UNIVERSITY FOR DEVELOPMENT STUDIES

ASSESSING THE FOOD SECURITY STATUS OF SMALLHOLDER FARM HOUSEHOLDS IN THE NORTHERN REGION OF GHANA

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DECLARATION

I hereby declare that this thesis is the result of my own work and that no previous submission of this work for degree has been made elsewhere. Work done by others that served as source of information has been acknowledged by reference to the authors.

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ABSTRACT

Smallholder farmers play a vital role in food production especially through subsistence farming. However, their households are major casualties of food insecurity despite their efforts in food production. This study seek to assess the food security status, factors influencing household food security status and coping strategies used among smallholder farm households in West Mamprusi (WMD) and Mamprugu Moaduguri (MMD) Districts in the Northern region of Ghana. The study used the COC, HDDS and HFCS methods to explore the food security status of households in the study area. Additionally, the logit model was used to determine the factors that influence household food security whiles the the kendall's coefficient of concordance was used to identify and rank the copping strategies used by households in the study area. A multistage sampling technique was used to select the respondents that were interviewed. In all, 200 smallholder farm households were interviewed to collect data for analysis. Mean farmland sizes was 3.49 acres, the major months of adequate and inadequate household food provisioning were August to November (44%) and May to July (54%) respectively. The study revealed that about 52% of households in the study area was food secure. The Binary Logit Model (BLM) revealed that Locality, sex, education and access to employment had positive relationship to household food security whiles household size and marital status had negative relationship to food security status of households. Reducing the expenditure on the household to the minimum to buy food, consuming less food within meals, reducing number of meals per day and consuming low quality and cheaper food were the coping strategies adopted by households in the study area to mitigate the effects of food insecurity. The study recommends that development partners in food security should launch education programmes on nutrition especially on the different food groups and dietary diversity practices among the smallholder farm households. This will re-orient their daily diets towards the consumption of a more diversified diet.

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DEDICATION

I wish to dedicate this work to my late parents Mr. Alhassan Santos Mumuni and Madam Lamnatu Alkali Tahiru for their love and care that they showed me right from birth till their demise. May their souls rest in PERFECT PEACE, Amen. I also dedicate this piece of work to my uncle Lukman Alkali Tahiru, my grandparents Alhaj Tahiru Alkali and Hajia Adama Tahiru Alkali for their enormous support and council towards my education, and to all my friends especially Alhassan Sualisu (Figo), Mohammed Munir Ghale and Mohammed Sufianu Fuseini (Babamu) for all your support during my study of the course.

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ACRONYMS

CAADP: Comprehensive African Agriculture Development Programme

CFSVA: Comprehensive Food Security and Vulnerability Analysis

COC: Cost of Calorie

FANTA: Food and Nutrition Technical Assistance

FAO: Food and Agriculture Organisation

FSI: Food Security Index

GDP: Gross Domestic Product

GHI: Global Hunger Index

GIEWS: Global Information and Early Warning System

GoG: Government of Ghana

GSS: Ghana Statistical Service

HCR: Headcount Ratio

HDDS: Household Dietary Diversity Score

HFCS: Household Food Consumption Score

HFIAS: Household Food Insecurity Access Scale

HLPE: High Level Panel of Experts on Food Security and Nutrition

IFAD: International Fund for Agricultural Development

IFPRI: International Food Policy and Research Institute

MMD: Mamprugu Moaduguri District

MoFA: Ministry of Food and Agriculture

MoFA-SRID: Ministry of Food and Agriculture – Statistical and Research

SI: Surplus Index

SSA: Sub-Saharan Africa

UN: United Nations

UNCTD: United Nation Conference on Trade and Development

UNDP: United Nation Development Programme

UNEP: United Nation Environment and Poverty

UNESC: United Nation Economic and Social Council

UNICEF: United Nations Children Education Fund

USAID: United Agency for International Development

WB: World Bank

WFP: World Food Programme

WHO: World Health Organisation

WMD: West Mamprusi District

CHAPTER ONE

INTRODUCTION

1.1 Background

Food (in) security can be seen as a global phenomenon following the FAO (2013) report which estimates that a total of 842 million people in 2011–13 suffer from chronic hunger or do not get enough food to satisfy their needs. However, compared to the estimated total of 868 million people in 2010-12, then there is a reduction mainly due to intensification associated with the 'green revolution' (Royal Society, 2009) and expansion into previously uncultivated areas (Green *et al.*, 2005; Ramankutty *et al.*, 2008). Reducing hunger and food insecurity has therefore remained an essential part of the international development agenda since the World Food Summits in 1996 and 2001. Food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life (FAO, 2002).

The role of smallholder farmers in ensuring food security at the global, national and household level cannot be over emphasized because of the number of mouths they feed. Prakash-Mani (2013) estimated that about 25 percent of food supplied in the world comes from smallholder farmers in Asia, Latin America and Africa. The FAO (2014) also projected that about 80 percent of the food consumed in many developing countries in sub-Saharan Africa and Asia come from smallholder farms. There are hopes that if smallholder agriculture is improved, farmers can also improve their standards of living thereby reducing hunger in their local communities (Prakash-Mani, 2013).

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Food security in northern Ghana continues to be challenged due to the seasonal and unstable domestic production as a result of the erratic rainfall pattern, soil infertility, high food prices and inflation, low household incomes and persistent high level of unemployment **(**Nyanteng *et al.,* 2003). According to Biederlack and Rivers (2009), food insecurity rates in the North range from 10 to 30 percent, whereas the rates in the South range from 1 to 7 percent.

The WFP's 2009 reported that about 10% of the estimated 1.2 million people in Ghana (approximately 5% of the population) continuous to have limited access to sufficient and nutritious food come from the northern region. Paradoxically, households producing food crops are often the most food insecure in the northern region of Ghana (Biederlack and Rivers, 2009).

Similarly, the 2012 Comprehensive Food Security and Vulnerability Analysis (CFSVA) reported about 10% of households in northern region of Ghana to be food insecure with some level of food insecurity. The highest incidence of food insecurity in the region was found in central Gonja (53.2%) with the least being Nanumba north (1%).

1.2 Problem Statement

Northern Region is the third poorest regions in Ghana (Biederlack and Rivers, 2009). This development coupled with the recent economic crisis Ghana has faced for the past 2 years has serious implications of the food security status of households in the region. It makes the region more vulnerable to food insecurity.

According to the 2012 report on the State of Food Insecurity in the World, the number of hungry people in the world remains unacceptably high. Almost 870 million people are

chronically undernourished and majority of these people live in developing countries (FAO, WFP and IFAD, 2012). The challenge of food insecurity is further complicated by the paradoxical and contradictory fact that most of the chronically food insecure and undernourished populations are smallholder farmers who are actively engaged in agriculture and food production (FAO and WHO, 2013) yet Ghana's domestic economy continues to revolve around subsistence agriculture, accounting for about 35% of the GDP and employing about 55% of the work force (Seini and Nyanteng, 2005). Smallholders produce food and non-food products on small scale with limited external inputs. They cultivate field and tree crops, livestock, fish and other aquatic organisms.

Wiggins and Keats, (2013) reported that the problem of smallholder farmers is due to the fact that they buy more food than they sell because they are not able to produce enough food to adequately feed themselves throughout the year. It is also reported that majority (more than 80%) of the smallholder farmers in the world are food insecure and depend on land as their primary source of livelihood (Cruz, 2010 and Valdés *et al.*, 2010). The World Bank, (2008) report noted that three out of every four (75%) poor people leave in rural areas and depend on agriculture for their livelihood.

1.3 Research Questions

The following research questions were asked.

- What is the food security status among smallholder farm households in the northern region?
- What are the factors influencing the food security status among smallholder farm households in the region?
- What are the copping strategies used among smallholder farm households in the region?

1.4 Research Objectives

1.4.1 Main Objective

The main objective is to: assess the food security status among smallholder farm households in the northern region of Ghana and suggest directions for policy intervention.

1.4.2 Specific Objectives

The specific objectives are:

- To establish the food security status among smallholder farm households in northern region of Ghana.
- To determine the factors influencing household's perceived food security status among smallholder farm households in the region.
- To identify and rank the coping strategies used by smallholder farm households in the region.

1.5 Justification

Governments throughout the world have adopted various strategies aimed at ensuring food security following the United Nations General Assembly declaration of reducing extreme hunger and poverty by 2015. Despite these attempts, most countries, especially in the developing countries are still faced with the challenged of reducing extreme hunger and poverty (Djurfeldt *et al.*, 2011).

It has been argued that although smallholder farmers constitute the highest proportion of food producers in developing countries and therefore arguably hold the key to addressing the sorry state of affairs, they have been largely neglected by policy makers and researchers (HLPE, 2013).

In the light of this revelation, there is the need for more empirical studies on harnessing the potential of smallholders as a major starting point for effective policy interventions aimed at addressing the food security question becomes imperative-the gap that this research attempts to fill.

The information will be useful to the Ministry of Food and Agriculture and other developmental organisations (stakeholders) in terms of policy formulation and intervention on food security.

Furthermore, the results of the research would serve as a baseline for further studies and an inspiration for other African countries with similar characteristics to emulate and implement.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter reviewed literature on the concept of food security, dimensions of food security, global food insecurity, food security in Africa, food insecurity in Ghana and food insecurity in the Northern region of Ghana, food aid, dietary diversity, and household food consumption score, factors influencing food security status, food insecurity coping strategies and the methods of estimating food security status.

2.2 The Concept of Food Security

Definition of Food Security

Hunger or lack of food is debilitating nearly one third of the world's population even today. There are a substantial proportion of the Ghanaian populations who are hungry despite the successful implementation of the green revolution geared toward accelerating agricultural growth. The FAO/WHO Conference held in Rome (in 1992) declared that "hunger and malnutrition are unacceptable in a world that has both the knowledge and resources to end this human catastrophe; and recognized that "access to nutritionally adequate and safe food is a right for every individual".

The term "food security" gained prominence after the World Food Conference in 1974 and ever since has become a household name and attracted so many definitions from various organizations and individual researchers **(**Kuwornu *et al.,* 2013). The initial food security focus was macroeconomic in nature and was mainly concerned with assuring the availability and price stability of foodstuffs at the international and national levels. Consequently, food

security was traditionally measured through aggregate food supplies, food availability, accessibility, and adequacy (Busch and Lacy, 1984; FAO, 2003a; FAO, 2003b).

The definitions of food security have evolved over time. At the 1974 world food summit, food security was defined as the "availability at all times of adequate world food supplies of basic foodstuff to sustain a steady expansion of food consumption and to offset fluctuations in production and prices" (UN, 1975). Accordingly the World Bank (WB), (1986) defines food security as "access by all people at all times to enough food for an active and healthy life".

Mean while, the WB made distinction between chronic and transitory food insecurities. Chronic food insecurity reflects continuous "inadequate diet caused by the inability to acquire food. It affects households that persistently lack the ability to buy food or produce their own food." Whereas, transitory food insecurity is defined as "a temporary decline in households access to enough food". This results from instability in food prices, food production and household income and leads to famine. This definition was subsequently modified by FAO to include the nutritional value and food preferences. In fact, the FAO, (1996) defined food security as a situation where all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for a healthy and active life. The inclusion of "safe and nutritious" stresses food safety and nutritional composition whiles the addition of food preferences" changes the concept of food security from mere access to enough food, to access to the food preferred (Kuwornu *et al.*, 2013). Similarly, the Ministry of Food and Agriculture (MoFA, 2007) of Ghana defines food security as "good quality nutritious food hygienically packaged, attractively presented, available in sufficient quantities and located at the right place at affordable prices all year

round". These definitions imply that food insecurity reflects uncertain access to enough and appropriate food (Barrett, 2002). Food security was initially viewed as the adequacy of food supply at the global and national levels until the mid 1970's. This view only takes into account food production oriented variables and overlooked the multiple forces which come to play to affect access of food (Kuwornu *et al.,* 2013). Food security at the global level does not guarantee food security at the national level nor does it ensure food security at the household level. For example UNDP (1992) noted that calorie supply at global level in 1990 was over 110 percent compared to the total requirement. Yet in the same period, more than quarter of the world's population was short of enough food **(**UNDP, 1992).

The inclusion of stability of food supply, and food and nutrition safety in the definition of food security (MoFA, 2007) has added additional dimensions to food security. Jrad *et al.,* (2010), elaborated on five dimensions of food security as food availability, food accessibility, food utilization, stability of food supply and food and nutrition safety. Achieving food security requires sufficient availability of physical supply of food, access to food supply through production and markets (given sufficient purchasing power) and appropriate utilization food to meet the specific dietary needs of individuals (Lovendal, 2005, Yared, 2001). Food security may be analyzed at different conceptual levels; regions, countries, households and individuals. Much analysis of the topic is however focused on the macro level (Lofgren and Richards, 2003). Recognizing that the main problem of food security is lack of access rather than aggregate shortage of supplies, focus on food security has since (World Food Conference of 1974) moved from global and national perspective to the household and individual level (Diaz and Robinson, 2001). Even though individual food security is often the main focus of attention (Olayemi, 1998 and Ajibola, 2000, Omotesho *et*

al., 2006), food security is a measure of household condition but not that of each individual in the household.

2.3 Dimensions of Food Security

As stated above, many institutions and researchers identified four pillars underpinning food security; these are food availability, food accessibility, food utilization and food stability (Lovendal, 2005, Yared, 2001). Jrad *et al.*, (2010), elaborated on five dimensions of food security namely food availability, food accessibility, food utilization, stability of food supply and food and nutrition safety. It may thus be inferred from their concept that food security is not just production issue.

2.3.1 Availability of Food

Food availability plays a critical role in enhancing food security at the individual, household and national levels. It is the extent to which sufficient quantity and quality of food is physically present in an area. Supplying enough food to a given population is a necessary condition but not a sufficient condition to ensure that people have adequate access to food (FAO, IFAD and WFP, 2013).

Over the last two decades, food supplies have grown faster than the population in developing countries resulting in rising food availability per person and leading to a reduction in the proportion of the undernourished from about 24% to 14% of the population between 1990 and 2013. Only Africa and Southern Asia did not benefit fully from these improvements. Diets in these two regions remained imbalanced and heavily dependent on cereals and roots and tubers (FAO, IFAD and WFP, 2013).

Nevertheless, George, (1999) argues that the physical availability of food alone would not ensure economic access to food for all population but rather satisfactory production levels and stability of food supply should be matched by reduction in poverty and increased economic and physical access to all.

2.3.2 Access to Food

When communities, households and individuals have enough resources to obtain sufficient food for nutritious diet through combination of home production, stocks, purchase, barter, gifts, borrowing and food aid, the situation is considered as access to food (WFP, 2012).

FAO, IFAD and WFP, 2013, reported the ability of an individual to access food depends (to a large extent) on two pillars: economic and physical. Economic access is determined by disposable income, food prices and the provision of and access to social support systems. However, Physical access is determined by the availability and quality of infrastructure including ports, roads, railways, communication and food storage facilities as well as other installations which facilitate markets viability.

Access to food may be influenced negatively by physical insecurity such as conflict, border closure, restricted seasonal job migration, and/or the collapse of social safety net institutions which protect people with low incomes (IFPRI, 2006).

2.3.3 Food Utilization

Food utilization refers to the ability to obtain energy and nutrients from food for a healthy life. Proper childcare practices, diets with sufficient energy and nutritional values, safe

drinking water, adequate sanitation, knowledge of food storage and processing are essential to achieving adequate food utilization (WFP, 2012).

Food utilization involves two distinct dimensions. The first dimension is captured by anthropometric indicators which are caused by undernutrition which is especially prevalent in children under five years. These indicators include wasting (being too thin for one's height), stunting (being too short for one's age) and underweight (being too thin for one's age). Measurements of these indicators in children under five years are effective approximations of the nutritional status of populations. The second dimension is captured by several indicators which reflect food quality (preparations) and health and hygienic conditions.

Outcome of these indicators (of food utilization) may convey the impact of inadequate food intake and poor health. Wasting, for instance, may be the result of short-term inadequacy in food intake whereas stunting is often caused by prolonged inadequate food intake, repeated episodes of infections and acute under nutrition.

Food utilization may be reduced by endemic diseases, poor sanitation conditions, lack of appropriate nutrition knowledge and cultural taboos which affect access to nutritious food (IFPRI, 2006).

2.3.4 Food Stability

A fourth component of food security which ensures food availability and food access is food stability. For households to be food secure, they need access to food at all times. Families should not be at risk of becoming food insecure as a consequence of shocks and cyclical events such as seasonal food shortages. Note however that households with adequate food for

consumption may still be food insecure if continuous availability and access to food is limited.

2.3.5 Food and Nutrition Safety

Food safety is part of a wide range of issues which go beyond the avoidance of food-borne pathogens, chemical toxicants, and other hazards (FAO, 2002). There is growing concern of consumers of developed countries about the effects of the food they eat on their health. Consumers expect food not only to meet their nutritional needs but also to be wholesome and tasty, and produced ethically with respect to the environment, animal health and welfare. This however is not largely a priority in developing countries where the major concerns are access and availability of a nutritious diet throughout the year at relatively low costs (FAO, 2002). Developing countries are forced to overlooked food safety due to high poverty and illiteracy rate.

Food safety constitutes an effective platform for poverty alleviation, social and economic development, while opening and enlarging opportunities for trade. However, ensuring food safety comes with a cost, and excessive food safety requirements may impose constraints on production, storage and distribution systems, which may possibly result in trade barriers or impede competitiveness (FAO, 2002).

2.4 Global Food Insecurity

Despite the growing attention of multinational organisations, world household food insecurity continues to worsen daily globally (Project Concern International, 2009). The FAO (2013), report stressed that, globally about 842 million people and 12% of the global population were unable to meet their dietary energy requirement in 2013 despite the considerable efforts taken

to curb global hunger. Several factors have been responsible for the global food insecurity situation. Key among these factors is the high price for the world's staples (rice, wheat and maize) with inflation of 120% and 75% for wheat and rice respectively (ibid).

Also, the problem of food security is further exacerbated among poor households where access to food is heavily constraint since about 1 billion people globally live in extreme poverty (less than US$1 per day) and generally consume less than 1,600 calories a day (Pinstrup-Aderesen, 2002).

In addition, the over dependence of countries on imports poses a serious threat to food security. For example, Ghana gains from the export of fresh horticultural food to Europe has also resulted in the country importing significant quantities of country's staple demand (usually rice) exposing the country to the world food price hikes.

Moreover, climate change due to global warming has influenced world household food security. Climate change highly affects countries that are largely dependent on rain-fed agriculture. Droughts caused by La-ninas have caused household food insecurity especially in Ethiopia where 7 million people are classified as food insecure and a further 10 million classified as prone to drought, (ibid). Household food insecurity has also increased poverty among the global population leading to high global hunger index of 15.1% in 2010 (Grebmer, *et al.,* 2010).

2.5 Food Insecurity in Africa

Despite a good performance with high economic growth rates over the last decade, Africa has not made significant progress on some of its major challenges, especially food security and

employment for the growing youthful population (United Nations Economic and Social Council (UNESC), 2012). From 2011 to 2012, the state of food security has not changed much in the world and for that matter Africa although Ghana and Malawi have been declared food secured due to their agricultural policies and performance, the food security situation in the majority of African countries remained the same or even worsened (FAO, IFAD and WFP, 2013).

In this regard, many African countries have aligned strategies with the Comprehensive African Agriculture Development Programme (CAADP) with a renewed commitment and support for its implementation since 2008 coupled with national agricultural strategies within which national food security priorities have been identified for investment and policy support (UNESC, 2012).

At the global level, the FAO Food Outlook for 2011 reports that chronic hunger in Africa increased dramatically over the period 1990 to 2007 and even more with the 2008-2009 financial and food price crises. Political instability, wars, bad weather conditions and lack of incentives for agricultural transformation played a major role in compounding food insecurity in Africa. Food and agricultural production and productivity have barely improved (except in few cases such as Malawi and Rwanda) and other critical elements such as inter-sectoral linkages and diversification in staple production are lacking as well.

Rapid population growth and climate change continue to negatively impact food security and need to be factored in efforts at sustainable strategies and policies.

The political and social uprising in North Africa and West Africa have increased household food insecurity, displaced thousands of people and affected local economies. The drought in the Horn of Africa and the Sahel has persisted, leaving millions of people destitute (UNEP, 2007).

The Global Hunger Index (GHI), an indicator used to measure hunger, combines three equally weighted indicators in one index number: (a) proportion of people who are undernourished; (b) prevalence of underweight in children below five; and (c) the mortality rate of under-five children (IFPRI, GHI, 2010). The International Food Policy Research Institute (IFPRI), (IFPRI, GHI, 2011) reported GHI estimates for 122 countries, showing that, over the 1990-2011 period, the GHI score for sub-Saharan Africa fell by 18%, much less than in South Asia (25%) and the near East and North Africa (39%). Although 16 countries in Africa have improvement in their GHI score during this period, only one country in sub-Saharan Africa - Ghana - ranked among the 10 best performers. About 83% of the countries in sub-Sahara Africa have their hunger situation worsened.

Meeting the food needs of families in Sub-Saharan Africa remains a serious challenge. This challenge emerges due to widespread poverty and conflict (Misselhorn, 2005; Oldewage-Theron *et al.,* 2006); drought, famine and other negative weather patterns exacerbated by global climate change (Rosenzweig *et al.,* 2001); environmental degradation and deforestation (Baro and Deubel, 2006), increased food prices due to the growth in demand for biofuels (Trostle, 2008) and low agricultural productivity **(**Haile, 2005). The combination of these factors restricts access to food for many in developing countries.

In North Africa, the Arab spring effects in Libya resulted in the displacement of large numbers of people and disruption in the flow of goods and services. This situation later spread to the Sahara desert with the infiltration of armed groups throughout northern Mali, which further exacerbated the displacement of population (FAO; Sahel crisis, 2012). The World Food Programme (WFP) initiated a regional emergency operation, covering Mauritania, Mali and the Niger, to provide food assistance to the affected people. In Southern Africa, prospects for the main 2012 maize crop are generally favourable; and relatively low prices have helped stabilize food security (FAO, 2012).

In West Africa, post-election violence caused a large population disruption, which disturbed trade and livelihoods in Côte d'Ivoire and the neighbouring countries. The coup d'état of March 2012 in Mali, coupled with the taking over of Northern Mali by armed groups, has also caused displacement of populations to neighbouring countries (Niger, Mauritania, Senegal and Burkina Faso) and towards the southern part of the country, which is still under Government control (FAO; Sahel crisis, 2012).

Food insecurity has increased in drought-affected pastoral areas (Somalia, Kenya, Djibouti and Ethiopia) despite bumper harvests in 2010 and generally low and stable food prices. The recent drought of 2011-2012 in the horn of Africa has been qualified by experts as the worst drought in 60 years, caused by a prolonged lack of rain and resulting in dry conditions (FAO; GIEWS, 2012). The severity and scale of the drought has raised concerns because about 80% of the population in this sub-region depends on crops and livestock for their livelihood and food security, while only about 1 per cent of arable land is irrigated (GIEWS, 2011). The drought has led to a humanitarian crisis and heavy economic costs as about 13 million or

more people are estimated to be in need of emergency food aid and livelihood assistance in Djibouti, Ethiopia, Kenya and Somalia. According to Save the Children's report, (2012), East Africa is facing a "double-dip" hunger crisis that could plunge millions of people back into emergency levels of hunger and malnutrition.

2.6 Food Security in Ghana

Food security remains a fundamental challenge in Ghana and can be put into two perspectives thus stagnating production in the food crop sector which contributes significantly to food insecurity, but with increasing exports in horticultural crops (Wolter, 2009). Ghana has been fairly stable in terms of food security on national basis, although, some pockets of food insecurity situations have been recorded in some areas particularly in the three northern regions.

Ghana was severely affected by the 1983 drought in West Africa where acute food shortage was recorded and this saw people depending on all kinds of material for survival. Among the food consumed during this period, cocoyam comb, rhizome of bamboo, and unriped bananas were substituted for plantain which under normal circumstances were not part of Ghanaian foodstuff (Kuwornu *et al.,* 2013). The WFP's 2009 report estimated that about 1.2 million people in Ghana (approximately 5% of the population) continue to have limited access to sufficient and nutritious food, and about 55% of these 1.2 million people comes from households that are primarily food and cash crop farmers, agro-pastoralist, food processors, or unskilled labourers (Biederlack and Rivers, 2009). The basic factors for these food insecure households as noted by Biederlack and Rivers (2009), are high dependency on agriculture, lack of education, lack of access to output markets, and poverty.

Interestingly, about 18.2% of Ghanaians fell below the extreme poverty line and declared as chronically food insecure (GSS, 2008).

Malnutrition is still unacceptably high among children of below five years and women reproductive age as it accounts for about 22% of children too short for their age (stunted), while 7% of children too thin for their height in Ghana (WFP, 2009).

Mulugeta and Hunde (2009), and WB (2008), attributed inefficient production techniques, inadequate extension access and input supplies as causes of food insecurity.

The Government of Ghana (GoG) over past decades implemented several programs through accelerated agriculture growth and development strategies to improve food security in Ghana (MoFA, 2007). Key among these programs is the "Operation Feed Yourself" led by the Acheampong's government in the late 1970s, fertilizer subsidy which allow farmers to access fertilizer at reduced prices and also provision of livestock to selected farmers to serve as out growers. However, the interventions faced several challenges although recommendable. For instance, the fertilizer subsidy comes too late, sometimes several months after farmers have planted their crops hence less effective on the crops.

Selection of committed farmers has been a major setback to the livestock improvement programme. In most cases farmers selected are perceived to be aligned to particular political parties leading to over politicization of the selection processes. This results in distribution of the livestock to political cronies rather than committed and experienced farmers. This has made the programme less effective and not visible to many (Kuwornu, *et al.*, 2013).

2.7 Food Security in the Northern Region of Ghana

Food security in the northern region of Ghana continues to be threatened among other things by the seasonal and unstable domestic production due to erratic rainfall pattern, soil infertility, high food prices and inflation, low household incomes and persistent high level of unemployment (Nyanteng *et al.,* 2003). The WFP's 2009 reported that about 10% of the estimated 1.2 million people in Ghana (approximately 5% of the population) continuous to have limited access to sufficient and nutritious food come from the northern region. Paradoxically, households producing food crops are often the most food insecure in the northern region of Ghana (Biederlack and Rivers, 2009).

2.8 Food Aid

Food aid to households is an important relief for emergencies during food shortfalls in households and also increases access to food by households (FAO, 2008). The United States is the world's largest food aid donor and provides approximately half of the world's food aid to vulnerable populations. In 2008, the US government provided more than 2.6 million metric tons (MT) of food commodities to 56 million beneficiaries worldwide (USAID, 2009).

The volume of food aid into Ghana has decreased by about 50% between the early 1990s and 2002. The share of food aid (converted in kilocalories) in the DES has decreased from 4% in 1990-92 to 1% in 2001-2003 (FAO, Statistics Division, Food Security Statistics). Ghana received 59 685 tons (t) of food aid in 2005. Of these, 57 190 t were cereals (comprised of 59% of wheat and wheat flour, 33% of blended and fortified foods, 5% of coarse grains and 2% of rice) and 2 495 t were non-cereals food commodities (comprised of 67% of oils and fats and 24% of pulses) (WFP, 2006). About 93% of food aid was provided as project food aid, mainly to support poverty reduction activities and malnutrition reduction activities

(particularly for pregnant and lactating women, and children under five), and for school the feeding programme. The WFP has supported a Supplementary Feeding and Health and Nutrition Education Project for the past ten years in Ghana.

2.9 Dietary Diversity

Dietary diversity is the number of different foods or food groups consumed over a reference period (Hatloy *et al.*, 1998; Lorenzana and Sanjur, 1999; Morris, 1999). However FAO, (2011) defines dietary diversity as a qualitative measure of food consumption that reflects household access to a variety of foods, and is also a proxy for nutrient adequacy of the diet of individuals. Household dietary diversity score (HDDS) is the sum of the different food groups consumed over a 24-hour period. HDDS recall involves 12 food groups consumed by households and it is classified as ≤3, 4 to 5 and ≥6 as lowest dietary diversity, medium dietary diversity and high dietary diversity scores respectively (Kennedy, Ballard, & Dop, 2011). Household dietary diversity score (HDDS) is meant to reflect (in a snapshot form) the economic ability of households to access variety of foods. Studies have shown that increase in dietary diversity is associated with socio-economic status and household food security (Hoddinot and Yohannes, 2002; Hatloy *et al.*, 2000).

Dietary diversity scores have been validated for several age and sex groups as proxy measures for macro and micronutrient adequacy of diets. Scores have positively been correlated with adequate micronutrient density of complementary foods for infants and young children (FANTA, 2006), and macronutrient and micronutrient adequacy of diets for non breast-fed children (Hatloy *et al.*, 1998; Ruel *et al.*, 2004; Kennedy *et al.*, 2007), adolescents (Mirmiran *et al.*, 2004) and adults (Foote *et al.*, 2004).

2.9.1 Measurements of Dietary Diversity

There are several approaches used by researchers in measuring dietary diversity. One approach, suggested by Kant *et al.,* (1991), Hatloy *et al.,* (1998), and Swindale and Ohri-Vachaspati (1999) is the number of food groups consumed. Kant *et al.,* and Hatloy *et al.,* suggest eight food groups while Swindale and Ohri- Vachaspati suggest 12 food groups. However, Krebs-Smith *et al.,* (1987), Drewnowski *et al.,* (1997) and Hatloy *et al.,* (1998) reported that alternative and better approach is to count each food item separately.

There are advantages and disadvantages of these approaches. For example, knowing that a household consumes four food groups, instead of four different types of cereals is more indicative of a diverse diet. Conversely, changes in food consumption resulting from higher incomes may be evidenced by improved quality of foods rather than consumption of different food groups (Hoddinot and Yohannes, 2002).

2.9.2 Importance of Dietary Diversity

Dietary diversity is recognised as an attractive indicator of food security (Hatloy *et al.,* 1998; Lorenzana and Sanjur, 1999; Morris, 1999) due to the following reasons. A more varied diet is a valid outcome in its own right. This implies that household consumption of different food groups are much better placed to be food secure.

Furthermore, a more varied diet (directly or indirectly) is associated with a number of improved outcomes in areas such as birthweight **(**Rao *et al.*, 2001), child anthropometric status (Allen *et al.,* 1991; Hatloy *et al.,* 2000; Onyango, Koski and Tucker ,1998; Taren and Chen, 1993; Tarini, Bakari, and Delisle, 1999), improved hemoglobin concentrations (Bhargava, Bouis, and Scrimshaw, 2001), reduced incidence of hypertension (Miller,

Crabtree, and Evans, 1992), reduced risk of mortality from cardiovascular diseases and reduced the risk of cancer (Kant, Schatzkin, and Ziegler, 1995).

Moreover, dietary diversity questions at the household or individual levels make it possible to examine the status of food security. Finally, obtaining these data is relatively straightforward because it is much easier to recall what has been consumed over the previous day.

2.10 Household Food Consumption Score (HFCS)

Household food frequency is the rate of consumption of food groups by household members over a given period, usually 7 days. Household Food Consumption Score (HFCS) is a frequency-weighted HDDS. HFCS is calculated using the frequency of consumption of eight different food groups consumed by a household during the 7 days before a survey (IFPRI, 2008) which include main staples, pulses, vegetables, fruits, meat and fish, milk, sugar, oil. HFCS is measured using standard 7 day food data by classifying food items into food groups; summing the consumption frequencies of food items within the same group (any consumption frequency greater than 7 is recoded as 7; multiplying the value obtained for each food group by its weight for example 2, 3, 1, 1, 4, 4, 0.5 and 0.5 are weights for main staples (cereals, roots and tubers), pulses, vegetables, fruit, meat/fish/eggs, milk, sugar and fat/oil respectively; summing the weighted food group scores and finally recoding the variable HFCS from a continuous variable into a categorical variable for the food consumption groups using appropriate thresholds: 0-21 as food poor, 21.5-35 as borderline and >35 as acceptable, **(**IFPRI, 2008). The main advantage of using household dietary diversity and household food frequency as proxy indicators of household food insecurity is objectivity and measurability (Aiga and Dhur, 2006).

2.11 Factors Influencing Household's Perceived Food Security Status

Several factors (variables) influence household's perceived food security status. These are as follows

Age of household head

The age of household head has an impact on his or her labour supply for food production (Babatunde *et al.,* 2007). Young and energetic household heads may cultivate larger farms compared to the older and weaker ones. Age may also determine the ability of younger household heads to seek and obtain off-farm jobs and earn extra income for family support. Arene and Anyaeji, (2010), however found older household heads to be more food secure than the younger household heads. Hence, the expected effects of age of household head on food security could either be positive or negative.

Gender of Household Head

In most cases, the head of a household is a male but there are situations where women take up the role of household heads. Gender looks at the role played by individuals (male or female) in providing household needs including food. Research show that female headed households have higher dependency ratios than male headed ones (Maxwell *et al.,* 2000). However, Levin *et al.,* (1999) alluded to the fact that households headed by females are more disadvantaged than male-headed households because of the difference in access to income, educational levels, better employments, conflicting roles in the household such as childcare and work etc. This hinders the capacity of such households (female headed) to allocate labour to on-farm and other extra income-generating activities. The expected effect of gender on the food security status of a household is positive.

Farm Size

Farm size is the total area of land cultivated for food and cash crop by households, measured in acres. Positive relationship has been established between farm size and improved household income and food security status (Jayne *et al.,* 2005). The larger the farm size of the household, the higher the expected level of food production. It is, therefore, expected that a household with larger farm size be more food secure than a household with a smaller farm size. Hence, the expected effect on food security is positive.

Access to Employment

Access to employment supplements household income. Employment opportunities diversify and increase the income of households. The level of off-farm activity may influence households' food security but this may be positive or negative depending on the level and gains from the activity (Babatunde *et al.,* 2007) because off-farm activity may provide money thereby augmenting the food security situation of the household. However, Levin *et al.,* (1999) and Maxwell *et al.,* (2000) noted that, the kind of work household heads are engaged determines the incomes, access to resources and other social services and access to food in terms of affordability. On the other hand, if farmers spend more time on off-farm activities at of farm work, and particularly if the wage earned from the off-farm activities does not commensurate with farm income, the food security situation could be worsened. Therefore, the expected effect of access to employment on food security could be positive or negative.

Level of Education of Household Head

Education is a social capital which is expected to have positive influence on household food security. According to Shaikh, (2007), educated individuals have the capacity to process and

apply information passed on to them effectively for their benefit. Lower educational levels impede access to better job opportunities and hamper profitable entrepreneurship (FAO, 2012). Furthermore, increase in female education increases their returns, has the potential of reducing their fertility level, improve their productivity as well as contribute positively to national growth (Herze *et al.*, 1991).In addition, high educational level of household heads is associated with better employment opportunity and higher incomes and may translate into higher purchasing power and better nutrition knowledge for all household members through improving dietary diversity (Hoddinott and Yohannes, 2002).The expected effect of this variable on food security is positive.

Dependency Ratio

This is usually measured by the total household size divided by the number of individuals working to support the household. Owing to scarcity of resources, increase in household size especially, the non-working members put pressure on consumption than production (Feleke *et al.*, 2003). Therefore, increase in the number of non-working members of a household (dependency ratio) increases the food insecurity level of the household (Ojogbo, 2010). The expected effect of this variable on food security is thus negative.

Household Size

It is the total number of household members who lived and eat with household at least for six months. Household size is an important variable which influences households' food security and it is expected to have a negative effect on household food security (Beyene and Muche, 2010; Mequanent, 2009). Increasing family size tends to exert more pressure on food consumption than the labour it contributes to production (Tsegay, 2009).

Locality

The location of the households in this study was denoted by dummy (0 1). Location in terms of nearness to market, education and transport infrastructure have significant influence on households food security status. Location of households is useful in examining the composition and nature of inhabitants in terms of cultural diversity, social and economic lifestyle and migrant settlement areas which may have tremendous influence on household dietary patterns (Anarfi and Ahiadeke, 2006). The expected sign could be negative.

Marital Status

Marital status is an important factor in determining household food security. The marital status variable in this studies is dummy (0 for unmarried and 1 otherwise). Married household heads would have many mouths to feed compared to unmarried household heads. The expected sign is negative.

2.12 Food Insecurity Coping Strategies

Devereux (2001), defines coping strategies as response to adverse events or shocks. The definition by Snel and Staring (2001), captures the broad notion of coping strategies. It involves “all the strategically adopted acts that individuals and households (in a poor socio-economic position) use to restrict their expense or earn extra income to enable them acquire basic necessities (food, clothing, shelter) to meet society’s level of welfare” (Snel and Staring, 2001). This latter definition implies that coping strategies involves a conscious assessment of alternative plans and actions. This does not necessarily mean that choice of strategies is always successful; in fact, coping strategies often yield unintended negative effects.

Frank, (2000) defines coping strategies as the methods used by households to survive when confronted with unanticipated livelihood failure. Coping strategies are 'ex post' measures in

that they seek to reduce the impact of a negative event (Donald, 2008). The Coping strategies that are usually adopted by households to mitigate the effect of food insecurity are relying on less preferred/inexpensive food; borrowing food, or relying on help from friends or relatives; gathering wild food, hunting or harvesting immature crops; consuming seed stock held for the next season; sending household members to eat elsewhere; limiting portion size at meal times; restricting adult consumption in favour of small children; reducing the number of meals eaten in a day; skipping entire days without eating and begging from neighbours or friends (Mjonono, Ngidi & Hendriks, 2009).

Therefore, strategies pursued by households differ in several aspects (Maxwell *et al.*, 2003) depending on varying degrees of wealth behaviours, educational level of household heads and understanding of problem issues. However, some coping strategies are common to households although the extent to which such strategies enable a household to remain afloat depend on the assets at their disposal (Devereux, 2001). The tendency is that the lower the household asset status, education and understanding of the problem at hand the more likely the household would engage in erosive responses such as selling off productive assets like farm implements (Hoddinott, 2004).

Increased reliance on coping strategies is associated with lower food availability and the higher the weighted sums of coping strategies, the more food insecure the household (Maxwell *et al.*, 2008).

2.12.1 Consumption and income coping strategies

Literature distinguishes between risk management (income soothing) and risk coping strategies (consumption soothing). The former attempts to reduce the ex-ante risk impact through income diversification. Faced with income or food shock, households may protect

their food consumption by purchasing or obtaining food from other sources (Davies, 1993). Risk coping strategies deal with consequences (ex-post) of risk. It involves self-insurance through precautionary savings and informal group-based risk-sharing (Davies, 1993). However, households may insure themselves by building up assets during 'good' years, to deplete the stocks in 'bad' years (Dercon, 2000). They may modify their food consumption by reducing food and the number of consumers (Corbett, 1988).

2.13 Estimating Food Security Status

There are various approaches of estimating levels of household food insecurity.

There is however, no single approach that is universally acceptable (method) for measuring food security statuses (Aiga and Dhur, 2006). Global household food security levels can best be described by high food prices, high levels of malnutrition, high levels of maternal mortality, high levels of vulnerability and high levels of poverty (UN Food Security Taskforce, 2008). Vulnerability is the probability of an acute decline in food access or consumption due to hazards in the physical or social environment. A typical hazard includes weather disturbances, such as drought, or man-made disturbances, such as civil war or extreme price fluctuations (Donald, 2008).

Aiga and Dhur, (2006) reported that measuring household food security or insecurity becomes very difficult since there exist no single indicator to be better captured in the definition of the situation but left in the hands of the researchers who conducts each assessment leads to varying results. The various methods used to establish food security status among other things are the cost-of-calorie approach (COC), food security index approach (FSI), household dietary diversity score approach (HDDS), and household food consumption score approach (HFCS).

2.13.1 Cost-of-Calorie Approach (COC)

The COC approach is the most common and widely used approach to establish food security status. This method was proposed by Greer and Thorbecke, (1986) to food security line. The method is used to estimate the minimum calorie requirements (level) necessary for human survival. This minimum level is referred to as the 'food security line'. Based on the estimation, households whose average cost of daily calorie consumption is equal to or more than the minimum calorie (level) are said to be food secure while a household with average cost of daily calorie consumption lower than the minimum calorie (level) is considered food insecure. Calorie adequacy was estimated by dividing the estimated calorie supply for the households by the household size adjusted for adult equivalence using the consumption factor for age-sex categories. This approach has been used by (Ojogho, 2010; Oluyole *et al.*, 2009; Adenegan and Adewusi, 2007; Kuwornu *et al.*, 2013) to establish households food security status in Nigeria and Ghana respectively.

2.13.2 Food Security Index Approach (FSI)

The food security index approach is used to establish household status based on the Recommended Daily Calorie Intake approach (RDCI). This is done by calculating total calorie consumed (TC) within a household and dividing the TC by the total number of adult equivalent in the household. Based on the estimation, households whose food security index is equal to or more than the RDC are said to be food secure while a household whose food security index lower is than the RDC is considered food insecure. This method (Food Security Index) was used by several researchers (KhatriChhetri and Maharjan, 2006; Omotesho *et al.*, 2006, Arene and Anyaeji, 2010) to establish household food security status.

2.13.3 Household Dietary Diversity Score (HDDS)

Food and Nutrition Technical Assistance (FANTA), (2002) carried out a research to explore whether dietary diversity can act as a proxy to measure household food security status. The FANTA project identify scientifically validated, easier and more user friendly approaches to measuring the access component of household food security using the Household Food Insecurity and Access Scale (HFIAS) approach by classifying households as food secure, mildly food insecure, moderately food insecure and severely food insecure. The indicators of food insecurity were according to household dietary diversity score and months of inadequate household food provisioning (Swindale & Bilinsky, 2009). The HDDS approach was also used by Funmilola and Patricia, (2014) to examine household food security status in Nigeria and Kenya respectively.

2.13.4 Household Food Consumption Score (HFCS)

The WFP's Humanitarian Practice Network in 2005 estimated the proportion of food insecure households in Darfur in two steps. The first step classifies households in three consumption groups as acceptable, borderline and food poor using the dietary diversity and food consumption scores. The second classification of households was households' primary source of food (specifically food aid) and was classified into three groups as food secure, vulnerable food insecure and food insecure households. This classification was aimed at estimating the sustainability of the then food consumption levels through the analysis of the primary source of food consumed (Aiga and Dhur, 2006).

CHAPTER THREE

METHODOLOGY

3.1 Introduction

This chapter looks at the methodology for the study. The chapter dealt with the study area, population, sampling procedure and technique, sources and type of data and data analysis and presentation.

3.2 The Study Area

Northern region has two main seasons: the rainy season, which runs from May to October and the dry season, which runs from November to April. The regions average annual rainfall ranges from 750 to 1050 mm and the intensity of the seasonal rains decreases northward.

The region is made up of 23 districts. The West Mamprusi district (WMD) was divided into two district in 2012 (Northern regional Electoral Commission, 2012) namely WMD with Walewale as its district capital and Mamprugu Moaduguri district (MMD) with Yagba as the district capital.

The district is characterised by a single rainy season, which starts in late April with little rainfall, rising to its peak in July-August and declining sharply and coming to a complete halt in October-November.

The area experiences occasional storms, which have implications for base soil erosion depending on its frequency and intensity especially when they occur at the end of the dry season. Mean annual rainfall ranges between 950mm - 1,200mm. The dry season is characterised by Hamattan winds. These winds, which blow across the Sahara desert, are

warm and dry causing significantly daily temperatures and causing the soil to lose moisture rapidly. Maximum day temperatures are recorded between March-April of about 45°C while minimum night temperatures of about 12°C have been recorded in December-January. The humidity levels between April and October can be as high as 95% in the night falling to 70% in the day. Night humidity for the rest of the years ranges between 80% and 25%.

The area is drained by the White Volta and its tributaries the Sissili and the Kulpawn rivers. Flooding by the White Volta is an annual problem caused mainly by the numerous small rivers, which flow into it especially below Pwalugu. Occasional flash floods have also been caused by spilling of waters from the Bagri Dam, further up stream in Burkina Faso. The prevailing rainfall and the nature of the underlying rock formations determines to a large extent the ground and surface water potential for the district. The present combination of heavy run-off, high evaporation and transpiration and low infiltration rates to recharge aquifers in some areas in the district, contribute to water deficiencies especially to the west of the White Volta, the south around Fio area and eastern parts around Shelinvoya.

The natural vegetation of the district is classified as Guinea Savannah Woodland, composed of short trees of varying sizes and density, growing over a dispersed cover of perennial grasses and shrubs. The climatic conditions, relief features and soil texture which foster water logged conditions (especially in the area west of the White Volta) in the rainy season and draughty soils in the dry season tend to develop a characteristically hardy tree vegetation adapted to long periods of dry spells. The existence of dense woodlands and forests along river valley (especially areas along the basin of the White

Volta and its tributaries) is gradually beginning to change due to the influx of people into these areas as a result of the successful control of river borne diseases (e.g. Onchocerciasis). The vegetation is also annually affected by bushfires, which sweep across the savannah woodland each year.

Total land area for the two Districts is 5013km^2, with 45,781 hectares being put to cultivation. The average farm size is between 0.5 – 2.4 hectares. Land is normally acquired either by inheritance, from the chief or family heads. The principal land uses reflect the almost total rural base of the district economy. About 77.4% of the people depend heavily on agriculture for their livelihood. Large amounts of land are therefore put to the cultivation of major crops like maize, millet, guinea corn, groundnuts and cotton. Important minor crops cultivated include cowpea, cassava and yam. There are a lot of good lands for tree crops and large scale mechanized Agriculture.

3.3 Sampling Procedure and Techniques

A multistage sampling technique was used in this study. The first stage involves the selection of districts and municipalities. This was done using purposive sampling techniques where West Mamprusi Distrct (WMD) and Mamprugu Moaduguri District (MMD) were selected because of the perennial floods situation in the area.

The second stage involves the selection of communities and villages that were visited using purposive and simple random sampling. The district capitals were purposively chosen while the villages were done using the simple random sample technique. The communities include Walewale, Yagba, Zangum, Boagya, Jadama and Kwankuo. Walewale and Yagba were

purposively chosen because they are the major markets and therefore were considered to investigate the role it plays as household food sources.

The third and final stage was the selection of the farm households that were interviewed. Respondents were selected using simple random sampling, and data regarding their socio-economic characteristics, food availability, food accessibility and access to institutions were obtained for analysis.

The sample frame purposively includes smallholder farmers in the West Mamprusi and Mamprugu Moaduguri Districts of the northern region of Ghana. 100 respondents were selected from of each the district making 200 respondents. Respondents of the study were household heads and principal care givers of the households. Household heads were considered as the main respondents because of their knowledge about food production and landuse. In cases where the household head was different from the principal care giver, he/she was requested to identify the person responsible for preparing or overseeing preparation of food for consumption, to answer questions on household food consumption patterns and coping strategies.

3.4 Sources and Type of Data

Both primary and secondary data were collected and used for the study. The primary data were collected from the selected communities in the study area using both open and close ended questionnaire.

3.5 Data Analysis and Presentation

Descriptive statistics and inferential statistics (the cost-of-calories [COC], Household Dietary Diversity Score [HDDS], Household Food Consumption Score [HFCS], Logit models and Kendall's coefficient of concordance) were the analytical techniques used for the study. The software packages that were used for the analysis include SPSS, STATA and Excel.

3.5.1 Objective One: Establishing Household Food Security Status

Researchers have used several methods to establish household food status. However, this study used the COC, HDDS and HFCS to examine the food security status among smallholder farming households in the WMD and MMD of the northern region of Ghana.

Cost-of-calories (COC)

The cost-of-calories approach to measuring food security status was proposed by Greer and Thorbecke (1986). This method was used by Kuwornu *et al.,* (2011), Ojogho (2010), and Oluyole *et al.,* (2009) to establish household food security status in Edo state in Nigeria. The function is given as: $\ln h = \alpha + bC$ 1

Where: h = Household food expenditure

C = calorie consumption (kcal)

α = intercept term

b = coefficient of the calorie consumption

From equation 1, the cost of minimum recommended energy level, Z can be calculated as:

$Z = e^{\alpha + bL}$

Where: L = Recommended Daily Energy level (kcal)

α = intercept term

b = coefficient of the calorie consumption

Based on the minimum recommended energy level (Z), a household whose average cost of daily calorie consumption is equal to or more than Z is said to be food secure while a household with average cost of daily calorie consumption lower than Z is considered food insecure.

The surplus or shortfall was calculated using the function below:

$$P = \frac{1}{n}\sum_{j=1}^{m} Gj \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots . 2$$

Where: P = Surplus/Shortfall,

L = Recommended Daily Per Capita Requirement (2,450Kcal),

G_j = Calorie faced by household,

X_i = Per Capita Food Consumption Available to household

N = Number of households that are food secure (for surplus index) or food insecure (for shortfall index).

G_j can be expressed as: $\frac{Xi-L}{L}$

Food Security Index

To establish the food security status of farm households in the study area, I constructed the Food Security Index (Z_i) and determined the food security status of each household based on the food security line using the Recommended Daily Calorie Required

approach as used by Babatunde *et al.*, (2007). Households whose Daily Calorie Intake were equal or higher than the Recommended Daily Calorie Required were considered food secure households and those whose Daily Calorie Intake were below the Recommended Daily Calorie Required were considered food insecure households. The Food Security Index is given as: $Z_i = \frac{Y_i}{R}$ 3

Where Z_i = Food security index of i^{th} household

Y_i = Actual Daily Calorie intake of i^{th} households

R = Recommended Daily Calorie Requirement of i^{th} household.

To obtain Per Capita Daily Calorie Intake; daily calorie intake of each household was divided by household size. Households' Per Capita Daily Calorie Requirement was also obtained by dividing the households' Daily Calorie Requirement by household size. Based on the food security index estimated, the study further estimated other indices such as food insecurity gap (FIG), headcount ratio (HCR) and Surplus Index (SI). Food Insecurity gap is given by:

$$\frac{1}{M}\sum_{i=1}^{n} G_i \text{ ... ... 4}$$

Where

M = Number of food insecure households

G_i = Calorie intake deficiency for the i^{th} household. G_i was further expanded in a form:

$$G_1 = \frac{Y_i - R}{R} \text{ ... ...5}$$

Where *Y* and *R* are as defined previously (above).

The headcount ratio (HCR) is given as: $\frac{M}{N} * 100$ 6

Where N = number of sample households

To determine the Daily Recommended Calorie Requirement or food needs of each household, the Ghana Statistical Service (GSS) and IFPRI (2000) standard of 2,900 kcal was used.

To determine households' daily calorie requirement household members were categorize into different age groups based on the fact that different age groups have different calorie requirements. The daily energy (calorie) requirements of various compositions of the households were however converted into adult equivalent using the equivalent scales as shown in Table 3.1

Table3.1 Recommended Daily Energy Intake and Equivalent Scale

Age Category (years)	Average energy allowance per day (kcal)	Equivalent scale
Children (<6)	1150	0.4
Children (6 -18)	2250	0.9
Adults (> 18)	2900	1

Source: Ghana Statistical Service (2000).

To obtain Total household composition or calorie requirement the total number of adults in each households was multiplied by the recommended calorie requirement of 2,900kcal (i.e Total Number of adults*2900kcal). For total food requirements for children were converted to adult equivalent. This was done by multiplying the total number of children below the age of six (6) years in each household by Recommended Daily Calorie Requirement of 2900kcal and conversion factor of 0.4.

The total number of children between the ages of 6 to 18 years in each household was also multiplied by Recommended Daily Calorie Requirement of 2,900kcal and a conversion factor of 0.9 to obtain their adult equivalent. The total Daily Calorie Requirement for each household was obtained by summing up the requirement for the three age groups estimated

above. The procedure was repeated for Recommended Daily Calorie Requirement of 2,260 kcal (FAO Ghana).

Households' daily food consumption (Daily Calorie Intake) was obtained from household own food production and purchases to supplement own food production. The data on actual food consumed (maize, rice, cassava, and plantain) by each household per week was obtained and converted into kilogram. The energy content of 1kg of each foodstuff (maize, cassava, rice and plantain) was obtained from literature as showed in Table 3.2.

Table 3.2 Cereal Equivalent Conversion Ratios

Food crops	Calorie/kg	Milling ratio	Maize equivalent
Maize	3590	0.85	1
Rice	3640	0.65	0.92
Cassava	1490		0.40
Plantain	1350		

Source: Nutrition and Food Science Department, University of Ghana, Legon

The total quantity of each food (in kilogram) consumed was then multiplied by the energy content (e.g. total kilogram of cassava consumed per week *1,490kcal = total kcal of cassava consumed). This procedure was repeated for rice and plantain. However, due to processing and grinding losses, the quantity of maize consumed per week was multiplied by the energy content (3950kcal) and the milling ratio of 0.85. The total kilocalories of maize, cassava, rice and plantain consumed by each household were summed up and divided by 7 to obtain Actual Daily Calorie Intake.

3.6.2 Household Dietary Diversity Score (HDDS)

Household dietary diversity was measured by summing the number of foods or food groups consumed over a reference period usually 24 hours. HDDS was established using 12 food

groups, the score which ranges between 0 -12 was used to measure household dietary diversity and ranked accordingly into high dietary diversity (6 - 12), medium dietary diversity (4 - 5) and low dietary diversity (0 -3) (FAO, 2008b).

The twelve (12) food groups included in the HDDS were: Cereals; roots and tubers; Vegetables; Fruit; Meat, poultry, offal; Eggs; Fish and sea foods; Legumes, nuts and seeds; Milk and milk products; Oils and Fat; Sugar/honey, condiments and Beverages (FAO, 2007).

3.6.3 Household Food Consumption Score (HFCS)

Household food consumption score was measured by summing and weighting the counts of foods or food groups consumed over a 7 day period. HFCS was established by considering the consumption of 8 food groups: main staples (cereals, roots and tubers), pulses, meat/fish/eggs, milk, vegetables, fruit, sugar/honey and fats/oil, and were factored with 2, 3, 4, 4, 1, 1, 0.5 and 0.5 respectively. HFCS of 0 – 28, 28.5 – 35, and 35.5 and above were considered as food poor, borderline and acceptable household food security status respectively.

3.7 The factors influencing household's perceived food security status

Several discrete models have been used to predict and analyse data in research of this nature. The logit model is probably the simplest and best-known probabilistic choice model among the discrete choice models (Zakir, 2009). The model is a generalized linear model (GLM) and is based on a binomial regression in which the dependent variable is dichotomous. The

covariates can be continuous, categorical or combination of both (Stefan, 2010). During the last few decades many studies have been conducted using this model. Theil, (1969) used the model in a multinomial extension (Zakir, 2012). Crag and Uhler, (1970) employed the logit model to estimate demand for auto-mobile, McFadden, (2001), Hosmer and Lemeshow, (2000) and Cramer, (2003) also used the model in logistic regression. Similarly, several researchers have used the model to determine factors that influence food security status among households. Babatunde *et al.,* (2007) used the model to study the factors influencing food security status of rural farming households in north central Nigeria. Kumorwu *et al.,* (2013) also employed the model to determine the factors influencing farm households in the forest belt of the central region of Ghana.

For this study the Logit model was used due to its simplicity in the interpretations of the coefficients. The dependent variable in this case, food security status, is a binary variable which takes a value of one (1) for food secured household and zero (0) for food insecure household. The cumulative logistic probability model was specified by Pindyck and Rubinfeld, (1981) as: $Pi = F(Zi) = 1 + \frac{1}{1+e^{-(\alpha+\sum \beta i Xi)}} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 7$

Where: P_i is the probability that an individual is being food secure given X_i (the explanatory variables); α and β_i are parameters to be estimated. The log odds of the probability that an individual is being food secure is given by:

$$\log\left(\frac{Pi}{1-Pi}\right) = Zi = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 \ldots . + \beta_n X_n \ldots\ldots\ldots\ldots 8$$

Where: X_1 = Locality, X_2 = Household size, X_3 = Dependency ratio X_4 = Gender of household head, X_5 = Age of household head, X_6 = Marital status, X_7 = Level of Education, X_8 = Access to Employment, X_9 = Farm size

Table 3.3 Variables Influencing Household's Perceived Food Security Status

Variable	Descriptions	Measurement	A priori Expectations
X_1	Locality of household head	Urban = 1, Rural = 0	+/-
X_2	Household size	Number of adult equivalent	+/-
X_3	Dependency ratio	ratio	-
X_4	Sex of household head	Male = 1, Female = 0	+/-
X_5	Age of household head	Years	+/-
X_6	Marital status	Married = 1, Unmarried = 0	+/-
X_7	Level of Education	Number of years	+
X_8	Access to Employment	Yes = 1, No = 0	+
X_9	Farm size	acres	+

3.8 Identification and ranking of coping strategies among smallholder farming households

Various methods for testing ranking of an object have been identified from literature and notable among them are Garrett's ranking score techniques, Friedman's two-way analysis of variance and Kendall's coefficient of concordance. There is close relation between

Friedman's test and Kendall's coefficient of concordance (Legendre, 2005). They address hypotheses concerning the same data and use Chi square test for testing. However, they differ in the formulation of their respective hypothesis. Whereas Friedman's test focuses on the items being ranked, the hypothesis of Kendall's test focuses on the rankers themselves. The Garrett's ranking score techniques on the other hand uses average scores of rankers and arrange them in either ascending or descending order. However, the limitation of this method is that it involves a number of steps and it does not test the level of agreements between rankers. Kendall's coefficient of concordance was employed for this study because the Kendall's (W) provides the test of agreements of the rankers (respondents) among their rankings which the Friedman's and Garrett's test lacks. The Kendall's coefficient of concordance (W) is given as:

$$W = \frac{12S}{P(n^3-n)-PT}; \quad 0 \leq W \leq 1 \ldots\ldots\ldots\ldots\ldots\ldots\ldots 9$$

$$S = \sum_i^n = 0(R - \bar{R}) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 10$$

Where R_1 = Total rank for the $_i$th strategy

$\bar{R}$ = Mean value for each total rank strategy

P = Number of respondents (raters)

n = Number of strategies to be ranked

T = Correction factor for ties

CHAPTER FOUR

RESULTS AND DISCUSSIONS

4.1 Introduction

The presentation and discussion of the findings include demographic characteristics of the households, household food production, household food consumption patterns, household sources of food, household food security status, and household coping strategies in the event of food shortage among the smallholder farm households.

4.2 Socio-economic Characteristic of Households

The socioeconomic characteristics of households presented in this study are: age, gender, marital status, educational status and household size.

4.2.1 Age of Household Head

The data shows wide range of age groups, however majority of the smallholder farmers are in their economically active working group. The mean age for the total respondent household was 53.3 years, 52.65 years for WMD and 53.94 years for MMD. The study also revealed low (8.5%) representation of the youth. This is as a result of the fact that older household heads has better access to farm lands for cultivation in northern region. This is clearly shown in table 4.1 below

Table 4.1 Age of Household Head.

Age Group	WMD (n = 100)	MMD (n = 100)	Pooled (n = 100)
	Percent	Percent	Percent
≤30	3	3	3
31-40	9	2	6
41-50	37	41	39
51-60	32	26	29
>60	19	28	32
Total	100	100	100
Mean	52.65	53.94	53.3
SD	12.58	11.40	12.00
Min	**25**	**25**	**25**
Max	**90**	**90**	**90**

Source: Field Survey Data, 2015.

4.2.2 Gender of Household Head

The gender analysis of respondents also revealed that a majority (81%) of the household heads are males and female headed households being in the minority (19%) for the two districts under study. However for WMD, males accounted for 85% of the respondents and only 15% for females whilst for the MMD, males were 77% and females 23% (Table 4.2). It is evident from the finding that males are the majority of household heads from both districts.

This observation could be due to the fact that males are traditionally regarded as heads of families and as such in the northern region an elderly male household member is usually regarded as household head as oppose to women who are often regarded as house wives with the role of carrying out house-keep responsibilities such as cooking, serving of food, breastfeeding etc.

Table 4.2 Sex of Household Head

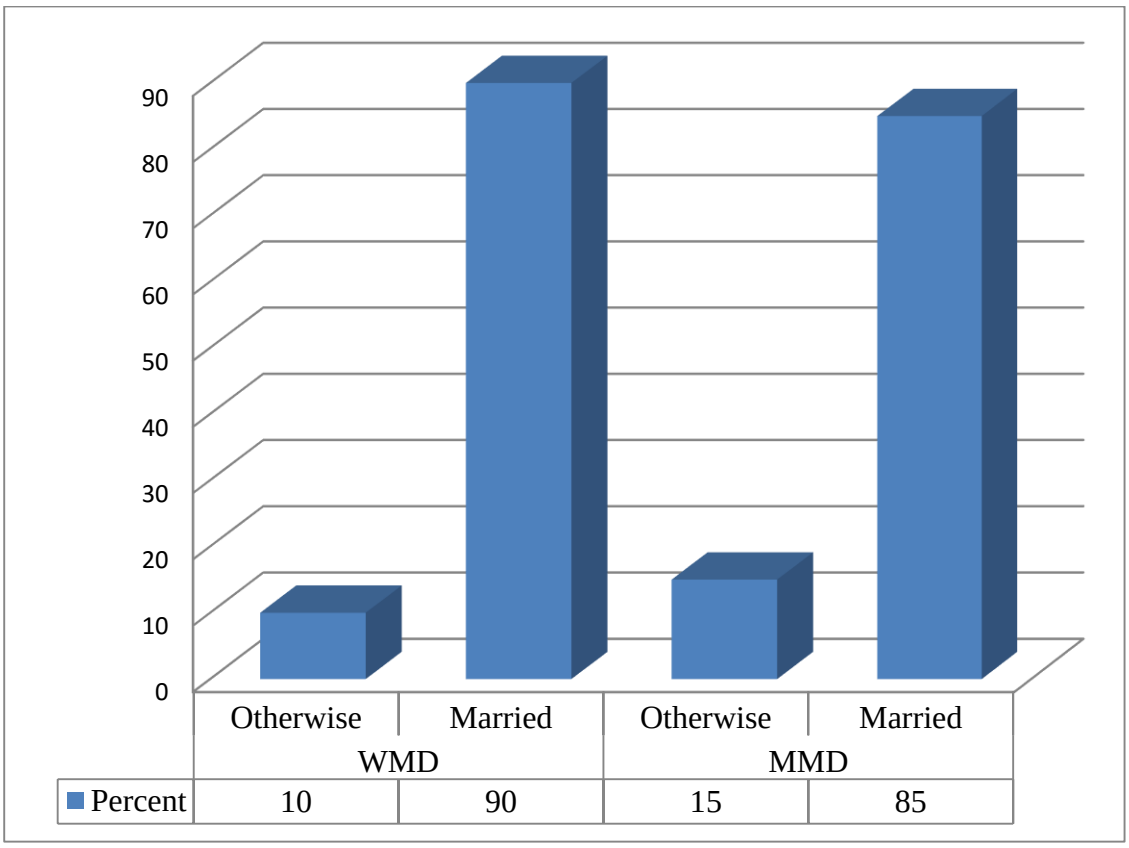
Sex	WMD (n = 100)	MMD (n = 100)	Pooled (n = 100)
	Percent	Percent	Percent
Male	85	77	81
Female	15	23	19
Total	**100**	**100**	**100**

Source: Field Survey Data, 2015.

4.2.3 Marital Status of Household Head

The marital status of the respondents was 87.5% being married whiles the remaining 12.5% were not married. In the WMD 90% were married and 10% were not, while in the MMD, 85% were married and 10% not married. This is shown in figure 4.1.

Figure 4.1 Marital Status of Respondent



Source: Field Survey Data, 2015.

4.2.4 Size of Household

The classical definition of a household generally used for research in Ghana, refers to 'a group of people who live together, not necessarily in the same building; who usually eat from the same pot; and who pool their incomes and other resources to purchase or produce food'. This definition is adopted for the current study.

From Table 4.3, the mean household size per adult equivalent was 8.2 for both districts. The result from the one-way means comparison showed that there is no significant difference between the means. This implies that households in the two districts will have equal likelihood of being food secure or insecure. However, the mean household size for WMD and MMD was 8.19 and 8.11 respectively. The data further revealed a wide range of household size (6-10), with minimum household size of 5 and maximum of 19 in the WMD and a minimum household size of 5 and maximum of 15 in the MMD. The mean household size (8.2 for total sampled households, 8.19 for households in the WMD and 8.11 for households in the MMD) was below the district, regional and national average of 8.9 urban households in agriculture for the WMD and MMD respectively, 8.7 rural households in agriculture also at the district level, 8.5 households at the regional level and 9.6 households at the national level as stated GSS (2013). This means that there is a high probability of respondent households at both districts to be food secure since the mean household size in each district is below the mean household size at both the regional and national levels.

Table 4.3 Household Size in the WMD and MMD

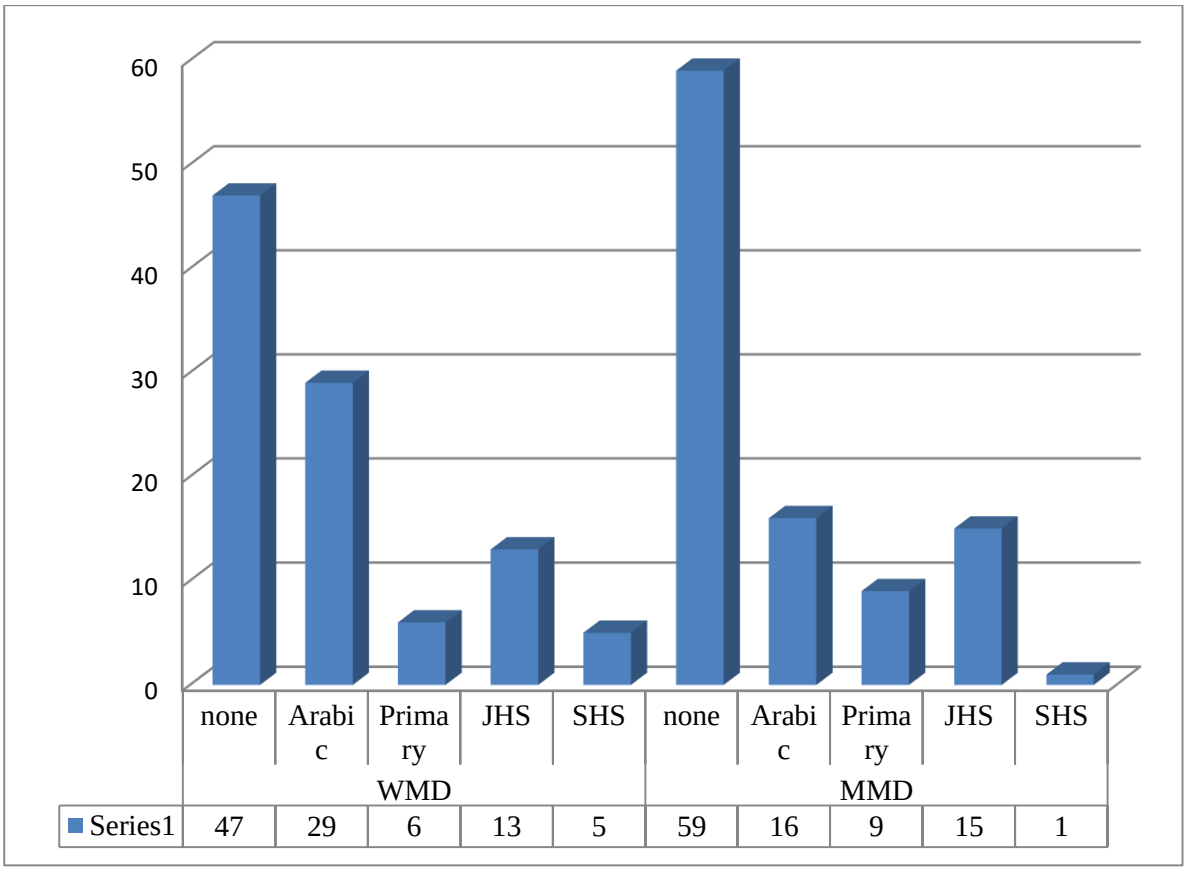
Household Size	**WMD (n = 100)**	**MMD (n = 100)**	**Pooled (n = 100)**
	Percent	Percent	Percent
1-5	32	33	32
6-10	44	46	45
11-15	20	19	20
16-20	3	2	2
>20	3	0	1
Total	100	100	100
Mean	8.19	8.40	8.92
SD	4.08	2.81	3.22
Min	5	5	5
Max	20	15	20
	t-test	significant	Mean diff.
	0.205	**0.838**	**0.074**

Source: Field Survey Data, 2015.

4.2.5 Educational Status of Household Heads

Educational level of household heads in the study area showed that about 53% of total sampled households had no form of formal education, 23% had Arabic education and 24% had some form of formal education from primary to SHS. This clearly indicates high rate of illiteracy in the study area. However, the study further revealed a high rate of literacy in the WMD as about 53% of the respondent had Arabic education to SHS whilst in the MMD illiteracy rate is still high accounting for almost 60% of the respondents. The high literacy in WMD can be attributed to the fact that access to school facilities are much higher in the district as compare to the other district since most of the schools in the study area are normally distributed in the WMD.

Figure 4.2 Educational Level of Household Heads



Source: Field Survey Data, 2015.

4.2.6 Farm Size of Household

The mean farm size was 3.49 acres with an average of 15.4 years of farming experience. However, a one-way means comparison t-test was computed to determine whether there is a significant difference between the mean farm size of WMD and MMD using the mean farm size of WMD as the base mean. The results indicate a significant difference between the mean farm sizes of the two districts at 1% level of significance. From Table 4.4, the mean farm size for WMD was 3.39 whiles the mean farm size for MMD was 3.58. This means that farm households in the MMD will have probability of being food secure as farm size and experience are major determinants of households' food security status.

Table 4.4 Farm size of Households

Farm Size	**WMD (n = 100)**	**MMD (n = 100)**	**Pooled (n = 100)**
	Percent	Percent	Percent
1-2	22	15	18
3-4	72	85	79
5-6	5	0	2
7-8	1	0	1
Total	**100**	**100**	**100**
Mean	52.65	53.94	53.3
SD	3.39	3.58	3.49
Min	2	2	2
Max	7	4	7
	t-test	significant	Mean diff.
	2.585	0.011	0.18500

Source: Field Survey Data, 2015.

4.3 Household Type of Housing

The Table 4.5 below shows the type of dwellings that households in the study area occupied. The type of dwellings that featured most in the study area are the compound house (71%) with mud bricks (76%) being the main construction material for the outer walls whiles 24% of the dwellings was made with gravel sand. This was attributed to the fact that mud is naturally available and cheaper for construction compared to sea sand bricks and stones. However, about 98.5% of the dwellings in the study area were made of iron sheet roofs and about 86.3% were earth floor.

Table 4.5 Household housing type in the study area

Housing Type	WMD (n = 100)	MMD (n = 100)	Pooled (n = 100)
	Percent	Percent	Percent
Traditional Hut	21	27	24
Compound house	71	70	71
Modern	8	2	5
Total	32	26	29

Source: Field Survey Data, 2015.

4.4 Household Energy Sources

Household energy sources have been divided into two (2) based on usage. These include energy used to light the household and energy used for cooking. The respondents were asked to mention their source of energy in the household for the purposes of lighting and cooking. The respondents gave the following in tables 4.6 and 4.7.

Table 4.6 Household lighting energy Sources in the study area.

Energy Source	WMD (n = 100)	MMD (n = 100)	Pooled (n = 100)
	Percent	Percent	Percent
Electricity	42	0	21
Kerosene	6	28	17
Flashlight/torch	52	72	62
Total	100	100	100

Source: Field Survey Data, 2015.

The results show that 62% of households in the study area used flashlight/torch as their main source of lighting their dwellings, 21% use electricity and 17% use kerosene lamps. This was anticipated because at the time of the study, communities under these districts were yet to be connected to the national grid. The use of flashlight was as a result low access to kerosene by respondents. The WMD has 42% of respondents using electricity because most of the communities in the district were yet to be connected to the national electricity grid as compared to the MMD with no single community connected to the grid not even the district capital Yagba.

Table 4.7 Household cooking energy source

Energy Source	WMD (n = 100)	MMD (n = 100)	Pooled (n = 100)
	Percent	Percent	Percent
Charcoal	21	13	17
Firewood	51	63	57
Charcoal/firewood	16	20	18
Others	6	4	5
Total	100	100	100

Source: Field Survey Data, 2015.

From Table 4.7 above, 57% of the households used firewood as their main source of cooking energy, 17% use charcoal, 18% use charcoal and firewood and only 5% others (crop residues, animal wastes). The dry season in the study area provide to households with dry trees and shrubs which can be processed into charcoal for household use.

4.5 Household Other Sources of Income

Agriculture plays significant role in households' income generation in the study area. Households income from agriculture accounted about 70% of all income earned by the respondents followed by regular wage (14%) and the least income generating source were from other source (casual work).

Table 4.8 Household source of income in the study area

Income Source	WMD (n = 100)	MMD (n = 100)	Pooled (n = 100)
	Percent	Percent	Percent
Agriculture	68	72	70
Private business	15	12	14
Regular wage	8	9	8
Remittance	5	3	4
Rent	2.5	2	2.25
Others	1.5	2	1.75
Total	100	100	100

Source: Field Survey Data, 2015.

4.6 Major crops cultivated in the study area

It can be observed from Table 4.9 that, majority of the households (58%) cultivated maize in the study area. About 9% of the households also cultivated rice which is often seen as a cash crop that can be stored for some time as compared to yam and cassava. Tomato, cowpea and pepper were cultivated as border crops mainly by women.

The finding indicates that food crops production were major crops households cultivated in the study area as cereals are the major stable food. Rice and groundnut could be sold for money for other household needs (payment of school fees, clothing etc). The result confirms the finding of Donald (2008) that household own production of staple food crops contributes significantly to household food availability and also food accessibility which in turn increases the probability of the household being food secure.

Table 4.9 Major crops cultivated by household in the study area

Major crops	**WMD (n = 100)**	**MMD (n = 100)**	**Pooled (n = 100)**
	Percent	**Percent**	**Percent**
Maize	53	60	57
Rice	10	8	9
Groundnut	9	4	6
Cowpea	6	5	6
Yam	3	4	4
Pepper	4	3	3
Tomato	2	4	3
Millet	8	6	7
Sorghum	5	6	5
Total	**100**	**100**	**100**

Source: Field Survey Data, 2015.

4.7 Months of Adequate Household Food Provisioning

Months of household food provisioning of households in the study area showed about high number (44%) of the households had enough food provisioning during the months of August to November followed by the December to March and the least of months was April to July. This implies that households had better access to food and more availability of food in August to November than any other months. Harvesting is usually done in August to

December in the study area thereby making food available during these months (August to December). As a result of this, households' food access and availability during these months were expected to be better compared to the other months of the year. The months households' food access and availability worsen are the months from April to July.

Table 4.10 Months of Adequate Household Food Provisioning

Months	WMD (n = 100)	MMD (n = 100)	Pooled (n = 100)
	Percent	Percent	Percent
August to November	46	42	44
December to March	33	36	34
April to July	21	22	22
Total	**100**	**100**	**100**

Source: Field Survey Data, 2015.

4.8 Months of Inadequate Household Food Provisioning

Months of inadequate household food provisioning in the study area revealed that about 58% of households' had inadequate food provisioning in the months from May to July, 26% had inadequate food provisioning from January to April and 16% had inadequate food provisioning from August to December. This means that, largely in the months of May to July households' were not able to access food adequately due to the fact that food cultivation usually starts in these months hence limiting household food availability. This is illustrated in Table 13 below.

Table 4.11 Months of Inadequate Household Food Provisioning

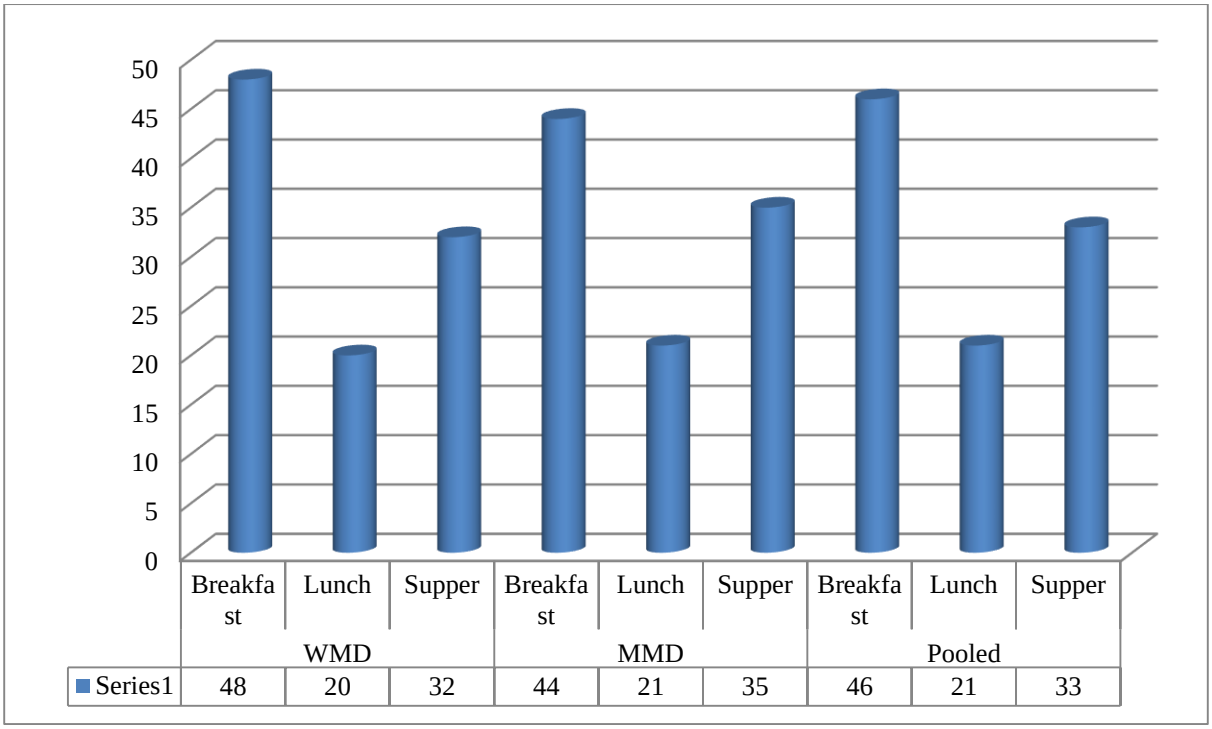
Months	WMD (n = 100)	MMD (n = 100)	Pooled (n = 100)
	Percent	Percent	Percent
May to July	54	62	58
August to December	17	15	16
January to April	29	23	26
Total	**100**	**100**	**100**

Source: Field Survey Data, 2015.

4.9 Household Food Consumption Pattern

Household food consumption pattern was ascertained by asking the member of the household responsible for food preparation and serving of food in the household (principal caregiver) food consumption questions concerning foods their household members had consumed during different meals. The meal pattern of sampled household in the area had majority (48%) of the households consuming breakfast, 32% consumes supper and 21% consuming lunch. The consumption of breakfast was to provide household members with instant energy required for a daily activity and that of supper was to regain the energy lost during the day. However, lunch had the least of respondents because it was skipped as way to cope with food insecurity. This is illustrated in figure 4.3.

Figure 4.3 Meals Pattern among Sampled Households in the Study Area

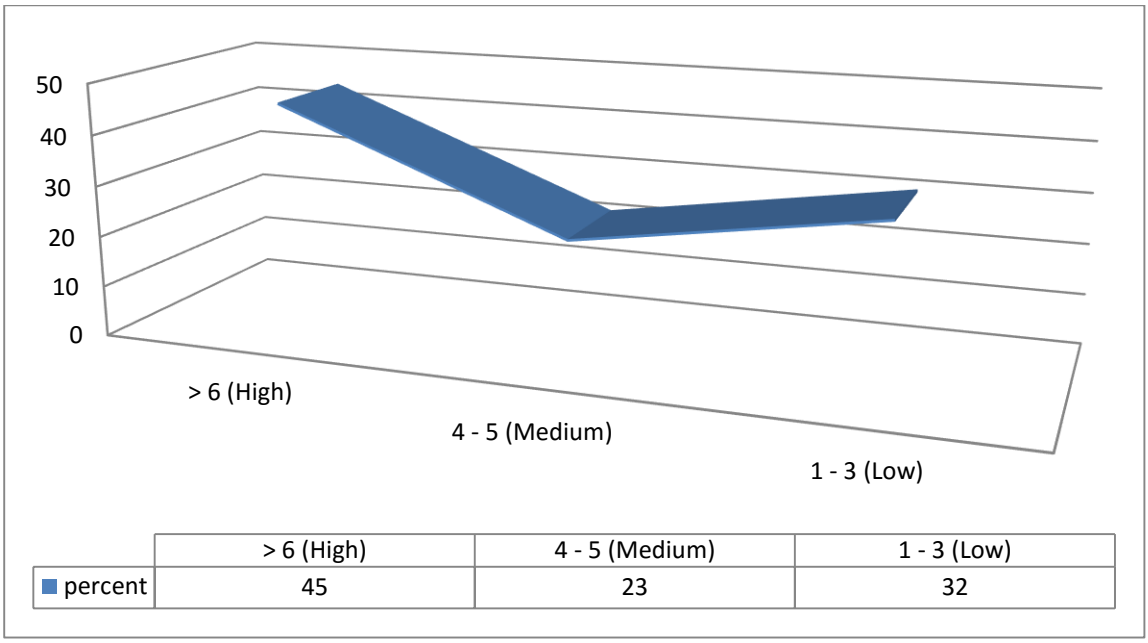


Source: Field Survey Data, 2015.

4.9.1Household Dietary Diversity (24HR) Recall

The results from the study showed that, households' dietary diversity score for the respondent in the area was relatively poor as 32% of the respondents consumed 1 -3 food groups and classified as low dietary diversity households, 23% of the respondent had consumed 4 and 5 food groups and classified as medium dietary diversity households and 45% of the households consumed 6 or more food groups and classified as high dietary diversity households. This could be attributed to the fact that majority of the respondent households in the study engage in dry season gardening which ensure the availability of both vegetable and income to the household for diversified household food. Figure 4.4 shows the dietary diversity of the households in the study area.

Figure 4.4 Dietary Diversity of Respondent Household in the Study Area



	> 6 (High)	4 - 5 (Medium)	1 - 3 (Low)
percent	45	23	32

Source: Field Survey Data, 2015.

4.9.2 Household Food Frequency (7 Days) of Respondents in the Study Area

The household food consumption is the quantitative aspect of food consumed within the household over a given period (usually 7 days). Respondent households were asked how many times a particular food group(s) had been consumed within the household in the previous 7 days based on the 8 food groups (IFPRI, 2008)

Table 4.12 Household Food Frequency (7 Days) of Respondents in the Study Area

Food Type	Household Total consumption (%)	Household Frequency of Consumption (%)							
		0	1	2	3	4	5	6	7
Maize	99.5	0.5	2.5	4	6.5	4.5	0.5	3.5	78
Vegetables (in soup)	74.5	25.5	0	3	0.5	43.5	4	4.5	19
Millet	64.5	35.5	3.5	1.5	47	4	2	3	3.5
Beans/Pulses	63.5	36.5	4	44.5	2.5	4	3.5	3	2
Bread/Wheat flour	54	46	0	2	42	1	2	4	5
Nuts	41.5	58.5	10.5	14	16.5	0.5	0	0	0
Sugar/Honey	24	76	2	5.5	13	0	0	0	3.5
Milk	23.5	76.5	4.5	11	6	1	0	0	1
Fruits(water melon, orange)	19.5	80.5	0.5	8	9.5	1	0.5	0	0
Rice	15	85	2	0	9	0	0	0	4
Yam/Tubers	10	90	3.5	2.5	4	0	0	0	0
Eggs	8.5	91.5	8.5	0	0	0	0	0	0
Red meat	7.5	92.5	1.5	3	3	0	0	0	0
White meat (poultry, fish)	6	94	4	1.5	0.5	0	0	0	0
Sorghum	5	95	2.5	1.5	0.5	0.5	0	0	0

Source: Field Survey Data, 2015.

From Table 4.12, the analysis revealed that majority (99.5%) of households consume maize due to its availability and as the major stable food (about 78% of the respondent household had consumed maize 7 times in seven (7) days) in the study area. Vegetables (74.5%), millet

(64.5%), pulses (63.5%) and bread/wheat flour (54%) was followed in order of consumption. Millet accounted for 64.5% mainly because it is also used for the preparation of local diets (porridge and Tou-zaafi) in the study area. Vegetables (okra, kenaf, tomato) were consumed along side with the main staple foods and these results in the high consumption of the food (vegetables) in the area. However, households' consumption of fruits was low since 19.5% of the respondents reported in the 7-day period of consuming fruits. The main fruit consumed in the study area was water melon.

4.9.3 Household Food Consumption Score (HFCS)

From Table 4.13 below the HFCS for the households' showed that overall; a majority (52%) of households had acceptable level of HFCS, while about 34% and 14% of households were food poor and borderline respectively in the study. This is as a result of the high consumption of cereals in the study area. The result of this study is similar to Icheria (2012), who found that 50.7% of smallholder farmers in Kenya had acceptable level of food consumption.

Table 4.13 Household Food Consumption Score in the study area

Household Category	**WMD (n = 100)**	**MMD (n = 100)**	**Pooled (n = 100)**
	Percent	Percent	Percent
Food Poor (0-28)	27	42	34
Borderline (28.5-42)	15	12	14
Acceptable (> 42)	58	46	52
Total	100	100	100

Source: Field survey Data, 2015.

4.10 Respondent Household Food Sources in the Study Area

Household member responsible for household food preparation and serving (principal caretaker) were asked for their households' food sources and the following information were given below in Table 4.14.

From Table, the results show that households' main sources of food for almost all the food consumed in the household was from the market. Maize, eggs and white meat (79.5%, 5.5% and 5.5% respectively) was mainly sourced from household own production. This implies that household sources of food for consumption in the study area had their supplies from the market rather than own production since households food production are not able to meet household food consumption needs as a result of low yields, soil infertility, inadequate storage facilities and the overreliance on rain.

This is clearly evident from the results of households' months of adequate food provisioning which showed that, households in the study area had enough food from August to December. This finding is divergent from Kaloi, *et al* (2005) and Gitu (2004) points of view that much of the food consumed in rural households in Kenya is obtained from the farm and very little is purchased from the market and, on the average 30% of the food consumed by rural households is purchased while 70% is derived from own farm production.

Table 4.14 Household Food Sources in the Study Area

Food Type	Household Total consumption (%)	Main Household Sources of Food Items (%)			
		Purchase	Own production	Barter	Gifts (Friends, relative and neighbours)
Maize/Cereal	99.5	20	79.5	0	0
Vegetables (in soup)	74.5	70.5	4	0	0
Millet	64.5	58.5	2.5	2	1.5
Beans/Pulses	63.5	60	3	0	0.5
Bread/Wheat flour	54	54	0	0	0
Nuts	41.5	40	1.5	0	0
Sugar/Honey	24	18	6	0	0
Milk	23.5	18.5	5.5	0	0
Fruits(water melon, orange)	19.5	19.5	0	0	0
Rice	15	12	3	0	0
Yam/Tubers	10	5	5	0	0
Eggs	8.5	3	5.5	0	0
Red meat	7.5	7.5	0	0	0
White meat (poultry, fish)	6	0.5	5.5	0	0
Sorghum	5	4.5	0.5	0	0

Source: Field survey Data, 2015.

4.11 Food Security Status of Among Smallholder Farm Households in Northern Region

4.11.1 Food Security Status According to Food Security Index

The food Security status among smallholder farm households in the two districts is presented in Table 4.15. The results from the study revealed that a majority 58% of the respondents were food secure and about 42% were food insecure. This clearly indicates that smallholder farm households in the two districts were food secure since about 58% of the respondent households were food secure. However, food secure and food insecure households in the WMD were 61% and 39% respectively whilst in the MMD food secure and food insecure households were 55% and 45% respectively. This result was however not in line with the finding of Wiggins and Keats, (2013) who reported that about 67% of the world's food insecure is found among smallholder farming household because smallholder farmers are net buyers of food than seller of same.

Table 4.15 Food Security Status among Smallholder Farm Households in WM and MM Districts in Northern Region by FSI

Item description	WMD		MMD		Pooled	
	Food Secure	Food Insecure	Food Secure	Food Insecure	Food Secure	Food Insecure
Percentage of households	61	39	55	45	58	42
Number of households	61	39	55	45	58	42
Mean (FSI)	2.08	0.63	1.92	0.72	2	0.67
SD	1.51	0.18	0.90	0.19	1.21	0.19
Food Insecurity gap/Surplus	0.42	0.28	0.27	0.38	0.35	0.33
Head Count	0.61	0.39	0.55	0.45	0.52	0.48

Source: Field survey Data, 2015.

The mean food security index for food secure households in the study area was found to be 2.00 and food insecure households were found to be 0.67. Analysis of mean food security index for WMD and MMD were found to be 2.08 and 1.92 for food secure households respectively and 0.63 and 0.72 respectively for food insecure households.

On the food insecurity gap, the study revealed an average of 0.33 for the food insecure households and 0.35 for the food secure households in the study area. This implies that food insecure households consumed 33% less of daily calorie requirement for an active working life where as the food secure households consumed 35% more than daily calorie requirement for an active working life. However, food secure households in the WMD consumed about 42% in excess of the daily calorie requirement whiles the food insecure households consumed 28% less than daily calorie requirement for an active working life. In the MMD, food secure households consumed 27% more than their daily calorie requirement whiles food insecure households consumed 38% short of the daily calorie requirement for an active working life.

4.11.2 Descriptive Statistics of Continuous Variables

Age disaggregated Food Security Status of Households by Food security Index (FSI)

Household age ranges from 25 – 90 years for total sample respondents and for both food secure and food insecure households. The mean age for total sample respondent was 53.3 years whiles for food secure and food insecure household heads the mean was 51.2 and 56.2 years respectively. The odd of household heads being a factor of food security is 0.99. Thus, food security status of older household heads is 99% higher than younger household heads. The possible explanation for this is that older household heads spends much of his/her time

on farm activities than younger household heads who spend much time in town and prefer urban life to rural life.

Table 4.16 Age-disaggregated Food Security Status of Household by FSI

Age Group	WMD				MMD				Pooled				Odd ratio
	Food Secure		Food Insecure		Food Secure		Food Insecure		Food Secure		Food Insecure		
	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%	
≤30	3	4.9	0	0	2	3.6	1	2.2	2	4.2	1	1.1	
31-40	5	8.2	4	10.3	2	3.6	0	0	3	5.9	2	5.1	
41-50	25	41	12	30.8	28	50.9	13	28.9	27	46	12	29.9	**0.99**
51-60	17	27.9	15	38.4	9	16.4	17	37.8	13	22.1	16	38.1	
>60	11	18	8	20.5	14	25.5	14	31.1	13	21.8	11	25.8	
Total	**61**	**100**	**39**	**100**	**55**	**100**	**45**	**100**	**58**	**100**	**42**	**100**	

Source: Field survey Data, 2015.

From the study, household heads of age greater than 50 years were more likely to be food insecure in both districts than households' heads of age less than 50. This accounted for 23 respondents out of 39 respondents of the food insecure households in the WMD and 31 respondents out of the 45 food insecure respondents in the MMD. Analysis on food secure households showed that 28 out of 61 of the respondents representing 45.9% in the food secure households in the WMD more than 50 years whiles 23 out of 55 respondents representing 41.5% in the food secure households in the MMD were aged more than 50 years. This means that household heads with age less than 50 years are more food secure and are better able to mitigate the effects of food insecurity since they fall within the economically active working group.

Household Size-based Food Security Status of Households by FSI

On average, the household size per adult equivalent for the sample was 8.6 members per household. However, the average household size for food secure and food insecure

households was 6.3 and 10.8 persons respectively. The odd of household size being a factor of food security is 0.59. This means that food security status of smaller households is 59% higher than larger households. The results showed that in the WMD and MMD, households with 1-5 members were more food secure than households with 6 or more members. This means that household with fewer members have a lower probability of being food insecure than households with larger members. The reverse is true. The finding confirms that of Beyene and Muche (2010) and Mequanent (2009) who found a negative relationship between household food security status and size. This is shown in the Table 4.17 below.

Table 4.17 Household Size-based Food Security Status of Households by FSI

Household Size	**WMD**				**MMD**				**Pooled**				**Odds ratio**
	Food Secure		Food Insecure		Food Secure		Food Insecure		Food Secure		Food Insecure		
	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%	
1-5	31	50.9	1	2.6	32	58.2	1	2.2	32	54.5	1	2.4	
6-10	24	39.3	20	51.2	18	32.7	28	62.2	21	36	24	56.7	0.59
11-15	6	9.8	14	35.9	5	9.5	14	31.1	5	9.5	14	33.5	
16-20	0	0	3	7.7	0	0	2	4.4	0	0	2	6.1	
>20	0	0	1	2.6	0	0	0	0	0	0	1	1.3	
Total	**61**	**100**	**39**	**100**	**55**	**100**	**45**	**100**	**58**	**100**	**42**	**100**	

Source: Field survey Data, 2015.

Farm Size-based Food Security Status of Household by FSI

The total land that is cultivated by all households in the study was 696 acres ranging from 1 to 7 acres per household. However, for the food secure households, the total land for cultivation was 402 acres with a mean of 3.48 acres per household whilst for the food insecure households the total area under cultivation was 294 acres with a mean farm size of 3.56 acres per household. The odd of household head farm size being a factor of food security is 1.07. This means that food security status of smaller farms is 107% higher than larger households with larger farms. From the study, a majority (81%) of the food secure households had farms of size greater than 2 acres. On the other hand, 83.4% of the food insecure households also had farms of size greater than 2 acres. This implies that, households that cultivate more than 2 acres are less food secure as compared to those farm households that cultivates less than 2 acres. This is shown in the Table 4.18 below.

Table 4.18 Farm Size-based Food Security Status of Household by FSI

Household Farm size	**WMD**				**MMD**				**Pooled**				**Odds ratio**
	Food Secure		Food Insecure		Food Secure		Food Insecure		Food Secure		Food Insecure		
	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%	
1-2	15	24.6	7	17.9	8	14.5	7	15.6	11	19	7	16.7	
3-4	43	70.5	29	74.3	47	85.5	38	84.4	45	77.6	33	78.6	1.07
5-6	3	4.9	2	5.2	0	0	0	0	2	3.4	1	2.4	
7-8	0	0	1	2.6	0	0	0	0	0	0	1	2.4	
Total	**61**	**100**	**39**	**100**	**55**	**100**	**45**	**100**	**58**	**100**	**42**	**100**	

Source: Field survey Data, 2015.

4.11.3 Descriptive Statistics of Discrete Variables

Sex-disaggregated Food Security Status of Household by FSI

From the study, it was revealed that about 81% of the total food insecure households were male headed and only about 19% were female headed. The odd of sex being a factor of food security is 3.00. This means that food security status of households headed by males is 300% higher than households headed by females. This could be that male respondents in the study area have better access to farm lands than their female counterparts who are normally engage in the productive role (child care, breastfeeding etc) and also households with high dependency ratio. Among the 39 food insecure households in the WMD, about 7.7% of them were female headed whiles about 92.3% of the respondents household were male headed. Conversely, in the MMD about 28.9% of the 45 food insecure households were female headed households and about 71.1% of the 45 food insecure households were male headed households. This finding affirm the findings of Gebre, (2012), oluyole *et al.*,(2009) and Amaza *et al* (2006) that male headed households are more food secure than female headed households. The results discussed above are presented in Table 4.19 below.

Table 4.19 Sex-disaggregated Food Security Status of Household by FSI

Sex	**WMD**				**MMD**				**Pooled**				**Odds ratio**
	Food Secure		Food Insecure		Food Secure		Food Insecure		Food Secure		Food Insecure		
	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%	
Male	49	80.3 %	36	92.3	45	81.8	32	71.1	47	81	34	81	3.00
Female	12	19.7	3	7.7	10	18.2	13	28.9	11	19	8	19	
Total	**61**	**100**	**39**	**100**	**55**	**100**	**45**	**100**	**58**	**100**	**42**	**100**	

Source: Field Survey Data, 2015.

Education-disaggregated Food Security Status of Household Head by FSI

The study revealed that, a majority (53%) of the household heads had no formal education which reflects high rate of illiteracy in the study area. Food insecurity was worse in illiterate headed household with 56.7% whiles about 43.3% of food insecure households headed by literates. For the food secure households, about 51.3% had educated household heads whiles 48.7% had uneducated household heads. The odd of level of education of household head being a factor of food security is 1.24. This means that food security status of literate households is 124% higher than illiterate households. This means that educated household heads are able to cope more than uneducated household heads in food insecure situations because they have great advantage of being employed. This is shown in table 4.20 below.

Table 4.20 Food Security Status of Household Head Based on Level of Education by FSI

Education	**WMD**				**MMD**				**Pooled**				**Odds ratio**
	Food Secure		Food Insecure		Food Secure		Food Insecure		Food Secure		Food Insecure		
	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%	
Educated	36	59%	19	48.7	24	43.6	17	37.8	30	51.3	18	43.3	1.24
Uneducated	25	41	20	51.3	31	56.4	28	62.2	28	48.7	24	56.7	
Total	**61**	**100**	**39**	**100**	**55**	**100**	**45**	**100**	**58**	**100**	**42**	**100**	

Source: Field Survey Data, 2015.

At the districts level, WMD recorded 48.7% of the food insecure households having heads with some level of formal education and 51.3% of the household heads had no formal education. In the MMD 37.8% of the food insecure households had heads with formal

education and 62.2% of the household heads had no formal education. On the other hand, 59% of the food secure households in WMD were educated with the uneducated recording 41%. However, the study further revealed a high figure of 56.4% of the food secure household heads in the MMD of not being educated and about 43.6% of the household heads were educated.

Marital Status Based Food Security Status of Households by FSI

The marital status of household heads was categorized as married or otherwise (not married). From Table 4.21, married household head were about 87.5% whiles the remaining 12.5% were not married. The odd of marital status being a factor of food security is 0.19. This means that food security status of unmarried household heads is 19% higher than married household heads. The results shows that married household heads are more likely to be food insecure as opposed to unmarried household heads since about 86% of married household heads were food insecure while about 14% of unmarried household heads were food insecure. This implies that married household heads in the study area are more food insecure than unmarried household and this could be due to the fact that married household heads have more mouths to feed than for labour and thus exerting more pressure on households food consumption and vice versa.

Table 4.21 Marital Status and Food Security Status According to FSI

Marital Status	WMD				MMD				Pooled				Odds ratio
	Food Secure		Food Insecure		Food Secure		Food Insecure		Food Secure		Food Insecure		
	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%	
Married	55	90.2	35	89.7	45	81.8	40	88.9	50	86	38	89.3	0.19
Unmarried	6	9.8	4	10.3	10	18.2	5	11.1	8	14	4	10.7	
Total	**61**	**100**	**39**	**100**	**55**	**100**	**45**	**100**	**58**	**100**	**42**	**100**	

Source: Field Survey Data, 2015.

4.11.4 Level of food security among farm households by FSI

The results on the level of food security among farm households by the FSI approach is presented in Table 4.22.

The level of food security reveals that a majority (58%) households' were food secure and the remaining (42%) of the sampled households were food insecure with different levels of severity. Out of the 42 food insecure household, 19.05% were classified as mildly food insecure, 16.67% as moderately food insecure and about 64.29% as severely food insecure respectively. However, at the district level 7.69% were classified as mildly food insecure, 17.95% as moderately food insecure and 74.36% as severely food insecure at the WMD whilst 28.89% of the respondents were classified as mildly food insecure, 17.78% as moderately food insecure and 53.33% as severely food severely food insecure at the MMD respectively.

Table 4.22 Level of Food Insecurity among Smallholder Farm Households by FSI

Food Status	Calorie consumption per person per day	WMD		MMD		Pooled	
		Freq.	%	Freq.	%	Freq.	%
Food Secure	Above 2450	61	100	55	100	58	100
Mildly Food Insecure	Between 2150- 2450	3	7.69	13	28.89	8	19.05
Moderately Food Insecure	Between 1850 -2150	7	17.95	8	17.78	7	16.67
Severely Food Insecure	Below 1850	29	74.36	24	53.33	27	64.29
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**

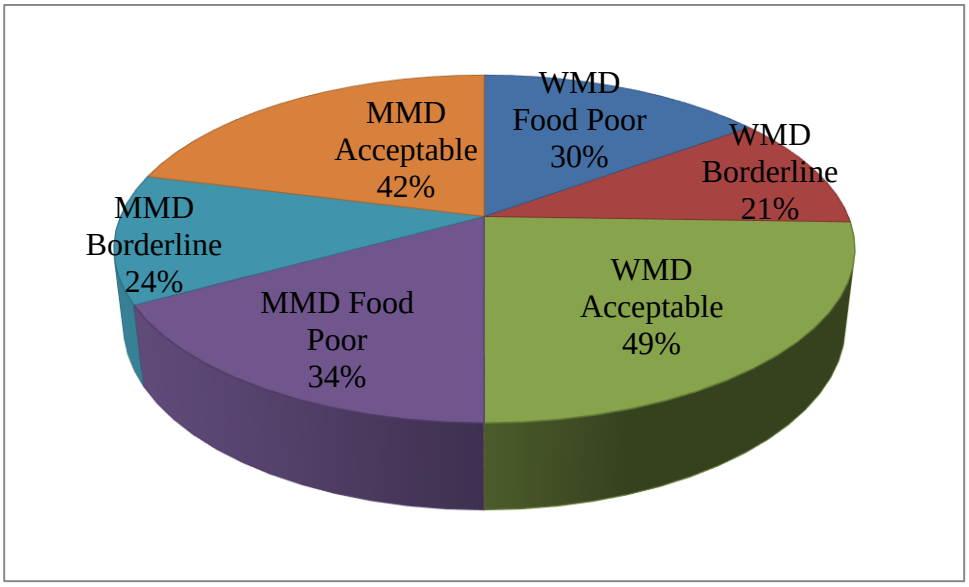
Source: Field Survey Data, 2015.

4.12 Household Food Security Status by Household Dietary Diversity Score (HDDS)

Household food security status according to household dietary diversity score shows that about 50% of the households had high HDDS of 6 and above food groups, 30% of the households had low HDDS between 1-3 food groups and 21% had medium HDDS between 4-5 food groups in the previous 24 hours with a mean food groups of 2 in the WMD. In the MMD, about 42% of sampled households had high HDDS of 6 and above food groups, 24% had medium HDDS of 4-5 food groups and 34% had low HDDS of 1-3 food groups in the previous 24 hours with a mean food groups of 2. The food security status of the household by this index in the WMD was then 21% as food poor, 30% as borderline and 49% as acceptable whiles in the MMD 34% were food poor, 24% as borderline and 42% were acceptable. Overall, about 46% of the household had high HDDS of 6 and above food groups, 22% had

medium HDDS between 4-5 food groups and 32% had low HDDS of between 1-3 food groups. This implies that households food status were classified as 46% were acceptable, 22% borderline and 32% were food poor in the study area. This is clearly illustrated in figure 4.5 below

Figure 4.5 Household Food Security Status by HDDS



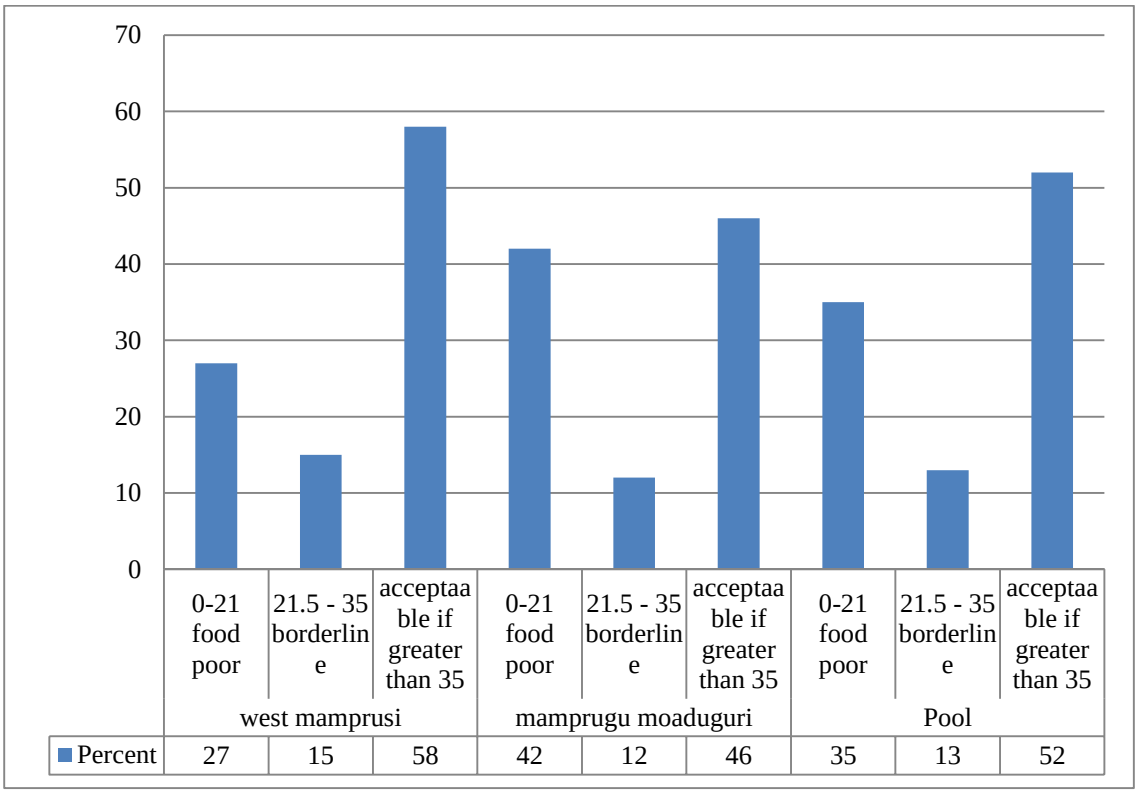
Source: Field Survey Data, 2015.

4.13 Household Food Security Status by Household Food Consumption Score (HFCS)

Analysis of the household food consumption score shows that majority (58%) of households in the WMD had acceptable HFCS of more than 35, 27% had poor HFCS and only 15% had borderline HFCS in the area. Household food security status according to the HFCS was then being 27% food poor, 15% borderline and 58% acceptable. In the MMD, 46% of the households had acceptable HFCS of more than 35, 42% of the household had poor HFCS and only 12% of the household had borderline. This translates to 46% acceptable, 42% food poor and 12% borderline in terms of households' food security status. Generally, 52% of the household had acceptable HFCS above 35, 35% of the households had poor HFCS and 13% had borderline. This implies that 52% of the households' were acceptable, 35% were food

poor and 13% were on borderline in terms of household food security status in the study area. This is shown in figure 4.6 below.

Figure 4.6 Household Food Security Status by HFCS



Source: Field Survey Data, 2015.

4.14 HDDS and HFCS

From Table 4.23, households that had low HDDS and poor HFCS were 26, 17 of the households' had low HDDS and borderline. The total food insecure households' in the study area was then 43 (sum of 26 and 17) which is 21.5% of the respondent households classified as food poor. Households with low HDDS and acceptable HFCS were 21, households with medium HDDS and poor HFCS were 40, and households with medium and borderline were 5. These frequencies were added together to get households vulnerable to food insecurity (borderline). Therefore, households' at borderline in the study area was then 33%. Households that had high HDDS and poor HFCS were 3, households that had high HDDS and borderline HFCS were 5, and 83 households had high HDDS and acceptable HFCS but 0

household had neither medium HDDS nor acceptable HFCS in the study area. Therefore, 45.5% of the households in the study area were classified as food secure.

Table 4.23 Level of Food Security by HDDS and HFCS

Percent of Household			Categories of HFCS			
			Poor = 0 - 21	Borderline = 21.5 - 35	Acceptable = > 35	Total
Categories of HDDS	Low = ≤ 3	Frequency	26.0	17	21	64
		HDDS	40.6	26.6	32.8	100
		HFCS	37.7	63	20.2	32
	Medium = 4 & 5	Frequency	40.0	5	0	45
		HDDS	88.9	11.1	0	100
		HFCS	58.0	18.5	0	32
	High = ≥ 6	Frequency	3.0	5	83	91
		HDDS	3.3	5.5	91.2	100
		HFCS	4.3	18.5	79.8	45.5
	Total	**Frequency**	**69**	**27**	**104**	**200**
		HDDS	**34.5**	**13.5**	**52**	**100**
		HFCS	**100**	**100**	**100**	**100**

Source: Field Survey Data, 2015.

4.15 Factors Influencing Household's Perceived Food Security Status

The dependent variable (food security) is binary. Households were asked to state whether their households were food secure based on the number of months of household food provisioning for all household members and dietary diversity which is measured by the composition of household daily meals (number of food groups consumed in household). The binary logit model was used to determine factors influencing household's perceived food security status, socioeconomic characteristics of households were regressed on their food security indices. The results are presented in Table 4.24.

The result from the binary logistic regression model showed 6 variables of the 9 factors to have significantly influence household's perceived food security status in the study area. These variables include locality, household size per adult equivalent, and sex of household head, marital status of household head, household head education and household head access to employment. With the exception of household size per adult equivalent and marital status of household head which showed negative relationship with food security all other variables had positive relationship with household food security status. The results of the study however met the a priori expectations of the variables influence on households' food security status.

Table 4.24 Marginal Effects of Factors Influencing Household's Perceived Food Security Status

Variables	Coefficient	Standard Error	p-values	Marginal effect (dy/dx)
Locality	0.235353	0.09564	0.014**	0.422806
Household size_AE	-0.1225476	0.01974	0.000***	-0.083866
Dependency ratio	0.0161316	0.14079	0.909	0.292068
Sex of household head	0.266141	0.14846	0.073*	0.557109
Age of household head	-0.0020288	0.00561	0.718	-0.008972
Marital status of household head	-0.2979407	0.1081	0.006**	-0.086069
Household head education	0.0495171	0.09824	0.614	0.242073
Access to employment	0.4475219	0.10135	0.000***	0.646169
Farm size	**0.0148115**	**0.06504**	**0.820**	**0.142282**

*** 1% significance ** 5% significance * 10% significance Number of Obs = 200

Wald Chi2 (12) = 110.36 Prob> Chi2 = 0.0000 Pseudo R^2 = 0.4055

Log pseudo likelihood = -80.880294

Locality

This variable has positive influence on household food security status at 10% level of significance. This implies that urban households have greater probability of being food secure. This was expected because urban household heads are better placed to engage in other income generating activities than rural household heads hence increased urban households' income levels and thus increase urban households' access to food holding all things constant. The value of the marginal effect implies that if urban household is increased by 1 the probability of the household being food secure will be increased by 0.42 holding all other factors constant.

Sex of Household Head

Sex of household head was found to have positive relationship with food security status at 10% significant level. This indicates that male headed household are more food secure than female headed household head. This could be due to the fact that males are traditionally regarded as heads of families and as such in northern region older male household member is usually regarded as household head as suppose to women where there are often regarded as house wives whose role is to carry out house-keep responsibilities such as cooking, serving of food, breastfeeding. The value of the marginal effect means that an increase in male headed household increases the probability of the household being food secure by 0.56holding all other factors constant.

Access to Employment

This variable affects household food security status. The variable had the expected sign and significant at 1% significant level. The positive relation indicates that household heads who have access to employment are more likely to be food secure than household heads without

access. This means that households access to employment opportunities help household heads to diversify and increased amount of income received by households. The marginal effect shows that households with access to employment increase their probability of being food secure by 0.65 when all other factors are held constant. This result confirms the finding of Gebre, (2012) which indicates that households who have access to employment are less likely food insecure than no access

Household Size

Household size had a negative and significant effect on household food security at the 1% significant level. This implies that the probability of household being food secure decreases with increase in household size. The marginal effect shows that an increase in household size decreases the probability of the household to be food secure by 0.084 holding all things constant. This means that larger household size tends to be food insecure compared to smaller family size in the study area. This is because larger family size has more mouths feed than they are for labour hence the more likely they are to be food insecure compared to smaller family size. This fully agrees with my a prior expectation. This result is in conformity with the finding of Frehiwot, (2007), Abebaw, (2003), Sikwela, (2008) and Gebre, (2012).

Marital Status of Household Head

The study showed a negative relationship between marital status and household food security status in the study area. This means that households headed by unmarried people are more likely to be food secure than those headed by married people. The marginal effect implies that married household heads food security status decreases by 0.086 holding all things constant. This may be due to the fact that married household heads may have more responsibilities in food provisioning to the household than households whose heads are not married. This is in line with the finding of Robert *et al* (2013) but however contrary to the finding of Haliu *et al* (2007) in Ethiopia and Kaloi *et al* (2005) in Uganda.

4.16 Food Insecurity Coping Strategies Adopted By Small Holder Farming Households in the Study Area

The food insecurity coping strategies that were adopted by the respondent households in the study area to mitigate the effects of food insecurity are presented in the table 4.25.

Table 4.25 Food Insecurity Coping Strategies Adopted in the Study Area

Food Insecurity Coping Strategy	WMD		MMD		Pooled	
	Mean Rank	Rank	Mean Rank	Rank	Mean Rank	Rank
Reduce the expenditure of the household to least to buy food	1.98	1st	1.89	1st	1.94	1st
Consume low quality and cheaper food	3.00	2nd	6.81	7th	4.91	4th
Consume less food within the meals	4.33	3rd	2.73	3rd	3.53	2nd
Reduce number of daily meals	4.71	4th	2.66	2nd	3.69	3rd
Buy food by debt	5.52	5th	4.97	5th	5.25	5th
Borrow food from relatives, friends and neighbours	5.85	6th	4.87	4th	5.36	6th
Sell some food items to buy other food items	6.21	7th	7.91	9th	7.06	8th
Collect wild food	6.57	8th	5.84	6th	6.21	7th
Reduce adults' food consumption to secure the need of children for food	7.07	9th	7.44	8th	7.26	9th
Send some members of the household to live with relatives or with other families	10.34	10th	10.78	11th	10.56	11th
Travel to search for jobs	10.48	11th	10.1	10th	10.29	10th
Kendall's W	0.64		0.79		0.72	
X^2	638.38		792.18		715.28	
Df	10		10		10	
Significance	**0.000**		**0.000**		**0.000**	

Source: Field Survey Data, 2015.

The result revealed the most widely used strategies in the study area in order of importance are reduce the expenditure of the household to least to buy food, consume less food within

meals, reduce number of daily meals and consume low quality and cheaper food with about 72% level of agreement among the respondent household heads. However, in the WMD about 64% of the respondents adopted reducing household expenditure to least to buy food, consume low quality and cheaper food, consume less food within meals and reduce number of daily meals whiles in the MMD about 79% of the respondents adopted reducing household expenditure to least to buy food, reduce number of daily meals, consume less food within meals and borrow food from relatives, friends and neighbours. This implies that when household are faced with food shortage, the immediate strategy that these households would adopt by the household heads in the study area is to reduce the expenditure of the household to least to buy food. As the food insecurity situation becomes severer other strategies that are sever would be adopted by households such as consume less food within the meals, reduce number of daily meals and consume low quality and cheaper food.

Household heads in the study area also adopted other strategies with great difficulties. Such strategies adopted by the household include buy food in debt and borrow food from relatives, friends and neighbours. However, household heads finds it convenient to borrow food from relatives than friends or neighbours for fear of been humiliated in the unlikely event there is misunderstanding between the two persons. Even though, one would have expected households to send some members of the household to live with relatives or other families as a way of fostering family ties and relations, it was one of the least adopted strategies in the study area.

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter highlights the summary of findings, conclusions, and recommendations of the study as well as suggestions for further research.

5.2 Summary

The study seeks to assess the food security status of smallholder farm households in the WMD and MMD of the Northern Region of Ghana. A multistage sampling technique was used to select the respondents that were interviewed. In all 200 smallholders farm households were interviewed. The households were selected from six communities in two districts. Food consumption data of 1786 individuals in 200 households were used for the analysis.

The study revealed that agriculture remains the major income generating activity engaged in by households in the study area. However, other income generating activities in the study area include private business, regular wage jobs, remittance from relatives and friends, property rent and others (casual work). Private business accounted about 15% to households' income, for regular wage jobs accounted for 8%, remittance 5% and only 1.5% from other sources (casual work).

The major source of household food items was the market. Maize, eggs and white meat was mostly sourced from household own production. Household food status according to COC, HDDS and HFCS in the study area were slightly food secure, relatively high and acceptable

respectively. The classification of household food status by combing HDDS and HFCS showed that majority of households' were food insecure in the study area.

Factors that significantly influence household's perceived food security status in the area was locality, household size, sex, marital status, education and access to employment. Household size and marital status showed a negative relationship with food security whiles all other variables had positive relationship with household food security status.

The major coping strategies that are adopted by households' in the study area was to reduce the expenditure on the household to minimum level to buy food, consume less food within meals, reduce number of daily meals and consume low quality and cheaper food. Other strategies were adopted though with great difficulties. Such strategies adopted by the household include the buying of food in credit and the borrowing of food from relatives, friends and neighbours.

5.3 Conclusions

The study reveals that household food consumption pattern were characterized by relatively high HDDS but majority of the household had acceptable HFCS.

The majority of the smallholder farm households were found to be food secure and acceptable HFCS using the COC and HFCS methods whiles of the households were classified as acceptable using the HDDS approach. However, by combing the HDDS and HFCS indicators, the findings showed that a majority of the households in the study area can be classified as food insecure.

Locality, sex, education and access to employment had positive relationship to household food security whiles household size and marital status had negative relationship to food security status of households.

Reducing the expenditure on the household to the barest minimum to buy food, consuming less food within meals, reducing number of meals consumed per day and consuming low quality and cheaper food products were some of the coping strategies adopted by households in the study area to mitigate the effects of food insecurity among households in the study area.

5.4 Recommendations

The study provides the following policy recommendations.

i. Strategies focusing on increasing food security and that promotes the utilization of a variety of locally available foods are needed in rural communities.

ii. The government, NGO's and development partners in food security should launch education programmes on nutrition especially on the different food groups and dietary diversification practices among the smallholder farm households. This will help households re-orient their daily diets towards the consumption of a more diversified diet.

iii. Government should give adequate priority and attention to policy measures directed towards educating and provision of better family planning. This will help control household size for healthy life and general welfare of household members.

iv. Since the food insecurity coping strategies employed by the farm households have short term impact, there is the need to encourage farm household to explore ways to increase the volume of food production as well as improve access to income generating activities that are more sustainable.

v. The research was conducted for the WM and MM districts in the northern region of Ghana; hence the results may not be representative of the food security status of farm households across the country. Therefore, extending this study to cover other regions of the country is a useful avenue for future research. This could project the national status of food security and provide a basis for addressing the problem of food insecurity nationally.

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APPENDICES

Appendix A

University for Development Studies

M. Phil Agricultural Economics

Questionnaire on Assessing the Food Security Status of Smallholder Farm Households in the Northern Region of Ghana

Enumerator: please conduct the interview with the head of this household or the spouse of the household head.

Good day, I am…….. conducting my research on Assessing the Food Security Status of Smallholder Farm Households in the Northern Region of Ghana. This is solely for academic purpose and in partial fulfillment of the requirements for the award of MPhiL. Agricultural Economics. The outcome of the study would contribute to the already existing literature on Food Security in the region and the nation as a whole. All information obtained would be treated confidentially. I hereby seek your consent to administer this questionnaire on your household which will take possibly 45mins of your time. Are you willing to participate in the survey?

Thank you.

Identifying Information

PART ONE: HOUSEHOLD COMPOSITION

1.1 Household ID..... **1.2** Date of interview (dd/mm/yy).....

1.3 Enumerator Name..... **1.4** Community.....

1.5 District..... **1.6** Location: Rural/Urban.....

1.7 Household size: Male..... Female..... Total.....

Part One continued

1.8	ID		1	2	3	4	5	6	7	8	9	10	11
1.9	Sex	(1=Male/2=Female)											
1.10	Age												
1.11	Marital status	1.Single 2.Married 3.Divorced 4.Widow 5.Separated											
1.12	Educational level of household members	1-Illiterate, 2-Read and write, 3-Primary School, 4-Intermediate School, 5-Secondary School, 6- Diploma after secondary School, 7-University Degree, 8-Post Graduate Study, 9-Others											

1.13	HH members 4-16 years	Working status	1- Student and working part time 2- Only student 3- Working and left school, 4- Not working and left school											
		Give two main reasons for absenteeism	1. Illness; 2. Care for younger sibling; 3. Can't afford costs; 4. Work to earn money; 5. Unpaid HH or farm work; 6. Care for ill person; 7. School too far; 8. Security; 9. Other___											
1.14	HH members >15 years	Working status	1-Employed; 2-Pensioner and working; 3-Pensioner and not working; 3-Unemployed and looking for a job; 4- Unemployed and not looking for a job											
1.15	HH members >15 years	job	1-Farming (Self Employed); 2-Agricultural labour; 3-Skilled labour; 4-Non-Skilled labour; 5-Public servant; 6-Self-employed (Non-Farm); 7-Other (Indicate)											
1.16	Number of working hours in the previous week (the week before the survey)													
1.17	For employed	Did you change the place of your work during the last 12 months	Yes No											
		Did you change job during the last 12 months	Yes No											
1.18	For non-employed	Did you have a job during the last 12 months	Yes No											
1.19	Average number of meals / day for HH	1-Three & more 2-Two 3-One 4-I don't												

	members (>2 years old)	know											
1.20	Chronic illness	1-Yes 2-No 3-I don't know											
1.21	Type of the illness	1-Hypertension, 2-daibetus, 3-gastric ulcer, 4-anemia, 5-cardiac problems, 6-kidney problems, 7-hepatic problems, 8-joint problems, 9-respiratory problems , 10-others											
1.22	Diarrhoea problems during the past 2 weeks	1-Yes 2-No 3-I don't know											
1.23	Fever in the past 2 weeks	1-Yes 2-No 3-I don't know											
1.24	Any cough in the past 2 weeks	1-Yes 2-No 3-I don't know											
1.25	Disability status	1-Disable 2-non disable											

1.26. Which of the following housing types best describes the type of dwelling this household occupies? (a) Traditional Huts (b) Compound House (c) Semi-modern House (d) Modern House

1.27. Which of the following best describes the **household structure?** (a) Female Centered *(*No husband/ male partner in household, may include relatives, children, friends) (b) Male Centered (No wife/ female partner in household, may include relatives, children, friends) (c) Nuclear (Husband/ male partner and wife/ female partner with or without children) (d) Extended (Husband/ male partner and wife/ female partner and children and relatives)

PART TWO: LIVING POVERTY INDEX

2.0 Over the past year, how often, if ever, have you or your family (household) gone without: *(Read each question aloud and circle the most appropriate response. Circle only ONE answer for EACH ROW).*						
Conditions	Never	Just Once or	Several Times	Many Times	Always	Don't Know

		Twice				
2.1 Enough food to eat?						
2.2 Enough clean water for home use?						
2.3 Medicine or medical treatment?						
2.4 Electricity in your home?						
2.5 Enough fuel to cook your food?						
2.6 A cash income?						

PART THREE: FOOD INSECURITY

HOUSEHOLD FOOD INSECURITY ACCESS SCALE (HFIAS) *(READ the list and categories and circle only **ONE** answer for each question)*				
Household Food Insecurity Access Scale (HFIAS) for last four weeks	No (Answer to question is 'No')	Rarely (once or twice)	Sometimes (3 to 10 times)	**Often (more than 10 times)**
a. In the past three months, did you worry that your household would not have enough food?				
b. In the past three months were you or any household member not able to eat the kinds of foods you preferred because of a lack of resources?				
c. In the past three months did you or any household member have to eat a limited variety of foods due to a lack of resources?				
d. In the past three months, 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?				
e. In the past three months, did you or any household member have to eat a smaller meal than you felt you needed because there was not enough food?				
f. In the past three months, did				

you or any household member have to eat fewer meals in a day because there was not enough food?				
g. In the past three months, was there ever no food to eat of any kind in your household because of lack of resources to get food?				
h. In the past three months, did you or any household member go to sleep at night hungry because there was not enough food?				
i. In the past three months, did you or any household member go a whole day and night without eating anything because there was not enough food?				
j. In the past three months, did you or any household member eat a cooked meal less than once a day?				

PART FOUR: FOOD CONSUMPTION

4.1 Now I would like to ask you about the types of foods that you or anyone else in your household ate yesterday during the day and at night.

(Read the list of foods. Circle yes in the box if anyone in the household ate the food in question, circle no if no one in the household ate the food)

Code	Food item	Yes	No	If Yes, how many times during Last 24 Hours	If Yes, many DAYS eaten in past week (0-7 days)	Sources of food (see codes below)
1	Bread/wheat flour					
2	Rice					
3	Pasta/macaroni					
4	Other grains/cereals					
5	Potatoes					

6	Beans / Pulses					
7	Red meat (sheep/goat/beef)					
8	White meat (poultry/fish)					
9	Eggs					
10	Milk					
11	Yoghurt, Cheese					
12	Vegetables (tomatoes, etc)					
13	Fruits (Banana, Apple, Orange…)					
14	Soft drinks (Coke, Fanta…..)					
15	Nuts					
16	Others					

Food sources code
1-Purchase
2-Own production
3-Traded good or service
4-Borrowed
5-Receive as gifts
6-Household reserve
7-Others

PART FIVE: MONTHS OF ADEQUATE HOUSEHOLD PROVISIONING (MAHP)

Now I would like to ask you about your household's food supply during different months of the year. When responding to these questions please think back over the last 12 months.	
(a) In the past 12 months, were there months in which you did not have enough food to meet your family's needs? *(READ the question and circle the appropriate answer)*	1- Yes 2- NO If No, Skip Question (b) If Yes, continue with question (b)
(b) If yes, which were the months (in the past 12 months) in which you did not have enough food to meet your family's needs?	

PART SIX: EXPERIENCE OF FOOD PRICE CHANGES

6.0 Now I would like to ask you about your household's experience of food prices over the past six months.

6.1 Over the past six months have you or your household gone without certain types of food because of the price of food (it is unaffordable)?

(a) Yes (b) No

6.2 If Yes, how often? (a) About once a month (b) About once a week (c) More than once a week but less than every day of the week (d) Every day (e) Don't know

6.3 Which type(s) of foods have you or your household gone without because of the price? Read the lists of foods in the box below and tick the food types.

Types of food	Tick
a. Any [INSERT ANY LOCAL FOODS], bread, rice noodles, biscuits or any other foods made from millet, sorghum, maize, rice, wheat, or [INSERT ANY OTHER LOCALLY AVAILABLE GRAIN]?	
b. Any potatoes, yams, manioc, cassava or any other foods made from roots or tubers?	
c. Any vegetables?	
d. Any fruits?	
e. Any beef, pork, lamb, goat, rabbit, wild game, chicken, duck, other birds, liver, kidney, heart, or other organ meats?	
f. Any eggs?	
g. Any fresh or dried fish or shellfish?	
h. Any foods made from beans, peas, lentils, or nuts?	
i. Any cheese, yoghurt, milk or other milk products?	
j. Any foods made with oil, fat, or butter?	
k. Any sugar or honey?	
l. Any other foods, such as condiments, coffee, tea?	

6.4 Where does this household normally obtain its food? (a) Super market (b) small shop/restaurant/takeaway (c) informal market/ street food (d) Grow it (e) Food aid (f) Remittance (food) (g) Shared meal with neighbours and/or other households (h) Food provided by neighbours and/or other households (i) Community food kitchen (j) Borrow food from others (k) Don't know

PART SEVEN: AGRICULTURE & ANIMAL ASSETS

7.1 What kind of food did you or your household produce during the past season? (a) Any grain crops (b) Any root and tuber crops (c) Any Vegetables (d) Any fruits (e) Other food (including meat, egg)

7.2 How important do you feel the food that you or your household produce is to this household? (a) Not important at all (b) Somewhat important (c) Important (d) Very important (e) Critical to our survival (f) Don't know

7.3 If you look at the food requirements of this households over a year, for how many months of the year are you normally able to feed your household ONLY through food that your household produce?

7.4 How do people in this household use the food which you produce? (a) Eat it (b) Sell it (c) Give it to friends/relatives (d) Feed it to livestock/poultry (e) Don't know

7.5 What source(s) of fertilizer did you or any member of your household use for your crops? (a) Organic manure from own livestock (b) Buy organic manure from others (c) Inorganic fertilizer (d) Did not use any

7.8 How many animals do your household own? Cattle |__|__| Sheep |__|__| Goat |__|__| Fowls

|__|__ Guinea Fowls||__|__| Ducks__|__ Donkey |__|__|

7.9 Do you have a household vegetable plot /garden? YES NO

7.10 In all, how much land does your household have access to for farming (acres)?

|__|__|,|__|__|

PART EIGHT: HOUSEHOLD ASSETS

8.1 Does your household currently own any of the following household assets?

Private Car ☐ Taxi ☐ Refrigerators ☐ Tractor ☐ Motor king ☐

Computer ☐ TV/radio ☐ Satellite dish ☐ Ceiling/stand fan ☐

Donkey cart ☐ Stove☐ Bullock plough ☐

PART NINE: INCOME AND INCOME SOURCES

Income

9.1 What is your estimate of total household income for: Last month in ID? _____

Sources of income

9.2 What is your household's main income source? |__|__| Amount |__|__||__|__| Percentage of Total |__|__|

9.3 What is your second most important income source? |__|__| Amount |__|__||__|__| Percentage of Total |__|__|

9.4 What is your third most important income source? |__|__| Amount |__|__||__|__| Percentage of Total |__|__|

Codes for Income source
1-Regular wage
2-Rent(home/land/other)
3-Private business
4-Kinship/gift/charity
5-Remittance
6-other(Please indicate)

PART TEN: COPING STRATEGIES INDEX (CSI)

10.1

Consumption Coping Strategy Index (CSI)							
	Relative Frequency						
In the past three months, if there have been times when you did not have enough food or money to buy food, how often has your household had to:	**All the time Every day**	Pretty often 3-6 */week	Once a while 1-2 */week	Hardly at all <1 */week	Never 0*/week	Severity Ranking	Score
1. Turn to the consumption of low quality and cheaper food stuff (Shift to less preferred food).							
2. Borrow food from relatives, friends							

and neighbours.							
3. Buy food by debt.							
4. Sell some food ration items to buy other food items							
5. Consume less food within the meals.							
6. Reduce number of daily meals.							
7. Reduce adults' food consumption to secure the need of children for food.							
8. Reduce the expenditure of the household to the least to by food							
9. Send some members of the household to live with relatives or with other families.							
10. Travel to search for jobs.							
11. Collect wild food							
12. Others (Indicate) ---------- ----------							
TOTAL							

PART ELEVEN: HOUSEHOLD EXPENDITURE

11.1: What is your estimate of total household expenditure for the last month in (Ghc)?

11.2: Household Expenditure Activities

Expenditure activities	**Total expenditure (Ghc)**	**In-kind (value in Ghc)**
IN PAST WEEK (*if nothing, use '0')*		
- Bread		
– Food and Groceries		
– Tobacco		
– Food & drinks (consumed outside the home)		
– Tea		
-Other food (including fruits and vegetables		
– Tomatoes		
– Potatoes, pasta		
– Vegetable oil, animal fat		
– White Meat(sheep, goat, cattle)		
– Red Meat(poultry)		
– Eggs, yoghurt, milk		
– Beans / lentils		
– Sugar		
– Rice		
– Soft drinks		
– Alcoholics		

IN PAST MONTH/YEAR (*if nothing, use '0')*		
– Medical expenses/Health care		
– Cooking fuel/ Gas		
– Medical items and drugs		
– Housing/Rent		
– Cooking fuel/ Kerosene		
– Electricity		
– Fines or debts		
– Education/school fees		
– Clothing/shoes		
– Transportation		
– Equipments/Tools/Seeds/…..etc.		
– Celebrations/Social events		
– Educational and entertainment events		
– Maintenance of household assets		
– Purchase of household furniture		
– Purchase of Silver and Gold		
– Fragrance, Manicure…..		
– Other/miscellaneous		

11.3 How would you say the economic conditions of your household are today compared to a year ago? (a) Much worse (b) Worse (c) The same (d) Better (e) Much better

Thank you very much for spending this time talking with me. The information you have provided is very valuable and I appreciate you sharing it with me. Just to reiterate, no one can link what you have said to you or this household, so your confidentiality is totally guaranteed. Goodbye.

Appendix B

Odds ratio

FOOD_STA	Odds Ratio	Std. Err.	z	P>z
LOC	2.782674	1.205914	2.36	0.018
HHS_AE	.5923516	.0498352	-6.22	0.000
Dep_Rati	1.071363	.6452471	0.11	0.909
SOHM	3.001439	1.878338	1.76	0.079
AOHM	.9913682	.0237824	-0.36	0.718
MSOHHM	.1945637	.1648773	-1.93	0.053
HH_EDUC	1.236262	.5230026	0.50	0.616
ACC_EMPO	7.096078	3.564634	3.90	0.000
FARMSIZE	1.065336	.2963172	0.23	0.820

Experience

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
experience	100	15.5800	8.09187	.80919

One-Sample Test

	Test Value = 15.01					
	T	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
experience	.704	99	.483	.57000	-1.0356	2.1756

Farm Size

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
farm size	100	3.5750	.71554	.07155

One-Sample Test

	Test Value = 3.39					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
farm size	**2.585**	**99**	**.011**	**.18500**	**.0430**	**.3270**

Household size

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
Household size	100	8.1160	3.61114	.36111

One-Sample Test

	Test Value = 8.19					
	t	Df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Household size	**-.205**	**99**	**.838**	**-.07400**	**-.7905**	**.6425**