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ANALYZING FOOD INSECURITY AND COPPING STRATEGIES OF RURAL HOUSEHOLDS IN HULET EJU ENESIE WOREDA OF AMHARA REGION

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BAHIR DAR UNIVERSITY

COLLEGE OF AGRICULTURE AND ENVIRONMENTAL SCIENCES

DEPARTMENT OF AGRICULTURAL ECONOMICS

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M.Sc. Thesis

By

Melesse Zeleke

June, 2018

Bahir Dar, Ethiopia



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By

Melesse Zeleke

**Submitted in Partial Fulfillment of the Requirements for the Degree of Master of
Science (MSc.) in “Agricultural Economics”**

Major Advisor: Fentahun Tesafa (Assistant Professor)

Co Advisor: Zemen Ayalew (PhD)

June, 2018

Bahir Dar, Ethiopia

THESIS APPROVAL SHEET

As a member of the Board of Examiners of the Master of Sciences (M.Sc.) thesis open defence examination, we have read and evaluated this thesis prepared by **Mr. Melesse Zeleke** entitled “**ANALYZING FOOD INSECURITY AND COPPING STRATEGIES OF RURAL HOUSEHOLDS IN HULET EJU ENESIE WOREDA OF AMHARA REGION**”. We hereby certify that; the thesis is accepted for fulfilling the requirements for the award of the degree of Master of Sciences (M.Sc.) in **Agricultural Economics**.

Board of Examiners

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DECLARATION

This is to certify that this thesis entitled “**ANALYZING FOOD INSECURITY AND COPPING STRATEGIES OF RURAL HOUSEHOLDS IN HULET EJU ENESIE WOREDA OF AMHARA REGION**” submitted in partial fulfillment of the requirements for the award of the degree of Master of Science in “**Agricultural Economics**” to the Graduate Program of College of Agriculture and Environmental Sciences, Bahir Dar University by Mr. **Melesse Zeleke** (ID. No. BDU0906142PR) is an authentic work carried out by him under our guidance. The matter embodied in this project work has not been submitted earlier for award of any degree or diploma to the best of our knowledge and belief.

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DEDICATION

To *Hulet Eju Enesie Woreda* Severely Food Insecure Rural Households

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ABBREVIATIONS/ACRONYMS

ACF	African Care for Food
AFSHS	African Food Security and Hunger Survey
BMI	Body Mass Index
CDF	Cumulative Distributive Function
CFSVA	Comprehensive Food Security and Vulnerability
CIA	Central Intelligence Agency
CSA	Central Statistics Agency
CSI	Copping Strategy Index
ETB	Ethiopian Birr
FANTA	Food and Nutrition Technical Assistant
FAO	Food and Agriculture Organization
FCS	Food Consumption Score
FGD	Focus Group Discussion
GDP	Gross Domestic Product
GFSI	Global Food Security Index
HDDS	Household Diet Diversity Status
HEEWAO	Hulet Eju Enesie Woreda Agriculture Office
HFIAP	Household Food Insecurity Access Prevalence
HFIAS	Household Food Insecurity Access Scale
MoFED	Ministry of Finance and Economic Development
MUAC	mid Upper Arm Circumference
NMA	National Meteorological Directorate
OLS	Ordinary Least Square Regression
RHFI	Rural Household Food Insecurity
TLU	Tropical Livestock Unit
UNICEF	United Nations International Children Emergency Fund
USAID	United States Agency for International Development
VAM	Vulnerability Analysis and Measurement
WFP	World Food Program
WWW	Worldwide Web

ABSTRACT

Food security is one of the critical issues that need to be addressed in developing countries like Ethiopia. Besides, national food security does not guarantee for insuring the household food security. Therefore, this study aimed to analyze food insecurity and coping strategies of rural households in Hulet Eju Enesie Woreda. Mixed research design was employed on this study. Primary data from a sample of 202 rural households were collected using food consumption frequency, household food insecurity access scale and the coping strategy modules developed by the World Food Program during data collection customized in the context of Ethiopia. Based on the analyses of food consumption score and food insecurity access scale, the study identified 15.35, 75.25 and 9.41% of the respondents were in poor, borderline and an acceptable level of food consumption respectively. Likewise, this study resulted 27.72% food secure and 26.73, 36.14 and 9.41% of the respondents were mildly, moderately and severely food insecure, respectively. The ordered probit regression model was applied to identify the determinants of household food insecurity status in the study area. The results of this econometric model analysis indicate that family size and credit utilization are significantly and positively related, while head sex, land size, livestock ownership, and annual income are significantly and negatively related to food insecurity level of rural households. In addition, eating less expensive foods, decreasing portion sizes at meal times, and reducing the number of meals per day were identified as the major coping strategies of households for food insecurity in Hulet Eju Enesie Woreda. Finally, this study suggests that unless the government and other relevant stakeholders devise strategic interventions focusing on improving food security at the household level, the food insecurity of rural households is expected to be further aggravated in the woreda that at least the severely food insecure ones may be forced to adopt the livelihood deteriorating measures as their coping strategies.

Key Words: Diet Diversity, Food Consumption Score, Food Insecurity Level, Household Food Insecurity Access Scale, Ordered Probit, and Coping Strategy

Chapter 1 INTRODUCTION

1.1 Background of the Study

Food insecurity problem is perceived in the global, national, community, as well as household levels. Sub-Saharan Africa is the worst of all regions with close to 223 million people (24.8%) in the prevalence of undernourishment and food insecurity (FAO, 2014). In line with this, African food security/hunger survey (AFSHS) agrees that Africa remains the region with the highest prevalence of undernourishment. The report indicated that the five African countries with the most number of people in a state of hunger/under nourishment has varied between 10 million and 32 million people. Ethiopia registered the highest share (32.1 million) followed by Tanzania (15.7 million), Nigeria (12.1 million), Kenya (11 million) and Uganda (10.7 million). Significantly, four of these countries with the most number of people affected by hunger/undernourishment are East African countries (Ethiopia, Tanzania, Kenya, and Uganda) (AFSHS, 2014).

A report by the United States Agency for International Development (USAID) indicated that Ethiopia is the second most populous country in sub Saharan Africa, where food insecurity is a major and ever worsening problem (USAID, 2012). According to Abduselam Abdulahi (2017), food insecurity in Ethiopian history has started since 1953, and experiences El Niño drought in 2015/16, which results over 40 percent of Ethiopian population have been affected, 27 million people become food insecure and total population of 18.1 million people required food assistance in 2016. In the same year, though the global hunger reduction continues, about 795 million people are chronically undernourished in 2014–16 (Ibid).

In another way, the prevalence of under nutrition has fallen from 18.6% to 10.9% globally, from 23.3% to 12.9% for developing countries and 47.2% to 31.5% in East African countries (FAO, 2015). However, this estimation indicates that Ethiopia (ranking no. 1) is the worst of all African countries as more than 35% of its total population is suffering from chronic undernourishment and food insecurity (Ibid). Similarly, world food program estimated over 7.1 million people who found in Eastern Tigray, North Eastern Amhara and Eastern Oromia of Ethiopia was living in the conditions of food crisis (WFP, 2014). The problem is aggravated by backward agriculture, land degradation, drought, population pressure, poor infrastructure facility, and low level of off-farm/non-farm activities (Birara Endalew *et al.*, 2015).

Food insecurity is relatively higher in rural areas than urban; with about 44.6% and 28% of households in rural and urban areas, respectively (MoFED, 2012). Amhara region, which represents more than 27% of the national population, is prevalent of food insecurity year to year. The proportions of households who are food insecure were about 42.5% in the region (Ibid). This was the highest one and much higher than the national average, which was only 33.6%. These all imply that food insecurity is still the persistent problem in the region even after the country has shown economic progress. However, appraisals of literatures show that Amhara region is limited on studies to a specific areas including Hulet Eju Enesie Woreda on the severity of food insecurity at the household level.

1.2 Statement of the Problem

Agriculture is the main source of income and employment and thus food security of Ethiopia. Currently, it contributes 72.7% employment, 35.8% of the country's GDP and share above 90% of the export (CIA, 2018). However, the sector faced continuous and challenging problems that are induced by environmental crises, demographic and socioeconomic constraints, which adversely affect households' production system and thus leaves the country and/or households to remain food insecure (Bereket Zerai and Zenebe Gebreegziabher, 2011). Yet again, national food security does not guarantee food security at the household or the individual level (Duffour, 2010).

A study by Frehiwot Fantaw (2007), demonstrated that 45% of households in Amhara region were chronically food insecure. Similar to this study, above 48% rural households were vulnerable to food insecurity in the region (Mesfin Welderufael, 2014). Moreover, food insecurity is ever worsening problem due to rapidly increasing population pressure followed by land degradation resulting a loss of agricultural production that in turn increases the challenge of adequately meeting nutritional needs at household level (USAID, 2012).

In line with these, Hulet Eju Enesie is one of the most populous, the highest population densities and their farm land was being extremely cultivated and depleted woredas in Amhara region; where by researches on food insecurity and related issues are nulled out (CSA, 2007 and WAO, unpublished). Moreover, in developing country context food security is often seen as the amount of energy available from staple food consumption. The quality of diet in terms of a range of nutrients and food components is not taken into

account; hence, low-quality and monotonous diets are common and the risk of micronutrient deficiencies is high in Ethiopia (Arimond et al., 2010 and FAO, 2013).

Besides these, studies made earlier identified mechanisms to solve the food shortage problem taken by households are local strategies that vary from community to community. This leads to difficulties in the empirical evaluation of the severity of the food insecurity problems and of the strategies in giving priority in applying national food security improvement programs and monitoring activities at different geographical locations.

Therefore, this study was progressed to fill these information gaps through analyzing the level and determinants of food insecurity in both quality and quantity aspects by conducting food consumption score analysis and measuring household food insecurity access scale and reduced coping strategy index of rural households in *Hulet Eju Enesie Woreda* for signifying development planners, interventionists and future researchers who desire to apply their knowledge on food insecurity and related issues.

1.3 Objectives of the Study

1.3.1 General objective

The overall objective of the study is to analyze the level of rural household food insecurity and its coping strategies in *Hulet Eju Enesie Woreda*;

1.3.2 Specific objectives

The study specifically aims

- To assess dietary diversity status of rural households
- To estimate food insecurity level of rural households
- To determine factors affecting the level of rural household food insecurity
- To identify coping strategies of rural households for food insecurity in the study area.

1.4 Research Questions

This study was expected to answer the following research questions:

1. How does the status of rural household's dietary diversity look like in *the Hulet Eju Enesie woreda*?
2. How do we describe the level of food insecurity in rural part of the *woreda*?
3. What are the factors affecting rural household food insecurity in the study area?
4. What are the strategies that rural households adopt to cope up with food insecurity?

1.5 Significance of the Study

A study of analyzing food insecurity situations and the respective coping strategies is valuable because it provides information that will enable effective measures to be undertaken so as to improve the food security status and bring the success of development programs in the study area. It enables development practitioners and policy makers to have better knowledge as to where and how to intervene in rural areas to minimize the severity of food insecurity or to bring food security. Moreover, the empirical analyses carried out contribute towards better food gap estimation. Thus, such studies are important in that they could help in designing food security development programs and food security related policies. Further, the effective performance of this study is essential to provide secondary data to other researchers to conduct further research on food insecurity issues in the Woreda and elsewhere in similar scenarios.

1.6 Scope and Limitations of the Study

Research is a resource intensive pursuit of wisdom. It requires the appropriate technical, financial, and geographical qualifications. The study was conducted only on one *Woreda* of East *Gojjam* zone. It focused on estimation of the effect of socio-demographic, economic, institutional and some biophysical factors of household food insecurity status. But, it could not venture to investigate the wider environmental dimensions of food insecurity. Only the dimensions of food insecurity in terms of diet diversity and access scale were investigated. Additionally, this study was done for academic requirement and the survey was a cross-sectional study. Therefore, the study period was too short to indicate any trend to see factors that can have effects on household food insecurity in different seasons. Moreover, there were resource and time limitations to study on two or more *woredas* for better comparisons of them with a study done at the same time.

1.7 Organization of the Thesis

This paper is organized into five chapters. The first chapter ends with this sub section; the second chapter deals with theoretical and empirical literatures reviewed from various sources. Following this, the third chapter provides the detail of the research methodology adopted on sampling, collecting and analyzing the appropriate data. Then after, chapter four of the thesis consists of the major findings and the discussions pertaining to the pre determined objectives; and the paper winds up by presenting conclusion and recommendations in chapter five.

Chapter 2 LITERATURE REVIEW

In this section, relevant and available literatures on the subject of the study were reviewed exhaustively. It deals with the basic concepts, and the empirical findings consisting of studies made earlier on food insecurity and coping mechanisms. Then after, it ends with critical evaluations of the literatures and development of analytical framework for studying food insecurity at household level.

2.1 Theoretical Review

2.1.1 Concepts of food security, dietary diversity and food insecurity

The concept of food security was originated in the mid-1970s, during the international discussion on world food crisis. The primary focus of the discussion was convincing food availability problems and price stability of basic foodstuffs to some level at the international and national level (FAO, 2005).

Food security is defined in different ways by international organizations and researchers, but without much difference in the basic concept. According to Getahun Bikoara (2003), food security is a concept that can generally be addressed to the global, national, regional, community and at the household level. It was conceived as the adequacy of the food supply at the global and national level. Such view favored macro-level food production and supply oriented variables that overlooked the micro-level food access.

USAID (2008) defined food security is a situation that exists when all people have sufficient physical and economic access to safe and nutritious food to meet the dietary needs including food preferences to live a healthy and active life at all times. Similarly, food security is defined as adequate availability of and access to food for households to meet the minimum energy requirements for an active and healthy life as recommended by the Ethiopian government (Wali and Penporn, 2013).

Therefore, household dietary diversity can be one of the ways to estimate household food security (Vakili *et al.*, 2013). It has been used as an indicator for economic access of a household to a variety of foods (Admassu Tesso *et al.*, 2017). Dietary diversity comprises food diversity and food frequency which specify the food groups a household consumes and the number of days in which a particular food group is consumed over a reference period respectively. Thus, a composite food consumption score (FCS), is used as a proxy

indicator to food access; food consumption. It is based on the food diversity, food frequency and the relative nutritional importance of the food groups consumed (WFP, 2008, 2009).

In contrast, food insecurity is defined as the lack of capability to produce food and to provide access to all people at all times to enough food for an active and healthy life (WFP, 2009). In this context, it is defined as limited or uncertain availability of nutritionally adequate and safe foods or limited or uncertain ability to acquire acceptable foods in socially acceptable ways. It is also the condition whereby households lack access to enough food both in quantity and quality on a sustainable basis.

Household food insecurity takes different forms, depending on whether food insecurity is chronic (with household almost always short of food) or transitory (resulting from temporary adverse circumstance). Chronic food insecurity is persistently inadequate diet caused by the continual inability of households to acquire needed food either through production or through purchasing. Chronic food insecurity is rooted in poverty; on the other hand, transitory food insecurity is a temporary decline in a household access to food, due to factors such as instability of production, income, or food prices (Ahmed Mohammed, 2015).

2.1.2 Food security/insecurity/ indicators

Recently, WFP defined food insecurity as a situation where the conditions of food availability, food access and food utilization are not satisfied. Therefore, the three pillars of food security are increasing the availability of food, improving access to food and enhancing the nutritional adequacy of food intake (WFP, 2012).

Food availability: it is achieved when sufficient quantities of food are available within a country through domestic production, commercial imports, national stocks, and food aid. Household food availability exists when adequate quantities and varieties of food are on hand in local markets, either from local production or from imports. Food availability is primarily a concern in the agriculture-based economies of developing countries. Production estimates are an indicator of food availability that is based on area and yield estimates during and after the agricultural season. But, production estimates are usually available from ministries of agriculture. Therefore, food availability is often measured at a national level nonetheless it can also be explored at the level of local food markets. Wholesale or market

prices of staple foods are also other indicators of food availability, as opposed to retail prices, which are indicators of food access (Ibid).

Food access: Food access is referred to as the claims by individuals to adequate resources to acquire appropriate foods for a nutritious diet. Access is largely determined by the ability of households and individuals to obtain food from own production, purchases, and other sources. It is ensured when households are able to acquire adequate amounts of food. Food access depends on own production, household income and the distribution of income within households and the price of the goods (Ibid). Food consumption and coping strategies are the two main indicators of food access at household level. Food consumption can be measured directly by measuring individual intakes, household caloric acquisition (the number of calories, or nutrients, available for consumption by household members over a defined period), and dietary diversity. Coping strategies reflect the activities to which people resort to obtain food, income and/or services when their normal means of livelihood have been disrupted (CFSVA, 2009). The coping strategy index (CSI) can also be used to analyze coping strategies and as a proxy indicator of food access. It reveals the severity of the strategies that households use to manage shortfalls in food consumption.

Food utilization: it refers to the household food preparation and use in maintaining a balanced diet and intra-household distribution, along with individuals' ability to absorb and metabolize nutrients. Food security is not just only about the quantity of food consumed, but also quality and that your body must be healthy to enable the nutrients to be absorbed (WFP, 2007). It is not enough that someone is getting what appears to be an adequate quantity of food if that person is unable to make use of the food because he or she is often feeling sick. Mid-upper arm circumference (MUAC), Body mass index (BMI) and Disease prevalence are the main indicators of food utilization at an individual level. But one social anthropology aspect of utilization is the question of nutritional quality. This aspect underlines the importance of processes, including marketing, storage, cooking practices, feeding practices and food habit to the attainment of food security. Therefore, diet diversity can also act as a proxy indicator of nutritional quality in the social and cultural environment. To better reflect a quality diet, the number of different food groups consumed is calculated, rather than the number of different foods consumed (ACF International, 2011).

2.1.3 Conceptual framework of the study

Conceptually, from the revisions of the literatures, food availability can be a necessary but not sufficient for food accessibility, and food access is a necessary but not sufficient condition for food utilization. In a larger sense, two broad groups of factors determine food security/insecurity/. These are supply side factors and demand side factors. The supply-side factors are those that determine food supply or food availability. In other words, they are determinants of physical access to food at national, household and intra household levels. The demand side factors, on the other hand, are factors that determine the degree of access of countries, households, and individuals to available food. They are, in other words, determinants of economic access to food. Common to these two sets of factors however are factors that affect the stability of both physical and economic access to foods. But the analysis of stability of these factors implies macro-economic indicators while the formers can describe micro economic indicators of the economy of a nation or region.

2.2 Empirical Review

2.2.1 Food insecurity and dietary diversity in Ethiopia

Achieving food security in its totality continues to be a challenge not only for the developing nations but also in the developed world. The difference lies in the magnitude of the problem in terms of its severity and proportion of the population affected (Tsegay Gebrehiwot, 2009).

Ethiopia has experienced long periods of food insecurity. As a result, more than half of the population is poor and food insecure of which the largest group is rural people with insufficient assets to produce and purchase food (Adugna Lemi and Sisay Asefa, 2001). Similarly, the combination of man-made and natural factors results serious and growing food insecurity problem, which expose five to six million people with chronic and transitory food insecurity problem each year; and ten million people, are exposed to vulnerability with weak resilience (FAO, 2006).

Another survey made by UNICEF (2014) prevails that about 10% of Ethiopia's citizens are chronically food insecure and this figure rises to more than 15% during frequent drought years; 2.7 million people require emergency food assistance and 238,761 children require treatment of severe acute malnutrition in 2014. According to the report of the Global Food

Security Index, among 109 countries, Ethiopia ranks 86 with the total scores of 38.5 with the score changes of 2.2 (GFSI, 2015).

The other concept related to food insecurity is food consumption patterns. In Ethiopia food consumption of rural households is mainly described by consumption of staple foods and thus by poor dietary diversity. According to Ephrem Tegegne (2015), most of the products that households consume are cereals (99%), oil (92%) and root and tubers (75%). In contrast, only 11.3% of the households utilize meat products. The study found, among the total respondents, 48.0% of them are borderline consumers, 28.5% are acceptable consumers and the rest 23.5% laid on poor consumption level.

A similar study of diet quality analysis shows the dominant food groups consumed within rural households were cereals and cereal products (99.3%), legumes and legume products (98.7%), and spice or condiments account 90%, with a small number of households (10.7%) utilize dairy products during the recall period of the food consumption frequency (Adisie Tadesse, 2016). Unfortunately, this study resulted none of the respondents can reach at highly diversified food consumption level and only 32% were moderate consumption, with all the remaining households were under low diversified food consumption.

2.2.2 Determinants of household food insecurity

Factors determining household food insecurity in various developing countries have been documented in some literatures and these factors are more often than not location-specific; different study areas were found to have varying attributes as food security determinants with some habitual attributes (Robert *et al.*, 2013). Table 2.1 tried to summarize the empirical results of the various studies conducted in different parts of Ethiopia. All studies (except the one using ordered logit) used a binary logit/probit model taking food (in) security status as the dependent variable with dichotomous discrete choices (of food secure and food insecure) to identify the determinants of food security/insecurity/ of rural households.

Table 2.1: Summary of Food Insecurity Status and Its Determinants

No.	Author	Year	Study Area	Dependent Variable	Approach	Status (%)	Model Used	Significant Variables	
								Positively	Negatively
1	Alem Shumye	2007	Tehuludere	Food Insecurity	Calorie Intake	69.2	Binary Logit	Family Size, and Food Aid,	Participation on Off Farm and Non-Farm Activities, Annual Production, Land Size, TLU and Land Tenure
2	Fekadu Beyene and Mequanent Muche	2010	Ada Berga	Food Security	Caloric Acquisition	36.0	Binary Logit	Age of HH, Non-Farm Income, Cultivated Land Size, Use of Fertilizer, Livestock Ownership, Oxen Ownership and Soil and Water Conservation Practice	Head Education level, Family size
3	Girma Gezmu	2012	Addis Ababa	Food Insecurity	Caloric Intake	58.2	Binary Logit	Household Size and Head Age	Head Education, Credit Usage, Asset Possession, And Access to Employment
4	Teklay Negash and Solomon Alemu	2013	Adwa	Food Insecurity	Income, Expenditure	63.3	Binary logit	Age Dependency Ratio, Family Size, Crop Disease and Fertilizer Utilization	Access to Extension Service, Off Farm Income, Number of Oxen, Land Size and Participation in Safety Net Program
5	Misgana Asmelash	2014	Laelay Mychew	Food Security	Caloric Intake	31.2	Binary Logit	Land Holding Size, TLU, Annual Income, and Use	Family Size

6	Tewodros Tefera and Fekadu Tefera	2014	Mareko	Food Security	Caloric Intake	38.0	Binary Logit	of Chemical Fertilizer Head Age, Education Level of Head, Cultivated Size, Seed Use, TLU, DA Contact, Credit Received, and Off Farm Income,	Family Size, Absence of Adequate Rain & Occurrence of Pest
7	Mesfin Welderufael	2014	Amhara Region	Food Insecurity	Caloric Acquisition	48.0	Binary Logit	Family Size, Head Age, and Head Employment	Livestock Ownership and Farm Size
8	Tilksew Getahun and Fekadu Beyene	2014	Babile	Food Insecurity	Caloric Acquisition	56.67	Binary Logit	Pest Infestation	Education, Non-Farm Income, Irrigation Scheme, and Cultivated Land Size
9	Yisihake Ergicho, Fisseha Asmera and Solomon Tilahun	2015	Shashogo and East Badewacho	Food Insecurity	Caloric Intake	90.0	Binary Logit	Family Size, TLU, and Distance to Market	Land Size, Off Farm Income, Head Education Level, Saving, Intensity of Fertilizer, and Death of HH
10	Goitom Weldegerima, Abreham Kebdom and Nigussie Yohannes	2015	Wonago	Food Security	Caloric Acquisition	68.0	Binary Logit	Farm Size, Soil Fertility Status, Non-Farm Income and Use of Improved Seed	Slop of the Plot
11	J Baptiste H.	2015	Ruanda	Food Insecurity	VAM	23.0	Binary Probit	Household Size, Food Expenditure, Soil Erosion Index, and Copping Strategy Index	Farm Animal, Asset Index, Food Acquisition Level, Problem, Spending Level, Land suitability index,

12	Ahmed Mohammed	2015	Bule Hora	Food Security	CFSM	23.0	Ordered Logit	Head TLU, Sex, Land Use of Improved Seed, Soil Fertility Status and Non-Farm Income	Size, Status	and Membership to Agricultural Cooperative
13	Teklay Negash, Aynalem Shita and Nega Afera	2015	Afar	Food Insecurity	Income, Expenditure	63.3	Binary Logit	Sex and Family Size	Head Status, Education Access to Extension Service, and Safety Net Participation	
14	Adisie Tadesse	2016	Menz Gera	Food Insecurity	HDDS and Caloric Acquisition	68.0	Binary Probit And Tobit	Head education, Sex, Family Size, Irrigation Use, Off Farm Income, Distance From Market and Infestation of Pests	Head Size, Oxen Ownership and Livestock Ownership	

Source: Own review (2017/18)

Critical Evaluation: most of the studies have been analyzed with caloric intake (classical approach) that the data collection is too bulky, time taken and the estimation show only binary outcomes, food security and food insecure, which is limited to looking out the detail of the severity of household food insecurity. Moreover, the determinants of food insecurity/security/ are not the same in different areas. Therefore, this study investigated those determining factors affecting food insecurity in *Hulet Eju Enesie Woreda* for resulting the reliability of & improvement and/or dis-improvement of those factors, by the comparisons of the result of the study with the above listed out literatures.

2.2.3 Food insecurity coping strategies in Ethiopia

The victims of food shortage communities in rural Ethiopia have exercised a range of mechanisms, though not similar everywhere due to variation in the socioeconomic, socio-cultural, demographic and geophysical conditions of the area. The responses are always determined by the nature of the crisis: its speed, knowledge, intensity & duration and the resilient capacity (Alem Shumye, 2007).

A study by Frehiwot Fantaw (2007) mentioned out the mostly used coping mechanisms by farm households in Amhara region. These include livestock sales, agricultural employment and certain types of off-farm employment and migration to other areas, requesting grain loans, sale of wood or charcoal, small scale trading, selling cow dung and crop residues, reduction of food consumption, consumption of wild plants, relying on relief assistance, relying on remittance from relatives, selling of clothes and dismantling of parts of their houses for sale. These imply some of them are likely to be implemented only after the possibilities of certain other options have been pursued.

However, a study by Adane Tadesse (2008) generalized household's common mechanisms into six short term coping strategies; among them, he described consuming less preferred food was the most commonly used coping strategies. Following this, about 84.7% and 83.2% of the households used meal reduction and small animal sale as coping mechanisms, respectively. Moreover, he mentioned that 67.1%, 64.3% and 63.8% of the households employed sale of productive assets, borrowing grain from relatives or friends and livelihood adjustment (replanting of crops, replacing long cycle crops by short cycle crops) as coping strategies at the time of food shortage.

Correspondingly, Yenesew Sewnet (2015) listed out the major causes and coping strategies of food insecurity in rural Ethiopia. He described that the smallholders' agriculture suffers from natural disasters, shortage of farm land, population growth, lack of technological know-how, lack of appropriate policies and institutions, unfavorable external terms of trade, and lack of rural infrastructures (schools, roads, markets, and health etc.). Then after, he identified minimizing number and quantity of meals in a day, diversifying livelihood income sources, migration and wage labor are the most pursued coping strategies by rural households in Ethiopia.

2.2.4 Analytical framework of the study

As it is repeatedly mentioned, food security at the household level is conditioned by a household own production and members' ability to purchase food of the right quality, at the right time, at an appropriate place and at an acceptable price. It includes food availability, access and utilization. Therefore, the analytical framework of this study incorporates five groups of variables that can adversely affect household food availability, access and utilization, which in turn determine the household's food security/insecurity/ situation (Figure 2.1). These are demographic, socio cultural, natural, economic, and institutional factors (Meskerem Abi, 2011 and Yenesew Sewnet, 2015).

Demographic factors: these comprise the sex of household head, age of household head, education status of household head, family size and dependency ratio within the household.

Socio-cultural factors: encompass work habit, eating habit, food preferences and food rationing, cultural and religious ceremonies, health status, saving or expensive habit and social support.

Natural factors: include rainfall distribution, recurrent drought, soil erosion, soil fertility status, crop pest and disease and livestock disease.

Economic factors: consist of land size, livestock size, family labor, farm implements and farm and non-farm income generating activities.

Institutional factors: these include development of infrastructures including extension services, irrigation technology, credit services, farm input distributions, roads, schools and health services constrain agricultural production and production and productivity.

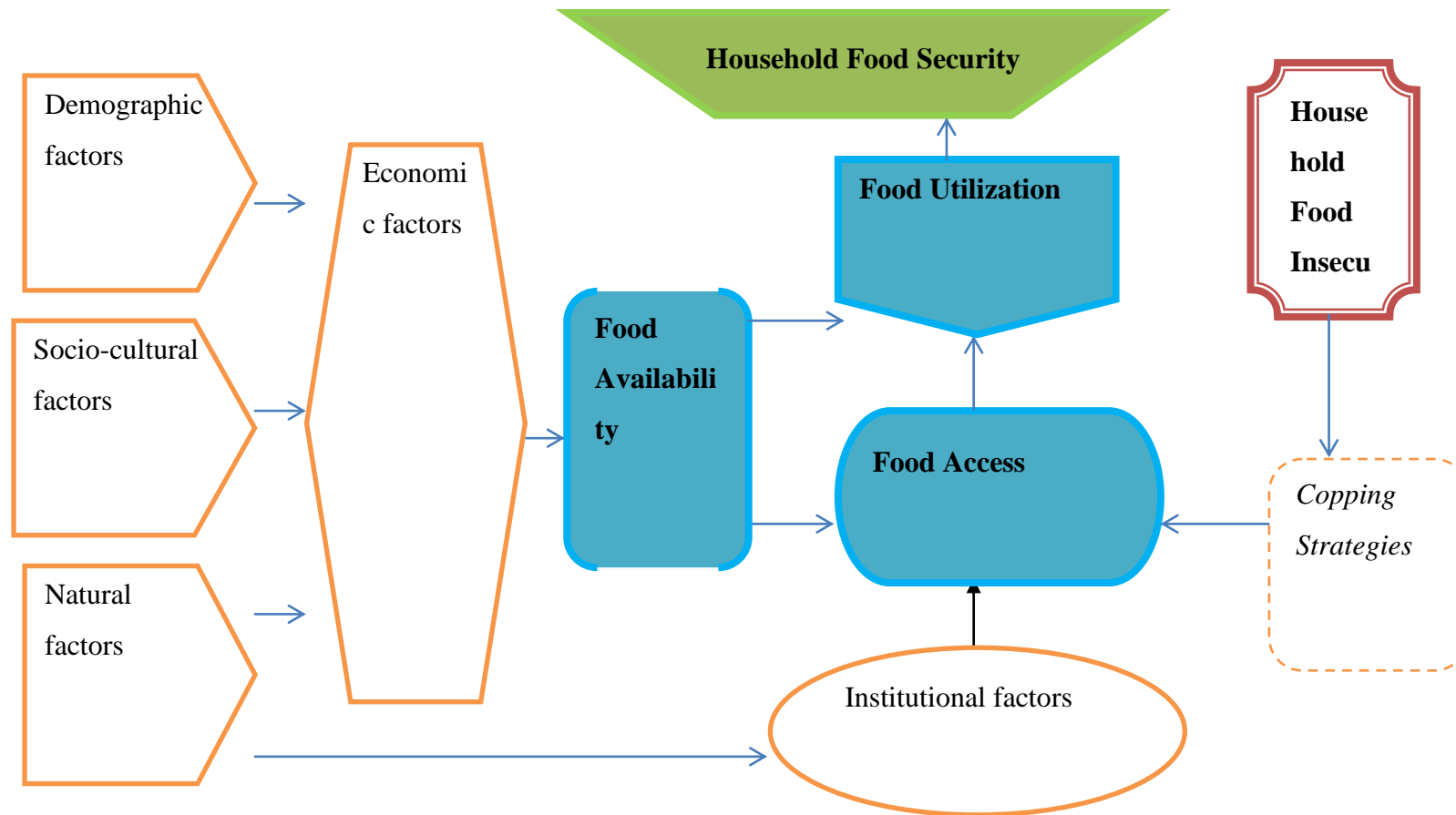


Figure 2.1: Analytical Framework of the Study

Source: Modified from Meskerem Abi (2011)

Chapter 3 RESEARCH METHODS

This section deals with the methodological approaches and the research design that's different phases and steps followed to conduct the research.

3.1 Description of the Study Area

Geographical Location: The study was conducted in *Hulet Eju Enesie Woreda*, East Gojjam Zone of Amhara National Regional State. It is bordered on the south, by *Debay Telatgen*; on the west, by *Bibugn*; on the northwest by West Gojjam Zone (*Gong Kolela*); on the north, by *Abay River* (which separates it from the *Debub Gondar Zone*); on the east by *Goncha Siso Enesie* and on the southeast by *Enarj Enawga*. The *woreda* town (*Motta*) is located 368 km Northeast direction from *Addis Ababa* and 120 km southeast direction from *Bahir Dar* (capital city of the region). The absolute location of *Hulet Eju Enesie Woreda* is $10^{\circ}45'0''$ - $11^{\circ}0'0''$ N latitude and $37^{\circ}34'30''$ - $38^{\circ}1'30''$ E longitude (see Figure 3.1).

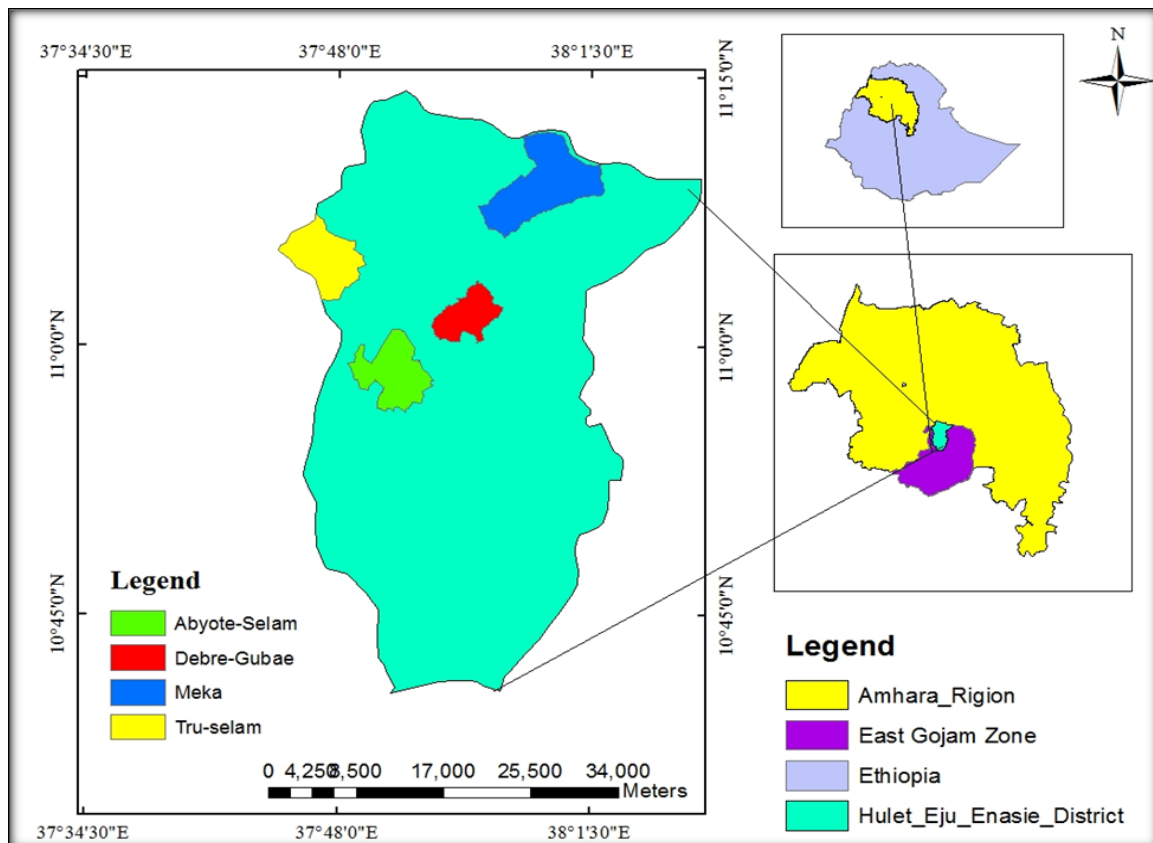


Figure 3.1: Map of the Study Area

Demographic profile: The *woreda* has a total population of 106,366 in 2007, of whom 53,014 are men and 53,352 are women, which shows an increase of 38.27% over the 1994 national census. *Hulet Eju Enesie* has a population density of 184.17, which is greater than the Zone average of 153.8 persons per square kilometer (CSA, 2007). A total of 24,794 households (21,087 male headed and 3,707 female headed households) are found in this *woreda* (WAO, unpublished).

Socioeconomic profile: Mixed production of crops and livestock are the cornerstone of the economy of this *woreda*. Agricultural activities are dependent on the *current* (summer) rains which fall from May to October. The main crops cultivated are *teff*, barley, maize, Sorghum, Bean, potato, millet, etc. The bulk of the produce is used for household consumption. The main constraints on crop production among the poor are land degradation, shortage of farm land and crop diseases. Livestock ownership is also important for building household capacity to cope with livelihood shocks. The major types of livestock's of the *woreda* include cattle, sheep, goat, horse, mule, donkey etc. Raising sheep and cattle is a key economic strategy. Sheep provide most of the regular income from livestock. Cattle are most valuable assets, and they are owned only by the middle and better-off households. Children are responsible for herding livestock. But, the search for work is the main livelihood strategy for poor households and so they depend on the availability of workers in the family for a significant portion of their income.

Agro Climatic and Ecological condition: *Hulet Eju Enesie woreda* has an elevation varying from 1200 to 3500 meters above sea level. Topographically the *woreda* has a relief feature: 65% of plateau, 15% of mountainous and 20 % of valley. There are four main seasons in the *woreda*, namely *Bega* (dry) from March to May, *Kiremt* (rains) from June to August (main rainy season), *Tibi* from September to November, and *Meher* from December to February (harvest season). *Hulet Eju Enesie woreda* is divided into two agro-ecological zones, namely *Woina Dega* and *Kola*, which accounts 52%, and 48% respectively. The rainfall distribution in the *woreda* varies from year to year and across seasons. Accordingly the annual rainfall distribution varies between 1150mm- 1189mm which is bimodal in nature, receiving the greatest rainfall in summer and the smallest portion in spring (NMA, 2012).

3.2 Sampling Techniques and Procedures

This study used a statistical representation of the *woreda* households. In doing so the size of the sample was determined by (Yamane, 1967).

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

Where: n = sample size

N = total number of rural households in the *woreda* and

e = margin of error = 7% level.

Accordingly,
$$n = \frac{24794}{1 + 24794(0.07)^2} = 202$$

Then, the study followed two-stage sampling procedures to draw representative samples of rural households in the study *woreda*. In the first stage, the total *kebeles* available in the *woreda* were grouped into two strata on the basis of agro-ecological condition as a stratification factor; *weyina daga* and *kola*. A total of twenty five *kebeles* (comprising 24,794 households), thirteen *woina dega*, and twelve *kola kebeles* are found in the *woreda*. In the second stage, a two-step approach was followed; first to select two *kebeles* randomly from each stratum and then to draw the sample respondents from each selected *kebeles*. Accordingly, *Abyote Selam* (1252) & *Debre Gubae* (967) were selected from *Woina Dega*, and *Meka* (971) & *Tiru Selam* (806) were selected from *kola* as representatives of the total *kebeles* in the respective agro-ecologies. Finally, a total sample of 202 rural households was chosen from these four *kebeles* following a sampling procedure of probability proportional to sample size (see Figure 3.2).

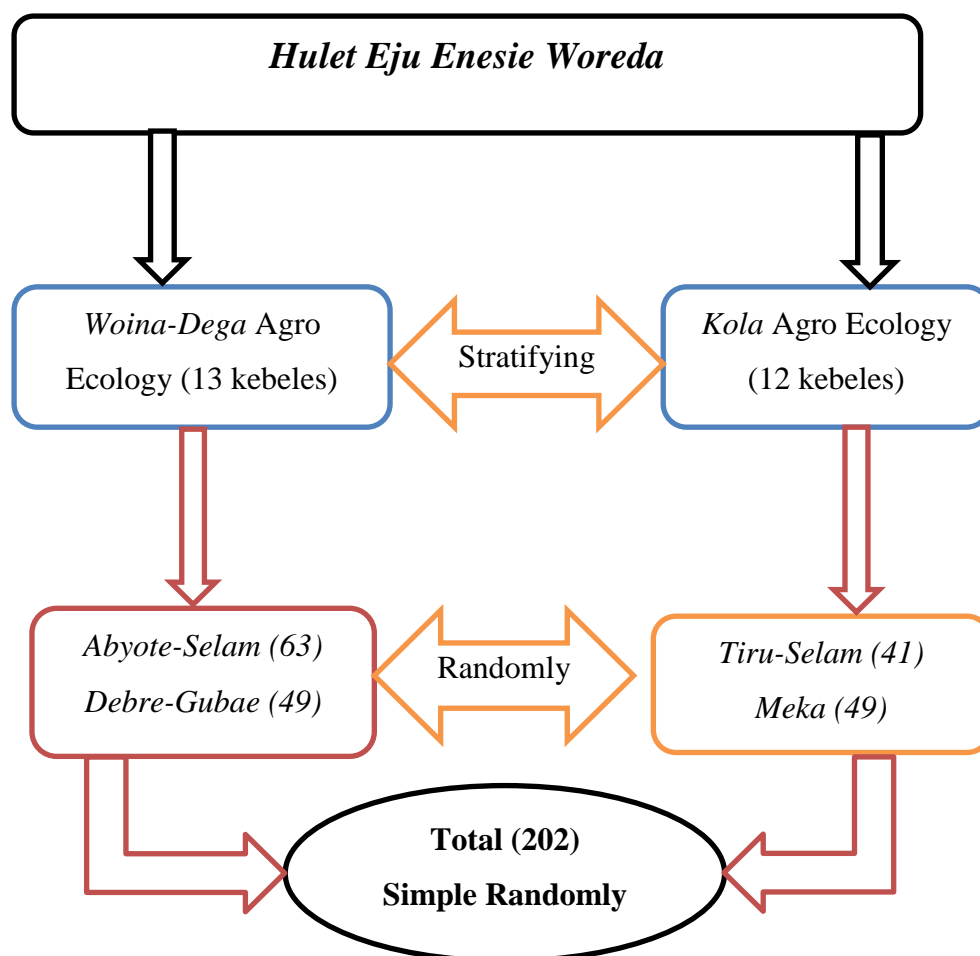


Figure 3.2: Sampling Procedures

3.3 Types, Sources and Methods of Data Collection

In the data collection process both quantitative and qualitative data were collected. To generate the quantitative data interview schedule were used at household level. A seven day recalls period was used to collect data on food consumption frequency and the respective coping strategies through structured questionnaires developed based on the various modules of WFP. The questionnaire included the necessary elements of questions that can comprise all the food items commonly produced and/or consumed in the rural areas of the *woreda* to collect data on the total food consumption frequency of the food items by each household as an indicator for dietary diversity.

Also, the questionnaire incorporated demographic and socioeconomic characteristics of rural households (see Appendix 1). Moreover, the questionnaire manipulated household food insecurity access scale (HFIAS) to analyse levels of Rural Household Food Insecurity

(RHFI). These data can help to identify important variables that affect RHFI. Thus, primary data were obtained from sample households via the interview survey method (Figure 3.3). In addition, secondary data were collected from published and unpublished documents, worldwide wave (WWW) sources, CSA websites, and *woreda* agriculture office reports to support the effective implementation of the study. Together with the quantitative data collection, checklists were developed for collecting the qualitative data (see Appendix 2). In line with this, two focus group discussions (FGDs); one at *woina dega* agro ecology (comprising of twelve households) and one at kola (comprising of nine households) agro ecology, were conducted to obtain the qualitative data for supporting the quantitative ones.



Figure 3.3: Methods of Data Collection

3.4 Methods of Data Analysis

The raw quantitative data collected from the rural household survey were edited, coded, entered, cleaned, and analysed using both SPSS versions 23 and STATA-14 statistical software. The study used both statistical and econometric analytical techniques. Descriptive statistics such as frequency, percentage, minimum, maximum, mean, standard deviation, tables, graphs, and pie-charts were used to summarize and present the data in a manageable form, and to describe the socioeconomic and biophysical characteristics of sample households in the study *woreda*. Inferential statistics were also used to interpret the descriptive data and make inference about population characteristics. Specifically, χ^2 -test were used to show the association between the categorical variables to dietary groups. Similarly, one way ANOVA (F-test) were applied for showing the significance of the mean difference of the continuous variables between the outcomes. All together with the

quantitative data analysis, conceptual explanations of the qualitative responses and feelings of the households were also added to the explanation of quantitative figures.

1) Household food insecurity analysis

Food consumption score (FCS): dietary diversity indicator

The analysis of dietary diversity and frequency provides important information on household consumption. Households food consumption level was analysed based on food consumption score (FCS) or the index of a household which was obtained by summing up the weighted score of frequency of each food groups within seven days before the survey (WFP, 2008). Weights were assigned based on the relative nutritional importance of different food groups that the household consumed (WFP, 2009); (Table 3.1). Dietary diversity specifies the food groups (such as main staples, pulses, vegetables, fruits, meat, milk, sugar, oil, and condiments) a household consumes and food frequency (the number of days in which a particular food group is consumed over the seven days).

Table 3.1: Household food consumption score (FCS)

No	Food items	Food groups	Weight
1	Cereals and Tubers (teff, maize, wheat, barley, rice, oats, millet, any other grains, potato, sweet potato, marrow, etc.)	Main staples	2
2	Pulses and Legumes (peas, beans, chickpea, vetch, lentils, other pulses)	Pulses	3
3	Vegetables (tomato, onion, carrot, cabbage, lettuce and other vegetables)	Vegetables	1
4	Fruits (orange, banana, avocado, papaya, mango, other fruits)	Fruits	1
5	Meat and fish	Meat	4
6	Milk and dairy products	Milk	4
7	Sugar and honey	Sugar	0.5
8	Oils and fats	Oil	0.5
9	Spices, tea, coffee, salt, milk for tea	Condiments	0

Source: WFP (2008)

Then diet diversity status of households can be measured by grouping FCS of the household obtained by multiplying the frequency of consumption of each food groups with the respective weight given to each food group. The FCS ranges between 0 and 112, where a higher FCS indicates better food consumption in terms of dietary intake and dietary diversity; a lower FCS indicates deteriorating household food consumption. Accordingly, the respondents were classified into three groups of household diet diversity status (HDDS)

as Poor ($FCS \leq 28$), Borderline or Moderate ($28 < FCS \leq 42$) and Acceptable ($FCS > 42$) consumption levels (Ibid). This study adopted the recommendation of WFP food consumption module using a standard seven-day recall period, which ensures both good time coverage and reliability of the respondent's memory (FANTA, 2005). But, FCS does not consider foods consumed outside the home. It provides no indication of the quantities of each food stuff consumed or intra-household consumption. Therefore, FCS alone cannot reflect the current food insecurity situation. It must be considered together with other indicators (Ibid).

Household Food Insecurity Access Scale

HFIAS was applied to measure the level of RHHFI in this study. HFIAS is an adoption of the approach of USAID's Food and Nutrition Technical Assistance (FANTA) used to estimate the prevalence of food insecurity. In contrary to FCS, it measures the aspect of utilization, that do not directly capture nutritional quality, rather it attempts the household's perception of changes in the quality of their diet regardless of the diet's objective nutritional composition (Coates *et al.*, 2007). In addition HFIAS inquire both the respondents' perceptions of food vulnerability or stress and behavioral responses to food insecurity (Ibid). Therefore, the respondents were asked nine close ended frequency of occurrence questions of which the severity of the condition is increased in the follow up questions (see Appendix 1, IX). Hence, the households were assigned into four levels as food secure, mildly food insecure, food insecure with moderate hunger, and food insecure with severe hunger in increasing order of severity based on whether the household responded affirmatively to each access related condition (Table 3.2).

Table 3.2: Household Food Insecurity Access Scale (HFIAS) measurement

Questions	Frequency		
	Rarely	Sometimes	Often
1a			
2a			
3a			
4a			
5a			
6a			
7a			
8a			
9a			

Note: Green color- denotes Food Secure, Blue color- Mildly Food Insecure, Yellow color- Moderately Food Insecure, and Red color represents Severely Food Insecure level

Source: Coates *et al.* (2007)

As table 3.2 shows;

Food secure household: experiences none of the food insecurity (access) conditions or just experiences worry, but rarely.

Mildly food insecure (access) household: worries about not having enough food sometimes or often, and/or is unable to eat preferred foods, and/or eats a more monotonous diet than desired and/or some foods considered undesirable, but only rarely. But it does not cut back on quantity nor experience any of three most severe conditions.

Moderately food insecure household: sacrifices quality more frequently, by eating a monotonous diet or undesirable foods sometimes or often, and/or has started to cut back on quantity by reducing the size of meals or number of meals, rarely or sometimes. But it does not experience any of the three most severe conditions.

A severely food insecure household: forced to cut back on meal size or number of meals often, and/or experiences any of the three most severe conditions (running out of food, going to bed hungry, or going a whole day and night without eating), even as infrequently as rare in the last four weeks (30 days).

2) Determinants of household food insecurity: Ordered probit regression model

An econometric model was used to reveal the effect of different variables on the level of RHFI. According to Park (2010), the nature of the dependent variable determines the type of econometric model used. For this study, ordered probit/logit model should be used to express and estimate the relationships between explanatory variables and the ordered outcome variable. Though ordered probit and logit model can be used interchangeably, these models have minor differences. Their difference lies in the distribution of error terms. In the logit model, errors are assumed to follow the standard logistic distribution; whereas, the probit model assumed to follow the standard normal distribution; i.e. in the probit model, ‘ F ’ is the standard normal cumulative distribution function (CDF), which is expressed as an integral:

$$F(z) = \Phi(z) \equiv \int_{-\infty}^z \phi(v)dv,$$

Whereby $\Phi(z)$ represents cumulative distribution function and

$F(z)$ - is a strictly monotonic function between zero and one.

It increases most quickly at $z = 0$, $F(z) \rightarrow 0$ as $z \rightarrow -\infty$ and $F(z) \rightarrow 1$ as $z \rightarrow \infty$. Probit model can also be derived from underlying the latent variable model. Let y^* be an unobserved or latent variable and suppose that

$$y^* = \hat{\beta}_0 + \hat{\beta} X + \varepsilon, y=j \text{ and } \mu_{j-1} < y^* \leq \mu_j, j = 1, 2, \dots, J$$

, is an indicator function; where $\mu_0, \mu_1 \dots \mu_J$ are introduced as threshold parameters, discretizing the real line, represented by y^* , in J categories (William, 2012). Formally, let the ordered categorical outcome y is coded without loss of generality in a rank preserving manner, i.e. $y \in \{1, 2 \dots J\}$ where J denotes the total number of distinct categories, then,

$$y^* = \hat{\beta}_0 + \hat{\beta}_1 x_1 + \dots + \hat{\beta}_k x_k + \varepsilon$$

$$y = 0 \text{ if } y^* \leq 0$$

$$y = 1 \text{ if } 0 < y^* \leq \hat{\mu}_1$$

$$y = 2 \text{ if } \hat{\mu}_1 < y^* \leq \hat{\mu}_2$$

.....

$$y = J \text{ if } \hat{\mu}_{J-1} < y^* \leq \hat{\mu}_J$$

Where y^* is the latent variable, y is the outcome variable, β_k are the predicted coefficients of each variable, X_k s are the explanatory variables, ε is random term and J s are the number of ordered categories. Accordingly, the study used Household Head Sex, Household Head Age, Head Education Status, Household Size, Dependency Ratio, Household Land Size, Livestock Ownership, Annual Income, Extension Contact, Credit Utilization, Nearest Market Distance, and Occurrence of Pests were used as $X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9, X_{10}, X_{11}$, and X_{12} respectively.

3) Household coping strategies

Efforts to measure food insecurity (access) have sometimes relied in part on an index of coping strategies. Resource augmentation coping strategies are important to consider in gaining a more detailed picture of the experience of food insecurity (access) in any particular context. Coping strategies usually measured at household level since households are the social unit through which most individual's access food (FAO, 2008). Reduced Coping Strategy Index reveals the severity of the strategies that households used to manage shortfalls in food consumption. It always measures the same behaviors, has greater applicability, and assists in the geographic targeting of resources (Ibid).

The reduced CSI uses a seven-day recall period because it is easier for respondents to remember than a thirty-day recall period. The reduced CSI examines the five most common behavioral changes in response to food shortages (Table 3.3). As seen in the table, the index requires filling in the frequency of the measured behaviors and then multiplying them by their respective severity weights. The sum of the totals for each strategy yields the reduced CSI of the household composite score. The higher the score means that the household (or aggregate of households) is employing coping strategies more frequently and/or that it is using more severe coping strategies than a household (or aggregate of households) with lower CSI scores (WFP, 2008).

Table 3.3: Reduced Copping Strategy Index analysis

No.	Strategies	Severity weight
1	Rely on less preferred and less expensive foods	1
2	Limit portion size of meals	1
3	Reduce number of meals eaten in a day	1
4	Borrowing money or grains from neighbors/relatives	2
5	Restrict consumption by adults for children	3

Source: CFSVA Guidelines (2009)

The advantage of the reduced CSI is that it measures the same set of behaviors and uses the same universal weights across countries and regions (WFP, 2009). This normalizes behaviours and severity scores, facilitating the comparison of food insecurity across populations. Additionally the reduced CSI correlates with the above mentioned food insecurity measurement tools.

Therefore, in this study the respondents were requested to remind the number of days taken within a week for each strategy prior to the survey time. Multiple responses of internationally accepted coping mechanisms were allowed in the survey. This is due to the fact that the proportion of households that have adopted one or more coping strategies in the study area indicates the prevalence of food insecurity (Ibid). Accordingly, the most important information collected relates to how often a household uses strategies to cope up difficulties in obtaining food.

3.5 Working Hypothesis and Definitions of Variables

In order to explain the determinants of food insecurity, discrete and continuous variables were identified based on economic theories and reviewing of previous studies. Accordingly the following variables were suggested to probe the research question of this thesis.

Dependent Variable: as mentioned before the dependent variable in this study is the level of rural household food insecurity taken as an ordered outcome variable as food secure, mildly food insecure, moderately food insecure, and severely food insecure.

Explanatory Variables: the dependent variable was expected to be predicted by the following explanatory variables;

- i. **Household Head Sex:** It is a dummy variable. It is labelled as 0 for female headed and 1 for male headed household. According to Fekadu Beyene and Mequanent Muche (2010) male headed households are assumed in a better position to manage the farming system within the society. *Citrus paribus*, female-headed households were more food insecure than male-headed households (Mesfin Wolderufael, 2014). With these regards, male headedness was hypothesized to have a negative effect on food insecurity in this study.
- ii. **Household Head Age:** It is a continuous variable and measured by year. It is a proxy measure of farming experience. Older people have relatively richer experiences of the social and physical environments as well as greater experience of farming activities. Moreover, age of household has a negative and significant effect on food insecurity (Fekadu Beyene and Mequanent Muche 2010; Girma Gizmo 2012 and Mesfin Wolderufael 2014). Therefore, in this study age of household head was hypothesised to influence food insecurity negatively.
- iii. **Head Education status:** It is a dummy variable taking a value of 0 if the household head is illiterate and 1 if literate. Studies conducted by Tilksew Getahun & Fekadu Beyene (2014), Yishak Ergicho *et al.* (2015), Teklay Negash *et al.* (2015) and Adisie Tadesse (2016) indicated that education has a negative and significant effect on food insecurity. Being illiterate was assumed to decrease farmers using information relevant to farm productivity, thereby aggravate food insecurity. In contrary, households led by literate heads are more likely to understand modern farming technologies provided through extension workers and

any media like radio, phones, etc. Therefore, educational status was assumed to have a negative influence on household food insecurity status.

- iv. **Household Size:** refers to the total number of the members living in a household and share the same pot at least four days in a week. It is a continuous variable and measured in number. Studies conducted by Alem Shumye (2007), Girma Gezmu (2012) and J. Baptiste (2015) shows that this variable has a positive and significant effect on food insecurity. Households, who depend on limited productive resources, need more food to fulfil their food requirement; as a result, they suffer from food insecurity due to the increase of household size. So, the study also hypothesized that food insecurity and household size are positively related.
- v. **Dependency ratio:** it is the ratio between percent of the younger age group (0-14 years) and older age group (greater than 65 years) to the labor force in a single household. The larger the economically inactive household members the more implication on food consumption than on labor supply to boost production. The expectation is that the household with large number of economically dependent family members will face food insecurity because of the high dependency burden. Thus, it was hypothesized that the family with a relatively large number of dependent family members (high dependency ratio) positively affects household food insecurity status (Degye Goshu *et al.*, 2012 and Teklay Negash & Solomon Alemu, 2013).
- vi. **Household land size:** refers to the total size of a household land holding. It is a continuous variable and measured in hectares. Food production in rural household can be increased mainly through ownership and expansion of land under cultivation. Alem Shumye (2007); Yishak Ergicho *et al.* (2015) and Ahmed Mohammed (2015) found that farm size has a significant effect in augmenting food security; the smaller the farm size, the higher being food insecure. Likewise, in this study, it was hypothesized that larger landholding was expected to influence household food insecurity negatively.
- vii. **Livestock holdings:** refers to livestock owned by a rural household and measured by the number of Tropical Livestock Unit (TLU) (Storck *et al.*, 1991); (Appendix 3). The wealth status of the household was measured by the number of livestock owned, since livestock is the most important indicator of wealth in rural Ethiopia. Besides, household's livestock affects its ability to withstand abrupt changes in production, prices, income or unforeseen events that create the need for additional

expenditures (Alem Shumye, 2007; Misgana Asmelash, 2014; Tewodros Tefera & Fekadu Tefera, 2014 and Mesfin Wolderufael, 2014). They found TLU has negative and significant relationship with food insecurity. In these regards, this study was rational to expect a negative relation between livestock holding and food insecurity.

- viii. **Annual income:** these refer to the current cash asset that the head leads the life of the household members. It is a continuous variable measured by ETB. Most farmers commonly generate their income from their farm. However, they occasionally look for external sources of off-farm incomes and none farm activities. Household income determines the household's access to food (Yilma Muluken, 2005; Misgana Asmelash, 2014; and Goitom Woldegerima *et al.*, 2015). Therefore, it is expected that the household annual income and food insecurity are negatively related.
- ix. **Extension contact:** It is a count variable and measured by the number of contacts the farm household with development agents per year. Extension contact is expected to reinforce technology adoption. Those households who frequent contact with extension workers are likely to have up-to-date information on production technologies that would help them to increase their production and productivity and thus food insecurity can be alleviated (Tewodros Tefera & Fekadu Tefera, 2014; and Teklay Negash *et al.*, 2015). Therefore, in this study, this variable was assumed to affect food insecurity negatively.
- x. **Credit Access:** It is defined as a dummy variable 1 if the household uses credit and 0 if not. Rural credit has emerged as an alternative source of cash for households with financial constraints. It is an important source of investment in activities that generate income for farm households. Therefore, credit utilization can act as a weapon to improve livelihood assets. Moreover, studies by Girma Gezmu (2012), Degye *et al.* (2012) and Tewodros Tefera & Fekadu Tefera (2014) showed a negative and significant effect of credit access on food insecurity. Hence, this study hypothesized credit utilization and household food insecurity are negatively related.
- xi. **Access to market service:** It is a continuous variable measured by minutes taken to reach at the market. Nearness to market centers creates access to additional income by providing non-farm employment opportunities, easy access to inputs and transportation facilities. A study done by Degye *et al.* (2012), Yishak Ergicho *et al.* (2015), and Adisie Tadesse (2016) revealed a negative and significant effect on

food insecurity. Therefore, it was hypothesized that households who have good accessibility to market centers have a better chance to improve farm household food security status than who do not have proximity to market centers.

- xii. **Occurrence of pests:** It is a dummy variable that takes a value of 1 if the household crop is infested by insect and pest, and 0 if not. According to Teklay Negash & Solomon Alemu (2013), Tilksew Getahun & Fikadu Beyene (2014), and Adisie Tadesse (2016), pest infestation is a bad bio physical factor that restrains crop production and causes of food deficit. These studies revealed that this variable has contributed positively and significantly to food insecurity. Hence positive association was hypothesized between household food insecurity and pest invasion.

Table 3.4: Variables notation, measurement, and effect on rural household food insecurity

Variable	Notation	Type	Code/Measurement	Effect on RHHFI
Household Head sex	SEXHH	Dummy	0 for female headed and 1 for male headed	-
Household Head age	AGEHH	Continuous	Years	-
Head education status	EDuStaHH	Dummy	0 for illiterate and 1 for literate	-
Household size	HHFSz	Continuous	Number	+
Dependency ratio	DepRatio	Continuous	Number	+
Household land size	LandSz	Continuous	Hectare	-
Livestock ownership	LvskHold	Continuous	TLU	-
Annual income	HHINCM	Continuous	ETB	-
Extension contact	ExtnCont	Continuous	Number of times/year	-
Credit utilization	CrdtUtln	Dummy	0 for non-utilizer and 1 for credit utilizer	-
Nearest market distance	MktDst	Continuous	Time taken in minutes	+
Occurrence of pests	OccurPest	Dummy	0 for non-affected and 1 for affected	+

Chapter 4 RESULTS AND DISCUSSION

In this section the results of the study are presented and discussed pertaining to previously determined specific objectives. It briefly presents the diet diversity status, the relationship between the selected predictor variables with the outcome variables, the food insecurity status, and the result of the econometric model analysis. Finally, the chapter ends up by discussing food insecure household coping strategies.

4.1 Measuring Rural Households Diet Diversity Status

As table 4.1 shows, the three most food groups that households consume are staples (100%), oil (96.04%), and pulses (99%) in the *woreda*. Fruits, animal products, and vegetables are rarely consumed in the study area.

Table 4.1: Number of households across food groups and consumption frequency (n=202)

Food groups	Number of days eaten per week								Households consumed the food group (%)
	0	1	2	3	4	5	6	7	
Staples	0	0	0	0	0	0	0	202	100
Pulses	2	0	13	21	30	32	35	69	99
Vegetables	144	42	16	0	0	0	0	0	28.71
Fruits	0	0	0	0	0	0	0	0	0
Meat	195	7	0	0	0	0	0	0	3.46
Dairy products	149	46	6	1	0	0	0	0	26.23
Sugar & honey	200	0	2	0	0	0	0	0	0.09
Oil and lipids	8	0	5	11	3	2	0	173	96.04

Source: Own survey (2017)

As described in the methodology section, FCS of the household was obtained and households were grouped into three ordinal categories of diet diversity status as poor ($FCS \leq 28$), borderline ($28 < FCS \leq 42$) and acceptable ($FCS > 42$) consumption levels.

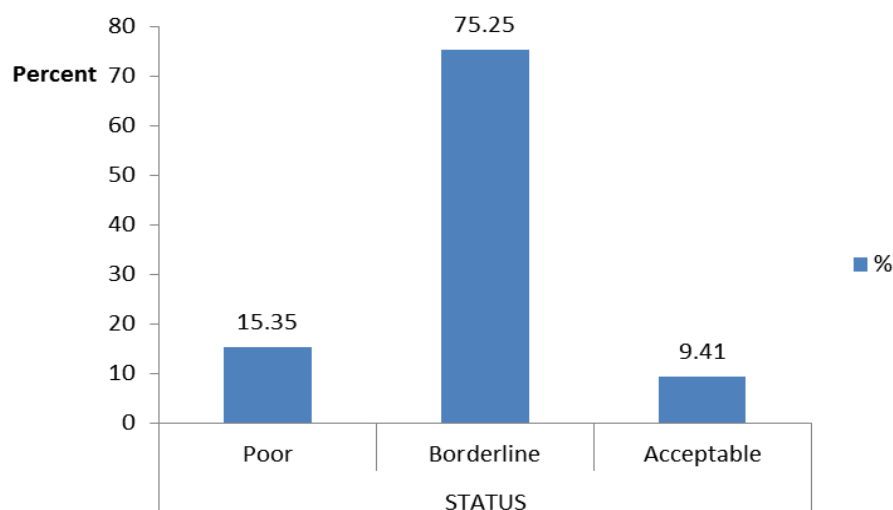


Figure 4.1: Diet Diversity Status of Rural households

Source: Own survey (2017)

Accordingly, the study identified 15.35, 75.25 and 9.41% of the households were poor, borderline and acceptable consumers in the study area, respectively (Figure 4.1). This figure also implies most of the households are borderline consumers followed by poor and acceptable consumers in the study *woreda*. The finding is similar to (Ephrem Tegegne, 2015) and contradicts with (Adisie Tadesse, 2016).

4.2 Household Characteristics across Dietary Diversity Categories

The socioeconomic characteristics of households were analysed across dietary diversity categories (such as poor, borderline, and acceptable level food consumption) (Table 4.2).

Table 4.2: Household characteristics across dietary diversity categories with respect to dummy variables

Household Dietary Diversity Status										
Variable	Category	Poor		Borderline		Acceptable		Total		X ² value
		n	%	N	%	n	%	N (202)	%	
SEXHH	Female	8	29.63	17	62.96	2	7.41	27	13.37	4.900*
	Male	23	13.14	135	77.14	17	9.71	175	86.63	
EDuStaHH	Illiterate	23	19.83	79	68.10	14	12.07	116	57.43	7.467**
	Literate	8	9.30	73	84.88	5	5.81	86	42.57	
CrdtUtln	Not Utilize	17	14.78	87	75.65	11	9.57	115	56.93	0.680
	Utilize	14	16.09	65	74.71	8	9.20	87	43.07	
OccurPest	Not Affected	18	14.06	103	80.47	7	5.47	128	63.37	7.400**
	Affected	13	17.57	49	66.22	12	16.22	74	36.63	
AgroEcolgy	Woina-Dega	18	16.07	89	79.46	5	4.46	112	55.40	7.206**
	Kola	13	14.44	63	70.00	14	15.56	90	44.6	

Note: ** and * are significant at $p < 0.05$ and $p < 0.1$ probability level respectively.

Source: Own survey (2017)

Sex of household head: In the study area, the majority of the sample households were male headed 175 (86.63%) while the remaining 13.37% of the respondents were female headed households. The head of a household strongly influences the household livelihood strategies. The survey result indicated that 29.63% of female headed households were found at poor consumption level; whereas, the corresponding figure for male headed households was 13.14%. But female headed households comprise 7.41%, while male headed households comprise 9.71% of acceptable consumers. Much more common to observe a good deal of female headed households, in the developing countries like Ethiopia, may have lower resource ownership as compared to their male-headed counterparts. Therefore, the relative percentage figure of diet diversity status by the sex of the household head indicated that female headed households reveal a larger tendency to poorer consumption level than male headed households. Additionally, the chi square test indicated that the sex of the head and diet diversity status had statistically significant association at $p < 0.1$ significance level.

Head Educational Status: Among 202 sampled households only 86 (42.57%) was headed by literates. The educational level of literates in the study area was also very low. Out of them, 59.3% were only read and write (1-4), 39.53% completed primary school, and only 1.16% enjoyed secondary school. An educated farmer is able to use modern agricultural technologies, perform farming activities based on cropping calendar, and manage resources properly. All these factors boost production and improve availability and accessibility of enough food; and thus improve their consumption pattern. The Chi-square test also showed diet diversity status and educational status of household head had statistically significant association at $p < 0.05$ significance level.

Credit utilization: Farmers opt for credit to fulfil their financial requirement. Nearly half of the sampled households (43.07%) utilize these services to fulfil their financial requirement. There are also stabilized formal financial institutions that are functional in the provision of credit needs more than a decade in the study area. The major formal sources of credits in the area have been the Amhara Credit and Saving Share Company (ACSSC) (93.10%) and farmer's cooperatives (6.9%). These institutions focused on rendering credit services to farmers so that they used to purchase agricultural inputs and build their assets such as oxen and bee hives. The study revealed that the utilizers used this service for an average of four consecutive years. They used the loan for the purpose of animal production

and fattening (25.29%), to purchase agricultural inputs (43.68%), for asset building (1.15%), for renting land (2.3%) and for both animal and crop production (17.24%). Additionally, some households (10.34%) were used for immediate consumption within the household during food shortages. Therefore, credit utilization had been important role in poorer households. However, results of chi-square analysis showed no systematic association between utilization of credit and household diet diversity status of sample households.

Occurrence of pests: Crop pests and insects are limiting factors of households' agricultural production in the study area. The result of the survey implied that out of the total respondents 74 (36.63%) were affected by pest invasion. Pests and insects hamper agricultural yields, raise production costs, and limit the storability and marketability of crops. The sample respondents described that legumes (41.9%) and cereals (21.6%) produces are prominently affected by pests. The occurrences of pests are different in different agro ecology conditions. Pest infestations are relatively susceptible in *kola* than in *woina dega* area. Among 74 pests affected respondents 28 (37.84%) were found in *woina dega* agro ecology. Aphids rust and crickets were mostly occurred pests on field pea, wheat, and *teff* farmlands respectively. Further, the respondents mentioned that damping off was occurred on onion produces in this agro ecology.

On the other hand, out of the pest affected respondents, 46 (62.16%) were found in *kola* areas. Termite, crickets, and boll worm were the pests occurred on the major cereals and legume products. Additionally, stock borer and bacterial wilt were occurred on pepper produce in the *kola* area. In general, the study estimated the occurrence of pests result an average loss of 4,416.93 ETB per affected household. Therefore, these occurrences of pests in different types of crops result difference in diet diversity status between households. Similarly, the chi-square test shows there is a significant association between household diet diversity status and pest infestations at $P < 0.05$ probability level.

Table 4.3: Households characteristics across diet diversity categories with respect to continuous variables

	Household Dietary Diversity Status								F value
	Poor		Borderline		Acceptable		Total		
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	
AGEHH	46	9.77	43	10.61	48	13.55	44	10.85	2.058
HHFSz	6	1.76	5	1.75	5	1.96	5	1.76	0.448
DepRatio	0.63	0.42	0.71	0.53	0.50	0.50	0.68	0.51	1.458
LandSz	0.76	0.32	0.97	0.47	1.14	0.54	0.95	0.46	4.386**
LvskHold	3.68	2.19	4.87	2.16	6.34	2.26	4.83	2.26	8.984***
HHINCM	9961.16	6116.15	17482.81	7678.99	21696.08	8879.71	16724.79	8171.23	17.170***
ExtnCont	25	11.93	30	9.65	30	8.04	29	10.02	3.586**
MktDst	91.45	32.38	91.82	42.04	90.79	32.88	91.66	39.76	0.064

*Note: *** and ** are significant at $P < 0.01$ and $p < 0.05$ probability level respectively.*

Source: own survey (2017)

Age of household head: The survey revealed that the age of the respondents ranged from 24-70 years with the average age of 44 years. Out of 202 sampled respondents, 8.42% were younger than 30 years, and about 2.48% were older than 64 years. Age of the household head is also regarded as an important variable with an effect on the household diet diversity status. The mean age of poor consumers (46) was less than the mean age of acceptable consumers (48). Older households are usually better than younger households (especially newly formed households) in terms of resource endowment. However, the F test showed that the mean age difference between diet diversity statuses was not statistically significant.

Household size: The average household size of the sample households was 5 with a range of 2-10 members. The survey result revealed that 31.19% of the households have a household size of below average and 49.01% of the households have a household size of above average. Households with larger household size were more likely to be at risk of becoming a poor consumer. However, the F test indicated that there is no significant difference in mean of family size between the three categories of consumption levels.

Dependency ratio: The mean dependency ratio of sample households was 0.68 with a standard deviation of 0.51. This means, every 100 persons within the economically active population groups support not only themselves, but also supporting an average of 68 dependent household members with all basic necessities. The poor consumer households have a larger number of economically inactive household members (63%) as compared to the acceptable consumer sample households (50%). But, the F-test result revealed no significant mean difference between the three groups of diet diversity status.

Household land size: the study area is largely characterized by mixed farming systems in which their income sources is determined by both crop and livestock production. Hence, owning land is a very critical resource to rural households. Similarly, farmland possession means a lot of the rural livelihoods in the study area. Farmers who own farmland are richer, in relative terms, than those who do not. As indicated in the Table 4.3, the mean land size owned by the sample households was 0.95 hectares. Though, some households (6.44%) own land size of 2 or 2.25 hectares, the survey results show 28.22% of the respondents own less than or equal to 0.5 hectares. As no land redistribution was made after 1995, there is increasing trend of land fragmentation among household members as new grown- ups, which makes individuals' possession of land is very small. Therefore,

small land holding in the study area has discouraged many farm households to use crop rotation and fallowing. Small land holdings also influence the consumption behavior of households as they face shortage of land to grow more types of crops to ensure the availability of food grain at different periods of a year. The statistical analysis also showed that there is a significant difference in size of cultivated land between poor, borderline, and acceptable consumers at 5% significance level.

Livestock holding (in TLU): Livestock species that are generally kept to make-up the livestock resources in the *woreda* include cattle, sheep, goats, donkeys, and mules. Bees are also practiced widely in the *kola* area. The average numbers of livestock holding of the sample respondents were 4.83 in TLU. Livestock are an important source of income and draft power for crop cultivation. Even, they are most important insurance to increase access of quality foods (dairy products, meat, and egg) which have higher nutritional contents. Additionally, the F test presented a significant difference between poor, borderline, and acceptable groups in livestock holding in terms of TLU owned at 1% probability level.

Household annual income: based on the survey result the mean and median of the respondents' annual income were 16,724.79 ETB and 15,686.25 ETB respectively. The main sources of income for the study area are crop production and livestock rearing. They earned an average and standard deviation of 9,499.5 and 6,587.92 ETB respectively from crop production. Similarly, they earned an average and standard deviation of 4,415.75 and 3,497.85 ETB respectively from livestock production. Additionally, 68.81% of the households also involved in other non-farm income generating activities to diversify their income sources. They earned an average of 4,082.70 ETB with a standard deviation of 2,433.70 ETB. In the *woreda*, carpentry, tailor, sale of local drink, local responsibility, daily labor, renting land, and carting were identified as income generating activities besides farming. Therefore, income is one of the important variables affecting household diet diversity status. In addition the F test revealed there is a significant difference in income of the three consumption groups at $p < 0.01$.

Extension contact: In a country such as Ethiopia, where the majority of the farmers are illiterate, agricultural extension plays a significant role in assisting farmers to identify and analyse their production problems and make them aware about opportunities for improvement. Hence, the effectiveness of the various production inputs partly relies upon the availab

ility of sound agricultural extension services at community levels. To this end, *Hulet Eju Enesie Woreda* Agriculture Office (HEEWAO) is providing this service in the area. At least three development agents are assigned at each *kebeles* to give reliable and continuous technical support and advice on agricultural activities. Extension agents contact farmers, both on an individual and group basis. As indicated in table 4.3, the sample households responded that they were visited individually by development agents for an average 29 times per year and there is also a significant difference between the three categories with regard to contact to the development agents at $p < 0.05$ probability level.

Market distance: Access to food is mediated by market access and price fluctuations. In the study area the main market center for the sampled household were in *Motta* town. It takes an average of 91.66 minutes (approximately 9 km) for one-way. Therefore, nearly a quarter of the respondents' felt it was not easy to access. Food price volatility also undermines diet for the poor who, by definition, are net food purchasers. Farmers were asked whether they faced seasonal price fluctuation and 50.99 % stated that they faced the problem. Among them, 60.19 % of the respondents reported there was a great fluctuation of pulses and cereals price in the study area. But the statistical analysis revealed there is no significant mean difference on the poor, borderline, and acceptable consumers.

4.3 Agro Ecology and Diet Diversity

Among the total sampled households, 112 (55.40%) were found in *woina dega* and the remaining 44.60% were found in *kola* agro ecological zones. The agro-ecology potential includes multiple aspects such as the altitude, rainfall distribution, topography (slope), soil type, and soil quality. Therefore, it determines the type and level of crop production in the particular area. In the *woina dega* agro ecology, the major crops were *teff*, maize, wheat, barley, and vetch & field pea in successive orders.

On the other hand, in the *kola* agro ecological zone millet, maize, *teff*, sorghum, vetch and chick pea were the major crops produced in the area in successive order. Haricot been and red pepper were also the major cash crops in this Agroecology. The *kola* area is more suitable for crop diversification and crop rotation as compared to the *woina dega* area.

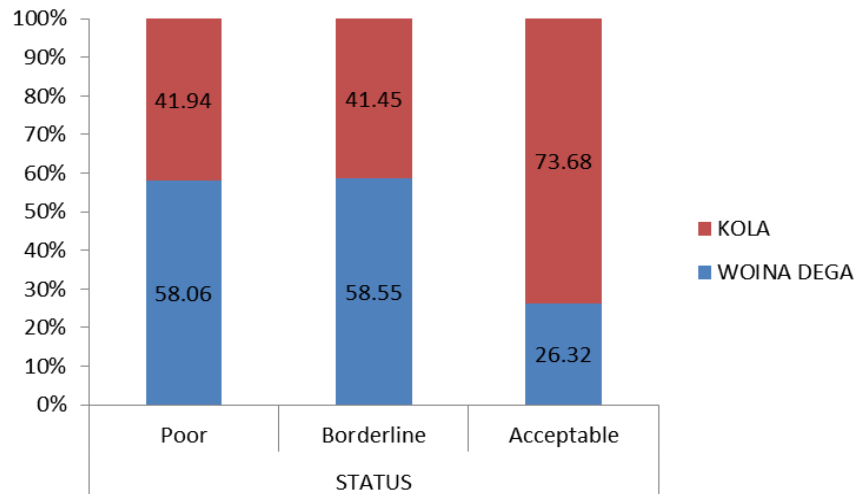


Figure 4.2: Diet Diversity Status versus Agro-Ecology

Source: Own survey (2017)

As Fig. 4.2 shows, the percentage share of poor households is greater than the acceptable in *woina dega*; whereas, the reverse is true for *kola* area. Therefore, *kola* peasants are more favored of diet diversity than the *woina dega* peasants. Similarly, the chi square test also shows there is a significant association between diet diversity status of rural households and agro ecological conditions at $p < 0.05$ probability level (Table 4.2)

4.4 Household Food Insecurity Measurements

Measuring HFIAS provides information on some indicators of food insecurity (access) at the household level. These can be calculated to help understand the characteristics of and changes in RHFI (access) in the surveyed population.

4.4.1 Household food insecurity access related conditions

Household Food Insecurity Access-related conditions are the first indicators which provide specific disaggregated information about behaviours and perceptions of sampled households. These indicators present the percent of households that responded affirmatively to each question, regardless of the frequency of the experience. Thus, they measure the percent of households experiencing the condition at any level of severity. This shows that the percent of households who responded ‘yes’ to a specific occurrence question (Table 4.4). Each indicator can also be further disaggregated to examine the frequency of experience of the condition across the households.

Table 4.4: Summary of household food insecurity access related conditions

No.	Conditions	Yes; n (%)			
			Rarely	Sometimes	Often
1	Worry about food	170(84.16)	24(11.88)	99(49.01)	47(23.27)
2	Not able to eat preferred food	109(53.96)	83(41.09)	25(12.38)	1(0.5)
3	Eat a limited variety of foods	146(72.28)	54(26.73)	14(6.93)	78(38.61)
4	Eat foods they really don't want	6(2.97)	4(1.98)	2(0.99)	0(0)
5	Eat a smaller meal than they felt	92(45.54)	38(18.81)	35(17.33)	19(9.41)
6	Eat fewer meal in a day	86(42.57)	50(24.75)	17(8.42)	19(9.41)
7	No food of any kind in the HH	2(0.99)	1(0.5)	1(0.5)	0(0)
8	Go to sleep hungry	14(6.93)	11(5.45)	3(1.49)	0(0)
9	Go whole day & night without eating	0(0)	0(0)	0(0)	0(0)

Source: own survey (2017)

The table also shows worry about food (84.16%), eat a limited variety of foods (72.28%) and not able to eat preferred food (53.96%) were the three most food insecurity conditions experienced by the households. Additionally, the households experience the three groups of domains as anxiety and uncertainty about household food supply (84.16%), insufficient quality (72.28%), and insufficient food intake (45.54%) in decreasing order of household food insecurity access related domains.

4.4.2 Household food insecurity access prevalence

The second indicator of food insecurity is measuring of HFIAS score. The HFIAS score of a household is obtained by summing up the codes for each frequency of occurrence question for the respective household. In this study the minimum and the maximum score were 0 and 20 with a mean and standard deviation of 5.69 and 4.67 respectively.

Household food insecurity access prevalence (HFIAP) is a categorical indicator of food insecurity level based on the HFIAS score. HFIAP indicator categorizes households into four food insecurity (access) levels. Accordingly, the analysis of this study resulted 27.72% (56) food secure and 26.73% (54), 36.14% (73) and 9.41% (19) of the *Hulet Eju Enesie Woreda* rural households were mildly, moderately and severely food insecure, respectively (Figure 4.3).

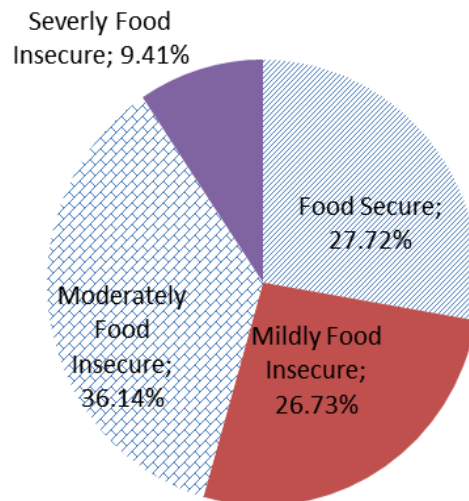


Figure 4.3: Rural Households Food Insecurity Level

Source: Own survey (2017)

Further, the HFIAS prevalence shows the relative percentage of each HFIA category households. Therefore, from a food insecure group of households 36.99%, 50% and 13.01% were mildly, moderately and severely food insecure respectively.

4.4.3 Agro ecology and food insecurity

The chi-square analysis showed no systematic association between agro-ecological zones and food insecurity level of rural households (Appendix 4). *Hulet Eju Enesie Woreda* farming system can be characterized as subsistence mixed farming. Land size and livestock ownership are the most important resources to increase food availability and access in the study area. The size and quality of the privately owned land matters a household crop production than other variables. Even though, there was some numerical mean difference of land holding size in between *woina dega* (0.964 hectare) and *kola* (0.937 hectare) agro ecologies the difference would not statistically significant (Appendix 9).

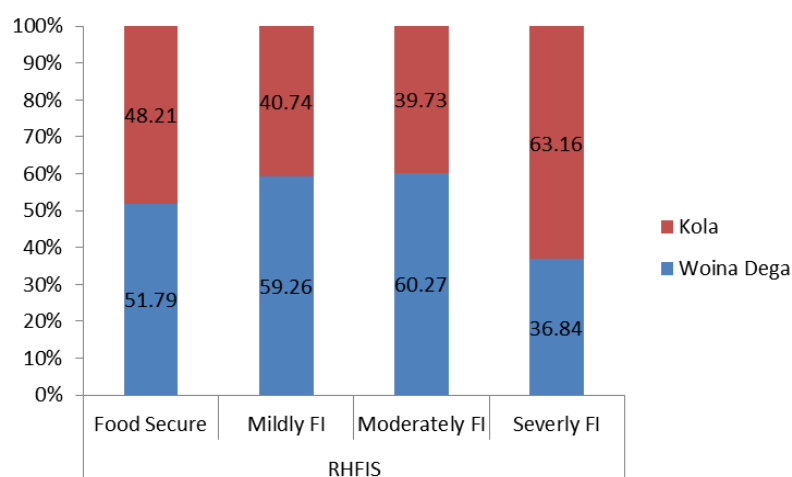


Figure 4.4: Food Insecurity versus Agro-Ecology

Source: Own survey (2017)

Moreover, food purchasing power of a household is largely determined by the presence of small ruminants within the household and ownership of livestock show significant difference between the two agro ecologies at $p < 0.05$ level (Ibid). Despite these facts, there was only a numerical difference in percentage share of food insecurity status between the two agro ecologies (Figure 4.4). The respondents described a number of natural and environmental threats are challenging farming activities not to produce enough food for their families from year to year. According to their view holding small and infertile farm land, vulnerability to pest and late onset and early offset rainfall distributions were among the challenges. Therefore, the food insecurity status in the study area was largely laid on the risk aversion behavior of the individual household than the residents' agro ecology.

4.5 Determinants of Rural Household Food Insecurity

The previous subsections dealt mainly with a description of the sample and a univariate test of the existence of an association between the diet diversity status and explanatory variables. Similarly, descriptions of the sample and a univariate test of the existence of an association between the food insecurity level and explanatory variables were undertaken (Appendix 4 and 5). However, identification of these factors alone is not enough unless the relative influence of each factor is known for priority based intervention. Therefore, as discussed in the methodology section, ordered probit regression model was used to show the relative influence of hypothesized explanatory variables on the level of rural household food insecurity.

Before going into the detail of the model analysis, the assumptions of multiple linear regressions was verified. The first test carried out was a test of normality. This test was used to assure the assumption that the error term is normally distributed. The test result confirmed that the residual term was being normally distributed (Appendix 6). Then, the potential explanatory variables were identified using various individual and stepwise econometric tests (Appendix 7 and 8). Finally, the validity of the model was checked through log likelihood ratio test to show its fitness. This is used to test whether all predictors regression coefficient in the model are simultaneously zero. The test result rejected the null hypothesis that all of the twelve regression coefficients are simultaneously equal to zero at less than one percent significance level. Therefore, the following table shows the result of the model on determinants of food insecurity in the study area. Six of the twelve hypothesized variables had significant influence on food insecurity on rural households at less than 10% significance level (see table 4.5). Moreover, the explanation of each significant explanatory variable is discussed below.

Table 4.5: Result of Ordered Probit Regression Model

<i>RHFI</i>	<i>Coef.</i>	<i>Z</i>	<i>mfx(0)</i>	<i>mfx(1)</i>	<i>mfx(2)</i>	<i>mfx(3)</i>
Male_HH	-0.559**	-2.09	0.118	0.102	-0.179	-0.041
AGE_HH	-0.008	-0.78	0.002	0.001	-0.003	0.000
Litrat_HH	-0.097	-0.47	0.025	0.013	-0.034	-0.005
HHSz	0.524***	7.97	-0.136	-0.071	0.182	0.025
Dep_Ratio	0.052	0.28	-0.013	-0.007	0.018	0.002
LandSz	-0.528**	-2.38	0.137	0.071	-0.183	-0.025
LvskHold	-0.086**	-2.07	0.022	0.012	-0.030	-0.004
LogHHINCM	-3.765***	-7.90	0.977	0.507	-1.307	-0.177
Extn_Cont	-0.001	-0.16	0.000	0.000	0.000	0.000
Crdt_Utlzr	0.281*	1.65	-0.072	-0.039	0.097	0.014
Mkt_Dst	0.003	1.24	-0.001	0.000	0.001	0.000
Pest Affected	0.117	0.67	-0.030	-0.016	0.041	0.006
Number of Obs		202				
Log likelihood		-188.3300				
LR chi ² (12)		147.93				
Prob > chi ²		0.0000				
Pseudo R ²		0.2820				

*Note: ***, ** and * are significant at $P < 0.01$, $p < 0.05$ and $p < 0.1$ probability level respectively.*

Source: own survey (2017)

Explanation of significant explanatory variables

Head Sex: The coefficient of this variable was found negatively related and significant at five percent significance level. The sign indicates male headed household and food insecurity are negatively related. In other words, female headed households were more food insecure than their counterpart male headed households. The result of marginal effect analysis also shows keeping other things constant, as the household is male headed it is more likely to be food secure and mildly food insecure by 11.8 and 10.2 percent, respectively, while being moderately food insecure and severely food insecure is less likely by 17.9 and 4.1 percent respectively. Poverty and low social status on female living in developing countries may have a result of low resource ownership in the study area like other parts of rural Ethiopia. Similarly, the social calamities and cultural taboos limit female headed households from involvement on main farming activities such as ploughing and are not in a better position to manage their farm land as well as to utilize their family labor properly. Consequently, they are obliged for sharecropping arrangement to their farm land; in turn decrease the owned yield substantially, which can be used for a safeguard of food security. This confirms the research hypothesis (Fekadu Beyene & Mequanent Muche, 2010, and Mesfin Wolderufael, 2014).

Household size: household size is one of the demographic factors which is highly significant ($p < 0.01$) to have considerable effect on the level of RHFI. The sign of the coefficient is showing its direct relation to food insecurity level. The result is consistent with the predicted hypothesis; Alem Shumye (2007) and Girma Gezmu (2012). It is believable because increasing household size to a smallholder and low productive resource holder farm households means increasing demand for food, or reduces access to different sources of food consumption frequency as well as items of different food groups and leads to more severe food insecurity. The result of this study also shows at *citrus paribus*, the increase of household size by one unit will decrease households to be food secure and mildly food insecure by 13.6 and 7.1 percent and will increase households to be moderate and severely food insecure by 18.2 and 2.5 percent respectively.

Household land size: Clearly, the result of this study indicated differences in land holding between rural households' results a significant effect on their food insecurity level at 5% probability level. The sign of the coefficient shows there is an inverse relation between household land size and food insecurity level. This can be explained by; subsistence rain-

fed agricultural production is a major employment and source of income in the study area. The existence of land plays an invaluable role as the backbone of the rural livelihood is based on it. Moreover, the size of the land concerns the availability of crop residues and private pasture land which in turn determines the number of livestock reared. The interpretation of the marginal effect implied holding other things constant, increasing the size of land by one hectare increases the household to be included under food secure and mildly food insecure groups of 13.7 and 7.1 percent, while the household was being less likely to be included under the moderate and severe groups of 18.3 and 2.5 percent respectively; the result is similar to Yishak Ergicho *et al.* (2015) and Ahmed Mohammed (2015), which show the confirmation of the proposed hypothesis.

Livestock Holding (in TLU): The result of the study indicates that livestock size is significant at $p < 0.05$ significance level. The coefficient indicates there is an inverse relation to the level of rural household food insecurity. The analysis of changing effects indicates an increase of household's livestock ownership (in TLU) by one unit results the household is more likely to be included under the first two ordered categories (food security and mildly food insecure) by 2.2 percent and by 1.2 percent respectively at *ceteris paribus*. At the same time the increase of livestock holding by one unit results the household is less likely to be moderate and severely food insecure categories by 3.0 and 0.4 percent respectively. Livestock are a major source of household income which could invest in purchasing of farm inputs that increase food production as well as increase purchasing power of food during food shortages. Literally speaking, all of the respondents reported ownership of livestock fulfills several purposes. They are used as livelihood assets and social security for the rural peasants. Additionally, livestock production is considered as a means of saving and means of coping mechanism during crop failure and other calamities. Therefore, this empirical study found the consistency of the hypothesis that livestock can serve as a vehicle for better livelihood and contributes significantly to rural development (Misgana Asmelash, 2014; and Mesfin Wolderufael, 2014).

Household income: as shown in the table above the negative and significant coefficient of logHHINCM implies its inverse relation to the level of food insecurity at $p < 0.01$ probability level. The marginal effects also show at *ceteris paribus*, a one unit increase in logHHINCM results the household is more likely to be food secure and mildly food insecure by 97.7 and 50.7 percent respectively. But an increase of LogHHINCM by one unit results the household is less likely categorized under moderately and severely food

insecure categories by 130.7 and 17.7 percent respectively. Similar to Yilma Muluken (2005), Misgana Asmelash (2014), and Goitom Woldegerima *et al.* (2015), it confirms the hypothesis of the study; income is the basis for implementing both agricultural and non agricultural activities. Therefore the difference in income made different living standard between households.

Credit utilization: the result of the model showed that credit utilization is significant at probability level of 1% and positively related to the level of rural household food insecurity. The marginal effects analysis implied that keeping all other factors the same, if the household is credit utilizer; the household is less likely to be food secure and mildly food insecure by 7.2 and 3.9 percent, while it is more likely to be moderate and severely insecure category by 9.7 and 1.4 percent respectively. Unfortunately, this result contradicts the proposed hypothesis. In light of this, the study identified most of the food insecure households use credit to fulfil their immediate cash deficit and for covering personal costs like college education and health problems rather than using to create some productive assets. This can be due to the incapability of the households to own and to use other collaborative resources for effective implementation of loan purpose. It is also the creation of a sense of dependency to borrow, to pay, and to borrow to repay the loan year to year and mismanagement of the loan that can describe the severity of household food insecurity.

4.6 Coping Strategies of Rural Households

People facing the problem of food shortage make strategic decisions about how to meet their needs. These decisions and actions are what are commonly called coping strategies. All households were not equally vulnerable to food shortage. Therefore, households pursue different coping strategies for these shortages. Hence, the study identified the set of strategies employed by households which varies depending on the severity of the food insecurity occurrence condition. The sample households were reminding a number of days taken within a week for each internationally accepted coping strategies and nearly all of them have reported that they have adopted at least one mechanism (Table 4.6).

Table 4.6: Copping strategies of Food Insecure Rural Households

Strategy	Yes: 146 (%)	No: 146 (%)
1. Rely on less preferred and less expensive foods	119(81.51)	27(18.49)
2. Limit portion size of meals	92(63.01)	54(36.99)
3. Reduce number of meals eaten in a day	86(58.9)	60(41.1)
4. Borrowing money or grains from neighbors or relatives	6(4.11)	140(95.89)
5. Restrict consumption by adults for children	14(9.59)	132(90.41)
6. Sale of live animals for purchasing grains	66(45.21)	80(54.79)
7. Renting out land for cash source	11(7.53)	135(92.47)
8. Selling of physical assets	9(6.16)	137(93.84)
9. Engaging in others farm for seasonal work	6(4.11)	140(95.89)
10. Sending household members to daily labor	5(3.42)	141(96.58)

Source: own survey (2017)

As the table indicated the most prevalent coping mechanism endured by the households during food shortage was eating less preferred and less expensive foods (81.51%). Following these decreasing the size of meal at a time (63.01%) and the number of meals per day (58.9%) are other strategies followed by food insecure rural households in the woreda. In the study area the daily favorite (acceptable) food is *teff enjera* from grains and pea and vetch from pulses. But in the occurrence of food shortage these foods were substituted by *enjera* prepared only from maize and marrow, potato and spinach serve as less expense and less preferred food at the *woina dega* and *enjera* only from millet, haricot been (raw form), *gibto* are less expensive and less preferred foods in the *kola* area of the *woreda*. Eating less preferred and less expensive foods in the *woreda* implied economic inferiority by saying a nickname “*Derek Bel*”. Generally, the above three strategies are related to changes in the consumption pattern of rural households. Another important coping mechanism taken for food insecurity was increasing of food or income accessibility through borrowing grains or cash from relatives/neighbours. This was practiced by 4.11% of food insecure households. Lastly, from the seven day recalls questions, the more severe food insecure households reduced the consumption of adults in order for children to eat. As described in the methodology section, this strategy is considered as the worst of all; it is used by 9.59 % of the households. After all the survey result, reduced CSI was calculated for each household and it ranges from 0 to 20 with a mean and standard deviation of 5.479 and 4.236 respectively. Besides, the correlation coefficient between reduced CSI and HFIAS was 0.94 showing that they are strongly and positively related to each other.

Additionally, the study identified different local strategies undertaken to escape rural food shortage in the *woreda*. The coping strategies mainly aimed at increasing alternative income sources, which include selling of livestock, renting out land and selling of physical assets. Livestock, besides their complementary relationship with crop production, provides hedging against risks of food insecurity. Live animals are sold as ways of getting access to cash income and to purchase food crops for the household. Accordingly, about 45.21% of the food insecure households were involved in selling animals (mostly small ruminants). Similarly, 7.53% and 6.16% of the food insecure households practiced rent out land and sell of physical assets (eucalyptus and hop) to increase their income. The other prevalent coping mechanisms mentioned were involved of household members in daily work and seasonal migration of the household head as labor. From the food insecure households 3.42% and 4.11% of them were engaged on these strategies respectively. They engaged daily labor in *Motta* town and seasonal labor at *Metema*, *Pawi*, *Minjar*, and *Wolega* surroundings.

Chapter 5 CONCLUSION AND RECOMMENDATIONS

This section has two subsections. The first subsection deals with the generalization of the study. The second subsection deals with future directions forwarded based on the conclusion.

5.1 Conclusion

This study concludes that food insecurity was analysed both in quality and quantity aspects in *Hulet Eju Enesie Woreda*. Hence, it generalized food insecurity is prevalent in this *woreda*. The study found 15.35%, 75.25%, and 9.41% of the rural households were poor, borderline and acceptable consumers respectively. Similarly, 27.72%, 26.73%, 36.14% and 9.41% of them were food secure, mildly, moderately and severely food insecure respectively. This implies that rural households cannot easily reach at acceptable consumption level and most of the households are found food insecure in the study area.

In the study area, both demand and supply side factors affect food shortage problem concurrently. The study identified a range of demographic, economic, institutional, and natural factors that determine food insecurity level of rural households. Among these, sex of the head and asset ownership are the major factors affecting both quality and quantity aspects of food insecurity simultaneously. The sex of household head strongly influences resource ownership, which literally affects livelihood strategies. Thus the social and cultural taboos on female headed households made limited in farm resources ownership and activities in the area. In the same way, the income sources are limited only on crop production and livestock rising in *Hulet Eju Enesie Woreda*. Besides, income inequality is existed between rural households. Furthermore, the study generalized household head education status, extensions contact, infestation of pests and agro ecological condition of the peasants were the major problems with food quality while household size and credit utilization were problems of food access and related conditions of food insecurity.

Finally, the study concluded that all households were not equally vulnerable to food shortage. Therefore, households pursue different coping strategies for these shortages. The coping strategies mainly aimed at increasing alternative income sources. Hence, the study generalized the most dominant strategies employed by households were changing diet, increasing short term food accessibility and rationing in decreasing order.

5.2 Recommendations

Based on the findings of the study the following issues are forwarded as a recommendation to reduce household food insecurity situation of *Hulet Eju Enesie Woreda*.

- ☞ Empowering females: most female headed households were poorer and more food insecure than male headed households. Therefore, development workers should strengthen their weight to empower female headed households in the area through improving their productive assets.
- ☞ Problems of insufficient farmlands should be optimized: The diminishing farm size has affected the sustainability of rural livelihoods. Due to land shortage and increased population pressure, horizontal expansion in the study area may not be feasible. Hence, the trust of household food security improvement rests on improving farm production and productivity. This will be well by improving the quality of the land through improved soil and nutrient management and promotion of labor intensive agricultural technologies.
- ☞ Strengthening the provision of veterinary services: Livestock was found as an important source of wealth that could contribute to food security in the study area. Therefore, emphasis should be given to feed resources improvement and management, control and prevention of animal diseases and the development of marketing facilities for animal and animal products.
- ☞ Improving income per capita of household members: Large family size accelerated consuming a low diversified diet and the level of food insecurity as well as increases frequency and severity of coping mechanisms. But this effect can be reduced by diversifying income sources. Income diversification can be emphasized by promoting both off-farm and non-farm employment opportunities, through which some members of the households could shift from direct reliance on land for their livelihoods. Also, diversifying farm activities, beside annual crop production where potential exists such as focusing on perennial crops, vegetables, and fruit through small scale irrigation should be encouraged.

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APPENDICE

Appendix 1: Questionnaire for formal household survey

Dear respondent! This questionnaire is prepared for an objective of analyzing a study entitled: “**ANALYZING FOOD INSECURITY AND COPPING STRATEGIES OF RURAL HOUSEHOLDS IN HULET EJU ENESIE WOREDA OF AMHARA REGION**”. Confidentially the study will be realized by your genuine response. So you are kindly requested to respond with the correct one.

I. AREA PROFILE

Region	Zone	Woreda	Kebele	Village	Agro ecology
Amhara	East Gojjam	Hulet Eju Enesie			
	Name	Date		Signature	
Enumerator					
Supervisor					

II. HOUSEHOLD PROFILE

1. Household code _____
2. Name of the household head _____
3. Sex of the household head 0. Female 1. Male
4. Age of household head _____
5. Marital status of the household head 0. Otherwise 1. Married
6. Education status of the household head 0. Illiterate 1. Literate
- 6.1. If literate, how much is age of schooling _____
7. Household members information; would you list names of household members starting from spouse (wife/husband), eldest to the smallest one.

Name	Sex 1. Male 2. Female	Age	Relation to head	Current status	Main occupation	Education level
	Code		Code 1	Code 2	Code 3	Years
1						
2						
3						
4						
5						
6						
7						
8						

9						
10						

Code 1: Relation to household head

- | | |
|-------------------|-------------------|
| 1. Household head | 4. Mother/father |
| 2. Spouse | 5. Other relative |
| 3. Daughter/son | 6. Employee |

Code 2: Current status of the member

- | | |
|--------------------------------|---|
| 1. Live in the household | 4. Studying/training/ outside the village |
| 2. Working within the country | 5. Other (specify) _____ |
| 3. Working outside the country | |

Code 3: Main occupation of the member

- | | |
|------------------------------------|--|
| 1. Farmer or family farm worker | 6. Weaver/tailor/blacksmith/potter |
| 2. Domestic work (incl. Housewife) | 7. Student |
| 3. Laborer (hired labor) | 8. Unable to work (not in the labor force) |
| 4. Government employee | |
| 5. Trader | |

III.CROP PRODUCTION AND UTILIZATION OF THE HOUSEHOLD

Code 1: Plot cultivation

- | | | |
|----------------|-------------------|---------------|
| 1. Annual crop | 2. Perennial crop | 3. Grazing |
| 4. Fallow | 5. Shared-out | 6. Rented-out |

1. **Land characteristics;** could you characterize your land on the following parameters please?

Plot No.	Plot cultivation	Plot area	Soil fertility 1. Low 2. Medium 3. High	Slope 1. Flat 2. Moderate 3. Steep	Soil erosion 1. Low 2. Medium 3. High	Access 1. Own 2. Shared in 3. Rented in
	Code 1	Hectare	Code	Code	Code	Code
1						
2						
3						

4						
5						
6						
7						
8						
9						
10						
11						
12						

** Note that Meher season refers to June 1 to January 30 and Irrigation season refers to February 1 to May 30.*

2. Crop production and utilization: how much of the harvested crop was used for saving seed, gifts, own consumption, sold and other purposes by each crop season in the year 2016/17? (Note: write 0 if no any quantity for each crop activities)

	2	3	4	5	6	7	8	9
Crop grown	Total harvested yield (Kg)	Saved for seed(Kg)	Exchange (Kg)	Consumption(Kg)	Sold (Kg)	For other uses (Kg)	Unit price (ETB/kg)	Total value (ETB)
Teff								
Maize								
Wheat								
Barley								
Millet								
Sorghum								
Oats								
Peas								
Beans								
Chick peas								
Vetch								
Lentil								
Niger seed								
Rapeseed								
Sunflower								
Linseed								
Groundnut								
Potatoes								
Tomato								
Carrot								
Cabbage/lettuce								
Onions/garlic								

Peppers								
Potatoes								
Tomato								

2. Do pests occur on year 2016/17? 0. No 1. Yes

2.1. If your answer is yes, where did it occur?

1. On production 2. On harvest 3. In the home

2.2. On which crops do pests occurred?

1. Cereals 2. Pulses 3. Fruits 4. Vegetables

2.3. Could you tell me the estimated cost of the occurrence of the insects or pests on the yield or output?

a. In kind_____

b. In cash_____

IV. LIVESTOCK HOLDING AND PRODUCTS CONSUMPTION

1. Livestock holding

No.	Livestock type	How many does your Household currently own?	Number of animals sold	Sale value (Br.)
1	Ox			
2	Cow			
3	Bull			
4	Heifer			
5	Calf			
6	Sheep			
7	Lump			
8	Goat			
9	Kid			
10	Donkey			
11	Horse			
12	Mule			
13	Poultry			
14	Honey bee/ colony			

2. Livestock products consumption and income

Livestock products	Own consumption (Birr) (Write 0 if no own consumption)	Sales (Birr) (Write 0 if no sale)
Meat products		
Dairy products		
Egg		
Honey and wax		
Animal rent/cart		
Hides/skins		
Manure		
Others		

V. HOUSEHOLD INCOME AND ITS SOURCES

- Do you participate in the following income generating activities; income earned in the year 2016/17?

No.	Type of income generating activities	Did any of your household members participate ? 0. No 1. Yes	If yes, how much income did earned during the last year?
1	Carpentry		
2	Petty trade		
3	Weaving		
4	Pottery		
5	Tailor		
5	Sale of crop by-products		
6	Sale eucalyptus		
7	Sale of hop		
8	Sale of local drink and food		
9	Sale of charcoal and firewood		
10	Salary for local responsibility		
11	Wages for daily labor		
12	Remittance		
13	Other gifts/assistance		
14	Pension		
15	Rent of land		
16	Cart		
17	Others		
	Total income earned		

VI. HOUSEHOLD EXPENDITURE

1. Have you incurred the following expenses on your farm or in the home during the year 2016 / 2017?

	Items	Expense	
1.	Agricultural inputs	In kind; write 0 if no	In cash (Br.); write 0 if no
	Chemical fertilizer		
	Improved seed		
	Herbicides		
	Pesticides		
	Water pump		
	Ploughing materials		
	Renting land		
	Others		
2.	Membership expenses		
	Tax		
	Schooling		
	Clothing		
	Transport		
	Health		
	Others		
	Subtotal		
3	Food grains		
	Total expense		

VII. INSTITUTIONAL FACTORS

1. Extension services

1. Did you get extension services in 2016/17 production season? 0. No 1. Yes

1.1 If your answer to Q. 1 is yes, who did provide the service/s?

1. Development agents 2. Health extension officers 3. Woreda agriculture expert
4. Woreda health expert 5. NGO and others

1.2 For how many times did you contact these professionals within a year?

2. If your answer for Q.1 is no, what do you think is the reason for it?

1. There is/are no extension office and/or agents in this Kebele
2. The distance between extension office and my home
3. The service was delivered on unappropriated time

4. There is a lack of skilful experts in this profession,
If (_____)
3. How far your home is found from Kebele extension offices? _____ Km.
- 2. Credit access**
4. Did you use formal credit services found in your Kebele/woreda? 1. Yes 2. No
- 4.1 If your answer to Q. 4 is yes, who did provide these services?
1. ACSSC 2. PEACE 3. CBO 4. DEV. BANK
5. Other micro finance (specify _____)
- 4.2 For how many continuous years did you use these services? _____ Yr.
- 4.2.1 What is the reason of using credit for continuous years?

- 4.3 For what purpose did you use the loan obtained?
1. Animal production and/or fattening 3. Household consumption
2. Fertilizer and other inputs 4. Asset building
5. Trade 6. If others, specify _____
- 3. Market access**
6. Could you easily get a market in your locality? 0. No 1. Yes
- 6.1 If your answer to Q. 6 is yes, how far is your home from the nearest market center? _____ (minutes), _____ km.
- 6.2 Is the availability and price of the items are irregular? 0. No 1. Yes
- 6.2.1 If your answer is yes, how do you describe its frequency?
1. Weekly 2. Monthly 3. Seasonally 4. Annually
- 6.2.2 On which type of products did the price fluctuation occur?
1. The main staples 2. Pulses 3. Vegetables
4. Fruit 5. More than one product

VIII. FOOD SECURITY INDICATORS

Food Consumption and Sources (Dietary Diversity and Frequency); better if wife or food cooker

1. Yesterday, how many times did the older children and adults (above 13 years) in this household eat? _____ times
2. How many times did children (6-13 years) in this household eat? _____ times

3. Could you please tell me how many days in the past one week (7 days) your household has eaten the following foods and what the source was (use codes on the right, write 0 for items not eaten and if several sources, write up to two)?

No	Food items	Number of days eaten last 7 days	Food sources (Write up to two)	
			Code 1	
1	Staples (teff, maize, wheat, barley, millet, any other grain)			
2	Pulses (peas, beans, chickpea, vetch, lentils, other legumes)			
3	Vegetables (spinach, tomato, onion, carrot, cabbage, other vegetables)			
4	Fruits (Orange, banana, avocado, papaya, mango, other fruits)			
5	Meat and egg			
6	Milk/dairy products			
7	Sugar/honey			
8	Oils and fats			
9	Condiments			

Code 1: Food source codes

1. Own production (crops, animals)
2. Hunting, fishing, gathering
3. Exchanging labor items for food
4. Borrowing
5. Purchase
6. Gift from family/friends

IX. HOUSEHOLD FOOD INSECURITY MEASUREMENT

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

No	Questions: For the last four weeks,	Response 1. Yes 2. No	If yes, how often did this happen?
		Code	Code 1
1	Did you worry that your household would not have enough food?		
2	Were you or any household member not able to eat the kind of foods you preferred because of lack of resources?		
3	Did you or any household members have to eat a limited variety of foods due to lack of resources?		
4	Did you or any household members have to eat some foods that you really did not want to eat because of a lack of resources to obtain other types of food?		
5	Did you or any household members have to eat a		

	smaller meal than you felt you needed because there was not enough food?		
6	Did you or any household members have to eat fewer meals in a day because there was not enough food?		
7	Was there ever no food to eat of any kind in your household because of lack of resources to get food?		
8	Did you or any household members go to sleep at night hungry because there was not enough food?		
9	Did you or any household members go a whole day and night without eating anything because there was not enough food?		

Code 1: How often did this happen

1= rarely (once or twice)

2= sometimes (three to ten times)

3= often (more than ten times)

X. COPPING STRATEGIES

In the past seven days if there have been times when you did not have enough food or money to buy food how often has your household had to the following

No.	Strategies	Frequency (0-7)
1	Rely on less preferred and less expensive food	
2	Borrow food, or rely on help from a friend or relative	
3	Limit portion sizes at meal times	
4	Restrict consumption by adults in order for a small children to eat	
5	Reduce number of meals eaten in a day	

Could you have other local strategies that you used in the past to combat the food shortage please?

1. _____
2. _____
3. _____

Would you have additional comments on the questionnaire or on others that you want to provide us

_____?

Thank you!!

Appendix 2: Checklist for Focus Group Discussions

You are kindly appointed to represent your local peasants for discussing about the following and any related qualitative issues, please discuss in detail.

1. How do you understand the food security / insecurity?
2. How do you perceive the food insecurity situation of your localities?
3. Do you observe any household who cannot cover its food need?
4. Which groups of people do you think are more vulnerable to food insecurity and why?
5. How do you think the relationship between socioeconomic factors and food insecurity in this area? How do you think these factors cause this problem?
6. What do you think is the main source of livelihood in your localities, have you ever seen any household who have no any of these sources?
7. How do you describe the agricultural performance of your localities? Have you ever faced constraints on agricultural production?
8. How do you describe the availability of development services (extension and irrigation services, health, school, credit, water supply, market regulation, and other facilities)? Please discuss deeply
9. What are the survival strategies used by people in the area to cope with food stress?
10. Is there measures taken by the government to improve household food security?

Appendix 3: Conversion factors of TLU

Animal Category	TLU
Ox	1.10
Cow	1.00
Bull	0.60
Heifer	0.50
Calf	0.20
Sheep	0.01
Goat	0.09
Donkey	0.50
Horse	0.80
Mule	0.70
Poultry	0.01

Source: Strock, *et al.* (1991)

Appendix 4: Rural household food insecurity and dummy variables

		Rural Households Food Insecurity Level									
		Food Secure		Mildly FI		Moderately FI		Severely FI			
		n	%	n	%	n	%	n	%	X ² value	P value
SEXHH	Female	3	11.11	8	29.63	10	37.04	6	22.22	8.649	0.034
	Male	53	30.29	46	26.29	63	36.00	13	7.43		
EDuStaHH	Illiterate	29	25.00	27	23.28	43	37.07	17	14.66	9.994	0.019
	Literate	27	31.40	27	31.40	30	34.88	2	2.33		
CrdtUtln	Not Utilize	39	33.91	33	28.70	34	29.57	9	7.83	7.977	0.046
	Utilize	17	19.54	21	24.14	39	44.83	10	11.49		
OccurPest	No	36	28.13	33	25.78	47	36.72	12	9.38	0.172	0.982
	Yes	20	27.03	21	28.38	26	35.14	7	9.46		
AgroEcolgy	Woina dega	29	25.89	32	28.57	44	39.29	7	6.25	3.972	0.264
	Kola	27	30.00	22	24.44	29	32.22	12	13.33		

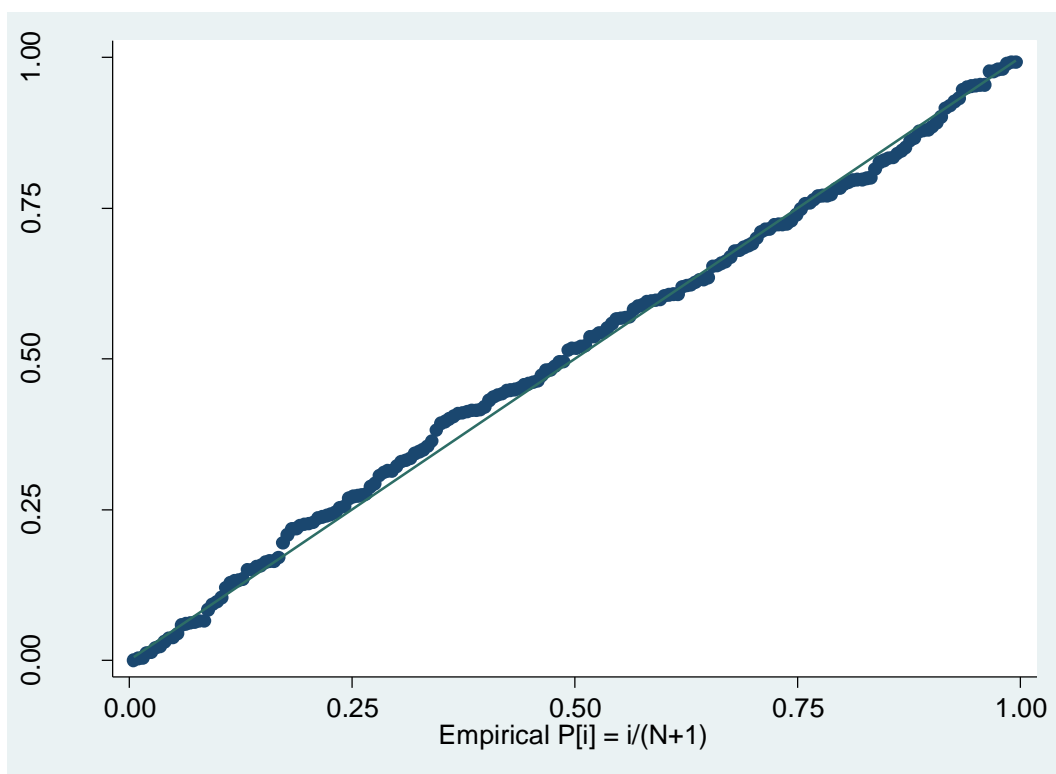
Source: Own survey (2017)

Appendix 5: Rural household food insecurity and continuous variables

	Rural Households Food Insecurity Level									
	Food Secure		Mildly Food Insecure	Moderately FI		Severely FI		F value	P value	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean			Std. Dev.
AGEHH	45	13	42	11	45	10	45	9	0.797	0.497
HHFSz	5	2	5	2	6	2	6	2	7.312	0.000
DepRatio	.53	.49	.78	.51	.71	.54	.67	.42	2.416	0.068
LandSz	1.046	.509	.916	.519	.940	.412	.822	.301	1.390	0.247
LvskHold	5.53	2.34	4.89	2.40	4.53	2.00	3.73	2.00	3.910	0.010
HHINCM	21126.60	7933.10	18909.80	7596.49	13760.61	6475.04	8929.70	6425.99	20.148	0.000
ExtnCont	30	7	28	9	31	11	19	10	8.760	0.000
MktDst	84.71	38.55	103.65	41.58	88.01	38.95	92.11	36.34	2.464	0.064

Source: Own survey (2017)

Appendix 6: Normal probability plot of the residual of the model



Source: Own survey (2017)

Appendix 7: VIF test for explanatory variables

Variable	VIF	1/VIF
AGEHH	1.77	0.564775
EDuStaHH	1.61	0.619492
LandSz	1.50	0.665735
HHFSz	1.46	0.683563
LogHHINCM	1.35	0.739370
DepRatio	1.31	0.761011
LvskHold	1.25	0.800494
SEXHH	1.20	0.830614
ExtnCont	1.09	0.914390
MktDst	1.09	0.918164
CrdtUtln	1.07	0.934702
OccuPest	1.06	0.939626
Mean VIF	1.32	

Source: Own survey (2017)

Appendix 8: Econometric tests

i. Heteroscedasticity test

Breusch-Pagan / Cook-Weisberg test for heteroscedasticity

Ho: Constant variance

Variables: fitted values of RHHFIS

$$\chi^2(1) = 0.50$$

$$\text{Prob} > \chi^2 = 0.4809$$

ii. Omitted variable test

Ramsey RESET test using powers of the fitted values of RHHFIS

Ho: model has no omitted variables

$$F(3, 186) = 1.32$$

$$\text{Prob} > F = 0.2686$$

iii. Tests of endogeneity

. ivregress 2sls RHHFIS SEXHH AGEHH HHFSz DepRatio LandSz ExtnCont CrdtUtl

MktDst OccurPest (LogHHINCM = EDuStaHH LvskHold)

Ho: variables are exogenous

$$\text{Durbin (score)} \chi^2(1) = 2.58712 \text{ (p} = 0.1077\text{)}$$

$$\text{Wu-Hausman } F(1, 190) = 2.465 \text{ (p} = 0.1181\text{)}$$

Appendix 9: Continuous variables with respect to agro ecology

	Agro Ecology					
	Woina-Dega		Kola			
Variables	Mean	Std. Dev.	Mean	Std. Dev.	t- value	P value
AGEHH	44	10	44	12	-0.368	0.714
HHFSz	6	2	5	2	3.233	0.001
DepRatio	.73	.51	.61	.51	1.698	0.091
LandSz	.962	.461	.939	.469	0.353	0.725
LvskHold	5.20	2.27	4.37	2.17	2.646	0.009
HHINCM	18202.05	8376.44	14886.43	7557.79	2.646	0.004
ExtnCont	29	9	29	11	0.380	0.705
MktDst	79.92	35.68	106.28	39.92	-4.888	0.000

Source: own survey (2017)

Appendix 10: Dummy variables with respect to agro ecology

Agro Ecology							
Variables	Category	Woina dega		Kola		X² value	P value
		n(112)	%	n(90)	%		
SEXHH	Female	17	62.96	10	37.04	0.713	0.398
	Male	95	54.29	80	45.71		
EDuStaHH	Illiterate	62	53.45	54	46.55	0.440	0.507
	Literate	50	58.14	36	41.86		
CrdtUtln	Not Utilize	63	54.78	52	45.22	0.048	0.827
	Utilize	49	56.32	38	43.68		
OccurPest	No	84	65.63	44	34.38	14.656	0.000
	Yes	28	37.84	46	62.16		

Source: own survey (2017)

AUTHOR'S BIOGRAPHY

The author, Melesse Zeleke was born on April 20, 1991 in Hulet Eju Enesie woreda near to Motta town in Amhara Region, Ethiopia. After his childhood, he attended his Primary (1-8), Secondary (9-10), and Preparatory education (11-12) at Kernewary Primary School, Sedie Secondary School, and Motta Higher Level Preparatory School respectively. Then after, he joined Jimma University in 2011 and graduated with Bachelor of Science Degree in Agricultural Economics in a Great Distinction at 2015. Soon after graduation, he worked as a Graduate Assistant in Assosa University, Department of Agricultural Economics for a year. Later, he joined Graduate Program of Bahir Dar University in 2016 to pursue his study for Master of Science Degree in Agricultural Economics.