FOOD INSECURITY AND COPING STRATEGIES OF FARM HOUSEHOLDS IN KAHAMA DISTRICT, TANZANIA

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ABSTRACT

The objective of this study was threefold to determine food security status based on Dietary Energy Consumed (DEC) per Adult Equivalent (AE) per day, to identify the farm households' food insecurity coping strategies and to examine factors influencing food production and supply. 150 farm households in Msalala and Isagehe division responded to a survey that was conducted between November and December 2012, but 137 households were selected for the analysis after removing the HIES data which were not properly filled. Focus Group Discussion (FDG) were conducted in all surveyed villages whereby descriptions of food security situation, factors associated with crop production and supply and coping strategies were discussed. Both data from 24 hrs recall and Household Income Expenditure Survey (HIES) indicate that the averages of DEC per AE and per capital per day were below the cut off point of 2200 kcal and 2100 kcal respectively, implying that food insecurity existed among farming households in the area. The binary regression analysis result indicates that five predictors were highly significant in influencing food security/insecurity at $P \leq 0.05$ levels. Multiple regression analysis showed that, ten independent variables included in the model, six were significant at P = 0.000 and the ten independent variables accounted for R squire 54.3% (R^2 = 50%) of variation in food production and supply. Food insecurity coping strategies adopted by the households were used to avert the impact of food insecurity on a temporal basis. The study concludes that food insecurity existed in the study area among farming households, and recommends that farming households be supported in terms of both short term and long term strategies to improve food production and supply.

DECLARATION

Neither I ANNA **MARCO NGONGI** do hereby declare to the Senate of Sokoine University of Agriculture that this dissertation is my own original work and has neither been nor being concurrently submitted for a higher degree award in any other institution.

_____ _____

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The declaration is confirmed

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DEDICATION

This valuable work is dedicated to my beloved parents the late Mr. Michael Benson Kambanyuma Ngongi and the late Mrs. Aloicia Simba Tuli, who laid the foundation of my education which made me what I am today.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

LIST OF ABREVIATIONS

AE	Adult Equivalent
AIDS	Acquired Immuno Deficiency Syndrome
CS	Coping Strategies
CUTS	Consumer Unity and Trust Society
FAD	Food Availability Decline
FAO	Food and Agriculture Organization
FSIT	Food security Information Team
FGD	Focus Group Discussion
FHH	Female Headed Household
HFIAS	Household Food Insecurity Access Scale
HIES	Household Income and Expenditure Survey
HBS	Household Budget Survey
HIV	Human Immuno-deficiency Virus
KDC	Kahama District Council
KDP	Kahama District Profile
MHH	Male Headed Household
MDG	Millennium Development Goal
NFRA	National Food Reserve Agency
NSGRP	National Strategy for Growth and Reduction of Poverty
NAIVS	National Agricultural Input Voucher System
SFTZ	Savannas Forever Tanzania
SSA	Sub- Saharan Africa
SUA	Sokoine University of Agriculture
SSR	Self Sufficient Ratio

SPSS	Statistical Package for Social Sciences
TAS	Tanzania Shillings
URT	United Republic of Tanzania
WB	World Bank
WFP	World Food Programme
WOCAN	Women organizing for change in Agriculture and Natural resource management

CHAPTER ONE

1.0 INTRODUCTION

Food is an important basic human need for survival, growth, and good health. Freedom from hunger is the most fundamental human right that can be attained if an individual is food secure. Despite this reality the number of people suffering from food insecurity globally is disproportional big, and is estimated at 925 million (WB and FAO, 2010). According to WB and FAO Developing countries account for 98% of the World's under nourished, and a third of these reside in sub-Saharan Africa alone Graaf *et al*. (2007) argue that, although some of these countries report to have adequate food at the national level, this does not generally guarantee food security at the household level. On average, about 70% to 80% of Africans still live in rural areas and many face seasonal food shortages. The rural food insecure population is also among the poorest segment of the society (Brummet *et al*., 2011: Leyna *et al.,* 2007; Bukusuba *et al.,* 2007).

Food insecurity coping strategies play a crucial role in the development of farm households. However, some strategies seem to be difficult to achieve and are too general among farm households to fulfil food requirements. Maxwell *et al*. (2008) argue that though many households adopt a number of food consumption coping strategies, some coping strategies are likely to be as norms as they do not contribute to improving food security among the population, for example eating of less preferred foods. Shariff and Khor (2008) have pointed out that several food coping strategies are associated with food insecurity, and they are mostly acceptable to vulnerable households in different cultures for example skipping meals. According to Leyna *et al*. (2007) the use of household perceptions of food needs and coping strategies as an alternative indicator in measuring food insecurity has proven to be a good and cost-effective method, as it is simple, cheap,

and provide timely and valuable information on food and nutrition needs at the household level.

Although Tanzania is not drought prone, food insecurity is both transitory and chronic in nature (URT, 2009a). On average Tanzania produces about 95% of her food requirements. In some years, the country's food self sufficiency, as measured by the Self Sufficiency Ratio (SSR), is over 100. A Survey carried out by the Food Security Information Team (FSIT) in 2008 in Tanzania, identified a total of twenty districts in ten regions as food insecure; these are Shinyanga, Arusha, Kilimanjaro, Lindi, Manyara, Mara, Mwanza, Mtwara, Singida, and Tabora (URT, 2009a). According to URT (2009b) the percentage of people with food poverty based on the indicator of poverty head count index increased from 16.6 % in 2007 to 17.4 % in 2008-09.

Kahama District in Shinyanga Region does enjoy a boom of food production in some years, especially during seasons of adequate rainfall which leads to good harvest. However, there are inequalities across ecological zones, and administrative divisions, particularly in Isagehe and Msalala Divisions which have been more frequently affected by incidences of food insecurity than has been the case in other areas in the district (KDP, 2011). Despite high frequency of food insecurity in these two divisions, it is still possible to find households with food surplus side by side with food insecure households. These two groups of households share common climatic condition and weather situations, similar soil types and topography (KDP, 2011). Therefore, the study aimed at understanding how households in Kahama District cope with food insecurity.

1.2 Problem Statement

As pointed out in section 1.1, the percentage of people with food poverty in Tanzania, based on the indicator of poverty head count index increased from 16.6 % in 2007 to 17.4 % in 2008-09 (URT, 2009b). Kahama is among the districts with high incidences of food insecurity in Tanzania. In 2011-12 the district had about 23 083 food insecure households and 14 637 households were identified in Isagehe and Msalala Divisions. Approximately, 85% of the residents are engaged in agriculture, with farm sizes varying from 0.4 to 20 ha per household. Five main agro-ecological zones have been distinguished and these are as follows: cotton, paddy, tobacco, maize and chickpeas. Other crops grown include cassava, sweet potatoes, sorghum, groundnuts, millet and beans. The district is under National Agricultural Input Voucher System (NAIVS) since 2008. Thus, availability of input through NAIVs was expected to increase productivity and hence reduce food insecurity in the district but, between 2009 and 2012 the district remained in need of food aid from the government and other development partners. Also families with food insecurity had to adopt some coping strategies including working as casual labourers on farms of the better-off households or through sales of firewood and or charcoal to urban centres (Mung'ong'o, 2002).

Despite having five main agro-ecological zones with varieties of both food and cash crops and benefiting from NAIVS as pointed out above, the district is among food insecure areas in Tanzania, especially the eastern part. Since 2009 the district has been receiving food relief from the government and other organizations like the Word Food Programme (WFP) and the nearby Buzwagi and Bulyanhulu gold mines. Isagehe and Msalala Divisions have high incidences of food insecurity in the district (KDP, 2011), whereby about 41,657 households have ample or food surplus live next to food insecure households, despite sharing common climatic and weather conditions, similar soil types,

land topography and common socio-cultural environment. According to information from KDC office, in 2009-10 the district received 857 tons of maize as relief food from NFRA and in 2011-12 the amount of food assistance from the NFRA and other development partners reached 4 140 tons which was distributed to the above mentioned divisions. This study therefore aimed at understanding the intensity of food insecurity and how farm households cope with the situation.

1.3 Justification for the Study

Data on the intensity of food insecurity and coping strategies in Kahama District are scanty. Furthermore, the reviewed literature shows no evidence of studies conducted on household food insecurity and coping strategies in the district. Recent studies conducted in Kahama were mainly on the analysis of the performance of chickpeas value chain Jamhuri (2011), and market chain analysis on African indigenous vegetables in Tanzania (Osano, 2010).

The aim of the current study was to assess food insecurity and coping strategies of farm households in the district. The study is in line with the National Strategy for Growth and Reduction of Poverty phase two (NSGRP II), cluster number one of growth for reduction of income poverty, particularly goal number four which stresses on ensuring food and nutrition security, environmental sustainability and climate change adaptation and mitigation. It is also in line with Millennium Development Goal number one of eradicating extreme poverty and hunger. In addition, empirical information generated in relation to linkages on food insecurity and coping strategies could enhance the understanding of various stakeholders, policy makers, and development practitioners interested in rural food security. Thus, help in planning and developing interventions to improve food security at the village and district levels.

1.3.1 Overall objective

The overall objective of the study was to assess food insecurity and coping strategies of farming households in Kahama District, Tanzania.

1.3.2 Specific objectives

1. To determine food security status among farming households based on DEC per day.
2. To identify coping strategies of food insecurity among farming households in the district
3. To examine factors influencing food production and supply among farming households.

1.3.3 Research questions

1. What is the intensity of food insecurity among farming households in the study area?
2. What are the most popular used food insecurity coping strategies adopted by farmers within the study area?
3. What challenges are associated with food production and supply among farming households in the study area?

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Definition of Key Concepts

2.1.1 Food security

Food security has been defined as a situation when all the people, at all times, have physical and economic access to sufficient, safe and nutritious food needed to maintain a healthy and active life (WB and FAO, 2010). The concept of food security is built on four pillars: (i) Food availability: physical presence of sufficient quantities of food at a household level, whether from production or markets. (ii) Food access: people have sufficient resources to obtain appropriate food for a nutritious diet; (iii) Food utilization: people have sufficient knowledge of nutrition and care practices and have access to adequate water and sanitation; (vi)Food stability refers to the need to assess food in both short and long term (Hartwig *et al.,* 2011; Babatunde *et al*., 2008). Regardless of the definition adopted, availability of food and access to food are two essential determinants of food security. However, availability does not necessarily ensure access. Food may be available globally but not to all countries, all households, or individuals within the household have access to it (Dauda, 2010).

According to Kruger *et al.* (2008), household food security encompasses three dimensions availability, accessibility, and utilization. Food availability is understood as having a sufficient quantity of food available for consumption. Physical availability refers to what is available for consumption in the community, depending on access to arable land and the ability of a household to obtain food through production. Food access

is the ability of a nation and its households to acquire sufficient food on a sustainable basis. Access to food refers to whether the available food can be obtained, and includes households that have the resources, ability, and knowledge to produce or procure food. In Africa, the factors responsible for low food production performance include low level of input use, poor mechanization, and weak research base, lack of incentives to producers, poor infrastructure and poor access to markets (Quaye, 2008).

2.1.2 Food insecurity

Food insecurity is the opposite of food security. Therefore, it may be defined as a situation where people, individuals at times, lack physical and economic access to sufficient, safe and nutritious food needed to maintain a healthy and active life. According to Frongillo and Nanama (2012), household food insecurity results when food is not available, cannot be accessed with certainty in socially acceptable ways, or is not physiologically utilized completely. Food insecurity occurs whenever enough and safe foods are not available or the ability to acquire such foods is limited. Food insecurity represents a major public health concern and is a useful index of health and well-being because it is associated with poverty, ill health, poor dietary intake, and limited social capital (Hadley *et al*., 2006).

2.1.3 Food insecurity coping strategies

Food insecurity coping strategies are activities, which maintain food security or combat food insecurity that has occurred at the household level. Coping strategies are directly attributed to household activities rather than external factors. According to literature (Chhetri and Maharjan, 2006): Hadley *et al.* 2007; Maxwell *et al.*, 2008**)** households adopt both *ex ante* and *ex post* coping strategies in their endeavour to be food secure. Generally, there are four categories of strategies, namely consumption, expenditure,

income, and migration. Consumption strategies include buying food on credit, relying on less-preferred food substitutes, reducing the number of meals eaten per day, regularly skipping food for an entire day, eating meals comprised solely of vegetables, eating unusual wild foods, restricting consumption of adults so children can eat normally, and feeding working members at the expense of non-working members. Expenditure strategies include the use of savings and avoiding health care or education costs in order to buy food. Income strategies include, the use of pension, small businesses and selling household and livelihood assets such as livestock. Migration strategies include sending children to relatives or friends' homes or migrating to find work (Maxwell *et al*., 2008).

Increased use of coping strategies indicates a decrease in food security. Likewise, a decrease in food security results into increased frequency and severity of coping strategies. Thus, the analysis of coping strategies indicates a decreasing food security situation when coping strategies accelerate from temporary measures (e.g., reduction in number or quality of meals for a brief, defined time period) from which a household can recover, to measures that undermine future lives and livelihoods and damage social, financial, physical, or natural assets irreversibly (Maxwell *et al.,* 2003).

According to Young *et al.* (2001:4) understanding the severity of food insecurity is essential for determining the best type of response. The severity of food insecurity is gauged by its impact on people's ability to feed them in the short term, and its impact on livelihoods and self-sufficiency in the longer term. These two perspectives allow the severity of food insecurity to be judged as follows:-

A population or livelihood group is considered acutely food insecure if:

(i) People experience a large reduction in their major source of food and are unable to make up the difference through new strategies;

(ii) The prevalence of malnutrition is abnormally high for the time of year, and this cannot be accounted for by either health or care factors;

(iii) A large proportion of the population is using marginal or unsustainable coping strategies;

(iv) People are using 'coping' strategies that are damaging their livelihoods in the longer term, or incur some other unacceptable costs, such as acting illegally or immorally.

2.2 Factors Contributing for Food Insecurity in Tanzania

In Tanzania, several factors could be responsible for reducing a household's food security these include; drought, poor technology, low production due to low productivity of land, labour and other production inputs, high incidences of crop and livestock pests and diseases, others are; inadequate processing, storage and marketing infrastructure. According to URT (2006), the HIV/AIDS pandemic has also contributed to a loss of labour for household agricultural production. Other factors are; overselling due to competing needs for cash including health, education and clothing and inadequate post harvest management knowledge (URT, 2006; Quaye, 2008).

2.2.1 Individuals social economic characteristics and food security

Individual's socio-economic status can be defined as the economic and social components of status that distinguish and characterize people Dauda, (2010). They include, sex, age, education, household size, marital status, and farming experience that could influence household food security.

2.2.1.1Sex of the household head and food security

Sex is believed to be a key determinant of food security. Women who are generally the primary caregivers in the family are at the centre of food production, purchase and preparation (Amaza *et al.,* 2009). When food is scarce or food prices rise, women are often responsible for taking on the increased workloads and often sacrifice their own nutrition first to ensure that their children and families can eat (FAO and WOCAN, 2010). Women work together to organize solutions which are often the only force that allow communities to cope with the extreme hardships that food insecurity can bring. Because of this central role in keeping together households and communities, grassroots women possess a wealth of knowledge on the causes and effects of food insecurity (FAO and WOCAN, 2010). A study by Babatunde *et al.* (2008) on determinants and vulnerability to food insecurity found that male headed household poses more resources than female headed households and that female headed household were more vulnerable to food insecurity than male headed households.

As a result of food insecurity, several patterns have emerged in many places. Women have increasingly become heads of households and therefore primarily responsible for the acquisition of food for the entire family, and so they began to bear the brunt of the effects of food insecurity. Increased poverty reduced incomes, leading to malnutrition as a result of decreased food consumption at the household level, which further perpetuates these vulnerabilities. The impact of the crisis is stronger among women because they oversee food production and introduce different coping strategies with decreasing resources to ensure food is available at household level during times of crises. This leads to more stress for women as they internalize and feel the pressure of increased responsibility more than is the case with men (WOCAN and FAO, 2010).

2.2.1.2 Education of the household head and food security

Education is very important in making decisions related to production and use of crop produce at the household level. Households with better education and other forms of human capital stand a better chance of accessing non-farm income and or credit. As Idrisa *et al. (*2007) point out that an increase of one's education is likely to increase ones related skills and, hence, the ability to acquire new skills. In addition, education is also associated with production of higher quality crops and greater participation in non-farm activities. Therefore, educated people are able to manage food demands in their households; whereas low levels of formal education among farmers make the introduction of improved agricultural technologies by extension agents difficult.

2.2.1.3 Marital status of the household head and food security

The significance of marital status on agricultural production and food security can be explained in terms of the supply of agricultural family labour. Family labour is expected to be more available where the household heads are married. Female headed households (FHH) have higher dependency ratios which hinders household capacity to allocate labour to on-farm or other income-generating activities. FHH also, tend to have older heads with and fewer years of education relative to the male headed households (MHH) (Kuwornu *et al.,* 2012). A study by Obayelu (2010) in the North Central Nigeria, showed existence of a slightly larger percentage of married household heads that were food secure compared to the single (unmarried) class who were food secure.

2.2.1.4 Household size and food security

Generally, large sized rural households are expected to be more able to easily supply the labour required for their crop production, basically due to abundance of their own labour. As Basukuba (2007) points out, household size is normally seen as equivalent to family

labour endowment. In addition, in situations where hired labour is costly to monitor, households with a greater endowment of labour are not only placed to farm their land more intensively but, also to conduct critical operation at the right time than is the case with households that are dependent on hired labour. Therefore, larger households have more potential of obtaining higher yields and hence being more food secure than smaller households. Previous studies in Tanzania, for example, Kayunze (2000) found less poverty in Mbeya, and this was attributed to the fact that many households in Mbeya have more labour force in terms of a bigger proportion of adult members who work either on farm or otherwise.

2.2.1.5 Farming experience of the household heads and food security

According to Amaza *et al.* (2006) farming experience is an important factor in determining both the productivity and the production levels in farming. However, the effect of farming experience on productivity and production may be positive or negative. Generally, it would appear that up to a certain number of years, farming experience would have a positive effect; after a span of time, the effect may become negative. The negative effect may be derived from aging or reluctance to change from old and familiar farming practices and techniques to modern and improved farming practices. A study by Kuwornu *et al.* (2012) shows that an experienced farmer is expected to have more insight and ability to diversify his or her production and minimize risk of food shortage. In addition, an experienced farmer is more likely to have adequate knowledge on pest, disease management and weather. Therefore, effect of farming experience on food security is likely to be positive.

2.2.1.6 Age of the household head and food security

The age of the household head is expected to have an impact on his or her labour supply for food production (Babatunde *et al*., 2007). As age increases, other factors such as farming experience may influence food security status of the households. Therefore, the effects of age are likely to be either positive or negative. The positive effect and negative effects of age imply that as people get older the effect of age is stronger. A positive effect of age means that as people get older the effect of age gets stronger (Kuwornu *et al.*, 2012).

2.3 Methods of Food Security Determination

There are various methods of determining food security; these include qualitative and quantitative methods. Qualitative methods include self-appraisal, whereby households evaluate themselves on whether or not they had food shortage within the past twelve months. Quantitative methods include the number of meals eaten per day (under normal circumstances adult members eat at least three meals per day and children are required to eat at least five meals per day). Amounts of grains harvested, bought, and received freely per capita per year and per AE per year. Generally, households with less than 200 kg per capita per year and those with less than 270 kg per adult equivalent per (AE) year are considered to be food insecure (Kayunze, 2008).

The use of Dietary Energy Consumed per capita per day and per AE per day; households are considered food insecure if they consume less than 2100 kcal per capita per day and less than 2200 kcal per AE per day.

Another method is Household Income and Expenditure Survey (HIES), whereby food consumed is converted into DEC per capita per day and per AE per day (Kayunze *et al*.,

2009). According to Leyna *et al.,* (2007) coping strategies at household's level can be used as an indicator in measuring food insecurity. Coping strategies are simple, cheap, and provides timely and valuable information on food and needs at the household level.

2.4 Causes of Food Insecurity

Food insecurity in Africa is considered as a challenge across the region, and that its causes are complex, attributed to multiple, and often intertwined factors (Pauw and Thurlow, 2011). The main concerns are the impacts of climate change, an increase in food prices, loss of subsistence and traditional food crops and cash crop (FAO and WOCAN, 2010). General causes of food insecurity in Tanzania, and which are similar in many other developing countries, include the small size of acreage; dependency on rainfall; the use of low-level technologies for tillage, poor crop and livestock husbandry, poor storage and processing of crop and livestock products, post harvest losses, financial inability to use improved seeds, fertilizers, pesticides, and herbicides; low prices offered in cash crops, poor markets for agricultural and livestock products; poor agricultural extension services; poor division of labour at the household level; bad farming practices leading to various environmental degradation; and poor transportation means that affects distribution of input supply and products transportation to market places (Kayunze *et al.,* 2009).

According to URT (2006), the major factors affecting food availability are low production due to low productivity of land, labour and other production inputs, high incidences of crop and livestock pests and diseases, inadequate processing, storage and marketing infrastructure. This is caused mainly by inadequate finance to obtain productivity enhancing inputs or capital, limited availability of support services and appropriate technologies. In addition, many rural households face labour shortages due to migration of young people to the urban areas in search of employment. The

HIV/AIDS pandemic has also contributed to a loss of labour for household agricultural production since the infected and those caring for them cannot devote enough time and energy for agricultural production (URT, 2009b; Basukuba *et al.,* 2007). Other factors affecting food availability include high pre and post harvest losses due to pests and, disease and climatic conditions. According to Makale (2012) losses caused by insects during six months of storage were 2% to 3% for husked maize cobs, as regards threshed from grains loses due to insects infestation after three months storage was 15%. Rodents cause serious wastage of the stored produce as much as 20% loss per year, both by their consumption and fecal contamination.

Poor transportation infrastructure also impacts on food security in Tanzania as it restricts the flow of food from surplus to deficit areas. The central railway line connecting Dar es Salaam with Dodoma is ineffective since 2008. Since then, the service between these regions has been discontinued. The road network connecting central to western Tanzania for Kigoma and Katavi Region which are surplus areas is also largely unpaved. Masalawala *et al*. (2010) points out that Tanzania could feed herself through domestic production, however food produced in the country cannot be efficiently distributed, making it inaccessible or unavailable in some areas

2.5 Agricultural activity in Tanzania

As CULTS (2011) indicates, in 2008, agricultural activities grew by 4.6 % compared to 4.0 % in 2007. The growth was mainly attributed to the increase in crop production as a result of favourable weather in the 2007/08 agricultural season. This was possible through the governmental efforts that aimed at increasing land productivity by smallholder farmers through the National agricultural Input voucher System (NAIVS), the promotion of organic manure, intensive extension methods, and promotion of high

yielding varieties, have played a role in this regard. Private sector-farmers collaboration linking farmers with research, markets, storage facilities and other services and participation of smallholder farmers in cash crop farming has also contributed to the improved productivity of crops, leading to an increase of the growth rate of crop sub-sector from 4.5 % in 2007 to 5.1 % in 2008 (CULTS 2011).

The use of agricultural inputs is fundamental in modern agriculture in developed countries, and they were a primary ingredient in the green revolution that swept through Asia and Latin America during in the 1960s and 1970s. However, the green revolution largely by-passed Sub-Saharan African (SSA), and the use of agricultural inputs remains very low (Baltzer and Hansen, 2011). In 2002-2003, farmers in SSA used on average 9 kg of fertilizers per ha of arable land as opposed to 100 kg per ha used in South Asia, 135kg in Southeast Asia, and 73kg in Latin America. While agricultural production and productivity soared in Asia and Latin America during the last four decades, production and productivity have largely stagnated in Africa, resulting into a rising dependency on imported grains and an increase in the number of food insecure people (Baltzel and Hansen, 2011).

Agricultural Input Subsidy Programme in Tanzania, which was initiated in 2008 and later expanded into the NAIVS in 2009, was launched by the Government of Tanzania in response to high prices of food and fertilizer that prevailed in 2007-2008. According to Baltzel and Hansen (2011), Agricultural input use in Tanzania is very low; farmers use on average of 8 kg/ha of fertilizers and only 5.7% of the rice farmers and 0.7% of the maize farmers use improved seed varieties together with fertilizers. The fact that agricultural productivity is low by international standards and relative Tanzania's own potential is proven through field research and on-farm trials for example, Senar *et al.*

(2012) argue that it is the view of the government that the best way to improve national food security in the face of high international food prices is to promote the use of agricultural inputs to raise productivity.

Seeds and fertilizers are essential inputs that affect productivity in the agricultural production process. On average, Tanzanian farmers used a total of 4.8 kg/ha of fertilizers per annum, during the 1996-2002. Although this was an increase of 47% in fertilizer use over the 1990-95 period, it compares poorly with the neighbouring Kenya, which had the average annual consumption of 31.8 kg/ha. Approximately, 93% of the seeds used each planting season are recycled from the crops in the previous season. This does afford a cheap way of obtaining seeds for farmers especially smallholders (Masalawala *et al.*, 2010).

2.6 Food Security as a Development Issue

Food security is a development issue in the sense that food insecurity, retards development in that: (a) it reduces the capacity of physical activity and the productive potential of the labour while labour is the most important asset the food insecure people have; for example most rural populations are aware of malaria as a serious illness and malaria's effects agricultural productivity which is necessary in promote economic growth, and reducing rural poverty: (b) it impairs people's ability to develop physically and mentally; hence it retards child's growth, reduces cognitive ability and seriously inhibits school attendance and performance thus, compromising the effectiveness of investment in education; Food insecurity also has a negative impact on education and health as explained in the following paragraph (Kracht 2005; Pandya, 2012;47).

A study which was carried out in Nepal showed that the probability of attending school was only 5% among nutritionally stunted children, as opposed to 27% among children with normal nutrition (World Bank, 1993). The development of human resource through education helps to alleviate food insecurity, in the sense that people with more education produce more rationally, through such means as proper use of fertilizers, improved seeds, pesticides and herbicides. According to the World Bank (1993), four years of primary education boost farmers' annual productivity by 9%. With regard to health, without sufficient calories and nutrients, the body slows down, making it difficult to undertake the work needed to produce food. Without good health, the body is also less able to make use of the food that is available.

The HIV/AIDS epidemic is both a cause and effect of food insecurity. Rates of infection, viral loads and opportunistic infections will rise with malnutrition, which lowers immunity. In turn, the epidemic is likely to contribute to food insecurity as those living with the virus lose labour, time and capital to the effects of the disease (Basukuba *et al.*, 2007).

A study by Quandt *et al.* (2004) showed that social and psychological health has significant impacts on food insecurity and hunger. The study further points out further that food insecurity is associated with poorer health (e.g., more colds, anaemia, and earaches), which translates into greater school absenteeism, poorer school performance, anxiety, and behavioural problems. While governments and citizens have a role to play in order to achieve food security, it is good for both to have common objectively measurable indicators for food security this will help when planning to improve food security in communities, as food security can be determined in the same ways without under or over estimation of the levels. The measurements should also be standard so that

the results can easily be compared with other results of food security measurement elsewhere in the world. The merits and demerits of various methods used should also be clear to those using them so that specific methods befitting certain situations are used.

2.7 Theoretical Framework of Food Security

This study is guided by two theories of food security namely, Malthusian and Anti-Malthusian theory and the entitlement approach to food security. The entitlement to food theory which contends that food insecurity occurs due to people lacking entitlement to access food, and Malthusian theories which argues that population increase causes food scarcity; and Anti- Malthusian which argue the opposite to the Malthusian theory, thus an increase in population causes increase in food production (Kayunze, 2008).

2.7.1 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*., (2007:44), argue that food insecurity is caused by having being 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.

Education may lead to lower birth rates, and therefore reducing family size and

Expansion of food production for example during the green revolution of India in the 1970s as a result of improved agricultural technology is difficult today because the environmental changes has left farmers with few options to improve food crop output.

Demands for water 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.,* 2008).

2.7.2 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). .

According to Sen, (1981) people's exchange on entitlements reflects their ability to acquire food. Sen sub-divides these entitlements as follows: (a) production-based entitlements, (b) own-labour entitlements, (c) trade-based entitlements, and (d) inheritance and transfer entitlements. He argues that people do not usually starve because of an insufficient supply of food at the local, national, or international level, but because they have insufficient resources, including money ('entitlements') to acquire it.

Some of the limitations of Sen's work include the entitlement approach which views famines and other food-related emergencies as economic disasters. His approach concentrates on rights within the given legal structure in that society, but some transfers are illegal acts, and therefore not accommodated by the entitlement approach nor can they be measured easily (Young *et al*., 2001). Research into people's responses to famine, often referred to as 'coping strategies', has shown that their priorities in times of

food stress are to preserve productive assets to protect livelihoods, rather than to meet immediate food needs.

Understanding the severity of food insecurity is essential for determining the best type of coping strategies (Young *et al*., 2001). Again Sen, (1984) also argue that during war, the ratio of food producers to food consumers falls, employment-based entitlements, during a war cash crop production and marketing networks collapse, employment opportunities (demand for agricultural labour, petty trading activities) contract and farmers and pastoralists are attacked for food and livestock. Entitlement theory has been criticised on two further counts. First, it implies a straightforward 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 (Young *et al*., 2001).

(a) Production based Entitlement

Improving agriculture technology will lead to a reduction in hunger and food insecurity, agriculture has played and will continue to play this fundamental role. It contributes to two main key criteria, increasing the availability of food at prices that poor people can afford and providing improved job and income that will provide poor people the means to access increased food crop production.

(b) Inheritance and transfer entitlements (from the state, or private gifts and loans).

Transfer entitlement provides a mechanism of social order and cooperation governing the behaviour of set of individual within a given community. Transfer entitlement support values and produce and protect interests. Thus, can help mitigate food insecurity at the household level, for example by households giving food one another.

(c) Trade-based entitlements

Food prices vary seasonally, but poor households often sell their crops just after harvesting at lowest price because of an urgent need for cash for credit payments, school fees and medical bills. Market forces in terms of supply and demand for food affect food prices hence the extent to which various people have access to food through buying it. The supply of food can be compounded by poor infrastructure, or poorly integrated food markets in famine-prone areas as well as high transport costs and risks. According to Graaf, (2011) high transport costs, small markets and lack of infrastructure are the main common factors that affect agricultural production and food security negatively in all SSA countries.

Food production greatly affect food markets, because it takes time for planted seeds to bear fruits, food production cannot be expanded rapidly, and the supply of food will be inelastic with regard to demand. Consequently, where the level of food supply is low, relative to its demand, the prices will tend to rise. On the other hand, where the supply is greater than the demand, prices will tend to fall (Graaf, 2011).

(d) Own-labour entitlements (waged labour and professions)

Own-labour entitlements help people to generating sufficient income to allow people to access food. Improving access to food through increasing incomes can be seen as helpful to look at the impact of increasing agricultural productivity in three main areas which hare direct impact on farmers' incomes, including those of smallholders, impact in terms of increasing rural employment opportunities and rural wage rates including those in the non-farm rural economy and wider impact on economic growth and poverty reduction more generally. In response to a decline in people's entitlements, people actively try to protect their livelihoods. These livelihoods are normally termed as coping strategies and

they can be as short-term and long term coping strategies in responses to declining food entitlements (Young *et al*., 2001).

2.7.3 Conceptual Framework for Food Security and Coping Strategies

The conceptual framework (Fig.1) for this study is derived from (1981) concept of entitlement to food by Sen. The entitlement approach to hunger discusses the ability of people to command food through the legal means available in the society. The independent variable in this study is coping strategy, which influences the dependent variable food security. The independent variable includes consumption (Buying food on credit, skipping meals and eating less preferred food). Then there is Expenditure (avoiding health cost and education cost); Income, (selling household asset); and migration, (migrating to work and sending children to relatives).

The conceptual framework assumes that the independent variables have a direct influence on the dependent variable which is food security status. The indicators for food security status are Dietary Energy Consumed, Kilogram's of grain harvested or bought and the number of meals eaten per day. The conceptual framework also assumes that the intermediate variables also have an influence on background variables. These variables include agro-ecological factors, (drought, pest and diseases, postharvest management); institutional factors, (agricultural extension services, markets, and food prices); cultural factors, (land owned, seasonal feastings), and Social factors (loss of off farm job). Factors contributing to food insecurity indicate a probability of failure to attain a certain threshold level of energy requirement for a healthy life. In the household level, less land ownership, drought or water scarcity, loss of off-farm jobs, poor technology, food price fluctuation are the main risk factors. Others include weak agricultural extension services, poor division of labour at the household level, financial inability to use improved seeds,

fertilizers, pesticides, and herbicides and bad farming practices leading to various environmental hazards. Background variables in the conceptual framework consist of age of the household head, sex of the household head, marital status, years of schooling of household head and household size, all of which have a direct influence on the independent variable and the interdependent variables. Income generating activities have influence on the dependent, access to food and farming activities which also have influence on household's income; which again influences the access to food which leads to food insecurity coping strategies.

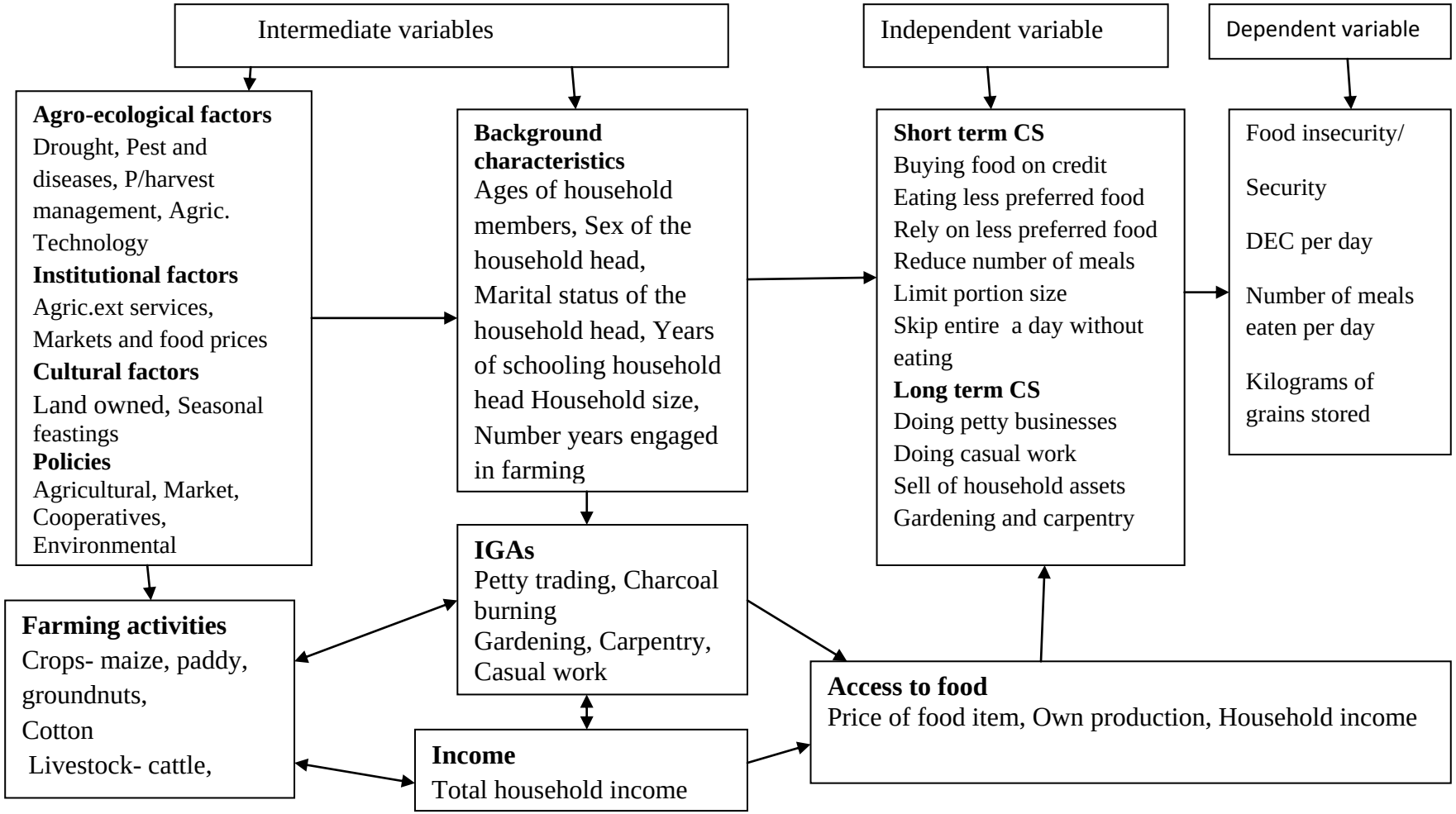

Figure 1: Conceptual Framework of Food Security/Insecurity and Coping Strategies.

CHAPTER THREE

3.0 RESEARCH METHODOLOGY

3.1 Description of the Study Area

Kahama District where the study was conducted found in the Northwest of Tanzania, South of Lake Victoria. As shown in (Fig. 2) it is bordered by Shinyanga and Nzega Districts to the East, Geita Region to the North, Bukombe District to the West and Tabora District to the South (KDP, 2011). The area was selected based on the fact that no studies on food security and coping strategies have been conducted. In addition, the need for food aid has been increasing since 2009 -12. Generally, food aid in tonnes for the above period was 856 (2009), 666 (2010), 768 (2011) 1108.8, (2012), and 713 (2013). In the year 2009 the amount of food received from NFRA was 125 tons of maize, 19 tons of beans, and nine tons of vegetable cooking oil. In 2010, the district received 200 tons from Bulyanhulu Gold Mine.

Kahama District is administratively divided into 2 councils with 5 divisions, which have been subdivided further into 55 wards and a total of 232 villages and 97 streets. Roughly, the district lies between latitudes 3°15 and 4°30 south of Equator and longitudes 31°00 and 33°00 East of Greenwich. Kahama District Council has 187 villages and Kahama Town Council has 45 villages and 97 streets. Politically, the District has two constituents namely Kahama and Msalala, each represented by one elected Member of Parliament (KDP, 2011). The study was conducted in Isagehe Division in Kahama Town Council and Msalala in Kahama District Council. These two divisions are the most affected by food deficit.

Rainfall in Kahama District is generally erratic; there is no clear pattern, and the district is characterized by highly unreliable conventional rainstorms causing considerable

differences in rainfall both in terms of space and time. Nevertheless, rainfall variability on a year-to-year basis is not exceptionally high, averaging between 750 and 1030 mm per year (KDP, 2011). The rains fall for approximately five (5) months from late October to early May. This rainy period is characterized by a two-week to one-month dry spell, mostly in January and February (KDP, 2011).

Temperatures in Kahama District are relatively constant throughout the year; with mean daily temperatures ranging between 20° and 26° C. August and September are the warmest months. Due to relatively small difference in elevation, the district temperatures are essentially the same throughout the district (KDP, 2012). Relative humidity in the District is 79% on average with little variation during the year. During the rainy season the relative humidity values are between 80% and 85% and are slightly lower during the dry season. On a monthly basis wind speed seems to have little variation averaging 0.9 m/sec. During the rainy season, wind speeds are slightly lower than during the dry season. According to KDP (2011), strong winds are frequently associated with rainstorms, particularly at the onset of the rains. The district is located on the inter-rift plateau at altitudes ranging from 1050 to 1500 meters above the sea level.

The land surface can best be described as an almost flat to undulating plains. Residual hills of low relief are common; the highest hills are not much higher than 300 meters above their surrounding plains. These undulating to flat plains are characterized by frequent bottomlands, which are the lowest levels in the landscape locally known as *mbuga*. These are in fact very shallow, wide and flat seasonally flooded valleys (KDP, 2011).

In Kahama District, land is mainly used for crop cultivation and livestock production. Major crops grown include paddy, cotton, tobacco, maize, legumes, sorghum, cassava, groundnuts, millet beans and sweet potatoes. Fruit trees commonly found include mangoes, lemons, oranges, bananas, guava, and papaya. With the exception of mangos, the rest of fruit crops are grown around homesteads, cashew nut trees are found in a few places in the district (KDP, 2011).

Kahama District has a total population of 766 010 (392 049 female and 373 961 males). Kahama Town Council (KTC) has a population of 242 208 (117 498 males and 124 710 female) Kahama District Council (KDC) has a population of 523 802 (256 463 males and 267 339 females) URT, (2013). Most (85%) of residents in Kahama District depend on subsistence agriculture and livestock rearing as their main source of livelihood. Approximately, 80% of the total arable land (482 320) ha or 57% of district area) is utilized either for crop production or as grazing land. Farm sizes vary from 0.4 to 20 ha per farm household. According to KDP (2011:21), the District has five main agro-ecological farming systems as shown below;

(i) Cotton farming system (28%) of the total district area)
(ii) Rice farming system (17%)
(iii) Tobacco based farming system (19%)
(iv) Maize farming system (34%) and
(v) Maize-chick pea farming system (< 2%)

The main food crops cultivated in Kahama District include; maize, cassava, sweet potatoes, sorghum, groundnut, millet and beans; and the main cash crops include, cotton, tobacco, and rice. However, the production of all these crops is severely constrained with unreliable rainfall, prolonged drought and unfavourable market outlets. In some years, the district enjoys an increased production, especially during the favourable rainfall

condition. Introduction of power tillers has promoted crop production among farmers. However, the farm households in Isagehe and Msalala Divisions have remained in need of food assistance (KDP, 2011).

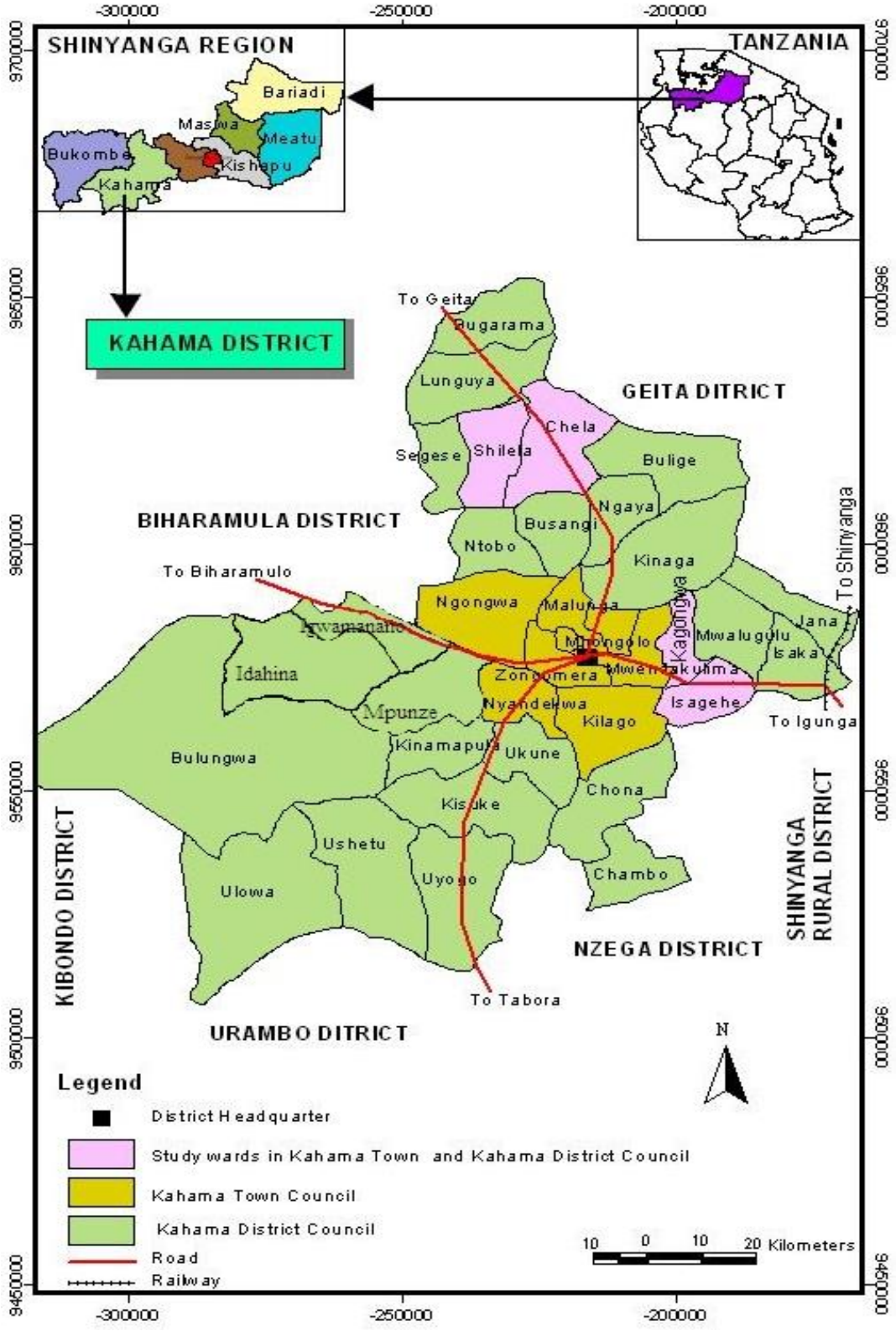

Figure 2: Map of Kahama District showing the study area

3.2 Research Design

A cross sectional research design was used in the study. Data were collected from the field at a single point in time. This design according to (Babbie, 1990; Bailey, 1998) is useful for descriptive purposes as well as for determination of relationship between and among variables at a particular point in time. Data collection was undertaken for about two months, in the months of November to December 2012. According to Matthews and Ross (2010), a cross sectional research design is cost effective and allows inclusion of participants or groups of people from whom a comparison can be made.

3.2.1 Sample size

A sample of 150 farm households was selected from a total of 3 796 farm households from eight villages to represent the total population at a confidence level of 95% and level of precision of 8%; this was thought to be optimum. According to Matata *et al.*, (2001) an optimum sample is the one which fulfils the requirement of efficiency, reliability and flexibility.

The sample size was calculated using the following formula:-

$N = Z^2pq / d^2$……..... (1)

Where N = sample size, z = statistical certainty desired, p = estimated prevalence rate and $q = 1 – p$ (proportion without the attribute of interest), and d = degree of precision. The desired precision (*d)* was set at 8 percent (0.08) and Statistical certainty was set at 95 percent (z = 1.96). Because the general prevalence rate of key variable was not known, the value of p was set at 50% (0.5) to maximize the impact of this variable on the sample size. Thus, the resulting sample size was:-

$$n = \frac{(1.96 \times 1.96) \times 0.5 \times (1 - 0.5)}{0.08 \times 0.08} = 150 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

The unit of analysis for the study was the household, with the assumption that the household is where one can get most of information with regard to the study objectives.

The intention was to interview 150 households from eight villages. However, due to delays in receiving research funds, the data were collected during agricultural season activities, thus some of the sampled households didn't complete filling in exercise books for HIES data; therefore only 137 households were included in the analysis.

3.2.2 Sampling procedure

Purposive sampling was employed whereby 2 divisions, 2 wards from each division were selected after which 2 villages were randomly selected from the respective wards. This made a total of 8 villages for the study. According to Matthews and Ross (2010), purposive sampling is generally associated with small, in depth studies with research designs that are based on the gathering of qualitative data and focus on the exploration and interpretation of experience and perception. Households included in the study were randomly selected, through proportional stratified sampling due to the different sample sizes for each population in the eight villages; the eight villages formed the strata.

The four wards formed a stratum and a sampling fraction obtained was multiplied by the number of households in each of the wards to get the number of households, making a total of 150 respondents. Specific households included in the study were obtained through simple random sampling which was carried out by choosing the first household

randomly, using a table of random numbers and then choosing each of the subsequent households by adding the respective sampling interval for each of the selected villages.

Table 1: Sample selection

Wards	Villages	Number households (N)	Households selected (n=150)	Households actually involved in the study (n= 137)
Shilela	Malito	371	15	13
	Shilela	247	10	10
Chela	Jomu	407	16	16
	Mhandu	522	21	15
Isagehe	Kidunyashi	362	14	14
	Mpera	539	21	20
Kagongwa	Gembe	277	11	11
	Kishima	1071	42	38
	Total	**3796**	**150**	**137**

3.2.3 Data types and sources

Primary data are the data observed or collected directly from first-hand experience Dodge (2003). In this study primary data collected included socio-economic characteristics of respondents as well as crop production practices and food supply, food consumption and expenditures, and food insecurity coping strategies. Primary data were collected using a questionnaire (Appendix 4), and Household Income Expenditure Survey (HIES) form (Appendix 6), followed by key informants interview and Focus Group Discussion (FGDs). Data collection was between October and December 2012. FDG and key informants involved village leaders, village executive officers, influential people, sub village leaders and agricultural extension workers and a checklist (Appendix 5) was used to guide the discussion and interview. Information gathered through key informants' interviews gave insight on crop production, food security status and coping strategies employed by farm households.

Secondary data are the data that were collected by someone else or for a purpose other than the current one (Dodge, 2003). In this study, secondary information was collected through reviewing literature on the state of food insecurity in Tanzania and reports on the trend of the food aid from Kahama District Office.

Quantitative data are the data whose items are described in terms of quantity and in which a range of numerical values are used without implying that a particular numerical value refers to a particular distinct category (Dodge, 2003). The following quantitative data were involved in the study; respondent's age (years), sex of respondent, respondent's education level, family size, farm size, total area cultivated per season, farming experience, the amount of seeds used, the amount of agricultural inputs bought, the number of livestock kept, the amount income from different sources, strand of sunflower farming, crop productivity, the amount of various food items consumed within the households, and income spent on food and non food items. Qualitative data are the data which describe items in terms of some quality feelings, and opinion (Matthews and Ross, 2010). The following qualitative data were involved in the study; food insecurity coping strategies available in the area, and the availability of opportunities towards food production and supply. Perception on food situation at village and household level, types of crops grown and farmers suggestion on how to improve food availability in the study area.

3.2.4 Methods of data collection and tools used

In this study both qualitative and quantitative methods were employed. According to Matthews and Ross (2010), a mixed method can best be thought of as a combining qualitative and quantitative method in a way that is best for a research. Eight FGD, with eight to sixteen people were used per discussion. Information on Household food

security was collected through questionnaire which included a standardized validated short questionnaire including a nine-item household food insecurity access scale (HFIAS), and 24 hours recall period. Household Income and Expenditure Survey (HIES) for 30 days and food insecurity measure questions of coping strategy (CS) which were developed during the FGDs.

For the purpose of food security analysis in this study, food composition table and aggregate household calorie consumption were constructed and food security condition was calculated on basis of calorie requirement, according to sex and age of household members as recommended by Food and Agriculture Organization (FAO, 2007). Consumption below the minimum level of 2200 kilocalorie requirements indicates food insecurity; in Tanzania, the minimum recommended dietary energy intake is 2200 kcal per adult per day (URT, 2002).

3.3 Data Analysis

Data analysis is the process of evaluating data using analytical and logical reasoning to examine each component of the data provided (Dodge, 2003). Data were analysed using Statistical Package for Social Sciences (SPSS) computer 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.

3.3.1 Determination of household food insecurity access scale

The HFIAS consists of two types of related questions. The first question type is called an occurrence question. There are nine occurrence questions that ask whether a specific condition associated with the experience of food insecurity ever occurred during the previous seven days). Each severity question is followed by a frequency-of-occurrence question, which asks how often a reported condition occurred during the previous four weeks. Each occurrence question consists of the stem (timeframe for recall), the body of the question (refers to a specific behaviour or attitude), and two response options (0 = no, 1 = yes. Each HFIAS frequency-of-occurrence question asks the respondent how often the condition reported in the previous occurrence question happened in the previous four weeks. There are three response options representing a range of frequencies (1 = rarely, 2 = sometimes, 3 = often) (FANTA, 2005). The HFIAS indicator categorizes households into four levels of household food insecurity (access): food secure, mild, moderately and severely food insecure. Households are categorized as increasingly food insecure as they respond affirmatively to more severe conditions and/or experience those conditions more frequently.

According to FANTA, (2005) a food secure household experiences none of the food insecurity (access) conditions, or just experiences worry, but rarely with a score of less or equal to ten. A mild food insecure (access) household worries about not having enough food sometimes or often, and/or is unable to eat preferred foods, and/or eats a more monotonous diet than desired and/or some foods considered undesirable, but only rarely. However, such a household does not cut back on quantity nor experience any of the three most severe conditions (running out of food, going to bed hungry, or going a whole day and night without eating) with a score of between eleven and sixteen.

A moderately food insecure household sacrifices quality more frequently, by eating a monotonous diet or size of meals or number of meals, rarely or sometimes. Nonetheless, it does not experience any of the three most severe conditions; the score is between seventeen and twenty two. A severely food insecure household has graduated to cutting back on meal size or number of meals often, and/or experiences any of the three most severe conditions (running out of food, going to bed hungry, or going a whole day and night without eating), even as infrequently as rarely. In other words, any household that experiences one of these three conditions even once in the last seven days is considered severely food insecure; its score is between twenty three and twenty seven (FANTA, 2005).

3.3.2 Determination of adult equivalent (AE) units

In order to calculate adult equivalent (AE) units, the sex and age of every individual in the household must be known first. This is done because household size includes of different age and sex and household size are greater than AE units. This is because children, women and old people are less than average adults in term of essential needs especially dietary energy. AE deflates the children to be equivalent fractions of adults. A two-step procedure is used; the first step constants reflecting caloric requirements by age and sex are added up for every household member to get all the household members in terms of AE. The constants are presented in (Appendix 2). For example; if a household has four members who are: a) female aged 53 years, b) female aged 14 years, c) male aged 9 years, and d) male aged 4 years, e); they are equivalent to $0.88_{(\text{First Person})} + 1.00_{(\text{Second Person})} + 0.76_{(\text{Third Person})} + 0.48_{(\text{Fourth Person}))} = 3.12$ adult equivalent units. However, the value 3.12 is not used directly as a denominator for computing values per adult, because of economies of scale.

After the above is done the second step follows which involves adjusting the above adult equivalent units for economies of scale due to the fact that larger households need fewer amounts of resources per person due to sharing some facilities. The adjustment was done by multiplying the AE units by average cost constants given in Appendix 3.Therefore, since 3.12 is approximately equal to 3, then 3.12 is multiplied by 0.897, which is the average cost (Appendix 3) corresponding to three adults living together, in order to adjust 3.12 for economies of scale. Hence, the AE equivalent units are 2789, i.e. 3.12 x 0.897. This should be the denominator for calculating values per AE in that household. Such a procedure is followed for every household in a sample. If the three-people households consumed 9 305 kcal per day, their DEC per adult equivalent per day would be 9305/2.789, which 2982.4 kcal per AE per day.

3.3.3 Determination of dietary energy consumed and food insecure households

Dietary energy consumed per adult equivalent per day (DEC) was calculated based on all food items consumed within 24 hours. The Tanzania Food Composition Tables Lukmanji and Hertzmark (2008) were used for the calculation. DEC obtained for all food items was added to get the amount of kcal consumed per day which was then divided by household adjusted adult equivalent. In this case, a household was said to be food insecure if it had consumed less than 2200 kcal per adult equivalent per day.

3.3.4 Determination of DEC per capita and food insecure households

DEC per capita was calculated based on only grains consumed because grains are the main staple foodstuffs in the research area, and their importance as a basis for DEC determination is justified by studies by Ashimogo (1995) and Kayunze, (2008) who have reported that in Tanzania, cereals supply 80% while other foods supply 20% of dietary

energy using only grains; the DEC obtained has to be inflated by multiplying it by 100/80 to cater for energy from other foodstuffs.

Tanzania Food Composition Tables Lukmanji and Hertzmark (2008) were used for the calculation. The tables show that 1 kg of white maize flour contains 3620 kcal and one 1 kg of rice contains 3580 kcal. Therefore, the amounts of maize eaten were multiplied by 3620 while those of rice eaten were multiplied by 3580 to get the amounts of kcal consumed in maize and rice respectively. DEC obtained using the above procedure was multiplied by100/80 to take into account energy from other sources. DEC amounts obtained in that way were divided by household sizes to get DEC per capita (Kayunze, 2008).

3.3.5 Determination of food security based on grains obtained per AE per year

According to Mosha (1990), cited by Nyaruhucha *et al.* (2006) the recommended amount of maize cereal per capita per year is three bags. However, Kayunze *at al.* (2009) point out that, the amount of grains required per adult equivalent per year whereby the cut-off point is 270 kg per AE per year in Tanzania. The amount of grain for both maize and rice harvested, bought, received freely from friends and relatives and the amount borrowed was summed up to get the total grains available for the season 2011/12. The amount obtained was divided by the number of the adjusted adult equivalent in the household. In this case, households' members were said to be food insecure if they had less than 270 kg per capital per year.

3.3.6 Determination of monetary poverty line per AE per day

The entitlements approach includes having money to buy food. The approach is based on calculating the amount of money that is required to obtain food that contain minimum

amount of dietary energy. Households that are unable to obtain such amount of money are said food insecure. It is argued that most food insecure households are those who fail to achieve access to adequate food even by devoting large proportion of available resources to food. Although the entitlement to food approach explains food insecurity to a large extent, it has widely been criticized as being not a good indicator (Maxwell, 1992).

In this case, minimum of amount of money can be calculated using, the headline poverty line for 2007. The first step is to convert the monetary value of December 2012 by using its headline poverty line of 2007 this aimed at getting the present monetary value. The headline poverty line of 2007 was 7%. The second step is to convert the monetary value to the present headline. Then the adjustment is done by dividing monetary value with adult equivalent units and seven days in order to get the value adjusted adult equivalent per day then multiplied by 28, in order to get, monetary value per adult equivalent for 28 days.

a) Monetary value for 2007 was 13 998 per AE for 28 days with its headline poverty line of 7%.

(b) Monetary value for December 2012 was X with its headline poverty line of 12.1% URT, (2012b). Based on this the monetary value for 2012 is:-

12.1 x13 998 / 7 = 24 196 TAS per AE per 28 days.

In this case, a household was said to be insecure in monetary terms if it had spent less than 24 196 TAS per AE per 28 days.

3.4 Regression Analysis

3.4.1 The binary logistic regression model

The model for the binary logistic regression which was used in determining factors associated with a household likelihood of being food secure is as specified below:-

Model $Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots B_{14} X_{14} + e$…….. 2

Where;

Y = Households food security status, 1 = Food secure, 0 =Food insecure (measured by DEC)

β_0 = Constant and $X_{1\ to}\ X_{14}$= Number of independent variables

X_1 = Marital status respondent. (1= Married; 2 Not married

X_2 = Education of house members .Measured in years of schooling

X_3 = Household size. Number of members

X_4 = Availability and source of agricultural extension (1 = Yes; 2=No)

X_5= the use of ox plough in cultivation (1 = Yes; 2=No)

X_6= the use of organic or inorganic fertilizers (1 = Yes; 2=No)

X_7= the use of improved seeds (1 = Yes; 2=No)

X_8 = the use of herbicides/insecticides (1 = Yes; 2=No)

X_9 = the costs of food items. Measured in TAS

X_{10}= Reliance on less preferred foods (1 = Yes; 2=No)

X_{11}= Borrowing food from relatives (1 = Yes; 2=No)

X_{12} = Purchasing food on credit (1 = Yes 2=No)

X_{13} = Consumption of seed stock (1 = Yes; 2=No)

X_{14} = Reducing number of meals eaten in a day (1 = Yes; 2=No)

e = Error term

3.4.2 The multiple linear regression model

Multiple regression analysis represents a logical extension of two variables regression analysis. Instead of a single independent variable, two or more independent variables are used to estimate the values of a dependent variable (Gupta, 1990).

For objective three multiple linear regression was used, before running it collinearity/multicollinearity diagnostics were tested in order to detect whether there is a correlation among the independent (X) variables. According to Pallant, (2005), the Variance Inflation Factors (VIF) values above ten is a common cut off point of determining multicollinearity, VIF values above ten indicates multicollinearity. For this case variables that were highly correlated were not included in the analysis. Appendix 10 indicates that VIF for ten variables is around or less than ten; there was no collinearity observed in the results which implies that there was no linear relationship existing between and among two or more of the independent variables. Again Pallant (2005) argues that multiple linear regression does not require the distribution of data that are skewed for both dependent and independent variables. Before running the regression analysis, a transformation of skewed data was done to make them have a normal distribution.

Multiple linear regression model was run to quantify the combined effect of the factors contributing to food production and supply as independent variables as well as gauge the role of each variable in explaining the variances in the dependent variable. According to Pallant, (2005), the number of independent variables that are required in the multiple regression analysis is calculated by the following formula $N > 50 + 8m$ (where m = number of independent variables). Therefore in this study, according to the number of household included in the analysis, ten independent variables were required for the analysis.

The factors used as predictors and which were included in the model were, sex of the household head, the number of plots owned, the total annual income, the amount of maize produced, the amount of paddy produced, the number of cattle kept, household size, years of farming and If the household practices long term coping strategies (CS) the model is as specified below

$Y = a + \beta 1X1 + \beta 2X2 + \beta 3X3 + \beta 4X4 + \ldots \beta 10X10 + e$…… ..... 3)

Where:

Y= The dependent variable was amount of grains available per year measured in kilogram's.

Y= $f\{$ sex of the household head X_1 + number of plots owned X_2 + total annual income X_3+ amount of maize produced X_4 + amount of paddy produced X_5 + number of cattle kept X_6 + household size X_7 + years of farming X_8 +number of plots owned X_9 + and If household practices long term coping strategies $X_{10}\}$

a= Intercept (constant) term.

X_1 to X_n= Independent variables.

e= Random error term.

β1toβn=Standardized partial regression coefficients for independent variables.

3.5 Indicators of Food Security used

The following indicators of food security were used in the study:

(a) The numbers of meals eaten per day by households whose adult members had eaten an average of less than 3 meals per day and whose children of five years of age or below had consumed less than 5 meals per day were considered to be food insecure.

(b) The amount of grains harvested, bought and received freely per capita per year, those households with less than 270 kg per AE per year were considered to be food insecure.

(c) Dietary Energy Consumed per adult equivalent per day based on 24 hours data collected using a household questionnaire. Households were said to be food insecure if they had consumed less than 2200 kcal per AE per day.

(d) Dietary Energy Consumed per capital per day based on HIES data collected for 30 days; in this case, households were said to be food insecure if they had consumed less than 2100 kcal per capita per day.

(e) The amount of money spent on buying food items per adult equivalent per day based on data collected for 30 days. Households were said to be food insecure if they had spent less than 24 196 TAS per AE per 28 days.

3.6 Study Limitations

Several problems were encountered during data collection; these include the fact that some farmers had problems of memory recall on the value of crops that were sold due to poor record keeping. A study by Mbwambo (2007) on Agro- biodiversity and Food Security among Smallholders Farmers on the slopes of the Uluguru Mountains reported similar problems whereby in some cases the researcher had to make their own estimates. Another problem is that some of the farmers showed interview fatigue resulting from past experiences on research studies, whereby farmers were given money in exchange to responding to interview questions. Furthermore, some farmers failed to record data on HIES for 30 days for the reasons not known to the researcher; such farmers were excluded from the analysis. However, a study by Frongilo and Nanama (2008) indicates that data on dietary energy intake are difficult and time-consuming to collect especially in the African context with complex family structure.

Due to the above limitations the following measures were undertaken to resolve the problems:-

- In addressing the issues of record keeping more probing was done and finally a consensus on the estimates was recorded.
- Although the study intended to collect data from 150 respondents, only 137 households participated fully in the study, the rest 13 respondents were dropped and were not included in the final analysis.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 Respondents Demographic and Socio-Economic Characteristics

4.1.1 Age of the household head and household food security

Age has been found to determine how active and productive the head of a household would be. Age has also been found to affect the rate of household adoption of innovations, which in turn, affects household productivity and livelihood improvement strategies (Amaza *et al.,* 2009).

Observation from the study show that more than two thirds (73.8%) of the respondents were between the age of 36 and 60 followed by those above 60 years and those between the age of 21 and 35 (13.1%). Generally, most of the household heads (86.9%) were in the active and productive age range of less than 60 years. In the active age, individuals are expected to be very active on the farm activities and more responsive to agricultural extension programme. The results in Table 2 show the cross tabulation between age and food security; the percentage household heads with 36 to 60 years who are food insecure was higher (77.7%) than that of the food secure households (61.8%) of the same age group. These finding reveals that, as age of the household's head increases food insecurity at household level also increases. This might be due to low use of agricultural technology which is one of the main problems hindering realization of food security and also reduced capacity of energy required for agricultural activities .These findings are in line with those from a study by Babatunde (2008) which show that vulnerability to food insecurity increases as the age of the household head increases.

Again, a study by Idrisa (2008) has also revealed that age, in correlation with farming experience has a significant influence on the decision making process of farmers with respect to risk aversion, adoption of improved agricultural technologies, and other production-related decisions.

Table 2: Respondents socio-economic characteristics and food security (n = 137)

Characteristics	Categories	Food insecure		Food secure		All	
		F	%	F	%	F	%
Age	21 -35	13	12.6	5	14.7	18	13.1
	36 – 60	80	77.7	21	61.8	101	73.8
	>60	10	9.7	8	23.5	18	13.1
Marital status	Married	89	86.4	29	85.3	118	86.1
	Not married	14	13.6	5	14.7	19	13.9
Sex of the HH	Male	92	89.3	30	88.2	122	89.1
	Female	11	10.7	4	11.8	15	10.9
Education level	No formal	6	5.8	4	11.8	10	7.3
	Primary	84	81.6	27	79.4	111	81.0
	Secondary	13	12.6	3	8.8	16	11.7
Household size	1 – 4	11	10.7	11	32.4	22	16.0
	5 – 8	66	64.1	19	55.8	85	62.1
	> 8	26	25.2	4	11.8	30	21.9

4.1.2 Household heads marital status and households food security

Marital status has a strong implication on food security. The significance of marital status on agricultural production can be explained in terms of the supply of agricultural family labour (Amaza *et al.*, 2009). The findings in Table 2 indicate that 86.1% farmers were married and about (13.9%) were single; these include the widows, the divorced, or

the separated. The study findings in Table 2 also indicate that the percentage of married farmers who are food insecure was higher (86.4%) than that in households who are food secure (85.4%). The difference is not significance. Again the percentage of unmarried farmers who are food secure was higher (14.7%) than that in households who are food insecure (13.6%). The differences between the food secure and insecure households are scientifically not significant see under section (4.5: Table 21). This might be because among other factors, married farmers in most cases have big number of people to be fed especially in situation where all members depend on the household head. Similar findings are reported in a study by Obayelu (2010) who found that households with unmarried individuals were more food secure than those of married individuals.

4.1.3 Sex of the household head

Sex of the household head plays an important role in providing the households with basic needs including food, shelter and clothing (Kuwornu *et al.,* 2012). The study results (Table 2) indicate that out of the 137 households, 89.1% were male headed households (MHH) while 10.9% were female headed households (FHH). The results in Table 2 also indicate that the percentage of food insecure households is slightly higher among MHH (89.3%) than is the case with food secure household (88.2%). However there are a slight higher percentage of food secure households headed by females (11.8%) as compared to food insecure households headed by female (10.7%). The differences between the food secure and insecure households are scientifically not significant as presented under section (4.2.12: Table 14).

These slight differences might be because; among other reasons, in MHH there is larger number of non working members of household which increases the food requirement of household thereby probability of high food insecurity. The observations in Table 2 also

conform to the results in a study by Obayelu (2010) and Babatunde *et al.* (2008) on determinants and vulnerability to food security found that MHH were more food secure as compared to FHH, because MHH poses more resources than FHH. Again similar results are also reported in a study by SFTZ (2009) who found that households headed by women in Mara region suffer moderately to severe food insecurity than is the case with households headed by men.

4.1.4 Education of household head

Education is widely believed to be a key determinant of food security; knowledge associated with primary education has been known to substantively make one improve household food security. The results on the education level of the household head show that 81% farmers had primary education, 7.3% had no formal education, and 11.7% had secondary education, which implies that majority (92.7%) of the farm household heads are educated. And the findings show that formal education was high among the respondent. This observation seems to suggest that there is higher likelihood of households adopting agricultural technologies and therefore improve their crop production and hence become food secure. However, the results in Table 2 indicate a group of household heads with primary education had a relative higher percentage (81.6%) of food insecure households than is the case with food secure households (79.4%) in the same categories of education level. Table 21 indicates that education was slightly significant influencing food security at 10%. This is because among other reasons some households had low productivity due to drought.

These findings are in line with those in a study by Leyna (2007) who found that majority of people living in rural areas had primary education and only few (14.1%) were food secure. Also, the results are in agreement with CIMMYT (1993) who reported that in

Tanzania, most farmers have primary education and rely on traditional farming practices as a result majority experience transitory food insecurity.

Education level of the household head could be very important in making decision related to production of general commodities and production and agricultural products. For example, Urassa (2009) argues that households with more education or other forms of human capital stand a better chance of accessing non farm income or credit and they, therefore, could be more able to afford inputs. The point here is that such farming households may be more aware of the benefits of using various modern agricultural technologies and more efficient in their farming practices. Therefore, farming households with more education had the possibility of obtaining higher yields and become food secure.

4.1.5 Household size

The significance of household size in agriculture and food security depends on the fact that availability of labour for farm production, the total area cultivated for different crop farming, the amount of farm produce retained for domestic consumption and the marketable surplus are all determined by the size of the farming household (Amaza *et al*., 2009). Results in Table 2 show that household size of the respondents ranged between one and 20 members; the mean was 6.84, and a standard deviation was 2.8. The household size by category shows that about two thirds (62.1%) of the households had five to eight members, and 16 % had one to four members, and one fifth 21.9% had more than eight members. Again findings in (Table 21) indicate that household size was significant influencing food security at 0.01. These results reveal further that more than half (52.6%) had at most seven household members. This shows that the average

household size in the study area was higher than the Regional average of 5.9 members (URT, 2012b).

The above observation implies that the size of most of the households is big and this could be attributed to the extended nature of many families whereby parents live together with sons and grand children thus, requiring much spending for their daily sustenance. Many families had more than three members except three families which had one and two members. This enabled farmers to engage more in agricultural production because of the labour force available in the household; many times it is farmers with more labour that are able to take advantage of the available human resource in agricultural production resulting into high yields.

The results of cross tabulation between household size and food security (Table 2) indicate that households with 5 to 8 members (55.8%) were more food secure than households in other categories, this might be due to the fact that, the larger household size, the greater the responsibilities, especially, in a situation where many of the household members are engaged in any income generating activity and do not depend on the household head for subsistence. According to Basukuba (2007), having large numbers of people in a household is normally seen to contribute to family labour and therefore large households had the possibility of obtaining sufficient labour for high agricultural production and therefore attaining food security. Table 2 shows further that the group of 5 to 8 members is mostly affected by food insecurity (64.1%) as opposed to the rest categories of family sizes. This might be a result of having a big number of dependants who need to be fed. The study by Amaza *et al*. (2009) found that households with large sizes had higher probabilities of being food insecure than those with smaller sizes, and vice versa. This is obvious because the larger the household size, the greater

the responsibilities, especially, in a situation where many of the household members do not generate in any income but only depend on the household head.

4.2 Factors Influencing Farm Households' Food Production and Supply.

4.2.1 Households ownership of farmland

In Tanzania, the agricultural sector is the main source of employment and livelihood for more than two-thirds of the population. It is an important economic sector in terms of food production, employment generation, production of raw materials for industries and foreign exchange earnings. Land is a major resource of agricultural production (URT, 2010a). Most (85%) of the residents Kahama, as is the case in many other parts of Tanzania, depend on subsistence agriculture and livestock rearing as their main source of income. The results of the current study show that on average total land owned ranging from 0.5 acres to 400 acres. The results in Table 3 show that more than one third (39.4%) of the respondents had 0.5 to 4 acres, 32.8% had 5 to 9 acres, and the rest had between 10 acres and above. These findings reveal that farmers in the study area engage in subsistence farming since crop production is at a small scale level. The results in Table 3 show further that household with 0.5 to 4 acres were much more food insecure with percentage of (42.7%) than those who were food secure of with percentage of (32.4%). Again households with 5 to 9 acres were more food secure 35.3% than those who were food insecure (31.1%). On average, rural households own around 5 acres (URT, 2010a).

4.2.2 Farming experience of the household heads

Farming experience is an important factor in determining both productivity and the production level in farming. The farming experience of household heads in the study area varied widely, with a minimum of only 1 year and a maximum of 60 years. The

average farming experience was 20 years. The findings in Table 3 indicate that about 20.4% of the farmers had farming experience of 1 to 10 years, about 40.8% had farming experience of 11 to 20 years, 22.6% had farming experience of 21 to 30 years and the rest (16.1%) had farming experience of more than 31 years. This finding implies that on average farming household heads had considerable experience in farming. The results in (Table 3) show that households with farming experience of between 11 and 20 of years of were among those with a slightly large percentage (41.2%) of food security as opposed to households with other ranges of faming experience.

Results in Table 3 further show that about two fifths (40.8%) of households with 11 to 20 years of farming experience was food insecure as opposed to the rest of the groups. These findings imply that farming experience may be positive or negative related to food productivity and production. According to Amaza *et al*. (2009), generally, it would appear that up to a certain number of years, farming experience would have a positive effect on productivity and production; after that period, farming experience may have negative effect on productivity and production. The negative effect may be derived from aging or reluctance of these household to change from old and familiar farming practices and techniques which they (households) are used to, and to those that are modern and improved where as new entrants into the agricultural activities may easily embrace the new technologies and end up with low productivity and hence food insecure.

Table 3: Households socio economic characteristics and food security

Characteristics	Categories	Food insecure (n=103)		Food secure (n=34)		All (n=137)	
		F	%	F	%	F	%
Acres	0.5- 4	44	42.7	11	32.4	54	39.4
	5 – 9	32	31.1	12	35.3	45	32.8
	10 -14	10	7.3	3	8.8	13	9.5
	15 and above	17	9.7	8	23.5	25	18.2
Yrs of Farming	1 -10	22	21.4	6	17.6	28	20.4
	11 – 20	42	40.8	14	41.2	56	40.8
	21 - 30	23	22.3	8	23.5	31	22.6
	30 and above	16	15.5	6	17.7	22	16.1

4.2.3 Causes of food shortages in the study area

Results in Table 4 indicate that nearly all (95.5%) respondents said that the main cause of food shortage during 2011/12 season was inadequate rainfall and drought. This has implications on food security whereby, in the event of drought, households may have limited access to safe and nutritious food which is needed to maintain a healthy and active life. More than three quarters (79.6%) of respondents reported a failure to use improved seeds, fertilizers and pesticides, followed by family members' irresponsibility 51.9% and having big household size *vis-a-vis* food production as the main causes 51.9%. However, low supply of food in the market was not supported by almost three quarter 74.5% of the respondents. In addition 25.5% and 40.1% of the respondents agree that lack of income to buy food and higher prices of food in the market were the causes of food insecurity in the study area. These results are in agreement with the previous studies for example:-

A study by Kayunze *et al.* (2007) showed that general causes of food insecurity in Tanzania, which are the same as in many other developing countries, include: dependency on rainfall; poor crop and livestock husbandry, poor storage facilities and financial inability to use improved seeds, due to higher prices of fertilizers, pesticides, and herbicides and poor markets for agricultural and livestock products. Others are weak agricultural extension services; poor division of labour at the household level; and poor transportation systems and which constrain input supply and products haulage to the market place.

According to Kangalawe (2012) at the household level, less land ownership, drought or water scarcity, loss of off-farm jobs, poor technology, indebtedness, and food price fluctuation are the main risk factors contributing to food insecurity. Others include weak agricultural extension services; poor division of labour at the household level, financial inability to use improved seeds, fertilizers, pesticides, and herbicides and bad farming practices leading to various environmental hazards.

Again the results of the current study comply with findings of the study by Mung'ong'o (2002) who argues that, additional factors contributing to food shortages in Shinyanga region are reported in a study by which include; prolonged drought periods (which lead to poor harvests), poor farming methods, lack of storage structures at the household level and low use of pesticides, poor farm producer's prices and soil infertility.

Table 4: Main causes of food shortages in the area during this season (n = 137)

Causes of food shortages	Frequency	Percent
Family members irresponsibility	81	59.1
Lack of income to buy food	67	48.9
Low supply in the market	35	25.5
Failure to use improved seeds, fertilizers and pesticide	109	79.6
Big household *vis-a-vis* food production	81	59.1
Higher prices of food stuff in the market	55	40.1
Inadequate rainfall or Drought	131	95.6

NB: Multiple responses existed hence column tallies may exceed 137 and 100% respectively

4.2.4 Perception on food situation at village and household level

Based on the rating of food situation in the villages during data collection period (November to December), about three quarters (75.2%) of the respondents said that the most critical period of food shortage is January to March, while many families have plenty food between the months of April and June. This is the period when crops like sweet potatoes, maize, cassava, and groundnuts are being harvested. Households situation was not different at village level results in Table 5 show that about half 52.6% of the household have plenty of food between April and June; likewise fewer households have plenty of food between January and March. About half (54%)of the households believed food status is moderate during the months of October through December with only (6.6%) of the households reporting their food status as being scarce during the months of April through June which is the harvesting period.

Participants in focus group discussions (FGDs) pointed out that, months of critical food shortages were January to March, and having food surplus starts in June which is the harvesting period for cereals. These findings are similar to those reported by Kayunze (2008) in a study of HIV/AIDS and food security in Rufiji. The study revealed that the most critical months of food shortage is December to January.

Table 5: Percentage distribution of perception of food situation at village and household level on quarterly (n = 137)

Months	Village %			Household %		
	Plenty	Moderate	Scarce	Plenty	Moderate	Scarce
July- Sep	32.1	40.9	27.0	27.7	50.4	21.9
Oct-Dec	32.8	67.2	0 .0	3.6	54.0	42.3
Jan-Mar	0.07	25.1	75.2	5.8	48.2	46.0
April-June	43.1	54.0	2.9	52.6	40.9	6.6

4.2.5 Number of members working in the field and number of working days

The number of workers and total working days in the farm for the whole agricultural season can help in obtaining information on food production and food security. The respondents were asked to indicate the type and number of workers in the farm. It was revealed that the minimum number of members working in the farm per household was one and the maximum was twelve; and for the labourers, the minimum number was one and the maximum number was seventeen. More than three quarters (77.3%) of the respondents were found to have one to five members working on the field with more than three fifths (65.1%) of the respondents working for more than a hundred days.

Study observations (Table 6) shows that most (83.9%) of the respondents had more than one to fifty days of working as casual labourers. Only 31 households use community

groups on their farms with about 83.9% of the households using one to fifty working days. These results imply that working as an agricultural labourer was a common phenomenon in the study area as agriculture is the main activity for rural households. On the other hand, mutual exchange of labour is common practice in rural agricultural areas as well as in the study area. This phenomenon is locally known as *ng'wilimilija*[1].

Table 6: Percentage distribution of number of members and number of working days in the field

Category of working group	Number of members			Number of working days		
	1 - 5	6 -10	>10	1-50	51-100	>100
Family members	77.3	21.1	1.5	8.1	32.8	65.1
Casual labourers	62.3	32.3	6.4	82.3	11.3	6.4
Community groups	41.9	38.7	19.4	83.9	9.7	6.4

NB: Multiple responses existed hence column tallies may exceed 137 and 100% respectively

4.2.6 Categories of people working in the field, types of crops grown and food security

The results also show a notable difference between categories of members working on the field and food security as indicated in Table 7 About three quarters (75.2%) of the respondents who use family labour were food insecure. More than one fifth 24.8% of the respondents who use casual labourers were food secure. Table 7 also indicate that households that use casual labourers are relatively lower food insecure (20.4%) than households that use family labour only (75.2%); so it may be not wrong to assume that using casual labourers in agricultural production is more effective than using family labour only. A study by Liberio (2012) on factors contributing to adoption of sunflower

1 . *Ng'wilimilija* Means working as an agricultural labourer in the fields of well off farmers

farming innovations in Mlali Ward, Mvomero District found that more than half of the farmers use family labour as their source of labour in farm activities, and about 43% used both family labour and hired labour in farm activities.

Table 7: Categories of working group, crops grown and food security

Characteristics	Categories	Food insecure		Food secure		All	
		Freq	%	Freq	%	Freq	%
Group	Family members	103	75.2	34	24.8	137	100
	Casual labourers	28	20.4	34	24.8	62	45.2
	Community Groups	18	13.3	13	9.5	31	22.8
Crops	Maize	93	67.8	34	24.8	127	92.7
	Paddy	72	52.6	34	24.8	106	77.4
	Chickpeas	7	5.1	11	8.0	18	13.1
	Groundnuts	11	8.0	17	12.4	28	20.4

NB: Multiple responses existed hence column tallies may exceed 137 and 100% respectively

4.2.7 Crop production and types of crops grown by households

Production of main crops in the 2011/2012 season is as shown in Table 8. Household minimum production for maize was 20 kg and the maximum was 6 000 kg; for paddy the minimum production was 10kg and 15 000 kg and for Chickpeas the minimum production was 50 kg and the maximum was 4540 kg. The amounts of maize and paddy sold were 20 kg to 2000 kg and 20 kg to 5000 kg respectively. However the amount of chickpeas sold ranged between 30 kg and 4000 kg. The study results reveal further that few farmers in the study area grow sunflower, cotton, groundnuts, and cassava. The main food crops in Kahama District are maize, paddy, cassava, sweet potatoes, sorghum, groundnut, millet and beans. Cotton and tobacco constitute the main cash crops, although

all have suffered from unreliable rainfall, prolonged drought and unfavourable market outlets (KDP, 2011).

The study observed further that nearly all (92.7%) cultivate maize and (77.4%) of farming households cultivate paddy. Table 7 indicates that there is a slightly large percentage (8%) of food secure households who cultivate groundnuts and chickpeas and (2.4%) as opposed to the percentage of food insecure households who also cultivate groundnuts and chickpeas. These results suggest that households who cultivate more than one crop are more food secure than others. The results of this study are in line with earlier findings by Babatunde *et al.* (2007) who found that farmers growing both food and cash crops were more food secure than those growing food crops only. Generally, households growing cash crop can sell the same and the money realised can be used to purchase food for household consumption.

In addition, the quantities of households own food production increases the probability of the households' food security.

Table 8: Amount crops produced and amount sold

Crop	**Amount produced in Kgs**		**Amount sold in Kgs**	
	Minimum	**Maximum**	**Minimum**	**Maximum**
Maize	20	6000	20	2 000
Paddy	10	15 000	20	5 000
Groundnuts	10	4 500	10	4 000
Cotton	10	1 820	10	1820
Chickpeas	50	4 540	30	4 000

4.2.8 Agricultural extension services and food security in the study area

An increase in the frequency of contact with an extension officer has been found to increase the adoption of Agricultural technology (Liberio 2012). The findings in Table 9 indicate that majority 94.2% of the households have access to agricultural extension services and only 5.8% had no access to the village extension officer. The results also show that a slightly large percentage 97.0% of food secure household were those with access to Agric Extension services, unlike the case with households with no access to extension services, whereby only 3.0% were food secure. Farmers got agricultural advice from extension staffs which encourage them to adopt agricultural innovations such as the use of improved seeds, insecticides and pesticides, spacing, fertilizers, harvesting methods, and storage techniques so as to improve their food security.

These results are supported by van den Ban and Hawkins (1996), cited by Liberio (2012) who observed that extension plays a great role in popularizing farm technologies. Hence, to make a farmer competent, the extension agent is expected to work closely with farmers. Study observations (Table 9) show that a large percentage (93.2%) of food insecure households were those with access to Agric Extension services; this might be due to the reason mentioned in section 4.2.3 that the major causes of food insecurity in the study area are inadequate rainfall and drought.

Table 9: Accessibility of extension services and food security

Access of Extension services	Food secure		Food insecure		All	
	F	%	F	%	F	%
YES	33	97.0	96	93.2	129	94.2
NO	1	3.0	7	6.8	8	5.8

4.2.9 Agricultural technology used in the study area

The respondents were asked to indicate the types of technologies they use in their crop production. The results in Table 10 indicate that more than three quarters (80.3%) use animal power during cultivation and very few (6.6%) use a tractor or power tiller. The results further show that two thirds (66.4%) use improved maize seeds, about a quarter (24.1%) use insecticide or herbicides, less than three quarters (71.5%) use organic fertilizers, and less than one third (31.4%) use inorganic fertilizers. The acreage cultivated by ox- plough, tractor, and or power tiller ranges from one to 50 acres and three to 100 acres respectively. The amount of improved seeds used ranged from one to sixty kilograms in an area of 0.5 to nine acres. The results also indicate that the amount of inorganic and organic fertilizers used ranges from 50 kg to 400 kg and 1000 kg to 120 000 kg respectively. The average amount of organic fertilizer used was 13 500 kg.

The observation from the study show that animal power, organic fertilizer and improved seeds were more widely used in cultivation than pesticides tractor/power tiller and inorganic fertilizers. These findings suggest that animal power, improved seeds and inorganic fertilizers were affordable to most farmers. Affordability and availability influenced the adoption of improved maize seeds, the use of animal power and the use of organic fertilizers by farmers in the study area. These results comply with those reported by Nkonya *et al.* (1997) who observed that the adoption of improved seed, and to some extent, chemical fertilizer in Tanzania, is influenced by both characteristics of household

heads and the resources they own. During FGD it was pointed out that farmers who are well-off are the ones who adopt the technology as compared to the resource poor farmers.

Several studies indicate that the adoption of different technologies is very low in Tanzania; for example, According to EAC (2011) report estimates that the rate of use of improved seed varieties in SSA is about 24%, the use of chemical fertilizer stood at only 13%, and the use of control system for Agricultural covered only 4% of the cultivated land. Tanzanian farmers on average used 4.8 kg/ha of fertilizers annually during 1996-2002. These statistics compare poorly with the neighbouring Kenya, whose average use of fertilizers is 31.8 kg/ha annually. Approximately, 93% of the seeds used in each planting season are recycled from the crops of the previous season (Masalawala *et al.*, 2010).

In addition, the URT (2010a) indicates that the proportion of crop farming households using improved seeds is 24%; while the households using chemical fertilizers were 13% with Kilimanjaro, Mbeya, Rukwa and Dar es Salaam regions having the highest proportions. However a study by Baltzer and Hansen (2011), indicates that agricultural input intensity in Tanzania is very low, farmers use an average 8 kg/ha of fertilizers (below Sub Saharan Africa average), and only 5.7% of rice farmers and 0.7% of maize farmers use improved seed varieties together with fertilizers.

Table 10: Agricultural technologies used by households for the season 2011/12 (n=137)

Technologies available	Frequency	Percent
Use animal power during cultivation (plough)	110	80.3
Use tractor or power tiller	9	6.6
Use improved seeds	91	66.4
Use insecticide or herbicides	33	24.1
Use organic fertilizers	98	71.5
Use inorganic fertilizers	43	31.4

NB: Multiple responses existed hence column tallies may exceed 137 and 100% respectively

4.2.10 Type and number of livestock kept by households

The livestock kept by the surveyed households included, cattle, goats, sheep, pigs, donkeys, and chicken. About three quarters (75.9%) of the farming households in the surveyed area were engaged in crop production as well as livestock keeping as their major source of income, and that 24.1% were engaged in crop farming only (Table 7). The number and types of livestock kept in the study area are as shown in Table 11 which shows that more than four fifths 82.5% of the respondents kept chicken, about 38% kept sheep and goats, more than half 59.9% kept cattle. The minimum number of cattle kept was one and the maximum was 180, and the standard deviation was 9.8. The minimum number of chicken kept was one and the maximum was fifty. Table 11 suggest that there is a high level of crop and livestock activities carried out by the farming household. Livestock, particularly cattle, chicken, sheep, goats and donkeys are kept by farming households to provide food, income, draft power, milk, and manure. Livestock in Tanzania are a common asset among agricultural households, with about 40 percent of them partly depending on livestock for their livelihoods (URT, 2010a).

The study investigated the cross tabulation between food security and livestock keeping. The indicators of food security based on DEC per AE, DEC per capita and number of meals. Appendix 5b shows that households that kept livestock were slightly more food secure than households relying on crop production only. This implies that during food shortages livestock keepers may sell part of their stock and the money realized can be used to buy food. According to URT, (2010) livestock plays a significant role to farmers not only as an indicator of wealth, means of paying dowry or a source of cash income, but also as a source of food security especially during times of crop failure. Indeed, the keeping of livestock in Tanzania seems to improve further food security situation.

The observed result (Appendix 6) are contrary with those of Idrisa *et al.* (2008) and SFTZ (2009) on farm household and food security who found that the depth and severity of food insecurity was higher among livestock keepers than among those involved in crop farming.

Table 11: Percent distribution of households with livestock (n = 137)

Type of livestock	Frequency	Percent
Chicken	113	82.5
Ducks	25	18.2
Cattle	82	59.9
Sheep/Goats	52	38.0
Donkeys/Pigs	18	13.1

NB: Multiple responses existed hence column tallies may exceed 137 and 100% respectively

4.2.11 Type of assets owned by households

The level of asset ownership in a household is an indication of its endowment and provides a good measure of a household resilience in times of food crisis, resulting from

famine, crop failures, or natural disasters. According to Amaza *et al. (2*006) household wealth assets are important to lessen financial burden of the households during events that stress household budgets. Table 12 shows the number and value of assets owned by the respondents; more than four fifths (87.6%) own bicycles, almost all 97.1% households own hand hoes. Again about half (48.2%) own ox-ploughs, and more than three quarters (77.4%) own cell phones. The minimum and maximum number of assets owned was one to five for bicycles, one to seventeen for hand hoes, one to four for cell phones and one to three for ploughs and radios. The minimum and maximum value of assets owned by households were 3500 and 27 636 000 TAS respectively.

The findings in Table 12 also show that hand hoes were the most common asset owned by households, followed by bicycles, cell phones, and ox-ploughs. This is an indicative of improved economic welfare among the households. However, having a high proportion of households owning hand hoes indicates that majority of farming households use hand hoes in most of their farming activities and even those using tractors and power tillers use hand hoes for weeding. These results are in line with the results of studies by URT (2010a) and Masawala (2010) that about 70% of Tanzania's cultivated land is through the hand hoe as a major tool, 20% of the cultivated land is by oxen and only 10% is by the use of tractor. Ox-ploughing is the leading mechanization method in the study area. The results in (Appendix 5) show further that the vulnerability to food insecurity was higher among the household with assets value of ≤ 200 000 TAS (41.7%), and percentage of food secure was higher (52.9%) among the households with assets value of more than 400 000 TAS; this means the latter are more food secure then the former.

Some previous studies show that there is a great relationship between asset ownership and vulnerability to shocks and contingencies. For example, in the studies by Shariff and Khor (2008) and Swift (1989) show those households with low number and diversity of productive assets may be more vulnerable to external shocks. Again findings in a study by Castro *et al.* (1981) who showed that some landless peasants actually owned valuable assets which they hire out, examples include tractors and sewing machines as in the case of Tanzania.

Table 12: Distribution of type of assets owned by farm households (n = 137)

Type of assets owned	Frequency	Percent
Hand hoe	133	97.1
Plough	66	48.2
Cell phone	106	77.4
Radio	92	67.2
Motorcycle	7	5.1
Sewing machine	26	19.0
Tractor	1	0.7

NB: Multiple responses existed hence column tallies may exceed 137 and 100% respectively

4.2.12 Households average annual income

Average annual income refers to the sum of earnings of a household from both off-farm and on-farm sources (Babatunde *el al.*, 2007). The minimum and maximum amount of annual income were 6000 and 16 415 000 TAS respectively. Table 13 shows the distribution of the average annual income of farming households in the study area. Income level of the respondents reveals that households with an income of less than 300 000 TAS constituted 32.8%. The highest 42.3% percentage of the household was from those with an income of more than one million TAS per year.

The observation from the study also shows that the incidence of food insecurity was higher among those households with an average income of less than three hundreds TAS per year whose proportional was (31.4%) and there was a slightly higher percentage of food security among households with an average income of more than one million TAS per year these were 19.0 % of all the households surveyed (Table 13). The implication of this finding is that farm households with more income per year had the ability to access food and in amounts which were enough to subdue hunger and therefore had higher chances of being food secure.

According to Arene and Anyaeji (2010), the more a household head engages in gainful employment, the higher he/she earns income and the greater the chances of his/her being food secure. Income is expected to increase a household's food production and access to more food both in terms of quality and quantity.

Table 13: Distribution of average annual income and food security (n=137)

Characteristic	Food insecure households %	Food secure Households %	Total surveyed households %
Average income			
≤ 300,000	31.4	1.4	32.8
301,000 – 600,000	12.4	2.2	14.6
601,000 – 900,000	8.0	2.2	10.2
>900,000	23.3	19.0	42.3

4.4.13 Households expenditure on food and non food items for 28 days

Respondents were asked to indicate costs of food items consumed and non food items bought within 28 days. The results in Table 19 show that the costs of non food items were higher than those of food items for 28 days. The minimum and maximum expenditure for food items for 28 days were 11 800 and 549 200 TAS respectively. The

average expenditure was 209 038 TAS per household. The average expenditure seems to be higher for rural areas; this might be attributed by larger household's size. The per capita expenditure ranged from 3900 to 189 000 TAS with an average of 34 986 TAS and the minimum and maximum expenditure for non food items was 3900 and 499 800 TAS respectively. The average expenditure for non food items was 110 680 TAS. High expenditure in non food items in HIES data was on such items as agricultural inputs for example seeds, fertilizers, and hand hoes.

Also there was an increase in the expenditure in items such as telecommunications and education due to purchase of school uniforms and payment of school fees. The results in Table 14show a relatively higher expenditure than that shown in the Household budget survey of 2007. The average levels of consumption expenditure per 28 days by rural area was 16 418 TAS as an average expenditure per capita, and 82 715 TAS as an average expenditure per household (URT, (2009a). There might be a slight difference in these figures due to inflation. On the whole, bearing in mind of a possibility of data inaccuracies, this expenditure pattern seems to obey Engels' Law on food demand structure relative to demand for other consumer items. Food prices have direct and indirect influences on the three pillars of food security, which are food availability, access and utilization. Food prices have direct influence on food access (Masawala *et al.*, 2010).

Table 14: Expenditure on food and non food items for 28 days (TAS**)**

Type of expenditure	Mean	Minimum	Maximum
Expenditure on all food items consumed by all household members	209 038	11 800	549 200
Expenditure of food items per capita for 28 days	34 990	1 685	189 000
Expenditure of non food items per household for 28 days	110 680	3 900	499 800

4.2.14 Households purchase of cereals for food

Just less than three quarters (72.2%) of the respondents reported to have started buying cereals for home consumption during the months of July through September (Table 15). Very few (11.1%) reported to have done so during April through June, and about 16.7 % did the same during October through December. The minimum and maximum amounts of cereals bought were 40 kg and 1 200kg respectively. This implies that majority of the households do not harvest enough cereals to sustain their families for at least 6 months within the year.

Table 15: Showing months households started buying cereals (n= 90)

Months	Frequency	Percentage
April- June	15	16.7
July - September	65	72.2
November- December	10	11.1

4.2.15 Results of the multiple linear regression model

To determine the factors influencing food production and supply of farming households, socioeconomic characteristics of households were regressed on their total grain available per year for consumption at household level. Table 14 presents predictors affecting food

production and supply at farm households level, whereby the regression model was significant at (P= 0.000) and the ten independent variables accounted for R squire 54.3% (adjusted R^2 = 50%) of variation in food production and supply. Indices and results are presented in Table 16 the results show six variables: the total annual income, the amount of maize and paddy food production, household size, the number of plots owned, and the number of cattle owned in the household as significantly influencing food production and supply of farming households in the study area at $p \leq 0.005$.

The total amounts of food produced by households from their own farm were measured in kilogram. The quantity of household own production increases the amount of food supply within the households. Agricultural production is essential to ensuring availability and therefore food security**.** The amount of own production of major food crops was therefore found to be positive and significant. The standardized regression coefficient of 0.59 and 0.32 for maize and paddy were significant at (P = 0.000) respectively. The positive sign of the variable indicates that the higher the output levels of household, the greater the food produced and the more likely it is for the food to be supplied and available at the household level. This is expected because according to URT (2010a), agricultural sector is the main source of employment and livelihood for more than two-thirds of the population in Tanzania. Agriculture is an important economic sector in terms of food production, employment generation, production of raw materials for industries and foreign exchange earnings.

The number of household members was negatively and significantly at ($p \leq 0.05$) influenced food production and supply, implying that the larger the family size the less the food produced and supplied at household level. The results (Table 16) are in contrast with the results in the previous findings presented under section 4.1.5. However, these

finding findings are in conformity with the results in the study by Idrisa *et al.* (2008) who observed that the larger the household size, the greater the responsibilities, especially, in a situation where many of the household members do not generate any income but only depend on the household head, and that households that are food secure have small size and low dependency ratio.

Table 15: Multiple linear regression results of factors responsible for food production and supply

Model	Un standardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
(Constant)	5.016	0.328		15.279	0.000
Sex of the household head	-0.174	0.166	-0.072ns	-1.048	0.297
Number of plots owned	0.113	0.049	0.161**	2.318	0.022
Total annual income	0.031	0.013	0.163**	2.338	0.021
Amount of maize produced	0.000	0.000	0.316*	3.231	0.002
Amount of paddy produced	0.000	0.000	0.587*	6.090	0.000
Number of cattle kept	-0.018	0.004	-0.437*	-4.452	0.000
Dependence on rain	0.084	0.060	0.099ns	1.408	0.162
Household size	-0.097	0.022	-0.337*	-4.450	0.000
Years of farming	0.009	0.006	0.128	1.634	0.105
If HH practices CS	0.196	0.106	0.131	1.858	0.066

Y = Total grain available per year (Kg)

R = 73.7%; R squared = 54.3%; Adjusted R square 50%; F. statistics 11.99; N =137

Years of farming and engagement long term coping strategies (LCS) were slightly positively significant at $P \leq 0.10$. The result implies that an increase in the years of farming and engagement LCS activities are positively related to food production and supply. Similar findings are reported in the previous studies for example Kowornu, (2012) points out that farming experience refers to the number of years the household head has engaged him/herself in farming. And all things being equal, an experienced household head is expected to have more insights and ability to diversify his or her

production to minimize risk of food shortage. An experienced farmer is also expected to have adequate knowledge in pest and disease management as well as good knowledge of weather and therefore he/she is expected to have higher levels of food production and supply. According to Amaza (2006) farming experience on productivity and production may have either a positive or negative effect on agricultural production. As discussed earlier in (section 4:2:2) generally, up to a certain number of years, farming experience would have a positive effect on agricultural production; after that period, farming experience may have a negative effect.

A household's annual income refers to the sum of earnings of a household from both off-farm and on-farm sources (Babatunde *el al.,* 2007). A household's total annual income was positive and significant (p = 0.005) to food production and supply with (standardized regression coefficient of 0.16. This implies that household with more income have better access to food production and supply. About 75.9% of the respondents are engaged in crop production and livestock keeping as a primary occupation. Results from the regression analysis showed that livestock keeping was negatively related to food production and supply with standardized regression coefficient of -0.44which was significant at p = 0.000. This implies that an increase in number of livestock led to a decrease in a household's food production and supply access to more quantity and quality foods. This is surprising result, as pointed earlier under (section 4.2.9). Again this was also mentioned during the FGD that during food shortages households with livestock or other assets may sale part of their stock or assets including land and use money obtained to buy food. Households who kept livestock were more food secure as compared to those without cattle. The study findings are in contrast with those by Kapunda (1994) which showed livestock play a significant role to farmers not only as an indicator of wealth, means of paying dowry or a source of cash income, but

also as a source of food security especially during times of crop failure. Indeed the keeping of livestock in Tanzania seems to improve further food security situation. The original finding may still be true as a household could buy what they do not produce using cash from livestock sales, this is shown by other indicators (Appendix 5), where the findings indicates that basing in the indicator of DEC per AE per day and number of meals per day, households who kept livestock were more food secure as compared to those without cattle.

Dependence on rainfall and lack of irrigation had a positive but insignificant relationship with food production and supply. This is unexpected result because during the FGDs it was revealed that drought among the factors responsible for food insecurity in the study area. Nevertheless the positive correlation might be a result of the fact that some households were producing enough food for their families and surplus for sale. Also households with low production had to cope with shortage through doing various activities to ensure food is available for their members. According to Kangalawe (2012) and URT (2006) climatic and environmental changes have resulted into declining agricultural productivity. These changes have serious implications on the livelihoods of the people and whose negative impacts are more severely felt by poor people and poor countries. Sex of the household head was also negatively related to food production and supply. However, the relationship was statistically insignificant. As pointed in section 4:1:3 that male headed household are more food insecure than female households.

The prevailing food insecurity coping strategies mentioned by farming households in the study area to mitigate effects of food insecurity are presented in Table 19. The results from the table reveal that the most widely used strategies by farming households in the study area in the order of importance include petty trading; casual works, selling of

livestock, charcoal making, gardening, and carpentry. The coping strategies had standardized regression coefficient of 0.13 and insignificant at $p \leq 0.005$. The positive regression coefficient implies that CS and food production and supply are positively related. An increase in the engagement into CS might lead to an increase of the supply of food. According the available literature (Chhetri 2006: Hadley *et al.*, 2007: Maxwell *et al.,* 2008**)** households adopt both short and long term coping strategies in order to ensure food availability and supply at a household level.

4.3 Determination of Food Security Status among Farm Households

4.3.1 Number of meals per day

The respondents were asked to state the numbers of meals that adults and children of less than five years old had consumed in their households during the period of 24 hours. The results from the study (Table 17) show that adults in more than half (59.9%) of the households consume at least three meals; whereas about two fifths (40.1%) consume less than three meals. And among children under-five year old, about (90.4%) of the households reported children ate four to five meals or more in 24 hours and very few (9.6%) households reported to have children who eat less than three meals in 24 hours. These results are consistence with those from the household budget survey which show that in the period of 2001/01 and 2007 there has been a fall in the proportion who usually consume two meals (55.8% to 49.8%) and an increase in the proportion who consume three meals a day (42.8% to 48.9%). According to URT (2009a) most households usually consume two or three meals per day; however in the urban areas three meals is a norm.

Table 17: Percentage distribution of number of meals for adults and children

Number of meals	Adults (n =137) Percent	Number of meals	Children (n=83) Percent
< 3	40.1	< three	9.6
Three	59.2	4- 5	90.4
> 3	0.7	>5	0.0

4.3.2 Food security status among farm households basing on HFIAS

The HFIAS consists of two types of related questions. The first question type is called an occurrence question and the frequency of occurrence question (Refer to sub section 3.4.1). The respondents were first asked nine occurrence questions that is, whether the condition in the question happened at all in the past seven days in the household (yes or no). If the respondent's answer is "yes" to an occurrence question, a frequency-of-occurrence question is asked to determine whether the condition happened sometimes (once to three) or often (more than six days) in the past seven days. The scores are as presented in section 3.4.1. The analysis of the HFIAS data in (Fig. 3) shows that about 14.6% of the households were severely food insecure, 24.8% were moderately food secure, and 38% were mildly food insecure and about 22.6% were food secure.

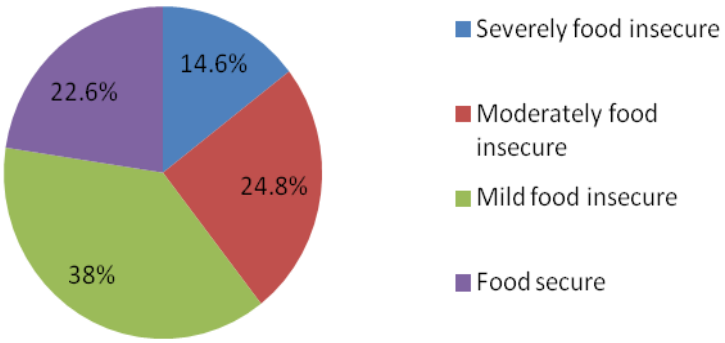

Figure 31: Food security status based on data from HFIAS (n = 137)

4.3.3 DEC per adult equivalent per day from 24 hrs recall data

Food security status of farming households in the study area is presented in Table 18; results from the study show that the minimum and maximum amounts were 440 and 4 482 kcal respectively per AE per day. More than half (59.9%) of the households were food insecure since the amount of kcals consumed were less than 2 200 kcals per AE per day, and about 40.1% were food secure in the whole sample. The average amount of kilocalories was 2111 implying that on average all households were food insecure since the average was below 2200 kcals. These results imply that more than half of the respondents were food insecure. In Tanzania, households are said to be food secure if they consume at least 2200 kcal per AE per day (URT, 1999).

4.3.4 DEC per capita per day based on data from HIES.

The main staple foods in Kahama District are maize and rice however; sweet potatoes and cassava provide a good source of food. Based on the amounts of maize
and rice eaten per capita for 28 days (Table 18), the cut-off point for a household to be secure is 2100 kcal per capita per day (Refer sub section 3.4.4). The results indicate that minimum and maximum amounts of kilocalories were 670 and 4469 respectively, the mean amount of kcal consumed per capita per day was 1759, implying that all households were insecure. This might be attributed to higher consumption of non-grain energy foodstuffs; especially sweet potatoes and cassava which were not included in the analysis although the foodstuff are consumed in the area especially between September and December where the majority of the households consumed *mapalage*[2] and *mbute*[3]. The results indicate further that about three quarters (75.2%) of the households were

2. *Mapalage* local name for boiled and dried sweet potatoes.

3. *Mbute* is fermented and dried cassava

food insecure since the amounts of DEC were less than 2100 kcal per capita per day, while about 24.8% were food secure. This observation implies that food insecurity exists among the households in the study area.

4.3.5 Food security based on grains obtained per AE per year

The Amount of grain for both maize and rice harvested, bought, received freely from friends and relatives and the amount borrowed was summed up to get the total grains available for home consumption for the whole season 2011-12. The analysis of food security status through the use of grains obtained which is presented in Table16 reveals that less than half (48.2%) of the households were food secure, while 51.8% of the households were food insecure. Based on the amounts of grains obtained per AE per year the cut-off point is 270 kg per AE per year in Tanzania (URT, 1999; Kayunze *et al.*, 2010).

The median grains available for home consumption for the whole of 2011-12. season were 249 kg, with the standard deviation of 270.2 kg, and the minimum of 0 kg, and the maximum of 1360 kg per AE per year. This implies that more than half (51.8%) of the households were food insecure in terms of grain available per AE per year. This observation is supported by the presentation in Table 4 which shows that lack of income, low supply of food in the market and high prices of food in the market were not the cause of food shortage in the area. Therefore the reason for food security in terms of grain available per AE per year, could be attributed to a combination of sources of grains obtained (harvests, gifts, bought or received freely) from relatives and friends.

A study by Chhetri and Maharjan (2006) indicates that food insecure households depend on different strategies to cope with food deficit situation and thus ensure food security in

their families. The results in Table 18 also show that the proportional of kcals per AE per day, kcals per capita per day and grain per capita per day are almost higher for food insecure households in all these three methods of food security determination. The results suggest that the incidence of food insecurity does exist within the study area.

4.3.6 Monetary food poverty per adult per day based for 28 days

A household was said to be food insecure based on monetary term if it had spent less than 24 196 TAS per capita per 28 days (Refer section 3.4.6) Based on the costs of food items consumed by all households, the incidence of food secure households was 87.6% while that of food insecure was 12.4%. The minimum and maximum costs were 2559 and 194 063 TAS per capita per 28 days respectively. Using this indicator, majority of the households were found food secure as compared to other indicators above.

Table 16: Food security determination based on various method (n =137)

Characteristics	Categories	Frequency	Percent
DEC per AE per day			
	Food secure ≥ 2 200 kcal)	56	40.1
	Food insecure < 2 200 kcal)	81	59.9
DEC per capital			
	Food secure ≥ 2 100 kcal)	34	24.8
	Food insecure < 2 100 kcal)	103	75.2
Grains obtained per AE per year			
	Food secure ≥ 270 kg	66	48.2
	Food insecure < 270 kg	71	51.8
Monetary Food Poverty per AE/28days	Food secure ≥ 24 196	120	87.6
	Food insecure < 24 196	17	12.4

4.4 Coping Strategies Against Household Food Insecurity

4.4.1 Food insecurity coping strategies adopted by farm household

More than three quarters (75.9%) of the households reported to have been relying on less preferred foods at least more than once per week as a means of dealing with food shortages. Under half (48.2%) reported to have been borrowing food from friends/relatives so as to improve their food availability. Observations from FGDs show that borrowing food from informal sources in all villages was common, whereby if one borrows one bag of maize or paddy he/she is then required to return two to five bags of maize and paddy respectively. The condition is commonly locally known as '*fogonho*.[4] About two-fifths (41.6%) reported to have been purchasing food on credit at least more than once per week; and over two fifths (43%) of the respondents reported to have been reducing the size of meals. About a fifth (21%) of the households reported to have consumed seed stocks at least once in a week. This has serious consequences on crop production and evidence shows that lack of seeds during planting periods might lead to low agricultural productivity and hence food insecurity. Moreover, about two thirds (62.8%) of the respondents reported to be reducing the number of meals at least once in a week. A small proportion (4.4%) of the households reported to be skipping meals for the whole day at least once per week. These coping strategies indicate a decreasing food security situation temporary that a household cannot destroy future livelihoods assets.

The steps taken here are in line with the previous results in a study by Norhasmah (2010); Chhetri and Maharjan (2006) which indicate that during food crisis, the affected households adopt a variety of coping mechanisms to survive: such strategies may include finding additional food or income generating activities or migration so as to ensure food availability in their households. According to Kuwornu *et al*. (2012) eating less preferred

4 . *Fogonho* Borrowing food or money from informal sources

and less expensive food is the immediate strategy normally adopted by the households faced with food shortage. However, as food insecurity gets worse other more severe strategies such as reduction of the quantity of food consumed and skipping meals for the entire day are then used. A study by Chhetri and Maharjan (2006) on food insecurity and coping strategies indicates that households that are vulnerable to food security adopt different strategies to cope with shocks that might affect them. Food deficit coping strategies might be short term or long term.

Apart from the above mentioned coping strategies, households do also adopt other long term strategies. Table 19 shows the coping strategies that were mentioned by individual households. About 43.3% of the households are involved in small businesses and casual labour. While very few (13.3%) households are engaged in other activities such as charcoal making, gardening, carpentry, masonry and selling of livestock. The findings also imply that apart from farming activities, people also have some non-farm jobs which help them to increase food availability at the household level. Small businesses or petty trading is another coping strategy which is adopted in rural areas. Working as a casual labourer is widely adopted livelihood strategy in the study villages, particularly among resource poor households. Working as a casual labourer includes engagement in agricultural production during farming season.

Table 17: Farm household food insecurity coping strategies (n=137)

Characteristics	Categories	Frequency	Percent
Short term CS	Rely on less preferred foods	104	75.9
	Borrow food from friend/relative	66	48.2
	Purchase food on credit	57	41.6
	Consume seed stock for next season	29	21.2
	Limit portion size at mealtimes	59	43.1
	Reduce number of meals eaten	86	62.8
	Skip entire day without eating	6	4.4
Long term CS	Petty trade	39	28.5
	Casual work	39	28.5
	Sell of livestock, charcoal gardening and carpentry	12	13.3

NB: Multiple responses existed hence column tallies may exceed 137 and 100% respectively

4.4.2 The relationship between a households coping strategies and food security

Apart from engaging in different coping strategies, majority of the respondents' households remain food insecure. Results from the study (Table 20) show that households adopt a combination of different coping strategies. Despite having many coping strategies results from the study show that the majority of households are still food insecure, very few households are food secure. Skipping meals or the entire day was one of the least practiced coping strategies by farmers although all of the households that practiced this strategy were food insecure. This implies that the coping strategies used here refer to short-term means of dealing with food insufficiency within the households.

These results are in line with the results from a study by Chhetri and Maharjan (2006) who argues that household with food deficit situation depends on different strategies to cope with food deficit instead of making them food secure.

Table 20: Cross tabulation of food security status and coping strategies (n = 137)

Food insecurity coping strategies	Food insecure %	Food secure %
Rely on less preferred and less expensive foods	67.8	24.7
Borrow food, or rely on help from a friend/ relative	37.2	10.9
Purchase food on credit	35.8	5.8
Consume seed stock held for next season	16.0	5.1
Limit portion size at meal times	32.1	10.9
Reduce number of meals eaten in a day	48.2	14.6
Skip entire days without eating	4.4	0.0

NB: Multiple responses existed hence column tallies may exceed 137 and 100% respectively

4.4.3 Results of the Binary Regression Analysis

Various predictors that affects food security listed in Table 21 were used to do a regression of each of them with the dependent variable (Dietary energy consumed per capita per day), the regression coefficients and their levels of significance (P= 0.000) are as presented in Table 21. The results indicate that only two predictors were significant at 1% which is household size and eating of less preferred foods. Four predictors were significant at 5% level the use of organic or inorganic fertilizers, costs of food items, purchasing food on credit and borrowing foods from relatives and three were slightly significant at 10% level education, source of agricultural Extension services and reducing number of meals.

The significance of marital status on agricultural production can be explained in terms of the supply family labour in agricultural production. Family labour is expected to be widely available where the household heads are married. Marital status was positively but not significantly associated with food security. The results deviates from the institution theory and food security which consider a family as an institution that can help to mitigate food insecurity at the household level through members helping one another (Kayunze *et al.,* 2007).

The level of farmers' education is believed to influence the use of improved technology in agriculture and, hence, farm productivity. The level of education determines the level of opportunities available to improve livelihood strategies, enhance food security, and reduce the level of poverty. Education is linked to the level of exposure to new ideas and managerial capacity in production and the perception of the household members on how to adopt and integrate innovations into the household's survival strategies. The regression results also show that education was negatively associated with food insecurity at -184: $p = 0.082$ levels of significance. This implies that a household with members of low education level would be more vulnerable to food insecurity. This can be explained in different aspects; for example, the ability to formulate successful strategies such as, budgeting or economizing might be important in preventing hunger when economic resources are scarce; this may be related to formal education in several ways.

Concepts such as budgeting may actually be learned in formal education settings; similarly individuals with higher educational attainment may have greater opportunities to master these skills through the socio-economic opportunities afforded by formal

education. Table 2 shows that majority (81%) of the households head had primary education.

The above observation is supported by literature for example, Dauda (2010) argues, education is widely believed to be a key determinant of food security. Knowledge associated with primary education has been known to substantially improve nutrition and consequently improve food security of the household. Dauda points out further that, women tend to be less educated than men, however evidence shows that women's education is a crucial factor in determining household food security. Also, a study by Swift (1989) indicates that very few households with at least one formal educated member starve as a result of food insecurity. A study by Amaza *et al.* (2009) further reported that the higher the educational level of a household head, the more the food security status of the family.

Household size had a negative effect, indicating that large households are more likely to be food insecure as compared to small and medium households (- 440; p = 0.001). These results are in line with Neo-Malthusian theory that population has a negative influence on food security. The study by Amaza *et al*. (2009) found that households with large sizes had higher probabilities of being food insecure than those with smaller sizes, and vice versa. This is obvious because the larger the household size, the greater the responsibilities, especially, in a situation where many of the household members do not generate any income but only depend on the household head. Amaza *et al* (ibid) argue further that the significance of household size in agriculture is linked to the fact that the availability of labour for farm production, the total area cultivated for different crop enterprises, the amount of farm produce retained for domestic consumption, and the marketable surplus are all determined by the size of the farming household. However,

some previous researches in Tanzania for example Kayunze (2000) have shown a positive relationship between household size and food security. Also, a study by Basukuba (2007) reveals that large numbers of people in the household are normally seen as equivalent to family labour and therefore, a large household has the potential of obtaining sufficient labour which is capable of producing more food and therefore become food secure. Nonetheless, Basukuba's argument will only be true if there is no under employment of the labour force available.

Agricultural technologies that were entered in the model includes the use of ox plough in cultivation, the use of power tiller or tractor in cultivation, the use of improved seeds, the use of insecticide or herbicides, the use of organic fertilizers and or the use of inorganic fertilizers. However, the regression was not significant for almost all the technologies except the use of inorganic/organic fertilizers which was positively significant at (1,622; P = 0.043); the reason might be because in the sample only a few of the households used appropriate technologies and to a small extent except the use of plough in cultivation, organic fertilizer, and the use of improved seeds (Table 10). The second explanation is that during FGD on the factors leading to food insecurity in the area, unreliable rainfall as a result of weather changes was identified as among the most important causes of low agricultural production. Therefore, despite that some technologies are being practised by farmers; crop failure was still a common phenomenon due to shortage of rainfall. This partly explains the lack of significant association between technologies and food security in the study area. According to Baltzer and Hansen (2011), agricultural input intensity is very low in Tanzania; farmers use on average 8 kg/ha of fertilizers below SSA average which is 9 kg/ha, and only 5.7% of rice farmers and 0.7% of maize farmers use improved seed varieties together with fertilizers.

Table 18: Predictors of food security on DEC per capita

Indicators entered in the model	Beta	Standard error	P- value	Expected β
Marital status of household head	1.254	0.796ns	0.115	3.504
Education level household head	-0.184	0.106*	0.082	0.832
Household size	-0.555	0.152***	0.000	0.574
Source of agricultural Extension services	1.194	0.668*	0.074	3.301
Use of ox plough in cultivation	-0.497	0.756ns	0.510	0.608
Use of improved seeds	0.271	0.595ns	0.648	1.312
Use of organic or inorganic fertilizers	1.622	0.802**	0.043	5.065
Use of herbicides/insecticides	0.956	0.697ns	0.170	2.600
Costs of food items	0.000	0.000**	0.005	1.000
Rely on less preferred foods	-3.340	0.940***	0.000	0.035
Borrowing food from relatives	1.917	0.811**	0.018	6.797
Purchasing food on credit	-1.332	0.677**	0.049	0.264
Consumption of seed stock	0.121	0.694ns	0.862	1.129
Reduce number of meals eaten in a day	1.212	0.660*	0.066	3.359
Constant	-2.221	2.147	0.301	0.109

Chi=54.664; P=0.005; N=137; ns= not significant: *** significant at 1%** significant at 5%** and *significant at 10%

The results from the binary regression analysis also show that out of the four coping strategies entered in the model, three were significantly associated with food security. Relying on less preferred food was one of the predictors that were negative and significant (-3.340; P = 0.000), implying that households which experience food insecurity adopt this strategy frequently in order to sustain their lives (ration for survival). The majority (83.2%) of the respondents practiced this strategy whereby the less preferred food mentioned were *matobolwa/mapalage* and cassava. This results support the concept of using coping strategies as an indicator of food insecurity and that households with more than eight months of food self-sufficiency may be able to manage the overall calorie requirements by adopting a combination of coping strategies. However, these strategies are helpful for less food self- insufficient households to sustain their lives but not to make them food secure (Chhetri and Maharjan, 2006). These

observations are also supported by findings from a study by Basukuba *et al.* (2007) which showed that eating less preferred food has a negative repercussion on food security.

Borrowing food from friends or relatives was a positive significant (1.971; P = 0.018); predictor of food security this implies that the practice of borrowing food is a positive coping strategy since it contributes to a household's food security and quality of food eaten as well. This means that the household which borrow food from friends and relatives might meet their caloric requirement at particular time and become food secure. During the FGDs, informal borrowing of grains was reported as way to getting food among households with food deficit. It was reported that informal loans from local traders and landlords are being provided where the borrower had to repay the loan with interest at a later time usually after the next harvest. For example, one bag of maize would attract three bags after harvesting and two bag of paddy would attract 5 bags.

These above results are in line with the institutional theory and food security. Institutional elements are important for food security. Institutions regularize life, support values, produce and protect interests, and can help mitigate food insecurity at the household level. The practice of households borrowing or giving one another food is also common among the people in Kahama District. However, this phenomenon may result into a household's being trapped in a viscous circle of food insecurity for a long time even under good years of harvests.

Purchasing food on credit was negatively associated with food insecurity; (lower caloric intake); the association was statistically significant at 5% level (-1.332; P = 0.049); this implies that a households ability to buy or get food on credit helps to reduce a

households food short falls. This result supports the market theory of food security where the supply is greater than the demand, prices will tend to fall and therefore majority can afford to buy food. Food expenditure includes the value of food consumed from home production plus the food bought and the food obtained from relatives and friends as gifts. Therefore, household's income and expenditure patterns are important in determining poverty and nutrition outcomes.

The results from the binary regression analysis show that food expenditure was one of the significant predictor of a household's food security. This suggests that households with more income are likely to become food secure than poor households. The results conform with the entitlement theory and food security by Sen, (1981) which says that people do not usually starve because of an insufficient supply of food at the local, national, or international level, but because they have insufficient resources, including money ('entitlements') to acquire it. These results also correspond with the results in a study by Pauw and Thurlow (2011) which reported that there is a relationship between calorie intake and income; and that income improves food security by increasing consumer ability to purchase more or better quality foods.

4.5 Farm Household Suggestions in Relation to the Study

The result in Table 22 shows the respondents' opinions with regard to what needs to be done to improve household's food security in Kahama District. About a third (32.8%) said distribution of input should start early before the start of the rainy season and about a fifth (22.6%) said prices of inputs should be reduced or subsidized. This implies that if the two suggestions are worked upon the chances of increasing agricultural production would be enhanced. Other suggestions are as shown in Table 22.

Table 19: Farm household suggestions

Additional comments of farm households	Frequency	Percent
Distribution of input should start early before rainy season	45	32.8
Prices of inputs should be reduced or subsidized	31	22.6
Need for food aid	30	21.9
Extension workers should help farmers	23	16.8
Reducing Manufactured and raise crops price	3	2.2
Need for water supply for irrigation	4	2.9
Reply of answers of this research	1	0.7

CHAPTER FIVE

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

This study was conducted in order to determine food insecurity and coping strategies of farm households in Kahama District. Specifically, the study aimed at determining food Security status based on dietary energy consumed (DEC) at household level; to identify most popular food insecurity coping strategies adopted by farming households and what challenges are associated with food production and supply among farming households in the study area. Based on the empirical results it can be concluded that food insecurity exists in the study area in terms of DEC per AE per day, DEC per capita per day and grains per AE per year. It can also be concluded that: education level of the household head, household size, source of agricultural extension, organic or inorganic fertilizers, reliance on less preferred food, costs of food items, purchasing food on credit and reducing number of meals were significantly related to households, food security/insecurity.

It is also concluded that the most households had adopted both long and short term strategies. The most popular coping strategies were rely on less preferred foods, borrowing food from friends or relatives and purchasing food on credit, and petty trading and casual works for short and long term respectively. Finally, it can be concluded from the study that many factors significantly affect food production and supply of farming households in the study area, the most important were; total annual income, the amount of maize and paddy produced, household size, and number of plots owned.

5.2 Recommendations

Based on the study's observations and conclusions the following are recommended:

i. Extension staff in the study area need to see how they can help farming households can raise their crop productivity. This could be done through farmers field schools (FFS), agricultural resource centres and farmers exchange visits. Doing this could help farming households see the importance of adopting improved technologies which could in turn improve their productivity and enable households be food secure

ii. Farming households need to further diversify their livelihood strategies especially into off-farm income generating activities. Doing this will enable households avoid the term effects of some of their food insecurity coping strategies such as charcoal burning and doing casual works. Income from the off-farm activities could also be a good source of household income which could then be invested in improved technologies for higher agricultural productivity.

iii. The government and other stakeholders need to work towards enabling households to access credit and inputs at affordable rates. Doing this could increase households use of improved technologies in their production, thus produce and earn more hence the possibility of improving households food security status.

iv. Farm households need to adopt drought resistant food crops as doing this will ensure households have something for consumption. However, this need a change in farmers mind set.

v. Further research is required because the results may not be representative of the food security status of farming households across the Kahama District. Therefore, extending this study to cover other division and wards of the district may be necessary.

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APPENDICES

Appendix 1: Concept, operational definitions, units of the variables and measurement

Concept	Operational Definitions	Units	Measurement
Age	Number of years one was born	Years	Ratio
Sex	Being female or male biologically	1. Male 2. Female	Nominal
Education level	Number of years one spent at school	Years	Ratio
Family size	Number of members in a Household	Number of members	Ratio
Marital status	Having a spouse around or away	1.Married 2.Unmarried	Nominal
Number of adults	Labour force in the household	Number of members	Ratio
Food insecurity	Grains obtained per capita per year (Food insecure < 270 kg) Dietary Energy Consumed (Food insecure < 2200 kcal or < 2100 kcal) Number of meals eaten per day (Food insecure < 3 meals)	Kilograms kcal meals	Ratio
Coping strategies	Mechanisms employed when households are food insecure	1. if a house practices strategy (a) 0. if a house don't practices strategy (a)	Ordinal/Nominal
Farming experience	Years of farming	Years	Ratio
Land owned	Area of land cultivated	Acre	Ratio
Amount of produce (maize, paddy)	Amount of maize, paddy produced	kg	Ratio
Total annual income	Income from produce ,animals sell and nonfarm activities	shillings	Ratio
Prices of harvests	Monetary value of harvests	Shillings	Ratio
Agric ext. extension service	Getting contact with agric. officers	1.Yes 2.No	Nominal
Technology	Agricultural technology used	Kilograms of seeds used Kilograms of Fertilizers used Kilograms of insecticides used Acres cultivated by using tractor/power tiller	Ratio
Food prices	Monetary value of food items	Shillings	Ratio
Nonfarm income	Monetary value	Shillings	Ratio

Appendix 2: Caloric requirements by age and sex for East Africa

Age group	Sex	
	Male	**Female**
0 – 2	0.40	0.40
3 – 4	0.48	0.48
5 – 6	0.56	0.56
7 – 8	0.64	0.64
9 – 10	0.76	0.76
11 – 12	0.80	0.88
13 – 14	1.00	1.00
15 – 18	1.20	1.00
19 – 59	1.00	0.88
Above 60+	0.88	0.72

Source: Collier *et al.* (1990)

Appendix 3: Household economies of scale constants in East Africa

Household size (Number of adults)	Marginal cost	Average cost
1	1.000	1.000
2	0.892	0.946
3	0.798	0.897
4	0.713	0.851
5	0.632	0.807
6	0.632	0.778
7	0.632	0.757
8	0.632	0.741
9	0.632	0.729
Above 10+	0.632	0.719

Source: Collier *et al.* (1990)

Appendix 4: Questionnaires on the food insecurity and coping strategies of farm households in Kahama District, Tanzania

Questionnaire No.....Date of interview……..

A. Location

1. Division……..2, Ward……3.Village……

B. Demographic Characteristics

Name of household head /respondents……..

4. Household composition

Serial number	1	2	3	4	5	6	7	8	9	10
Sex (1=M; 2= F)										
Marital status										
Years of birth										
Years of schooling										
Main occupation										

5 For how long have you lived in this village?.....

D. Information on food supply and production.

6. How much land does your household own……acres.

For how long have you been doing farming activities in this village…….years.

7. Are all the acres in one plot Yes/ No, If no how many plots do you have……and what are the sizes of each plot?

Land owned	Plot No	Plot No	Plot No	Plot No	Plot No	Plot No	Plot No 7

8. How did you acquire that land 1.Inheritance 2. Open virgin land 3. Buying 4. Land allocated by village government 5. Other means (specify)

9. Do you rent any land for your crop production Yes/No, If yes how many acres……..

10. What type of crops do you grow? What acreage for each crop were under production for the last two seasons (2010-11 and 2011-12)

Season	Crop/acreage	1/area	2/area	3/area	4/area	5/area
2010-11	Cash crops					
	Food crops					
2011-12	Cash crops					
	Food crops					

11(b) On average how many people work in farm

No	Type of workers	Number of workers	Number of working days
1	Family members		
2	Casual labourers		
3	Community groups		

12. (a) Please can you tell me what was the production level in (kg) amount sold and money received, or stored for each crop in kilograms?

Cash crops	**Amount produced (Kg)**	**Amount sold (Tshs)**	**Food crops**	**Amount produced (Kg)**	**Amount sold,(Tshs)**	**Amount stored Kg**

(b) What are other uses of your crop produce?
1……..
2……
3…….

13 (a) What type of livestock do you keep?

Type of livestock	**Available**	**Amount Sold**	**Amount bought**	**Money received**
Chicken				
Ducks				
Shorts				
Cattle				
Donkey /Pig				
Dogs				
Cats				

(b) What livestock products did you produce in your household? (Last 30 days)

Type of livestock products	**Available**	**Amount Sold**	**Money received**
Milk			
Eggs			

(b) What type of assets did your household own?

Assets	**Amount owned**	**Value Tshs**	**Assets**	**Amount owned**	**Value Tshs**
Bicycle			Water pump		
Motorcycle			TV set		
Ox-cart			Hand hoe		
Ox -Plough			Ox-ridges		
Cellular phone			Furniture		
Sewing machine			Radio		
Tractor			Generator		

14. Apart from agriculture what other income generating activities is family members engaged?

HH member	**IGA Done**	**Revenue obtained**
Father		
Mother		
Others members (specify)		

15 In your own opinion what is the cause of food shortage in this village? Rank

Causes of food shortages during this season	**Yes**	**No**
a. Inadequate rainfall /Drought		
b. Lack of income to buy food		
c. Low supply in the market		
d. Failure to use improved seeds, fertilizers, and pesticide		
e. Big HH vis-a-vis household food production		
f. Higher prices of food stuff in the market		

16. (a) Do you seek any agricultural advice Yes/No. If yes from whom

i. Village or Ward extension service

ii. Neighbours' farmers

iii. Others specify

(b) Is there any Non Governmental Organization like NGO/CBO/FBO which provides agricultural services? Yes/No. If yes what organization?

i. …….

ii. ……

iii. ……..

17. In your own opinion what are the main problems associated with crop production in this village

S/n	Opinion	Yes	No
a)	Diseases and insects pests for both crop		
b)	Dependence on rain and lack of irrigation		
c)	Traditional method of farming		
d)	Too much rainfall during planting season		
e)	Use of local seeds		
f)	Inadequate extension services		
g)	Weak distribution of fertilizers and insecticides		
h)	Use of improved seeds		
i)	Too much use of organic fertilizers		
j)	Use of improved methods of farming		

18. Which among these technologies do you use in your crop production?

No	Technology	YES	NO	Amount
a)	Use of ox plough in cultivation			
b)	Use of power tiller/tractor in cultivation			
c)	Improved seeds			
d)	Use of insecticide or herbicides			
e)	Use of organic fertilizers			
f)	Use of inorganic fertilizers			

C. Food security status

19. Household Food Insecurity Access Scale (HFIAS) Measurement Tool

In the past 7 days, have there been times when you did not have enough food or money to buy food, how Often has your household had to…. (1-IX if yes how often tick)		RELATIVE FREQUENCE		
		Every day Often (3)	Sometimes (2)	Rarely (1)
I.	In the past7 days, did you worry that your household would not have enough food?			
II.	In the past 7 days, were you or any household member not able to eat the kinds of foods you preferred because of a lack of resources?			
III.	In the past 7 days, did you or any household member have to eat a limited variety of foods due to a lack of resources?			
IV.	In the past 7 days, did you or any household member have to eat some foods that you really did not want to eat because of a lack of resources to obtain other types of food?			
V.	In the past 7 days, did you or any other household member have to eat fewer meals in a day because there was not enough food?			
VI.	In the past 7 days, did you or any household member have to eat a smaller meal than you felt you needed because there was not enough food?			
VII.	In the past 7 days, was there ever no food to eat of any kind in your household because of lack of resources to get food?			
VIII.	In the past 7 days, did you or any household member go to sleep at night hungry because there was not enough food?			
IX.	In the past 7 days, did you or any household member go a whole day and night without eating anything because there was not enough food?			

20 (i) What is your general view in food security status in your village? (Rank)
1. Plenty 2. Moderate 3. Scarce
July-September……. October-December…….. January-march….. April-June……
(ii) What rank of food status do your households have in this season? (Rank)
1. Plenty 2. Moderate 3. Scarce
July-September……. October-December…….. January-march….. April-June……
21. (a) For the last 24 hours how many meals did your family members eat……..
(b) Since the last harvest, did you or other adult in your households reduce the number of meals because there wasn't enough food? 1. Yes 2.No. If yes which meal was reduced?

1. Breakfast
2. Lunch
3. Dinner
4. Breakfast and lunch
5. Lunch and Dinner

22. For all those meals mentioned that you eat list the foodstuffs in the following table

Protein Foods	**Frequency and amount eaten**			**Carbohydrates foodstuff**	**Frequency and amount eaten**		
	Number of times	**Kg**	**Value Tshs**		**Number of times**	**Kg**	**Value Tshs**
Beef				S/potatoes			
Fish pieces				Rice			
Beans				M/porridge			
Chicken				Cassava			
Goat meat				Banana			
G/Vegetables				Sugar			
Sardines				Rice burns			
Green gram				Chapatti			
Groundnuts				Sugar			

23. How many meals do you provide to under five years children……

24. Did your household receive food aid last season Yes/No
If the answer is yes, how much food aid (kgs.) your household received?
1. Cereals……. 2.Pulses …… 3. Oil……

E. Information on Coping Strategies

25. Based on your experiences, what do you do when your household does not have enough food or money to buy food?

(a) Consumption Coping Strategy Responses (CS) how often, in the past seven days, a household had to rely on each individual coping behaviour?

No	In the past 7 days, if there have been times when you did not have enough food or money to buy food, how many days has your household had to:-	All the Time? 6-7 days	Every day Often? 5-3 days	Once in a While? 2-1days	Once one day	Never 0 day
1	Rely on less preferred and less expensive foods					
2	Borrow food, or rely on help from a friend or relative?					
3	Purchase food on credit					
4	Consume seed stock held for next season					
5	Send household members to eat elsewhere?					
6	Limit portion size at mealtimes?					
7	Reduce number of meals eaten in a day?					
8	Skip entire days without eating?					

26 (a) Since last harvest did you buy cereals to feed your family 1. Yes 2. No. If yes when did you started (month)……..How much cereals did you buy since then ……..kg

(b) Since last harvest did you borrow or received cereals freely from friends or relatives?

1. Yes 2.No.If yes what amount……kg

27 Do you have any question to ask, or any additional comments would you like to make please feel free……..

THANK YOU VERY MUCH FOR ANSWERING THESE QUESTIONS

Appendix 5a: Main occupation of respondent's households

Main occupation	Frequency	Percentage
Crops only	33	24.1
Crops/ animal	104	75.9

Appendix 5b: Distribution of main occupation, assets value and food security

Characteristics		Food insecure		Food secure		All	
		F	%	F	%	F	%
DEC per capita	Crops only	24	24.3	9	26.3	33	24.1
	Crops/ animal	79	76.7	25	73.5	104	75.9
DEC per AE	Crops only	23	28.8	10	17.5	33	24.1
	Crops/ animal	57	71.3	47	82.5	104	75.9
No of meals	Crops only	14	25.5	19	23.2	33	24.1
	Crops/ animal	41	75.5	63	76.8	104	75.9
Assets' Value	≥200 000	43	41.7	7	20.5	50	36.5
	201000-400 000	22	21.4	9	26.5	31	22.6
	>400000	38	36.9	18	52.9	56	40.8

Appendix 6: Check list for FGD on food insecurity and coping strategies of farm household's in Kahama

District, Tanzania

A. Food production and supply

1. What are the major crops grown in your village? Which crop is important and why? Rank according to their importance.
2. What is your general view with regard to food security status in your village?

……

3. In which months do many household experience food shortages within a year

……

4. What factors contributes to food insecurity in your village.
   i. Cultural factors that causes people to use much food
   ii. Agro- Ecological factors
   iii. Institutional factors

B. Strategies for coping with food shortages.

5. What ways do these household uses to cope with food shortages?
   a. Dietary change
   b. Short term increase of food availability
   c. Short terms decrease the number of people in the house hold
   d. Rationing or managing shortfalls
6. What are the long term methods of coping with food shortages?
   a) Months in which people eat more and few meals within the year.
   b) Months in which people seek loans for consumption
   c) Months in which people migrate for casual employment.

Appendix 7: Household income and expenditure survey form, records of amount and monetary values of food consumed by all household members for 30 days

	Foods eaten by all household members and their monetary value						Non food items bought or received freely				
	Food harvested		Food bought		Food obtained in other ways		Goods bought or received freely	Goods bought		Goods obtained freely	
Foodstuffs	Amount	Value	Amount	Value	Amount	Value		Amount	Value	Amount	Value
Maize							Education (uniforms, school fees				
Rice											
Cassava							House rent, renting of instrument				
Green gram											
Groundnuts							Health costs and treatments				
Potatoes											
Cow peas							Entertainment Newspaper, Radio, cassettes				
Cooking oil											
Sardines											
Meat							Communication by letter or mobile phones				
Milk											
Vegetables											
Bread/Buns/							Fuel for cooking and kerosene				
Sorghum											
Banana											
Fruits							Clothes, bed sheets coats shoes etc				
Sugar											
Tomatoes							Transport cost and maintenance				
Salt											
Soft drink							Cleanliness ,soap and oils				
Water							Utensils				
Onions							Agric tools and chemicals				
Chick peas							Furniture				