



**DILLA UNIVERSITY  
SCHOOL OF GRADUATE STUDIES**

**DETERMINANTS OF HOUSEHOLD FOOD SECURITY STATUS: THE  
CASE OF GORCHE WOREDA, SOUTHERN ETHIOPIA**

**M.Sc. THESIS**

**BY**

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**School of Graduate Studies**

**Determinants of Household Food Security Status: The Case of Gorche  
Woreda, Southern Ethiopia**

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MASTER OF SCIENCE IN AGRICULTURE (AGRICULTURAL  
ECONOMICS)**

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**AUGUST, 2020**  
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## **DEDICATION**

I would like to dedicate this thesis to my family for their unreserved love, consistent encouragement, sincere support and understanding during my study period.

## STATEMENT OF THE AUTHOR

First, I declare that this thesis is my solely work and that all sources of materials used for this thesis have been duly acknowledged. This thesis has been submitted in partial fulfillment of the requirements for M.Sc. Degree at the Dilla University and is deposited at the University Library to be available to borrowers under rules of the library. I seriously declare that this thesis is not submitted to any other institution anywhere for the award of any academic degree, diploma, or certificate. Brief quotations from this thesis are allowable without special permission provided that accurate acknowledgement of source is made. Requests for permission for extended quotation from or reproduction of this manuscript in whole or in part may be granted by the head of the major department or the Dean of the School of Graduate Studies when in his or her judgment the proposed use of the material is in the interests of scholarship. In all other instances, however, permission must be obtained from the author.

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## **BIOGRAPHICAL SKETCH**

I was born in Sidama Zone Gorche woreda; Southern Ethiopia on September 4, 1978 E.C. I attended primary and high school education in Haroshifa and Arbegona secondary and preparatory schools respectively. After completion of My secondary education in 1997, I joined Alage ATVET College and also yardistic International collage and graduated with Diploma Animal Health and BSc degree with Disaster Risk Management and sustainable development in 2000 and 2004 respectively. I again joined School of Graduate Studies of Dilla University in 2016/17, to pursue my post graduate (M.Sc.) studies in Agricultural Economics.

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## **LIST OF ACRONOMYS AND ABBREVIATIONS**

EHRD	Ethiopia Humanitarian Requirements Document
FAO	Food and Agriculture Organization
FGD	Focus Group Discussion
GTP	Growth and Transformation Plan
MOFED	Ministry of Finance and Economic Development
PASDEP	Plan for Accelerated and Sustainable Development to End Poverty
RDO	Research and Dissemination Office
SDPR	Sustainable Development and Poverty Reduction Strategy
SNNPR	Southern Nations Nationalities and Peoples Region
UNDPIC	United Nations Department of Public Information
WFP	World Food Program

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## **ABSTRACT**

*In most of the developing countries, lack of resources and little market accessibility are among the major factors that affect small farming household food security. This study aims to investigate rural households' food security status and identifying the determinants of rural household food security status in Gorche woreda of Sidama zone, Southern Ethiopia. For this study, a total of 136 households were selected from four rural kebelles by using systematic random sampling technique. Primary and secondary data sources were used to undertake this study. The data were analyzed using descriptive statistics and econometric regression models. Food security status is calculated using dietary intake method. The survey result shows that about 62(45.59%) of sample respondents were food insecure, while 74(54.41%) were food secure. Further, the results of logistic regression show that age of the household head significantly and negatively influencing the food security status of rural households. Furthermore, farm land size, distance from the main road, membership in cooperative and off-farm engagement do significantly and positively affect the rural household food security status of the study area. The results suggest that local food security can be enhanced by creating off-farm employment opportunities, improved road infrastructure; giving priority to old aged, strengthen the existing farmer cooperatives and proper utilization of farm land.*

Keywords: Determinants, food security, Gorche, logistic regression

# 1. INTRODUCTION

## 1.1. Background of the Study

According to the United Nations Universal Declaration of Human Rights 1948 “everyone has the right to a standard of living adequate for the health and well-being of himself and his family, including food, clothing, housing and medical care.

The right to an adequate standard and well-being regarding food implies right to adequate food, freedom from hunger and the ability to acquire food and improve conditions that helped to develop and sustain food security (UNDPI C 1998).

FAO defined food security as a situation “when people, at all times, have physical and economic access, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life”. According to this definition, there are three important interlinked components of food security: food availability measured by food production and food supply, food access measured by the level of income; and food utilization measured by nutrition, health and care giving FAO (1998).

Food security has many dimensions, ranging from global, regional, national, local, and household to the individual level. The determinants of food security differ at different levels i.e. from global to regional and national to household and individual level because food security is deemed to be a multidimensional phenomenon encompassing climate change, civil conflicts, natural disasters and social norms.

Some studies, for instance by FAO (2014), revealed that we are living in a world where Eight hundred and forty two million people do not have enough to eat and the vast majority of hungry people live in developing countries, where 14.3 percent of the population is undernourished yet the world produces enough food to feed everyone with at least 2,720 kilocalories per day which is well above the Food and Agriculture Organization of the United Nation’s recommended minimum of 2220. Ironically food insecurity remains globally widespread and stubbornly high. Food is a basic need and food security is a major concern not only to the Government of food insecure countries but to the world at large FAO (2014).

Studies on food security situation of Ethiopia confirmed that, despite some improvements in

recent years, poverty and food insecurity remain widespread and the main challenges in Ethiopia. These challenges are further exacerbated by climatic shocks such as failure of rainfall, which adversely affect agriculture and allied activities, the main livelihood activities for the rural population. In fact, following the failure of rainfall during the 2015 agricultural seasons, estimates suggest that about 10.1 million people require emergency food assistance in 2015 (EHRD, 2016). This indicate that food security situation in Ethiopia has been a challenge to government, donors, and other international organizations.

The SNNPRS is one of the poorest regional economies of the country. Many studies shows that most of its households able to feed itself with sufficient food only for less than six to nine months of a year (Amsalu *et al.*, 2012). The situation of Gorche woreda is not different.

Despite that high number of households requiring continuous food assistance, little work has been done at the woreda in order to understand the food security problem at the household level. The status and the determinants of food security at household level in the rural areas of Gorche woreda are not well documented. The purpose of this study is, therefore, to analyse the status of household food security and investigate its critical determinants in the rural areas of Gorche woreda.

## **1.2. Statement of the Problem**

In Ethiopia, food shortage has aggravated the already poor economy of the country and it varies from one area to another depending on the state of the natural resources and the extent of development of these resources. Both chronic and transitory problems of food insecurity are widespread and severe mainly in the rural areas of the country. The reasons are mainly due to environmental and human factors (Webb *et al.*, 1992).

The government of the country has been making relentless effort to ensure food security. The government has designed and implemented the Agricultural led industrialization policy as a major long term strategy to bring about overall development in the country. Under the umbrella of this policy, the contemporary government of the country has designed and launched four major five year development plans to realize various major development goals including ensuring food security (FDRE, 1996).

Sustainable Development and Poverty Reduction Strategy (SDPR), Plan for Accelerated and

Sustainable Development to End Poverty (PASDEP) and Growth and Transformation Plan (GTP) - I were the first , second and third five year development plans, respectively, implemented since 1999/2000, while GTP - II, the one which is currently being implemented. These plans have various inbuilt strategies and programs aimed at improving the production and productivity of the agriculture sector peculiarly to contribute towards the realization of food security (MOFED, 2015).

Despite such efforts of the government and the great agricultural potential of the country due to its water resources, its fertile land areas and its large labor pool, the country is still confronting with reoccurring food insecurity problem, Some empirical studies conducted on food security situation of the country revealed that though favourable food security conditions prevail in most parts of the country, 7.1 million people were estimated to live in conditions of chronic food insecurity and emergency in Amhara, Tigray, Oromiya, Southern Nations Nationalities and Peoples, Somali and Afar Regions (WFP, 2016).

On the other hand, the studies conducted by Feleke (2012), kidane *et al.* (2012) and Fekadu *et al.* (2014) showed that the household food insecurity situations and lower resilience capabilities in rural parts of the country is associated with so many social, economic, political and natural factors which varies across locations. Besides, the field report of problem identification team confirmed that household food insecurity is amongst the top priority problems in Gorche woreda of Sidama Zone. In addition, any empirical study has not yet been conducted in this area. Thus, the food security status and the factors affecting household food security status are not clearly known. This indicates that there exists information gap on the food security status and factors influencing household food security status which is paramount important to design and implement appropriate programs, projects and other interventions aimed at ensuring food security. In order to reduce such gaps this study intended to analyze the rural household food security status and its determinants in Gorche woreda of Sidama zone, Southern Ethiopia.

### **1.3. Objectives of the Study**

The General objective of this study is to examine the determinants of food security status among the households of Gorche woreda of Sidama zone, Southern Ethiopia.

The specific objectives are specified as follow:

1. To estimate the extent of food security status of rural households of the study area;
2. To identify the determinants of food security status of the rural household in this study area

#### **1.4. Research Questions**

The following will be Research question as a fundamental basis for this study;

1. To what extent of rural households' food secure?
2. What are the principal determinants of food security among households in the study area?

#### **1.5. Scope and Limitations of the Study**

The purpose of the study is to identify status and determinants of household food security status in selected rural area of Gorche woreda. The survey of the study was conducted in four kebeles of the woreda on randomly selected 136 sample households. Since, the unit of analyses is household level; intra-household food situation is not analyzed, i.e. it was assumed that all household members equally share the food available for the household. In addition, the study was carried out within few months' time and this has limited time to capture more data by the survey; particularly the data that can indicate chronic food insecurity. That is, the study has no enough data over years to make a comparative analysis of household food security status over long periods. However; qualitative data collected through Focus Group Discussion (FGD), Key Informant interview (KII) and review of relevant government reports and academic papers have supplemented the study with information. The second limitation is, again limited by the data, the current study tried to see nutritional status only in the context of sufficiency of calorie intake.

#### **1.6. Significance of the Study**

A study about the determinants of food security status and generating relevant data on food security status rural households is vital because it had significance in insuring food security in the study area. Therefore; first, the study provides local level information which can be helpful for planners, policy makers, researchers and development actors in both the governmental and non-governmental organizations working in the area as well as elsewhere in the country with

similar socioeconomic, cultural and physical environment in designing comprehensive, appropriate and effective policies of improving household food security. In addition, the study provides documentation on status and determinants of household food security as well as their relationship in the rural area of the study site. This can also be helpful in supporting informed decision making during design and implementation of household food security programmes in the study area. Second, the study was also expected to add to the wealth of information currently available on household, particularly rural, food security, in Ethiopia.

### **1.7. Organization of the Thesis**

This thesis is organized into five chapters. Besides this introductory chapter, chapter two, a review the literature on current issues and debates on food security and empirical evidences are presented. Chapter three deals with research methodology which includes data type and sources, description of study area, study design and sampling procedure, methods of data collection and data analysis were presented. Results and dissections were presented in chapter four and conclusion and recommendation were discussed in chapter five.

## **2. LITERATURE REVIEW**

This chapter tries to provide the theoretical perspective and conceptual framework of food security. This covers the conceptual definition of food security, the forms of food insecurity, measurements and techniques used to assess the status of food security. It also presents overview of Ethiopian government policies and strategies related to food security and review on general determinants of food security. Moreover; it presents an empirical review on the situation and determinants of household food security in Ethiopia. Finally, it presents the conceptual framework used in this study to identify the potential determinants of rural household food security status in Gorche woreda.

### **2.1. Definition and concepts of Food Security**

Food security is defined as a situation that 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 (USDA, 2018). Individuals who are food secure do not live in hunger or fear of starvation. Food insecurity, on the other hand, is a situation of “limited or uncertain availability of nutritionally adequate and safe foods or limited or uncertain ability to acquire acceptable foods in socially acceptable ways,” Gary Bickel; William Hamilton; John Cook (2000).

The term ‘food security’ originated in international development literature in the 1960s and 1970s. At that time the conventional wisdom was that food insecurity was conceived primarily as a supply issue at an aggregate level because of the significant short falls in food supply and high food prices in the world market in the early 1970s. However, despite the favorable supply conditions and low food prices after mid-1970s, the incidence of food insecurity remained high in many developing countries (Sijm, 2001).

This anomaly of widespread food insecurity amid a world of surpluses stimulated the analysis of the nature and causes of food insecurity. In the early 1980s, however, a paradigm shift occurred in the field of food security following Sen’s (1981) claims that food insecurity is more of a demand concern, affecting the poor access to food, than a supply concern, affecting availability of food at the national level. Since then, accepted wisdom has defined food security as being primarily a problem of access to food. At the same time, the unit of

analysis shifted from the global and national level to the household and individual level. Overtime a large number of different definitions have been proposed.

A report by Maxwell and Frankenberger's (1992) lists 194 different studies on the concepts and definition of food security and 172 studies on indicators. There are approximately 200 definitions and 450 indicators of food security (Hoddinott, 2001). Several studies have explored the similarities among definitions of food security to identify its fundamental components. According to the World Bank report, the conventional food security is defined as "access by all people at all times to enough food for an active and healthy life" (World Bank, 1986).

This indicates that the cause of food insecurity could be other factors such as a loss of endowments, unemployment, a fall in wages or unfavorable shift in the terms of trade of food in exchange for assets. This consideration enabled to move a step forward in entailing not only food availability (adequate supply of food) but also food access through home production, purchase in the market or food transfer.

In 1996, the World Food Summit held in Rome declared and broadly set the definition of food security as "all people at all times have physical and economic access to sufficient, safe and nutritious foods to meet their dietary needs and food preferences for an active and health life". Although there were agreements on some aspects of food security, controversies also existed. These include: relative importance of supply (food availability) versus demand (food access) variables in causing and solving food insecurity, the right indicators to measure food security, the impact of policy interventions on food security in the recent past, and the lessons or policy implications for the near future to reduce the extent of food insecurity. At present, a combination of these definitions with focus on three components of food security: availability, access and utilization are serving as a working definition. In the context of subsistence farm households, food security refers to the ability to establish access to productive resources such as land, livestock, agricultural inputs and family labor combined to produce food or cash (Tolosa, 2005).

Consistent with this, Bonnard (2009) argued that with respect to the three components of food security, agriculture constitutes the most important factor in availability, a primary factor in access where livelihoods are agriculture-based and a complementary factor regarding food

quality and processing for utilization. Based on temporal dimension, two types of household food insecurity can be distinguished as chronic and transitory. Chronic (permanent) food insecurity is a continuously inadequate diet resulting from lack of resources to produce or acquire food, while transitory food insecurity is a temporary decline in the household to access enough food (World Bank, 1986; Reutlinger, 1987).

A household is said to be food insecure when its consumption (available food) falls below the daily standard Minimum 17 Recommended Allowance (MRA) of caloric intake for an individual to be active and healthy. The worst form of transitory food insecurity is famine. Hence, this study is concerned with a transitory food insecurity faced by farm households of any magnitude ranging from mild to severe. In this study, the concepts of transitory food insecurity and seasonal food shortage are synonymous and will be used interchangeably.

## **2.2. Theoretical Review on Food Security**

Different theories viewed by different authors in relation to food security which clustered in three broad categories (Sen, 1981; Devereux, 1993).

I) **Political economy theory:** it mainly related with land tenure in security, weak targeting of safety nets, lack of accountability and transparency in local governance. Food insecurity is a political phenomenon that is not only caused by lack of food production nor by market irregularities, but due to political powerlessness. Thus, rather than sticking to the availability of food and people access to food as the only means out of food insecurity and famine, political economy theory proposes that interventions have to focus on state reconstruction, good governance and accountability (Arega, 2013).

II) **Food economy theory:** this theory incorporate two important food economy approach such as food entitlement decline and food availability decline approaches. In addition lack of delivery of inputs to increase agricultural production and weak marketing infrastructure, lack of access to purchase the basic needs are related to the food economy theories in respect to food availability and accessibility decline theories (Arega, 2013).

III) **Food accessibility decline theories:** academic and policy focus started to shift towards micro level issues affecting food security status of individuals, households and communities. Theoretical basis for this paradigm shift will set by Amartya Sen's 'entitlement approach'.

The 'entitlement approach' and later works that build on it focus on the access of households to food through own production, income, gathering of wild foods, community support (claims), assets and migration. Hence, during the 1980s, due to the growing incidence of hunger, famine and malnutrition in many parts of the third world, the concept of food security will be redefined in such a way that the unit of analyses shifted from national and global levels to household and individual levels. It will be also made to focus on food availability as well as on access to food. The argument on 'accesses' in the early 1980s was a turning point to the progress of the concept and assessment of various food security related problems. In this approach, hunger and famine are the results of failure in specific socio-economic groups in the society to obtain adequate food by legitimate economic means. This means, lack of physical, human or social resources causes people's access to food to fall below their subsistence needs (FAO, 1983).

### **2.3. Food Security Situation of Ethiopian**

Ethiopia is the second most populous country in Africa with an estimated population of 94.3 million people in 2013 (CSA, 2013). As indicated by Africa Food Security and Hunger/Undernourishment Multiple Indicator Scorecard, Ethiopia ranked as first in having the highest number of people in state of undernourishment/ hunger which is 32.1 million people. This makes it, the fourth African country scoring (37.1%) of the population being undernourished/ in hunger (African Development Bank, 2014). The livelihoods of rural Ethiopian people are highly sensitive to climate. Food insecurity patterns are seasonal and linked to rainfall patterns, with hunger trends declining significantly after the rainy seasons. Climate related shocks affect productivity, hamper economic progress and exacerbate existing social and economic problems (Anderson *et al.*, 2015).

Food insecurity situation in Ethiopia is highly linked up to severe, recurring food shortage and famine, which are associated to recurrent drought. Currently there is a growing consensus that food insecurity and poverty problems are closely related in the Ethiopian context. Droughts and other related disasters (such as crop failure, water shortage, and livestock disease, land degradation, limited household assets, low income) are significant triggers, more important factors which increase vulnerability to food security and undermined livelihoods (MoARD, 2010).

Ethiopia has been a net importer of food for more than three decades. In the decade between 1985 and 1994, net domestic production of cereals that on average account for about 85 per cent of household food consumption ranged between 82.7 and 93.8 per cent of total supply. Even though, different factors are contributing to vulnerability of the country which includes rapid population growth with low per capita income, rain-fed agriculture, under-development of water resources, land degradation, low economic development, and weak institutions. Drought, human and livestock diseases as well as resource-based conflicts are aggravating factors for the food insecurity situation in Ethiopia (Fisseha, 2014).

About 10 percent of Ethiopia's citizens are chronically food insecure and this figure rises to more than 15 percent during the frequent drought years. World Food Program found long-term effects of chronic malnutrition cost Ethiopia approximately 16.5 percent of its GDP each year. 2.7 million People will require emergency food assistance in 2014 and 238,761 children require treatment for severe acute malnutrition in 2014. Estimated number of food insecure people was 4.5 million August, 2015 and by the end of the same year this figure had more than doubled to 10.2 million Ethiopians (UNICEF, 2014).

Asefa, and Zegaye (2003) found that factors contributing to the current of food insecurity includes production fluctuations, low non-farm employment, low income, regional fragmentation of the markets, high rate of natural degradation, low level of farm technology, high level of illiteracy and inadequate quality of basic education, poor health and sanitation, high population growth, poor governance and inter-state, intra-state military conflicts and wars all these factors impede the achievement of food security and sustainable economic development.

As cited in Endalew *et al.* (2015) their review in Ethiopian food security situation assessment found that survey results of Goal Ethiopia and concern worldwide in two woredas of the Gambella regional state of Ethiopia's (Jikawo and Lare) indicated that the global acute malnutrition was 19.2 percent and 18.2 percent respectively. In the same way, deterioration of food security situation in Oromiya regional state is prevailed in Arsi zone. The affected woredas are Jeju, Diksis, Sude, Robe, Bilbilo, Sire and Guna. Poor performance of the belg seasonal rains led to shortage of pasture and water and poor development of planted crops.

The estimates reveal results: over 41 per cent of Ethiopian population is considered to be

undernourished (FAO, 2010). In addition, an estimated 7.6 million (or 11 per cent of the rural population) are currently considered chronically food insecure, meaning each year they are relying on resource transfers to meet their minimal food requirements. Over the past four years between 2.2 and 6.4 million additional people were food-insecure or not able to meet their food needs in the short term due to transitional factors. They are temporarily dependent on relief food assistance (FAO, 2015).

Both the number of undernourished people and the prevalence of undernourishment have declined steadily since 1990 (FAO/WFP, 2010). Even though, significant progress in reducing undernourishment was shown in the period 1990-2005, Ethiopia is faced one of the strongest drought shocks for many years like that of 2015 where 27 millions Ethiopian became food insecure and 18.1 millions dependent on relief food assistance (Catley *et al.*, 2016).

#### **2.4. Food security situation of SNNPRS**

According to the 2010 DPPC half year report on SNNPR food security situation, the Southern Nations, Nationalities and People's Regional State (SNNPR) the study area is located is one of the food insecure regions in Ethiopia. The report also revealed that the food insecure in rural areas of the region includes the following vulnerable groups: landless and the poor without assets, very small and fragmented land holders, female-headed households, families with large size, dislocated pastoral members, drought and pest affected households.

According to Dechassa, (2002), Sidama Zone is found in SNNPR, which is located 275 km south of Addis Ababa. It is one of the highly populated areas in Ethiopia, having a density of 47 people/km<sup>2</sup>. Sidama is characterized by three agro ecological zones: the dry midlands/low land (20%), the middle land (48%) and the high lands (32%). Sidama is known for its diverse, intensive and well-established agro forestry system in which a diversity of perennial and annual crops is grown together. This system of production largely contributed and helped to keep the environment conserved (Dechassa, 2002).

In the low land, however, soil erosion is an important production constraint due to intensive agricultural diversification. In Sidama Zone mixed agriculture (crop and livestock production) is practiced. Enset is the main staple crop both in high land and mid land while maize is so in the low land. Despite its poor performance in the low land, still farmers grow enset more for

cultural and traditional purpose than for food. In the 1999 drought, both enset and coffee were destroyed not only from the severity of the drought but also enset was the only crop to rely on and also use the leaves as feed to livestock to tackle feed shortage.

## **2.5. Causes of Food Insecurity**

The causes of food insecurity, in sub-Saharan Africa, are highly related with poverty and mainly include unfair rural development policies, war, lack of technological changes, institutional weakness, lack of basic infrastructures and drought. Although, causes of food insecurity vary among households and localities, the common ones as suggested by Young (1992), are reduction of people's food entitlements due to poor harvest; reduction in food availability; increased market prices; loss of livestock and other resources; loss of waged laborer or other sources of income. These conditions together thus explain the issues to entitlement. Entitlements are the legal means by which an individual or households gain access to his/her basic requirements.

A combination of short-term and long-term causal factors can explain the trend towards the increasing food insecure caseload. Long term factors, such as the interaction between environment, high population growth, diminishing land-holdings, and a lack of on-farm technological innovation have led to a significant decline in productivity per household. These trends have combined with the repeated effects of drought over the years, to substantially erode the productive assets of communities and households. A loss of community assets (e.g., pasture and forest) had led to increasing environmental degradation and increased the pressure on farm leading to declining investment in soil and water conservation practices. More importantly, households are less able to cope with shocks because they cannot accumulate saving (e.g., livestock holdings and food stores) even in good years (FDRE, 2002).

## **2.6. Measurement of Food Security**

Measuring household food security is essential at the outset of any development; i.e. to identify the food insecurity status, to assess the severity of their food deficit and to characterize the nature of their insecurity. However, as defined and conceptualized above food security and its complement, food insecurity is inherently unobservable. According to (Von Braun *et al*, 1992), different indicators are needed to capture the various dimension of food

insecurity at the country, household and individual levels:

**Countries level:** It to some extent be measured in terms of demand (requirement) and supply i.e. the quantities of available food and needs. According to (Hoddinot, 1999), the supply of food may be from current production and stocks and from previous production whereas the need has to be determined on the basis of biological or nutritional requirement of a given society for a certain period of time usually a year or a day. However, national-level measures inherently lend themselves only to addressing national-scale food availability shortfalls, not intra national access and utilization concerns.

**Household level:** Measured by direct survey of dietary intake (in comparison with appropriate adequacy norms). However, they measure the existing situation and not the downside risks that may occur. The level of, and changes in socio-economic and demographic variables such as real wage, employment, price ratio and migration properly analyses can serve as proxies to indicate the status of, and change in food security.

**Individual level:** Anthropometrics information can be a useful complement because the measurements are taken at the individual level. Yet such information is the outcome of changes of health and sanitation environment and other factors. Most importantly, this information indicates food security after the fact. Income and consumption has been traditionally used as a measure of food security. But, consumption is a better measure of longer-term household welfare as it is subject to less temporal variation than income. In addition, most analyses rely on measuring food consumption. (Hoddinot, 2001a) made comparison of different outcome measures of household food in secularity namely, individual intake, household calorie acquisition, dietary diversity and indices of household coping strategies in terms of time requirement, cost, skill and susceptibility to misreporting and briefly discussed them as follows:

## **2.7. Empirical Studies on Food security in and outside of Ethiopia**

Various studies have been documented on the influence household food security situation in developing countries. Different literatures use different proxies as a measure of food security and use different methodologies.

A study in Pakistan by (Asghar and Muhammad, 2013) found that household size, household

income, irrigation facility, and age determine food security. In contrast to the results by (Greenwell and Pius, 2012), found that age has a positive impact on household food security and justified that experience has more weight for a household status to be in food security.

According to a study in Bangladesh by (Majumder *et al.*, 2012) profession and crop cultivated, farm size and professional support found to be significant determinant of the household food security. In this study, it seems that variables like age and other household characteristics are not controlled. In a South African township of Kwakwatsi a study revealed that male headed households, vulnerability to food insecurity increases with age of the household headed but it would decrease with an increase in household income and the employment status of the household headed. In female-headed households' vulnerability to food insecurity increases with household size and age of the household headed, while it decreases with household income (Ndofo, 2013).

(Greenwell and picus, 2012) in their study in Malawi, used reported food security status, a continuous dietary diversity index and food end time as measure of food security. Logistic, ordinary least square, and quintile regressions were used as an estimation method. This study found that household food security is determined by credit access, age, sex of the household head, extension information, assets or wealth and education. In this literature age is found to have negative association with the food security status. The justification given is that even if young farmers tend to be less experienced, yet they are more food secure due to their dynamic and energetic nature. The type of food insecurity observed in Sub-Saharan Africa is a combination of widespread chronic food insecurity, resulting from continuing or structural poverty, transitory emergency related food insecurity, which occurs in periods of intensified pressure caused by natural disasters, economic collapse, or conflict (FAO, 2004).

However, 99% of the food insecurity in Sub-Saharan Africa is grown under rain fed agriculture. Hence, food production is vulnerable to adverse weather conditions. The reason behind is that there was an over decline in farm input investment including fertilizers, seeds, and technology adoptions. Other causes include rapid population growth, limited access to agriculture related technical assistance, under developed agricultural sector and lack of knowledge about profitable soil fertility management practices leading to expansion in to less-favorable lands (Boussard *et al.*, 2005). The situation in Ethiopia is not much different from

the conditions in other developed and developing regions. All these studies are conducted using cross-sectional data. Despite these works are carried out in different regions, we may need to know, if the determinants found to be similar or different.

According to (Hiwot, 2014) based on the results of the conditional logit model, among the priority variables fitted in to it, rainfall shock and household size negatively and significantly determine food security. While, farm land size, land quality and credit access positively and significantly determine food security at varying levels of significance. In the fixed effects model these same sets of variables significantly determine nutritional status in the same sign as they determined food security with only differences in magnitude and significance of the coefficient estimates. Additionally, off-farm income, fertilizer use and oxen ownership are priority variables that are found to be significant in this model.

A study by (Haile *et al.*, 2005) at korodegaga, a peasant association found in Oromia region of Ethiopia, used cross-sectional data and a binary logistic regression as the econometric model. The study controlled for many factors which meant to have an impact on food security status of a given household in the district. Out of the eleven factors that will be fitted to the model, farm land size, oxen ownership, fertilizer application, education of the household head, and household size found to be significant determinant of household food security. This study again did not take in to account rain fall shock.

Similarly, a study at Ada Berga, a district in the central Ethiopia, (Beyene and Muche, 2010) found that off-farm income, livestock and land holdings, agricultural practices and farming activities significantly affect household food security. Chemical fertilizer uses also affects food security positively. In a study in Jiggiga district of central Ethiopia, that uses an empirical analysis by a logit model, (Hussien and Janekarnkij, 2013) find out that fertilizer use, credit access, extension service, and household income have positive influence on food security. Generally complex sets of variables such as size of land, quality of available land, educational level of the farm owner, quality and quantity of technology and capital available are important factors in influencing the level of food production (Foster, 1992).

A study done in Wolaita Zone Offa Woreda showed that education level of household head, access to credit, total cultivated land, household active labor forces, household members participation into income generating activities participation in rural institutions, participation

in off-farm activities, dependency ratio, participation in non-farm activities, frequency to extension contact and livestock rearing were significantly associated with household food insecurity (Bogale, 2014). Thus, controlling for all these complex sets of variables is useful to obtain an unbiased estimate of it and their corresponding impacts on food security.

However, the analyses of determinants of food security of rural households remain a long-standing challenge. Thus, to identify the determinants of food security, assessing the status of household food security and its association with different demographic and socio-economic factors is the main drive of this study to guide policy decisions, devise appropriate interventions and integrated efforts to combat food security problem in the study area.

Generally, food security is defined differently by different organizations. Measuring of food security may include individual food intake, household caloric acquisition and indices of household coping strategies can be used as parameters. Hence, in this study, the aforementioned calorie level will be taken as a frame of reference in individuals' calorie level. Though there are numerous studies conducted on food security in Ethiopia, the issues at the level of each woreda has not been yet supported with empirical study, which is also true for Abaya woreda. Thus, this study will aim at fulfilling the gap by providing concerned stakeholders with valid findings regarding the causes of food security status in this woreda.

## **2.8. Conceptual Framework of the Study**

Based on the above literatures review and experience about the study area, the Conceptual Framework of the study is shown as a diagram in figure 1 below. Figure 1 depicts the dependent variable, i.e. the household food security status (HHFSS) of household and the categories of independent variables expected to affect the household food security status in the study area. The arrows show the direction in which the categories of the independent variables (the determinants of the household food security status) influence the dependent variable, i.e. household food security status.

First the per capita kilocalorie available (PKcal) to a household was calculated from survey data collected through questionnaire from the household. This per capita kilocalorie available to a household depends on household's (HH's) food availability and access at the household level through production, purchase, gift, transfer or food aid and borrowing. Second the food

security status of the household categorized in two cluster i.e. food secure and insecure households on the bases of 2200Kcal consumption threshold.

As it is shown in the figure, there are different categories of factors (independent variables) related to household's demographic characteristics, socio-economic factors and institutional factors such as the household's agricultural credit use, Institutional and infrastructural factors, Distance to market, Distance to main road, Extension contact and Cooperative membership and extension services. These are expected to affect household's food availability and access through their influence on production, purchase, gift, transfer, food aid and borrowing.

Demographic factors such as age and sex of household head, household size and educational status of household head have an influence on food availability and access at household level which in turn affects the food security status of the farm households. Age of household head has positive relationship to status of household food security, however; some literatures also show that age has mixed results with household food security. Sex of household head was expected to have influence on household food security, i.e. male headed households have better status of household food security than female headed households. Household size was expected to have negative influence on the status of household food security, while educational status of household head was expected to have positive contribution to the status of household food security.

The socio-economic or productive resources of a household such as farmland size, irrigation utilization, total livestock ownership and participation in off/non-farm income generating activities also have an immense influence on status of household food security. From this study it was expected that farmland size, irrigation water utilization, total livestock owned by the household (in terms of TLU) and participation in off/non-farm income generating activities would affect food availability and access at the household level and therefore, would have positive correlation with food security status of the household.

Agricultural credits, membership to cooperative, distance to the main road and agricultural extension contact was expected to have positive and market distance expected to have negative influence on the availability and the access of food to a household, which in turn, contributes to better status of household food security. In the diagram, these factors are shown as institutional factors.

Apart from the variables mentioned above, a number of factors interact to determine food availability and access at household level; which in turn affects the status of household food security. These are natural related factor such as the occurrence of crop pests and diseases.

The following diagram (figure 1) visualizes the variables stated above and expected to determine the status of household food security.

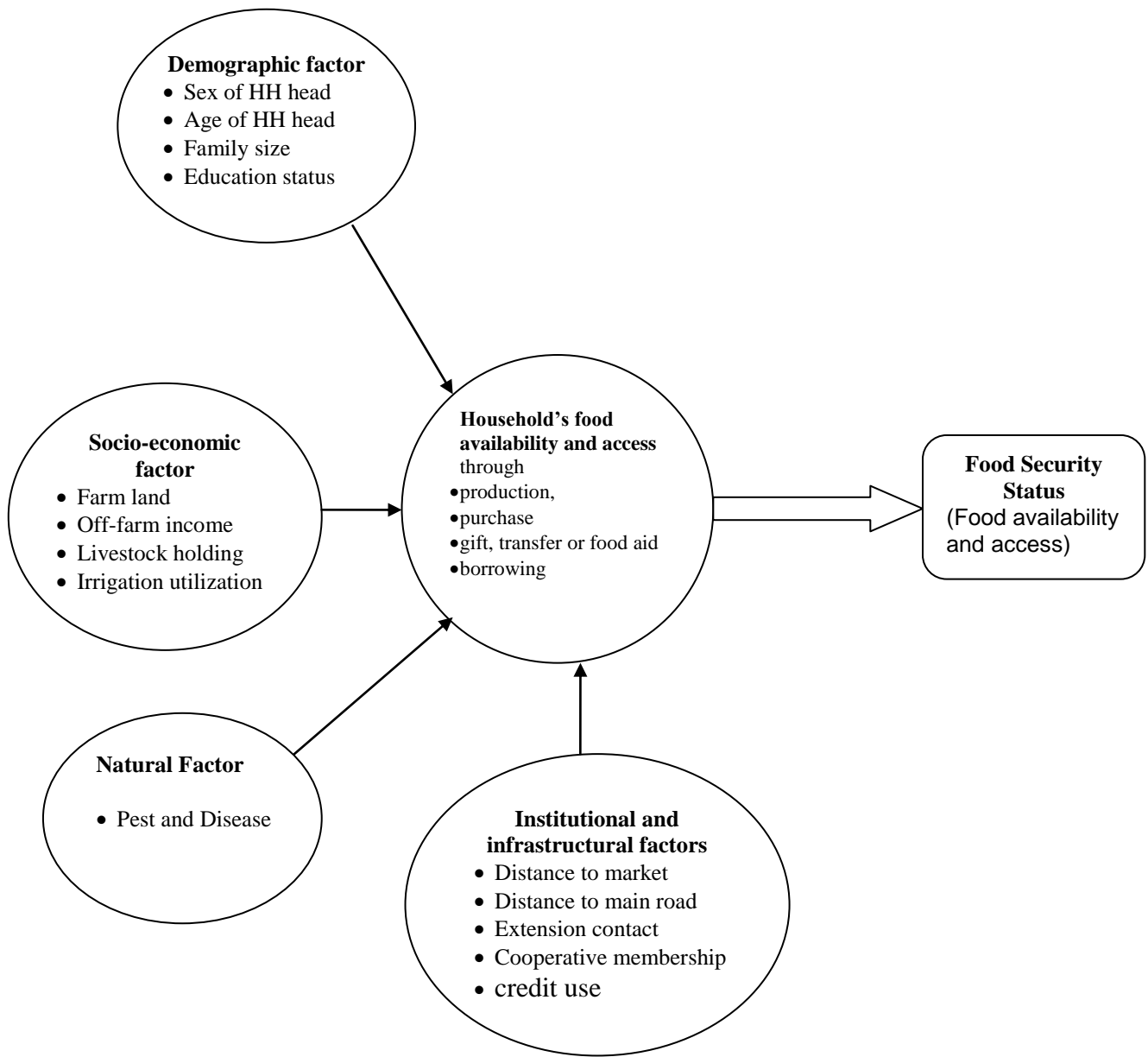


Figure 1: Conceptual Framework of the study

Source: Own construction, 2020

### **3. RESEARCH METHODOLOGY**

This chapter presents the research methodology used in the study including location and description of study area, sampling procedure and sample size determination, type and sources of data and methods of data analysis.

#### **3.1. Location and Description of the Study Area**

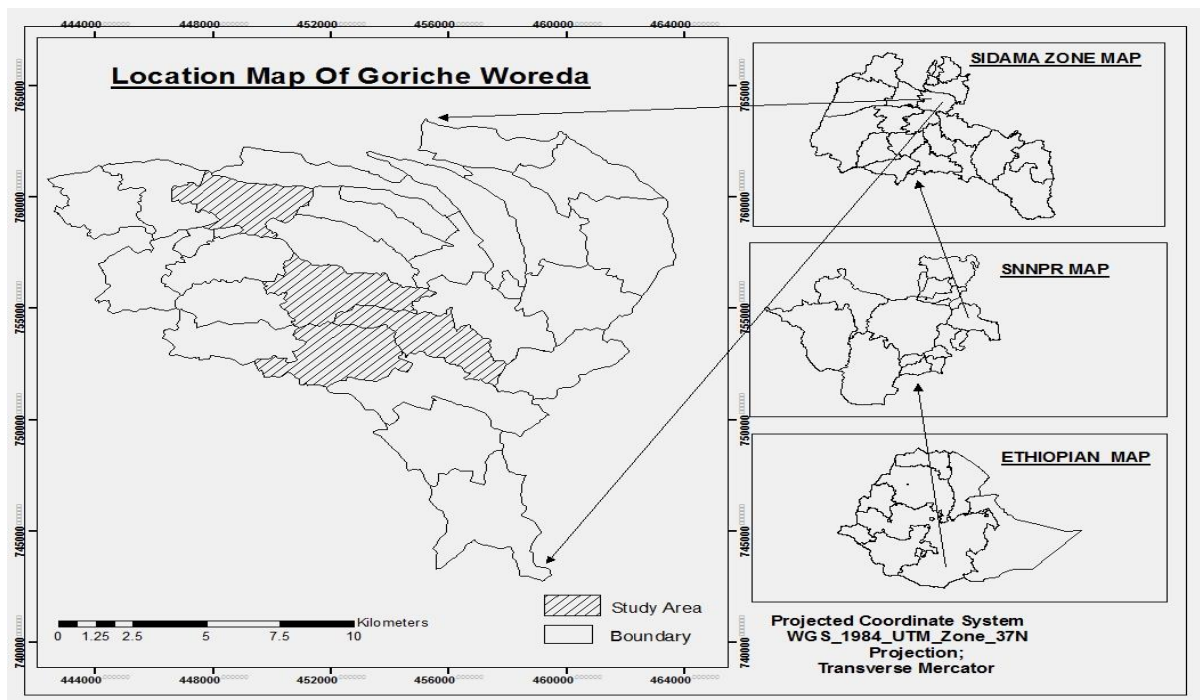
Gorche woreda is located in Sidama Zone, SNNPR State; relatively it is situated in south of Wonsho Woreda, North of Melga, east of the Kokosa woreda Oromia region and west of Shebedino woreda. The capital of study area is Gorche, found to south of 47 km away from Hawassa. The area of the woreda is 18914 km/squares. Administratively the woreda is divided in to 21 rural and 3 urban kebeles.

Total population of the woreda is 130,919, out of the total population 66868 are males and 64051 are females. There are total of 26933 households in the woreda. The proportion of male and females headed 50.6% and 49.4%, respectively. The total rural dwellers are 125,341 and urban dwellers are 5,578 (CSA, 2008).

The mean annual rainfalls of study area are 900-1500 mm and mean annual average temperature of the study area ranges between 12 and 27 degree centigrade. The altitude of the study area about is 2000-3400 m above sea level. The rainfall pattern is evenly distributed in the study area throughout the year. Because of the study area is grouped in to dega agro-ecological zone and mountainous.

The soil is dominantly clay loamy type with fine textured characteristics, fertile and suitable for agricultural practices. Gorche Woreda considered as Dega agro-ecological zone, dominantly produce inset and cereal crops for a livelihood and having two major cropping seasons namely Belg and Meher and small scale irrigation is also experienced in some areas. But out of a Sidama zone woreda's, Gorche woreda is grouped in to meher specialization. From the total consumption and other purposes, at normal time, meher season crop produce 4380 hectare of land and among the hectare of land, barely it covers 2620 hectare of land. A meher season crop contributes about 81% of the woreda average and the remaining 19% is from the Belg season (GWA0, 2010). Barely production is the major means of livelihood and income generation.

Figure 2 Map of the study area



Source: CSA

### 3.2. Research Design

Community-based cross-sectional study design was used. This study was a mixed type of research involving both qualitative and quantitative methods. The strategy followed in this research is concurrent triangulation to explain concepts, characteristics, descriptions and measures to express situations of the issue.

### 3.3. Data Type, Sources and Methods of Data Collection

Both quantitative and qualitative data were employed to collect data from primary and secondary data sources. The major methods deployed to gather information from primary sources were household Survey Questionnaire; Focus Group Discussion and Key informant interviews.

Based on their educational qualification and work experience four development agents who have been working in the study area over the past many years were selected and trained as enumerators. The data collection process has been continuously supervised by the researcher on a daily basis for incompleteness, omission and incorrectness. The interviewers were trained

on how they should present the questions to the respondents. Questionnaire pretest was conducted and modifications were made based on the feedback of the pretest. The pre-test had a significant contribution in allowing modifications of ill-prepared and unclear questions. Secondary data pertinent to the study were collected from woreda, zone and national agricultural offices and research centers. Different offices and personal contacts were made to obtain additional information.

### 3.4. Sampling Techniques and Sample Size Determinations

An important decision that has to be taken while selecting a sampling technique is about the size of the sample. Appropriate sample size depends on various factors relating to the subject under investigation like the time aspect, the cost aspect, the degree of accuracy desired, etc (Gupta and Gupta, 2002; Rangaswamy, 1995). If sample size is too small, we may fail to achieve the objectives of our analysis. But if it is too large, we waste resources when we deal with the sample. So that appropriate sample size has to be applied in order to get good representative data.

This study undertaken in Gorche woreda of Sidama zone, where among the woredas found in Sidama zone, the woreda population density increased from year to year and it has been known by food shortage but not engaged in Productive Safety Net program. A two-stage sampling procedure was used to select the sample households in the study Woreda. The details of the sampling method applied is presented and discussed below. In the first stage, from a total of 22 rural Kebeles found in the study woreda four rural kebeles were selected randomly using lottery method of simple random sampling technique. In the second stage, 136 sample respondents were selected from four kebeles. Households to be selected from each kebele were fixed by considering number of households in each Kebele. This means that probability to population size (PPS) sampling technique was employed.

The sample size for the study was determined following (Yamane, 1967); which is given as:

$$n = \frac{N}{1 + N(e)^2} \text{----- (1)}$$

Where: n = sample size,

$N$  = population size in the selected Kebeles and

$e$  = precision level or sampling error which does not exceed 5-10%.

In this study 8% confidence level is inserted into above equation 1. Subsequently, final sample size of this research was calculated and given in Table 1, i.e. 136 respondents were sampled and interviewed.

**Table 1: Distribution of sample household by sample Kebeles**

No.	Kebeles	Total population (N)	Sample household (n)
1	Murancho Gucho	313	40
2	Harbe wolbato	308	39
3	Luta bongodo	282	36
4	Harbe gata	169	21
	Total	<b>1070</b>	136

Source: Own survey data, 2020.

### **3.5. Methods of Data Analysis**

In this study descriptive statistics, inferential statistics and econometric data analysis methods were employed.

#### **3.5.1. Descriptive and inferential statistical analysis**

Descriptive statistics used to describe the basic features of the data in the study. It provides simple summaries about the sample and the measures. Descriptive statistics which were applied for analyzing data for this study include mean, standard deviation, percentages and tables and inferential statistics such as t-test and chi-square test were also applied.

#### **3.5.2. Econometric Model specification**

One of the purposes of this study is to assess the determinants of food security status of the rural households. The dependent variable in this case is a dichotomous variable, which takes a value of 1 if the household is food secure and 0 if it is food insecure.

When one or more of the independent variables in a regression model are binary, we can

represent them as dummy variables and proceed to analyze. Binary models assume that households belong to either of two alternatives and that depends on their characteristics. Thus, one purpose of a qualitative choice model is to determine the probability that a household will fall in one of either alternatives (in this study becomes food secure or food insecure).

The Probit and Logit models are commonly used models. The Probit probability model is associated with the cumulative normal probability function whereas; the Logit model assumes cumulative logistic probability distribution. The advantage of these models over the linear probability modal is that the probabilities are bounded between 0 and 1. Moreover, they best fit to the non-linear relationship between the probabilities and the independent variables; that is one which approaches zero at slower and slower rates as an independent variable ( $X_i$ ) gets smaller and approaches one at slower and slower rates as  $X_i$  gets large (Train, 1986).

Usually a choice has to be made between Logit and Probit models, but the statistical similarities between the two models make such a choice difficult. Gujarati (1988) illustrated that the logistic and probit formulation are quite comparable. It does not matter much which function is used except in the cases of where the data are concentrated in the tails following points. For this study the Logit model is selected, though both Logit and Probit models may give the same result. The logistic function is used because it represents a close approximation to the cumulative normal distribution and is simpler to work with. Moreover, as Train, (1986) pointed out a logistic distribution (Logit) has got advantage over the others in the analysis of dichotomous outcome variable in that it is extremely flexible and easily used function (model) from the mathematical point of view and lends itself to a meaningful interpretation and relatively inexpensive to estimate. So that to address the second objectives of the study Logit model will be employed.

Following Pindyck and Rubinfeld (1981) the cumulative logistic probability function is specified as

$$P_i = F(Z_i) = F[\alpha + \sum (B_i X_i)] = \left[ \frac{1}{1 + e^{-[\alpha + \sum (B_i X_i)]}} \right] \dots \dots \dots (2)$$

**Where:**

e represents the base of natural logarithms (2.718)

x<sub>i</sub> represents the i<sup>th</sup> explanatory variable

P<sub>i</sub> is the probability that a household is being food insecure given x<sub>i</sub>,

α and β<sub>i</sub> are regression parameters to be estimated

Interpretations of the coefficients are understandable if the logistic model can be written in terms of the odds and log of odds (Hosmer and Lemeshow, 1989). The odds ratio is the probability that a household would be food insecure (P<sub>i</sub>) to the probability that it will be food secured (1 - P<sub>i</sub>).

$$(1 - P) = \frac{1}{1 + e^{z_i}} \text{----- (3)}$$

And putting using natural logarizm:

$$Z_i = \text{Ln} \left( \frac{P_i}{1 - P_i} = \alpha \right) + \beta_1 x_1 + \beta_2 x_2 + \dots + \beta_n x_n \text{----- (4)}$$

**Where:**

Z<sub>i</sub> represents is a function of explanatory variables x<sub>i</sub>

α is the intercept

β's are the slope parameters in the model

**3.6. Definition of Variables and Working Hypothesis**

**3.6.1. Dependent variables of the study**

The dependent variable which will be used in the logistic regression analysis is a binary variable which takes a value of one for food secure and zero for insecure households. The most important reason of a qualitative choice model is to determine the probability that an individual with a given set of attributes should make one choice rather than another. Household's food insecurity situation determined by comparing total kilocalorie consumed in household per adult equivalent per day with the daily minimum requirement of 2200 Kcal/AE/day.

### 3.6.2. Independent variables of the study

After an analytical procedure clearly delineated, it is necessary to identify the potential explanatory variables that can influence the state of household food insecurity.

Thus, the following explanatory variables were identified and their influence on household food security status was examined.

**Sex of household head:** It is a dummy variable and a person who economically supports or manages the household (i.e. 1 if the household head is male and 0 otherwise). Male-headed households have more access to agricultural technologies, more labor power and farm land as compared to female headed households. Whereas, Women farmers may need a long adjustment period to diversify their income sources fully and become food secure (Christina *et al.*, 2001; Adugna Eneyew, 2008). Hence, male headed households are in a better position to pull labor force than the female-headed ones. Thus, it is hypothesized that male headed households are more likely to be food secure than female headed households.

**Age of household head:** Age is a continuous explanatory variable peculiar to the household head. As age of household increases, it is assumed that farmers could acquire more knowledge and experience. According to (Haile, 2005) an older households heads are expected to have better access to land than younger heads, because younger mean either have to wait for land redistribution, or have to share land with their families. However, as the age of the head of the household increases there is unable to work hard for the survival of his family members. In light of this, age of the head of the household and food security status is negatively correlated.

**Education level of household head:** It is a dummy variable which takes a value of 1 for illiterate and 0 for literate. The education level of the households head in particular and the education levels of the households' members in general affect the households' livelihood in various ways (Tesfaye, 2003; Adugna, 2008). An educated household head has the capacity to innovate and to adopt timely technology and has better understanding of the cash crops that can help them to have a better income than the non-educated households (Fekadu, 2008). It has negative relationship between education level of the household head and household food insecurity according to the study of (Frehiwot, 2007). So, education status is hypothesized as positive relationship with food security.

**Distance from market center:** This variable is a continuous variable measured in kilometer; it will take from the home of the household to the nearest market place. Closeness to market centers creates access to additional income via off-farm/non-farm employment opportunities, easy access to information on inputs and transportation (Gemechu *et al.*, 2016; Dorward *et al.*, 2003). It is has been noted that the farther the market center is, the lesser the income from the sale of farm produce. Especially for perishable commodities, if the market place is located far away from the farm, the commodity may perish before reaching the market. And to avoid such incidences, the farmer sells his output for cheaper price thus reducing the income and bringing negative impact on household food security. Therefore, it is hypothesized that there is a negative association between distance to the nearest market center and household food security status.

**Small-scale irrigation use:** It refers to a dummy variable taking a value of 1 if the household used small-scale irrigation and 0, otherwise. Small-scale irrigation in the Ethiopian context refers to smallholder farms with the size of scheme amounting less than 200 ha (Mengistie, and Kidane, 2016). Empirical study has shown that access to reliable irrigation water can enable farmers to adopt new technologies and intensify cultivation, leading to increased productivity, overall higher production and greater returns from farming (Hussain *et al.*, 2004). Similarly, another empirical result found that in moisture-stressed areas, getting moisture through irrigation would improve the situation and help to boost agricultural outputs (Tirfe and Hamda, 2011). Evidence suggested that small-scale irrigation has benefited some households by providing an opportunity to increase agricultural production through double cropping and by taking advantage of modern technologies and high yielding crops that called for intensive farming (Woldeab, 2003). Accordingly, it is hypothesized that participating in small-scale irrigation would have a positive influence on food security of the household.

**Membership to social cooperatives:** It was used as a proxy for social capital. It is a dummy variable taking a value of 1 if the household is member of the farmers' cooperative and 0, otherwise. Local institutions functioning at the community level and social capital play a role in maintaining food security at the individual and household levels (Tolosa, 2009). Similarly, evidence sought that membership to cooperative has a positive impact on achieving food security (Dzanja *et al.*, 2015). It is hypothesized that social capital has a positive association to household food security.

**Family size:** Is the continuous variable; which refers to the total number of household members who lived and eat with household head at least for six months. The larger the size of family accompanied by the more dependency ratio results livelihood insecurity in farming households (Bezmer, *et al.*, 2002). Hence, an increase in household size implies more mouth to be feed from the limited resources. Similarly according to (Hilina, 2005) expectation is that, as the family size increases the probability of the household to have disguised unemployment increases which would in turn affect the well-being of the household. Therefore, it is hypothesized that large family size has negative relationship with food security.

**Farm size:** Is a continuous explanatory variable measured in hectare. It is prominent resource associated with household food security status. As the farm size increases, provided other associated production factors remain the same, the possibility that the household gets more output is high. (Lewin and Fisher, 2010) point out that size of cultivated land and food insecurity has negative relationship. Therefore, it is hypothesized that households with large cultivated land will have more likelihood to be food secure and vice versa.

**Off/non-farm activities participation:** This is a dummy variable which representing whether or not participation of a household head in diversified income. The presence of off-farm activity and ability to generate additional income had a positive association with household food security status (Tsegaye, 2009). Hence, households who did not engage in off-farm activities are more likely to face food deficit, if farm income is not enough. Yet, (Basher, 2010) indicated that the availability of off/non-farm income and food security have positive relationship. It is hypothesized that, households who managed to earn higher off/non-farm income are less likely to be food insecure. Thus, off/non- farm income is expected to have a negative impact on food insecurity.

**Pest and disease:** Is dummy variable and one of the factors affecting production and reducing yield. (FSB, 2007) reported that among the major challenges, pests and disease plays greater role of food security in Ethiopia. Hence, it is expected that households affected by pest and disease have positive linkage with household food insecurity than not affected households.

**Livestock owned (TLU):** It is a continuous variable measured in tropical livestock unit (TLU). Livestock contributes as a source of transport, nutrition and income. It also serves as a means of coping mechanism during shortage of food or crop failure (Almaz, 2015). The types

of animal reared in the woreda include cattle, sheep, goat, donkey and chicken these are the prominent sources of wealth to farm households. Hence, Households with large livestock size are expected to be less vulnerable to food insecurity. Therefore, it is hypothesized that livestock owned would be positive relation with household food security.

**Credit use:** It is a dummy variable and serves as a means to boost production and expand income generating activities, so that derived revenue increases and purchasing power of the household to escape from risk of food insecurity advances. Thus, it initiates investment in on-farm and/or off-farm activities and enhance sustainable food security (Devereux, 2006). Moreover, it helps to smooth consumption when household face with temporary food problem (Tekle and Berhanu, 2015). So, it hypothesized that households who have access to credit are expected to be food secure.

**Frequency of extension contact:** Is a continuous variable measured in contact times per week and the effort to disseminate new agricultural technologies are mainly successful if there is smooth and frequent contact between development agent and the rural household. Here, extension contact between a farmer and development agent has potential force to accelerate effective dissemination of adequate agricultural information, which in turn, enhances farmers' decision to adopt new technologies (Kidane *et al.*, 2005). Therefore, it is hypothesized that households who frequent extension contact would have negative relation with household food insecurity than zero contact.

**Table 2: Summary of variables, definitions, measurement and hypothesis**

<b>Name of</b>	<b>Descriptions of variables</b>	<b>Variable types</b>	<b>Variable Value</b>	<b>Sign</b>
AGEHHH	Age of household head	Continuous	Year	+
SEXHHH	Sex of household head	Dummy	1=Male,0=Female	-
FAMISIZE	Family size	Continuous	Number	+
EDULHH	Educational level of head	Dummy	1 illiterate, 0=literate	-
FARMSIZE	Farm land holding	Continuous	Hectares	-
PESTDIS	Pest and disease	Dummy	0= No, 1= Yes	+
LIVOWN	Livestock	Continuous	TLU	-
CREDACC	Credit use	Dummy	0= No, 1= Yes	-
OFF-FAAC	Off/non-farm activity	Dummy	1= participate, 0	-
REXTCON	Extension contact	Continuous	Number	-
IRRIGUSE	Irrigation use	Dummy	0= No, 1= Yes	+
DISROAD	Distance road	Continuous		-/+
DISMARK	Market distance	Continuous	Kilometers	
MARISTA	Marital Status	Dummy	1=married,	

Source: Own derived, 2020

## **4. RESULTS AND DISCUSSION**

This chapter presents and discusses the results of households' food security analysis in the study area. The first section of the chapter reports the food security status of the households. The next three sections present socio-economic background, about resource endowment, food aid and institutional characteristics of the sample households. The purpose of these sections is to provide the first impression about households' food security status. Then, sample respondent households food insecurity coping strategies are presented and discussed. Finally, the results of econometric analysis of the determinants of food security status of the households is presented and discussed.

### **4.1. Food Security Status of the Sample Households**

The households' food security status can be measured by direct survey of income, expenditure and consumption. In this study, households' food or calorie acquisition/consumption per adult per day is used to identify the food secure and food insecure households. The calorie consumed by the household is compared with the minimum recommended calorie of 2200 kcal per adult per day. If the consumption/acquisition is less than the recommended amount then, the household is categorized as food insecure and if greater than, as food secure.

The reason for use of this measure was that it produces a crude estimate of the amount of calorie available for consumption in the household. Moreover, it is not obvious to respondents how they could manipulate their answers. Because the questions are retrospective, rather than prospective, the possibility that individuals or households will change their behavior as a consequence of being observed is lessened (Hoddinott, 2001). In addition, the reliability of income data in subsistence farming where record keeping is limited is always questionable (Tesfaye, 2003). Of course, it cannot be denied that measuring food security in terms of income is consistent with objectives of many rural development interventions aimed at raising the level of income of rural households. However, the correlation between income and food security status of household is not always strong (Hoddinott, 2001).

The households' food security status was measured by direct survey of consumption. Data on the available food for consumption, from home production, purchase and /or gift/loan/wage in kind for the previous seven (7) days before the survey day by the household was collected.

Then the data were converted to kilocalorie and then divided to household size measured in AE. Following this, the amount of energy in kilocalorie available for the household is compared with the minimum subsistence requirement per adult per day (i.e. 2200 kcal). As presented in Table 3 the food security status of farm households that had been determined using descriptive analysis. The result of the household food balance model revealed that from the total sample households, 74(54.41%) households were found to be food secure who fulfill the minimum recommended daily calorie (2,200 kcal/AE/day). While 62(45.59%) of them failed to supply this daily minimum requirement. The t-test result shows that there is a statistically significant difference among the two groups at 1% probability level in terms of food calorie intake.

Table 2: Energy available per AE in kcal for sample households

Energy available per AE in (kcal)	Food secure (N=74)	Food insecure (N=62)	Total (N=136)	t-value
Minimum	2746.241	1396.00	497.94	16.392***
Maximum	3060.923	1566.915	4793.98	
Mean	2903.582	1481.458	2129.779	
Standard Deviation (SD)	371.711	626.439	870.30	

Note: \*\*\* Significance at less than 1% probability level

Source: Own survey Results, 2020

## 4.2. Sample Household Characteristics'

### 4.2.1. Household size

Household size, which means number of individual members of a household, is a variable used by many empirical studies on food security to see how it affects food security status of the households. The distribution of sample households with regard to household size, measured in AE, show a statistical difference between food secure and food insecure households.

As shown in Table 4, the minimum family size in AE was 1.75. The 1.75 result indicated that household which consists of a husband and wife had an AE of one and 0.75, respectively, which adds up to 1.75 AE. All respondents were married, widowed with few numbers of

children or divorced but also having some children which sum up 1.5 AE and more, other than the household head. The maximum family size in AE was 12.2. From food insecure households (52%) have got a family size which ranges from 5.91 to 12.2. On contrary, only (11.11%) of food secured households, got family size which ranges from 5.91 to 12.2. On the other hand, only (8.33%) of food insecure and about (39%) of the food secure got a family size, measured in AE, which ranges from 1.75 to 3. This means that the higher the family size, measured in AE, the more it is related to food insecurity status of the households in the study area.

The mean family size of food insecure and food secure households was 6.21 and 3.94, respectively. The standard deviation of household size for food insecure was 2.11 and that of food secure was 1.96, while that of the total respondent households was 2.892.

Table 3: Distribution of sample households by family size in AE

Family size in AE	Food secure (N=74)		Food insecure (N=62)		Total (N=136)	
	Number	Percent	Number	Percent	Number	Percent
less than 3	6	4	6	4	12	9
3-4	26	19	28	21	54	40
5-6	15	11	28	21	43	32
7-8	12	9	10	7	22	16
9-10	2	1	2	1	4	3
>10	1	1	0	0	1	1
Total	62	46	74	54	136	100
Mean	6.21		3.94			
SD	2.11		1.96			
Minimum			1.75			
Maximum			12.2			
t-value			5.517***			

Note: \*\*\* Significance at less than 1% probability level

Source: Own survey Results, 2020

#### 4.2.2. Age and sex of the household heads

The average age of household head of surveyed households was 45 years. The age range of all respondents ranged from 20 to 77 years. On comparison, (41.67%) of the food insecure households fell within age category of 51 to 64 years, while only (11.11%) of the food secure households fell within the same category. On the other hand, (69.44%) of food secure households were under the age category of 20 to 35 years, while only (14.29%) of food insecure households had age which were under the same category. The mean age of food insecure and food secure households were 48 and 35, respectively.

Table 4: Distribution of household head by age groups

Age group in (Years)	Food insecure (N=62)		Food secure (N=74)		Total (N=136)	
	Number	Percent	Number	Percent	Number	Percent
20 – 35	9	14.29	51	69.44	60	44
36 – 50	20	32.14	12	16.67	32	24
51 – 64	26	41.67	8	11.11	34	25
65 – 77	7	11.29	2	2.78	9	7
Mean	48.62		35.25			
SD	11.448		11.495			
Minimum			20			
Maximum			77			
t-value			5.855***			

Note: \*\*\* Significance at less than 1% probability level

Source: Own survey Results, 2020

#### 4.2.3. Gender and marital status of the household heads

The sex of respondent household heads had shown a variation due to the fact that as there were few numbers of female headed households. From food insecure, (95.16%) of them and (97.3%) of food secure ones were male headed households. While only (4.84%) of the food insecure households and (2.70%) of food secure ones were female headed households. On the other hand, out of the whole sample, (97.79%) were male headed while the remaining (2.21%) were female headed households. The Chi-square test had shown that the sex of the respondent head was 3.61.

The majority of the respondents (94.12%) were married, while (2.94%) and (2.94%) of the respondent household heads were divorced and widowed, respectively. The marital status of food insecure, food secure and all respondent cases was presented in Table 6.

Table 6: Distribution of household head by gender and marital status

Gender of Household heads	Food insecure (N=62)		Food secure (N=74)		Total (N=136)		X2 - value
	Number	Percent	Number	Percent	Number	Percent	
Female	3	4.84	2	2.70	3	2.21	7.61*
Male	59	95.16	72	97.30	133	97.79	
<b>Marital status</b>							
Married	56	90.32	72	97.30	128	94.12	8.43*
Divorced	4	6.45	0	0.00	4	2.94	
Widowed	2	3.23	2	2.70	4	2.94	

Note: \* Significance at less than 10% probability level

Source: Own survey Results, 2020

#### 4.2.4. Educational level of the household heads

The educational status of the head of the households inclined to illiterate and to those who can read and write local language. About (45.16%) of food insecure households, (48.65%) of the food secure group and (47.06%) of all respondents were illiterates. With regard to the respondents who read and write Somali, (24.19%) of food insecure households and only (12.16%) of food secure ones could read and write Sidamifa language. Only (2.7%) of the food secure households heads have completed grade twelve. About (30.64%) of food insecure households and (36.48%) of food secure households had an educational level which ranges from grade one to twelve. The distribution of respondent household heads educational level is presented in Table 7.

Table 5: Distribution of households by level of education

Level of Education	Food insecure (62)		Food secure (74)		Total (136)		X2 – value
	Number	Percent	Number	Percent	Number	Percent	
Illiterate	28	45.16	36	48.65	64	47.06	2.848
Read and write	15	24.19	9	12.16	24	17.65	
1 - 4 grade	9	14.52	10	13.51	19	13.97	
5 - 8 grade	5	8.06	14	18.92	19	13.97	
9 - 12 grade	5	8.06	3	4.05	8	5.88	
>Grade 12	0	0.00	2	2.70	2	1.47	

Source: Own survey Results, 2020

### 4.3. Resource Endowment

This sub section also presents the different aspects of resource endowments such as, livestock resources and cultivated crop land in hectare were also given due consideration. In addition to these, remittances the household's get is also used to show the different characteristics of food insecure and food secure households.

#### 4.3.1. Cultivated crop land holding

As indicated in Table 8, the average land holding was 2.98 hectares per household. The cultivated land holding had ranged from 0.3 hectare to 5.98 hectares. About (50%) of food insecure, (8.11%) of food secure and (27.21%) of all respondents possessed cultivated crop land less than half hectares. The mean cultivated land size of food insecure and food secure households was 1.98 hectare and 3.78 hectares, respectively. The minimum cultivated land size was 0.3 hectares while maximum was 5.98 hectares.

Table 6: Distribution of sample farmers by cultivated land size

Land size in Ha	Food insecure (N=62)		Food secure (N=74)		Total (N=136)	
	Number	Percent	Number	Percent	Number	Percent
< 0.5	31	50	6	8.11	37	27.21
0.6 – 1	28	45.16	24	32.43	52	38.24
1.1 - 1.5	1	1.61	26	35.14	27	19.85
>1.5	2	3.23	18	24.32	20	14.71
Mean	1.98		3.78			
SD	2.55		2.02			
Minimum	0.30					
Maximum	5.98					
t- value	3.396***					

Note: \*\*\* means significant at less than 5% probability level

Source: Own survey Results, 2020

#### 4.3.2. Livestock resources

There was a variation among the respondents with regard to TLU owned which ranged from zero to 3 TLU per household for all respondents. As Table 9 shows, the mean livestock holding in TLU for food insecure households and food secure ones were 0.67 and 1.58, respectively. The standard deviation was 0.45 for food insecure households while 0.72 for food secure group. On the other hand, the t-test value shows that there is significant difference between the two groups' interims of TLU that is food secure household had more TLU than food insecure households.

Table 7: Average herd composition holding of the sample households

Livestock type	Food insecure (N=62)		Food secure (N=74)		Total cases (N=136)	
	Mean	SD	Mean	SD	Mean	SD
Cow	2.16	1.43	4.46	2.28	3.42	2.25
Oxen	0.13	0.42	1.30	1.09	0.76	1.03
Goat	0.11	0.45	0.19	0.54	0.15	0.50
Sheep	1.29	1.26	2.69	1.69	2.05	1.66
Donkey	0.06	0.36	0.18	1.30	0.13	0.98
Hourse	0.00	0.00	0.11	0.42	0.06	0.32
Poultry	0.94	1.32	2.16	2.11	1.60	1.89
Total TLU	.6665	.44515	1.5828	.72260	1.17	0.76
Min					0	
Max					3	
t-value	8.696***					

Note: \*\*\* means significant at less than 5% probability level

Source: Own survey Results, 2020

#### 4.4. Institutional Characteristics

This sub-section presents different institutional services available in the area.

Irrigation can increase agricultural productivity and is crucial to improving food security. Literature has shown that irrigation can contribute usefully to food security through enhanced crop production and farmer incomes. Thus, irrigation plays key role in production supplementing water during dry time. It is highly related with production of crops and livestock. From the total sample households interviewed, 54(39.7%) and 82(60.29%) is found to be user and non-user of irrigation respectively. The chi-square-test shows that there is a statistically significant difference in irrigation access among the sampled households at less than 1% probability level (table 10).

Credit serves as a means to increase production and expand income generating activities. Thus, a household that used credit initiate investment in farm and non-farm activities and achieve food security. The survey result revealed that, from the total sample households about 82(60.29%) is users and 54(39.74%) is non-users of credit.

The chi-square value which is 7.185 in table 10 shows that use of credit is statistically significant at 1% probability level.

Proximity of households to market center were assessed and the survey results showed that 1.16% from the food insecure group and 0% from the food secure group traveled a distance of less than 0.5 km away from the market. About 25.81% from the food insecure group and 67.57% from the food secure group traveled a distance in between 0.6 to 1 km to get the main market, while 72.58% of food insecure households and 32.43% of food secure households travel more than 1km distance to get the market. The result of chi-square test showed that there is a significant difference in the proportion of household heads' membership to cooperatives at 1% level of significance between the two groups.

Survey results also showed that 53% from the food insecure group and 0% from the food secure group resides less than 0.5 km from the main road. About 33.87% from the food insecure group and 21.62% from the food secure group resides in between 0.6 to 1 km away from the main road, while 12.90% of food insecure households and 60.81% of food secure households reside above 1km away from the main road. The result of chi-square test showed that there is a significant difference in the proportion of household heads' membership to cooperatives at 1% level of significance between the two groups.

As far as cooperative membership is concerned, nearly 70.97% from food insecure and 56.76% from the food insecure are not members of cooperatives respectively. While only 29.03% from the food insecure and 43.24% from the food secure households are members of cooperatives. The result of chi-square test showed that there is a significant difference in the proportion of household heads' membership to cooperatives at 1% level of significance between the two groups.

Another important variable with immense implications to household food security is engagement in off/non-farm income generating activities. Off/non-farm income generating activities help farmers to diversify their income sources and thereby reduce risk of vulnerability to food insecurity. The survey result in table 10 shows that about 93.38% of the sample households have engaged in one off/non-farm income generating activity whereas only 6.62% have not engaged.

The result of chi-square test showed that there is a significant difference in the proportion of household heads' membership to cooperatives at 1% level of significance between the two groups.

Access to agricultural extension services boost agricultural productivity and production and thus, improve the status of household food security. In this study, it is a number of times extension agent's visited and advised farmer per a week. The maximum extension contact in the sample households is 2.68 times per a week. The average contact of DA's with sample households is about 2.49 times per a week. The mean frequency of extension contact of food insecure and food secure households was 2.39 and 2.61 times per a week, respectively. The t value of the frequency of extension contact is about 1.145. This result shows that frequency of extension contact is statistically insignificant difference between means of the two groups (Table 10).

Table10: Institutional Characteristics of the sample households

Variables	Description	Food insecure (62)		Food secure (74)		Total (136)		X2 -value
		Number	Percent	Number	Percent	Number	Percent	
Irrigation use	Yes	17	27.42	37	50	54	39.71	7.185***
	No	45	72.58	37	50	82	60.29	
Credit used	Yes	45	72.58	37	50	82	60.29	7.185***
	No	17	27.42	37	50	54	39.71	
Distance to tarmac road(Km)	0 - 0.5	33	53.23	13	17.57	46	33.82	34.411***
	0.6 – 1	21	33.87	16	21.62	37	27.21	
	> 1	8	12.90	45	60.81	53	38.97	
Nearest market (Km)	0 - 0.5	1	1.61	0	0.00	1	0.74	24.035***
	0.6 – 1	16	25.81	50	67.57	66	48.53	
	> 1	45	72.58	24	32.43	69	50.74	
Member in cooperative	Yes	18	29.03	32	43.24	50	36.76	2.931*
	No	44	70.97	42	56.76	86	63.24	
Off-farm income	Yes	55	88.71	72	97.30	127	93.38	4.026**
	No	7	11.29	2	2.70	9	6.62	
Extension contact	Number	Food insecure (62)		Food secure (74)		Total (136)		t-value
		Mean	SD	Mean	SD	Mean	SD	
		2.39	0.92	2.61	1.32	2.49	0.10	

Note: \*\*\*, \*\* and \* means significant at the 1%, 5% and 10% probability levels, respectively

Source: Own survey Results, 2020

#### **4.5. General Food Security Situation of Sample Households**

Table 11 shows that from the total respondent's more than 41.6% were mentioned that strongly disagree and disagree on the availability of food to feed their family members throughout the year. This implies that the almost half of respondents in the study area have no enough physical availability of food throughout the year. Similarly, more than 39% of sample households reported that strongly disagree and disagree on the accessibility of good physical and economic access to food for their family members through the year.

The results revealed that from the total sample households less than 43.4% were mentioned that agree and strongly agree on the adequacy of food that is nutritious and safe, and produced in environmentally sustainable ways through the year for their family members. This implies that more than 56.6% of the respondents were have no adequate food for their family members. And the result shows that from the total sample households about 50% are reported that agree and strongly agree on the availability of food and access to food are unstable. This shows that in the study area half of them have not food stability throughout the year for their family members. Similarly, more than 42% of respondents are strongly disagree and disagree on the use of healthy diet for all their family members throughout the year (table 11).

Table 11: General food security situation of the sample household

Variables	Categories	frequency	percentage
Availability (there is enough food available in your farm land to feed the family members throughout the year)	Strongly disagree	13	9.6
	Disagree	44	32.4
	Neutral	41	30.1
	Agree	38	27.9
	Total	136	100.0
Accessibility (all family members in your farm land have good physical and economic access to food through the year)	Strongly disagree	11	8.1
	Disagree	42	30.9
	Neutral	40	29.4
	Agree	43	31.6
	Total	136	100.0
Adequacy (all family members in your farm land have access to food that is nutritious and safe, and produced in environmentally sustainable ways)	Strongly disagree	6	4.4
	Disagree	21	15.4
	Neutral	50	36.8
	Agree	56	41.2
	Strongly agree	3	2.2
Total	136	100.0	
Stability (There are periods where all family members in your farm land are food insecure b/c availability of food or access to food is unstable)	Disagree	10	7.4
	Neutral	58	42.6
	Agree	61	44.9
	Strongly agree	7	5.1
	Total	136	100.0
Acceptable (All family members in your farm land have access to culturally acceptable food, which is obtained)	Strongly disagree	8	5.9
	Disagree	19	14.0
	Neutral	43	31.6
	Agree	65	47.8
	Strongly agree	1	0.7
Total	136	100.0	
Utilization (in your farm land all family members use their food in ways that amount to a healthy diet)	Strongly disagree	17	12.5
	Disagree	29	21.3
	Neutral	32	23.5
	Agree	53	39.0
	Strongly agree	5	3.7
Total	136	100.0	

Source: Own survey Results, 2020

#### **4.6. Econometric Analysis**

A binary logit model was used to identify potential explanatory variables affecting household's food security status. Logistic regression is applied when the dependent variable is dichotomous. The model is estimated with STATA 15 computing software. In the estimation process data from the two groups, namely food secured households and food insecure households were pooled such that the dependent variable takes a value 1 if the household was secured and 0 otherwise. Prior to running the regression model, the explanatory variables were checked for the existence of multicollinearity and heteroscedasticity.

The VIF values of the variables in the model as shown in Appendix Table 3 are less than the critical values showing that there is no problem of collinearity. The maximum value of VIF obtained for these variables was found to be 1.37. This shows that there is no problem of multicollinearity. However, Breusch-Pagan test for heteroskedasticity indicated a small chi-square value (0.1786) implying the inexistence of heteroskedasticity problem in model.

Table 12: Logit regression estimates of factors affecting food security status of the households

Variables	Coef.	Std. Err.	mfz	z	P>z
Distance road	0.963**	0.414	0.229	2.32	0.020
Market distance	-0.867	0.567	-0.206	-1.53	0.127
Age of household	-0.778**	0.397	-0.185	-1.96	0.050
Marital status	-0.356	0.436	-0.085	-0.82	0.414
Education level	0.362	0.372	0.086	0.97	0.332
Extension contact	-0.318	0.261	-0.076	-1.22	0.222
Credit use	0.912	0.677	0.217	1.35	0.178
Membership cooperative	1.620**	0.699	0.350	2.32	0.020
Irrigation use	-0.392	0.657	-0.093	-0.60	0.550
Pest and disease	-0.779	0.668	-0.176	-1.17	0.244
Family size	-0.194	0.163	-0.046	-1.18	0.236
Off-farm participation	2.599*	1.344	0.529	1.93	0.053
Livestock holding	0.449	0.372	0.107	1.21	0.228
Farm size	1.836***	0.407		4.51	0.000
_cons	-5.502	3.219		-1.71	0.087
Number of obs			136		
LR chi2(14)			94.16		
Prob > chi2			0.0000		
Log likelihood			-46.65604		
Pseudo R2			0.5023		
Count R2			0.838		
Sensitivity/ Correct prediction of food insecure (%)			86.49%		
Specificity/ Correct prediction of food secure (%)			80.65%		

Note: \*\*\* \*\* and \* means significant at the 1%, 5% and 10% probability levels, respectively

Source: Own survey Results, 2020

The overall model goodness of fit represented by model count R-square is very good and about 83.8% of the households were correctly predicted out of the whole 136 household heads.

The log likelihood ratio which follows the chi-square distribution was found to be 46.65 which is significant at 1% this implies that the entire explanatory variable together explained the variation in the dependent variable.

As the estimated coefficients show that of the fourteen explanatory variables, food security status is significantly influenced by five explanatory variables. More precisely, distance from the main road, membership in cooperative, off-farm participation and farm size had positive and significant effect on the food security status of the households. Besides, age of household head had negative and significant effect on the food security status of the households

Distance to paved road is significantly associated with food security status and shows that a one unit increase in the distance to paved road increase the chances of a household being food secure by 28.7%. This implies that food secure households are located at far distance than the food insecure. This is probably due to the reason that households who lack access to institutional support, inputs and market produce only for their consumption; hence, they become self-sufficient and more food secure. Thus, infrastructure, such as roads, is important in the quick transportation of agricultural products, thereby facilitating market integration among regions. This will help to move the products from surplus areas to deficit areas to reduce the impact of food shocks on households.

Age of the household head was found to be negative and significant at less than five percent probability level. The negative sign is an indicative of its influence in the food security status of the rural households. This means that, an increase in the age of the household head increased the likelihood for the household to be food insecure. One possible reason may be that older household heads have larger number of family size as polygamy is a common practice. This opens up a chance for bearing children even at latter ages. The other possible reason is that a household which headed by older aged head face a family labor shortage since old children become independent having their own household. And due to this the household would be composed of young aged children with large family size. The marginal effect of 0.185 implied that, other things being constant, age of the household head increased by one year, the likelihood to be food secure decreased by 18.5%. The possible reason for such result might be the old age bearing of children so that the family number increases while the head of the household was getting older and older.

The coefficient of membership in farmer organization (cooperatives in this case) is statistically significant at 1% level and carries a positive sign. This implies that households whose heads are members of cooperative societies or other farmers' organizations had higher tendency of being more food secure than those households whose heads are not members. This can be closely linked to the beneficial effects of their membership, in terms of information sharing, production and other welfare enhancing services that these societies and organizations often offer. The result is supported by previous finding of Asogwa and Umeh (2012).

Off farm income found to be significantly determining food security status of the households at 1% significant level. In Ethiopian where productivity is constrained by many factors that contributes to food insecurity, diversifying income is worth practicing. According to Holden et.al (2004) stated, lack of employment restricts involvement in off farm activities. Had there been much employment, there would have been greater involvement than observed. For those households participated, off farm work has a positive impact on income, food security and hence food security. Thus, this show that off-farm income contributes to higher food production and farm income by easing capital constraints, thus improving household welfare in multiple ways.

It is evident from table 12 that farmland size owned by the respondent household has the highest positive and significant contribution to the status of household food security. The size of farmland is entered in to the model as a continuous variable. As it is also in table 12, other factors remaining constant, one unit increase in farm land size increase the chances of a household being food secure by 40.7%. This result is significant, showing that access to farmland is very important in improving household food security. This is consistent with the study by Haile (2005), Feleke (2003) and many other studies in Ethiopia that found out farm land size increases the likelihood of households being food secured.

## **5. CONCLUSION AND RECOMMENDATIONS**

### **5.1. Conclusion**

As outlined in the objectives, the focus of this study was to investigate the status of household food security and its determinants in rural Gorche. The study has based its analysis on the data collected through survey questionnaire from 136 sampled respondent households who were randomly selected from four kebeles. In addition, Focus Group Discussion (FGD) and Key informant interview (KII) was held with different members of community at all the four kebeles. Moreover, interview was made with relevant experts working at kebele and woreda offices and with office heads. Relevant and available secondary data was also collected from Woreda office of Agriculture (WoA) and Woreda office of Finance and Economic Development (WoFED). Academic papers and government reports relevant to the study area was also referred.

The data collected was analyzed using SPSS version 20 and Stata15 statistical package. The household food balance model was used to calculate per capita kilocalorie available to households to show the food security status of the sample households. Different statistical tools such as T-test, and Chi-square test and logistic regressions were used to analyse the data collected. Based on the data collected and the result of the analysis made, the following conclusions were drawn.

Concerning the status of household food security, 54.41% of the households in the study sample are found to be food secure while 45.59% are found to be food insecure. For the entire sample households the mean per capita kilocalorie available is 21219.779 kilocalories while the minimum average requirement in Ethiopia is 2200 kilocalories, showing that the study area is food insecure.

The logistic regression model result revealed that from the total thirteen (14) independent variables, five variables significantly influence household food security in the study area. These are distance from the main road, age of the household head, membership in cooperative, off-farm participation and family size.

In the study area, age of the households had a negatively influences household food security. This implies that an increase in the age of the household heads has less probability to be food

secured. On the other hand, farm land size, family size, membership in cooperative, off-far and off-farm participation positively influence household food security status. This means that a unit increase in these variables increases the probability to be food secured in the study area.

## **5.2. Recommendations**

Based on the findings discussed above, the following recommendations are very crucial to enhance improved food security at household level. The possible areas of intervention include:

Improvement in the infrastructure like road will not only reduce the transportation cost but it will also improve the availability of cheap food products at local level. Further, it will also increase household purchasing power and will improve food security status at local level. In this regard, local and federal governments are responsible to formulate intervention strategies to work jointly in order to alleviate the transportation problems and build a corporate institute that can supply agricultural inputs and provide information about the market situation.

Age of the household head had negative impact on food security. This means old household heads are less likely to be food secure. Therefore, local government intervention should focus on capacity building for older household heads should be given more priority. In addition, interventions intended to help farm households have to give priority to old aged peoples.

Membership of farmer cooperatives has a significant positive influence on households' food security status. It is thus important to strengthen the existing farmer cooperatives to reinforce farmer-to-farmer knowledge sharing through providing awareness creation, incentives, linking to the market and providing various facilities such as offices and stores by the regional and local government.

Promotion of off-farm employment generating schemes could enable the farm household get diversified income sources. Support to diversification away from precarious livelihood systems (e.g. agriculture) towards sustainable alternatives whose returns are not correlated with rainfall such as agro-industry or services such as community-based tourism. In general off-farm employment opportunities need to be generated in rural areas to accommodate surplus labor from agriculture sector in order to enhance labor productivity in agriculture sector and farm income.

Farmland size was found to be significantly affecting the status of rural household food security. Therefore; attention should be given by government to create access to better farmland size for the food insecure households. In addition, improvement in access to agricultural inputs, extension services, agricultural credit, and land productivity improvement technologies should be given more attention by government and non-governmental organizations. Even though these are already in the Government food security strategy, it will be important to design appropriate way to cascade the strategies to the local and household level. Thus, a help given to rural farmers increase their agricultural production and productivity which in turn improve their status of food security.

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## 7. APPENDICES

Appendix Table 1. Conversion factor of tropical livestock unit (TLU)

Livestock Category	TLU	Livestock Category	TLU
Ox	1	Horse	1.1
Cow	1	Sheep (adult)	0.13
Woyefen	0.34	Sheep (young)	0.06
Heifer	0.75	Goat (adult)	0.13
Calf	0.25	Goat (young)	0.06
Donkey (adult)	0.7	Hen	0.013
Donkey (young)	0.35		

Source: Storck, *et al.*, 1991

Appendix Table 2. Conversion factor for computing calorie intake

Food item	Unit	Calorie	Food item	Unit	Calorie
Wheat	Kg	3574	Beef	Kg	1148
Teff	Kg	3589	Milk	litter	737
Barely	Kg	3723	Butter	Kg	7363
Lentil	Kg	3522	Egg	No	61
Hose bean	Kg	3514	Honey	Kg	3605
Sorghum	Kg	3805	Pepper	Kg	933
Peas	Kg	3553	Maize	Kg	3560
Vetch	Kg	3470	Millet	Kg	3260
Linseed	Kg	5109	Check pea	Kg	3630
Sugar	Kg	3850	Garlic	Kg	118
Coffee	Kg	1103	Edible oil	Kg	8964

Source: EHNRI, 2000

### Appendix table/figure 3 Logistic regression results on the determinants that affect households food security

```
. logit foodsecu distance market age marital education visit credit membership irrigation pest Familysizeno offfarm TLU own
> ed
```

```
Iteration 0: log likelihood = -93.737916
Iteration 1: log likelihood = -47.483401
Iteration 2: log likelihood = -46.671304
Iteration 3: log likelihood = -46.656057
Iteration 4: log likelihood = -46.656036
Iteration 5: log likelihood = -46.656036
```

```
Logistic regression                Number of obs   =      136
                                   LR chi2(14)      =      94.16
                                   Prob > chi2       =      0.0000
Log likelihood = -46.656036        Pseudo R2      =      0.5023
```

foodsecu	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]
distance	.9630412	.4143547	2.32	0.020	.150921 1.775161
market	-.8668272	.5674772	-1.53	0.127	-1.979062 .2454077
age	-.778079	.3970405	-1.96	0.050	-1.556264 .0001062
marital	-.3561164	.4361306	-0.82	0.414	-1.210917 .4986839
education	.361595	.372488	0.97	0.332	-.3684682 1.091658
visit	-.3184773	.2607734	-1.22	0.222	-.8295838 .1926292
credit	.9115704	.6765023	1.35	0.178	-.4143497 2.237491
membership	1.620133	.6985797	2.32	0.020	.2509418 2.989324
irrigation	-.3924844	.6571718	-0.60	0.550	-1.680517 .8955486
pest	-.7792306	.6684263	-1.17	0.244	-2.089322 .530861
Familysizeno	-.193604	.163412	-1.18	0.236	-.5138856 .1266777
offfarm	2.598898	1.34422	1.93	0.053	-.0357261 5.233521
TLU	.448519	.3719355	1.21	0.228	-.2804611 1.177499
owned	1.836376	.4069113	4.51	0.000	1.038844 2.633907
_cons	-5.502224	3.219052	-1.71	0.087	-11.81145 .8070028

### Appendix Table/Figure 4. Multi-collinearity test for all explanatory variables

```
. vif
```

Variable	VIF	1/VIF
distance	1.79	0.558592
owned	1.73	0.579305
age	1.60	0.624887
irrigation	1.45	0.689304
credit	1.43	0.697748
market	1.40	0.715217
Familysizeno	1.39	0.718650
education	1.38	0.724794
membership	1.23	0.811640
pest	1.21	0.823827
visit	1.18	0.845852
marital	1.16	0.862835
TLU	1.13	0.882973
offfarm	1.13	0.883063
Mean VIF	1.37	

## Appendix Table/Figure 5. Breusch-Pagan/Cook-Weisberg test for heteroskedasticity

```
. hettest
```

```
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
```

```
Ho: Constant variance
```

```
Variables: fitted values of foodsecu
```

```
chi2(1)      =    1.81
```

```
Prob > chi2  =  0.1786
```