

ADAMA SCIENCE AND TECHNOLOGY
UNIVERSITY SCHOOL OF GRADUATE STUDIES
COLLEGE OF BUSINESS AND ECONOMICS



Determinants of Households Food Security in Adea
Berga District, West Sowa Zone, Oromia

Thesis Submitted in Partial Fulfillment of the Requirement for
the Master of Science in Developmental Economics

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TABLE OF CONTENTS	PAGE
DECLARATION -----	i
CERTIFICATE -----	ii
APPROVAL SHEET -----	iii
DEDICATION -----	iv
ACKNOWLEDGEMENTS -----	v
LIST OF TABLES -----	viii
LIST OF APPENDIX -----	ix
ACRONYMS USED IN THE TEXT -----	x
ABSTRACT -----	xi
CHAPTER ONE: INTRODUCTION -----	1
1.1. Background -----	1
1.2. Statement of the problem -----	3
1.3. Objective of the Study -----	4
1.3.1. Main Objective-----	4
1.3.2. Specific Objectives-----	4
1.4. Significance of the Study -----	4
1.5. Scope of the Study -----	5
1.6. Limitations of the Study -----	5
1.7. Organizations of the Study -----	5
CHAPTER TWO: LITERATURE REVIEW -----	6
2.1. Concept of Food Security and Food Access -----	6
2.1.1. Food security-----	6
2.1.2. Concept of food security-----	7
2.1.2.1. Food availability-----	8
2.1.2.2. Food access-----	9
2.1.2.3. Food Stability-----	9
2.4. Empirical Findings on Determinants of Household Food Security -----	9
2.5. Conceptual Framework of the Study -----	12
CHAPTER THREE: RESEARCH METHODOLOGY -----	15
3.1. Description of the Study Area -----	15

3.2. Sources of Data-----	18
3.3. Sampling Technique and Sample Size-----	18
3.4. Methods of Data Analysis-----	20
3.4.1. Descriptive Methods-----	20
3.4.2. Econometric analytical model-----	21
3.4.3. Dependent variable of the model-----	24
3.4.4. Independent variables of the model-----	24
CHAPTER FOUR: RESULTS AND DISCUSSION-----	28
4.1. Food Security Status of the Households-----	28
4.2. Demographic and Socio-Economic Characteristics of Sample Households-	29
4.3. The Result of the Logit Model-----	43
CHAPTER FIVE: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS-	49
5.1. Summary -----	49
5.2. Conclusion -----	50
5.3. Recommendations-----	51

DECLARATION

I, Moti Guta, declared that this thesis entitled “**Determinants of Households Food Security in Adea Berga District, West Showa Zone, Oromia**” is my original work and that all sources of the materials in the research paper have been duly acknowledged. The matter embodied in this project work has not been submitted earlier for the award of any degree or diploma to the best of my knowledge and belief.

Declared by:

Name: Moti Guta

Signature: _____

Date: October, 2016

Place: Adam, Ethiopia

CERTIFICATE

I, hereby certify that, Mr. Moti Guta Keweacha student of Masters of Developmental Economics at Adam Science and Technology University, School of Business and Economics, has completed his research project on “**Determinants of Households Food Security in Adea Berga District, West Showa Zone, Oromia**”, under my advice, guidance and supervision.

Advisor Signature

ADAMA SCIENCE AND TECHNOLOGY UNIVERSITY
SCHOOL OF BUSINESS AND ECONOMICS
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Determinants of Household Food Security in Adea Berga
District, West Showa Zone, Oromia

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DEDICATION

I dedicated this thesis manuscript to my mother **Gete Berga Bulto** for nursing me with affections and love in the success of my life.

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TABLE OF CONTENTS	PAGE
DECLARATION -----	i
CERTIFICATE -----	ii
APPROVAL SHEET -----	iii
DEDICATION -----	iv
ACKNOWLEDGEMENTS -----	v
LIST OF TABLES -----	viii
LIST OF APPENDIX -----	ix
ACRONYMS USED IN THE TEXT -----	x
ABSTRACT -----	xi
CHAPTER ONE: INTRODUCTION -----	1
1.1. Background -----	1
1.2. Statement of the problem -----	3
1.3. Objective of the Study -----	4
1.3.1. Main Objective-----	4
1.3.2. Specific Objectives -----	4
1.4. Significance of the Study -----	4
1.5. Scope of the Study -----	5
1.6. Limitations of the Study -----	5
1.7. Organizations of the Study -----	5
CHAPTER TWO: LITERATURE REVIEW -----	6
2.1. Concept of Food Security and Food Access -----	6
2.1.1. Food security -----	6
2.1.2. Concept of food security -----	7
2.1.2.1. Food availability -----	8
2.1.2.2. Food access -----	9
2.1.2.3. Food Stability -----	9
2.4. Empirical Findings on Determinants of Household Food Security -----	9
2.5. Conceptual Framework of the Study -----	12
CHAPTER THREE: RESEARCH METHODOLOGY -----	15
3.1. Description of the Study Area -----	15
3.2. Sources of Data -----	18
3.3. Sampling Technique and Sample Size -----	18

3.4. Methods of Data Analysis	20
3.4.1. Descriptive Methods	20
3.4.2. Econometric analytical model	21
3.4.3. Dependent variable of the model	24
3.4.4. Independent variables of the model	24
CHAPTER FOUR: RESULTS AND DISCUSSION	28
4.1. Food Security Status of the Households	28
4.2. Demographic and Socio-Economic Characteristics of Sample Households	29
4.3. The Result of the Logit Model	43
CHAPTER FIVE: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS	49
5.1. Summary	49
5.2. Conclusion	50
5.3. Recommendations	51

List of Tables

Table 1 No. of Households in Sampled Area (PAs) and No. of Sampled Households	19
Table 2: Food Security Status of the Total Sampled Households	29
Table 3: Distribution of sample household's age group	30
Table 4: Distribution of household head by Sex	31
Table 5: Distribution of sample households by marital status	31
Table 6: Distribution of Sample Households by Family Size.	32
Table 7: Educational Status of Sample Households during 2007/2015	33
Table 8: Off farm/ non-farm income of sampled households	34
Table 9: Distribution of sample farmers by cultivated land size.....	36
Table 10: Distribution of sample households by livestock holding in TLU	37
Table 11: Distribution of sample households by number of an ox or oxen owned.....	38
Table 12: Credit users and non-users food security status	39
Table 13: Use of commercial fertilizers	40
Table 14: Distribution of sample households by use of improved seeds	41
Table 15: Use of Chemicals on Crops.....	42
Table 16: Use of Improved Farm Tools by households.....	43
Table 17: The results of the logit model.....	44
Table 18: Marginal effects	58
Table 19: Logistic regression	59

List of Appendix

Appendix 1: Calorie composition of food consumed by sample households	60
Appendix 2: Conversion factor used to calculate adult equivalence scales	61
Appendix 3: Caloric content of the food consumed in the study area	61
Appendix 4: Survey Questionnaire	62

Acronyms Used in the Text

AE	Adult equivalent
B.C.	Before birth of Jesus Christi's
CSA	Central Statistical Authority
e.g.	For example
EHNRI	Ethiopian Health and Nutrition Research Institute
et.al	and others
etc	et cetera
FAO	Food and Agriculture Organization
FDRE	Federal democratic Republic of Ethiopia
GDP	Gross domestic product
HICES	Household Income, consumption & expenditure.
ICN	International conference on Nutrition
Kcal	Kilo calorie
M	meter
mm	Millimeter
MoA	Ministry of Agriculture
MoEDC	Ministry of Economic Development and Cooperation
MoFED	Ministry of Finance and Economic Development
N	North
NGOs	Non-governmental organizations
OGCIO	oromai Government Issue and communication office
PA	Peasant Association
PPS	Proportional Probability Sampling
RFI	Rural financial institution
SFSA	Syngenta Foundation for Sustainable Agriculture
Sh.C.	Share Company
sq.	Square
SRS	Simple Random Sampling
UN	United Nations
USAID	United States Agency for International Development
WHO	World Health Organization

WMS	Welfare Monitoring Survey
WoARD	Woreda of Agriculture and Rural Development
WoGCIO	At Woreda Government Issue Communication office
WoGICO	Woreda Government Issue communication office

ABSTRACT

The main objectives of the study was to measure and analyze the determinants of household food Security in Adea Berga district, West Showa Zone, Oromia National State by employing statistics methods and logistic regression model. Household calorie acquisition approach was used to analyze the state of household food security. Simple random sampling method was administered to select sample peasant association and then five peasant associations were selected among 37 peasant associations in the district. Finally, proportional probability sampling technique was used to select 240 sample households from selected five rural peasant associations. Supplementary information from secondary data was collected from various sources. The data was analyzed using descriptive statistics like mean, standard deviation, percentage and frequency distribution. Uni-variate analysis such as P-value and Chi-square (χ^2) tests were also used to describe characteristics of food secured and food in secured groups. The survey result showed that about 129 (53.75%) of sample respondents were food insecure, where as 111 (46.25%) were food secure. A logistic regression model was fitted to analyze the potential variables affecting household food security in the study area. Among fourteen explanatory variables included in the logistic model, nine of them were statistically significant at less than ten percent probability levels. All variables except number of ox owned and total livestock holding exhibited the expected signs (positively influence food security of the study area). Variables related to off-farm/non-farm incomes, size of cultivated land, use of improved seeds, use of improved farm tools, age of household, and use of chemicals on crops as well as commercial fertilizers do significantly affect household food security. Thus, designing and implementing development interventions with respect to the above potential variables are crucial to enhance sustainable food security in the study area. Improved technologies that increase the productivity of land should be given prior attention. It is also appropriate to the area to promote intensive agriculture, expand non-farm activities as well as agricultural inputs access to boost farm production and thereby attain food security.

CHAPTER ONE: INTRODUCTION

1.1. Background

The economic growth of developing countries depends to a great extent on the growth of the agricultural sector. Ethiopia is a country typified by a predominantly subsistence agrarian economy. The nature of farming in Ethiopia is characterized by traditional micro holdings and subsistence type with 86.4 % of agricultural households own land with areas of two hectares or less than two hectares of land on the average (CSA 2007), (*Girma2006*). The most important or dominant Farming System in Ethiopia is Smallholder farming system and accounts for more than 90% of the agricultural production and for about 95% of the total area under crop production.

In 2000, world leaders committed themselves to the Millennium Development Goals (MDGs) and one aim of the Millennium Development Goals is to eradicate poverty and hunger, including reducing by half the proportion of people who suffer from hunger between 1990 and 2015. Currently, 14.3 percent (827 million) people are affected by hunger in developing countries and the numbers of hungry people in the world is growing at a rate of four million a year; and the trend is not falling quickly enough to achieve the goal particularly in Africa and Southern Asia (FAO 2013). It is predicted that many people will not reach their MDG targets particularly in Sub-Saharan Africa where a third of the population is food insecure and there is an actual increase in the number of hungry people due to rapid population (SFSA 2004).

Projections from various sources show that the global food production trend will be positive by 2020 but food insecurity will be persistent. Sub-Saharan Africa is the most vulnerable region with respect to food security and it will be the food insecurity hotspots in 2020. The region's per capita consumption is projected to decline by 0.5 % per year through the next decade. By 2008, Sub-Saharan Africa is projected to account for 61 % of the total gap to maintain consumption and constitutes 79 % of the total nutritional gap (Shahla and Stacey 1999).

Ethiopia is one of the poorest countries, within Sub-Sahara, with indicators suggesting low levels of development. Some scalars believes that famine incidences caused by drought in

Ethiopia goes back to the 11th century and some even refer as far back as 253 B.C. Between 1900 and now about 18 famine periods were registered in the country's history (Glantz, 1987). In most instances famine and hunger are both rooted in food insecurity. It is usual to witness seasonal hunger usually in the months just before the coming harvest. On the surface it appears that erratic weather conditions have repeatedly triggered large-scale cattle and crop failures for the subsistence farmers.

The Ethiopian economy is predominantly agrarian, where almost half of the GDP is contributed by the agricultural sector (40.2%) and creates employment opportunities for over 80% of the population. Agriculture sector in Ethiopia is characterized by traditional method of farming with little surplus output and is heavily influenced by weather conditions. Only 20% of farm production is supplied to local market while more than 60% of production is used for own consumption, which puts the vulnerable, food insecure households in perspective (Dejene 2006).

In the last three decades food production in Ethiopia has never been sufficient to enable the populations to be food secure. Many Ethiopians live in conditions of chronic hunger with both a low average daily energy supply (kcal/capita/day) of 1880 and a very high (44%) prevalence of undernourishment (Adnew 2004).

Similar to this idea the proportion of population in the rural area unable to attain their minimum nutritional requirement is estimated at 52% (Devereux and Sussex 2003). Serious food shortages and high levels of malnutrition continue to affect a large number of people in several parts of Ethiopia (Ethiopia National Food Consumption Survey 2013).

Recent studies, for instance, have shown that the Ethiopian poor continue to become poorer and a greater number of peoples' livelihood insecurity is ever increasing. An expanding rural population struggles to eke out a living on ever decreasing plots of land whose fertility and productivity continue to decline. In normal years, at least 5 million people out of a population of 70 million are in danger of starvation. That number can rise to over 13 million if drought or other factors cause additional shortfalls in agricultural production (RI 2004).

1.2. Statement of the problem

Ethiopia is one of the poorest countries in the world with over 40 percent of its population is believed to be living below poverty line (MoFED, 2012). The country's economy is typically an agricultural economy and more than 80 percent of the total population in Ethiopia lives in rural areas. Agriculture accounts for about half of the overall GDP and for about 90 percent of the country's export earnings and supplies about 70 percent of the country's raw material to the secondary activities (MoFED, 2008).

Particularly, majority of the Ethiopian rural population has been chronically suffering food shortages more severely than the urban dwellers. Undernourishment and malnutrition are common in rural Ethiopia and millions of peasants live under starvation even these days. Moreover, landlessness, lack of modern means of production, and large family size (majority of which are dependent) are the major characteristics of the Ethiopian peasants at present as noted in (Mesay, 2011). Therefore, one can safely say that the Ethiopian rural community is the major contributor to the national economy and most poverty-affected group of people as well.

Both transitory and chronic food insecurity are common in Ethiopia. Moreover, food insecurity is one of the defining features of rural poverty affecting millions of people (FDRE, 2002). The problem of food insecurity has wide diversity and multiple dimensions, which ranges from the global, regional, country, local, household to individual level. However, more attention is given to the country level so far. Moreover, the various, complex and interrelated cause of household food security and local responses during crisis are not studied in detail, especially at a household level. In line with this, agriculture in the most part of the oromia region, where the study has been carried out, is dominantly backward and dominated by shifting cultivation and mixed farming. The food security related Problems of the region and West Shewa Zone in particular are similar to that of the country (WVE, 20012).

Food security and poverty reduction remains as a top issue and prior agenda as far as rural development is concerned. To ensure this objective governmental and nongovernmental organizations are working in the study area. However, the analyses of factors affecting food security the level of by the households remain a long-standing challenge. Thus, identifying, analyzing, and understanding demographic and socioeconomic characteristics of the

households that are responsible for variation in household food security is the main drive of this study to guide policy decisions, devise appropriate interventions and integrated efforts to combat food insecurity.

This is why the issue of the problem of food security has become the concern of many academicians, political leaders and other professionals these days. However, majority of the researches that have been done so far on issues related to food-insecurity in Ethiopia are very general and considers the problem from national level. Furthermore, even though there are scanty studies conducted on rural food security in Oromia national region, there is no study undertaken in Adea Berga district. Hence, this research work has tried to address the following questions:

- Who are the food secure household in the study area?
- How much is the extent and severity of household food insecurity?
- What determines household food security in the study area?
- How do these factors affecting the living conditions of households?

1.3. Objective of the Study

1.3.1. Main Objective

The major objective of the study was, to measure and analyzes the determinants of household food security in Adea Berga district.

1.3.2. Specific Objectives

- To analysis the major determinants of food security of households in the Adea Berga district,
- To determine the status of food security in the study area
- To measure and explain the food security situation of the district

1.4. Significance of the Study

Having clear picture and information on the status of food security and contribution of credit in the study areas, can provide basis for a detailed analysis on food security in the country. A

better understanding of factors affecting the status of food security at micro level is required by organizations concerned with community development, researchers, and development policies makers.

The study also provides directions for further research, extension and development schemes that would benefit the farming population. Furthermore, the result may identify areas of intervention to alleviate poverty in general, and food security, in particular.

1.5. Scope of the Study

To carry out any research work it is necessary to delimit the range of the study to manageable size. Due to time and financial constraints, the study was conducted only in Adea Berga district of West Showa Zone of the Oromia Regional State. The study covered five (5) of the thirty-seven peasant association of the district (Adada-Sodolbe, Bishan-Dimo, Biyo-Wogidi, Ejere-Negao and Maru-Chobot). From five PAs or 3,648 households' total samples drawn were 240 households. The scope of this research is limited to the analysis of the factors determine household food security in the study area. This study also used households as a unit of analysis. Even if the problems of food insecurity are multidimensional and dynamic, this study is based on factors related to individual households. Therefore, the study may not be comprehensive and exhaustive.

1.6. Limitations of the Study

The study was conducted to identify the determinants of household food security in the study area. So, the data used in the paper are cross sectional type. It is difficult to study households' food security dynamic. Furthermore, this study is wholly conducted in only one rural district of West Showa Zone. Hence, generalization of the result obtained in this study to the rest part of the Zone, West Showa, may be limited.

1.7. Organizations of the Study

The study is organized in five chapters. The first chapter introduces the background and justification for the study. Objectives, significance, and limitations of the study are also discussed in this chapter. The second chapter covers relevant literature review. The third chapter deals with the research methodology. In chapter four, results of finding is discussed from both econometrics and descriptive analysis. The fifth and the last chapter summarize the main findings of the study and draws recommendations.

CHAPTER TWO: LITERATURE REVIEW

2.1. Concept of Food Security and Food Access

2.1.1. Food security

Food security may have different meanings for different people. One of the definitions of food security in the 1970s focused on the supply side of food at national or international levels. More especially food security was identified with commercial food prices and physical food availability, rather than with demand and consumption and was stated as “availability at all times of adequate world supplies of basic food stuffs to sustain a steady expansion of food consumption and to offset fluctuations in production and prices (UN 1975).

Food security has been a global concern since the 1974 World Food Conference, held at a time when world food supplies were tight and large-scale food shortages and starvation appeared imminent. In response to the perceived crisis, such bodies as the World Food Council, the FAO Committee on World Food Security (with its Food Security Assistance Scheme) and the Committee on Food Aid Policies and Programs were formed. Their activities focused on increasing domestic agricultural production and creating international grain reserves. Food security was identified with commercial food prices and physical food availability, rather than with demand and consumption by poor people or nutritionally vulnerable groups (FAO 2014).

The International Conference on Nutrition (ICN), held in Rome in 1992, defined food security as "access by all people at all times to the food needed for a healthy life" (FAO/WHO, 1992a; cited in (FAO 2014). Essentially, in order to achieve food security a country must achieve three basic aims. It must:

- ensure adequacy of food supplies in terms of quantity, quality and variety of food;
- optimize stability in the flow of supplies;
- secure sustainable access to available supplies by all who need them.

Adequate food availability at the national, regional and household levels, obtained through markets and other channels, is the cornerstone of nutritional well-being. At the household

level, food security implies physical and economic access to foods that are adequate in terms of quantity, nutritional quality, safety and cultural acceptability to meet each person's needs. Household food security depends on an adequate income and assets, including land and other productive resources owned. Food security is ultimately associated with access to nutritionally adequate food at household level, i.e. the ability of households or individuals to acquire a nutritionally adequate diet at all times.

2.1.2. Concept of food security

The concept of food security differs from food self-sufficiency i.e. the food self-sufficiency is generally taken to mean the extent to which a country can satisfy its food needs from its own domestic production. The concept of food self-sufficiency and food security differ on two fundamental points: food self-sufficiency looks only at national production as the sole source of food supply while food security takes into account commercial imports as possible sources of food supply (Anne 1998).

Food self- sufficiency refers only to domestically produced food availability at the national level; whereas food security brings in elements of stability of food supply and access to food by the population. Country can increase its food security by increasing domestic food production and importing food (FAO 1998).

The most widely used and meaningful definition of food security is access by all people at all times to enough food for an active health life (World Bank 1986). Food security is defined as a situation where both food supplies are sufficient to cover food requirements on continuous and stable basis. This general definition of food security applies in principle, to aggregate national as well as to household food security.

As the definition of food security is elusive, the components of food security are also elusive, but the essential components in most cases include availability or supply and access to food at national, regional, and household levels. (USAID 1992) indicated that availability (supplies of food), accessibility (both physical and economic), and utilization (physiological ability to absorb and utilize consumed nutrients) are important components. Food security has three dimensions: availability, access and stability.

2.1.2.1. Food availability

The availability of sufficient quantities of food of appropriate quality, supplied through domestic production or imports. Problems with food availability at the national level arising from national production fluctuation are typically addressed with imports. In some situations, however, grain importation may be slow in coming, or may not come at all, because of logistical problems, trade distribution foreign exchange problems or credit issues.

Food availability is determined by the level of food supplies, composed of subsistence production and market supplies stemming from domestic production, food stocks, and food imports. Access to food is the result of the ability to express food needs (beyond subsistence) as effective demand. Stability refers to variations and the risk of short falls in food production, supplies and / demand over time.

As (Belayneh 2005) cited, in addition to the supply components, food security includes elements of access, vulnerability and sustainability that initiated a paradigm shift in early 1980s and that brought focus to the issue of access and entitlement to food. National food security is ability of the country to ensure on a long-term basis, that is its food system provides the total population access to timely, reliable and nutritional adequate supply of food. It also encompasses certain ability of the country to finance needed imports to meet immediate targets for consumption levels.

Food supply determines availability, food access is an expression of the ability to gain access to food, and both availability and access have to be ensured at the same time to achieve food security. This applies to global as well as national and individual levels. Food insecurity prevails if, at any time (occasionally, repeatedly or permanently, either the volume of food supply or demand (effective demand) fall short of requirements. The distinguishing point between national food insecurity and micro level food insecurity is that national food insecurity is food supply insecurity whereas micro- level food insecurity is also about food consumption insecurity. The per capita food supply (availability) indicates the country's capability to feed its population from domestic production and food import.

2.1.2.2. Food access

The accessibility dimension of food security is related to the entitlement approach which deals with the ability of people to command food through legal means available in the society including the use of production possibilities, trade opportunities, entitlement in comparison with the state and other method of acquiring food. For most of the malnourished, the lack of access to food is a greater problem than availability. Most of the food insecure people live in the rural areas where food is produced and available for purchase, but they cannot afford to buy it. For those whose usual food entitlement is to grow their own food, crop failure is particular problem.

Food access at national level ensured by having adequate resources or incomes to access food through purchase or exchange. As (Ahmed 2008) cited, food insecurity arises from a decline in access to food due to either a decline in domestic production or inefficient distribution mechanism and, hence, a risk in food price or general decline in the income that enables entitlement to food. Access to food is a core point of food security since, in the world, hunger is not only an aspect of food availability, but also the physically and economically, access to available food. Besides this, food security is also a question of vulnerability and sustainability (World Bank 1986).

2.1.2.3. Food Stability

To be food secure, a population, household or individual must have access to adequate food at all time. Food security is fundamentally a stochastic concept, subject to uncertainties and risks. They should not risk losing access to food as a consequence of sudden shocks (example, an economic or climate crisis) or cyclical events (example, seasonal food insecurity). The concept of stability can, therefore, refer to both the availability and access dimensions of food security.

2.4. Empirical Findings on Determinants of Household Food Security

Empirical studies conducted by various authors identified various factors influencing household food security. In a study done by (Abebaw 2003) in Dire Dawa, a binary logit model was used to identify the determinants of food insecurity among the rural households. In the study area from total explanatory variables, nine variables found to be statistically

significant at less than one five and ten percent of probability level. The significant variables were; family size, annual income, amount of credit received, age of household head, status of education, cultivated land size, livestock ownership (TLU) and number of ox owned. These findings were found highly food insecure determinants in the study area.

Logistic regression model was used to identify the continuous and discrete, potential variables capable of affecting the food security status in the district. The model results reveal that 8 explanatory variables were found to be significant at less than 10% probability level in the district. These significant variables include off-farm income and income per adult equivalent, family size, number of oxen owned the use of fertilizer, food expenditure pattern, number of livestock owned (TLU), and size of cultivated land (Mulugeta 2002).

Tesfaye (2005) carried out study on the cases of household food insecurity and coping strategies in Dodota-Sire district, Ethiopia. To address his objective, the researcher collective survey data on socio-demographic and socio-economic aspects from the household; and analyzed it both through descriptive and logistic model. Finally, family size was found to be negatively related with household food security. Whereas the number of oxen owned, use of chemical fertilizer, size of cultivate land farm credit use, total annual income per adult equivalent, food consumption expenditure, livestock owned , and off-farm income per adult equivalent were identified among the positive factors of household food security.

Yilma (2005) finding shows, the binary logit model results make known that among explanatory variables included in the model, family size, age of household head, use of chemical fertilizers, market distance, off-farm/non-farm income and total farm income were significant. The evidence of ordered logit model reveals that variables like family size, cultivated land size, yield loss due to insect and pest infestations, off-farm/non-farm income, total farm income and soil fertility problem were significant determinants of household food security status. Identifying and understanding factors that are responsible for household food security status and its determinants is important to combat food security problems at the household level.

The binary logit model identified six significant variables as determinants of the food security status of male-headed households, i.e. age of head of household, market distance, participation in ox fattening, off-farm/non-farm income, total livestock holding and crop

income. The model also identified three significant variables as determinants of the food security status of female-headed households, i.e. crop income, market distance and farm implements and other productive household items (Dereje 2006).

The econometric results indicate that: demographic characteristics (family labor supply); personal characteristics of the head (sex and education); resource endowment of the household (land and TLU owned); off/non farm income per AE and farm income per AE are the variables of the positively and significantly influence food security of households. Access to credit also contributes positively to food security status of households. On the other hand, crop infestation by pests, striga and partinnium (congress weed), have negative and significant influence on households' food security status. In general, the findings imply that those interventions that target women and that encourage households income source diversification, and build asset and human capital of households' will have a positive impact on food security of households in the area (Tewoderos 2007).

Tefera (2009) in his study identified the major determinates of food security in the study area by using the logit model. The model output clearly indicated the influence of hypothesized variable on the dependent variable. Variables which determinants of household food security status at less than 10% probability level and positively related and significant were Age of household head, Sex of household head, Level of education of the household, Size of cultivated land, Livestock holding, Use of chemical fertilizer, Access to improved seeds and Non-farm income.

Tsegay (2009) conducted on the determinants of food security and identified the major factors that jointly discriminate the rural households of Tigray region in to food secure and insecure households. Based on the 2004/05 Household Income, Consumption and Expenditure (HICES) and Welfare Monitoring Survey (WMS), the study found out that about 43% and 57% of the households were found insecure and secure, respectively. Furthermore distance to input sources, farm land size, TLU, number of oxen and household size were found to be the major discriminating variables.

Fekadu, *et. al.* (2010) in their study identified the major determinates of food security in the Central Ethiopia West Showa, by using the binary logit model. The model output clearly

indicated the influence of hypothesized variable on the dependent variable. It also indicated the appropriate measure to be taken for improving the food security status. Out of the total sixteen explanatory variables hypothesized access to credit, fertilizer, soil conservation, livestock ownership were positively related with less than 5% significance and oxen ownership, cultivated land size also positively related with less than 10% significant determinants of household food security status.

Another recent study done by Wali, *et. al.*(2013) in Jigjiga District of Ethiopia on the Determinants of Rural Household Food Security and collected data from 160 rural households in the study area using a stratified sampling technique and an empirical analysis included in the logit model, shows six explanatory variables were found to be statistically significant determinants of household food security among various factors. Variables such as: total household income, fertilizer use, extension service, access to credit and veterinary service were found to have positive influence; while agro-ecology affected the food security of the households in lowland negatively. Access to fertilizer, extension, veterinary and credit would increase household food security in the study area by 84%, 46%, 36% and 141% respectively. Therefore, researcher recommended that credit services, and agricultural input supply should be highly strengthened in the study area to secure their food status.

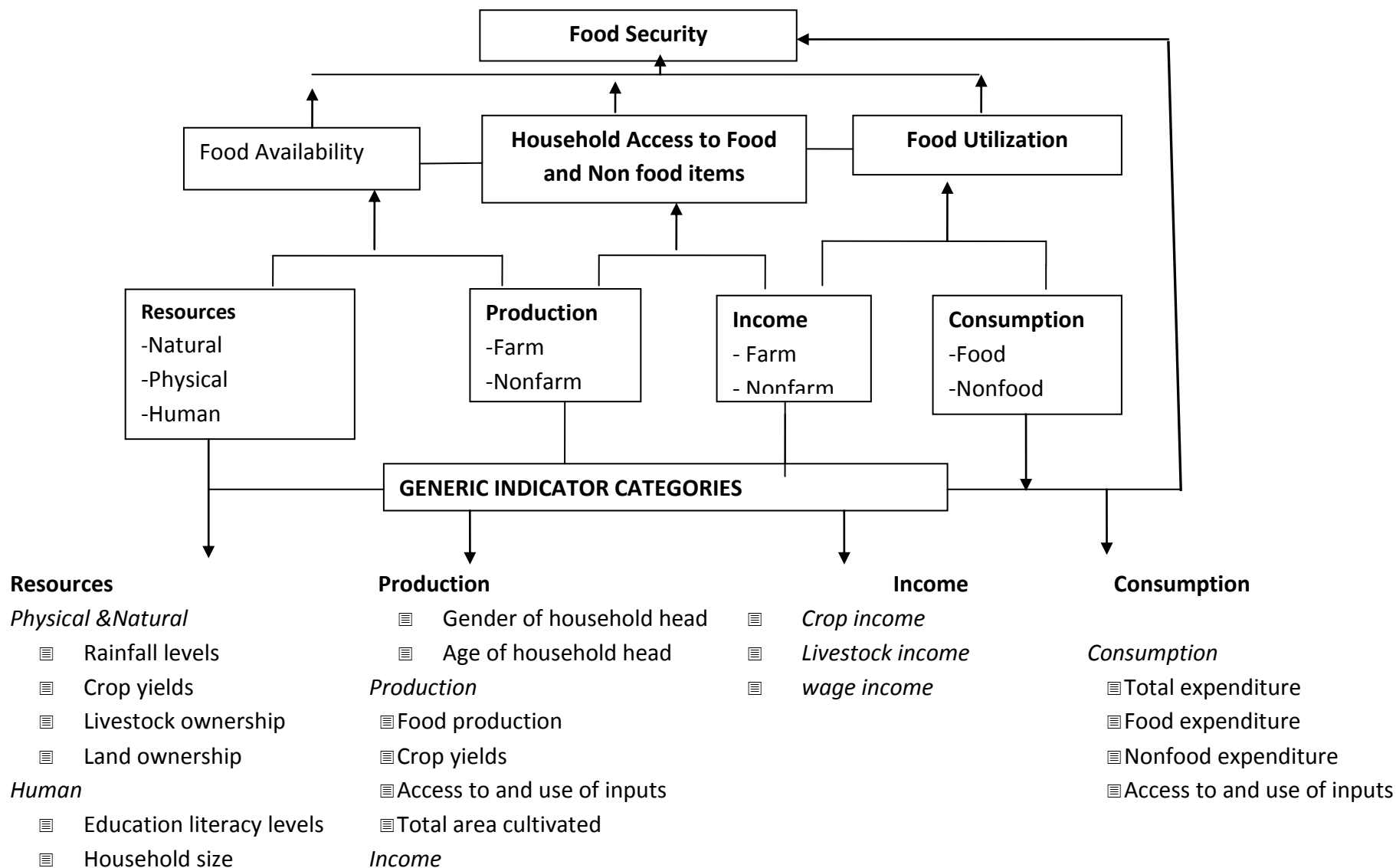
Misgina, (2014). In his study logit regression model was used for estimation of variable affecting food security status of Rural Household in the Laelaymychew Woreda, central Zone of (Tigrayi, three (3) of them were significant at less than 10% probability level. These were total annual income, use of chemical fertilizer, total livestock unit. From the rest explanatory variables, two of them like, family size of household head and size of cultivated land were significant at less than 5% probability level and positively related with dependent variables.

2.5. Conceptual Framework of the Study

From the above literature review, it can be understood that food security and rural households credit access is vital for improving food security of households. In Ethiopia agricultural production and productivity is low. This low agricultural production among other factors is due to low access to credit. In order to curb this constraint and improve the situation, identification and working on the problem that affects the extent of credit access and

enhancing agricultural productivity is essential. This can be done through analyzing different factors significantly affect food security.

The conceptual framework of this study was developed based on the assumption that credit access and food security is influenced by several interlinked factors that include personal and demographic, socio-economic, and institutional factors. As clearly illustrated in following figure below, the mentioned factors were assumed to affect food security in household farmers were taken into consideration. The conceptual framework highlighting the relationship of explanatory variables with the dependent variables is summarized below.



Source: Adapted from Chung et al. (1997:6) Webb and Von Braun (1994)

CHAPTER THREE: RESEARCH METHODOLOGY

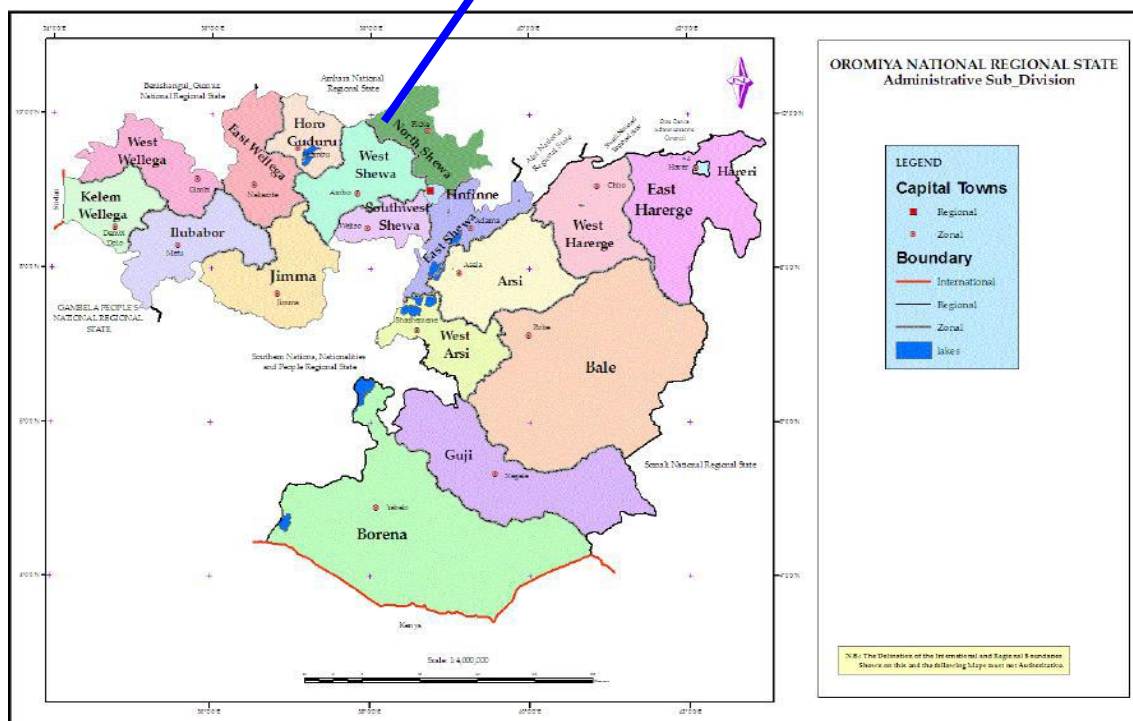
3.1. Description of the Study Area

Adea Berga district is one of the 19 districts of West Showa Zone which is found in Oromia regional state. The population density of the study area male 73,629, female 73,601, and total 147,230 is living in the district (WoGICO 2014). The district consists of 37 rural peasant associations and 23,658 total households in the district. The district has a distance of about 64km away from Addis Ababa to the West part of the country, with an area of 79,835 hectares (798.13934 sq. kilometers). Out of this 36,044 hectares is cultivable land, 4,564 hectares are used for grass land, 11,199 hectares are covered by different types of forests, 10 hectares occupied by factories, rocks, hilly, 45 hectares are covered by water and the rest is covered by others. Where its altitude ranges from 1,400 to 3,500 m and its agro-ecology is divided into lowland (37%), mid-altitude (34%) and highland (29%) with an annual rainfall of 918 mm to 1,368 mm.

In the district agriculture is the mainstay of the household economy, intensively carried out by those who have land and livestock. The landless are engaged in sharecropping and other non-agricultural income generating activities like daily laboring. Crop production and animal husbandry are major activities. Agricultural products are consumed at home and partly sold to earn cash to meet other household needs, educate children, and contribute to social affairs. The main crops grown include cereals (barley, wheat, sorghum and *teff*), pulses (Bean, Vetch, chickpea, pea and lentil), oil crops (Niger seed and linseed), fruits and vegetables (leman, orange and banana; are potato cabbage, onion, etc.)

The major livestock species managed in the area includes cattle, goats, sheep, donkey, mule and horse. The proportion of households with no ox, one ox and two or more oxen is 30%, 40% and 30%, respectively (WoARD, 2014).

The main reason to select this district is that still now there is a problem of food security shown in the rural household of the district and it is intended to investigate the determinants of food security at household level in the district.



Source: (OGCIO) Oromia Government Issue Communication Office

3.2. Sources of Data

The sources of the data for this research were both primary and secondary sources. Information was collected by designing semi-structured and structured questionnaires; interviewing key informants (KI) was the main source of primary data. In addition, secondary data collected from annual reports of the district as well as agricultural bureau, research report, unpublished documents, annual report of microfinance institutions in the district (Vision Fund Microfinance Institution, Wasasa Credit and Saving Microfinance and Oromia Credit and Saving Sh.Co.) and different types of journals.

3.3. Sampling Technique and Sample Size

In this study in order to capture a representative sample, Multi-stage sampling technique was adopted to select the required sample respondents and collection of data. Taking the logistics of field work, travel expenses, transport accessibility and time constraint into account, the Adea Berga district was selected purposively for two main reasons. First, the fact that the availability of formal credit service in the district (Oromia credit and Saving Sh.Co, Wasasa Micro Finance and Vision Fund Microfinance institutions). Second, the researcher's previous working experience and exposure to the district. This obviously helped the researcher in facilitating the study, building confidence of the respondents, and collecting reliable data. Simple random sampling (SRS) method was administered to determine sample PAs Maru-Chobot, Bishan-Dimo, Ejere-Nagao, Adada-Sodolbe and Biyo-Wagidi. Totally five PAs were selected among 37 PAs in the district.

Finally, proportional probability sampling (PPS) technique was used to select sample households from selected five rural PAs by applying the following Cochran (1977) formula,

$$n = \frac{NZ^2PQ}{e^2(N-1) + Z^2PQ} \dots\dots\dots 1$$

Where,

N: Total number of households in the five selected PAs 3,648 (100%)

P: Proportion of food secured households 743(20%),

Q: (1-P) proportion of food in secured households 2,905 (80%)

Z: Standardized normal variable and valued that corresponds to 95% confidence interval equal to 1.96

n: Number of sample size

e^2 : Allowable error 5%, (0.05).

By applying the above values, the sample size for the proposed study will be 231 respondents.

$$n = \frac{(3648)(1.96)^2(0.2)(0.8)}{(0.05)^2(3647) + (1.96)^2(0.2)(0.8)} = 231$$

In order to maintain the confidence of the data, the sample size is fixed as 240 by adding 9 more households. To decide the number of respondent from borrowers' households and non-borrowers households 240 respondents are equally divided in to two parts and 120 household respondents was selected from each stratum.

Table 1 No. of Households in Sampled Area (PAs) and No. of Sampled Households

S/N	Name of the PAs	Number of Households in Sampled Area (PAs)	Number of Sampled Households
1.	Adada-Sodolbe	441	29
2.	Bishan-Dimo	563	37
3.	Biyo-Wogidi	684	45
4.	Ejere-Negao	1,322	87
5.	Maru-Chobot	638	42
Total		3,648	240

Source: Owen Survey Data, 2015

Therefore, as the household was considered as basic sampling unit, 240 households 29 from Adada-Sodolbe, 37 from Bishan-Dimo, 45 from Biyo-Wagid, 87 from Ejere-Nagao, and 42 from Maru-Chobot were selected using probability proportional to sample size-sampling techniques.

3.4. Methods of Data Analysis

This study employed both descriptive statistics and econometric model to analyze the data. A descriptive statistical technique was done with the help of **Stata/SE 12.0** software and the basic principle for using descriptive statistics. Therefore, both descriptive statistics and econometrics model were employed to study the relationship between the dependent (Food security) and explanatory (independent) variables like age, sex, marital status of households, use of commercial fertilizers, use of improved seeds, use of improved farm tools, use of chemicals to protect pest infestation and different crop disease, credit access, family size of households, educational level of households and cultivated land size, off-farm income, total livestock and numbers of oxen.

3.4.1. Descriptive Methods

To measure and describe the determinants of food security in the study area the following data were collected: household demographic and socio-economic characteristics like age, sex, marital status of households, commercial fertilizers, improved seeds, improved tools, chemicals to protect pest infestation and different crop disease, credit access, family size, cultivated land size, off-farm income, total livestock and numbers of oxen. The descriptive analysis was performed using frequencies, mean standard deviation, percentage, chi-square (χ^2), P-value. The obtained result will use as an indicator of the relationship between dependent and independent variables.

3.4.2. Econometric analytical model

Food security in the present study measured in to two steps. Firstly, the food supply at a household level was determined by compiling a food balance sheet for each sampled household. Secondly, the food supply at the household level calculated in step one was used to calculate the calories available per kilogram per adult equivalent (AE) per day for each household by taking into account the age and sex of household members to attain 2,100 kilo calorie per AE per day was considered as food secure, and those households who had a lower amount deemed as food in secured. The study employed a logit model (Equation with the dependent variable (food security) being a binary variable having a value of one if a household was found to be food secure, and a value of zero otherwise.

The logit model is computationally easier to use and leads itself to a meaningful interpretation than the other types Pindyck and Rubinfeld (1998), Green (1993), Gujarati (2004). Following Maddala (1983), Green (1991) and Gujarati (2004) the logistic distribution function for the adoption of triticale can be specified as:

$$P_i = (Y=1/X) = \frac{e^{Z_i}}{1 + e^{Z_i}} = \frac{1}{1 + e^{-Z_i}} \dots\dots\dots (2)$$

Where: e is an exponential term,

P_i is the probability of household i being food secure. It is **1** if a household is food secure, otherwise **0**.

Y is the observed food security status of a household.

X_i is the household set of explanatory variables

Z_i is a function of n -explanatory variables (X_i) which can be expressed in linear form as:

$$Z_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots\dots\dots \beta_{14} X_{14}$$

From Equation 1, the probability of a household being food insecure is given by $(1 - P_i)$ which can be written as Equation 3:

$$P(Y=0/X) = 1 - \left(\frac{e^{Z_i}}{1 + e^{Z_i}} \right) \dots\dots\dots (3)$$

Therefore, the odds ratio $\frac{P_i}{1-P_i}$ is given by Equation 4:

$$\frac{P_i}{1-P_i} = \frac{\frac{e^{Z_i}}{1 + e^{Z_i}}}{1 - \left(\frac{e^{Z_i}}{1 + e^{Z_i}} \right)} = \frac{1 + e^{-Z_i}}{1 + e^{Z_i}} = e^{Z_i} \dots\dots\dots (4)$$

Now, $\frac{P_i}{1-P_i}$ is the odds ratio in favor of food security. It is the ratio of the probability that a household would be food secure (P_i) to the probability that a household would be food insecure ($1-P_i$).

Finally, taking the natural logarithm of Equation 4 and assuming linearity produces Equation 5:

$$L_i = \ln \left[\frac{P_i}{1-P_i} \right] = Z_i \dots\dots\dots (5)$$

Where: L_i is the logarithm of the odd ratio which is assumed linear for both variables and parameters.

If the disturbance term is introduced, the logit model in Equation 5 is represented by Equation 6:

$$Z_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_{14} X_{14} + \varepsilon_i \dots\dots\dots (6)$$

In Equation 6, the terms β_i are parameters to be estimated, and X_1 to X_{14} are explanatory variables used in the model included:

X_1 = Age of Household Head in years

X_2 = Gender of Household Head: (Male =1, Female = 0)

X_3 =credit access: it is dummy variable (1= for credit users, otherwise =0)

X₄ = Marital Status of household Head: (Married =1, Otherwise=0)

X₅ = Household size is continuous and measured by adult equivalent (AE).

X₆ = Education level of Household Head (it is continuous variables measured in number of years of formal education)

X₇ = Cultivate land size in hectare is continuous variables measured in hectars

X₈ = Off-farm income activity (If yes =1, otherwise= 0)

X₉= Use of Commercial Fertilizer. It is continuous variables and measured by kilograms.

X₁₀= No. of ox/Oxen owned .It is continuous variable and counted in number.

X₁₁= live stock holding is continuous variables and measured by total numbers of livestock units (TLU).

X₁₂= Use of improved seed (if yes=1, otherwise 0)

X₁₃=Use of chemicals on crops (if yes=1, otherwise 0)

X₁₄= Use of improved farm Tools (if yes 1, otherwise)

The parameters of the logistic regression model were estimated using the maximum likelihood approach.

From the estimated logit model, the marginal effects of each explanatory variable on household food security can be calculated using Equation 7:

$$\left(\frac{\partial P_i}{\partial x_i}\right) - P_i (1 - P_i) \beta_i \dots\dots\dots (7)$$

The significance of the model will be measured by pseudo-R² with Chi².

The definition of variables and working hypothesis of the model is given as bellow;

3.4.3. Dependent variable of the model

Households food consumption of kilocalorie intake per adult equivalent per year are greater than or equal to 2100 kcal regarded as food secure and assigned a value of 1, while household whose food consumption of kilocalorie intake per adult equivalent per year less than the cutoff point are regarded as food insecure and assigned a value of 0.

3.4.4. Independent variables of the model

A number of variables are expected to influence household food security. However, after reviewing relevant documents on the issue of food security and observing situation in the study area, the researcher identified the following variable as the main potential determinants factors for the time being in the study.

Age of household head (Age): It is a continuous variable and measured in number of years. Rural households devote most of their time or base their livelihoods on agriculture. The older the households head the better he/she has social network as well as the more experience on farming and weather forecasting. As a result, the chance for such household to be food secure is high Abebaw (2003), Yilma (2005), Genene (2006), Teklay (2011). Thus, it is hypothesized that the household head age is positively related to food security status.

Family size (Famsize): this refers to the total number of family members of the household in adult equivalent (AE). It is continuous and an important variable, which determines the household food security status in the study area. As family size increases, the number of mouths to be fed obviously increases which shares the available food in the household Abebaw (2003) Yilma (2005), Genene (2006) Gulled (2006). Hence, the expectation is that family size and food security status are negatively related.

Household head educational status (Educstat): it is a continuous variable. The educational back ground of household head is expected to have a positive impact on the household food

security status. This is because individual who have access to modern education has less resistant to change adoption of improved new way of farming system and enables them to read instructions on fertilizer, pesticides and weed killer packs; and diversification of household income which will enhance households' food supply. As a result it is expected that education will have positive impact on food security.

Sex of household head (Sex): it is a dummy variable of the model taking value of 1 if the household head is male, 0 otherwise. Male-headed households are in a better position to pull labor force than the female headed household. Moreover, with regard to farming experience males are better than the female farmers. A study conducted by Guled (2006) and Genene (2006), Teklay (2011) have indicated that sex of the household head has significant impact on food security status. Therefore, it was hypothesized that sex of household head is positively related to food security status.

Marital status (Martstat): It is a dummy variable representing the respondent's household head and it takes the value of 1 if married, 0 otherwise. The married household head expected to have a positive impact on the household food security status. This is because married household have access to cooperate on the labor supply of agricultural activities and sharing idea regarding to production of food grains than single (unmarried) household head.

Size of cultivated land (Sizeculand): This variable is continuous and represents the total land holding of the household measured in hectares. Total cultivated land owned by household is important resource for food production and is positively associated with food security status Mulugeta (2002), Abebaw (2003) Tesfaye (2005), Teklay (2011). Thus, it is expected that size of cultivated land will have positive impact on food security.

Livestock holding (Livestow): This represents the livestock holding of the households as measured in Tropical livestock unit (TLU). It is a continuous variable and has multiple benefits and is also perceived as a source of draft power, manure, and cash income from sale

of milk, butter, egg and live animals. The household having larger size of livestock can have better food security status Tesfaye, (2005), Mulugeta (2002), Yilma (2005) Guled (2006), Teklay (2011). Hence, it is expected that livestock holding will have positive impact on food security.

Use of improved farm tools (Usimtool): This was a dummy independent variable taking the value 1 if the household use improved farm tools, 0 otherwise. Improved farm tools augmented agricultural productivity by boosting overall production and this in turn contribute to household food security. Hence, it is expected that access to improved farm tools positively associated with food security.

Number of ox/oxen owned (Nooxen): It is a continuous variable measured in number. Oxen power is the main source of traditional means to cultivate land in the study area. It allows effective utilization of land and labor resources. It allows the family labor to pread over peak and slack period to carry out both farm and non-farm activities. HHs with relatively larger number of oxen does have better production and sustainable food security. Thus, it is hypothesized that the number of oxen available to the household increases the probability of the household being food secure Tesfaye (2005), Gulled (2006).

Use of commercial fertilizer (Commfert): It is continuous variable. The use of commercial fertilizer improves yield per unit area, and thus food security Tesfaye (2005), Mulugeta (2002), Yilima (2005). Fertilizer use has been perceived as improving productivity per unit of area. Households using fertilizer are expected to have better food production capacity than the non-users. Hence, it is hypothesized that the households who use commercial fertilizer are expected to be more food secure than the non-users.

Use of improved seed (Useimseed): Seed is the essential agricultural inputs, which affects production. It is a dummy variable taking value of 1, if the farmers used improved seeds and 0 otherwise. Improved seeds, particularly moisture stress resistant varieties can withstand

drought and erratic rain distribution. It increases agricultural productivity by boosting overall production, which in turn contributes to attaining food security at household level. Hence, it is hypothesized that using improved seeds have positive association with household food security Tesfaye (2005).

Access to credit (CrAccess): It is dummy variable. Credit serves as a means to boost production and expand income generating activities. Thus, a household who have access to credit does initiate investment in farm and non-farm activities and enhance sustainable food security. Thus, it is hypothesized that households who have access to credit are expected to be food secure Aschalew (2006).

Use of chemical on crop (Usechem): Agriculture today is plagued by the increasingly wide spread of resistant pests to pesticides (National Research council, 1989). Pests are one of the constraints of food security in the rural society Ehrlich and Ehrlich (1991). Insect and pest infestations are important biological factors restraining crop production and causes of food deficit in the study area. In light of this, it is hypothesized that insect and pest infestations have negative correlations with food security status. It is dummy variable that took value of 1 if the household doesn't face insect and/pest problem and 0 otherwise.

Off-farm/non-farm income (Offincome): Income from the agricultural production may not be the only source of income for the rural household. The success of households and their members in managing food insecurity is largely dependent on their ability to get access to off-farm/non-farm job opportunities in the study area. Hence, it is expected that the availability of off-farm/non-farm income is positively associated with household food security status Ayalew (2003), Yilma (2005), Teklay (2011).

CHAPTER FOUR: RESULTS AND DISCUSSION

4.1. Food Security Status of the Households

Food security at household level measured in many ways. In this study, household caloric acquisition employed to measure household food security status. Household food or calorie acquisition consumption per AE per day is used to identify the sample households as food secure and food insecure. Total calorie consumed by the household in a given period was compared with the minimum recommended calorie of 2100 kcal per AE per day. Based on the result obtained from this calculation, the household categorized as food insecure if their caloric consumption is less than 2100 kcal per AE per day and food secure if its consumption within that period was 2100 kcal per AE per day and above.

Measuring household food security using household caloric acquisition produces a crude estimate of the amount of calorie available for consumption in the household for specific period (Hoddinott 2001). The same author also states that, it is not obvious to respondents how they could manipulate their responses. As the questions are retrospective, rather than prospective, the possibility that individuals or households will change their behavior as a consequence of being observed is lessened (Hoddinott 2001).

As explained above the state of food security at household level was measured by direct survey of consumption on sample respondents. The data on the available food for consumption for the household for the last year was collected. The consumed portion of and the consumed food was converted to calorie then divided by household size. The amount of energy available for the household is compared with the minimum subsistence requirement per AE per day (i.e. 2100 kcal). Accordingly, the food security status of the total sampled households (240) using the computed HFBM result shows that 53.75% (129 households) were found food insecure while 46.25% (111 household) were food secured.

Table 2: Food Security Status of the Total Sampled Households

Household Food Security Status	Frequency	Percent	Cumulative
Food in secured	129	53.75	53.75
Food secured	111	46.25	100.00
Total	240	100.00	

Source: Own Survey Data, 2015

4.2. Demographic and Socio-Economic Characteristics of Sample Households

It is important to describe household's demographic & socio-economic characteristics of sample households for validation of the study results explanations. Hence, in the next sections the characteristics of sample households' such as family size, sex of household head, size of cultivated land, age of household head, educational status of household head, livestock holding, use of improved seeds, number of ox/oxen owned, use of commercial fertilizer, use of improved farm tools, access to credit, marital status of household head, use of chemical on crop and off-farm/non-farm income. These variables are helpful to observe differences among food insecure and secured households.

Age is a continuous explanatory variable peculiar to the household head. In this study, it was used to measure age of the household head in years. In rural households, most household head mostly devote his/her time on farming activities like food production and animal rearing. As shown in the Table 3. The mean age of food secured sample household heads was found to be 36.7 with standard deviation of 0.8775 while mean of food in secured sampled households head and standard deviation was found to be 38 and 0.8191 respectively. The maximum age observed for food secured household was 87 and for food in secured 72 where as the minimum was 26 for food secured and 18 years for food in secured. The chi-square (χ^2)

7.1859 and P-value 0.028 calculated confirms that there is association between age group of household heads and food security.

Table 3: Distribution of sample household's age group

Age of Household Head	Food in secured (N=129)		Food secured (N=111)		Total (N= 240)		Mean Difference	χ^2	P-value
	No.	%	No.	%	No.	%			
18-30	53	41.08	62	55.86	115	47.92	0.078	7.1859	0.028
31-64	61	47.29	42	37.83	103	42.92	0.184		
≥ 65	15	11.63	7	6.3	22	9.17	0.364		
Mean	38		36.7		37.39				
SD	0.8191		0.8775						
Maximum	72		87		87				
Minimum	18		26		18				

Source: Own Survey Data, 2015

Out of the sampled households, 159 household (66.25%) were male headed and 81 (33.75 %) were female headed. Among male-headed households 72 (45.28%) were food secure and 87(54.72%) were food insecure. Likewise, within female-headed households 39 (48.15%) and 42 (51.85%) were food secure and food insecure respectively. In this research it was hypothesized that male-headed households are more likely to be food secure than female-headed ones, because male-headed households are in a better position to pull labor force than the female household. Moreover, with regard to farming experience males are better than female farmers.

The chi-square (χ^2) 0.1772 and p-value 0.674 calculated confirms that there is no association between gender of household head and food security.

Table 4: Distribution of household head by Sex

Sex of Households	Food in secured		Food secured		Total (N= 240)		Mean Difference	χ^2	P-value
	No.	%	No.	%	No.	%			
Female	42	51.85	39	48.15	81	100	0.037	0.177	0.674
Male	87	54.72	72	45.28	159	100	0.094		
Total	129		111		240				

Source: Owen survey data, 2015

The marital status, about 105 households (94.6%) of sample households were married while 4 household (3.6%) and 2 household (1.8%) were divorced and widowed respectively food secured. The rest of the households 93 (72.09%), 2(1.6%), 21(16.27%) 13 (10.08%) were married, unmarried, divorced and widowed respectively, food in secured households.

Table 5: Distribution of sample households by marital status

Marital status of household	Food in secured (N=129)		Food secured (N=111)		Total (N= 240)		Mean Difference	χ^2	P-value
	No.	%	No.	%	No.	%			
Married	93	72.09	105	94.6	198	82.5	0.061	21.1228	0.000
Unmarried	2	1.6	0	0	2	0.8	1		
Divorced	21	16.27	4	3.6	25	10.41	0.68		
Widow/ed	13	10.08	2	1.8	15	6.25	0.73		

Source: Own Survey Data, 2015

Likewise, marital status chi-square (χ^2) 21.1228 and p-value 0.000 calculated confirms that the chi-square test approved there is a systematic association between marital status of the household head and household food security at a significant level of less than 5%. This can be explained in a way that in the study area, for the case of divorced women, the husband generally keeps the land, while the wife often leaves the area in addition with other assets, such as livestock and food grain due to traditional practice of male dominance; hence women might remain with low assets to produce enough for their households.

A number of empirical studies were made to see the influence of family size on state of household food security. This study meant to examine the association between family size and state of household food security. The average family size of the sample household was 5.34.

Table 6: Distribution of Sample Households by Family Size.

Family size in Number	Food in secured (N=129)		Food secured (N=111)		Total (N = 240)		Mean Difference	χ^2	P-value
	No.	%	No.	%	No.	%			
0 -3	14	10.85	9	8.1	23	9.58	0.2174	4.64	0.20
4-6	57	44.19	56	50.5	113	47.08	0.0089		
7-9	45	34.88	42	37.84	87	36.25	0.0345		
10 ≤	13	10.08	4	3.6	17	7.08	0.5294		
Mean	5.6		5		5.32				
SD	0.8188		0.687						
Maximum	11		11		11				
Minimum	2		2		2				

Source: Own Survey Data, 2015

However, it was noted that family size varied between 2 and 11 persons. The largest proportion of the household, about 217 (90.42%) had equal or more than 4 persons per family (see Table 6). Family size was hypothesized to have a negative impact in determining the state of food security, in such a way that a household with large family size tends to be food insecure than those with small numbers. As shown in Table 5 the chi-square (χ^2) test 4.6401 and P-value 0.2 shows that, in the study area there is no association between food security and family size.

The summary result presented in table 7 offers majority of household heads 164 (68.33%) were illiterate, followed by read and write and primary education level consisting of 38 household head (15.83%) and 33 household head (13.75%), respectively. It means that

Table 7: Educational Status of Sample Households during 2007/2015

Education status of household Head	Food in secured (N=129)		Food secured (N=111)		Total (N= 240)		Mean Difference	χ^2	P-value
	No.	%	No.	%	No.	%			
Illiterate	92	71.3	72	64.86	164	68.33	0.122	6.2598	0.10
Literate (Read and Write to high level)	37	28.68	39	35.14	76	31.67	0.0263		
Mean	1.4186		1.5856						
SD	0.71477		0.8992						

Source: Owen survey data, 2015

majority of them 202 (84.16%) were under low level of education. The mean education status and standard deviation of food insecure and secure households were 1.418605 (0.7147735) and 1.585586 (0.8991761), respectively.

It was hypothesized that household food security and education status of the household head has positive relationship. The chi-square (χ^2) 6.2598 and P-value 0.10 for this variable indicates that there is no association between educational status of the household head and food security status.

Agricultural products do not fully meet the needs of farming households. The off-farm/non-farm activities are the most appropriate alternative to improve the level of food security. Four most common non-agricultural activities known in the study area are: 1) Petty trade (grain, vegetable, fruits, etc), 2) Sales of local drinks, 3) Livestock trade and 4) Casually work in cement factories (Mugher, Bed-rock and Dangote) are the major type of off-farm/ non-farm job in the district.

Table 8: Off farm/ non-farm income of sampled households

Off farm/ non-farm income	Food in secured		Food secured		Total		Mean Differe nce	χ^2	P-Vale
	No.	%	No.	%	No.	%			
Yes	13	10.08	76	53.07	151	62.92	0.4172	87.1863	0.000
No	116	89.92	35	31.53	89	37.08	0.910		
Total	129	100	111	100	240	100			

Source: Owen survey data, 2015

Table 8 shows the access of households by off-farm/non-farm income. The survey result showed that 10.08 percent of the sample households food in secured and 53.07 percent involves in off-farm job and earned income from the mentioned job activities. Depending on

different empirical data off-farm income was hypothesized to be found positively associated. The chi-square (χ^2) 87.1863 and p-value 0.000 indicates that there is high association between off-farm income and food security in the district.

Land with its size and fertility is the most important basis for differences in production and wealth between households. In most of the cases farm households point out their meager land resources to explain their low economic status Fekadu and Mequanint (2010). Households in Adea Berge district thought that land holdings are critical resources determining the food security situation of the household. The respondents also revealed that landless households don't have their own crop production, no crop residues for their livestock, mainly engaged in daily laboring. Thus, it was hypothesized that households who own cultivated land are more likely to be food secure.

As indicated in the Table 9 the land holdings among the respondents range from 0 to 10 hectares. In the study area out of the total number of sample respondents 190 households (79.13%) are found to be holding equal to or less than 2.0 ha. Which is more land accessed than rural agricultural household, 86.4 percent of agricultural households own land with areas of two hectares or less (Girma 2006).

The mean comparison of two groups in terms of mean cultivated land size revealed that there is significant difference between food secure and insecure households, which is 2.08 hectares for food secure and 1.05 hectares for food insecure households. Their mean difference was 1.53 hectares. The chi-square (χ^2) 23.5791 and p-value 0.000 in Table 9 ratified that; there is association between cultivated land size and food secure household. Because farmers who have larger cultivated area are more likely to be food secure than those with smaller land area due to the fact that there is high possibility to produce more food.

Table 9: Distribution of sample farmers by cultivated land size

Cultivated land size in hectare	Food in secured (N=129)		Food secured (N=111)		Total (N= 240)		Mean Difference	χ^2	P-value
	No.	%	No.	%	No.	%			
0 -1.01	62	48.06	24	21.62	86	35.83	0.442	23.579	0.000
1.01- 2.0	42	32.56	62	55.86	104	43.3	0.192		
2.01 - 3.0	19	14.73	12	10.81	31	12.92	0.226		
3.1	6	4.65	13	11.71	19	7.92	0.368		
Mean	1.05		2.08				1.53		
SD	0.873		0.885						
Maximum	4		10						
Minimum	0		0						

Source: Owen survey data, 2015

Livestock production plays prominent role in the lives of rural communities. In the study area livestock is mainly reared as source of meat and milk, income, draught power. Sampled households owned include cattle, sheep and goat, equine and poultry. In most cases, rural households often use livestock as measure of wealth and considered as an asset which is liquid and serve as a security against crop failure (Sisay 2008). This can attribute to increase wealth and income base of farm households which makes more money available in households. Hence, it was hypothesized that there is positive relationship between household food security and total livestock holding measured in Tropical Livestock Units (TLU). It was one of the major data taken from the survey.

Table 10 reveals that the maximum and minimum number of TLU was 5 and 1 respectively and the mean value of tropical livestock unit holding of food insecure and secure households were 2.38 and 4.4, respectively. The chi-square (χ^2) 2.3302 and p-value 0.675, indicates that there is no association between household food security and livestock holding in the study area.

Table 10: Distribution of sample households by livestock holding in TLU

livestock holding in TLU	Food in secured (N=129)		Food secured (N=111)		Total (N= 240)		Mean Difference	χ^2	P-value
	No.	%	No.	%	No.	%			
0 -1.40	11	8.53	7	6.31	18	7.5	0.2222	2.3302	0.675
1.41-3.0	32	24.8	24	21.62	56	23.33	0.1429		
3.01-6.0	21	16.28	22	19.82	43	17.92	0.0233		
6.01-9.0	41	31.78	42	37.84	83	34.58	0.0122		
9.01	24	18.60	16	14.41	40	16.67	0.2		
Mean	2.38		4.4		3.3				
SD	1.2609		1.1534						
Maximum	4		5		5				
Minimum	1		3		1				

Source: Owen survey data, 2015

Like most parts of Ethiopia, oxen are the engines for agricultural works in the study area. Oxen are the most valuable units of wealth that farmers possess (Yared, 1999). Sample respondents perceive that if a household has a pair of oxen s/he is considered as independent and self reliant. He/she will never undergo share cropping arrangement nor rent out his/her land due to shortage of oxen. The household assures timely plowing and secured better

production. Oxen are major means of tilling crop land in the district. Among respondents 20 (15.5%) of food insecure and 20 (8.3%) out of respondent households were found to have no oxen at all. The mean oxen ownership was found to be 3.4187 and 1.8919 for food insecure and secure, respectively. Furthermore, the survey result of the chi-square (χ^2) 97.8126 p-value 0.000 also indicating that there is strong association between oxen ownership of respondents and food secure.

Table 11: Distribution of sample households by number of an ox or oxen owned

Number of Ox or oxen owned	Food in secured (N=129)		Food secured (N=111)		Total (N= 240)		Mean Difference	χ^2	P-value
	No.	%	No.	%	No.	%			
0	20	5.5	0	0	20	8.3	1	97.8126	0.000
1	47	6.43	2	1.8	49	20.04	0.9184		
2	34	6.35	22	19.82	56	23.3	0.2143		
3	23	7.83	49	44.14	72	30	0.3611		
4	5	.87	38	32.23	43	17.92	0.7674		
Mean	3.4187		2.22		2.86				
SD	1.0731		0.7787						
Maximum	5		5		5				
Minimum	1		1		1				

Source: Owen survey data, 2015

Credit service can be obtained from formal and non-formal sources. However, the respondents involve (participate) in this survey were clients of formal credit source (Oromia Saving and Credit Sh.Co, Wassasa saving and credit Microfinance Sh.Co, Vision Fund Microfinance Institution) which is exist in the district.

The formal sector (micro finances) provides microcredit to the farming community for productive purpose such as provision of fertilizer, improved seed, chemical and modern bee-hive. Fear of inability to repay interest rate of loan was the main reason for the low level of credit use in the district. When this survey data collected the credit users borrowed money from mentioned above micro finances in 2014/15 cropping year.

Table 12: Credit users and non-users food security status

Credit Users and Non-Users	Food in secured (N =129)		Food secured (N =111)		Total (N =240)		Mean Differe nce	χ^2	P-value
	No.	%	No.	%	No.	%			
Non-credit user	71	55.04	49	44.14	120	50	0.1833	2.8326	0.092
Credit user	58	44.96	62	55.86	120	50	0.0333		
Total	129	100	111	100	240	100	0.075		

Source: Owen survey data, 2015

Based on food security the result obtained from the survey shows that 58 (44.96%) of households are food in secured credit users households, whereas non-credit user food in secured households are 71(55.04%). In another case, 62 (55.86%) credit users' households and 49 (44.14%) non-credit users household were food secured during data was gathered from the respondents. Thus, it is hypothesized that households who have access to credit are expected to be food secure. In contrast, the chi-square (χ^2) 2.8326 and p-value 0.092 in table indicates there is no association between food security and credit in the study area.

Based on different empirical findings it was hypothesized that fertilizer utilization raise agricultural productivity through improving land fertility. Hence, it was expected that fertilizer utilization will contribute towards attaining households' food security. Table 13 reveals that the mean of commercial fertilizer used by food secured household were 368 kg

and 151 kg by food in secured household during their last cropping season. According to food insecure respondents, the major reasons for low use of fertilizer among in secured

Table 13: Use of commercial fertilizers

Use of commercial Fertilizers (in kg)	Food insecure (N= 129)		Food secure (N= 111)		Total (N = 240)		Mean Difference	χ^2	P-value
	No.	%	No.	%	No.	%			
0-100	20	15.5	0	0	20	8.33	1	76.798	0.000
101 - 200	43	33.33	8	7.21	51	21.25	0.6863		
201-300	24	18.60	14	12.61	38	15.83	0.2632		
301 - 400	22	17.05	17	15.32	39	16.25	0.1282		
401 - 500	12	9.30	32	28.9	44	18.33	0.4545		
≥ 501	8	6.2	40	36.04	48	2	0.6667		
Mean	151		368		252.3				
SD	1.4353		1.2700						
Maximum	450		650		650				
Minimum	0		0		0				

Source: Owen survey data, 2015

households include soil fertility condition, financial capacity, high price, prepare and use of compost, untimely supply (too early or too late) of inputs and fear of agricultural production risk (in low land area). The chi-square (χ^2) test of association of households who utilize fertilizer between the two groups indicates there is high association. This implies that fertilizer utilization in the study area could help to discriminate households in to food secured and in secured.

Use of improved seed was hypothesized to be positively or directly related to food security. Different researcher writes factors which can affect food security in Ethiopia: One of the factors often cited as cause for that cause food crises in Ethiopia is traditional agricultural practices. The use of traditional farm tools and implements, low-level use of improved agricultural inputs such as fertilizer, improved seed, and pesticides, inadequate post harvest technologies are believed to have, slowed the growth of agricultural production in general and of food grain production in particular. Among these low levels of improved seed utilization is considered as tradition for dependency on traditional farming. Therefore, use of improved seeds helps farmers to produce more and ultimately improve the food security situation (Tefera. 2009).

Table 14: Distribution of sample households by use of improved seeds

Use of improved seeds	Food in secured		Food secured		Total		Mean Difference	χ^2	P-Value
	No.	%	No.	%	No.	%			
Yes	3	2.33	67	60.36	70	29.17	0.9143	97.264	0.000
No	126	97.67	44	39.64	170	70.83	0.4824		
Total	129	100	111	100	240	100	0.075		

Source: Owen survey data, 2015

In this study the number and percentage of improved seed users among the food insecure and secure households was 3(2.33%) and 67 (60.36%) respectively. Furthermore, the chi-square (χ^2) 97.2643 and P-value 0.000 also ratifies that there is high association between use of improved seed and food security. The percent of households not used improved seed among food in secured were found to be very high (97.67%). The reasons justified by respondents

were high price, shortage of supply on time and financial capacity were the major factors to limit use of improved seed in district.

Insect and Pest infestation are biological factors limiting crop production and causes of food deficit in the study area. As a result, it was hypothesized that farmers with problem of pest infestation and fungal (*wagi*) crop disease are more likely to be food insecure than those who don't have the problem. In light of this, the chi-square (χ^2) 85.3022 analysis showed that the absence of rain fall, pest incidence, fungal diseases and poor health situation of the farmers were the problem associated with the state of food security at study area. Pest infestation is highly chronic problem in the low land sampled area whereas; fungal (*wagi*) crop disease was become common immense problem in high land and midland of the district. About 24.03% of food insecure farmers and 83.78% of food secure farmers reported to have the insect and pest infestation incidence problem.

Table 15: Use of Chemicals on Crops

Use of Chemicals on Crop	Food In Secured		Food Secured		Total		Mean Difference	χ^2	P-value
	No.	%	No.	%	No.	%			
Yes	31	24.03	93	83.78	124	51.67	0.5	85.3022	0.000
No	98	75.97	18	16.22	116	48.33	0.690		
Total	129	100	111	100	240	100	0.075		

Source: Own Survey Data, 2015

Use of improved farm tools was hypothesized to be positively related to food security. In this study the number and percentage of improved farm tools users among the food insecure and secure households was 20 (15.50%) and 72(64.86%) respectively. Likewise, the chi-square

(χ^2) and P-value 0.000 also improve that there is high association between use of improved farm tools and food security. The percentages of households which do not utilize improved farm tools among food in secured were found to be very high 98 (75.97%). Lack of information about agricultural improved tools, high price (too expensive) of the materials; no supply and shortage of financial capacity were the major reasons listed by respondents which can limit use of improved tools in Adea Berga district.

Table 16: Use of Improved Farm Tools by households

Use of improved Tools	Food in Secured		Food Secured		Total		Mean Difference	χ^2	P-value
	No.	%	No.	%	No.	%			
Yes	20	15.50	72	64.86	92	38.33	0.5652	61.4953	0.000
No	109	84.50	39	35.14	148	61.67	0.4730		
Total	129	100	111	100	240	100	0.075		

Source: Own Survey Data, 2015

4.3. The Result of the Logit Model

Logistic regression model was used to identify determinants of food security in the area. Accordingly, variables assumed to have influence on household food security in different contexts were tested in the model and out of fourteen (14) variables eight (8) of them were found to be significant. Among variables fitted in to the model size of cultivated land, use of commercial fertilizers, use of improved seeds, use of improved tools, use of chemical on crop and off-farm/non-farm income are found to be significant.

Table 17: The results of the logit model

<i>Foodsecu</i>	<i>Coef.</i>	<i>Std. Err.</i>	<i>Z</i>	<i>P> z </i>	<i>Odds Ratio</i>	<i>Marginal Effect (dy/dx)</i>
Sex	0.0362962	1.515	0.02	0.981	1.036963	0.0084351
Famsize	-0.2208148	0.9640822	-0.23	0.819	0.8018652	-0.0512371
Martstat	-2.573407	1.694488	-1.52	0.129	0.0762752	-0.597124
Commfert	1.256551	.6338441	1.98	0.047	3.513283	0.2915655
Useimseed	7.114401	3.101355	2.29	0.022	1229.547	0.8176211
Usimtool	5.162241	2.034773	2.54	0.011	174.5552	0.7834315
Usechem	4.311729	1.730029	2.49	0.013	74.56934	0.7756538
Livestow	-1.73851	.8415397	-2.07	0.039	0.1757821	-0.4033976
Nooxen	-2.475781	0.7924551	-3.12	0.002	0.0840973	-0.5744712
Offincome	5.783324	2.661164	2.55	0.011	882.9986	0.8691517
Educstat	-1.788095	1.434499	-1.25	0.213	0.1672786	-0.414903
Sizeculand	2.283906	1.146651	1.99	0.046	9.814942	0.5299492
Age	2.420244	1.312262	1.84	0.065	0.0888999	0.5615846
CrAccess	-1.149277	1.408005	-0.82	0.414	0.3168656	-0.2610375
_cons	5.36303	5.489852	1.16	0.246		0.0084351

Source: STATA output from own data

Size of cultivated land (Sizeculand): It is prominent resource expected to be associated with food security status. The model result pointed out that size of cultivated land and household food security has positive relationship and significant (5% probability level) in Adea Berga district (Table 17). This means households with large cultivated land produce more for household consumption and for sale and have better chance to be food secure than those having relatively small size of cultivated land. The odds ratio for this variable is 9.814942. This implies that maintaining other determinants constant, additional hectare of cultivated land will enhance food security status of the household by factor of 9.814942 holdings all other things remain constant and vice versa. On the other hand with one-hectare increase in

the cultivated land size, the probability of household being food secure will increase by 52.9 percent. This result is in line with the prior expectation of the researcher and empirical findings of (Teklay 2011), (Getinet 2011), (Mesay 2012).

Off-farm/non-farm income (Offincome): It was hypothesized to have positive association with household food security and the model output illustrates that it is significant at 5 % probability level and has positive relationship with probability of food security (Table 17). In this particular study, householders who solely depend on farm activities have inadequate income to purchase farm inputs and fulfill family needs and thus, they are found to be food insecure. This shows that off-farm/non-farm job opportunities play prominent role in managing household food security in Adea Berga district. The odds ratio in favor of food secure increases by factor of 882.9986 when off-farm/ non-farm income increases in birr by holding other things remain the same. In similar way if the off-farm/non-farm income increases by one, and other things held constant the probability of household being food secure will increase by 86.92 percent. Likewise, this finding is consistent with (Yilma 2005), (Getinet 2011), (Mesay 2011).

Use of commercial fertilizer (Commfert): It is another factor which was hypothesized to have positive association in the study area. The model result pointed out that use of commercial fertilizer was significant at 5 % probability level impact on household food security. When the household's utilization of chemical fertilizers is increases by one kilogram (1kg) and other variables remain constant the probability of household being food secured increased by 29.16 percent. The odds ratio for this variable was also found to be 3.513283. This means that the odds ratio result revealed that as a household uses one more kilogram of commercial fertilizer on his/her farm land a household more likely to become food secure by

factor of 3.513283 compared to those unused households. It was consistent with finding of (Tesfaye 2005), (Teklay 2011).

Livestock ownership (Livestow): It was found to have significant at less than 5% probability level and negative relationship with household food security (Table 17). Unfortunately, the result of the model turned out to be against prior expectation of the researcher and empirical finding of Tsegay (2009), Meseret (2012) and Mesay (2012) that households who possess large herd Livestock had higher probabilities of being food secure due to they can earn more income from livestock production and get opportunity to consume animal products.

The model result pointed out is that the marginal effect result implied as the number of livestock increases by one (1) more unit the probability food secured decreases by 40.34 percent. The odds ratio in favor of food security decreases by factor of 0.1757821. The probability that a house hold being food insecure increase by 40.34 percents when other thing is *ceteris paribus*. Even though, it is difficult to point out why this result happens for sure. Such kind of negatively relationship was shown on the households had 1.40 and above LTU. From this it is possible to understand as number of TLU increases the probability of food insecure of household is also increase and vice versa. This result may be due to cultivated land occupied by animal grass (pastures). It leads to reduce agricultural farm land size for cultivation and followed by declining of crop productivity. In addition to this when the number of livestock increase the farmer incurred more cost to buy hay, crop residue from relatives who hold less livestock, industrial by product in order to feed their livestock. Due to this more holding livestock exposed the households to food in secured in the study area.

Use of chemical on crops (Usechem): this variable is found to be positive and significant at less than 5% probability level. The positive sign is an indicator of its influence in increasing food security status. The result indicates that those households who have access to use of chemical on their crops to protect crop disease and pest infestation are more likely to be food secure than those who have no access. The odds ratio of 74.56934 for this variable indicates that, assuming other factors are constant, the odds ratio in favor of being food secure increases by a factor of 72.56934 as a farmer increases the use of pest and herbicides by one unit. The marginal effect of this variable also revealed that if households use chemicals on their crops when pest infestation and crop disease shows and increase utilization of this chemicals by one unit than other farmers those who are not use the probability of households being food secure increases by probability of 77.5 percent.

Number of ox/oxen own (Nooxen): It was significant at 5% level of probability and has negative association with household food security (Table 17). Oxen are main traction power in rural households of the district. Often times oxen plowing allows effective utilization of land and labor resources, and this in turn enables households to have better chance to increase food production. But the model output shows the negative relationship with food security. The marginal effect of the model describe that when households increase one ox and other variables remain the same the probability of households to become food insecure increases by 57.45 percents. It has also similar reason with number of livestock owned by household.

Use of improved seeds (Useimseed): It is another factor which was hypothesized to have positive association relation in the study area. The model revealed that use of improved seeds was significant at 5 % probability level impact on household food security. When the household's utilization of improved seeds is increases by one unit and other variables held constant the probability of household being to food secured will be increases by 81.76

percent. The odds ratio for this variable was also found to be 1229.547. This means the odds ratio result show as a household uses one unit of improved seed on his/her farm land the probability of a household to become food secure increases by factor of 1229.547.

Use of improved tools (Usimtool): This variable has positive influence on the probability of food security situation, which is significant at 5% level. This means those farmers who have access to improved tools use are more likely to be food secure compare to those who have no access to improved tools. The result indicates that, other factor kept constant, the odds ratio in favor of being food secure increases by a factor of 174.5552 as a farm households improved tools use increases by one unit. Likewise, the marginal effect also ratifies that if the household's uses improved seeds is increases by one unit and other variables unchanged the probability of household being to food secured will be increases by 78.34 percent.

Age of household head (Age): this variable showed a positive relation with food security and is significant at 10% probability level. This means that an increase in the age of household head increases the likelihood for the household to become food secure. This is possible because farmers get more and more experience in their farming operation, climatic knowledge of their area, accumulate wealth and use better planning than the younger ones. Hence, they have better chance to become food secure. This result agrees with the prior expectation of the researcher and the findings of Abebaw Shimeles (2003) and Ayalew Yimer (2003).

The odds ratio, keeping other factor unchanged, in favor of food security increases by a factor of 0.0889 when age of the household head increases by one year. One year increase in the age of the household head will result in an increase the probability of being food secure by about 56%.

CHAPTER FIVE: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1. Summary

This study was conducted in Adea Berga District, Western Showa Zone, Oromia National State. Mixed farming is found to be the prominent means of living in the district. The sector is underdeveloped and is characterized by low production and productivity. Recurrent drought and food shortage are found to be the common phenomena in the area. The combined effect of these and other related factors led the majority 53.75% of the households in the district to be food insecure. Food consumption of most farm households is below the minimum calorie requirement (2100 kcal/day/AE) set by the Ethiopian Health and Nutrition Research Institute (EHNRI).

The specific objectives of the study were to analysis the major determinants of food security of households in the study area; to measure and explain the food security situation of the district. Simple random sampling method was administered to select five PAs were selected among 37 PAs in the district. In another hand, proportional probability sampling (PPS) technique was employed to select sample households from selected five PAs by applying (Cochran 1977) formula, and 240 household respondents were selected. Semi structured interview schedule was used to collect the data from respondents. The data were analyzed employing descriptive statistics (by the help of STATA/SE 12.0 software; frequencies, mean, standard deviation, percentage, total, Pearson Chi-square (χ^2) and logistic regression model. Food secure and insecure households were identified based on the calorie intake extracted from the size and pattern of food consumption of each household. Potential variables presumed to determine state of food security at household level were analyzed with logistic regression model.

According to the result of the study 129 (53.75%) of sample households were found to be food in secured and 111 (46.25%) sampled households food secured. Food secured households were characterized by relatively large land resource endowments, significant income from off-farm and non-farm activities, and better use of improved seeds, improved farm tools, commercial fertilizer, age of household head, pesticides and herbicides. Z-test was employed to look into variables influence on state of household food security. All factors including use of commercial fertilizer, cultivated land size, total livestock holding, number of oxen owned, and other asset holdings significantly influence household food security. On the other hand among dummy variables, off-farm/non-farm income, use of chemicals on crop, use of improved tools, improve seeds were found to have significant association with household food security status.

In the logistic regression model, numbers of ox owned and total livestock holding, have significant and negative relationship with state of household food security. The rests of the variables, as expected, display positive relationship and significant association with household food security. Farm households with large land size, and increasing utilize of agricultural input were found to be less prone to food insecurity. Active involvement in off-farm/ non-farm activities significantly affects food security in the study area.

5.2. Conclusion

Food security is a multi dimensional issue. It is affected by a number of factors that vary between places. The major concluding remarks are based on, among others, survey findings, personal observations and community opinions.

The food insecurity problem in the district can be the result of unavailability of food to the household and/or poor utilization of the available food. Problem of food insecurity has implication on human nutrition and productivity in general. Food is not the only input in case of nutrition and food utilization. This implies that increased food access will not necessarily improve food utilization where other non-food factors are not favorable. The other cause might be ignorance. Households may not be aware of all components of healthy diet. Thus, efforts should be made towards improving food supply and proper utilization of food. Complementary approach between development activities and health and nutritional interventions should also be made. It is often essential to measure the severity of food insecurity as well as determine its effects across household members to find appropriate solution and precisely address problem of food insecurity.

5.3. Recommendations

Based on the research result the researcher has tried to forward certain suggestions in order to alleviate the existing situation of households' food in security in the study area:

An off-farm/non-farm income is among the major socio-economic variables that influence the state of household food security. Promoting and expanding non-farm activities are essential especially for those who have little or no land for cultivation. Indigenous skills associated with organize by micro and small scale enterprise of wood-work, metal-work, fast-food preparation, pottery etc. should be given prior attention in the study area. Trainings should be geared towards raising their skills so as to meet increased off-farm income and improved food security. People of similar interest and skill can be organized into cooperatives to enhance access to trainings facilities. In this regard the role of Technique and Vocational Training Office, Mughar Cement Factory Technical and Training Department and NGOs working in the area will be paramount.

Age is one of the major factors having significant and positive association with household food security. Keeping other factors constant elderly households are less prone to food insecurity than younger household heads. Long experience often matters to exploit indigenous practices and incorporate into development interventions to make agriculture moving forward. Thus, intervention that involve aged households enable to share their life long experience to younger household heads should be devised and implemented.

Size of cultivated land was found to have positive influence on household food security. Agricultural strategies should be designed and implemented that would have effect on maintaining the existing land size by promoting intensive agriculture. Measures such as appropriate land use, improved technologies should be in place to raise land productivity. Rural development plans should include government and non-governmental organization in promoting biophysical conservation activities.

Use of Improved seed was positively associated with food security in the study area. Improved seed augmented agricultural production and improved the food security situation of farmers. Introduction of different varieties of improved seed required appropriate attention by relevant actors. Strengthen linkage among farmer, extension and research to the required levels highly recommended in order to make the technology more suitable to end users.

Utilization of commercial fertilizer was found to be very significant and had a positive relation with food security status. By default, it is understood that farm inputs like fertilizers, seeds, insecticides and others increase production and productivity. This in turn increases own consumption thereby results in improved household food security status. This study found that, it had defects with regard to timely delivery by the suppliers and following the recommendation application. Therefore, strong awareness creating campaign need to be

organized by the district office of agriculture and/or cooperatives in order to make the rural households understand the benefit of using the recommended amount per area of land in the study area. Besides, timely delivery of inputs facilitation is mandatory to rise up technology use by small holders and then increase production and improve productivity, hence, to see households food secured.

Adada-Sodolbe, Biyo-Wogidi and Ejere-Negao are the most wide spread crop disease incidences in the study area which adversely affect crop production. The former seriously affects the productivity of wheat, bean, pea, barley and '*teff*' which are the dominant crops in the study area. Hence, the district agricultural office in cooperation with other concerned bodies is advised to address it.

Finally, more rigorous research works are advised to be under taken especially in the issues of fertilizer utilization, agricultural inputs like hybrids seeds, improved farm tools and crop diseases widely spread in the study area.

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Marginal effects after logit

$y = \text{Pr}(\text{Foodsecu})$ (predict)

= 0.63402847

Table 18: Marginal effects

<i>Variable</i>	<i>dy/dx</i>	<i>Std. Err.</i>	<i>z</i>	<i>P>z</i>	[95% C.I.]	<i>X</i>
Sex*	.0084351	.35239	0.02	0.981	-.682228 .699098	.6625
Famsize	-.0512371	.22411	-0.23	0.819	-.490487 .388012	2.40833
Martstat	-.597124	.41828	-1.43	0.153	-1.41694 .222695	1.40417
Commfert	.2915655	.13806	2.11	0.035	.020966 .562165	3.75
Useims~d*	.8176211	.13629	6.00	0.000	.550489 1.08475	.291667
Usimtool*	.7834315	.15438	5.07	0.000	.480861 1.086	.383333
Usechem*	.7756538	.1615	4.80	0.000	.459127 1.09218	.516667
Livestow	-.4033976	.20156	-2.00	0.045	-.798443 -.008352	3.29583
Nooxen	-.5744712	.20593	-2.79	0.005	-.978091 -.170852	2.7125
Offinc~e*	.8691517	.11257	7.72	0.000	.648519 1.08978	.370833
Educstat	-.414903	.31123	-1.33	0.183	-1.02491 .195106	1.49583
Sizecu~d	.5299492	.2747	1.93	0.054	-.008452 1.06835	1.92917
Age	.5615846	.3248	1.73	0.084	1.19818 .07501	1.61667
CrAccess*	-.2610375	.31092	-0.84	0.401	-.870436 .348361	.5

(*) dy/dx is for discrete change of dummy variable from 0 to 1

Source: STATA output from own data

Table 19: Logistic regression

<i>Foodsecu</i>	<i>Odds Ratio</i>	<i>Std. Err.</i>	<i>Z</i>	<i>P>z</i>	<i>[95% Conf.</i>	<i>Interval]</i>
Sex	1.036963	1.570999	0.02	0.981	.0532345	20.19916
Famsize	.8018652	.7730639	-0.23	0.819	.1211918	5.30554
Martstat	.0762752	.1292474	-1.52	0.129	.0027544	2.112195
Commfert	3.513283	2.226874	1.98	0.047	1.014341	12.16865
Useimseed	1229.547	3813.263	2.29	0.022	2.817523	536566.1
Usimtool	174.5552	355.1803	2.54	0.011	3.235421	9417.486
Usechem	74.56934	129.0071	2.49	0.013	2.511639	2213.927
Livestow	.1757821	.1479276	-2.07	0.039	.0337796	.9147334
Nooxen	.0840973	.0666433	-3.12	0.002	.0177927	.3974852
Offincome	882.9986	2349.804	2.55	0.011	4.794829	162609.8
Educstat	.1672786	.2399609	-1.25	0.213	.0100553	2.782837
Sizeculand	9.814942	11.25431	1.99	0.046	1.037186	92.87931
Age	.0888999	.11666	1.84	0.065	.0067905	1.16386
CrAccess	.3168656	.4461484	-0.82	0.414	.0200622	5.004622

Source: STATA output from own data

APPENDIX

Appendix 1: Calorie composition of food consumed by sample households

Food items	Unit	Kilocalorie
Barley	Kg	3723
Maize	Kg	3751
Sorghum	Kg	3805
Teff	Kg	3589
Wheat	Kg	3623
Irish potato	Kg	1037
Sweet potato	Kg	1360
Lentil	Kg	3522
Broad beans	Kg	3514
Peas	Kg	3553
Onion	Kg	713
Pepper	Kg	933
Beef	Kg	1148
Milk	Liter	737
Egg	Unit	61
Sugar	Kg	3850
Butter	Kg	7364
Edible oil	Lit	8964
Vetch	Kg	3470
Coffee	Kg	1103

Source: EHNRI, 1997 (Ethiopian health and nutrition research institute)

Appendix 2: Conversion factor used to calculate adult equivalence scales

Age groups (years)	Male	Female
0-2	0.40	0.40
3-4	0.48	0.48
5-6	0.56	0.56
7-8	0.64	0.64
9-10	0.76	0.76
11-12	0.80	0.88
13-14	1.00	1.00
15-18	1.20	1.00
19-59	1.00	0.88
60+	0.88	0.72

Source: World Bank (1986)

Appendix 3: Caloric content of the food consumed in the study area

Group No.	Food items	Food energy in Kcal per 100 grams portion
1	Cereals	
	Maize	
	White porridge	154.70
	White bread	223.40
	Injera	153.00
	Whole roasted	88.10
	White kitaa	223.40
	Wheat	
	Bread	222.00
	Kitaa	222.00
	Teff	
	Injera	358.80
	Porridge	165.40
2	Vegetables	

	Onion	71.30
	Cabbage	40.10
	Tomato	30.70
	Green pepper	46.50
3	Livestock products	
	Milk	73.70
	Meat	212.30
	Egg	295.10
	Cheese	132.40
	Butter	736.40
4	Others	
	Oil	896.40

Source: Ethiopian Health and Nutrition Research Institute (EHNRI, 1998).

Appendix 4: Survey Questionnaire

Determinants of Households Food Security in Adea Berga District

Instruction to enumerators

1. Make brief introduction to each respondents before starting any question, get introduced to the farmers (greet them in the local way), get his/her name, tell them yours, the institutions you are working for, and make clear the purpose and objective of your questions.
2. Please ask each question so clearly and patiently until the respondents understands (gets your point).
3. Please fill up the questionnaire according to the respondents reply (do not put own opinion).
4. Please do not try to use technical terms while discussing with respondents and do not forget local unit.
5. Circle the letter / number for all closed questions and write respondents' answer on

the space provided.

6. Use only pencil

GENERAL INFORMATION

1. SECTION: IDENTIFICATION OF RESPONDENT

1. Peasant Association-----
2. Village Name-----
3. Name of head of the household-----
4. Name of the enumerator/Interviewer-----
5. Type of Household
 - I. Male headed -----
 - II. Female headed -----

2. SECTION: DEMOGRAPHIC, ECONOMIC AND SOCIAL CHARACTERISTICS OF THE HOUSEHOLD

2.1. Household Information:

Serial No.	Name of the Household Member's (start from 'household head', then use age sequence: in a descending order)	Relationship to HH head (code)	Sex Male=1 Female=2	Age (in completers.)	Education (Highest class passed) (code)	Marital Status (code)
1.						
2.						
3.						
4.						
5.						
6.						
7.						

➔ Relationship to HH head (code):

Head=1, Wife/husband=2, Son/daughter= 3 Parent =4,
Grandchild =5, Brother/sister=6, other relatives=7, Not related=8

Education level (Code):

Illiterate =1, Can read and writes Afan Oromo/Amharic=2,

If attended school write No. of grades _____

Marital Status (code): _____

Married=1, Unmarried=2, Divorced/separated=3,
Widow=4, Abandoned=5,

3. SECTION: LAND RESOURCES

3.1. Do you have access to land? _____ 1. Yes 2. No

3.2. If the answer to Q3.1 is yes, what is the source of land?

1. Owned
2. Rented
3. Share cropping
4. Lease
5. Others sources, please specify _____

3.3. If the answer to Q3.1 is not what is the sources of food?

1. Purchase 2. From friends/relatives 3. Others _____

3.4. If the answer to Q3.1 yes, what is the total size of your land? _____ ‘timad /

Fachasa’

1. Cultivated area _____ 2. Grazing area _____
3. Fallow area _____ 4. Forest area _____
5. Others (specify) _____

4. SECTION: CROP PRODUCTION

4.1. List the type of crops you cultivated and their average production (including garden crops) for the last two years.

Type of crops	2005 E.C.		2006 E.C.	
	Area (<i>timad</i> / <i>Fachasa</i>)	Production (Qt)	Area (<i>timad</i> / <i>Fachasa</i>)	Production (Qt)
Annual crops				
1.				
2.				
3.				
4.				
Perennial crops				
1.				
2.				

4.2. Is what did you produce last year enough for your family? _____1. Yes 2. No

4.3. If yes for question No.4.2, what amount of grain stock was transferred to this year?_____Qts

4.4. If not for question No.4.2, for how long did you consume the product? For _____months.

4.5. What do you think the main causes of the food deficit of last year? (Put them of importance)

- | | |
|--|--------------------------------------|
| 1. Absence of adequate rainfall_____ | 2.Disease and pest infestation _____ |
| 3. Shortage of cultivated land_____ | 4. Poor quality of land _____ |
| 5. Too much rain ____ | 6. Animal disease _____ |
| 7. Poor health situation of the farmers_____ | 8. Others (specify) _____ |

4.6. During which months food shortages sever? _____month(s)

4.7. How did you cover the deficit? _____

1. Purchased food on cash

4. Borrow from neighbors

2. Sale of animals

5. Received gifts or remittance

3. Income from off-farm work in the locality

6. Others (specify)_____

4.8. What problems did you encounter in your farm operation last year? _____

1. Shortage of oxen

6. Crop disease problems

2. Shortage of labor

7. Shortage of rain

3. Shortage of live stock feed

8. Weeds and Pest problem

4. Shortage of improved seed

9. Low price of product

5. Shortage of chemical fertilizer

4.9. Do you use any irrigation scheme? _____ 1. Yes 2. No

4.10. If yes what type of it? _____ 1. Modern 2. Traditional 3. Both_____

4.11. If yes for question No. 4.10, what types of crops did you produce using irrigation?

Type of crops	2005 E.C		2006 E.C	
	Area (<i>timad/ Fachasa</i>)	Production (Qt)	Area (<i>timad / Fachasa</i>)	Production (Qt)
Annual crops				
1.				
2.				
3.				
4.				

5. SECTION: USE OF MODERN AGRICULTURAL INPUTS

5.1. Do you have access to commercial fertilizer? _____ 1. Yes 2. No

5.2. If the answer to the above question is yes, total amount of fertilizer used _____KG

5.3. If you didn't use commercial fertilizer, why?

- | | |
|---------------------------------------|------------------------|
| 1. Not necessary for cultivated crops | 4. Shortage of income |
| 2. Too expensive | 5. Lack of credit |
| 3. Land is fertile | 6. Other, specify_____ |

5.4. Do you have access to improved seed? _____ 1. Yes 2. No

5.5. If you do not use an improved seed on your farm what are the possible reasons?

- | | |
|------------------------------|----------------------------------|
| 1. Not heard about it | 3. Too expensive |
| 2. Not available (no supply) | 4. Other reasons (specify) _____ |

5.6. Do you use improved farm tools? _____ 1. Yes 2. No

5.7. If you do not use improved farm tools, why?

- | | |
|----------------------------------|---------------------------------|
| 1. Not available (no supply) | 4. Shortage of income |
| 2. Too expensive | 5. Lack of information about it |
| 3. Other reasons, (specify)_____ | |

5.8. Did you apply Herbicides, Pesticide or Fungal disease (*wagi*) medicine on your crops?

_____ 1. Yes 2. No

5.9. If not for question No. 5.7, why? _____

- | | |
|--|-----------------------|
| 1. Not available | 2. Too expensive |
| 3. No problem of weed, pest and fungal disease (<i>wagi</i>) | 4. Not heard about it |
| 5. Others (specify)_____ | |

6. SECTION: LIVESTOCK PRODUCTION

6.1. Do you own livestock? _____ 1. Yes 2. No

6.2. If yes, indicate the number of livestock owned in the following table:

Type of livestock owned	No. of livestock	Average price in (Birr)	No. born during last year	No. died during last year	Causes for deaths (Code) 1.Drought 2.Accidental	Sold during 2000E.C			No. of slaughtered
						Number	Total sales	Reasons for sale	
Oxen/bull									
Young bull									
Cows (Milking)									
Cows (Non-milking)									
Heifer									
Sheep									
Goat									
Donkey									
Horse									
Mule									
Others specify									

➤ Reasons for sale: to buy some food items for family consumption= 01;

To purchase Clothes=02; to purchase agricultural inputs and implements =03;

to pay taxes and other loans=04; Social obligations =05;

to purchase farm oxen =06; to cover health and education Expenses= 07;

Others specify. _____

➤ Reasons for deaths: disease=01; accident=02; other specify = 03

6.3. What do you use to till your land?_____

1. Hand tools/hoe 2. Rented oxen 3. Owned oxen 4.Other,
specify_____

6.4. If you use oxen for your farm operation, are they enough for your farm operation?

_____1. Yes 2.No

6.5. If you don't have enough oxen, how do you get additional oxen for your farm operation?

1. Hire from someone 2. Coupling with other farmer
3. Borrow from friends 4. By contributing labor to a person who has oxen
- 5.Others (specify)_____

6.6. Do you have enough feed for your animal? _____ 1. Yes 2. No

6.7. What is the source of feed for your livestock during wet season?_____

1. Own grazing land 5. Crop residue
2. Communal grazing land 6. Industrial by-products
3. Purchased hay 7. All
4. Improved pasture/forage 8. Others (specify)_____

6.8. If your answer for question No. 6.6 is no, how do you cover the deficit?_____

1. Purchase of pastureland 3.Do nothing
2. Give out the livestock temporarily to relatives 4.Other (specify) _____

6.9. Do you have exotic animal breed? _____1. Yes 2. No

6.10. What are the major livestock problems?_____

1. Animal diseases 2. Shortage of drinking water
 3. Shortage of feed 4. Other,
- specify_____

7. SECTION : HOUSEHOLD INCOME

7.1. Do you or any member of your family have off-farm/non-farm job? ____1. Yes 2. No

7.2. If yes, indicate the type of work and annual income for the year 2006 E.C.

Family member	Type of off -farm/non-farm job/ Jobs	Annual income (Birr) 2006 E.C

1. Head		
2. Spouse (Wife/husband)		
3. Son		
4. Daughter		
5. Grand child		
6. Relative		
7. Other(specify)		
8. Not related		

7.3. Type of off -farm/non- farm Jobs:

- | | |
|--|--|
| 1. Weaving/spinning | 6. Agricultural employment |
| 2. Milling | 7. Sale of fire wood and grass |
| 3. Other handcrafts (pottery, metal etc) | 8. Petty trading (grain, vegetable, fruits, etc) |
| 4. Livestock trade | 9. Daily laboring (specify), |
| 5. Sale of local drinks | 10. Others_____ |

7.4. Who is the major actor of agricultural practices under operation?

- | | | |
|----------|----------------|-----------------------|
| 1. Women | 3. Children | 5. Communal work |
| 2. Men | 4. Labor hired | 6. Other, specify____ |

8. SECTION: HOUSEHOLD ASSETS

8.1.If you have the following items currently, please complete the following table.

S/No.	Items	Amount	Estimated value in Birr
1.	House		
2.	Mud wall and grass roofed		
3.	Mud wall and Iron-sheet roofed		
4.	Stone wall and grass roofed		
5.	Stone wall and Iron-sheet roofed		
6.	Stored agricultural product		
7.	Valuables		

8.	Jewelry		
9.	Wrist watches		
10.	Agricultural equipment		
11.	Hoe		
12.	Spade		
13.	Maresha		
14.	Sickle		
15.	Axe		
16.	Others		
17.	Non agricultural equipment		
18.	Carpenter equipment		
19.	Black smith equipment		
20.	Weaving equipment		
21.	Building equipment		
22.	Others		
23.	Household goods		
24.	Bed		
25.	Tables & chairs		
26.	Radio/tape recorder		
27.	Cupboard		

9. SECTION: INFORMATION ON HOUSEHOLD CREDIT IN THE LAST TWO YEARS.

9.1. Household Credit Accessibility

a) How far is the Closest bank branch from your house?	b) Does any member of household have any bank account? Yes=1 No=0	c) Does any member of household have any savings account in the credit Association Institutions? Yes=1 No=0	d) In the last one year has any member of the household applied for any Credit? Yes=1 >>Q.9.1 No=0 >> Q.e	e) Reason(s) for not applying for any credit?
Reason for not applying (code): Lack of collateral=1; record of default loan=2; other, please specify=3.				

Amount of credit received (State separately very individual credit taking)	Amount of credit	Source (s) of credit (code)	Rate of interest (monthly/yearly)	Main reasons for taking loan? (code)	Real usage of loan (code)	Type of costs faced while availing credit (Specify time required to go to the place, cost of transport,	Number of years the household is receiving credit from formal or quasi-formal sources
Source of Credit (Code): Private commercial bank=1; public commercial bank=2; credit Association=3; relative/friends=4; other specify =5 Reason for taking loan (code): Consumption of food=1; asset creation e.g. to construct house=2; for the purpose of marriage=3; health expenses=4; education expenses=5; for purchasing agricultural inputs/equipment=6; repayment of loan=7; other, please specify=8;							

Real usage of loan (code): Consumption of food=1; asset creation e.g. building house=2; for the purpose of marriage=3; health expenses=4; education expenses=5; for purchasing agricultural inputs/equipment=6; repayment of loan=7; other, please specify=8;

Type of problems (code): Adequate credit was not obtained=1; complex rules and regulations=2; greater distance from residence=3, delay in disbursement=4, credit was not available due to lack of collateral=5; other, please specify=6.

9.2. Household Credit Situation:

9.2.1. Have you received any type of credit in 2006 E.C.? _____ 1. Yes 2. No

9.2.2. If yes to question No 9.3, for what purpose did you borrow? ____

- | | |
|-----------------------------------|-----------------------------|
| 1. Agricultural input purpose | 5. Household consumption |
| 2. Livestock purchase | 6. Farm implements purchase |
| 3. Start up new business | 7. Social obligation |
| 4. Expansion of existing business | 8. Other, specify _____ |

9.2.3. At what time do you usually take credit? During _____ months.

9.2.4. What are the Sources of credit? (In order of importance) _____

- | | |
|----------------------------------|------------------------------|
| 1. Traditional institutions | 4. Microfinance institutions |
| 2. Local Money lender | 5. Others, specify _____ |
| 3. Friends / relatives/neighbors | |

9.2.5. If you didn't borrow, why? (Multiple answers is possible) _____

- | | |
|---------------------------------|--------------------------|
| 1. Fear of inability to pay | 4. High interest rate |
| 2. Lack of asset for collateral | 5. No need of credit |
| 3. Service not available | 6. Other (specify) _____ |

10. SECTION 10: INFORMATION ON ROLE OF CREDIT IN FOOD PRODUCTION

10.2. Portion of Credit in the cost of Input Use in the last year

S/No.	Used input	Input cost (total in ETB)	Amount paid by credit (EtB)
1.	Land renting, land tax , etc.		
2.	Laborer cost, Purchasing cattle, Plough,		
3.	Irrigation		
4.	Fertilizer, Seed, Pesticides		
5.	Other (Specify)		

10.3. Credit received and production in last two years

Credit received in last year	Type of production (code)	Value of Production in last year	Credit received in the year before last year	Type of production (code)	Value of Production In the year before
Type of production (code): crop=1, Livestock =2, Vegetables & Fruit =3; Other =4; Put 1 in the “credit received” column & put 0 if no credit is received.					

S/No.	Did your household Consume any of these food items for the last seven days?	Local /standard ized/ Unit	Quantity	Source		
				Home produced	Purcha sed	Gifts /remittan ces/ wage in kind
1.	Cereals					

1.1.	Sorghum					
1.2.	Maize					
1.3.	Wheat					
1.4.	Barley					
1.5.	Millet					
1.6.	Teff					
1.7.	Other specify					
2.	Pulses					
2.1.	Peas					
2.2.	Lentils					
2.3.	Bean					
2.4.	Vetch					
2.5.	Chick pea					
3.	Animal and Animal Products					
3.1.	Cow milk					
3.2.	Butter					
3.3.	Cheese					
3.4.	Yoghourt					
3.5.	Cattle meat					
3.6.	Sheep meat					
3.7.	Goat meat					
3.8.	Chick meat					
3.9.	Egg					
4.	Fruits and Vegetables					
4.1.	Tomato					
4.2.	Carrot					
4.3.	Irish Potato					
4.4.	Sweet potato					
4.5.	Onion					
4.6.	Edible oil					
5.	Sugar					
6.	Salt					

7.	Other , specify					
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11. SECTION 11: HOUSEHOLD EXPENDITURE

11.2. Indicate the type and amount of expenditures of your family for the year :

S/N _o .	Category	Amount in (Birr)
1.	Food items (crops, animal products, sugar, salt, coffee, cooking oil, etc.)	
2.	Clothing (yearly): For adults, children and other household members	
3.	Housing and related (yearly)	
4.	Health care/treatment (yearly)	
5.	Education (yearly)	
6.	Assets bought for the HH last year (specify)	
7.	Farm inputs (fertilizer, seeds and chemicals	
8.	Taxes	
9.	Labor cost	
10.	social obligation	
11.	Other, please specify	
12.	Total Expenditures	

12. SECTION15: HOUSEHOLD CALORIC CONSUMPTION

N.B: Give thanks to the respondent for spending his/her valuable time and cooperation.

Name and Signature of the Interviewer

Name..... Signature.....Date.....