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LAND `OWNERSHIP ARRANGEMENTS, FOOD SECURITY AND FOOD CONSUMPTION PATTERNS IN THE AGRO-ECOLOGICAL ZONES OF RURAL GHANA

BY

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DECLARATION

I, LOIS ANTWI-BOADI, hereby declare that, with the exception of literature duly acknowledged by means of referencing, this dissertation is the result of my own original research undertaken with the guidance of my supervisor and that this dissertation, neither in part nor in whole has been presented elsewhere for the award of another degree. I, therefore, accept responsibility for any errors found in this work.

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ABSTRACT

Food insecurity remains a global health challenge especially for poor areas in developing countries. One of the ways through which access to food can be boosted for the rural dwellers is through access to land, as agriculture is the leading source of income for agricultural-based economies. Little attention, however, has been given to how land ownership arrangements of rural dwellers can affect their food security in Ghana. The study therefore examined the relationship between land ownership arrangements (owned, rented, or rent-free lands) and food security using household dietary diversity as a measure for the latter. Based on previous studies, dietary diversity was measured by categorizing households on the basis of a composite index score on unique food groups consumed into low and high dietary diversity. Bivariate and multivariate analyses were then used to examine the effects of dietary diversity on land ownership arrangements, as well as other socio-demographic and physical characteristics of households. The data source was the Climate Change, Women in Agriculture and Food Security Dataset by the Regional Institute for Population Studies (2016) which sampled 559 households in in four agro-ecological zones of rural Ghana. Results showed that age, occupation and educational level of the household head, as well as the number of daily meals of the household were significant predictors of high household dietary diversity. However, the agro-ecological zone, sex, status (marital and migration) of the household head, along with the land ownership arrangements and use of irrigation facilities by the household were not significant predictors of household dietary diversity. The study therefore did not establish any relationship between land ownership arrangements and dietary diversity (the measure of food security). The study recommends that external factors which may influence food security should be extensively studied in rural Ghana in order to improve individual and household dietary diversity.

DEDICATION

I dedicate this work to my late mother, Agnes Antwi-Boadi. You will forever be in my heart!

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LIST OF ABBREVIATIONS

DD- Dietary Diversity

HDD- Household Dietary Diversity

HDDS- Household Dietary Diversity Score

FAO- Food and Agriculture Organisation of the United Nations

IFAD- International Fund for Agricultural Development

UNICEF- United Nations Children's Fund

WHO- World Health Organisation

WFP- World Food Programme

CHAPTER ONE

INTRODUCTION

1.1.Background of the Study

The responsiveness of world leaders to food security has undoubtedly earned it a top priority as evidenced in yearly global updates and policies geared towards the reduction and/or elimination of food insecurity (Clapp & Murphy, 2013; FAO, IFAD and UNICEF, 2017; Food and Agriculture Organization, 2011a; Food and Agriculture Organization of the United Nations, 2010). It is estimated that about 10 percent of the world, thus one in every nine people, are food insecure (FAO, IFAD, UNICEF, WFP and WHO, 2018). Increased occurrence of food insecurity globally have been attributed to the rapid rates of growth in urbanisation, food prices, births, and demand for agricultural lands (Muraoka, Jin, & Jayne, 2014). This has led to challenges such as starvation, conflicts, under and malnutrition among others (Sasson, 2012) in every region in the world. However, the African continent faces the most pressing situation with almost 30 percent of its populace experiencing food insecurity (FAO et al., 2018).

Most of the issues of malnourishment recorded in Africa are found within the sub-Saharan Africa region. In 2017, about 34 percent of sub-Saharan Africans were food insecure with the middle and eastern parts of the region facing the worst experiences. Western Africa, which was comparatively better off, according to FAO et al. (2018), has witnessed a significant upstick with a rise from 21.9 percent in 2015 to 29.5 percent of the food insecure in 2017. The higher numbers in Western Africa have been attributed to the prevalence of droughts, increasing food prices, and rapid population growth (FAO et al., 2018). In Ghana, where the study is situated, the FAO et al. (2018) record a

9.3 percent and 6.1 percent prevalences of undernourishment and food insecurity respectively. From 2015 to 2017, about 2.2 million of Ghanaians faced severe food insecurity (FAO et al., 2018). The increase in the numbers have led to governments in both developed and developing countries prioritizing food security in their policies.

Food security "exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life" (World Food Summit (1996) as cited by FAO, 2006, p. 1; Food and Agriculture Organization of the United Nations, 2010, p. 8). From this definition, four dimensions can be noted. There is food availability, which looks at making sufficient food quantities available, whilst considering its quality and supply (Food and Agriculture Organization of the United Nations, 2010). The second dimension is food access which gives individuals and households resources needed to acquire foods that are nutritious (FAO IFAD UNICEF, 2017; Food and Agriculture Organization of the United Nations, 2010). The third dimension is the use of food to meet the needs of individuals physiologically. The last dimension, food stability, is a relatively new dimension and focuses on ensuring that people have access to food all the time, and thus combines food access and food availability (FAO, 2006). As such the last dimension may differ between regions and place of residence even in a given country.

The four dimensions of food security comprise of numerous indicators and measures, all of which are geared towards assessing that people are food secure through improved dietary intake and adequate nutrients (FAO, 2011). Based on the objectives of a study and the limitations of the data used, researchers have employed different ways to measure food security. In some studies, a

combination of the measures is used for a proper assessment of the food security status of an area. These measures for households include hunger scale, food insecurity and access scale, dietary diversity score among others (Kennedy et al., 2010; Labadarios et al., 2011; Leroy, Ruel, Frongillo, Harris, & Ballard, 2015; Waswa, Jordan, Herrmann, Krawinkel, & Keding, 2014). In other cases, there has been the use of a single measure as a proxy measure of food security (Ochieng, Afari-Sefa, Lukumay, & Dubois, 2017; Taruvinga, Muchenje, & Mushunje, 2013).

Out of these measures, Household Dietary Diversity (HDD), has proven to be one of the more accurate measures of food security for individuals and households (Swindale & Bilinsky, 2006; Vakili, Abedi, Sharifi, & Hosseini, 2013). Dietary diversity relates to the adequacy reflected in nutrient intake and balanced diets due to the consumption of some unique food groups (FAO, 2011). As such, HDD reflects food availability, accessibility and consumption as well as utilization (FAO, 2014a) and is also useful under circumstances where data for the measurement of food security is limited for households.

In Ghana, there have been several policies geared at increasing food security. Agriculture is the mainstay of the Ghanaian economy (Ghana Statistical Service, 2013), and it has been the prospect through which governments over the years seek to improve access to food. One of the most recent programmes, Medium-Term Agriculture Sector Investment Plan (METASIP) from 2011 to 2015 (Babu & Blom, 2017), seeks to use agricultural production to boost structural transformation economic growth and food security in Ghana. Also, the 2018 Budget Statement of the Government of Ghana, seeks to increase food security to food through an improvement in agricultural

production which would create more jobs and ultimately make the country food secure (Ministry of Finance, 2017). Improving dietary diversity could therefore achieve this goal.

The rural poor have also been the target of policies over the years in Ghana. This is because rural areas employ a higher proportion of agricultural workers in the country, who are also the most malnourished and food insecure (Ghana Statistical Service, 2013). To achieve this, inputs aimed at improving food production, access, utilization and reduction of food wastage (FAO IFAD UNICEF, 2017). The inputs would also have to consider socio-economic and political factors which could improve or worsen vulnerabilities of individuals and households. For agricultural-based economies, one the most important inputs would be the ability to gain access to agricultural lands.

Land has been important in the production of food and wealth for all countries (Godfray et al., 2010). In 2015, the World Bank estimated that over 37 per cent of the world's land was used for agriculture; over 42 per cent of which is in sub-Sahara Africa (The World Bank, 2015). In 2015, however, over 153 million individuals in sub-Saharan Africa suffered from severe food insecurity. In rain-fed agricultural regions, such as sub-Saharan Africa, land issues are of utmost concern as it is the most important element that makes food accessible for its populace (Kiptot, Franzel, & Degrande, 2014). It is therefore imperative to make land available and accessible to all, as it has constructive effects on food security and ultimately, empowerment of women, agricultural output, nutrition, and other sustainable outcomes of development (Bremner, 2012; Miggiano, Taylor, & Mauro, 2010; Muraoka et al., 2014).

The World Bank (2015) and Ghana Statistical Service (2013) have estimated that about 69 per cent of the total land mass in Ghana is suitable for agriculture; and this could be the reason for which 45 per cent of the population (70 per cent of which are in rural areas) are involved in agriculture. Although there are other income earning opportunities, it is undeniable that land and its tenure predominantly play an active role especially in the rural Ghanaian economy (Ghana Statistical Service (GSS), 2014).

Land tenure arrangements for any farming individual or household is closely linked to their ability to be food secure, through the improvement in their nutrition and dietary diversity. In some situations, people who own land are more able to produce and consume food when compared to others renting it (Koirala, Mishra, & Mohanty, 2016) whiles in other situations, the opposite remains due to tenure insecurity (Codjoe, 2006) especially with respect to the agro-ecological zone of a given area. As food security has various dimensions, other factors could affect how individuals and households have access to food. The household head characteristics such as sex (Doss, Summerfield, & Tsikata, 2014; Kiptot et al., 2014), occupation and educational statuses as well as the age (Delvaux & Paloma, 2018), marital status (Doss et al., 2014), and migration status (Codjoe, 2006) have been known to have effects on a household's food security. In addition to this, household characteristics such as the household size (Codjoe, Okutu, & Abu, 2016), agro-ecological zone (Waswa et al., 2014), number of meals consumed by a household per day (Leroy et al.,2015), and the use of irrigation facilities (Miggiano et al., 2010) could influence the capability of households in gaining access to and utilising food.

Although numerous factors affect food security in households, rural farming households in the agro-ecological zones of Ghana, who depend mostly on rain-fed agriculture, and are also poor would need access to land if food security is to be achieved. Based on this premise, the study examined how land ownership arrangements in the different agro-ecological zones of rural Ghana influences dietary diversity, which is a proxy measure of food security.

1.2.Problem Statement

Hunger and malnourishment have become a worldwide problem affecting the poor and vulnerable in society (FAO IFAD UNICEF, 2017). Although food insecurity is a global problem, developing countries (especially in sub-Saharan Africa in recent years) seem to be the most challenged among the different regions (Figure 1.1.).

Figure 1. 1 Prevalence of Undernourishment in the World by Region (2010-2016)

	2010	2011	2012	2014	2016*
	Percentage				
WORLD	**11.5**	**11.2**	**11.0**	**10.7**	**11.0**
AFRICA	**18.3**	**17.9**	**17.8**	**18.1**	**20.0**
North Africa	**5.1**	**4.8**	**8.5**	**8.3**	**8.3**
Sub-Saharan Africa	**20.6**	**20.2**	**20.0**	**20.4**	**22.7**
Eastern Africa	30.9	30.2	30.6	30.9	33.9
Middle Africa	23.8	23.1	22.5	24.0	25.8
Southern Africa	6.7	6.3	6.2	6.5	8.0
Western Africa	10.0	9.9	9.9	9.8	11.5
ASIA	**13.2**	**12.8**	**12.5**	**11.9**	**11.7**
SOUTHERN AMERICA AND THE CARRIBEAN	**6.8**	**6.6**	**6.4**	**6.3**	**6.6**
OCEANIA	**5.0**	**5.2**	**5.3**	**6.0**	**6.8**
NORTH AMERICA AND EUROPE	**<2.5**	**<2.5**	**<2.5**	**<2.5**	**<2.5**

*Projected value for 2016

Source: FAO et al. (2017)

Although sub-Saharan Africa is faced with the most widespread prevalence of undernourishment, some variations are noted. It is evident from Figure 1.1 that the Western part of sub-Saharan Africa (where Ghana is located) is better off when compared to the Eastern and Middle Regions. However, there is still much to be done if food security is to be eliminated. Ghana has generally been a food secure country, although there are small but unknown proportions of the population that are food insecure in every region (Ministry of Food and Agriculture, 2007). To eliminate food insecurity, the poor have been targeted, most of which are in the rural areas. As agriculture is the main employer of most of these rural poor, securing access to land could be a pathway to reducing food insecurity (Babu & Blom, 2017; Badami & Ramankutty, 2015; Muraoka et al., 2014). Several studies exist on the importance of land to food security (Badami & Ramankutty, 2015; Doss et al., 2014; Gardi, Panagos, Van Liedekerke, Bosco, & De Brogniez, 2015; Muraoka et al., 2014), yet the intricate relationship between access to land and food security among farming households in the various agro-ecological zones of rural Ghana has not been extensively studied at the national level. Also, there is limited knowledge on the factors affecting the ways through which rural farming households access food in Ghana.

Ghana has a total surface area of about 238,535 square kilometres, of which 21 per cent (50,092 km^2 of the total area) was arable land in 2014 (The World Bank, 2015). In urban localities, loans are used mainly to purchase lands (82%) and housing (73%) (Ghana Statistical Service (GSS), 2014). These lands are increasingly being used for residential, commercial, or other purposes that are not agricultural, even in rural areas (Cobbinah & Niminga-Beka, 2017). Changing ownership arrangements to land to favour the wealthy in the era of population growth could lead to decreased

food availability, accessibility and utilization for poor rural dwellers that depend on agriculture for sustenance.

In rural areas, however, agricultural lands are being used as guarantee to secure loans mainly for Agricultural inputs (81%) and agricultural equipment (70) (Ghana Statistical Service (GSS), 2014). This could lead to further food insecurity as lands used for food production may be lost when loans are not paid off. Food insecurity and its associated problems would then be heightened for poor rural farmers who may not have other income earning opportunities. Some problems associated with food insecurity or a low dietary diversity include infant mortality and child diseases, as well as malnutrition among men and women, with the worse cases among rural households (Ghana Statistical Service (GSS), Ghana Health Service (GHS), & ICF International, 2015). Without nutritious or balanced diets, child development could be retarded, as wasting, stunting and underweight increases whiles chronic and non-communicable diseases also increase (Ghana Statistical Service (GSS) et al., 2015).

In rural Ghana, it is estimated that the men and women in their reproductive ages are relatively thin/underweight (7.4% of women and 11.1% of men) compared to their urban counterparts (5.2% of women and 9.2% of men) (Ghana Statistical Service (GSS) et al., 2015). It is also estimated that Northern Region and Ashanti Region (regions where two of the study districts are located) have the highest under-5 mortality with the former experiencing the highest level of underweight among men and women in rural areas (Ghana Statistical Service (GSS) et al., 2015). The Northern part of the country has been associated with increasing poverty and the decreased consumption of balanced diets which could explain the high levels of malnutrition in the region (Darfour &

Rosentrater, 2016). Generally, rural diets are usually based on starchy staples with inadequate vegetables, fruits and animal products which could lead to undernourishment and underweight (Taruvinga et al., 2013).

To meet the micronutrient needs of households, there is the need to introduce foods with adequate nutrients into the diets of the rural poor farming households to reduce malnutrition. As such information on household dietary diversity could be used as a tool to assess, monitor and evaluate food security at individual and household levels (Swindale & Bilinsky, 2006). In the face of growing food insecurity, there is the need to know which tenure arrangements are available for rural farming households. This would aid in establishing the relationship between land and food security as well as other factors which affect the latter to contribute to the knowledge on reducing food insecurity in the rural areas of the various agro-ecological zones of the country. The study therefore examined land ownership arrangements and food security, emphasizing on dietary diversity as an indicator of the latter.

1.3.Rationale of the Study

Ghana is faced with both under-nutrition (mostly in rural areas), and over-nutrition (especially in urban areas). Food security can therefore be achieved with a thorough investigation of factors that affect access to food. For rural dwellers involved in agriculture, land could play an important role in reducing food insecurity through improved dietary diversity.

Dietary diversity is an indicator of food security which looks at the quality of diet based on adequacy of nutrients and diet. If dietary diversity is high, it may lead to improved health in terms

of reduced risk of infections and mortality (Taruvinga et al., 2013) and obesity (Codjoe et al., 2016). Dietary diversity has been a problem for rural areas in developing countries due to their diets excluding animal proteins, vegetables and fruits (Taruvinga et al., 2013). An understanding on the linkage between land and dietary diversity would assist in contributing knowledge on ways through which food security could be improved for the populace.

The Medium Term Agriculture Sector Investment Plan (METASIP) is one of the recent comprehensive policies in Ghana which aims to boost food security through agriculture (Ministry of Food and Agriculture (MOFA), 2010). As access to agricultural lands is important to reducing food insecurity, there is the need to revisit access to land (land tenure arrangements) and food in Ghana. Land rights highly affect farmers, especially those whose sole income and food stems from farming. Households involved in farming would thus be major beneficiaries if tenure arrangements in the various agro-ecological zones are added to the knowledge on land and food security in Ghana. With customary tenure as an important issue in Ghana, the study contributed to understanding why inaccessibility to land could affect food security. It also explored the arrangements available to rural farming households in their agro-ecological zones. Also, factors such as sex, occupation, education, age, marital and migration status of the household head, as well as irrigation use, agro-ecological zone, and number of meals consumed per day in the household would be examined in relation to food security (dietary diversity).

This study therefore added to the knowledge on the role of land in addressing food security with respect to the dietary diversity of households in the different agro-ecological zones of rural Ghana. Attention has also been paid to the socio-economic and demographic differences of individuals

with respect to food security. Access to land determines food production, access, and utilization, as well as wealth for farmers making it imperative to study land tenure arrangements and its relationship with food security in the various agro-ecological zones of Ghana. Also, the study used dietary diversity scores as a proxy measure of food security in the country.

1.4.Research Objectives

The study examined the relationship between land ownership arrangements and food security in the agro ecological zones of rural Ghana. This was achieved through the following specific objectives.

1.1.1. To ascertain the different kinds of land tenure arrangements of households in the agro-ecological zones in rural Ghana.

1.1.2. To examine the relationship between land tenure arrangements and dietary diversity of households in rural Ghana.

1.1.3. To explore the factors that affect household dietary diversity in rural Ghana.

1.5.Organisation of the Study

This study has been organised into five chapters. Chapter one looked at the study background, problem statement, rationale of the study and the study objectives. Chapter two reviews literature concerning land tenure arrangements and food security, in addition to a theoretical and conceptual framework. It also states the hypothesis. Chapter three examines the methodology adopted for the study whiles chapter four presents the results and discussions based on the objectives of the study. Chapter five summarizes the findings of the study with recommendations for further research.

CHAPTER TWO

LITERATURE REVIEW

2.0.Introduction

The problems associated with food insecurity are endless, the worst of which is its contribution to causing malnourishment and death through hunger. In 2013, 1 in 10 people were living on less than $1.90 daily, with about half of the extreme poor in sub-Sahara Africa (The World Bank, 2016). The FAO also estimated that about 815 million people suffered from food insecurity in 2016 as against 777 million people in 2015. As the poor are mostly rural farmers in sub-Saharan Africa, it is important to understand the factors that affect their food security (FAO et al., 2017).

Agricultural lands are primary to improving food security in rural households whose main activity is agriculture, and so this study reviewed literature on the linkages between land tenure and food security as well as factors that affect households' food security. Details on the concepts of land tenure, with a brief overview of the system of land tenure in Ghana are studied. This was followed by the relationships between land tenure and food security. Also the factors that serve as motivators and/or impediments to farmers in accessing food were considered. The section concluded with a theoretical and conceptual framework, as well as the hypotheses to the study.

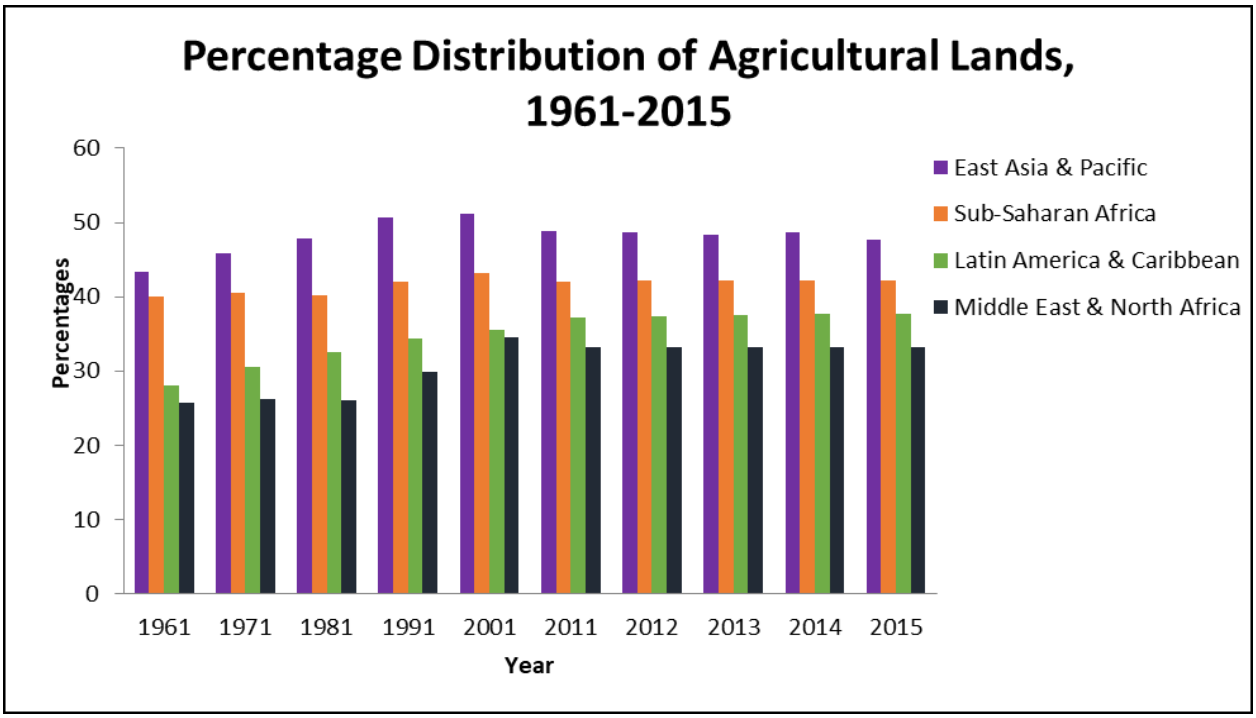
2.1.Issues on Land

The earth surface that has not been covered by water permanently is referred to as land or dry land. The importance of land cannot be surpassed, as the prosperity and survival of human beings have a connection to the land (Food and Agriculture Organization of the United Nations & United Nations Environment Programme, 1997). Its value increases with time and as such can be used for

natural resource exploitation, agriculture and habitat among others. In many societies, land serves as a source of wealth, status, security, and recognition, in addition to it being a productive asset (Alemu, 2015; Rao, 2011). Its distribution and ownership vary as its management and inheritance differ across boundaries.

Agricultural lands are needed for food production, which is critical for human survival. Its exploitation and use have increased worldwide over the years. Figure 2.1 shows the distribution of agricultural lands worldwide.

Figure 2. 1 Percentage Distributions of Agricultural Lands (1961-2015)



Source: World Bank (2015)

From Figure 2.1 it can be noted that the use of agricultural lands has increased in different regions over the years. The ownership and distribution of lands has increased over the years, even into areas previously not used due to population growth. Agricultural land use reached its peak in 2001 and has decreased slightly over the years. This could be due to the changes to which the land is put to (Cobbinah & Niminga-Beka, 2017). The different uses to which land is put are residential, commercial and agricultural purposes among others (Cobbinah & Niminga-Beka, 2017). These purposes yield their intended results when the distribution and management of land is done without discrimination.

Lands cannot be used for its various purposes without granting access to individuals and groups. Such access differs across cultures. In some societies, such as communist and socialist states, lands are state-vested whereas societies marked by conflicting interests between the private and state institutions manage their lands on the basis of clans (Rao, 2011). A study done in peri-urban areas of the Atwima Nwabiagya District Assembly and the Kumasi Metropolitan Assembly in Ghana showed that the increasing use of lands for commercial and residential purposes have led to farmlands (the income generating source) being abandoned (Amoateng, Cobbinah, & Owusu-Adade, 2013). For farmers who may not have access to land, food security may be worsened. Power to accessing lands in the hands of the few could lead to discrimination and even conflict (Huggins, 2010), and so it is important to consider the role of land tenure arrangements in reducing the unwanted effects of improper arrangements on access to land.

2.2.Issues on Land Tenure

There are both vast and complex researches on land tenure as a result of the differences in tenure systems globally (Ghebru & Holden, 2013). Such variations lead to researchers of land tenure specializing in different areas of interest. The system of land tenure, as defined by society, is used to determine the relationship between people and their lands (Alemu, 2015). To achieve stability, the importance of tenure security with respect to the political, social and economic structures of society should be ensured. For land tenure to be secure, governments may expropriate lands, with the assurance of promoting the management and conservation of land (Ministry of Food and Agriculture (MOFA), 2010). In the case of Ghana, land tenure management systems have failed to improve land investments (Ministry of Food and Agriculture (MOFA), 2010).

Land tenure intersects with development strategies such as housing and food security based on certain interests. In some situations, the government has the ultimate power to land allocation and reallocation, as has sometimes been the case of Ghana (Ministry of Lands and Natural Resources, 2017). There may also be interests overlapping between several parties. As such, the same land parcel would be shared with different rights to all parties (Food and Agriculture Organization, 2002). Members of a community may also have common rights to a parcel of land, but problems arise when competing interests to land lead to land disputes as evidenced in the growing populations of sub-Sahara Africa (Peters, 2009).

The purposes to which land can be put, and for that matter land is secured, disadvantages the poor and results in food insecurity in society (Miggiano et al., 2010). In many areas, the poor are not able to access land due to tenure insecurity. For smallholder farmers, who are the poorest in the

sub-region, land tenure insecurity affects both their productivity and food security. The arrangement of land tenure also worsens their plight as it could determine the crops grown, and whatever happens to the land on which they farm (Muraoka et al., 2014). Land tenure can also exert influence on the willingness of farmers to produce and invest in land.

2.2.1. Security of Land Tenure

When a person is secure in terms of their tenure to land, it implies that such a person believes in their right to a parcel of land, and can reap all benefits associated with the land (Holden & Ghebru, 2016). In some areas in sub-Saharan Africa where land is kept under customary tenure, the state- although claiming to be the 'owner' of the land- is not the custodian (Behrman, Meinzen-dick, & Quisumbing, 2012). Chiefs are rather often the landholders, keeping lands in custody for their people. In other tenure systems, men hold the rights to land, with women accessing land as a result of their relations to the men (Alemu, 2015). Although women may have much more rights under statutory law, such rights are limited in implementation putting women at a disadvantage (Behrman et al., 2012). All these affect the food security of individuals in the community dependent on land, especially agricultural land for their survival.

Access to land could be measured per land, individual or group level. When conflicts arise, it could be due to one party feeling insecure to their access to land (Almeida & Wassel, 2016). Such insecurities limiting access to land could stem from law enforcements, customs, possession duration, power structure, and the land's value among others (Holden & Ghebru, 2016). Land tenure insecurity in hindering access to land may be based on perceptions of past events, future expectations and legal information about land rights (Ma, 2013).

Land right documents for the use of specific land units may assure individuals of their rights to access land especially when such documents show some form of protection and social recognition (LANDESA, 2012). These legal documents, may not guarantee full security of tenure as there are other factors such as the right's duration, depth, width and legal restrictions (Quaye, Ampadu, & Onumah, 2014). When individuals do not have access to land, as a result of policy interventions, encroachments, etc., it affects their ability to make a living from the land. A strong security of tenure could increase the use of credit by putting up incentives to invest whiles enhancing the collateral land value (Peters, 2009). It is therefore imperative to analyse the time-varying measures associated with access or tenure of land. Knowledge of such measures may have impacts on food security and livelihood acquisition (Donkor & Owusu, 2014)

2.3.Access to Land

Creating access to land is complex as it involves the use of several strategies. National governments, for instance can use systematic means through land reforms to access land (Lipton & Saghai, 2017). Also, land can be accessed through its purchase. In some cases, migrants may work on lands, accumulate capital and purchase such lands from the owners (Boateng, 2017). Also, individuals or groups can possess land for a period, through lease or rent.

In Ghana, sharecropping (a form of land rent) is practised in many farming communities with the hope of the tenant (usually a migrant) getting a percentage of the produce or its income (Quaye et al., 2014). It therefore overlaps with rented land. In rural communities, land is usually inherited from parents. Inheritance is sometimes affected by lineage. Due to the cultural norms of a given

society, especially in sub-Sahara Africa, an individual may inherit land through matrilineal or patrilineal inheritance (Berge, Kambewa, Munthali, & Wiig, 2014). In such a situation, women have been known to receive lesser land, although women in the matrilineal inheritance are better off when compared to their patrilineal counterparts (Duncan, 2010a). There may also be unofficial cases where lands may be subject to illegal squatting. Although risky, the squatter has access to the land for the period in which the actual owner is not available (Chileshe, 2005; Food and Agriculture Organization of the United Nations & United Nations Environment Programme, 1997).

The decline in the agricultural lands has been attributed to increasing population and urbanisation. In Ghana, these reasons have led to a limit in access to land and also changes in crop distribution spatially (Ministry of Food and Agriculture, 2007). The production of Cocoa has shifted in the Brong Ahafo, Eastern, and Ashanti Regions to the Western Region with transitional zone having cassava replacing yam production (Ministry of Food and Agriculture, 2007). Land tenure insecurity is a problem in many African countries as issues such as unclear boundaries and lack of management of communal property exist (Ministry of Food and Agriculture, 2007). There are several factors which may limit and/or improve food security in any context. Some of these are social and demographic characteristics, whiles others are physical limitations.

Among the factors that affect accessibility to land, being in the younger ages or below forty years (Jayne, Chamberlin, & Headey, 2014) could improve one's access to land. Also, being married or in union as well as being female could hinder access to land (Alemu, 2015; Doss et al., 2014). Lands can also be accessed easily by individual in wealthier households (Rao, 2011), areas

practising matrilineal inheritance (Almeida & Wassel, 2016), and in humid agro-ecological zones (Darfour & Rosentrater, 2016). In Ghana, land distribution, or even allocation, is different between migrants, native youth and natives (Quaye et al., 2014).

2.3.1. Land Tenure Categorisation

The ways through which land can be accessed can be officially grouped into four categories- state, communal, private and open access as shown in Table 2.1. (Food and Agriculture Organization, 2002). Within these categorisations, there could be lands acquired through rent (including share cropping), rent-free lands (such as family lands) among others (Bartolini & Viaggi, 2013; Koirala et al., 2016) (Donkor & Owusu, 2014). These tenure arrangements could have implications on how owners or non-owners generate income (Jayne et al., 2014).

Table 2. 1 Land Tenure Arrangements and Access

Land Tenure Arrangement	**How to gain Access to Land**
Communal	Lands are assigned through common rights in a community. Chiefs transfer lands to family heads who distribute to family members. Lands cannot be accessed by non-members of the community
Private	Rights are assigned to private individuals or entities. Lands may thus be acquired through purchase, inheritance or gifts. Leasing and sharecropping could fall under such arrangement
Open Access	Everyone can make use of the land. It is common in grazing societies
State	Property rights are allocated to public sector authorities. These may include forest lands and other lands acquired to be used by the state

Source: (Donkor & Owusu, 2014; Food and Agriculture Organization, 2002; Quaye et al., 2014)

2.4.Land characteristics: The Case of Ghana

Ghana has a total surface area of about 238,535 square kilometres, of which 21 per cent (50,092 km^2 of the total area) was arable land in 2014 (The World Bank, 2015). Most households are in need of land for various purposes, the most popular use of which is agriculture (Ghana Statistical Service (GSS), 2014). In Ghana, access to land is ultimately managed by the Lands Commission (Ministry of Lands and Natural Resources, 2017).

Agricultural lands are important as the agricultural sector is the mainstay of the Ghanaian economy. All land tenure arrangements proposed by the Food and Agriculture Organisation are practised in the country. In rural areas, however, access to land is mostly by inheritance, rent-free or purchase. One of the private land tenure arrangements for instance is the sharecropping system practised among farmers especially in the rainforest and transitional zones of the country. It is a customary tenancy in which arrangements of "*abusa*" and "*abunu*" are made between tenants and owners (Quaye et al., 2014). The former has the tenant taking two parts of the produce or income after sales whiles the latter has the tenant equally sharing the income with the owner (Djokoto & Opoku, 2010; Quaye, Ampadu, Onumah, & Titiati, 2015). This system is helpful as the landless are able to have access to land for farming, and thus make a living while producing food for their survival for a period of time. Also, the tenant can increase their productivity, and as such may be more food secured (Codjoe, 2006).

2.5.Food Security

Food security has become a worldwide problem, and has been associated with the concepts of poverty and vulnerability. When a household is poor and food insecure, a large share of their income is spent on food. To generate income for their food needs, their vulnerability would increase as they may use a larger portion of their resources. Vulnerability is therefore associated with food insecurity, which is being unable to meet food needs over time (FAO IFAD UNICEF, 2017).

Food security has also been defined as making foodstuffs available in "sufficient quantities and with the adequate nutritional qualities" (Sasson, 2012, p. 8). Also, providing access to food includes both economic and physical food access that has the ability to meet the dietary needs of people, in addition to their preferences in terms of food (Ayifli, 2017). The existence of food security lies in people having an all-time access to safe, sufficient and nutritious foods to enable them live healthily. These concepts stem from the definition of food security provided by the Food and Agriculture Organisation of the United Nations which states that "food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life" (FAO, 2006, p. 1). From the definition, four dimensions have been drawn, that is, access, availability, stability and utilisation (FAO, 2014b).

The first dimension, that is, availability considers food quality, quantity and diversity. Food availability is when there is sufficient food to meet the minimum requirements of consumption for everyone, every time. It addresses physical and economic food access with indicators such as

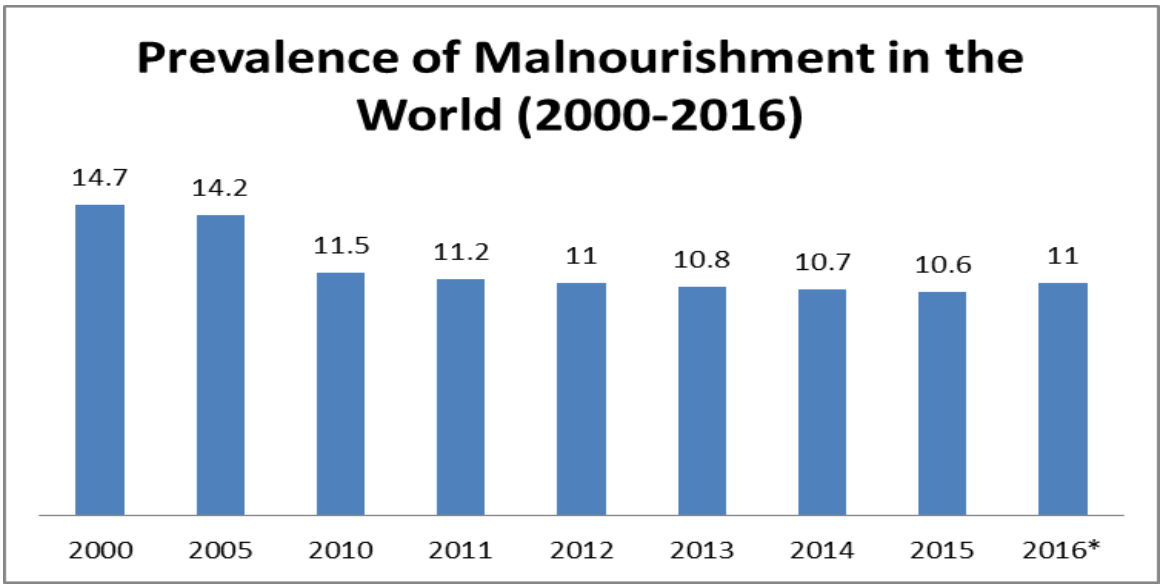
sufficiency of the energy supply gained from the dietary intake; amount of calories resulting from tubers, roots and cereals; the average supplies of protein (including that from animal sources); and the average value gained from food production (FAO, 2014b). Food must therefore be present at the right time and place.

The second dimension- accessibility relates to the degree of difficulty that people go through when obtaining the food from the market sources. It contains indicators including infrastructure such as transportation to the food source; physical access to food; food prices and income of the ones purchasing the food; and the frequency of undernourishment especially in children (FAO, 2014b). Use and stability go hand in hand. Use or utilisation of food considers the physical environment of the individual (non-food component) with issues such as the use of food through access to water, sanitation, adequate diet and even health care (FAO, 2006).

The last dimension, stability, focuses on policy, natural and economic factors associated with food supply over time. Factors such as area of land being irrigated, dependency on cereals, fluctuations in the domestic supply of food, and incidence of political instability are some indicators used to measure the risk of food security under the dimension of stability (FAO, 2014b). From the aforementioned dimensions of food security, it can be noted that there are several indicators of food security. On one of the indicators, adequate diet for instance, households and individuals may not have adequate meals when food is not available or accessible. Also, stability cannot be achieved when consumption does not take place over a period of time.

Food insecurity is presently on the rise and as such should be reduced or eliminated if healthy life is to be achieved worldwide. Figure 2.2 shows the prevalence of malnourished people in the world between 2000 and 2016. Food security though is a complex concept, and as such it is difficult to measure. For this reason, some proxy indicators could be used, one of which is the HDD. As a proxy measure of food security, the HDD could assist in measuring the food availability, accessibility and utilization and thus provide knowledge on who may be malnourished or food insecure. Malnourishment is steadily increasing (Figure 2.2), and this calls for the need to improve dietary diversity for the poor. The study therefore considered an indicator that encompasses the various components of food security.

Figure 2. 2 Prevalence of Malnourishment in the World, 2000-2016



Source: (FAO et al., 2017)

2.5.1. Household Dietary Diversity

One of the indicators of food security, which has proven to be an adequate measure of food availability, access and utilization, is the Household Dietary Diversity Score (HDDS). For food to be effectively utilized there is the need to ensure balance in every meal. The Household Dietary Diversity score accumulate scores of the unique food groups consumed by a household within a given period, usually 24 hours or 7 days (FAO, 2014a; Swindale & Bilinsky, 2006). A balanced diet has improved effects on the adequacy of calories and protein (both from animal and other sources). Its use is also related to the ease at which information can be gathered with improved accuracy for the examination of food security.

In computing for the score, different food groups consumed are put together on the assumption that each household would consume at least one of the food groups. It is a better measure than computing just for the number of meals without adding up the diversities which contribute to a balanced diet. Dietary diversity has therefore provided a meaningful way of providing balanced diet in order to sustain a given population. The 12 food groups and their respective examples are shown in Table 2.2

Table 2. 2 Food Groups used for HDDS

FOOD GROUP	**EXAMPLES**
Cereals and Grains	Corn, rice, sorghum, millet, wheat or other foods made from these (e.g. bread, porridge etc.)
White Roots/Tubers/Plantain	Potatoes, yam, cassava or other foods made from roots
Vegetables	Carrot, sweet potato, Cocoyam leaves and other Vitamin A rich vegetables and leaves
Eggs	Eggs from chicken, duck, guinea fowl or any other egg
Meats	Both flesh and organ meat from beef, pork game, chicken, insects or other animals
Fruits	Mango, pawpaw or any other juice solely made from fruits
Spices/Condiments/Beverages	Salt, black pepper, soy sauce, coffee, tea, alcoholic beverages etc.
Milk and Milk Products	Cheese, yoghurt, milk or other milk products
Fish/Sea Food	Dried or fried fish or shellfish
Sweets	Honey, sugar, sweetened drinks, chocolates, cakes etc.
Oils and Fats	Butter, oil and fats added to food or used for cooking
Legumes, Nuts and Seeds	Dried beans, lentils, nuts or foods made from these such as peanut butter etc.

Source: FAO (2010)

Other factors that affect food security especially among poor, rural farmers are age, sex of the household head, size of household and farm, educational level, off-farm activities, among others (Abu & Soom, 2016; FAO, 2014b). Although these factors are essential, granting farming households access to land could make a huge impact on improving their access to food through increased consumption of nutritious diets.

2.6.Linkage between Land Tenure and Food Security

Land and food security are fields which have been explored separately by different researchers. This is due to the vast variations in both fields (Doss et al., 2014). To form a relationship between access to land and food, there is the need to assess how access to land affects and is affected by food security. Addressing such a relationship can lead to improved food security, especially in Ghana, where this study is situated.

Land tenure and food security have a linear relationship (Miggiano et al., 2010). Once access to land is gained by the farmer, food production and income generation follow, and then food consumption and nutrition enhancement (a measure of food security) becomes a result. One of the forms of access to land is through ownership/ freehold tenure rights. When landowners are allowed to have complete control over the use of land, they could improve their investment on the land (Holden & Otsuka, 2014). More investments into the land implies higher food production. Some countries have undertaken revolutionary reforms of their lands by making the lands (both state and individual) to be state or collectively farmed (Keswell & Carter, 2014). To counter frequent land redistributions, there has been the introduction of low cost land certificates. These reforms have

led to a strengthening of the security of tenure, whiles improving productivity, investments, and ultimately food security (Deininger, Ali, & Alemu, 2011; Holden & Ghebru, 2016).

Weak access to land or tenure insecurity may sometimes lead to poor land management, land degradation, and less land productivity which results in food insecurity. An increased productivity of about 40 per cent on farm plots with a land certificate when compared to plots without a certificate was found in Ethiopia (Holden, Deininger, & Ghebru, 2009) . It has also been found in the highlands of Ethiopia that the degradation of land and population growth has led to increasing food insecurity (Asefa & Zegeye, 2003). An increased population leads to pressure on the land which results in land scarcity. With scarcity, many of the people would intensify their use of land increasing market participation and economic development. These lead to an increased dietary diversity, which is a proxy measure of food security. However, such intensification could also lead to degradation of resources as found among migrants in the transitional agro-ecological zone of Ghana (Codjoe & Bilsborrow, 2011). Migrants have been engaging in land intensification techniques due to lack of ownership. As such this may lead to food insecurity over time. Access to land can therefore be deduced from this review to have a major impact on food security.

Food security, or its lack thereof, could also have impacts on access to land. One of its manifestations lies in income of households and their nutritional status. Food security has resulted in nutritional deficiencies, especially among children in the developing world (FAO et al., 2017). In poor and hungry households, there is the tendency to choose to let go of assets which were otherwise a coping strategy in order to enhance consumption (Gebregziabher & Holden, 2011).

When they sell their assets, lands inclusive, such households end up landless or without access to land, and even livelihoods.

When families are faced with food insecurity, they may also migrate to seek greener pastures leading to a loss of on-farm labour for farming communities. With no lands to produce and invest in, food insecurity may become a problem (Holden & Ghebru, 2016). Access to land indicates the welfare of any given household in agrarian economies that lack off-farm income generating activities. Access to land should be given equally in such areas as the landless are the most poor in these agrarian economies (Koirala et al., 2016).

2.7.Factors Affecting Access to Food

There are several factors that affect food security (dietary diversity) especially among poor, rural farming households. The most important of these is having access to land, whether rented or owned. In some cases, land owners are able to produce and consume more food as compared to those renting the land (Koirala et al., 2016). In other cases, those who rent land, due to the timeframe of rent, may 'mine' the land and thus acquire more food (Codjoe, 2006). However there are other physical, social and economic factors that could either improve or hinder food security and nutrition of households. These include the sex, age, occupation, education, migration and marital statuses of household heads, as well as the household size, agro-ecological zone, irrigation use among others.

The sex of a household head is critical to ensuring the food security of a household (Doss et al., 2014). Both sexes should be given equality in access to resources, but in most cases, it is to the

disadvantage of women (Alemu, 2015). In developing countries, the increase in women's access to land increases food production from 2.5 per cent to 4 per cent, whiles reducing the malnourished by 5 per cent (Food and Agriculture Organization, 2011b). But with such gendered access to resources, female headed households are food insecure (Food and Agriculture Organization, 2011a). Such is the problem in Ghanaian agriculture. The Ministry of Food and Agriculture in Ghana considers gender inequality as a constraint to Ghanaian Agriculture (Ministry of Food and Agriculture (MOFA), 2010). Such discrimination of women has led to limited dietary diversity in their households, and thus food insecurity (Codjoe et al., 2016).

Age and occupation of the household head could also be influential in ensuring a high dietary diversity of the household. In Nigeria, ageing has been significant in the increase of the likelihood and frequency of food insecurity. Younger household heads are therefore better off when compared to the older household heads (Delvaux & Paloma, 2018). The case is different for Zambians. In a study by Jayne et al. (2014), they found that most farmers acquire farmlands after the age of forty as they are able to save more during the latter ages, boost their food security and acquire more lands. In rural farming households, the occupation of the household head could be important in providing direct or indirect access to food. A household engaged in gainful employment may have the income to purchase food and property (Abu & Soom, 2016). Farmers, for instance, may also have access to food as a result of their work being directly involved with food. Farming household heads with diversified income sources would also be more food secure as compared to their counterparts with a single income source (Delvaux & Paloma, 2018).

The educational, marital and migration status of the household head could also influence their food security status. A married household head is more likely to be food insecure especially when living with the partner (Hanson, Sobal, & Frongillo, 2007). Migrant farmers may not have access to resources and when they rent lands, they may not produce and consume more food due to lack of ownership (Koirala et al., 2016). Education also provides insight into healthy living. As such highly educated individuals are more likely to be food secure as compared to those with little to no education (Codjoe et al., 2016).

Other factors concerning the household, such as the household size could also influence dietary diversity (Abu & Soom, 2016; FAO, 2014b). Larger household sizes may imply that there are more mouths to feed and as such are less food secure than smaller household sizes (Mensah, James and Tuffour, 2013). An additional benefit of education is allowing or giving the farming household an option of adopting appropriate technology geared towards the effective utilisation of land. When households are advanced in knowledge on farming, they are more likely to adopt technology to enhance their food security, even as they invest efficiently into land (Miggiano et al., 2010).

The agro-ecological zone of a household could determine how food secure the household is. In Kenya, Waswa et al. (2014) found that dry zones were more food secure. Humid zones however experienced food insecurity. According to the Ministry of Food and Agriculture (2007, 2010), the agro-ecological zones recognised in the country are the rain-forest, forest-savannah transition, semi-deciduous forest, Guinea savannah, Sudan savannah and coastal savannah. These zones could lead to challenges in agricultural production (especially in the Guinea and Sudan Savannah) in the country especially for rural areas that are dependent on rain-fed agriculture. It could therefore

be the reason for high food insecurity levels in the Northern part of the country (Darfour & Rosentrater, 2016; Ghana Statistical Service (GSS) et al., 2015). However, the availability and abundance of non-timber forest products in these two agro-ecological zones could lead to improved DD. When households experience food shortages, less than three meals per day may be consumed and thus food insecurity worsens (Leroy et al., 2015). Although these factors are essential, permitting households to gain access to land could make a huge impact on improving their food security through increased consumption of nutritious diets.

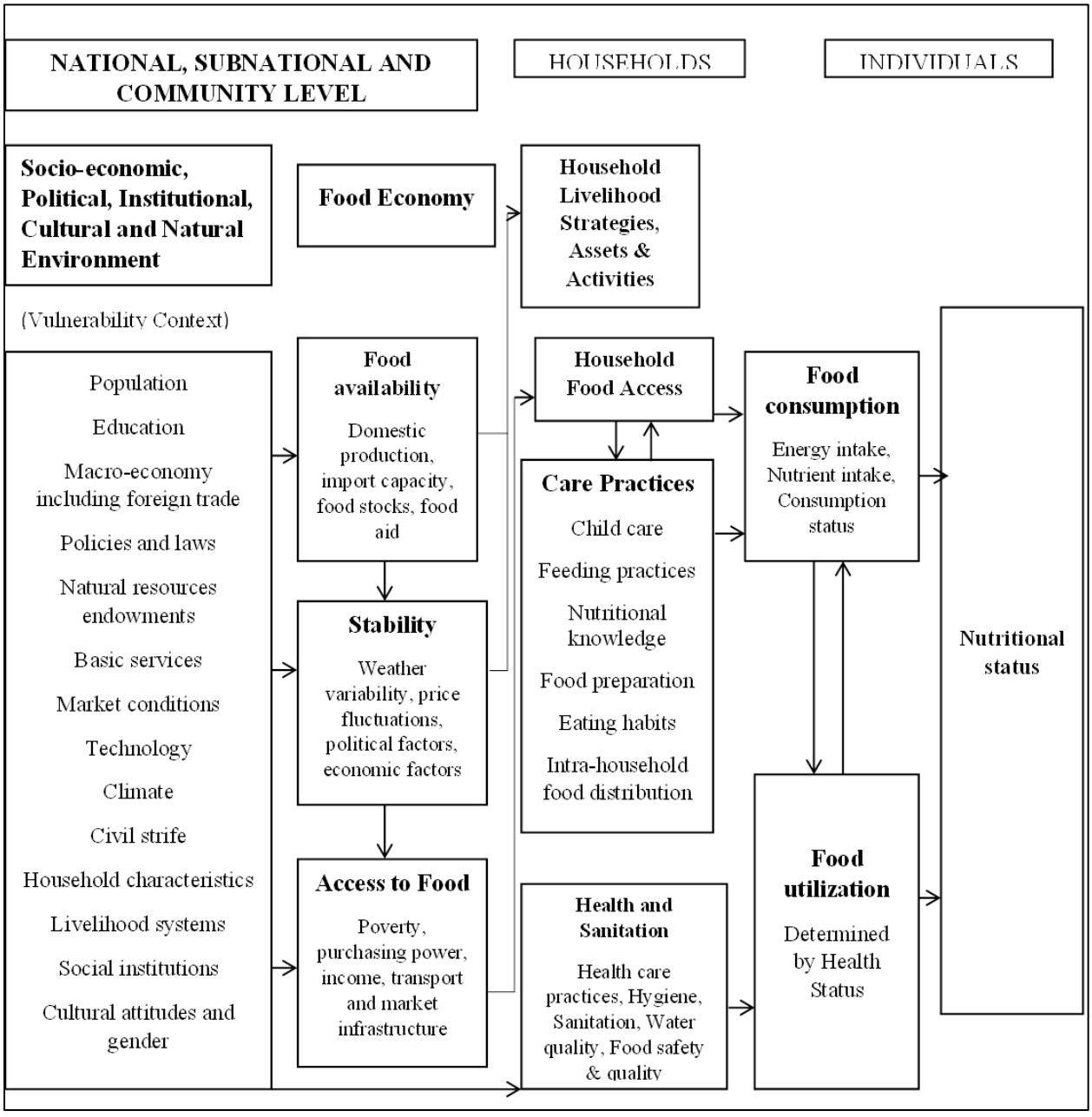
2.8.Theoretical and Conceptual Framework

2.8.1. Theoretical Framework

The concept of food security is complex with its interrelationships geared towards improving the nutritional status of individuals and households. One of the frameworks that consider food security and nutrition is the concept of Food Security, Livelihoods and Nutrition (2006) provided by the Food and Agriculture Organisation. The framework shows a linkage between the major factors that affect food security and its components. From the framework, there are several socio-economic, institutional, cultural and natural environmental factors that can lead to food security or insecurity. These factors have a direct impact on the components of food security at the national level. For instance, a country's natural resource endowment-of which land is included- could affect its ability to make food available, stable and accessible through various means shown in Figure 2.3. When a country or government puts in place the necessary resources to make food secure, households are the next recipients. The food security in a country has the tendency to affect the assets, activities and livelihood strategies of households. This ultimately affects the consumption and utilization of food (dietary diversity) at the household and individual levels. Thus, household

dietary diversity could be affected leading to malnourishment and food insecurity. For this reason, the framework on Food Security, Livelihoods and Nutrition was used as the theoretical framework to guide the study.

Figure 2. 3 Food Security, Livelihoods and Nutrition Framework



Source: FAO (2006)

From the framework, it can be noted that food security has influences depending on the context one finds him or herself. For instance, rural populations may be more likely to be food insecure through low dietary diversity as a result of the lack of access to natural resources, technology, education and markets. In a growing population, access to land is important, especially if farmers (usually located in the rural areas of developing countries) are to increase their productivity for food security to be achieved. As food security aims at improving the nutritional status of any given population, consumption and utilization of food is necessary. This is because, for food to be utilized, there must be availability and accessibility. For this reason, the conceptual framework shown in Figure 2.4 would consider food utilization (dietary diversity) as the outcome variable.

2.8.2. Conceptual Framework

Based on the framework provided by the Food and Agriculture Organisation (2006), the study adopted a conceptual framework which considers access to land through land tenure arrangements of rural farming households. Basically, rural farmers may gain access to land either through ownership (inheritance and purchase), rent (which includes sharecropping) or rent-free access in the study. Such access to land for a rural farming household could either boost or hinder food security. In this study, household dietary diversity scores (being low or high) for a farming household is used as the proxy measure to food security. Access to land therefore has a direct relationship with household dietary diversity.

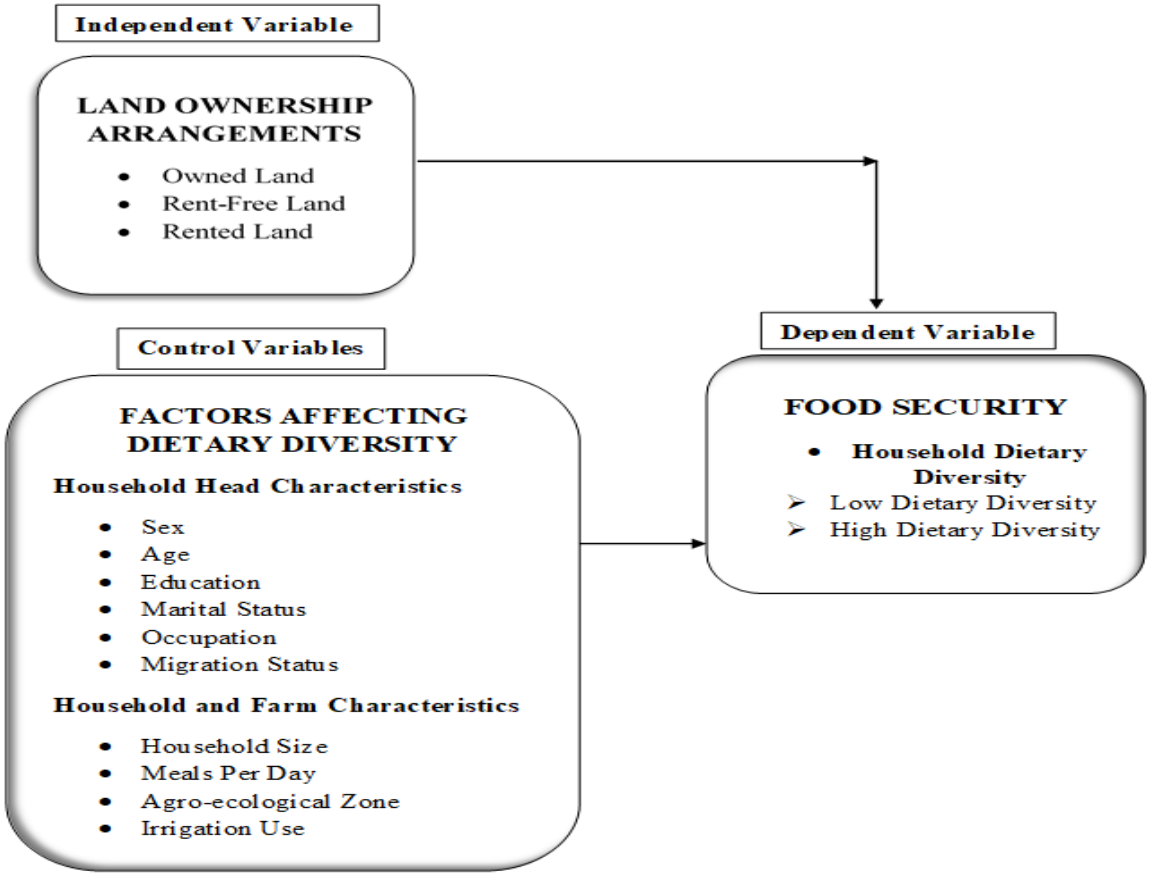
Also, food security in the Ghanaian context could be affected by some factors controlling its effect on HDD. These controlling factors could be the household's socio-demographic, physical and

economic characteristics. Malnourishment affects all age groups, especially the aged category. According to the FAO (2017), one of the fastest growing age groups over the next few decades would be the aged group. Without the strength and assistance, they are more likely to be food insecure. Also, several studies have shown that the women are at a disadvantage in terms of income and access to land (Alemu, 2015; Doss et al., 2014). For this reason, they are more likely to suffer from food insecurities as compared to their male counterparts. Other social factors such as education and marriage could also play a role in an individual's ability to gain access to food. In terms of schooling, individuals with access to schools and higher educational attainments are able to acquire knowledge on nutrition and are thus able to access healthier diet options. White-collared jobs which are well paying also make use of educated individuals. With a higher income, one is able to access food for a healthier life. In terms of marriage, Hanson et al. (2007) note that household heads who are married and living with their partners are more likely to be food secure. This could be a result of both partners putting together funds from their respective occupations and getting a higher income to afford the different food groups. For farmers who are married, additional hands on the farm would imply much productivity. As noted by Koirala et al. (2016), migrant farmers are usually unable to be productive as they cannot acquire lands. As such, their dietary diversity is bound to be low.

Other household and farm characteristics could also influence dietary diversity include household size; agro-ecological zone; use of irrigation facilities; and meals consumed per day. Households that are of larger sizes may have more mouths to feed and as such may be less food secure than smaller household sizes (Mensah et al., 2013). Humid agro-ecological zones are also more likely to be food secure than savannah zones (Ajani, 2010). Use of irrigation facilities could also affect

farm productivity and thus food security. With increase in income, farmers with increase the number of meals consumed in a day and be well nourished (Leroy et al., 2015). These factors could influence the capability of households in gaining access to and utilization of food. When these factors affect access to food, implications are made on food security which is indicated by HDD. The conceptual framework is shown through Figure 2.4.

Figure 2. 4 Conceptual Framework showing the Relationship between Land Ownership Arrangements and Food Security



Source: Author's Construct (2018)

2.9.Hypotheses

The study hypothesises that

i. Households with rented lands are less likely to have a low DD as compared to households owning lands.

ii. Household heads with no schooling are less likely to have a high DD as compared to household heads with some education.

iii. Female household heads are more likely to have a low DD as compared to male household heads.

CHAPTER THREE

METHODOLOGY

3.0.Introduction

The section on research methodology discusses the methods used in the study. It comprises of the data sources, study area, research and sampling design and size, measurement of the variables of interest, unit of analysis, and the analysis method. The chapter then ended with the limitations of the study.

3.1.Data Source

The study used the Climate Change, Women in Agriculture and Food Security Data set collected by the Regional Institute for Population Studies in four regions of Ghana. The aim of the study was to examine women's contribution to food security across four ecological zones in Ghana namely forest-savannah transition, savannah, forest and coastal zones. The selection of the agro-ecological zones were purposely chosen for their involvement in agricultural activities. Although there are six known agro-ecological zones in Ghana (MOFA, 2010), there are some shared characteristics. For instance the Sudan and Guinea Savannah share a uni-modal rainfall which led to the selection of one, whereas the rainforest and deciduous forest zone share likely characteristics in terms of rainfall and vegetation. This led to the selection of four main agro-ecological zones in Ghana.

The information was gathered from both male and female heads in the various households. As both sexes could better report on the need to include women in agriculture, the sample included both sexes. The data collection focused on rural farming households in four districts across four regions in Ghana. These districts are Mfantseman, Techiman, Amansie West and Tolon. A total

of sixteen farming communities (four in each district) were selected. Households were then randomly selected in the various districts The survey put together several research interests on migration, climate variability and climate change, land use, and food security. The Climate Change, Women in Agriculture and Food Security data was a cross sectional data collection.

3.2.Study Area

Ghana is a country in West Africa, with a total population of 24,658,823 persons in 2010 (GSS, 2013). The country has become one of the leading countries in sub-Saharan Africa in terms of economic growth and development. The selected study areas are located in the Central, Brong Ahafo, Ashanti and Northern Regions of the country.

Mfantseman Municipality is located in the Central Region of Ghana with about 144,332 persons (GSS, 2014). About 35 per cent of its population live in rural areas with three of ten of households involved in farming. Its proximity to the sea has also boosted its fish production. The rural communities selected from the Municipal were Kormantse, Biriwa (both of which are also fishing communities), Akobima and Dominase. These communities are found in the Coastal Savannah of Ghana. The Techiman Municipality is in the Brong Ahafo Region of Ghana, one of the most notable farming regions in Ghana. It has a population of 147,788 persons with about 36 percent of its population in rural areas. Almost half of its populace are involved in agriculture, along with a large proportion of migrant farmers. Access to land for the vulnerable has therefore become crucial in the municipal (GSS, 2014). The communities selected in the Municipal (transitional zone) were Nsuta, Nkwaeso, Tadieso and Hansua.

The Amansie West District of the Ashanti Region had a population of 134,331 in 2010 (GSS, 2014). With over 74 per cent of its population involved in agriculture, farming has become a major source of employment. In the rural areas, seven out of ten households are involved in agriculture. Most of the farmers though work as smallholder farmers. Moseaso, Manso Atwede, Manso Dominase and Manso Kwahu were the communities selected for the forest savannah region. The last of the study areas is the Tolon District in the Northern Region of Ghana. With a total population of 72,990, the district has served as a hub for farmers, employing over 92 per cent of its populace. With over 96 per cent of the farmers in rural areas of the Sudan savannah, access to land is necessary for the district. The communities selected for the study were Tingoli, Tunayili, Koblimagu and Kukuonayili.

3.3.Research Design

A cross sectional design was used in the study of Climate Change, Women in Agriculture and Food Security. Households were selected to estimate the linkages between the variables and outcomes of interest. As the dependent and independent variables were studied at one point in time, it would not be conclusive on the cause and effect relationship.

3.4.Sampling Design

Based on their classification as agricultural districts in the 2010 Population and Housing Census report by the Ghana Statistical Service, four communities per district were chosen. These communities were selected on the basis of the proportion of individuals engaged in crop farming as well as food market availability in or near the communities. The selection of enumeration areas in the selected districts was based on the updated 2010 Population and Housing Census enumeration area map by the Ghana Statistical Service. A random sampling was then used to list households in the enumeration areas.

3.5.Sample size

After the selection of the enumeration areas (EAs) in the various districts, a household listing was done in each of the selected EAs. The purpose was to identify women who were in the households that were involved in agriculture. After the listing, all households with women involved in agriculture in the EAs were selected and a sample was drawn from these households. A total of 35 female farmers per community were targeted and 560 interviews were completed in all 16 communities in the agro-ecological zones selected for the study. For the purpose of the study, however, households and household heads were sampled.

3.6.Unit of Analysis and Measurement of Variables

3.6.1. Unit of Analysis

The unit of analysis for the purpose of the study was at the household level. All households and household heads, i.e. both males and females were used for the study. This is because, in rural areas, household headship plays a major role in the distribution of food in the household. They therefore make an impact on the activities of the household. The answered questions relating to the linkages between access to land and dietary diversity were used for analysis.

3.6.2. Household Dietary Diversity

Dietary diversity seeks to measure the individual groups of food consumed by households over a seven day or 24-hour recall period, depending on the interest of the researcher (FAO, 2014a). The climate change, women in agriculture and food security dataset used a 24-hour recall period to capture food security in and outside the home, irrespective of the time within which the meals were

consumed. Twelve standardized food groups were then created using the HDDS from 0 to 12. The standardized food groups proposed by the Food and Agriculture Organisation of the United Nations were used (FAO, 2014a). The proportions of households with the various scores on the food groups is shown in Table 3.1.

Table 3. 1 Percentage Consumption of Food Groups

FOOD GROUP	**PERCENTAGE**
Cereals	88.9
White Roots and Tubers	63.0
Fruits	87.5
Vegetables	24.9
Meat	21.1
Eggs	7.5
Fresh or Dry Fish	88.0
Beans/Peas/Nuts	12.2
Milk Products	7.9
Fats/Oils	54.2
Sugar/Honey	34.9
Coffee/Tea	20.6

Source: Computed from Climate Change, Women in Agriculture and Food Security (2016)

It can be gathered from Table 3.1 that most protein based products (meat, eggs, beans, and milk) were not consumed as much by the respondents as the carbohydrate based products were. This is a typical situation in rural areas and has been known to lead to their malnourishment (Taruvinga et al., 2013).

The HDDS was created by scoring and summing up the food groups consumed by individuals or households over the recall period. It is based on the assumption that households should consume at least one of these food groups over a time period. Also, a dichotomous response for each food

group is created (Yes-1 and No-0). For the purpose of the study, the sum of the various foods consumed over the 24-hour period used in the study was categorized into two. Consumption of five or below food groups (0-5) showed that the household relatively did not have as much access to food as those who had above five did out of the twelve food groups (FAO, 201). These were thus represented as low dietary diversity (0-5) and high dietary diversity (above 5).

Access to land is the independent variable being measured. The question asked was: What is the type of tenure system on your land? The responses given were categorized as: 1= Owned Land, 2= Rented Land, and 3=Rent-free Land.

3.6.3. Control Variables

All control variables for the study were measured as categorical variables for the bivariate analysis but, household size, and number of meals consumed in a day were left as continuous variables at the multivariate stage of analysis.

For the household head characteristics, sex of the household head was measured as a dichotomous variable, female and male. Age of the household head was categorized for both bivariate analysis and multivariate analysis. Age, although continuous would be categorized to gain knowledge of the age groups that experience dietary diversities. The categories were 20 to 29 years, 30 to 39 years, 40 to 49 years, 50 to 59 years, and the elderly population who are 60 and above. Educational level of the respondents were grouped into those with no formal education, respondents who had attained pre-school/primary education, respondents with a Junior Secondary School (JSS), Junior High School (JHS), or Middle School Leaving Certificate. The Senior Secondary School or Senior

High School qualification followed, with Higher education being the last group. Respondents in union were grouped against those not in union (marital status). Migration status was measured using whether the respondent was born in the community of study and were thus categorized either as indigenes or migrants. In the farming communities, available occupations ranged from those not working, to farmers only, respondents into both farming and non-farming opportunities and then respondents who are not farmers.

The household characteristics considered household size as a continuous variable at the multivariate stage of analysis, but categorised the respondents into sizes from 1 to 4, 5 to 8, and more than 8 members. The four agro-ecological zones for the study were used, which are the Guinea Savannah, Coastal Savannah, Rainforest, and the Transition Zone. Use of irrigation as well as meals per day were dichotomous and grouped as either 'yes' or 'no' for the former and 'less than three meals' or 'three or more meals' for the latter.

3.7.Method of Analysis

This study presented results from secondary data on the relationship between land ownership arrangements and food security, using HDD as a measure of the latter. An understanding of such a relationship assists in adding knowledge to literature on land tenure and food security (HDD) in agro-ecological zones. For this reason, three analytical levels were used for the analysis- univariate, bivariate and multivariate.

The study used the Statistical Package for Social Sciences Version 23 for the analysis of data. To present the results of the objectives of the study, the bivariate analysis compared the relationship

between the independent and dependent variable and went further to establish the association between the variables. This was done with the assistance of chi-square test of association. As both the dependent and independent variables are categorised, the chi-square test brings out the strengths of the associations between the variables.

A binary logistic regression analysis was used at the multivariate level. The analysis for the examination of the association between access to land, as well as factors affecting household dietary diversity (low or high dietary diversity) as an indicator of food security was done. Associating land ownership status and HDD helps to demonstrate land tenure as an alternative for enhancing food security among farmers in rural Ghana.

As the dependent variable is categorical with 2 categories (low dietary diversity and high dietary diversity), the binary logistic regression analysis was used with the land tenure arrangements of the rural farming households as the independent variable and socio-economic and physical characteristics such as age, sex, marital status, occupation, education, agro-ecological zone, household size, migration status, and irrigation use as control variables. These help in explaining how food is accessed by rural farming households in Ghana.

The logistic regression model considers the log of the odds ratio (or exponential β) which was the ratio of households with low or high dietary diversity, expressed as a function of the predictor variable. When β is positive, there is a likelihood increase in the dietary diversity in relation to the reference category (Ref). A negative β also shows a likelihood reduction in dietary diversity

households with regards to the reference category. When the β coefficient is zero, there is an indication of no change with regards to the reference category.

It can be expressed mathematically as follows:

$$\ln \frac{p}{1-p} = \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 \ldots\ldots\ldots \beta_n x_n$$

where,

β_1 I = 0 up to n are logistic co-efficients

x_1, I = 0 up to n are the independent variables

p = probability of success

e = base of natural logarithms

The logistic regression is fitted for all rural farming households to determine the factors that influence their food security (low or high dietary diversity). The model estimates the probability that a farming household at a given time will be having less or more food groups consumed. In the logistic regression analysis, access to land is the independent variable whereas food security (HDD) is the dependent variable. The physical, demographic and socio-economic factors are the control variables.

3.8.Background Characteristics of Respondents

This section presents the proportions of respondents in the independent, control and dependent variables used. The purpose of the univariate analysis is to observe variations among the factors considered in the study. Table 3.2 considers the descriptions of the continuous variables in the study, while Table 3.3 looks at the categorical variables in the study.

Table 3. 2 Distribution of Respondents by Age, Household Size, Meals per Day and Dietary Diversity Score

Variable	Number	Mean	Standard Deviation	Minimum	Maximum
Age	559	50.21	13.56	23	90
Household Size	559	4.93	2.75	1	29
Meals Per Day	559	2.66	0.60	1	7
Dietary Diversity	559	5.11	1.83	0	12

Source: Computed from Climate Change, Women in Agriculture and Food Security Dataset (2016)

From Table 3.2, the range of the ages of the household heads is 67 years, with a median of 49 years. Majority of the respondents were thus in their middle ages to the aged category. The average household size was about 5, with some households having 29 persons. However, majority of the households had 4 persons. Concerning dietary diversity, some households reported that they had not consumed any of the food groups within 24 hours, whereas others had consumed up to all 12 food groups. The average number of food groups consumed was however 5 food groups.

Table 3. 3 Distribution of Respondents by Categorized Household Head, Household and Farm Characteristics

Variable		Frequency	Percent
Land Tenure Arrangement	Owned Land	439	78.5
	Rented Land	80	14.3
	Rent-Free Land	40	7.2
Sex	Male	359	64.2
	Female	200	35.8
Education	No Schooling	299	53.5
	Pre-school/Primary	88	15.7
	JSS/JHS/Middle School	145	25.9
	SSS/SHS	14	2.5
	Higher Education	13	2.3

Variable		Frequency	Percent
Marital Status	In Union	385	68.9
	Not in Union	174	31.1
Occupation	Farming Only	340	60.8
	Farming and Non-Farming	189	33.8
	Non-Farming Only	30	5.4
Migration Status	Migrant	134	24.0
	Indigene	425	76.0
Agro-ecological Zone	Guinea Savannah	140	25.0
	Rainforest	139	24.9
	Transition Zone	140	25.0
	Coastal Savannah	140	25.0
Irrigation Use	Yes	29	5.2
	No	530	94.8

Source: Computed from Climate Change, Women in Agriculture and Food Security Dataset (2016)

3.9.Limitations of the Study

The study was limited by the lack of data on a standard measure of food security and so interpretation of the results was done with caution. Also, the use of HDD as a proxy measure to food security could be flawed. Using a 24-hour recall period as proxies for intake of diets habitually may not be a true reflection of household consumption. Also, seasonality could affect food access and as such the availability of food in the household may present a different situation at the time of data collection when compared to different periods in the year. Notwithstanding these limitations, the results of the study are still useful in the evaluation of food security in rural Ghana.

CHAPTER FOUR

THE RELATIONSHIP BETWEEN BACKGROUND CHARACTERISTICS OF RESPONDENTS AND DIETARY DIVERSITY (FOOD SECURITY)

4.0.Introduction

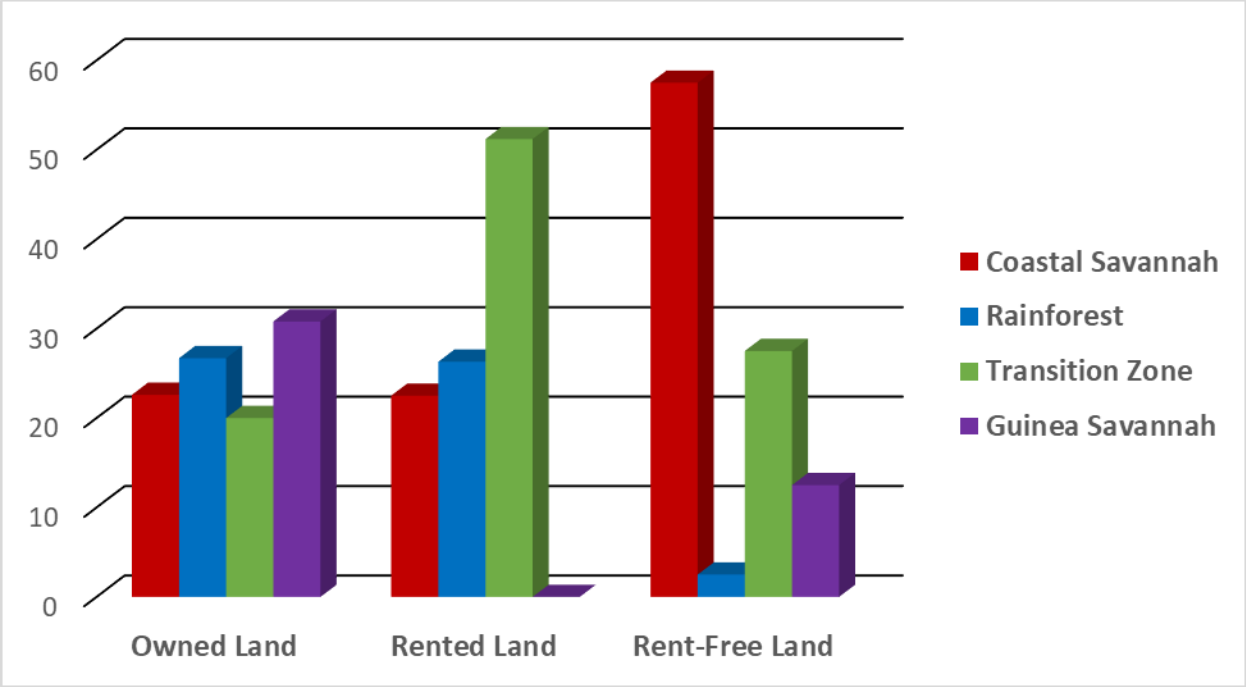
This chapter presents the analysis of the study. The first section focuses land tenure arrangements in the agro-ecological zones of the rural households. This is followed by the relationship between land tenure arrangements and dietary diversity of the households. Another section focuses on the factors affecting household dietary diversity in Ghana. The section also presents the variations in the relationship between the independent variables (age, sex, educational, migration, marital, and occupational statuses of household heads as well as the agro-ecological zone, household size, meals per day and adoption and use of irrigation facilities by households) and the dependent variable (Household Dietary Diversity as a measure of food security) as a fulfilment of the third objective. This study made use of all foods that have been consumed in or outside the home over the 24-hour period preceding the survey.

4.1.Land Ownership Arrangements in the Agro-ecological Zones of Rural Ghana

Land ownership arrangements are important in determining how households, especially those in rural areas, ensure their productivity and wellbeing (Food and Agriculture Organization, 2002). To strengthen and improve the use of resources, it has been recommended that agro-ecological zonings should be used as an appropriate tool of land management (Food and Agriculture Organization, 2002). The study therefore sought to examine the linkages between land ownership

arrangements and agro-ecological zones of rural farming households. Figure 4.1 shows the distribution of land tenure arrangements among rural farming households in the four agro-ecological zones. From the Table, access to land is gained through ownership (by inheritance and purchase), rent (including sharecropping), and rent-free.

Figure 4. 1 Percentage Distribution of Access to Land in the Agro-ecological Zones



Source: Source: Computed from Climate Change, Women in Agriculture and Food Security Data set (2016)

The Chi Square analysis showed a significant association between access to land and the agro-ecological zones of rural Ghana ($\chi 2 = 87.462$; $p < 0.001$). As such, land ownership arrangements were dependent on the agro-ecological zones of the rural farming households. In all, over 78% of the households across the rural areas owned land. Land ownership has proven to be important for poor rural farmers in sub-Saharan Africa as it can determine their willingness to invest in the land

(Muraoka et al., 2014). When the rural poor, who are mostly agricultural workers, thus do not own land, their dietary diversity and food security reduces (Ochieng et al., 2017).

The distribution of land ownership differed across the agro-ecological zones, with the Guinea Savannah having the highest portion of land owners (30.8%). The Guinea Savannah zone of Ghana has been characterised by communal land ownership, with high proportions of households either owning lands through inheritance or working on family lands (Muniru, 2013). The purchase of land is cumbersome as it requires a consensus and this deters land purchase or sales of family lands (Muniru, 2013). Also, none of the households in the Guinea Savannah rented lands. The Guinea Savannah is a dry agro-ecological zone with a single rainfall regime. A household dependent on agriculture for income would therefore logically opt for more humid zones to benefit from double rainfall maxima (two rainfall peaks) to engage in agriculture more profitably.

It can also be noted from Figure 4.1 that the transition agro-ecological zone also benefitted from all four land ownership arrangements, with the highest proportion of households making use of rented lands. The transition agro-ecological zone, due to its location benefits from higher dietary diversity. The zone is characterised by a variety of crops grown and the needed soil and climate suitable for agriculture (Codjoe & Bilsborrow, 2011). There is therefore a stream of migrants, both from the Northern and Southern part of the country, in the zone making use of rented lands.

The forest zone and coastal savannah together represent over 50 per cent of agricultural households in Ghana (Ghana Statistical Service (GSS), 2014). As such, they also had proportions of

households in all four land ownership arrangements. The Coastal Savannah however topped the proportions of households making use of rent-free lands. It could be inferred that as an area with high proportions of migrants, the lands in the Coastal Savannah are highly sought after and as such is difficult to purchase. Large family sizes may therefore make use of agricultural lands as an income earning opportunity. Family lands (rent-free) therefore abound in such areas. The rainforest zone however differs, with relatively larger proportions either owning or renting lands. Known as a humid and fertile zone, lands are usually owned and rented out to migrants occasionally. Also, lands belonging to families are not qualified as rent-free since all claim ownership of the land. This could explain the high proportions of owned and rented lands in the rainforest zone.

4.2.Access to Land and Household Dietary Diversity in Rural Ghana

Access to land has proven to be significant in influencing food security and dietary diversity of households (Cock, Haese, Vink, & Rooyen, 2015; Harris-Fry et al., 2015; Thorne-Lyman et al., 2010). As the main independent variable for the study, it is imperative if a rural farming household is to be food secure. The study therefore sought to examine the relationship between access to land and Household Dietary Diversity, which is a proxy measure of food security. The results of the association between land ownership arrangements and household dietary diversity are presented in Table 4.1.

Table 4. 1 Land Tenure Arrangements and HDD

Land Tenure Arrangement	Low Dietary Diversity	High Dietary Diversity	Total
	%	%	Frequency
Owned Land	62.2	37.8	439
Rented Land	62.5	37.5	80
Rent-free Land	70.0	30.0	40
Total	62.8	37.2	559
	$\chi 2$=0.961	***P* value= 0.618**	

Source: Source: Computed from Climate Change, Women in Agriculture and Food Security Data set (2016)

The chi-square test shows that there is no association between the land tenure arrangement and food security of a household. The association between access to land and food security is not significant and this could be due to other social, demographic and economic factors which may exert influence on both variables (Almeida & Wassel, 2016; Doss et al., 2014).

Generally all household heads, with their respective land ownership arrangements experienced a low dietary diversity. However, household heads who had access to land either through inheritance or purchase had a slightly higher dietary diversity as compared to those who rented and use lands without paying rents. Also, the lowest dietary diversity was noted among household heads with rent-free lands. Making use of lands without ownership has implications. Such lands could be taken ownership of at any point in time. Smallholder farmers who may therefore use such lands may not be able to invest towards the productivity of the land. With limited productivity, food

availability, and consumption reduces leading to food insecurity. Without the linkage due to generally low dietary diversity, access to and ownership of land does not guarantee a reduction or elimination of food insecurity as argued by FAO et al. (2017) and Silpakar (2008).

4.3.Factors Affecting Household Dietary Diversity in Rural Ghana

There are several household head, household and farm characteristics that influence access to food (Almeida & Wassel, 2016; Doss et al., 2014; Quaye et al., 2014), and thus, it is important to examine the relationship between such variables and food security. These factors include, but are not limited to, the household head's age, sex, educational level, marital status, occupation, and migration status. For the household, factors such as the agro-ecological zone in which the household is located, household size could also influence productivity and dietary diversity. Other farm characteristics of importance include the size of one's farm, adoption and use of irrigation facilities, and ability to employ labour by the household on the farm.

4.3.1. Age and HDD

The study sought to find the association between the age of the household and food security in the agro-ecological zones of rural Ghana (Table 4.3.1).

Table 4.3. 1 Household Food Security by Age

Age Groups	Low Dietary Diversity	High Dietary Diversity	Total
	%	%	Frequency
20-29	56.0	44.0	25
30-39	57.0	43.0	100
40-49	51.6	48.4	159
50-59	74.4	25.6	121
60 +	70.1	29.9	154
Total	62.8	37.2	559
	χ2=21.000	***P* value=0.000**	

Source: Source: Computed from Climate Change, Women in Agriculture and Food Security Data set (2016)

Age has been proven to be one of the important variables in demography that is associated with access to land and food. According to Jayne et al. (2014), the acquisition of lands for farming household heads in Zambia increases after the age of 40 as they are more able to save money accumulated from previous years of work. Farmers, in different age groups have different dietary needs and thus consume accordingly.

From Table 4.3.1, the age of the household head showed a significant association with household dietary diversity over the 24-hour period preceding the survey. Household heads in their forties had the highest dietary diversity (49%). Generally, household heads below the age of fifty had a relatively high proportion having a more diversified diet. Younger household heads are more able to diversify their income sources as they have the strength to, and as such earn a higher income to improve their food security (Delvaux & Paloma, 2018). However, the elderly could be more

vulnerable in terms of nutrition as their finances are usually limited (Lo, Chang, Lee, & Wahlqvist, 2012). It can therefore be concluded that respondents above the age of 50 are more likely to have a lower dietary diversity as compared to the counterparts below 50 years.

4.3.2. Sex and HDD

Several studies have proven that gender has a limiting influence on enhancing access to land and food security (Doss et al., 2014; FAO IFAD UNICEF, 2017). Food security has been to the disadvantage of women and has thus noted as a major constraint to Ghanaian agriculture (Ministry of Food and Agriculture (MOFA), 2010). This is because, females have a minimal access to land and resources needed to boost their food security (Delvaux & Paloma, 2018). In developing countries, food production (an aspect of food security) can be boosted from 2.5 per cent to 4 per cent, whiles reducing the malnourished by 5 per cent (Food and Agriculture Organization, 2011b) if women are included in matters relating to food. It was therefore imperative to find out whether female headed households in the agro-ecological zones of rural Ghana are better off when compared to their male counterparts. Table 4.3.2 shows a distribution of the household heads by sex and food security.

Table 4.3. 2 HDD by Sex of Household Head

Sex	Low Dietary Diversity	High Dietary Diversity	Total
	%	%	Frequency
Male	58.5	41.5	359
Female	70.5	29.5	200
Total	62.8	37.2	559
	χ2=7.922	***P* value=0.005**	

Source: Source: Computed from Climate Change, Women in Agriculture and Food Security Dataset (2016)

The chi-square test of association shows that there is a statistical association between sex of the household head and their DD. From Table 4.3.2, a higher proportion of the male household heads were more diversified in their dietary intake as compared to their female counterparts. These results are similar to the findings of Doss et al. (2014) on farmers which posit that women are less likely to be food secure as compared to men.

Generally, though, women are less likely to be diversified in their diets as compared to men (Codjoe et al., 2016). This is due to a limited income, occupational and educational access (Codjoe et al., 2016) as a result of the gendered roles assigned to women making them more vulnerable and less access to food, especially when they do not have access to agricultural lands (Doss et al., 2014; Food and Agriculture Organization, 2011a). These roles include women seeking employment from more care-related and less muscular jobs which may not earn them a high income (Food and Agriculture Organization, 2011b; FAO et al., 2018). It can therefore be concluded that female household heads are less likely to have a high dietary diversity as compared to their male counterparts (Mbwana et al., 2016).

4.3.3. Education and HDD

Another important socio-economic variable that could affect an individual's food security is their educational level. Education aids in skill and nutritional knowledge acquisition, whilst enhancing values and beliefs of society. It is integral to human existence and could affect the ability of individuals in being food secure. Table 4.3.3 shows the DD of household heads by their educational level.

Table 4.3. 3 HDD by Educational Level of Household Head

Educational Level	Low Dietary Diversity	High Dietary Diversity	Total
	%	%	Frequency
No Schooling	64.9	35.1	299
Pre-School/ Primary	65.9	34.1	88
JSS/JHS/Middle School	60.0	40.0	145
SSS/SHS	57.1	42.9	14
Higher	30.8	69.2	13
Total	62.8	37.2	559
	$\chi 2$=7.306	***P* value=0.121**	

Source: Source: Computed from Climate Change, Women in Agriculture and Food Security Data set (2016)

The chi-square test establishes that there is no association between educational level and HDD. A majority of the respondents in the selected rural areas had no schooling (53%) and this could reflect in their lower dietary diversities. Although the results show no significant association, some variations can be noted among the household heads.

From the Table, household heads with higher education had the highest proportion of high dietary diversity (69.2%), whereas household heads with pre-school/primary education had the lowest proportion of low dietary diversity (34.1%). Household heads without schooling were comparatively better than those with pre-school education, although their dietary diversity was low. With pre-school/primary education, one may not have the needed knowledge and skillset for an improved life or nutrition and this could explain why they are worse off. A similar principle applies to household heads without any schooling. Nutrition education is important and attained

as one progresses up the education ladder (Akerele et al., 2017; Taruvinga et al., 2013). It is therefore necessary to attain a higher level of education to access the knowledge and information needed to improve one's health and nutrition. This explains why household heads who are go higher on the educational ladder experience a more diversified diet, especially for those who had attained post-senior high school education (Cock et al., 2015).

4.3.4. Marital Status and HDD

In rural Ghana, the study sought to examine the association between marital status and dietary diversity of households. Table 4.3.4 displays the household dietary diversity according to the marital status of the household heads.

Table 4.3. 4 HDD by Marital Status of Household Head

Marital Status	Low Dietary Diversity	High Dietary Diversity	Total
	%	%	Frequency
In Union	60.0	40.0	385
Not in Union	69.0	31.0	174
Total	62.8	37.2	559
	$\chi 2$=4.123	***P* value=0.042**	

Source: Source: Computed from Climate Change, Women in Agriculture and Food Security Data set (2016)

From Table 4.3.4, household heads in union had a slightly higher proportion having a more diversified diet as compared to their counterparts who are not in union (never married,

divorced/separated, and widowed). According to Baltissen and Betsema (2016), the land ownership rights of women are usually secured through marriage. For this reason, most women are able to gain access to land when married especially in rural areas.

In rural Ghana, marriage has been a major source of land (especially for women) and also improves productivity on the farm (Duncan, 2010b). Spouses may be able to provide support on farms, thus enhancing the food security status of the household (Quaye et al., 2014). Farming household heads in union are therefore better able to enhance their consumption as production increases, enabling them to be more diversified in their diets as compared to their unmarried counterparts. From the study, it can be noted that household heads who are married are likely to have a higher dietary diversity, and thus food security, as compared to their unmarried counterparts.

4.3.5. Occupation and HDD

The main occupation of a household head could influence their dietary diversity, in addition to that of their households. Rural farming household heads engaged in more than one income earning opportunity may have enough income to sustain food security in their households. Table 4.3.5 provides a summary of the dietary diversity of household heads by their occupations.

Table 4.3. 5 HDD by Occupation of Household Head

Occupation	Low Dietary Diversity	High Dietary Diversity	Total
	%	%	Frequency
Farming only	66.2	33.8	340
Farming and non-farming	58.2	41.8	189
Non-farming only	53.3	46.7	30
Total	62.8	37.2	559
	$\chi 2$=4.521	***P* value=0.104**	

Source: Source: Computed from Climate Change, Women in Agriculture and Food Security Data set (2016)

The chi-square test of association shows no statistically significant association between occupation and HDD. Occupation of rural household heads has been noted to be one of the key influences of dietary diversity. This is due to its association with income and ultimate wealth (MOFA, 2010) and thus food security. Poor rural household heads who are usually farmers face difficulties in gaining access to the resources needed to improve productivity, and are thus food insecure.

From Table 4.3.5, it is worth noting, however, that household heads engaged in farming only have the highest proportion of low dietary diversity. An improvement is noted among household heads with off-farm income earning opportunities in addition to their on-farm income. When farmers are able to acquire more income from both on-farm and off-farm activities, they can improve their access to food through investments in their farming activities (Jayne et al., 2014). As such, having more than one source of income implied that a household would have a more diversified diet. It can also be noted that non-farming household heads had the highest proportion of high dietary

diversity. Non-farming income earning opportunities may be associated with higher educational level and thus higher income, which could lead to better dietary diversity. This is similar to the findings of GSS (2013) and MOFA (2010), that farmers are worse off and poor as compared to other occupations.

4.3.6. Agro-ecological zones and HDD

The agro-ecological zone in which a farm is located could have major influences on the food security of the household. Table 4.3.6 shows the dietary diversity among household heads in the four agro-ecological zones of the study.

Table 4.3. 6 HDD by Agro-ecological Zone of Household Head

Agro-ecological Zone	Low Dietary Diversity	High Dietary Diversity	Total
	%	%	Frequency
Rainforest	66.2	33.8	139
Coastal Savannah	69.3	30.7	140
Transition Zone	62.9	37.1	140
Guinea Savannah	52.9	47.1	140
Total	62.8	37.2	559
	$\chi 2$=9.127	***P* value=0.028**	

Source: Computed from Climate Change, Women in Agriculture and Food Security Data set (2016)

The chi-square test of association shows a significantly strong association between agro-ecological zones of household heads and their dietary diversity. From the Table, household heads with farms in the Guinea Savannah, a relatively dry location, had the highest dietary diversity. Such findings are in line with that of Waswa et al. (2014). In their study on Food Security in Western Kenya, it

was found that households in dry zones experienced less hunger than those in humid zones. This was attributed to more assistance being offered by Government and non-Governmental Organizations for residents of such areas. In Ghana, the northern part of the country has been noted to receive the largest support from foreign and local donors due to the high rate of poverty. This could explain why the household heads in the Guinea Savannah consumed more food groups (47.1%). It is also noteworthy that respondents in Savannah locations are able to cultivate diverse food crops to be sold in the southern part of the country. Usually, there is an abundance of non-timber forest products (NTFPs) in the Guinea Savannah zone (Ahenkan & Boon, 2011). They can thus store their food crops for future use as their adaptation to having a single rainfall regime. Also, out- migration mostly occurs in the zone and as such, families may receive remittances which could be used to boost the household dietary diversity (Food and Agriculture Organization of the United Nations, 2010)

Also, household heads in the Coastal Savannah experienced the lowest dietary diversity, followed by household heads in the Rainforest Zone. In the Coastal areas of Ghana, fishing is usually the main occupation due to their proximity to the sea (Akuffo and Quagraine, 2019). Crop farmers may not be able to cultivate as much as noted by Pollard, Kirk and Cade (2002). They also noted that the Coastal Savannah is one of the areas with drier climates, as such rainfall variability and increased temperatures often lead to decreased output of food as well as income. Although the forest zone could ideally be one of the most important food hubs in the country (Christian et al., 2015), lower dietary diversity was noted. As earlier found, such areas are usually rented out to migrants. Household heads farming in such areas may therefore not be able to produce as much

for consumption and income due to lack of ownership and smaller parcels of lands being used by families.

4.3.7. Household Size and HDD

The size of a household could have impacts on how food secure that household is. Table 4.3.7 shows the household sizes and their corresponding dietary diversity statuses.

Table 4.3. 7 HDD by Household Size

Household Size	Low Dietary Diversity	High Dietary Diversity	Total
	%	%	Frequency
1-4 members	67.8	32.2	283
5-8 members	58.2	41.8	232
9+ members	54.5	45.5	44
Total	62.8	37.2	559
	$\chi 2$=6.476	***P* value=0.039**	

Source: Source: Computed from Climate Change, Women in Agriculture and Food Security Data set (2016)

The chi-square test shows an association between household size and food security. As such, having more than more members in a household determines the status of food security of a household. The findings are not similar to that of Cock et al. (2015) who suggest that household heads with smaller household sizes are able to ensure their food security. When households are larger, a higher number of persons have a limited access to food as there are more mouths to feed (Mensah et al., 2013). In this study, however, larger household sizes have higher proportions of better dietary diversity. This could be attributed to such households being located in the Guinea Savannah where non-timber forest products are in abundance. Also, Codjoe (2006) notes that

larger household sizes may be able to increase their production with the availability of a larger on-farm labour size. As such, larger household sizes may have an improved dietary diversity.

4.3.8. Migration Status and HDD

The status of a household head in terms of migration could have an influence on their ability to gain access to land, whilst ensuring their food security. For this reason, the study sought to seek out the association between migration status of a household head and the food security of the household. Table 4.3.8 shows dietary diversity by migration status of household heads.

Table 4.3. 8 HDD by Migration Status of Household Head

Migration Status	Low Dietary Diversity	High Dietary Diversity	Total
	%	%	Frequency
Migrant	64.2	35.8	134
Indigene	62.4	37.6	425
Total	62.8	37.2	559
	$\chi 2$=0.145	***P* value=0.703**	

Source: Source: Computed from Climate Change, Women in Agriculture and Food Security Data set (2016)

The chi-square test shows no association between migration status of household heads and their HDD. Migrant farmers, as a result of tenure insecurity, in some cases are able to mechanize agriculture and as such produce more food and ultimately ensure their food security, as compared to indigenes (Codjoe, 2006). As such, they may be able to be as food secure as indigenes of a community. However, Barron, Thame and Herrero (2013) in studying the drivers and challenges for food security found that migrants may have a limited access to food as the destination areas may be more food insecure. It can be noted from Table 4.3.8 that farming household heads that

are indigenes had a slightly higher proportion with a more diversified diet as compared to migrant household heads.

4.3.9. Adoption and Use of Irrigation Facilities by HDD

Table 4.3.9 shows the patterns of adoption and use irrigation facilities by household heads with respect to their HDD status.

Table 4.3. 9 HDD by Household's Adoption and Use of Irrigation Facilities

Irrigation use	Low Dietary Diversity	High Dietary Diversity	Total
	%	%	Frequency
Yes	58.6	41.4	29
No	63.0	37.0	530
Total	62.8	37.2	559
	χ2=0.228	***P* value=0.633**	

Source: Computed from Climate Change, Women in Agriculture and Food Security Data set (2016)

From Table 4.3.9, the p-value for irrigation use is not significant. As such there is no association between a household head's adoption and use of irrigational facilities and their dietary diversity. However, it can be noted from the table that over 41 per cent of households using irrigation had a higher dietary diversity, as against 37 per cent of households that do not use irrigation. Irrigational facilities are important to improving production of food. The food security of households however entails several factors and this could explain why the association is not significant. This finding differs from that of Asefa and Zegeye (2003) who posit that for farmers to be food secure, they must use technology (including irrigation facilities) in Ethiopia.

4.3.10. Meals per Day and HDD

Table 4.3.10 shows the association between the average number of meals consumed in a day and the HDDS. Household perception of sufficient food quantity could affect the dietary diversity of the household. In experiencing food shortages, households may reduce their daily required foods.

Table 4.3. 10 Meals per Day and HDD

Meals Per Day	Low Dietary Diversity	High Dietary Diversity	Total
	Percent	Percent	Frequency
Less than 3	77.9	22.1	208
3 or more	53.8	46.2	351
Total	62.8	37.2	559
	χ2=32.302	***P* value=0.000**	

Source: Computed from Climate Change, Women in Agriculture and Food Security Data set (2016)

There is a significant association between the number of meals consumed in a household and their dietary diversity. From the table, almost 78 per cent of households consuming less than three meals in a day had a lower dietary diversity as opposed to those consuming three or more meals each day. Households with a perceived lack of sufficient food may cut down portion and thus may experience hunger due to lower income. For this reason, households with lower consumption (less than three-squared meals) may be less food secure (Leroy et al., 2015). When certain food groups are excessively consumed, without balancing the diets, households could increase their risk of diseases through obesity.

4.3.1.1.Interrelationships among Factors affecting HDD

This section focuses on examining the effect of access to land on household dietary diversity (food security) whiles controlling for physical and socio-demographic characteristics of the households with a binary logistic regression model. Table 4.3.11 and Table 4.3.12 considers the estimated coefficients and statistics predicted by the binary logistic model on the variables of interest.

The first model (Table 4.3.11) uses a binary logistic regression model with HDD as the outcome variable to analyse the effect of the main predictor variable (land ownership arrangements). In the table, the Exp (β) and the significance of the relationship between the variables are shown.

Table 4.3. 11 Logistic Regression Model of HDD and by Independent Variable in Rural Ghana

Land Ownership Arrangements	**Significance**	**Exp (β)**
Owned Land	0.621	
Rent-Free Land	0.330	0.71 [0.35, 1.42]
Rented Land	0..253	0.99 [0.60, 1.61]
Model chi-square	0.989	Df=2
Significance	P-value=0.610	
Nagelkerke R-Square	0.002	

Source: Computed from Climate Change, Women in Agriculture and Food Security Dataset (2016)

A Nagelkerke R-Square of 0.002 implies that approximately 0.2 per cent of the variation in high DD is explained by the household's land ownership arrangement. This implies that HDD used in

the study as a proxy measure of food security could have numerous factors which may serve as an explanations to the variations in DD. The results of the analysis however show that land ownership arrangement does not have any statistically significant effect on food security (Household Dietary Diversity).

Some linkages can be noted, however from the table. For instance, households with rented lands were 0.99 times less likely to be food secured as compared to those who own land. A similar finding applies to households making use of rent-free lands (either family lands, or squatting etc.). Such households were 0.71 times less likely to be food secured. As important as food security is, security of tenure for households becomes a priority as ownership gives households the opportunity to grow diverse crops, and harvest them for themselves. According to Codjoe (2006), such households can efficiently work on their lands in order to increase their produce. With the produce, they can sell more crops, earn higher incomes are live comfortably. A higher income does not only ensure food security; it also provides households with the opportunity to go into more intensive and mechanized agricultural practices which increases land output or crop yield, although it could also lead to degradation.

For rural dwellers, land ownership could thus serve as a means to improve food production and utilization, as well as storage. According to Koirala et al. (2016), when farmers make use of rented lands, owners are the ones to determine the extent to which the land can be put to use. For tenants or sharecroppers, this could be problematic especially when the farmer has no alternative income earning opportunity. This could explain the incidence of low dietary diversity among households making use of rented lands. In some forms of land rent, such as sharecropping, yields are shared

between the owner and tenant, leading to a further decline in food consumption especially for farmers with small farm sizes. Koirala et al. (2016) note that such farmers may rather use their income from their share to purchase items deemed more important than food, leading to lower food consumption and malnourishment.

For households engaged in rent-free lands, problems of commitment arises. Without direct claim of ownership, farming households may not put in the needed effort to invest in the land (Silpakar, 2008). Access to land, without investment, yields poorly further worsening the plight of households without the lands. Also, crops that may take years to cultivate and bring in more income may not be cultivated as tenants may be asked to give the land to its owner at any point in time. This could lead to poor food production and consumption in households making use of rent-free lands.

It has been established in literature that although access to land is important, there is the need to examine other household head, household and farm characteristics that may play a role in food security. Although food security is complex and may be affected by numerous factors, socio-demographic and other important factors could lead to either an improved or decreased dietary diversity. Table 4.3.12 considers all the predictors used in the conceptual framework to examine their relationship with dietary diversity.

Table 4.3. 12 Logistic Regression Model of HDD and Selected Indicators among Rural Farming Households in Ghana (2016)

Indicator	OR 95% CI	P-value
Access to Land		
Owned (*ref*)	1.00	
Rent-free	0.63 [0.29, 1.38]	0.251
Rented	1.06 [0.59, 1.91]	0.841
Sex of Household Head		
Female (*ref*)	1.00	
Male	1.42 [0.67, 3.01]	0.355
Age of Household Head		
20-29	1.81 [0.71, 4.63]	0.215
30-39	1.52 [0.84, 2.75]	0.170
40-49	2.09 [1.26, 3.49]	0.005
50-59	0.79 [0.44, 1.41]	0.419
60+ (*ref*)	1.00	
Occupation of Household Head		
Farming only (*ref*)	1.00	
Farming and non-farming	1.58 [1.04, 2.40]	0.031
Non-farming only	1.62 [0.67, 3.87]	0.282
Agro-ecological zone		
Coastal Savannah	0.69 [0.34, 1.39]	0.298
Rainforest zone	0.59 [0.30, 1.63]	0.127
Transition zone	0.95 [0.47, 1.92]	0.882
Guinea Savannah (*ref*)	1.00	
Marital Status		
In Union (*ref*)	1.00	
Not in Union	1.46 [0.69, 3.08]	0.326

Indicator	OR 95% CI	P-value
Educational Level		
No schooling	0.20 [0.06, 0.74]	0.015
Pre-school/Primary	0.22 [0.06, 0.83]	0.026
JSS/JHS/Middle	0.26 [0.07, 0.95]	0.041
SSS/SHS	0.31 [0.06, 1.66]	0.172
Higher education (*ref*)	1.00	
Migration Status		
Migrant	0.98 [0.61, 1.57]	0.961
Indigene (*ref*)	1.00	
Household size	1.71 [1.00, 1.16]	0.057
Irrigation Use		
Yes (*ref*)	1.00	
No	0.99 [0.62, 1.58]	0.892
Meals per day	1.81 [1.26, 2.59]	0.001
Constant	-1.506	P-value =0.000
Correct % prediction	68.2%	
Nagelkerke R^2	14.1%	
Model $\chi 2$ (df)	61.031 (21)	

Source: Computed from Climate Change, Women in Agriculture and Food Security Data set (2016)

The overall model is strongly significant (P<0.001) and predicts 68.2% of the responses correctly. The model also produced a Nagelkerke R-squared value of 14.1%. The Nagelkerke R-Square implies that about 14 per cent of the variation in high dietary diversity in rural Ghana can be explained by the independent and control variables.

From the table, it can be noted that although land ownership arrangements show no statistically significant relationship with dietary diversity, some changes are observed with the introduction of the control variables. From the table, households making use of rented farmlands were 1.05 times more likely to have a diversified diet as compared to those who owned land. However those making use of rent-free lands were 0.63 times less likely to be food secured. Although not similar to the findings of Koirala et al. (2016) and Jayne et al. (2014), there could be some possible explanations. Users of rented land, as a result of their lack of ownership, could have the time to engage in other income earning opportunities that could increase their ability to purchase the items needed in their communities. This could explain the slightly higher dietary diversity noted among renters. Landowners however, without other commitments may invest into the land. As climatic changes ensue, they are more likely to lose their crops leading to loss of income and difficulty in reinvesting into the land, leading to further impoverishment and food security. Those who rent land are however saved from further costs as they could rent other lands, whereas owners of the land may not be able to do so (FAO et al., 2018). The first hypothesis is however rejected as no statistical significance was noted in the relationship between land ownership arrangement and dietary diversity.

From Table 4.3.12, only age, occupation and educational level of the household head, as well as the number of meals consumed per day of the household were statistically significant at $p<0.05$ and would be interpreted.

Age may play a role on the foods that individuals choose to consume, especially with reference to their health, taste and economic circumstances (Lo et al., 2012). With respect to dietary diversity,

results showed that household heads from 20 to 49 had a higher dietary diversity for the 24 hours preceding the survey, than the aged household heads (60 and above). From Table 4.3.12, household heads from 20 to 29 years were 1.81 times more likely to be food secured as compared to household heads aged 60 and above. In the young ages, farmers may have the strength to work on their lands, take more risks and invest towards the success of their work (Delvaux and Paloma, 2018). Also, there is the strength to diversify their income sources in order to be more food secured. A similar principle applies to household heads from age 30 to 39 who were 1.52 times more likely to be food secured as compared to the elderly household heads.

Household heads from age 40 to 49 years, however were twice more likely to be food secured, as compared to the aged category. According to Jayne et al. (2014), similar findings exist in Zambia. They attributed this to higher access to land among respondents aged 40 and above, giving them the opportunity to save money accumulated from previous years of work. Such household heads are thus more likely to be food secured. A decline was however noted among household heads in their fifties (50-59 years) who were 0.8 times less likely to be food secured. Nearing the aged category, strength decline and lack of resources could lead to a decline in nutrition status. Added to this, when support from relatives are limited, such household heads may not have the income to improve upon their diets. This could explain the decline in the dietary diversity of the elderly or household heads in their fifties as compared to the aged who may be supported by friends and relatives as the known age at which one retires in Ghana is 60 years.

Household heads that have a diversified income source are more likely to be food secure when compared to their counterparts with a single income source. From Table 4.3.12, it can be noted

that rural farming household heads who engage in both farming and non-farming income earning opportunities were 1.58 times more likely to have diversified diets as compared to those engaged in farming only. This is in line the findings of MOFA (2010) and GSS (2015) that the poorest and most food insecure population in Ghana are agricultural workers or farmers. This could also explain why non-farming household heads were 1.62 times more diversified in their diets as compared to farmers.

Farming in rural areas, even with fertile lands, can be cumbersome without the needed resources such as technology and labour (especially for large farms). Without the necessary inputs, farmers may not be able to increase their crop yield especially in the face of increasing weather variability. Households that have more than one income source can therefore afford to purchase food, even if it is in smaller quantities. Households engaged in farming, although with more proximity to food, may not be able to purchase foods needed that are not cultivated by the household. There is therefore the need to engage in other income earning opportunities. This is similar to the findings of FAO (2017) as well as that of Delvaux & Paloma (2018) who suggest that diversifying rural income sources would aid in reducing hunger globally.

Again, household heads with some level of education had a higher dietary diversity as compared to those with no schooling. From the table it can be noted that all household heads within the lower levels of education had a lower likelihood of being food secured as compared to those who attain higher education. Within the levels of education, household heads who had never been to school were 0.2 times less likely to be food secured as compared to those who had attained higher education. Also, JSS/JHS and SSS/SHS/Middle level of education experienced are 0.26, and 0.31

times less likely to be diversified in their diet than household heads with higher education. Slight increases noted among those who attained pre-school/ primary education through to Senior Secondary/High School education show that the higher one is educated the more likely to be food secured. The study therefore fails to reject the second hypothesis as household heads with higher levels of schooling are more likely to be diversified in their diets as opposed to household heads with no schooling.

This finding puts forward that encouraging education, to at least a completion of basic school (JSS/JHS/Middle) could influence knowledge and intake of adequate nutrients of individuals and households. An explanation to the slightly high dietary diversity among household heads with pre-school/primary education could be that these rural household heads may be involved in relatively low income earning opportunities, although it is better than those with no schooling. Better employment opportunities are also associated with SSS/SHS and higher education which means better education on health and balanced diets in addition to purchasing power. As such, household heads with a higher education are more likely to have a high dietary diversity and be food secure than those with limited to no education (Codjoe et al., 2016).

A household's experience with food shortage and consumption could also affect their dietary diversity. In the study, the more meals consumed, the higher the likelihood of being food secured. This is similar to the findings of Leroy et al. (2015) who associate more meals consumed with higher food security.

CHAPTER FIVE

SUMMARY, RECOMMENDATIONS AND CONCLUSIONS

5.0.Summary of Findings

The objective of this study was to examine the relationship between access to land and food security in rural Ghana, with HDD as a measure of the latter. To achieve this, secondary data used was based on Household Dietary Diversity (dependent variable) and land ownership arrangements (independent variable). Also factors such as the sex, age, occupation, education, marital, and migration statuses of the household heads, as well as the household size, agro-ecological zone, food consumption per day and use of irrigation facilities by the households were controlled for. A binary logistic regression model was then employed to explore the relationship between food security and land ownership arrangements as well as the control variables.

The specific objectives of the study included ascertaining the land tenure arrangements in the four agro-ecological zones in rural Ghana. Under this objective, it was found that the relationship was such that, the agro-ecological zone of a household determined the land tenure arrangement. As such, the rural households in the Guinea Savannah were made of households that owned land with the remaining making use of rent-free land. On the other hand, renters of land were mostly located in the Rainforest and Transition zone which are regions highly suitable for agriculture. Also the Transition zone had the highest percentage of rented lands, with the Coastal Savannah having the highest rent-free lands. Owned lands were also highly found among households in the Guinea Savannah.

The second specific objective was to examine the linkage between tenure arrangements and dietary diversity of households in rural Ghana. Under this objective, it was found that the association and relationship was not significant. As such, having access to land (through tenure arrangements) did not ensure a higher dietary diversity of any given household. However, in terms of food security (HDD), households with rented lands were high on the rank with the binary logistic regression. Indigenes who may own land did not have a high dietary diversity as those who rent (mostly migrants) make use of the land efficiently and harness as much as they can due to lack of ownership. Households into rent-free lands also were the most likely to be food insecure in terms of dietary diversity as compared to households that own land**.**

The third and final objective for the study was to explore the factors that affect food security. According to the Climate Change, Women in Agriculture and Food Security Dataset, there were four main factors that could affect a household's food security. Household heads in their younger ages (20 to 49) were more likely to be food secured as compared to the elderly. Also, the higher one progresses up the educational ladder, the more likely he or she is to be food secured. Again, household heads involved in on and off farm income earning opportunities, as well as only off farm jobs were the most likely to be food secured as compared to farmers. Lastly, households consuming more meals in a day were more likely to be food secured in the four agro-ecological zones in rural Ghana.

5.1.Conclusion

In conclusion, household dietary diversity is an important measure of food security. Also, there is the need to include household characteristics in order to understand food security in households.

Improved food availability, access and utilization has numerous benefits for every country and the factors that affect it need to be well explored. In this study, an aspect of the 'Food Security, Livelihood and Nutrition Framework' by the FAO was examined. In the socio-economic context, vulnerability may worsen and from this perspective, the study sought to examine the linkage between land and food security. The focus of the study was on the land ownership arrangements, and dietary diversity of farming households in selected rural areas of Ghana.

Besides the 'land' factor, other socio-demographic and economic characteristics were examined. These were developed into a conceptual framework and controlled for in the study. Using secondary data, household head, household and farm characteristics were examined for their linkages with dietary diversity (proxy measure of food security). Based on the results from the binary logistic regression, the study rejects the first hypothesis as there was relationship between dietary diversity and access to land.

Food security is a complex concept comprising of several dimensions. As such, there may be other factors which may contribute to the dependent variable. These include a household's proportion of farmland cultivated, type of place of residence, eating taboos and customs of the society, household wealth status, religious affiliation of the household head, perceptions of access and availability of food, and factors put forth in the Food Security, Livelihoods and Nutrition Framework, among others. These explain why there was no association or relationship between land ownership arrangements and dietary diversity of the household.

The second hypothesis however is accepted as household heads with some level of education had a higher dietary diversity than those with no schooling. Education assists in providing information on nutrition and as such, household heads with some level of education (especially as the highest education) had a higher dietary diversity as compared to their counterparts with no education. Also, education is associated with better income earning opportunities and technology, all of which could improve purchasing power and food production and access for household heads with some level of education.

Although female household heads were more likely to have a lower dietary diversity, the third hypothesis which considers the sex of the household head in relation to dietary diversity is also rejected. This is because, in examining the relationship between sex of the household head and dietary diversity, no statistically significant relationship emerged.

5.2.Recommendations

Based on the findings previously presented, it is imperative to explore better proxy measures to food security. HDD may not provide evidence that food insecurity exists unless combined with other measures. When HDD is used alongside other food security measures, it may yield a substantive proxy measure to food security. Measures such as household hunger scale, household food insecurity and access scale among others could be used as composite measures to food security in rural Ghana.

There is also the need to examine the external, trans-disciplinary factors that affect dietary diversity to improve the understanding of food security in Ghana. These factors include, but are not limited to culture, policies, climate and market conditions among others. When such factors are explored in poor zones such as rural and urban poor communities, it could yield a better understanding of nutrition and food security in the country. Again, a mixed methods approach could be used in this study to provide a better context to understanding the effect of land ownership arrangements on food security, which was not achieved in this study due to the lack of data on the subject.

Also, the role of education of the rural households in increasing household dietary diversity and making households more food secure could be explored extensively. In the local assemblies, the importance of nutrition education could be established so that rural farming households, even without higher education, could get to know the benefits of consuming the various food groups. .

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