major concern especially whereby a particular variable is measured using different factors and that one of those factors is to be used to represent that variable. Factorability is the assumption that there are at least some correlations amongst the variables so that coherent factors can be identified. Kaiser-Meyer-Olkin (KMO) and Bartlett's are measures of sampling adequacy that's used to check factorability. From table 4.2, the Bartlett's test has a significant value of 0.002 which is less than 0.005. KMO is also approximately greater than 0.5. We thus conclude that

there is some relationship among the variables hence the data is sufficient for application of factor analysis.

Table 0.2: KMO and Bartlett's Tests

Sampling Adequacy Tests		Values
Kaiser-Meyer-Olkin measure of sampling adequacy		0.52
Bartlett's Test of Sphericity	Approx. Chi-Square	20.716
	Df	6
	Sig.	.002

Source: Author computations from field data, 2019

4.3.2. Multicollinearity

Multicollinearity is the undesirable situation where the correlations among the independent variables are strong. For Multiple Regression to be applicable, there should be no strong relationships among the independent variables. Statistics used to measure multicollinearity include tolerance and Variance Inflation Factor (VIF). Tolerance of a respective independent variable is calculated from $1 - R^2$. A tolerance with a value close to 1 means there is little multicollinearity, whereas a value close to 0 suggests that multicollinearity may be present. The reciprocal of the tolerance is known as Variance Inflation Factor (VIF). A VIF of 5 or greater than 5, indicates there is multicollinearity associated with that variable. Table 4.3 shows the values of the statistics, obtained from the data. The table indicates the test results for multicollinearity, using both the VIF and tolerance. With VIF values being less than 5, it was concluded that there was no presence of multicollinearity in this study.

Table 0.3: Table of Multicollinearity Statistics

Model Collinearity Statistics		
Variable	**Tolerance**	**VIF**
Natural factors	.823	1.216
Socio-economic factors	.916	1.092
Physical factors	.771	1.296

Source: Author computations from field data, 2019

4.3.3. Inferential Analysis: Correlations of the Study Variables

Table 4.4 illustrates the correlation matrix among the independent variables. Correlation is often used to explore the relationship among a group of variables (Pallant, 2010). That the correlation values are not close to 1 or -1 is an indication that the factors are sufficiently different measures of separate variables (Hope-Hailey Farndale, and Kelliher, 2010). It is also an indication that the variables are not multicollinear. Absence of multicollinearity allows the study to utilize all the independent variables.

Table 0.4: Pearson Correlation

Dependent and independent variables		Natural factors	Physical factors	Food security	Socio-economic factors
Natural factors	Pearson Correlation	1	.420*	.294*	.011
	Sig. (1-tailed)		.000	.011	.465
Physical factors	Pearson Correlation	.420*	1	.398*	.025
	Sig. (1-tailed)	.000		.001	.425
Food security	Pearson Correlation	.294*	.398*	1	-.243*
	Sig. (1-tailed)	.011	.001		.030
Socio-economic factors	Pearson Correlation	.011	.025	-.243*	1
	Sig. (1-tailed)	.465	.425	.030	

N=60

*. Correlation is significant at the 0.05 level (1-tailed).

Source: Author computations from field data, 2019

Table 4.4 indicated that natural factors and physical factors have significant positive moderate relationship as attributed by the correlation coefficient of 0.420 and p-value of 0.000. Logically it is expected that the two influence each other in various aspects. The results shows presence of a positive and significant weak relationship between natural factors and food security as proved by the p-value and the correlation

coefficient (r=0.294, p=0.011<0.05). There is a very weak but insignificant relationship between natural factors and socio-economic factors since the p value of 0.465 is greater than 0.05 level of significance and the correlation coefficient is 0.11.

The correlation matrix table shows presence of significant positive relationship between physical factors and food security (r=0.398, p=0.001). The results further show an insignificant relationship between physical factors and socio-economic factors as attributed the p value and correlation coefficient (r=0.025, p=0.425). A significant negative relationship between socio-economic factors and food security can be observed as indicated by the Pearson correlation coefficient of−0.243 and a p-value of 0.030.

4.3.4. Regression Analysis Results

A multiple linear regression analysis was done to examine the relationship of the independent variables with the dependent variable. The adjusted R2 is the coefficient of determination. This value explains how food security varied with natural factors, socio-economic factors and physical factors. The model summary (Table 4.5) shows that 76.3% of variation in food security can be explained by the three predictors namely natural factors, socio-economic factors and physical factors an implication that the remaining 23.7% of the variation in food security could be accounted for by other factors not included in this study.

Table 0.5: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.885[a]	.783	.763	.939

a. Predictors: (Constant), natural factors, socio-economic factors, physical factors

Source: Author computations from field data, 2019

Analysis of variance (ANOVA) was done to establish the fitness of the model used. The table 4.6 shows that the F-ratio (F=5.959, p=.001) was statistically significant. This means that the model used was appropriate and the relationship of the variables shown could not have occurred by chance.

Table 0.6: ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	9.824	3	3.275	5.959	.001[b]
	Residual	30.776	56	.550		
	Total	40.600	59			

a. Dependent Variable: food security

b. Predictors: (Constant), natural factors, socio-economic factors, physical factors

Source: Author computations from field data, 2019

The estimated coefficients (βs) show the contribution of each independent variable to the change in the dependent variable. The coefficients in table 4.7 results show that natural factors (β=.110, p=.233) though positive, insignificantly affected food security in Mwala sub-county. The results also show that socio-economic factors (β= -0.139, p=.033) negatively and significantly affected food security. Physical factors (β= 0.281, p=.011) were found to positively and significantly influence food security.

Table 0.7: Coefficients of Determination

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.479	.287		5.158	.000
	Natural factors	.110	.0091	.155	1.205	.233
	Socio-economic factors	-.139	.064	-.254	-2.180	.033
	physical factors	0.281	.106	.339	2.644	.011

a. Dependent Variable: food security

Source: Author computations from field data, 2019

4.4. Level of Awareness of Food Security

The concept of food security knowledge was analysed from a concept knowledge perspective and the local farmer know-how perspective.

4.4.1. Perception on Respondents' Concept on Food Security

To measure how respondents perceived the concept of food security; a five point hedonic scale was prepared. In order to capture their knowledge on food security, respondents were asked to mention what their understanding on food security was. The aim of this exercise was to examine whether the four basic component of food security (adequate, accessibility, stability of food supply and sustainability of food procurement) were clear to the household respondents. Table 4.8 shows results of five point hedonic scale measuring knowledge on food security. From Table 4.8, 59.9% of all the respondents had excellent knowledge on food security, with Mwala location having the highest number of knowledgeable respondents.

In Muusini location, respondents had the least number of excellent knowledge among the four locations and had a highest number of neutral and moderate knowledge respondents that was 30% and 26.4% respectively. Extremely ignorant and moderate ignorant household of respondents did not exist in Mwala location but did exist in Mbiuni location 3.5% and 6.8%, in Muusini location 6.4% and 0.5%, and in Kabaa 3.4% and 3.6%.

Table 0.8: Percentage of respondents with Knowledge on Food Security Concept N=60

	Location				
Type of knowledge	**Mbiuni**	**Muusini**	**Mwala**	**Kabaa**	**Total %**
Extremely Ignorant (Know Nothing)	3.5	6.4	0.0	3.4	3.3
Moderate Ignorant (below average)	6.8	0.5	0.0	3.6	2.7
Neutral (No clear evidence of presence of lack of knowledge)	11.0	30.0	16.7	3.7	15.3

Moderate knowledge (above average)	12.0	26.4	13.3	23.3	18.8
Excellent knowledge	66.7	36.7	70.0	66.0	59.9
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

During Focus Group Discussion (FGD`s), which were conducted among the four locations, the discussants were asked to explain their understanding on the term 'food security' from local perspectives. Participants in Kabaa location agreed unanimously that, a family would be considered food secure if it had enough maize grain for the entire season, while participants from Mbiuni location mentioned 'food security' to mean having enough maize to run for the whole year. Participants from Muusini and Mbiuni location explained that, a family may have large quantities of other cereal crops like millet/sorghum or maize grains yet the majority of households will still consider the family to be food insecure simply because they do not have beans. The same observation was made in Mwala and Kabaa locations. In Kabaa location where by participants considers being food insecure if there is no enough maize even if there is plenty of cassava.

Commenting on the concept of food security, one member from Mwala Location attested that "if household rely very much on maize for Githeri (mixture of maize and beans) preparation it implies that, the household is food insecure". Most household in Kabaa location consumed Githeri after the depletion of their cassava, mainly between February and April. In Mbiuni location, most of the household consumed food other than cassava in time when cassava stock got finished either due to crop rot, while in the field or because of excessive selling of raw cassava. In general participants complained that, there was a problem among the households on maintaining well balanced diet on their daily menu.

4.4.2. Determinants of Farmer Awareness

In order to ensure that explanatory variables included in the model were not in any way correlated with each other, a multicollinearity test was done through a variance

inflation factor (VIF) computation. A simple ordinary least square (OLS) regression was estimated with awareness as the dependent variable with the rest as explanatory variables. The VIF quantifies the severity of multicollinearity in an ordinary least squares regression. According to Gujarati (2004), VIF shows how the variance of an estimator is inflated by the presence of multicollinearity. The calculation of VIF follows equation 9;

$$VIF = \frac{1}{1 - R_i^2}$$ …………………………………………………… (9)

Where R_i^2 is the R^2 of the regression with the ith independent variable as a dependent variable. Table 4.9 presents the results of the VIF. The mean VIF is 1.31 with explanatory variables having a VIF ranging from 1.05 to 1.59. The VIF for the independent variables are less than five (<5) implying zero multicollinearity. This justifies the inclusion of these variables in the binary logit model (Maddala, 2000).

Table 0.9: VIF for Explanatory Variables

Variable	VIF	1/VIF
FARMDSIZE	1.58	0.633
INCOME	1.53	0.654
LANDSIZE	1.52	0.658
EDUC	1.07	0.935
GENDER	1.05	0.953
FARMERGP	1.04	0.962
Mean VIF	**1.30**	

Source: Model Analysis 2019

Table 4.9 presents the results of the binary logit model. The coefficient values explain the influence of each explanatory variable on the probability of respondents being aware about food security. Furthermore, the marginal effects give what would happen immediately if farmers become aware about food security. The independent variables that significantly influenced farmer awareness were gender, education, and income of the household.

Table 0.10: Logit Model Estimates of the Determinants of Farmers' Awareness on Food Security (Gender and Education Level Considered Categorical)

Variable	Estimates B	S.E.	Sig.	Odds Ratio
Land size	.215	.110	.049	1.240
Gender(male)	-2.647	.975	.007	.071
Education level			.136	
Education level (none)	2.135	1.718	.214	8.456
Education level (primary)	1.126	1.178	.339	3.085
Education level (secondary)	-.623	1.196	.602	.536
Monthly income	.000	.000	.716	1.000
Farmer member of group?(no)	-3.154	2.413	.191	.043
Farmer type(small scale)	1.829	.996	.066	6.229
Constant	-2.697	1.545	.081	.067

Source: Model Analysis, 2019

The results in table 4.10 show that people with bigger tracts of land were more aware of food security as compared to those with smaller parcels of land. Male headed households were less aware of food security as compared to female headed households by as much as 7%. The implication of this is that female headed households are more aware of food security than male headed households.

The odds of being aware of food security for farmers who have never been to school was 8 times greater than the odds of those who have been to tertiary level. The chances of being aware of food security for those who had attained primary education level was 3 times higher than those who had been to tertiary level. On the contrary, the odds of being aware of food security was about 53.6% less for those who had been to secondary level compared to those who were educated up to tertiary level. This implies that farmers' awareness was increased by the education level such as technical institutes, colleges and university compared lower levels of education.

The level of household income had no influence on the level of food security awareness whereas involvement in a farmers' group significantly impacted on the level of awareness. Those who did not belong to farmers' group were about 4.3 % less likely to be aware of food security compared to those who were members of any farmers' group. At the same time, large-scale farmers were about 6 times more likely to be aware of food security compared to smallscale farmers in Mwala sub-county. The odds ratio corresponding to the constant term was 0.067 which implies that regardless of the land size, gender, education level and monthly income, residents of Mwala sub-county are generally less aware of food security by about 6.7%.

4.5. Food Security Status

4.5.1. Respondents Rating on Food Accessibility

Majority of the respondents (51.7%) reported that it was difficult to access food in the household, 28.3% felt that it was difficult getting food, 18.3% were neutral about the statement while the smallest percentage (1.7%) said that food access was easy (Table 4.11). The implication of this is that generally it is very difficult for household in Mwala sub-county to access food.

Table 0.11: Food Access Rating

Opinion	Frequency	Percent
Very difficult	31	51.7
Difficult	17	28.3
Neutral	11	18.3
Easy	1	1.7
Total	60	100.0

Source: Author computations from field data, 2019

About 98% of the respondents evaluated food security status in their households as insecure in relation to their food access rate, while only 2% reported to be food secure (figure 4.1). This implies that the status of food security amongst residents of Mwala sub-county is very low, with most of them being food insecure.

49
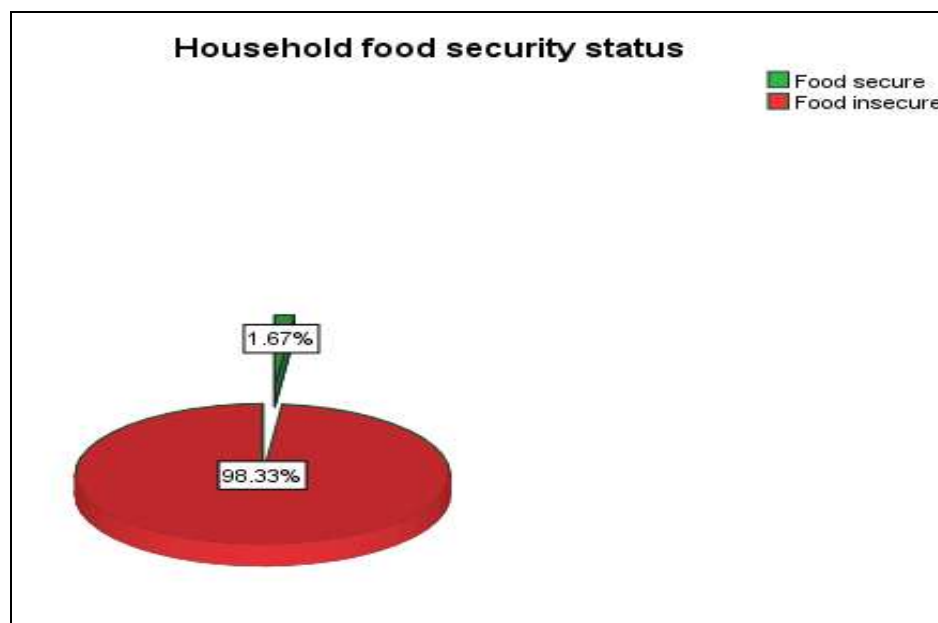
Figure 0.1: Food Security Status

4.5.2. Descriptive Statistics on Food Security

4.5.2.1. Number of Meals per Day

On average members in Mwala sub-county households take two (2) meals per day. This is further supported by the results on table 4.12 and figure 4.1 that depicts that majority of the households members (66.7%) take two (2) meals, followed by those who take three (3) meals (23.3%) per day. Only 10% of the household members take one at least one (1) meal per day. The results further imply that household members takes at least a meal per day.

Table 0.12: Meals taken in a day

	N	Minimum	Maximum	Mean	Std. Deviation
No. of meals taken per day	60	1.00	3.00	2.1333	.56648

Source: Author computations from field data, 2019

4.5.2.2. Main Food Consumed Within the Households

The biggest percentage (65%) of the households in Mwala sub-county depend on maize (maize flour) as the main food, followed by those who mainly consume both

maize and beans (26.7%), then those who feed on maize, rice and beans (5%) while the least number of households (5%) reported that their meals are mostly made of either maize or rice (Table 4.13 and Figure 4.2).

Table 0.13: Main food taken

Food type	Frequency	Percent
Maize (Flour)	39	65.0
Maize and beans	16	26.7
Maize and rice	2	3.3
Maize, rice, beans	3	5.0
Total	**60**	**100.0**

Source: Author computations from field data, 2019
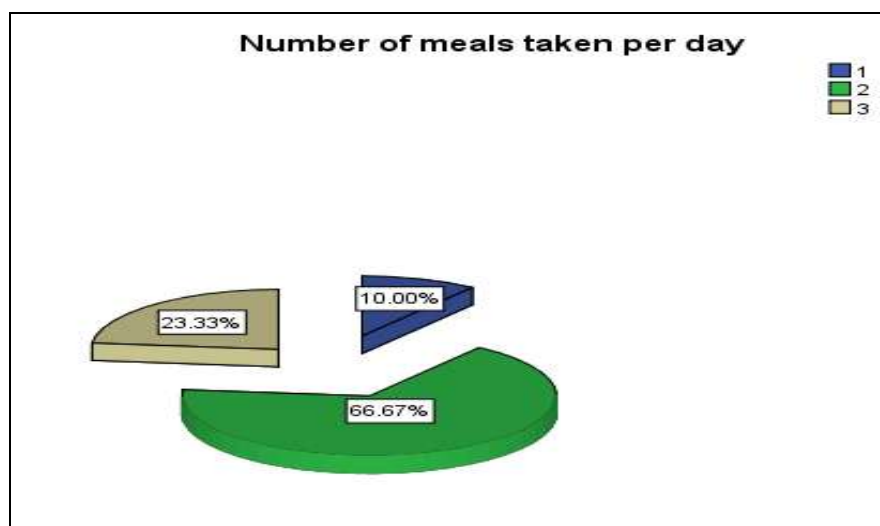
Figure 0.2: Number of meals per day

4.5.3. Causes of Food Insecurity

All participating respondents (100%) attributed their food insecurity to low and variable rainfall pattern while, 88.3% reported that postharvest losses were the main cause of food insecurity in their household. At the same time, 86.7% attributed their food insecurity status to poor agricultural practices with another 81.7% attributing high human population as a major contributing factor. Land degradation was reported to affect 78.3% of the population leading to unstable food supply, while poor market

and conflicts were recorded as major causes of food insecurity by 73.3% and 36.7% respondents respectively. Other causes reported included HIV/AIDS, old age, death of livestock and fluctuation on food prices (Table 4.14).

Table 0.14: Food insecurity causes in Mwala sub-county

Cause of Food Insecurity	Frequency	Percent
Low and variable rainfall	60	100.0
Poor agricultural practices	52	86.7
High human Population	49	81.7
Land degradation	47	78.3
Conflict	22	36.7
Postharvest losses	53	88.3
Poor market	44	73.3
Others: Death of livestock	1	1.7
Fluctuation in food price	1	1.7
HIV/AIDS	4	6.7
Old age	1	1.7

Source: Author computations from field data, 2019

4.5.4. Factor Influencing Food Security

The respondents were asked to indicate the factor mostly affecting food security in their respective households. A considerable number pointed out land use and changes in the rainfall pattern (climate change) with 66.7% and 61.7% respectively (table 4.15). Some 48.3% of the respondents reported access to market as the most influencing factor on food security while 30% pointed out the governance. The results have an interpretation that land use affects food security the most in the households of Mwala sub-county.

Table 0.15: Factor Influencing Food Security

Factor	Frequency(out of 60)	Percent
Climate change	37	61.7
Governance	18	30

Access to market	29	48.3
Land use	40	66.7

4.6. Social-economic Factors Influencing Food Security

4.6.1. Demographic Factors

4.6.1.1. Respondents' Household Position

Of the respondents, a bigger percentage (60%) was household heads while the remaining 40% was not (table 4.16).

Table 0.16: Head of Household

Head of household?	Frequency	Percent	Valid Percent
Yes	36	60.0	60.0
No	24	40.0	40.0
Total	**60**	**100.0**	**100.0**

4.6.1.2. Distribution by Gender

The respondents profiled comprised of 65% females and 35% males. This Implies that majority of the respondents who participated in the study were females.
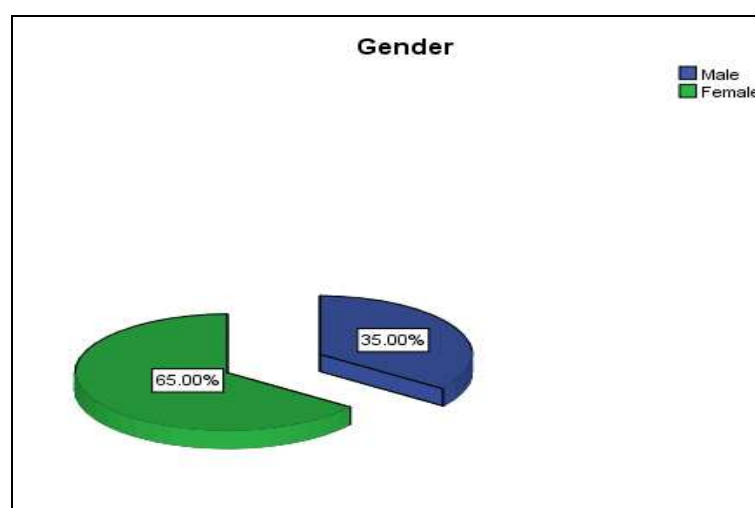

Figure 0.3: Distribution by gender

4.6.1.3. Distribution by Age and Level of Education

Most of the respondents (33.3%) were aged between 50 to 60 years, followed closely by those between 41 to 50 years (31.7%) and those between 31 to 40 years (21.7%). On the other hand, majority (53.3%) of the respondents had attained secondary level of education, followed by those with primary level of education (28.3%), then those with tertiary level of education (13.3%). About 5% of the respondents had no basic education. The implication of these results is that majority of those interviewed were between 31 to 60 years of age inclusive and had attained either the primary or secondary level of education (Table 4.17).

Table 0.17: Respondents' age and level of education

		Respondent's age	Respondent's level of education				**Frequency**
			None	Primary	Secondary	Tertiary	
	18-24 years	3.3%	1	0	1	0	**2**
	25-30 years	6.7%	0	1	2	1	**4**
Age of the	31-40 years	21.7%	0	2	7	4	**13**
respondent	41-50 years	31.7%	0	4	13	2	**19**
	50-60 years	33.3%	2	10	8	0	**20**
	over 60 years	3.3%	0	0	1	1	**2**
Total			**3**	**17**	**32**	**8**	**60**

4.6.1.4. Descriptive on the Household Size and Average Monthly Income

The average number of people living in a particular household in Mwala sub-county was 6 persons, with the minimum number of people being 2 and the maximum number being 12 persons. The standard deviation of 2.246 in table 4.18 implied that the average number of persons living in a particular household lie between 3 and 8. Therefore that there was no huge difference between the number of persons living in a particular household and the other.

On average the monthly average income of household in Mwala Sub-county was KSh.10, 308.33 with the minimum and maximum average monthly income for the

households in this study being KSh. 2,000 and KSh. 35,000 respectively. The standard deviation was Ksh. 8,260, relatively bigger. This is an implication that there is a large difference between the average monthly incomes of households. Some households earn high monthly income compared to others.

Table 0.18: Number of people and average monthly income

	N	Minimum	Maximum	Mean	Std. Deviation
Number of people in the household	60	2	12	5.80	2.246
Average monthly income	60	2,000	35,000	10,308.33	82,60.120
Valid N (list wise)	60				

Source: Author computations from field data, 2019

4.6.1.5. Respondents' Occupation

Majority of the respondents (83.3%) were purely Crop farmers, 10% were both business persons and farmers, 5% were employed while 1.7% comprised of crop and livestock keeper as shown on table 4.19. This imply that farming is the main source of food for majority of households.

Table 0.19: Respondents Occupation

Occupation	Frequency	Percent
Business + farming	6	10.0
Employed	3	5
Crop Farming	50	83.3
Crop and livestock keeping	1	1.7
Total	**60**	**100.0**

Source: Author computations from field data, 2019

4.6.1.6. Market Food Prices

Most of the respondents (51.7%) reported the food prices at the market as very high (Figure 4.4) compared to the prevailing food prices in other Markets within the county. About 31.7% rated the food prices as high, 10% as moderate, and 1.65% as low and 1.65% as very low.
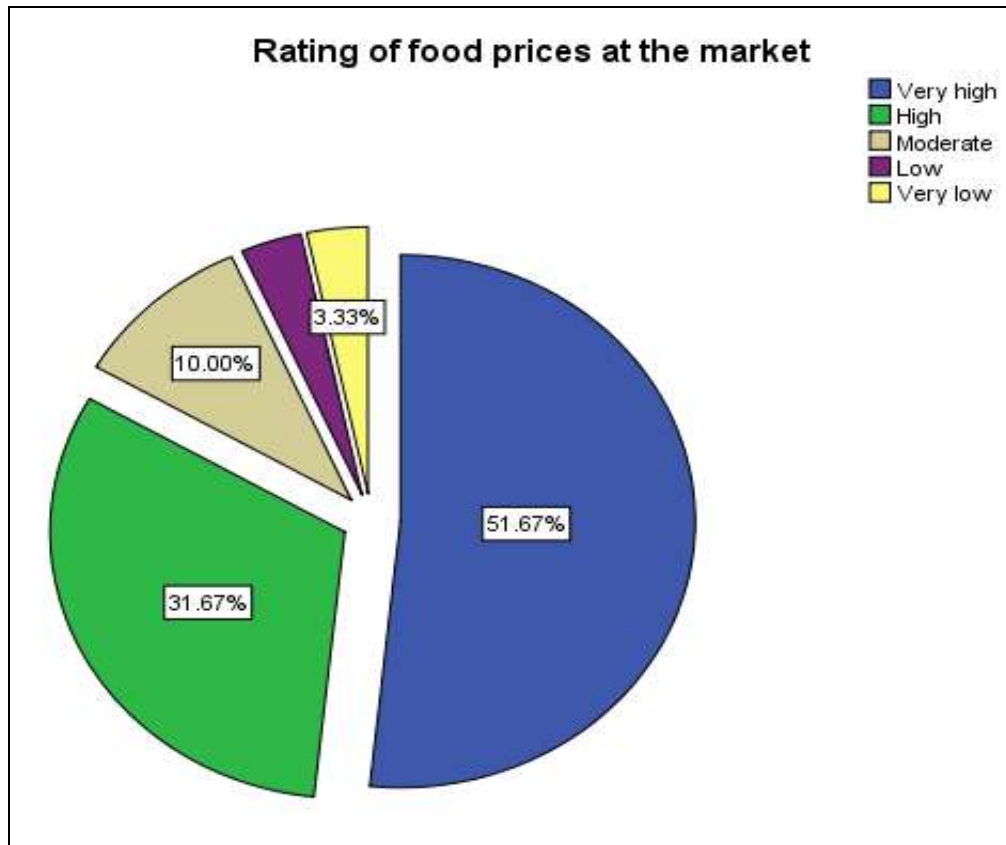
Figure 0.4: Food Prices Rating

4.6.2. Government and Food Security

Awareness on food security as a human right was used to identify the impact of governance on food security. The respondents were asked whether they were aware that food security is a human right and majority (55%) reported that they were aware while the remaining 45% were not aware as shown in table 4.20.

Table 0.20: Food Security Awareness as a Human Right

	Frequency	Percent
Aware	33	55.0
Not aware	27	45.0
Total	60	100.0

Source: Author computations from field data, 2019

4.6.3. Socio-economic Factors in Relation to Food Security

Majority (38.3%) of the respondents strongly disagreed to the statement that government ensure that households have adequate food. This was followed by those who strongly agreed to the statement at 23.3%, then those who disagreed to the statement 16.7%, then those who agree (13.3%) and finally those who were neutral on the statement (8.3%) (Table 4.21).

The respondents were also asked to give their opinion on whether the ministry of agriculture advises them on the best agricultural practices. Table 4.21, shows that majority (30%) of the respondents strongly disagreed, followed by those who agreed (20%), then those who disagreed and strongly agreed (18.3%) and finally those who were neutral on the statement (13.3%). In general the residents of Mwala sub-county don't agree with the statement.

About 28.3% of the respondents strongly disagreed with the statement that the government provides them with certified seeds (table 4.21), this was followed by those who disagreed and strongly agreed (21.7%). Next was those who agreed (18.3%) and finally those who were neutral on the statement (10%). This implies that majority of the respondents did not have access to government subsidised seeds.

Table 0.21: Responses on Socio-economic Factors

Statement	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
Government ensure that households have adequate food	14(23.3%)	8(13.3%)	5(8.3%)	10(16.7%)	23(38.3%)
Ministry of agriculture advise on best agricultural practices	11(18.3%)	12(20.0%)	8(13.3%)	11(18.3%)	18(30%)
Government provides seeds to farmers	13(21.7%)	11(18.3%)	6(10.0%)	13(21.7%)	17(28.3%)

Source: Author computations from field data, 2019

Respondents' opinion on the extent to which they think the government affect the availability of food in their households is shown on table 4.22. Majority (31.7%) reported that the government affect food availability in the house hold to a very small extent.

Table 0.22: Extent to Which Government Affect Food Availability in Household

	Frequency	Percent
Very large extent	16	26.7
Large extent	10	16.7
Neutral	9	15.0
Small extent	6	10.0
Very small extent	19	31.7
Total	60	100.0

Source: Author computations from field data, 2019

4.7. Physical Factors Influencing Food Security

4.7.1. Market Accessibility and Food Availability

On average the residents of Mwala sub-county have to cover about 10.5 Kilometres to access the market in order to buy or sell food. The distance covered range between 0.5 to more than 10.5 Kilometres (Table 4.23).

Table 0.23: Distance Covered to Access the Market

	N	Minimum	Maximum	Mean	Std. Deviation
Distance to the market	60	.50	30.00	10.5250	6.67491

Source: Author computations from field data, 2019

The effect of market accessibility on food availability affected to a very large extend majority (58.9%) of Mwala Sub-county residents. This was followed by those who indicated large extent (26.7%). The results are as shown in table 4.24.

Table 0.24: Extent to which Market Accessibility Affect Food Availability

Feedback	Frequency	Percent
Very large extent	35	58.3
Large extent	16	26.7
Neutral	3	5.0
Small extent	1	1.7
Very small extent	5	8.3
Total	**60**	**100.0**

Source: Author computations from field data, 2019

Respondents' feedback was sought on the means they use to transport their produce to and from the market. About 57% reported that they carry the produce themselves. This was followed closely by those who use public means (53.3%), then 46.7% those who use donkeys and finally only 1.7% of those who use camels (Table 4.25). The implication of these results is that majority of residents of Mwala sub-county either

carry the produce themselves or use public transport to take their produce to the market and that camel transport is hardly ever used among the residents.

Table 0.25: Means of Transport

Means	Frequency(out of 60)	Percent
Donkey	28	46.7
Camel	1	1.7
Carry themselves	34	56.7
Public means	32	53.3

Source: Author computations from field data, 2019

4.7.2. Land size, use and productivity

On average, residents of Mwala sub-county own about 7 acres of land with some owning up to 30 acres and the least owning less than an acre. Of the total land size, on average about 66% is under food related activities, with some utilizing the entire piece of land for food production and some as low as 5% of the total land size. The standard deviation of 20.5 implies a large spread about the average percentage of land used for food related activities (Table 4.26).

Table 0.26: Land size and percentage of land under food related activities

	Minimum	Maximum	Mean	Std. Deviation
Land size	.13	30.00	7.3396	5.64735
Percentage of land under Food related activities	5.00	100.00	66.1450	20.53324

Source: Author computations from field data, 2019

In terms of land productivity, majority (51.7%) reported very low production from their land. Twenty percent (20%) rated their land productivity low, 16.7% rated it as

moderate, 8.3% rated it high while only a small percentage (3.3%) reported that their land productivity is very high (Table 4.27). This has an interpretation that in general land productivity is low in Mwala sub-county.

Table 0.27: Extent of Land Productivity

	Frequency	Percent
Very high	2	3.3
High	5	8.3
Moderate	10	16.7
Low	12	20.0
Very low	31	51.7
Total	**60**	**100.0**

Source: Author computations from field data, 2019

On the extent to which size of land affect food availability in the household, 56.7% rated it very large, 20% rated it large and minority (3.3%) rated it very small extent (Table 4.28). This is an implication that majority of the residents in the sub-county were of the opinion that land size is a key factor influencing food availability in their respective households.

Table 0.28: Extend of Effect of Land Size on Food Availability

	Frequency	Percent
Very large extent	34	56.7
Large extent	12	20.0
Neutral	8	13.3
Small extent	4	6.7
Very small extent	2	3.3
Total	**60**	**100.0**

Source: Author computations from field data, 2019

4.8. Natural Factors Influencing Food Security

4.8.1. Important Hazards in the Area

With regards to the hazards experienced, majority (68.3%) of the respondents reported that they had experienced delayed rains, followed closely by those who experience drought (66.7%) while a minority had experienced flash floods (Table 4.29).

Table 0.29: Hazards Experienced in Mwala Sub-county

Hazard	Frequency	Percent
Drought	40	66.7
Flash floods	8	13.3
Delayed rains	41	68.3

Source: Author computations from field data, 2019

Drought was rated as the most important hazard recurring in Mwala sub-county by 63.3% of the respondents followed by flood (33.3%). Out of all respondents about 26.7% rated pests and diseases as the third important hazard. The least rated hazard was water shortage (6.7%) (Table 4.30). This implies that Mwala households have enough water supply for their domestic needs despite the fact that drought is catastrophic in the area.

Table 0.30: Most Important Hazards

Hazard rating	Hazard	Valid N	Frequency	Percent
Hazard rated first	Drought	60	38	63.3
Hazard rated second	Flood	60	20	33.3
Hazard rated third	Pest and diseases	57	16	26.7
Hazard rated fourth	Animal diseases	40	7	11.7

Hazard rated fifth	Malaria	37	8	13.3
Hazard rated sixth	Increasing food prices	37	5	8.3
Hazard rated seventh	Conflict	36	7	11.7
Hazard rated eighth	Water shortage	36	4	6.7

4.8.2. Climate Change and Food Security

About 70% of the respondents strongly agreed that they had noticed weather changes in the area, 15% agreed, 6.7% neither agreed nor disagreed, 3% disagreed while 3.3% strongly disagreed. This implies that majority of the respondents had noticed the weather changes in Mwala sub-county.

Sixty one point seven percent (61.7%) strongly agreed to the statement that climate changes affect grazing and farming. This formed the majority followed by about 20% who agreed, the next 11.7% comprised of those who neither agreed nor disagreed while 3.3% disagreed and strongly disagreed with the statement. This implies that about 81.7% concurred with the statement that climate changes affect their grazing and farming in the area (Table 4.31).

Table 0.31: Opinion on weather changes within Mwala sub-county

Statement	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
I have noticed weather changes in the area	42(70.0%)	9(15.0%)	4(6.7%)	3(5.0%)	2(3.3%)
Weather changes affect farming and grazing of livestock	37(61.7%)	12(20.0%)	7(11.7%)	2(3.3%)	2(3.3%)

CHAPTER FIVE

DISCUSSION

5.1. Food Security Status in Mwala

Majority of the households covered in the research (98%) indicated that they were exposed to food shortage within the sub-county. The status of food security amongst residents of Mwala sub-county is very low, with only 7% of the total households being food secure.

A multiple regression analysis model was used to measure the food security index of Mwala Sub-county. From the multiple regression results in Table 4.20, equation 2 yields;

$$Y = 1.479 + 0.110X_1 - 0.139X_2 + 0.281X_3$$

According to the regression equation established, holding all independent factors constant, food security index was approximated at 2. This is interpreted to mean that at the baseline, that is, when natural, socio-economic and physical factors are held constant, then it would be difficult for the households in Mwala sub-county to get food. The study shows that the households in Mwala sub-country on average (66.7%) have the privilege of taking two meals per day (Table 4.12). The results further imply that households take at least 1 meal per day. Wambua (2008), learned that households skipped a meal as a coping strategy to periods of food shortage. Other strategies adopted by households that Adekoya (2009) identified included, consumption of unconventional food, reliance on help from relatives or friends outside the household, reduction in quantity served to children and purchasing food on credit. This indicates that, although Mwala Sub-county households have access to food, but its sustainability is not guaranteed while at the same time, its quantity is limited.

From the regression equation taking all other independent variables at zero, a unit increase in natural factors will lead to approximately 1 unit increase in food security (Table 4.7). The interpretation of this is that, as the extent to which weather or climatic factors approach or tend to small extent, the easier it becomes for the households in Mwala sub-county to get food. However, this influence is rendered insignificant by the corresponding p value of 0.233 (Table 4.7).

A unit increase in socio-economic factors will lead to approximately 1 unit decrease in food security (Table 4.7). This means that the more irresponsible/reluctant the government becomes in advising and supporting residents of Mwala sub-county on agricultural related activities, the more difficult it would be for them to get food. A number of the residents of Mwala sub-country reported not to have received government support on agricultural issues (Table 4.15). Accordingly, the study brings out the impact of the government in promoting food security among its citizens.

A unit increase in physical factors will lead to approximately 1 unit increase in food security (Table 4.7). The implication of this result is that the lower the market prices for the produce becomes the easier it would be for the households to get food hence food secure. This is because households would not be encouraged to sell their little harvest and further that it will be easier for them to buy food from the market when they have little or none. Other measure that will possibly contribute to food security under the physical factors is improvement in land utilization on agriculture related activities.

Food is a basic human need. However, the accessibility and availability of enough food in the desired quality throughout the year remains a dream for many people within Mwala sub-county. Majority (51.7%) of the residents of Mwala Sub-county find it difficult to access food in the household with only a small percentage (1.7%) having ease access (Table 4.11). With an average household size of 6 members, most of the households hardly meet and sustain their food needs (Table 4.18). They therefore adopted varied coping strategies such as; reducing or rationing household consumption and reducing the number of meals per day (to 2 or 1) (Table 4.12). Such kind of adaptation exposes household members to disease attack since they try to work hard in farms while consuming small quantity of a diet that is also unbalanced. Generally it is very difficult for household in Mwala sub-county to access food. Many factors contribute to this matter as the residents continue to battle with frequent droughts, market inaccessibility, lack of government support, low income levels, poor production and decreasing land size.

5.2. Food Security Awareness and Knowledge

Food security does not just mean physical availability of any single commodity such as maize as is the case depicted by Mwala sub-county residents. The concept of Food security covers *availability*, *accessibility* in terms of affordability in adequate quantities, *stability* in supply and *sustainability* and utilization of the food. The study showed a 59.9% excellent knowledge on food security by residents of Mwala location (Table 4.8). The possible explanation of that situation might have been because of higher literacy rate among respondents. It was also identified that nutritional security was wanting among the households. Lack of sustainable income was the main reason identified to contribute heavily on the food insecurity problem in Mwala Sub-county.

Despite majority of the respondents having excellent knowledge on food security, that did not mean majority of households were food secure. The high food insecure households consume at least a meal per day for an average of six family member (Table 4.12 and 4.18). A half of the population are farmers (50%) whose earnings largely go to food purchase depend on average KSh.10, 308 per month (Table 4.18), which is below the recommended Kshs. 18,168 by FAO /World Bank (GOK 2001; 2004). Unfortunately, this is not enough to buy other necessary foods like meat, fish, sugar, milk and other nutrition foods throughout the year. In addition, the cost of production within these households is high compared to the output. This situation makes households have limited access to nutritious food from either farm production or market purchase hence exposing them to the consequences of food insecurity. The lack of any of the four aspects of food security results in food insecurity, a common phenomenon in the sub-county.

It was observed that to most of the household, the concept of food security in the surveyed area implied physical availability of one commodity (maize). Majority of the household were aware of food security but could not identify with the four concepts of food security. Food security has generally been taken as synonymous with maize security (Nyoro *et al.,* 1999). In the context of Mwala sub-county, having enough maize to last a season or the whole year meant the residents were food secure. Others believe food security means having enough maize and beans to support the family.

While most households rely on maize as a staple crop, the declining production exacerbates the food security issue in the sub-county. Maize is a staple crop and contributes about 50% of daily caloric intake for most households (USDA, 2009). However, sole consumption of maize does not provide the recommended nutrients to the households, hence leading to nutritional insecurity. From the farmers' perspective, it is evident that the residents of Mwala sub-county did not have an idea of the four concepts of food security.

5.3. Determinants of Farmer Awareness

Gender, education, and income of the household significantly influenced farmer awareness of food security. The results show that a unit increase in land size, increase food security awareness by about 24 % among residents of Mwala sub-county (Table 4.7). This implies that those people with bigger tracts of land were more aware of food security as compared to those with smaller parcels of land. On the other hand Male headed households were less aware of food security as compared to female headed households by as much as 7% (Table 4.10). These results are in contract with Adugna's (2011) work, which showed that female headed households were food insecure than male headed households. The implication of this is that female headed households are more aware of food security than male headed households. This could be attributed to the fact that women usually spend more time on the farms as compared to men. According to Karaya *et al.,* (2013), women play a major role in primary food production and are therefore the main custodians of food security. The results are consistent with those of Adesope *et al,.* (2010) who found out that female consumers in Northern Nigeria were more likely to be aware of safety labels of sugar.

The odds of being aware of food security for farmers who have never been to school is about 8 times greater than the odds of those who have been to tertiary level. The chances of being aware of food security for those who had attained primary education level was about 3 times lower than those who had been to tertiary level. On the contrary, the odds of being aware of food security was about 53.6% less for those who had been to secondary level compared to those who were educated up to tertiary level (Table 4.10). This implies that those farmers who had been to technical institutes,

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colleges and university were more aware of food security compared to those who had been to secondary schools. Low education levels is frequently the basis to unemployable skills, strong cultural beliefs and practices leading to low adoption rate in modern farming practices hence awareness of food security and its concepts (Wambua *et al.*, 2014).

The level of household income had no influence on the level of food security awareness however, farmers' participation in a farming group increased their food security awareness. Those who did not belong to farmers' group were about 4.3% less likely to be aware of food security compared to those who were members of any farmers' group (Table 4.10). This finding concurs with those of Kumar (2011) that farmer's participation in social and community-based organization increased the probability of being aware about food security. Small scale farmers were more aware of food security compared to large scale farmers in Mwala sub-county. Consequently, regardless of the land size, gender, education level and monthly income, residents of Mwala sub-county are generally less aware of food security let alone its concepts or focus points.

5.4. Causes of Food Insecurity

In the recent years, Kenya has been facing severe food insecurity problems attributed to several factors; Climatic factors, high costs of domestic food production as a result of high costs of inputs especially fertilizer, internal displacement of farmers, high global food prices, low purchasing power due to high level of poverty among others (Wambua *et al.,* 2014; Endalew *et al.*, 2015).

Food security is closely tied to natural, physical and social-economic factors that have significant and moderate positive relationship which influences each other in various aspects. From the results a positive and significant weak relationship between natural factors and food security was identified. Normally natural factors such as climate change, drought, floods and famine are important determinants of food security situation in different parts of the world (FEWS NET, 2013). There too was a very weak but insignificant relationship between natural factors and socio-economic

factors. This is in concurrence with what one would expect as natural factors are sometimes unpredictable and uncontrollable.

From the correlation matrix a significant positive relationship between physical factors and food security was observed. This could be because physical factors are mostly human controlled and may have significant influence on food security issue. The results further show presence of insignificant relationship between physical factors and socio-economic (Table 4.4). This therefore imply that in Mwala sub-county governance has minimal or no influence on market accessibility, education levels and land use.

Furthermore, a significant negative relationship between socio-economic factors and food security was detected (Table 4.7). This means that national and local government have a negative influence on food security in Mwala sub-county. Mwala sub-country residents (100%) attribute their food insecurity to low and variable rainfall pattern, postharvest losses (88.3%), poor agricultural practices (86.7%) and population pressure (81.7%). Land degradation was reported to affect 78.3% of the population leading to unstable food supply, while lack of market and conflicts were recorded as major causes of food insecurity by 73.3% and 36.7% respondents respectively. Other causes reported included HIV/AIDS, old age, death of livestock and fluctuation on food prices (Table 4.14).

The multiple linear regression analysis explains how food security varied with natural factors, socio-economic factors and physical factors. A 76.3% of variation in food security can be explained to have been influenced by the three predictors namely natural factors, socio-economic factors and physical factors. This implies that the remaining 23.7% of the variation in food security could be accounted for by other factors not included in this study. Natural factors (β=.110, p=.233) positively though insignificantly affected food security in Mwala sub-county, socio-economic factors (β= -0.139, p=.033) negatively and significantly affected food security, while physical factors (β= 0.281, p=.011) were found to positively and significantly influence food security (Table 4.7).

5.5. Natural and Physical Factors

Changes in weather and climate were identified to play an important role in the food security status of Mwala sub-county. Weather changes negatively impacted both farming and grazing activities for 81.7% farmers. Majority (68.3%) of the farmers experienced delayed rains, drought (66.7%) while a minority (13.3%) experienced flash floods. Drought was rated as the most important hazard recurring in Mwala sub-county followed by floods. Pests and diseases were rated as the third important hazard. The least rated hazard was water shortage (6.7%) (Table 4.29). This implies that Mwala households have enough water supply for their domestic needs despite the fact that drought is catastrophic in the area.

The impact of climate change poses a significant challenge to agricultural productivity, as the frequency of drought is expected to increase both in intensity and extent. The dry periods are expected to get drier while the wet periods are projected to get wetter. Mwala sub-county experiences poorly distributed rainfall ranging between 500-1250mm per year (GOK, 2009). Being a drought prone zone, the reduced levels of short rains could have led to frequent droughts resulting in low productivity since short rains are the most productive and account for approximately 70% of the food output. Climate change is also responsible for unpredicted floods as the rainfall levels intensify during the wet season. Reduced precipitation has been observed to promoted abundance and spread of pest and diseases hence increasing the cost of production while reducing the production levels. Households have therefore developed low resilience to shocks as a result of repeated exposure to drought, floods and pest-diseases hazards.

Market accessibility has influenced food security in Mwala sub-county immensely. The residents cover about 10.5 Kilometres to access the market in order to buy or sell food (Table 4.23). In rural areas, households depend on agricultural production for about 20% of household food consumption and rely on the market for the rest (FEWS NET, 2013). The effect of market accessibility on food availability affected to a very large extend majority (58.9%) of Mwala Sub-county residents (Table 4.24). The high produce market prices experienced by most residents, reduce their chances of food

access and availability (Figure 4.4) as Hoddinott (1999) reported of remote village households facing higher food prices and less access to food variety. Additionally, 57% of the population lack a means of transporting their produce to and from the market and end up carrying the produce on their back, limiting the amount of produce marketed. Those who use public transport accounted for 53.3% of the population but high transport cost further limit their access to the market (Table 4.25). Given the high degree of market reliance, most households in Mwala sub-county become vulnerable to food insecurity due to the market inaccessibility (in relation to distance and means of transport) and high prices.

On average, residents of Mwala sub-county own about 7 acres of land on average and about 66% is utilized for food related activities though some utilize the entire piece of land for food production (Table 4.26). Depleted soils, irregular rainfall and lack of proper inputs has affected the land productivity. A majority (51.7%) reported low production from their land attributing it to land size and only 3.3% enjoying sufficient productivity (Table 4.28). Food security in Mwala sub-country can be attributed to a large extend on land use (66.7%), climate change (61.7%) and market access (48.3%) as was observed by Waweru *et al.,* (2015). Therefore land use affects food security the most in the households of Mwala sub-county.

5.6. Social-economic Factors

The major socio–economic factors that emerged significant in this study were low involvement of the government in promoting agricultural activities in the sub-county, low education levels, unfavourable marketing system, poor agricultural practices which contributes to low yields, poor post-harvest management leading to high rate of food waste and limited sources of household income.

Lack of country government and local government support was identified as the major social-economic contributing factor to food insecurity in the area. Majority (38.3%) of Mwala sub-county residents reported less involvement of the government in addressing food insecurity issue in the region. These residents rarely received extension services from the Ministry of agriculture on good agricultural practices.

Even though the government had made strides in promoting agriculture in the country through subsidized inputs, a good number (28.3%) of the respondents strongly disagreed (Table 4.21). This implies that Mwala Sub-county has not been benefiting fully from the government subsidized seeds, fertilizers and agricultural advisory services.

Other factors that affected to food security of households in the study area included respondents' occupation and income as evidenced by low average income of KSh.10, 308.33 per month (Table 4.18). Low income levels means that most households had low purchasing power leading to lack of the ability to access food during periods of shortage. These factors contribute to overdependence on agriculture as the sole source of income as also observed by Wambua *et al*., (2014) in their study on food insecurity issues of Kenyan dry lands ecosystem.

Notably 65% of the households were female headed exposed vulnerably to food insecurity. This can be attribute to the fact that male gender is more advantaged when it comes to property control and better access to education. This bias leads to most females having less authority over the land need for farming activities and marketing of produce which culminates to food insecurity (Wambua *et al.,* 2014; Adekoya, 2009).

The right to food as a basic need is fundamental and without it many other human rights cannot be enjoyed (Josanthony, 1999). In Mwala sub-county, 55% of the population know it's a human right to be food secure while 45% were not aware. Awareness could be one thing but achieving it is another, hence food insecurity is still rampantly the defining characteristic of the semiarid area of Mwala Sub-county. This has headed the residents (31.7%) to believe that the government was not in the forefront of ensuring adequate availability and sufficient sustainable supply of food within the household although access to food is a human right.

CHAPTER SIX

CONCLUSIONS AND RECOMMENDATIONS

6.1. Introduction

This chapter presents the summary of the major findings and the conclusions from the results of this study. It also presents the recommendations from the findings of the study. This has been done in respect to the stipulated objectives of the study and the research questions posed in Chapter One of the thesis.

With regard to the influence of climate change (natural factors) on food security, the study found out that majority (70%) of the participants reported to have experienced climate changes in the area. Delayed rains (68.3%) was the most experienced phenomenon describing the extent of the weather changes in the study area. Sixty one point seven (61.7%) of the respondents agreed that cliamte changes affected farming and grazing. Majority (61.7%) of the respondents indicated that climate change affected food security to a large extent, with 43.7% saying this was to a very large extent. The results shows presence of a positive and significant weak relationship between natural factors (climate change) and food security as proved by the p-value and the correlation coefficient (r=0.294, p=0.011<0.05).

With regard to the effect of governance on food security, majority (55%) reported that they were aware while the remaining 45% were not aware that food security was a human right issue. Findings of the study indicated that majority (38.3%) of the respondents strongly disagreed to the statement that government ensure that households have adequate food. This was followed by those who strongly agreed to the statement at 23.3%, then those who disagreed to the statement, then those who agree (13.3%) and finally those who were neutral on the statement. Over one third (31.7%) of the respondents felt that governance affected food security to a very small extent. The presence of a significant negative relationship between socio-economic factors and food security indicated by the Pearson correlation coefficient of−0.243 and a p-value of 0.030 means that governance have a negative influence on food security in Mwala sub-county. However, the *Beta* weight shows that a unit change in governance reduces food insecurity by 1 unit.

This study also assessed the effect of access to markets on food security. On average the residents of Mwala sub-county have to cover about 10.5 Kilometres to access the market in order to buy or sell food products. The distance covered range between 0.5 to 30 Kilometres. This implies that some residents are very close to the market places while others are as far as 30 kilometre. Field observations also showed that majority (51.7%) of the respondents felt that the food prices were too high, 31.7% rated the food prices as high, 10% as moderate and 3.3% as low and very low respectively. Over half (58.9%) of the participants felt that access to markets affected food security to a large extent. Access to markets has a strong positive correlation (r=0.398) and is shown through regression analysis to have a significant (df=59, p<0.05) influence on food security. The **Beta** weight show that an increase in access to market leads to an increase in food security by 1 unit.

Finally, this study also looked at the effect of land use on food security. Results of the study reveal that majority (94.5%) of the participants owned less than 10 acres of land. Over half (56.7%) of the participants indicated that they used at least half of their land for food production. Findings also show that over one fifth (20%) used over 75% of their land for food production. Further, slightly over two fifths (40.2%) of the respondents indicated that their land was fairly productive, while over two thirds (66.7%) felt that the proportion of land under crop impacted on their food security to a large extent. Land use has a strong positive correlation (r=0.025) and was found to significantly (df=59, p<0.05) influence food security in the study area. Indeed, the regression analysis indicated that land use (p=0.01) had a significant effect on food security both at the 95% and 99% level of confidence. The **Beta** weight shows that a unit increase in land use leads to an increase in food security by 24%. Both multiple regression and binomial logit models were employed in empirical analysis of the primary data. The key findings of the study were that gender, education and income of the farmer significantly affected awareness of food security.

6.2. Conclusion

The study concludes that climate change, access to market and land use are important determinants of food security in Mwala Sub-county. Climate change has had a

significant impact on food production in the study area evidenced by delayed erratic rainfall which influence farming and grazing.

Further, findings of the regression analysis indicated that governance was not a critical determinant of food security. However, the *Beta* weight showed that a unit increase in governance leads to a reduction (- .139) of food security by 13.9 units. This may mean that governance is not enough in enlightening about food security since there may be other factors such as climate change that could still hamper the realization of food security in the area. In addition, the local Ministry of Agriculture officials in the area were reported not to be active in promoting expansion of agricultural based alternative livelihood strategies to cushion residents to the vagaries of food insecurity. It emerged strongly in FGDs that residents were not provided with much needed inputs and education which could improve food production and hence food security in Mwala Sub-county.

6.3. Recommendations

Several recommendations of dealing with farmers' food insecurity in Mwala Sub-county are proposed herein. They focus on means of improving household food production, means of improving household food consumption patterns, means of improving food access through food purchases and means of improving the use of less drastic coping strategies in cases of household food insecurity. Basing on the above conclusions, it is clear that although residents of Mwala Sub-county have excellent knowledge on food security, majority of the households are food insecure. It is therefore recommended that:

Location and Sub-county officials should enlighten Mwala Sub-county residents on food as a human basic right and food security as an issue to consider beyond the simplistic matter of mere availability. Knowledge dissemination to farmers on the four pillars underpinning food security: food availability, food accessibility, utilization and stability in form of extension services can offer great opportunities of increasing the capacity of farmers' awareness and knowledge of food security that could help fight food insecurity. An enlightened resident on food security will be able

to appreciate the value of proper storage of harvested agricultural products for sustainability, increased productivity to enhance food availability and proper financial planning for improved accessibility.

Low level of education among the household in the study area was found to affect level of awareness of eating habits and had direct implication on their health. It is recommended that, there is a need for locations and Sub-county officials to engage the community in the study area to raise awareness on food security and its essential value to health so as to avoid and reduce health implication associated with poor diets. These will encourage community at large to be conscious and informed about awareness and importance of the nutritional content of food and therefore will lead the households to supports eating habits of healthy food.

Climate change was identified a major natural factor promoting food insecurity to a large extent. Alternative farming methods should be upheld in Mwala Sub-county such as precision agricultural, promotion organic and inorganic fertilizers use to improve crop productivity, water and soil conservation awareness, use of certified seeds and embracing planting of drought tolerant and resistant crop varieties suitable for the area. Financial intervention among the rural poor with the rationale of enhancing agricultural productivity to address the food insecurity concept should be a focus by the county and national government.

Residents of Mwala sub-county reported to cover long distances to access the market, while the food products fetched high prices leading to less access to food. The findings thus provide policy insights on key areas of intervention in terms of market and infrastructure. The country and sub-county government need to open up markets that are closer to the locations to enable resident cover short distance, reduce cost of food products and promote affordable food access in the sub-country.

REFERENCES

Achonga, B.O., Akuja, T.E., Kimatu, J.N. and Lagat, J.K. (2015): Implications of Crop and Livestock Enterprise Diversity on Household Food Security and Farm Incomes in the sub Saharan region, *Global Journal of Biology, Agriculture & Health Sciences,*Vol.4(2):125-129.

Adams, E.R., Hamilton, P.B. and Gibson, W.C. (2010). African Trypanosomes; Celebrating Diversity. *Trends in Parasitology*. Article in press

Adekoya, A.E. (2009). Food Insecurity and Coping Strategies among Rural Households in Oyo State, Nigeria. *Journal of Food, Agriculture and Environment*, vol. 7(3&4), 187-191.

Adesope, A.A.A., Awoyemi, T.T., Falusi, A.O. and Omonona, B.T. (2010). Willingness to Pay for Safety Label on Sugar and Vegetable Oil among Households in South–Western Nigeria. *Journal of Agriculture and Social Research*, 10(1).

Adugna E, Wogayehu B (2011). Causes of Household Food Insecurity in Wolayita: Southern Ethiopia. *Journal of Stored Products and Postharvest Research*, 3(3):35-48.

Allemann, J., S. M., Laurie, S., Thiart and H. J. Voster. (2004). Sustainable Production of Root and Tuber Crops (Potato, Sweet Potato, Indigenous Potato, Cassava) In Southern Africa. *South African Journal of Botany* 70 (1): 60-66.

Amaza, P.S., Umeh, J.C., Helsen, J. and Adejobi, A.O. (2006). Determinants and Measurements of Food Insecurity in Nigeria: Some Empirical Policy Guide (No. 1004-2016-78541).

Amwata, D. A., Nyariki, D. M., & Musimba, N. R. (2016). Factors Influencing Pastoral and Agropastoral Household Vulnerability to Food Insecurity in the Drylands of Kenya: A Case Study of Kajiado and Makueni Counties. *Journal of International Development*, 28(5), 771-787.

Arene, C.J and Anyaeji, J. (2010). Determinants of food security among Households in Nsukka metropolis of Enugu State, Nigeria. *Pakistan Journal of social studies* 30(1):9-16.

African Women's Studies Centre (AWSC) (2014). Status Report on the Kenya National Food Security: Zero Tolerance to Hunger, Kenya Constitution Article 43 (1) (c).University of Nairobi Press. Nairobi.

Babatunde, R.O, Omotesho, O.A and Sholotan, O.S (2007). Socio-Economic Characteristics and Food Security Status of Farming Households in Kwara state, North-central Nigeria. *Pakistan Journal of Nutrition* 6(1): 49-59.

Babbie, E., Mouton, J. (2002). Social Research. Belmont, CA: Wadsworth Group.

Bartfeld, J. and Wang, L. (2006). Local Level Predictors of Household Food Insecurity. Madison: University of Wisconsin.

Below, T. B., K. D. Mutabazi, D. Kirschke, C. Franke, S. Sieber, R. Siebert, and K. Tscherning. (2012). Can Farmers' Adaptation to Climate Change be Explained by Socio-Economic Household-Level Variables? Global Environmental Change 22(1):223-235.

Cooper, P. S., and Schindler, D. (2001). *Business Research Methods*. New York: McGraw-Hill/Irwin.

D'Haese, M., Verbeke, W., Van Hylenbroeck, G., Kirsten, J. And D'Haese, L. (2005). New Institutional Arrangements for Rural Development. The case of local wool growers association in Transkei area, South Africa. *The Journal of Development Studies,* 41 (8): 1444-1466.

De Waal, A. (1990). A Re- assessment of Entitlement Theory in the Light of the Recent Famines in Africa. *Development and Change*, 21(3), 469-490.

DFID (Department for International Development) (2004). Poverty and Hunger. Online document: http//www.Is.ac.uk/poverty-hunger/aims.html.

Droogers, P. (2003). Adaptation to Climate Change to Enhance Food Security and Preserve Environmental Quality: Example for southern Sri Lanka. *Agricultural and Water Management* 66: 15-33.

Endalew, B., Muche, M. and Tadesse, S. (2015). Assessment of Food Security Situation in Ethiopia: A Review. *Asian Journal of Agricultural Research*, 9(2), 55-68.

European Commission (2000). Integration of Food Security Objective within Poverty Reduction Framework. Directorate-General Development, Sectorial

Strategies, Rural Development, Food security. DEV/A/1/uwD (99),I:\uw\opm poverty\final text 1-3-2000.doc

FAO (Food and Agricultural Organization) (2014). *The State of Food Insecurity in the World*, FAO, Rome, Italy.

FAO (Food and Agricultural Organization) (2013). *Food Outlook: Biannual Report on Global Food Markets.* FAO, Rome, Italy.

FAO (Food and Agricultural Organization) (2012). *Gender inequalities in Rural Employment in Ghana an overview. Prepared by the Gender, Equity and Rural Employment Division,* FAO, Rome, Italy.

FAO (Food and Agricultural Organization) (2011). *The State of Food Insecurity in the World: How Does International Price Volatility Affect Domestic Economies And Food Security*? FAO, Rome, Italy

FAO (Food and Agricultural Organization) (2006). *The Role of Food and Agriculture*. FAO, Rome, Italy

FAO (Food and Agricultural Organization). (2001). *Handbook for Defining and Setting up a Food Security information and Early Warning System (FSIEWS)*, FAO, Rome, Italy

FAO, IFAD, WFP (2013): The State of Food Insecurity in the World. The Multiple Dimensions of Food Security." Food and Agriculture Organisation, Rome

FEWS NET (Famine Early Warning Systems) Kenya Food Security Report, (2014). Routledge.

FEWS NET (Famine Early Warning Systems). Kenya Food Security Report, (2013). Routledge.

FSR (Food Security Report). (2012). Prepared by Kenya Agricultural Research Institute, Food Security Portal. (http://www.foodsecurityportal.org/kenya/food-security-report-prepared-kenya-agricultural-research-institute#.V4ZNMyEi5mc.google).

Gladwin, C. H., A.M. Thomson, S. Jennifer, Peterson and A.S. Anderson. (2001). Addressing food security in Africa via multiple livelihood strategies of women farmers. *Food Policy* 26: 177-207.

GOK (Government of Kenya) (2012). National Food and Nutrition Security Policy. Nairobi: Government Printer.

Government of Kenya (2009). Mwala District Development Plan, 2008-2012.Nairobi: Government Printer.

GoK (Government of Kenya) (2004). Towards Achieving Food Security in Kenya. A paper presented by the permanent secretary, Ministry of Agriculture, Kenya at the African Conference on "Assuring Food and Nutrition Security in Africa by 2020. Prioritizing Action, Strengthening Actors, and Facilitating Partnerships". (April 2004), Kampala

GOK (Government of Kenya) (2001). Poverty Reduction Strategy Paper. Government printer, Nairobi.

Green, W.H. and Hensher, D.A. (2009), Modelling Ordered Choices, *New York: New York University.*

Gujarati, D. (2004), Basic Econometrics, 4th edition, The McGraw-Hill Companies.

Haile, H.K., Alemu, Z.G. and Kudhlande, G. (2005) Causes of Household Food Insecurity in Koredegaga Peasant Association, Oromiya Zone, Ehiopia. Agrekon 44(4):543–560.

Hoddinott John (1999). Choosing Outcome Indicators of Household Food Security, Technical Guide: International Food Policy Research Institute. Washington, D.C.

Hope-Hailey, V., Farndale, E., and Kelliher, C. (2010). Trust in Turbulent Times: Organizational Change and the Consequences for Intra-Organizational Trust. Research Methods for Business Students, 336-357.

Icheria B.K (2015). Household Food Insecurity and Coping Strategies among Small Scale Farmers in Tharaka Central Division, Kenya. *International Journal of Humanities Social Sciences and Education*. 2(2) 63-76.

Icheria, B. K. (2012). Household Food Insecurity and Coping Stategies among Small Scale Farmers in Tharaka Central Division, Kenya (Doctoral dissertation, Doctoral dissertation), Kenyatta University

Jenkins, C. J. and Scanlan, S. J., 2001. Food Security in Less Developed Countries, 1970 to 1990. *American Sociological Review*, 66(5), pp. 718-744.

Josantony, J. (1999), Food: Christian Perspective on Development Issues. Genprint: Ireland

Kaloi, E., Tayebwa, B. and Bashaasha, B. (2005). Food Security Status of Households in Mwingi District, Kenya. In African Crop Science Conference Proceedings (Vol. 7, No. pt. 2 of 3, pp. 867-873).

Karaya, R. N., Onyango, C.A. and Amudavi, D.M. (2013), Fighting Hunger Together: A Case of Women Farmers' Participation in Women Groups in Mwala Division, Kenya, *International Journal of Agricultural Management and Development, 3(3):189-200.*

Kayunze, K. A., Mwageni, E.A., and Mdoe, N.S.Y. (2009). Do various methods of food security determination give similar results? Evidence from Rufiji District, Tanzania. *Eastern and Southern Africa Journal of Agricultural Economics and Development 6*: 125 -145.

Kayunze, K. A. (2008). HIV/AIDs and food security in Rufiji District Tanzania. Thesis for award of PhD degree at Sokoine University Agriculture Morogoro, Tanzania. 258pp.

Kayunze, K. A., Mwageni, E. A., and Ashimogo, G. C. (2007). Entitlement to food and food security in Rufiji District, Tanzania. *Tanzania Journal of Development Studies* 8 (2): 29 - 47.

Kenya National Bureau of Statistics. (2013). Food Crisis in Kenya. Nairobi: Kenya Central Bureau of Statistics.

Kenya Food Security Steering Group (KFSSG). (2008). The Impact of Rising Prices on Disparate Livelihood Groups In Kenya 2008. Nairobi: Government Printer.

Kibaara, B. W. (2005). Technical Efficiency in Kenyan's Maize Production: An Application of the Stochastic Frontier Approach (Master of Science dissertation, Colorado State University).

Kimani, E. N., & Kombo, D. K. (2010). Gender and Poverty Reduction: A Kenyan Context. Educational Research and Reviews, 5(1), 024-030.

Kinyua Joseph (2004). Towards achieving food security in Kenya: Ministry of agriculture. Nairobi, Kenya

Klein, L. R., and Ford, G. T. (2003). Consumer search for information in the digital age: An empirical study of prepurchase search for automobiles. *Journal of interactive Marketing*, *17*(3), 29-49.

Kothari, C.R. (2008). Research methodology. Method and techniques. (2nd ed), New Delhi. New Age International (P) Ltd.

Kumar, D.S., Barah, B.C., Ranganathan, C.R., Ranganathan, R., Gurunathan, S. and Thirumoorthy, S. (2011). An Analysis of Farmers' Perception and Awareness towards Crop Insurance as a Tool for Risk Management in Tamil Nadu, *Agricultural Economics Research Review, 24:37-46*

Macrae, J., & Zwi, A. (1994). Famine, Complex Emergencies and International Policy in Africa: An Overview. War and Hunger: Rethinking International Responses to Complex Emergencies. London, Zed Books, 6-36.

Maddala, G.S. (2000), Introduction to Econometrics (3rdedn). New Jersey: Prentice-Hall Inc.

Magnani, Robert (1997). Sampling guide. IMPACT Food Security and Nutrition Monitoring Project, Arlington, Va.

Maxwell, S., & Smith, M. (1992). Household Food Security: A Conceptual Review. Household Food Security: Concepts, Indicators, Measurements, 1-72.

Mganga, K.Z., Musimba, N.K.R., Nyariki, D.M., Nyangito, M.M., & Mwang'ombe, A. W. (2015). The Choice of Grass Species to Combat Desertification in Semi- Arid Kenyan Rangelands is Greatly Influenced by their Forage Value for Livestock. Grass and Forage Science, 70(1), 161-167.

Muchena, F.N., Mbuvi, J.P. and Wokabi, S.M. (1988), 'Report on soils and land use in arid and semi-arid lands of Kenya', Ministry of Natural Resources, National Environment Secretariat, Nairobi, Kenya.

Mulandi Bernice (2007). Gaining Women's Views on Household Food Security in Wote Sub-location, Kenya. PhD Thesis, Miami University, Oxford, Ohio

Mutiso, F.M (2015). Determinants Influencing Sustainability of Agricultural Projects: A Case Of Mwala Sub-county, Machakos County, Kenya, PhD Thesis, University of Nairobi, Nairobi, Kenya.

Nguluu, S. N., Karanja, J., Kimatu J.N., Gicheru, P.T., Musimba, N. 1 , Njiru, E., Kathuli, P., Nzioki, H., Akuja, T., Muli, B.K., Nzombe, N.N. (2014): Refining Dryland Farming Systems as a Means of Enhancing Agrodiversity and Food Security in Eastern Kenya: A review. *Journal of Advances in Agriculture*. Vol.3, No.1, Pp. 142-149.

Nyariki, D.M., Wiggins, S. L., Imungi, J. K., (2002). Levels and Causes of Household Food and Nutrition Insecurity in Dryland Kenya. *Ecology of Food and Nutrition*, 41: 155-176.

Nyariki, D. M., and Wiggins, S. (1997). Household food insecurity in sub-Saharan Africa: lessons from Kenya. *British Food Journal*, 1997: 249-262.

Nyoro, J. K., Kiiru, M. W., & Jayne, T. S. (1999). Evolution of Kenya's Maize Marketing Systems in the Post-Liberalization Era (No. 680-2016-46751).

Okeyo B., (2015) Fisheries of Kenya's Coast: A socio-ecological system in transition, *Scholars' Press-* Germany

Orodho, A. J. (2003). Essentials of Educational and Social Sciences Research Methods. *Nairobi: Masola Publishers*.

Otieno, D.J (2013), Market and Non-Market Factors Influencing Farmers' Adoption of Improved Beef Cattle in Arid and Semi-Arid Areas of Kenya, *Journal of Agricultural Science, 5(1):32-43*

Pallant, J. (2010). *SPSS Survival Manual: A Step by Step Guide to Data Analysis Using IBM SPSS*, 6th Edn Crows Nest. NSW: Allen &Unwin.

Phillips, J. M. (1994). Farmer education and farmer efficiency; a meta-analysis. *Journal of Economic Development and Cultural Change.* 43:1439pp.

ROK (Republic of Kenya) (2010). The Constitution of Kenya. Government Printers. Nairobi

ROK (Republic of Kenya) (2008). Kenya Food Security and Nutrition Strategy. Nairobi: Government Printers.

Riely, F., Mock, N., Cogill, B., Bailey, L., & Kenefick, E. (1999). Food Security Indicators and Framework for Use in the Monitoring and Evaluation of Food Aid Programs. Nutrition Technical Assistance Project (FANTA), Washington, DC.

Sen, A. (1981). Poverty and Famines: an Essay on Entitlement and Deprivation, Oxford: Clarendon Press.

Soete, L., 1981. Technological Dependency: A Critical View. In: D. Seers, ed. *Dependency Theory. A Critical Reassessment.* London: Frances Pinter (Publishers), pp. 181-206.

Swift, J. (1989). *Why are rural households' people vulnerable to famine?* IDS Bulletin 20 (2), Institute of Development Studies, University of Sussex, Brighton, UK.

Tiffen, M., Mortimor, M. and Gichuki, F. (1994). More People Less Erosion: Environmental recovery in Kenya. Nairobi, Kenya

Tiffens, M. (2002). Questioning Desertification in Dry-Land Sub-Saharan Africa. *Natural Resources Forum*, 26: 218-233.

USAID (United States Agency for International Development) (2010). Food Security in Kenya: Situation report. Nairobi, Kenya. United States Agency International Development.

USDA (United States Department of Agriculture) (2009). *Access to Affordable and Nutritious Food: Measuring and Understanding Food Deserts and Their Consequences*. Economic Research Service, Washington

Wambua, B.N. and Kithia, S.M. (2014). Effects of Soil Erosion on Sediment Dynamics, Food Security and Rural Poverty in Makueni District, Eastern Kenya. *International Journal of Applied Science and Technology*. 4(1) 101-107

Wambua, B.V., Omoke, K.J. and Mutua, T.M. (2014). Effects of Socio-Economic Factors on Food Security Situation in Kenyan Dry Lands Ecosystem. *Asian Journal of Agriculture and Food Science* 2: 51 – 59.

Wambua, B.N (2008) Food Security in Semi–Arid Areas: An Analysis of Socio-Economic and Institutional Factors with Reference to Makueni district, Eastern Kenya, PhD Thesis, University of Nairobi, and Nairobi, Kenya.

Waweru, G.K., Omuterema, S. and Mugo, F. (2015). Association Between Household Food Access and Livelihood Food Strategy Factors in Githunguri And Mwala Sub-Counties, Kenya. *Developing Country Studies*, Vol.5, No.4, pp. 112-119

WFP (World Food Programme) (2012). Nutrition at the World Food Programme. Programming for Nutrition-Specific Interventions.

WFP (World Food Programme) (2009). Comprehensive Food Security and Vulnerability Analysis Guidelines. United Nations World Food Program.

WFP (World Food Programme) (2005), Emergency and food security assessment handbook. Rome

Young, H., Jaspars, S. Brown, R., Frize, J. and Khogali, H. (2001). *Food insecurity assessment in emergencies:* A livelihood approach. Westminster Bridge Road London United Kingdom.

APPENDICES

Appendix 1: Food emergencies for the year 2005
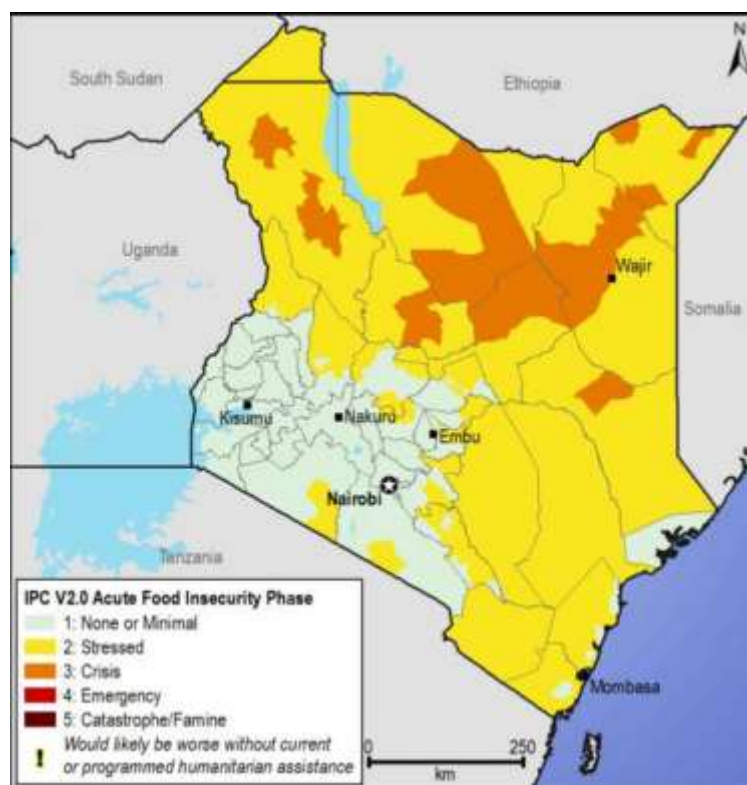
Food Emergencies, 2005

Dominant variable	Africa	Asia	Latin America	Europe	Total
Human	10	3	1	1	15
Natural	8	7	1	0	16
Combined	7	1	0	0	8
Total	25	11	2	1	39

Source: FAO, 2006

Appendix 2: Food security status for 2014/2015

Current food security outcomes, October 2014

Source: FEWS NET, 2014

Appendix 3: Questionnaire

My name is Mary Ndolo. Currently I am registered as a Masters student at South Eastern Kenya University in the School of Agriculture and Veterinary Sciences in the program of Master of Science in Agricultural Resource Management. I intend to undertake my thesis studies on the **Factors affecting Food Security in the Semi-Arid Regions of Kenya in Mwala Sub-county, Machakos County**. In this study, we work closely with Dr. Kilungo and Prof. T. Akuja of South Eastern Kenya University. The study will be effective or successful depending on your reliable responses and your response will be used only for the intended study. So, please indicate your response by encircling the different items and fill the provided space for the structured questionnaire.

1. **General Direction:**

✓ No need of writing your name

✓ Please answer all questions properly and clearly

✓ Be free to answer all questions (this is simply to indicate a solution for the problem of food insecurity)

Section A: Demographic Profile

1. Are you head of a household?   1. = Yes   2. = No
2. What is the age of household head if different from respondent?
    - i.   =18 – 24 years
    - ii.   =25 – 30 years
    - iii. =31 – 40 years
    - iv. =41 – 50 years
    - v.   =50 – 60 years
    - vi. = over 60 years
3. What is your gender?
    - i.   =male
    - ii.   =female
4. How old are you?
    - i.   =18 – 24 years
    - ii.   =25 – 30 years

iii.   =31 – 40 years

iv.   =41 – 50 years

v.   =50--60 years

vi.   = Over 60 years

5. Level of education

  i.   =None

  ii.   =primary

  iii.   =secondary

  iv.   =Tertiary

6. How many people live in this household?

………………………………………………………………………………

7. What is your occupation?

………………………………………………………………………......

8. What is the average monthly income in this household?

………………………………………………………………………………

Section B: Food Security

9. How many meals do you take in a day?

………………………………………………………………………………

10. What is the main food taken in this household mostly?

………………………………………………………………………………

11. What is the source of the food in this household?

………………………………………………………………………………

12. What was maize yield last season? ....   This season? ....

13. How difficult would you say getting food in the household is?

  i.   =Very difficult

  ii.   =Difficult

  iii.   =Neutral

  iv.   =Easy

  v.   =Very easy

14. How do you evaluate your household food security status?

  i.   Food secure

  ii.   Food insecure

15. If your answer is 'ii' above, what are the major causes for food insecurity in your household (allowing multiple responses)?

i. Low and variable rainfall

ii. Limited non-agricultural

iii. Population pressure

iv. Environmental degradation

v. Conflict

vi. Failure to properly utilize own production

vii. Lack of fair market

viii. Others specify_____

Section C: Climate Change and Food Security (Natural Factors)

16. I have noticed weather changes in the area.

i. =Strongly agree

ii. =Agree

iii. =Neutral

iv. =Disagree

v. = Strongly disagree

17. Which of the following have you experienced?

i. =Droughts

ii. =Flash floods

iii. =Delayed rains

18. What are the most important hazards recurring in your area? Put the below options in highest to lowest order (drought, flood, malaria, pests and diseases, conflict, animal diseases, increasing food prices, water shortage other specify _____).

19. Weather changes affect farming and grazing of livestock

i. = Strongly agree

ii. =Agree

iii. =Neutral

iv. =Disagree

v. = Strongly disagree

20. To what extent do weather changes affect food availability in your household?

    i.   =To a very large extent

    ii.   =To a large extent

    iii.   =Neutral

    iv.   = To a small extent

    v.   = To a very small extent

Section D: Governance and Food Security (Socio-economic Factors)

21. Are you aware that food security is a human right?

    i.   =Yes

    ii.   =No

22. Government officials ensure that households have adequate food

    i.   =Strongly agree

    ii.   =Agree

    iii.   =neutral

    iv.   =Disagree

    v.   =Strongly disagree

23. Ministry of agriculture officers advise us on best farming practices

    i.   =strongly agree

    ii.   =Agree

    iii.   =neutral

    iv.   =Disagree

    v.   =Strongly disagree

24. The government provides seeds to farmers

    i.   =Strongly agree

    ii.   =Agree

    iii.   =neutral

    iv.   =Disagree

    v.   =Strongly disagree

25. To what extent does governance affect food availability in your household?

    i.   =To a very large extent

    ii.   =To a large extent

iii. =Neutral

iv. =To a small extent

v. =To a very small extent

Section E: Access to Markets (Physical Factors)

26. How far do you have to go to access a market where you can buy or sell food?

……………………………………………………………………………………

27. How would you rate the food prices at the market?

i. =Very high

ii. =High

iii. =Moderate

iv. =Low

v. =Very low

28. To what extent does access to markets affect food availability in your household?

i. =To a very large extent

ii. =To a large extent

iii. =Neutral

iv. =To a small extent

v. =To a very small extent

29. How do you transport your produce to the nearby market?

i. On donkey back

ii. On camel back

iii. Carry it yourself

iv. By using public transportation

v. Others specify_____

30. Is the market faire for both purchasing and selling? (For both croppers and agro-pastoralists)

i. Yes

ii. No

Section F: Land Use (Physical Factors)

31. What is the size of your land?

    ……………………………………………………………………………………

32. What percentage of your land do you use for food related activities?

    …………………………………………………………………………………….

33. How productive would you say your piece of land is?

    i.   =Very high

    ii.   =High

    iii. =Moderate

    iv.   =Low

    v.   =Very low

34. To what extent does land use affect food availability in your household?

    i.   =To a very large extent

    ii.   =To a large extent

    iii. =Neutral

    iv.   =To a small extent

    v.   =To a very small extent

35. Which of the following factors affect food security most in your household?

    i.   =Climate change

    ii.   =Governance

    iii. =Access to markets

    iv.   =Land use

Section G: Knowledge about Food Security

36. Knowledge of food security will be measured by using a 5 points hedonic scale as follows:

Statement implying knowledge on food security	Yes	No	Scores by respondents
Food security means ensuring, adequacy of food supplies in terms of quantify quality and variety of food.			
Food security means optimizing stability in the			

flow of food supplies.			
Food security means access to nutritionally adequate and safe food.			
Food security means sufficient skills to acquire, prepare and consume nutritionally adequate diet including those to meet the special need of young children and pregnant mothers.			
Food security means access to health services and a health environment to ensure effective biological utilization of food consumed.			
Total score			

Key: Yes = 1 Mark No = 0 Mark

       5 - Excellent knowledge

       4 - Moderate knowledge (above average)

       3 -Neutral (no clear evidence of presence or lack of knowledge)

       2 - Moderately ignorant (Below average)

       1- Extremely ignorant (know nothing)

37. If your occupation is farming, classify it under the following

    1. Small scale [ ] 2. Large scale [ ]

38. Do you belong to any Farmers Group?

    1. Yes [ ] 2. No [ ]

Section H: Level of Awareness on Importance of Food Security

39. Did you receive any advice from the extension agent on proper grain storage practice in 2015/2016?

40. Are you aware of the importance of consuming nutritious food?

    1. Yes [ ] 2. No [ ]

41. Do you know which foods provide the nutrients referred to in the recommendations?

    1. Yes [ ] 2. No [ ]

42. Can you choose between different foods to identify the healthiest ones?

1. Yes [ ] 2. No [ ]

43. Do you know what the health implications of eating or failing to eat particular foods are? 1. Yes [ ] 2. No [ ]

44. State your location.

[ ] Mbiuni

[ ] Muusini

[ ] Mwala

[ ] Kabaa

Thank you for your Cooperation

Appendix 4: Focus Group Discussion Guide

General Questions

i.   What is food security?

ii.   What are the governance issues that you recommend to be addressed to promote food security?

iii. How have changes in the weather affected food availability of late in your village?

iv.   In your opinion, how do you think food production can be improved so all can be food secure?

v.   How does land ownership system affect availability, access and use of food here?

vi.   What problems do you experience in relation to access to marketing of your products?

Knowledge about Food Security

i.   What do you understand the term food security? (From local perspective)

ii.   Can you tell me various signs of food insecurity?

iii. What are the causes of food insecurity in your location?

iv.   How do you overcome the problem of food insecurity?

Level of Awareness on Importance of Food Security

i.   Do you understand about food security awareness and its importance to household?

ii.   What are strategies in ensuring awareness and importance of food security in households?