



**COLLEGE OF NATURAL AND COMPUTATIONAL SCIENCES**

**DEPARTMENT OF STATISTICS**

**STATISTICAL ANALYSIS OF FACTOR THAT AFFECT FOOD  
INSECURITY IN CASE OF GUBRE SUB CITY**

**PREPARED BY:-**

1. TOKUMA GIRMA ..... NCSR/388/11
2. ZENEBE GETAHUN ..... NCSR/566/11
3. TSEGAYE YOHANES ..... NCSR/409/11

**ADVISOR: GETU BOJA (M.Sc. In Biostatistics)**

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## **LIST OF ACRONYMS**

<b>AE</b>	Adult Equivalent
<b>CSA</b>	Central Statistical Author
<b>EGS</b>	Ethiopia Generation schema
<b>FAD</b>	Food Available Declines
<b>FAO</b>	Food and Agricultural Organization
<b>FDRE</b>	Federal Democratic Republic of Ethiopia
<b>FFSS</b>	Federal food security strategy
<b>FSCB</b>	Food security coordination bureau
<b>FSS</b>	Food security strategy
<b>HA</b>	Hectare
<b>HFS</b>	Households food security
<b>HH</b>	Households
<b>MOFED</b>	Ministry of Finance and Economic Development
<b>MOPED</b>	Ministry of Planning and Economic Development
<b>NGO</b>	Non-government Organization
<b>PSNP</b>	Productive Safety-Net Program
<b>R<sup>2</sup></b>	Coefficient of multiple determinations
<b>SNNPR</b>	South Nation Nationalities and People Region
<b>TLU</b>	Tropical Livestock Unit
<b>UN</b>	United Nations
<b>UNDP</b>	United Nations Development Program
<b>USAID</b>	United States Aid for International Development

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### ***Abstract***

An understanding of the major causes of food insecurity is important for interventions aiming to reduce it. Therefore, this study was conducted to analyze food insecurity status of Gubre sub city households', to identify determinants of food insecurity status of Gubre sub city households. Food insecurity in the analysis was based on household survey data gathered from 142 randomly selected households. Descriptive Statistics, such as percentage and frequency distribution were used. Univariate analysis such as Chi-square ( $\chi^2$ ) test and binary Logit regression were used to analyze the data. The results from descriptive statistics show that the majority (54.9 percent) total surveyed households were food insecure and 45.1 percent were food secure. The binary logit model outputs show that five variables were significant determinants of household food insecurity. These were dependency ratio, cultivated land, family size, education status and total monthly income of the households.

**Key words:** Food insecurity, logit, Binary logistic regression, Gubre sub city, Household.



# CHAPTER ONE

## INTRODUCTION

### 1.1 Background of the Study

Food insecurity in the world has been addressed as one of the biggest problems for over several decades now. One of the reasons for food insecurity in the world is the result of population increase. According to (UN, 2017) the world population reached 7.6 billion and estimated the population will exceed 8.6 billion by 2030 an increase of 1 billion people in just 13 years. While agriculture production of food remains the same, the increase of population will have an effect on food supply and food security.

Food insecurity has affected millions of people worldwide who suffer from hunger (FAO, 2010), estimates that, one third of world population are lacking food security worldwide and around 925 million people are chronically hungry due to extreme poverty, while up to 2 billion people lack food security intermittently due to varying Degrees of poverty (FAO, 2010). Data show that in 2017 an estimated 303,000 children require treatment for severe acute malnutrition (SAM) and over 2.7 million children (6 to 59 months) and pregnant and lactating women require supplementary feeding (HRD, 2016).

(FAO, 2019) The series of African food crises in the seventies and eighties have led to sustained interest in the various factors that influence peasant food security. The roles of crop conditions, government policy and peasant access to economic resources have received particular attention (Yared, 2013). Deepening food crises in several developing countries especially those in Sub-Saharan Africa (SSA), has increasingly become the concern of many researchers, planners, donors and international development agencies, who have given high priority to the study of food system and the problem of food insecurity (Gezahegn, 2015). Despite the available resources and the efforts made by governments in SSA (Sub-Saharan Africa), food insecurity remained one of the most crucial issues. In order to provide a dynamic perspective of the concept, to review the change in perception of food security over the last 75 years or so and analyzes the concepts related to food insecurity. A situation that one can probably better measure than food security itself and also reviews the related notion of vulnerability evolution which took place based on three types of factors;

- The world situation and the perception of food scarcity and food insecurity;
- The actions, recommendations and programs approved and implemented by national, international and non-governmental organizations;
- The practical and theoretical research conducted on the basis of experience and actual situations/case studies.

The deteriorating situation of food security in Ethiopia is caused by population pressure, draught, shortage of farm land, lack of oxen, deterioration of food production capacity, outbreak of animal and plant disease, poor soil fertility, forest attack, shortage of income, poor farming technologies, weak extension service, high labor wastage, poor social and infrastructural facility, and pre and post-harvest crop loss. (Mequanet, 2015)

To address food insecurity problem, the government of Ethiopia is taking a strong leadership role with programs that meet the varying needs of vulnerable households. A serious of successive droughts had already weakened Ethiopians food situation, with poor and erratic rainfall over the last two years. Ethiopia lies within one of the most food insecure regions in the world, with a large number of its population living at subsistence levels and dependent on farm production highly vulnerable to severe draughts. The smallholder peasant sector is the most important agricultural sub sector in the country. Its emphasis is on food grain crops where considerable improvements of cultivation practices, management and marketing need to be realized. The production volume of food grain crops as well as the per capita food production has shown tremendous fluctuations thus resulting in sever food shortage in the country. The main reasons for these are stochastic shocks such as recurrent draught, lack of incentives for the small scale food producers and poor extension services for the small peasant households (Mulugeta, 2016).

The country is generally characterized by poverty, high population growth rate, severe environmental quality degradation and recurrent drought (World Bank, 2012; Getachew, 2015). This resulted in poor performance of agricultural production for several years, to the extent that the country could not adequately feed its population from domestic production. This manifested itself in the prevalence of food insecurity, both chronic and transitory, which has almost become a structural phenomenon affecting the way of life for a large proportion of the

population of the country. The per capita gross domestic product (GDP) is one of the lowest in the world.

Although food self-sufficiency has remained the stated goal of the Government of Ethiopia, the problem of food insecurity has continued to persist in the country. Many households have already lost their means of livelihood due to recurrent drought and crop failures (Ayalneh, 2013). Therefore, what is needed now is to comprehensively address the problem of food insecurity in the country. Hence, a study of this sort in addressing the problem has an important role at least in clearly identifying specific factors and the severity of the problem that pertain to the area.

Thus, this research work would be under taking the above background and explores the factors that affect food insecurity in case of Gubre Sub city southern nation nationalities and people region (SNNPR), Ethiopia.

## **1.2 Statement of Problem**

Despite considerable investment and continues effort makes by the government and the donor agency, the prevalence of food in security in the country continues to rise and large proportion of population faces chronic food in security and their livelihoods are at risk. Complex combination of several factor have been cites as possible reason for this increases level of vulnerability to food insecurity the principal consequences includes ; change in climate, leading to more frequent drought, over dependency on substance farming, wide spread land degradation; lack of productive assets; limits income alternatives and opportunities; long-term exchange entitlement decline associated with worsen term of trade; increase population pressure; poor market integration; limits access to basic services(such as input, credit and information) backward technology, internal conflict during the 1970's and 1980's and issues having to do with the national economic policies and implementation constraints. The main target of this study is to identify the factors that affect food insecurity and to identify the consequences of food insecurity that affects households in the Gubre sub city.

## **1.3 Objectives of the study**

### **1.3.1 General Objective**

The main objective of this study is to assess factors that affect food insecurity in Gubre sub city.

### **1.3.2 Specific Objectives**

The specific objectives of the study are:

- ✓ To examine the effects of some variables that may influence food insecurity of households and identify the most important determinants.
- ✓ To describe the relationship between food insecurity and its determinants; and
- ✓ To analyze the impact of major determinants on the probability of household food insecurity.

## **1.4 Significance of the Study**

This study might be providing basic back ground information on the contextual cause's vulnerability to food insecurity. By doing so, the existing general lack of disaggregates information on food insecurity and vulnerability at this study area, household level will be reducing both for proper policy design and adequate target intervention. This study might be providing a new knowledge concerning proper utilization of food and storage among its rural peasants; hence contribute to the expansion of literature on the problems that affects food security. It provides to keep healthy food security and to analysis the consequence of food insecurity. In the same way, indigenous as well as international NGOs interested in the intervention with the aim of promotion rural development in study area also benefit from the finding of the study.

- This study is mainly tried to investigate whether there is imbalance between the food security and food insecurity problems or not on Gubre sub city.
- This study **would** be important to households of this area to know or learn the effect of factors that affects the food insecurity.
- It analyzes the most important factors that affect the food insecurity of the society of Gubre sub city for different purposes.

## **CHAPTER TWO**

### **LITERATURE REVIEW**

#### **2.1 Definition and Component of Food Security**

Literature on food security has spiraled since 1970's and as it has grown become more complex to the extent of creating the probability of conceptual confusion. On conceptual and definitional issues alone there are hundreds of different definitions of the term food security and more than 250 indicators (Weibe K, and D Maxwell, 1996). More specifically food security can identify with commercial food price and physical availability, rather than with demand consumption, vulnerable and will be stated as, availability at time of adequate world supply of basic food stuffs to expansion of food consumption and fluctuation in production.

Food insecurity in the world has been increasing each year in different countries, although the world produces enough food to feed everyone. Food insecurity is no longer seen simply as a failure of agriculture to produce sufficient food at national level, but instead as a failure of livelihood to guarantee access and entitlement to sufficient food at the household and individual levels. The most common working definition of food security varies around the one proposed (FOA, 2011-2013) to access all people at all times to enough food for an active and healthy life.

According to the World Food Summit plan of action of 1996, food security is generally defined as "all people, at all times, have physical and economic access to sufficient, safe and nutritious food for a healthy and active life". Food insecurity is therefore the inverse of food security: a condition in which a population does not have access to sufficient, safe and nutritious food over a given period to meet dietary needs and preferences for an active life. Possible causes are insufficient food availability, accessibility, and inadequate food utilization.

#### **2.2. Sources of Food Insecurity**

Households face a variety of risks, which may vary from natural to man-made factors (Debebe, 2017). Drought (climate) could be considered as a major cause of famine. (Hansen, 2006) provided a purely scientific, meteorological definition of drought and a definition that relates drought to human activities. (Devereux, 2013) and (Mesfin, 2016) argue that one cannot completely ignore climate, by saying "climatic shocks are neither a necessary nor sufficient cause of famine." With widespread crop failures, natural or other disasters as well as the risk of

fluctuation in production are some of the risk condition contributing to food entitlement failure. Moreover, variability in food supply, market and price variability, risks in employment and wages, and risks in health and morbidity, and conflict are also an increasingly common source of risk to food entitlements.

### **2.3 Component of Food Security**

Food security has three major components: availability, access and utilization (Kifle and Joseph, 1999). 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 level, regional, house hold and individual levels. (USAID, 2009) indicate that availability (supplies of food), accessibility (both physical and economics) and utilization (physiological availability to observe and utilize consumes nutrients) are important components. On other hand, transitory food insecurity; generally refers to extreme cases famine caused by war, flooding, drought, crop failure, pest infestations and loss of purchasing power in farming communities and market failures through high food prices. It focuses on extra and enters annual variation in the house hold food access and many affect any house hold, regardless of whether or not it has a chronic nature.

Chronic food in security: long term and deep-root food in security is largely drive endemic poverty or lack of productive assets. People are subject to continual problem of poor diet through an inability to acquire their basic food requirements; it is cause in food consumption that in values an inability to meets food requirements over a long period of time. Generally, food security is concept which in target a number of important issues, the magnitude of which ranges from micro to macro economics. That is, it is possible to analyze food security at the global, continental, national, sub-national, village Werada, house hold and individual level.

### **2.4 National Food Security Strategies**

The food security strategy (FSS) was three major components; it is anchored on the principles of achieving food security on international competitiveness and continues assistance (in the short and medium term until the country ultimately attains food self-sufficient in the long term). An official FSS is still nonexistent, which will be major constraints to effective and coordinates food security intervention by government and non-government (donors) including NGO's. The current revise strategy in 2002, aim to improve the implementation capacity and food security status of the people, speed up the economic development and improve the living standard of the

peoples. Some of food securities strategies were expected in the next five year plan are to ensure food security in the shortest possible time with limit investment, people living in high food insecurity area will be reset on unoccupied areas. The resettlement was entirely on voluntary basis. To improve and ensure food security in the drought prone, environmentally degrades food insecure region, the population will be made to engage in non-food producing activities.

Most NGOs argue that food security strategy is holistic approach but do not take into account /consider the diversify local socio-economic and agro-ecological conditions. The focus on the high potential areas of the country is neglecting the low potential areas of the country .While the latter is the home of the majority of the population of Ethiopia.

### **2.5 Public response to the problem of Food Insecurity in Ethiopia**

According to (Johannes, 2003), there are three broad categories of public response to food insecurity problems expects to. Supply based approaches emphasis to increasing the level and stability of production, increasing food reserves and influencing international food markets. The demand based approaches put emphasis on improving income productive assets available to vulnerable groups and other markets and non-market transfers. The emergency capability refers to the ability to adequate early warning systems emergency management and response mechanism and prevention measures.

### **2.6 Empirical Studies on Determinants of Food Security**

In developing countries including Ethiopia, some of the studies that were made to identify the determinants of household food security at micro level, has been summarized below. (Chung et al., 2017) reviewed that, the diverse determinants of food security status of households. The study highlights causal relationships between the various elements of food availability, access and utilization and focuses on the links between the resources commanded by household (level off-farm and non-farm production, household income, household and individual food consumption, and nutrition). (Yared, 2013) and (Chung et al., 2017) furthermore, identified that a range of important factors that lead to the food insecurity of household in developing world. The study showed that the larger the size of the household and the lower the share of non-farm earnings, the higher the probability of absolute poverty. Better access to productive assets and longer farming experience, on the other hand, reduce the incidence of poverty. A study by (Haddad, 2017) attempted to decompose changes in food (poverty) by household endowment

and other characteristics. The result appears to suggest that the higher the asset ownership in terms of land and oxen, distance to roads or towns and better human capital (better education) consistently lower poverty level. So better endowed households were placed to benefit much more from the changed circumstances. Other studies in Kenya by (Getachew, 2009) found that agro ecological zones, total land size, number of livestock, permanent off-farm employment, and total labor used for farming influenced household food consumption and food security. An empirical study in nine districts of Amhara Region by (Gezahegn et al., 2015) identified that food insecurity is correlated with lack of productive assets such as land and oxen. The results of their regression analysis suggest that the increase in land holding, oxen holding, use of fertilizer, dependency ratio, agro ecology, proximity to urban center, education and age of the household as well as seed application showed significant impact in food availability. Among these land and oxen were found the most important determinants for access to household food security. A study on agricultural technology adoption in Ethiopia by (Beyene, 2010) proved that adoption of improved technologies is required to improve food security and quality of life of the household. The result of his research suggests that education level of the household head, size of land, and number of oxen owned, proximity to the main road, and availability of the technological package and credit facility for down payment are affecting farmer's adoption decision and household food security. In summary, various studies were reviewed and different socio-economic and physical factors that were reported to have affected household food security status in different localities of the country.

## **CHAPTER THREE**

### **METHODOLOGY**

#### **3.1 Description of the Study Area**

The study were conducted at Gubre sub city in the southern nation nationalities and people region (SNNPR), Gurage zone position at 178km southwest of Addis Ababa and 9km east Wolkite town. Wolkite town is an administration and trading center of Gurage zone. It is found southwest of Addis Ababa along the main Addis Ababa-Jimma road at a distance 158km. Gubre is locate in the south west and east both by cheha Werada and the north by Wabe river which separates it from Abeshge and kebena wereda. Though the city established long years ago, it was developed very slow. The city is characterizes by lower temperature climate condition and high rainfall as compare to others urban centers in the country (DM GTP, 2011).

#### **3.2 Study Population**

The term population defines statistically as the totality of all subjects having a certain common characteristics that are being study. The target population for this study was households in Gubre sub city with total households of N=2500 (this information was taken from Gubre sub city Tena Unity bureau).

#### **3.3. Method of Data Collection**

Data may be obtained from several sources. Depending on the source, data can be classified as primary and secondary data. This study employed both primary and secondary data. The primary data were collected from sampled households through structured questionnaire.

#### **3.4. Sampling technique**

The study was conduct by using simple random sampling method from Gubre sub city, since; it is difficult to study overall population. Simple random sampling is the most widely used probability sampling method because it is easily to implement and easy to analysis. In simple random sampling all Households are equal likely to be selected as a sample. This is important to generalize and make overall conclusion based on the sample.

#### **3.5. Sample Size Determination**

In the planning of sample survey one of the first consideration is the sample size confidence level; the level of variability of the variables to be estimate, which can be measure by the

standard error or produce different levels of precision for the same sample size, or conversely different sample size for the same level of precision. Determining sample size is very important issue, because sample that is too large may be waste time, resource, and money, while sample too small may lead to inaccurate results. So appropriate sample size is one of the ways of gaining high precision. The sample size “n” is determined by proportional sampling method by using the formula;

$$n_0 = \frac{(z\alpha/2)^2 pq}{d^2} \dots\dots\dots (3.1)$$

$$n_0 = \frac{(1.96)^2 * 0.5 * 0.5}{(0.08)^2} = 150$$

$$n = \frac{n_0}{1 + \frac{n_0}{N}} \dots\dots\dots (3.2) \text{ (Cochran's, 1997)}$$

$$n = \frac{150}{1 + \frac{150}{2500}} = 142$$

Therefore, from the total population of 2500 take the sample of population 142 .The level of confidence that we use in this study is 95% because of this study considers the error made between the sample values and parameter at this level. So the level of significance is  $\alpha = 0.05$  and the related value of Z is  $Z\alpha/2 = 1.96$ , n = sample size,  $\alpha$  = level of significant which is equal to 0.05, P = proportion of success = 0.5, q = proportion of failure =  $1 - 0.5 = 0.5$ , the margin of error (d) = 8%, N = number of total population = 2500 and Z = the reliability coefficient.

### 3.6 Definition of Variables in the Study

It is necessary to identify the potential explanatory variables that would influence household food insecurity. Review of literatures, past research findings, experts and author’s knowledge of the food insecurity situation of the study area was used to identify the potential determinants of household food insecurity. Therefore, assigning the household food insecurity as the dependent variable, the following variables are selected to analyze whether they explain household’s food insecurity or not.

### **3.6.1 The Dependent Variable of the Model**

The household food security status which is the dependent variable for the logit analysis is a dichotomous variable representing the status of household food security. It was represented in the model by 1 for food insecure and 0 for food secure household. According to (Mohamed. A, 2016), these seven days recall period was selected due to the fact that it is appropriate for exact recall of the food items served for the household within that week. If the time exceeds a week, for instance 14 days, the respondent may not recall properly what she has been served before two weeks. The information to categorize households into two groups can be obtained by comparing the total household expenditure per AE per annum to the minimum level of expenses required to ensure survival per AE per annum. This minimum level of expense required per AE is computed based on the amount of calorie requirement by AE (2100 kcal/AE/day or 225 kg/AE/year which is set by the Ethiopian Government (MoFED, 2008). Accordingly, this value of minimum subsistence requirement was used as a cut-off point between food secure and insecure households in which case the household is said to be food secure if it meets this minimum and insecure otherwise.

### **3.6.2 The Independent Variables of the model**

The independent variables expected (hypothesized) to have association with food security status, were selected based on available literature. Efforts were made to incorporate demographic, biophysical and socioeconomic factors. Accordingly, the empirical model was built using the data collected on the following variables. The associated hypotheses of the study with respect to each one of the repressors is also presented below

Table 3.1: Lists of the explanatory variables:

No	Characteristics	Variables code and Description
1	Family size in number (FAMSZ)	1, $\geq 6$ 0, $\leq 5$
2	Age of the household head (AGE)	1, $\leq 29$ 2, 30-36 3, 37-47 4, $\geq 48$
3	Dependency ratio (DPR)	1, $\leq 1$ 2, 2-3 3, $\geq 3$
4	Education (EDUC)	1=literate 0=illiterate
5	Cultivated land size in Hectare (CLSZ):	0, 0-1 1, 1.1-2 2, $> 2$
6	Sex of household head	1=male , 0=female
7	Total income (in birr)	1, $\leq 500$ 2, 501-1000 3, 1001-1500 4, $\geq 1500$
8	Total livestock owned in TLU	1, $< 3$ 2, 4-7 3, 8-10 4, $> 11$
9	Number of ox owned in TLU	1, 0-1 2, 2-4 3, $> 4$

### **3.7. Methodology**

In order to meet the objective, set up on this study binary logistic regression model and tests related are employed as a general methodology.

#### **3.7.1 Logistic Regression Model**

The logistic model, as a non-linear regression model, is a special case of generalized linear model (McCullough and Nelder, 1989) where the assumptions of normality and constant variance of residuals are not satisfied. This model is a statistical technique for predicting probability of an event, given a set of predictor variables. The procedure is more sophisticated than the linear regression procedure.

Logistic regression is used to predict a dependent variable on the basis of independents and to determine the effect of the independent variables on the dependent; to rank the relative importance of independents; to assess interaction effects; and to understand the impact of covariate control variables. The impact of predictor variables is usually explained in terms of odds ratio and hence the name logistic regression, also called the log-odds function.

This model applies maximum likelihood estimation after transforming the dependent into a logit variable (the natural log of the odds of the dependent occurring or not). The validity of inferences drawn from modern statistical modeling techniques depends on the assumptions of the statistical model being satisfied. In order to valid the analysis the model should satisfy the following assumptions.

#### **3.7.2 Assumption of Logistic Regression**

- It does not need a linear relationship between the dependent and independent variables.
- The dependent variable must be categorical
- Larger samples are needed than for linear regression because maximum likelihood coefficients are large sample estimates. A minimum of 50 cases per predictor are needed.
- The independent variables do not need to be multivariate normal although multivariate normality yields a more stable solution. The error terms (the residuals) need to be binomially distributed.

- Logistic regression assumes linearity of independent variables and log odds; it requires that the independent variables are linearly related to the log odds. Otherwise, the logistic regression underestimates the strength of the relationship and rejects the relationship easily, that is being not significant (not rejecting the null hypothesis) where it should be significant. A solution to this problem is the categorization of the independent variables. That is transforming metric variables to ordinal level and then including them in the logistic regression model. Another approach would be to use discriminate analysis, if the assumptions of homoscedasticity, multivariate normality, and no multi-co linearity are met.

### 3.7.3 Binary Logistic Regression Model

Binary logistic regression is the statistical technique used to predict the relationship between the dependent and independent variable where the dependent variable is binary. (E.g.sex (male vs. female), response (yes vs. no), score (high vs. low) and many more) there must two or more independent variables. The Bernoulli distribution for Bernoulli trial specifies  $P(Y = 1) = \pi$  and  $P(Y = 0) = 1 - \pi$ , for which  $E(Y) = \pi$ . This special case for binomial distribution with  $n=1$ .

$$y = \begin{cases} 1 = \text{food insecurity} \\ 0 = \text{food security} \end{cases}$$

The statistical model for binary logistic regression is:

$$\pi(x) = \frac{\exp(\beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_i X_i)}{1 + \exp(\beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_i X_i)} \dots \dots \dots (3. 3)$$

Where:  $X_i$  independent variables included in the model.

$\pi$  =the probability of success, i.e. there is food insecurity

$1-\pi$  =the probability of failure, i.e. there is food security

$\beta_0, \beta_1, \dots, \beta_i$  are Parameters of the model.

### 3.7.4. Assumption of Binary Logistic Regression

- ✓ The response variable is dichotomies.
- ✓ The outcomes are independent and mutually exclusive.
- ✓ It requires large sample to be accuracies all models.

The general model for binary logistic regression is as follows:

$$P_i = \frac{\left( \exp(\beta_0 + \beta_1 x_1 + \dots + \beta_k x_k) \right)}{1 + \left( \exp(\beta_0 + \beta_1 x_1 + \dots + \beta_k x_k) \right)} \dots \dots \dots (3.4)$$

$$\ln\left(\frac{P_i}{1 - P_i}\right) = z_i = \beta_0 + \beta_1 x_1 + \dots + \beta_k x_{ki}$$

Where  $P_i$  = there is food insecurity

$1 - P_i$  = there is food security.

#### Odds ratio (OR)

It is the measure of how much the greater or(less) the odds are to subjects possessing the risk factor to experience particular outcomes?

**Interpretation  $e^{\beta_j}$**  Is the factor by which the odds changes when the  $j^{th}$  independent variable increase by one unit. If  $\beta_j$  is positive then the odds increase and if  $\beta_j$  is negative, the odds decrease. If  $P_i$  the probability of an event will occur then the probability of an event will not occur is given by:  $1 - P_i$ .

$$Odd(\pi) = \frac{p_i}{1-p_i} \dots \dots \dots (3.5)$$

Odds ratio is the ratio of two odds  $OR = \frac{\pi_1}{\pi_2}$  or  $OR = e^{\beta_j}$ .

Where  $X_i$  independent variable,  $\beta$  is parameter of the model

### 3.8. Estimation for Logistic Regression

The maximum likelihood and non-iterative weighted least squares are the two most computing estimation methods used in fitting logistic regression model (Hosmer and Lemeshow, 2000).

Consider the logistic model  $P(X_1) = \frac{e^{X\beta}}{1+e^{X\beta}}$ , since observed values of  $Y$  say,  $Y_i$ 's ( $i = 1, 2 \dots n$ ) are independently distributed as binomial and, the maximum likelihood function of  $Y$  is given by:

$$L(\beta|Y) = \prod_{i=1}^n p(Y_t|X_{t1}, X_{t2} \dots X_{tk}) = \prod_{t=1}^n \left[ \frac{e^{X\beta}}{1+e^{X\beta}} \right]^{Y_t} \left[ \frac{1}{1+e^{X\beta}} \right]^{1-Y_t} \dots \dots \dots (3.6)$$

### 3.9. Goodness-of-Fit Measures

The Pearson's Chi-square, the likelihood ratio tests (LRT), Hosmer and Lemeshow Goodness of fit Test and the Wald tests are the most commonly used measures of goodness of fit for categorical data (Hosmer and Lemeshow, 1989).

After fitting the logistic regression model or once a model has been developed through the various steps in estimating the coefficients, there are several techniques involved in assessing the appropriateness, adequacy and usefulness of the model. First, the importance of each of the explanatory variables will be assessed by carrying out statistical tests of the significance of the coefficients. Then the overall goodness of fit of the model will be tested (Agresti, 1996)

#### 3.9.1 Goodness of Fit of the Model

Assessing goodness of fit involves investigating how close values predicted by the model with that of observed values (Bewick and Jonathan, 2005). The comparison of observed to predicted values using the likelihood function is based on the statistic called deviance.

$$D = -2 \sum_{i=1}^n \left[ Y_t \ln \left( \frac{\hat{p}_t}{Y_t} \right) + (1 - y_t) \ln \left( \frac{1 - \hat{p}_t}{1 - Y_t} \right) \right] \dots \dots \dots (3.8)$$

For purposes of assessing the significance of an independent variable, the value of  $D$  are compared with and without the independent variable in the equation as given below:

$$\chi^2 = D \text{ (model without the variable)} - D \text{ (model with the variable)}$$

The goodness-of-fit  $\chi^2$  process evaluates predictors that are eliminated from the full model, or predictors (and their interactions) that are added to a smaller model.

#### 3.9.2 Likelihood Ratio Test

The likelihood ratio test statistic ( $G^2$ ) is the test statistic commonly used for assessing the overall fit of the logistic regression model. The likelihood-ratio test uses the ratio of the maximized value of the likelihood function for the full model (L1) over the maximized value of the likelihood function for the simpler model (L0). The likelihood-ratio test statistic is given:

$$G^2 = -2 \log\left(\frac{L_0}{L_1}\right) = -2[\log(L_0) - \log(L_1)] = -2[L_0 - L] \dots \dots \dots (3.9)$$

It is compared with a distribution with 1 degree of freedom. This log transformation of the likelihood functions yields a chi-squared statistic.

### 3.9.3 The Hosmer and Lemeshow Test Statistic

The final measure of model fit is the Hosmer and Lemeshow goodness-of-fit statistic, which measures the correspondence between the actual and predicted values of the dependent variable. The Hosmer and Lemeshow test statistics provides the number of responses among the covariate patterns, and is the average estimated probability. The Hosmer-Lemeshow statistic is used to test the hypothesis:

Ho=the model is a good fit

H1=the model is not a good fit.

### 3.9.4 Deviance

The Deviance (-2LL) statistic we will need to ascertain how good our regression model is once we have fitted it to the data – does it accurately explain the data, or does it incorrectly classify cases as often as it correctly classifies them? The deviance, or -2 log-likelihood (-2LL) statistic, can help us here. The deviance is basically a measure of how much unexplained variation there is in our logistic regression model – the higher the value the less accurate the model. It compares the difference in probability between the predicted outcome and the actual outcome for each case and sums these differences together to provide a measure of the total error in the model. The -2LL statistic (often called the deviance) is an indicator of how much unexplained information there is after the model has been fitted, with large values of -2LL indicating poorly fitting models.

### 3.9.5 The Wald Statistic

The Wald statistic is an alternative test, which is commonly used to test the significance of individual logistic regression coefficients for each independent variable (that is to test the null hypothesis in logistic regression model that a particular logit coefficient is zero). If the Wald test is not significant, then these explanatory variables can be omitted from the model. Wald

$Z^2$  statistic was used to test the significance of individual coefficients in the model and is calculated as:

$$Z = \frac{\hat{\beta}_j}{SE(\hat{\beta}_j)} \dots \dots \dots (3.10)$$

Each Wald statistic is compared with a  $\chi^2$  distribution with 1 degree of freedom. Wald statistic is easy to calculate but their reliability is questionable, particularly for small samples.

**3.9.6 Cox and Snell R Square Statistic**

A number of measures have been proposed in logistic regression as an analogy to  $R^2$  in multiple linear regressions. The Cox and Snell measure is based log-likelihoods and considers sample size. The maximum value that the Cox and Snell  $R^2$  attain is less than 1. The Nagelkerke  $R^2$  is an adjusted version of the Cox and Snell  $R^2$  and covers the full range from 0 to 1, it is often preferred.

Therefore, in this study  $R^2$  statistic to indicate how useful the explanatory variables are in predicting the response variables were used (Bewick and Jonathan, 2005).

$$R_{js}^2 = 1 - e^{\left[ -\frac{2}{n} [D(model\ without\ the\ variable) - D(model\ with\ the\ variable)] \right]}$$

The Nagelkerke measure is as follows:  $R_N^2 = \frac{R_{CS}^2}{R_{MAX}^2}$  ,

Where  $R_{MAX}^2 = 1 - \exp[2(n)^{-1} D(model\ without\ the\ variable)]$

## CHAPTER FOUR

### RESULTS AND DISCUSSION

Descriptive statistics and binary logistic regression methods are used to analysis of food insecurity the data are analyzed using the Statistical Package for Social Sciences (SPSS) version 16.0

#### 4.1 Descriptive Statistics

Table 4.1 Distribution of household background by food security status

variables	Categories	Food Security Status		Total
		Food Security	Food Insecurity	
		Count(percent)	Count(percent)	Count(percent)
Age	<=29	19(29.7%)	36(46.2%)	55(38.7%)
	30-36	17(26.6%)	17(21.8%)	34(23.9%)
	37-47	18(28.1%)	10(12.8%)	28(19.7%)
	>=48	10(15.6%)	15(19.2%)	25(17.6%)
Family Size	<=5	36(56.2%)	25(32.1%)	61(43.0%)
	>=6	28(43.8%)	53(67.9%)	80(57.0%)
Dependency ratio	<=1	29(45.3%)	12(15.4%)	41(28.9%)
	2-3	22(34.4%)	27(34.6%)	49(34.5%)
	>=3	13(20.3%)	39(50%)	52(36.6%)
Educational status	Literate	43(67.2%)	30(38.5%)	73(51.4%)
	Illiterate	21(32.8%)	48(61.5%)	69(48.6%)

Cultivated land	0-1	13(20.3%)	17(21.8%)	30(21.1%)
	1.1-2	44(68.8%)	48(61.5%)	92(64.8%)
	>2	7(10.9%)	13(16.7%)	20(14.1%)
Sex	Male	48(75.0%)	53(67.9%)	101(71.1%)
	Female	16(25.0%)	25(32.1%)	41(28.9%)
Own livestock	<=3	38(59.4%)	40(51.3%)	78(54.9%)
	4-7	17(26.6%)	32(41.0%)	49(34.5%)
	8-11	5(7.8%)	5(6.4%)	10(7.0%)
	>11	4(6.2%)	1(1.3%)	5(3.5%)
Own ox	0-1	35(54.7%)	55(70.5%)	90(63.4%)
	2-4	22(34.4%)	19(24.4%)	41(28.9%)
	>4	7(10.9%)	4(5.1%)	11(7.7%)
Monthly income	<=500	25(39.1%)	48(61.5%)	73(51.4%)
	501-1000	11(17.2%)	22(28.2%)	33(23.2%)
	1001-1500	17(26.6%)	4(5.1%)	21(14.8%)
	>1500	11(17.2%)	4(5.1%)	15(10.6%)

### Age of the Household Heads

Out of 142 heads of household included in the study, 55(38.7%) are heads of household below 29 age, and from this 19(29.7%) of food secure and the rest 36(46.2%) of food insecure and 34(23.9%) are head of household between 30-36 age and from this 17(26.6%) of food secure and 17(21.8%) of food insecure and 28(19.7%) are head of household between 37-47 age from this 18(28.1%) of food secure and 10(12.8%) of food insecure and 25(17.6%) are heads of

household whose their age above 48 from this 10(15.6%) of food secure and 15(19.2%) of food insecure.

### **Family size**

Out of 142 heads of household included in the study, 61(43.0%) are family size below or equal to 5, and from this 36(56.2%) of food secure and the rest 25(32.1%) of food insecure and 80(57.0%) are family size above or equal to 6, and from this 28(43.8%) of food secure and the rest 53(67.9%) of food insecure.

### **Dependency ratio**

Out of 142 heads of household included in the study, 41(28.9%) are dependency ratio below or equal to 1 ( $\leq 1$ ) and from this 29(45.3%) of food secure and the rest 12(15.4%) of food insecure and 49(34.5%) are dependency ratio between 2-3 and from this 22(34.4%) of food secure and the rest 27(34.6%) of food insecure and 52(36.6%) are dependency ratio above or equal to ( $\geq 3$ ) and from this 13(20.3%) of food secure and the rest 39(50%) of food insecure.

### **Educational status**

Out of 142 heads of household included in the study, 73(51.4%) are education status that is Literate and from this 43(67.2%) of food secure and the rest 30(38.5%) of food insecure and 69(48.6%) education status that is Illiterate and from this 21(32.8%) of food secure and the rest 48(61.5%) of food insecure.

### **Cultivated land**

Out of 142 heads of household included in the study, 30(21.1%) are cultivated land between 0-1 and from this 13(20.3%) of food secure and the rest 17(21.8%) of food insecure and 92(64.8%) are cultivated land between 1.1-2 and from this 44(68.8%) of food secure and the rest 48(61.5%) of food insecure and 20(14.1%) are cultivated land above 2 from this 7(10.9%) of food secure and the rest 13(16.7%) of food insecure

## **Sex**

Out of 142 heads of household included in the study, 101(71.1%) are sex male and from this 48(75.0%) of food secure and the rest 53(67.9%) of food insecure and 41(28.9%) are sex female and from this 16(25.0%) of food secure and the rest 25(32.1%) of food insecure.

## **Own livestock**

Out of 142 heads of household included in the study, 78(54.9%) are own livestock below or equal to 3 and from this 38(59.4%) of food secure and the rest 40(51.3%) of food insecure and 49(34.5%) are own livestock between 4-7 and from this 17(26.6%) of food secure and the rest 32(41.0%) of food insecure and 10(7.0%) are own livestock between 8-11 and from this 5(7.8%) of food secure and the rest 5(6.4%) of food insecure and 5(3.5%) are own livestock above 11 and from this 4(6.2%) of food secure and the rest 1(1.3%) of food insecure.

## **Own ox**

Out of 142 heads of household included in the study, 90(63.4%) are own ox between 0-1 and from this 35(54.7%) of food secure and the rest 55(70.5%) of food insecure and 41(28.9%) are own ox between 2-4 and from this 22(34.4%) of food secure and the rest 19(24.4%) of food insecure and 11(7.7%) are own ox above 4 and from this 7(10.9%) of food secure and the rest 4(5.1%) of food insecure.

## **Monthly income**

Out of 142 heads of household included in the study, 73(51.4%) are monthly income below or equal to 500 and from this 25(39.1%) of food secure and the rest 48(61.5%) of food insecure and 33(23.2%) are monthly income between 501-1000 and from this 11(17.2%) of food secure and the rest 22(28.2%) of food insecure and from this 21(14.8%) are monthly income between 1001-1500 and from this 17(26.6%) of food secure and the rest 4(5.1%) of food insecure and from this 15(10.6%) are monthly income above 1500 and from this 11(17.2%) of food secure and the rest 4(5.1%) of food insecure.

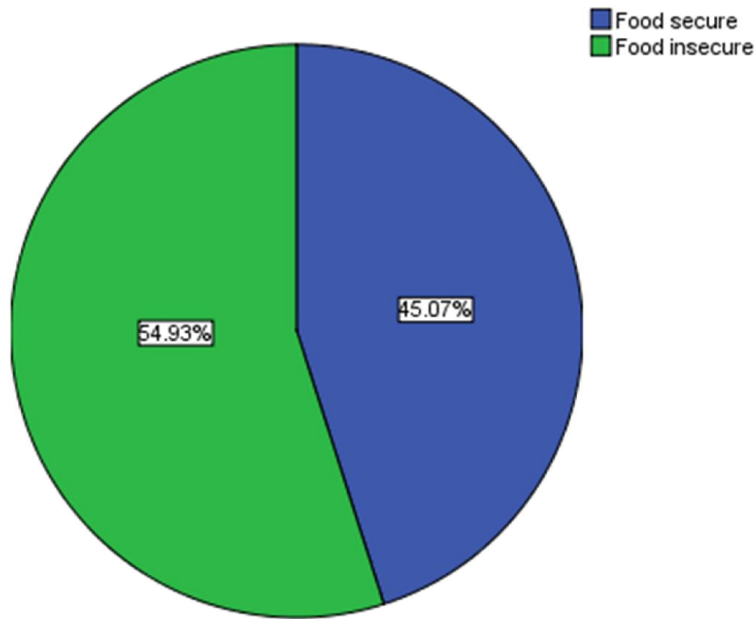


Figure 4.1 Food security status classification of Household

As the pie chart above shows 78(54.93%) household food insecure while 64(45.07%) household food secure.

## 4.2 Inferential statistics

### 4.2.1 Chi-square association test

This chi-square test of association is used to test the independence between dependent variable and independent variable that we take in our study. To check this association we see the p-value of the Pearson chi-square as shown in the following table. And if the p-value is less than alpha ( $\alpha$ ) value ( $p\text{-value} < 0.05$ ) then there is dependency between them.

Test hypothesis about association of explanatory variable with household food insecurity.

$H_0$ : There is no association between household food insecurity and each explanatory variable  $v_s$ .

$H_1$ : There is association between food insecurity and each explanatory variable.

Table 4.2: Chi square test for independent variable

		<b>Chi-Square Tests for variables</b>		
		Value	df	Asymp. Sig. (2-sided)
age	Pearson Chi-Square	7.230 <sup>a</sup>	3	.065
	Likelihood Ratio	7.284	3	.063
Family size	Pearson Chi-Square	8.401 <sup>a</sup>	1	.004
	Likelihood Ratio	8.455	1	.004
Dependency ratio	Pearson Chi-Square	19.367 <sup>a</sup>	2	.000
	Likelihood Ratio	19.999	2	.000
educational status	Pearson Chi-Square	11.613 <sup>a</sup>	1	.001
	Likelihood Ratio	11.798	1	.001
Cultivated land	Pearson Chi-Square	1.138 <sup>a</sup>	2	.566
	Likelihood Ratio	1.154	2	.561
sex	Pearson Chi-Square	.851 <sup>a</sup>	1	.356
	Likelihood Ratio	.857	1	.355
Own livestock	Pearson Chi-Square	5.113 <sup>a</sup>	3	.164
	Likelihood Ratio	5.263	3	.154
Own oxen	Pearson Chi-Square	4.142 <sup>a</sup>	2	.126
	Likelihood Ratio	4.148	2	.126
Total monthly income	Pearson Chi-Square	21.052 <sup>a</sup>	3	.000
	Likelihood Ratio	21.786	3	.000

From table 4.2 we observe that the p-values of family size, dependency ratio, educational status, and total monthly income all less than 0.05, level of significance, this indicates that reject  $H_0$ . So we can conclude that there is statistically significant association between household food insecurity with family size, dependency ratio, educational status, and total monthly income. But the p-values of age, cultivated land, sex, own livestock and own oxen had greater than 0.05, level

of significance, means that do not reject  $H_0$ . So there is no statistically significant association between household food insecurity with age, cultivated land, sex, own livestock and own oxen.

#### 4.2.2 Analysis of Binary Logistic Regression

Table 4.3 Dependent Variable Encoding

Original Value	Internal Value
Food secure	0
Food insecure	1

Table 4.4 Variables in the Equation

	B	S.E.	Wald	df	Sig.	Exp(B)
Step 0 Constant	.198	.169	1.376	1	.241	1.219

**Table 4.4** shows the logistic coefficient ( $\beta$ ) associated with the intercept as it is included in the model. This table contains analogous information as the Coefficients table in a standard regression. The logistic coefficient for the constant is similar to the y-intercept term in standard regression. The Wald statistics is a chi-square type of statistics and used to test the significance of the variable in the model. We see that the intercept model is  $\ln(\text{odds}) = 0.198$ . The Value of  $\text{Exp}(\beta)$  is the estimated odds ratio attributed to a variable. If we exponentiate both sides of this Expression we find that our predicted odds ratio  $[\text{Exp}(\beta)] = 1.219$ . That is, the predicted odds ratio of food insecure is 1.219. Since 78 of our respondents have food insecurity and 64 of them have food secure, our observed odds are  $\frac{78}{64} = 1.219$ .

##### a) Hosmer and Lemeshow Goodness of fit Test

The Hosmer and Lemeshow goodness of fit test statistic measures the correspondence between the actual and predicted values of response variable. Hosmer-Lemeshow test is used to test overall model goodness of fit.

The hypothesis test:

$H_0$ : the model is good fit vs.

$H_1$ : the model is not good fit

**Table 4.5 Hosmer and Lemeshow Test**

Step	Chi-square	df	Sig.
1	8.77	8	.362

From Table 4.4 above the P-value is 0.362 for the Hosmer-Lemeshow goodness of fit test is greater than 0.05, we will not reject the null hypothesis and we conclude that the model is adequately fit (good fit model)

**b) Omnibus test of Model coefficients**

**Table 4.6 Omnibus Tests of Model Coefficients**

	Chi-square	df	Sig.
Step 1 Step	63.653	18	.000
Block	63.653	18	.000
Model	63.653	18	.000

Table 4.6 gives result of “Omnibus test” Omnibus means “Overall” and so this output tells whether the model with all explanatory variables predicts the response better than the intercept only model. Hypothesis for Omnibus Tests of Model Coefficients:

- $H_0$ : There is no difference between model with only constant (null) and model with predictors Vs.
- $H_1$ : Not  $H_0$ .

From the results in Table 4.6 above, the null hypothesis that there is no difference between model with only constant (null model) and model with predictors (final) was rejected. This indicates that there is a significant difference between model with only constant and model

with independent variables, it means that model with independent variables better fits the data over model with only constant.

**c) Pseudo R-square Test**

Another measure of goodness-of-fit is R-square indices defined by (Cox and Snell, 1989 and Nagelkerke, 1991). The Cox and Snell cannot reach the maximum value of 1. But the Nagelkerke-square reaches the maximum value of 1.

**Table 4.7 Model Summary**

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1			
	131.818a	.361	.483

a. Estimation terminated at iteration number 5 because parameter estimates changed by less than .001.

The Cox and Snell and Nagelkerke pseudo R-square values of the model were 0.361 and 0.483, respectively. This implies that 48.3% of food insecurity is explained by logistic model that include all independent variable and the remaining one is explained by other factor.

**Table 4.8 Classification Table<sup>a</sup>**

Observed		Predicted			
		Food security status		Percentage	
		Food secure	Food insecure	Correct	
Step 1	Food security status	Food secure	42	22	65.6
		Food insecure	13	65	83.3
Overall Percentage					75.4

a. The cut value is .500

Another way of assessing the goodness of the fitted model is to see how well the model classifies the observed data. In the classification table show that how many respondents are correctly predicted and how many respondents are not correctly predicted. The result in the above table indicates that 65.6% of the respondents who have food secure were correctly predicted and 83.3% of the respondents who have food insecure were correctly predicted. Our model shows that of the 142 sample households included in the model, 107(75.4%) of correct classification of respondents in their household food security either secure or insecure. That is the fitted model has an overall predictive accuracy of 75.4% and this may be considered as adequate.

In general, the goodness-of-fit assessment of the multivariate logistic regression model implied that the model fits the data well.

**Table 4.9 Binary logistic regression analysis results for food insecurity**

		Variables in the Equation							
		B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I. for EXP(B)	
								Lower	Upper
Step1 <sup>a</sup>	Familysize(1)	-1.283	.487	6.932	1	.008	.277	.107	.720
	Depratio(ref)			8.398	2	.015			
	<=1	-1.811	.626	8.376	1	.004	.163	.048	.557
	2-3	-.950	.550	2.989	1	.084	.387	.132	1.136
	Educstatus(1)	1.046	.479	4.764	1	.029	2.845	1.113	7.275
	Income(ref)			12.443	3	.006			
	<=500	2.098	.831	6.377	1	.012	8.146	1.599	41.491
	501-1000	1.808	.862	4.403	1	.036	6.097	1.127	32.998
	1001-1500	-.130	1.012	.016	1	.898	.878	.121	6.381
	Constant	-.565	1.880	.090	1	.764	.568		

a. Variable(s) entered on step 1: Family size, Depratio, Educstatus, and Income.

The results of Table 4.9 show that family size, dependency ratio, education status, and average monthly income are significant indicators of food security status.

From the output of binary logistic regression Table 4.9 presented, the categorical variable family size group of <=5 household ( $\beta=-1.283$ , OR=.277, P=.008) were indicated that 0.277 times less likely to be food insecure as compared to family size in reference category (i.e., family size

>=6). Dependency ratio is also another significant determinant factor of food insecure. Accordingly, the estimated odds ratio for dependency ratio <=1 is ( $\beta = -1.811$ , OR = .163, P = .004, 95% CI: (0.048, 0.557)) which reveals that the food insecure is 0.163 times less likely in dependency ratio <=1 than the dependency ratio >=3. Regarding to education status, the estimated odds ratio for illiterate is ( $\beta = 1.046$ , OR = 2.845, P = .029, CI = (1.113, 7.275)) which is about 2.845 more likely have food insecure compared to literate (ref). The categorical variable income group of <=500 household ( $\beta = 2.098$ , OR = 8.146, P = 0.012) and income of 501-1000 ( $\beta = 1.808$ , OR = 6.097, P = 0.036) were indicates that 8.146 and 6.097 times more likely to be food insecure, respectively as compared to income in reference category (i.e., income groups >1500).

Based on the above output from Table 4.7, we can write the fitted logistic regression model equation as follows:

$$\ln\left(\frac{p_i}{1-p_i}\right) = z_i = \beta_0 + \beta_1 x_1 + \dots + \beta_k x_{ki}$$

Or

$$\text{Logit}\left(\frac{p}{1-p}\right) = \beta_0 + \beta_{11}X_{11} + \beta_{21}X_{21} + \beta_{31}X_{31} + \beta_{41}X_{41} + \beta_{42}X_{42}$$

Where:  $X_{11}$  is family size of household <=0,  $X_{21}$  is dependency ratio of household <=1,  $X_{31}$  is education status of household head,  $X_{41}$  is income of household <=500, and  $X_{42}$  is income of household 501-1000.

$$\text{Logit}\left(\frac{p}{1-p}\right) = -0.565 - 1.283X_{11} - 1.811X_{21} + 1.046X_{31} - 1.692X_{41} + 2.098X_{42} + 1.808X_{91}$$

### 4.3 Discussion

In this research out of 142 respondents 78 households have food insecure and 64 households have food secure. The chi-square test was carried out to determine the association between food insecure and individual independent variables. As a result, family size, dependency ratio, education status of household head, and total monthly income were significantly associated with food insecurity.

The study by Yared (2013) and Chung et al. (2017) showed that the family size of household and age of household head are significant effect on household food security status. In our study family size is significant effect on household food security status but age of household head is not significant effect on household food security status. A study by Haddad 2017 The result appears to suggest that the higher the asset ownership in terms of land and oxen, and better human capital (better education) consistently lower food insecure. In our study both land size education status are significant factor on household food security status, whereas oxen is not major significant factor household food security status. A study by Beyene, (2010) the result of his research suggests that education level of the household head, size of land, and number of oxen owned were significant determinant of household food security status. Our study shows that household's education level and size of land are significant effect on household food security status. But oxen have no significant effect on household food security status.

## **CHAPTER FIVE**

### **CONCLUSION AND RECOMMENDATION**

#### **5.1 CONCLUSION**

The main objective of the study was to identify some of the factors that influence household food insecurity in Gubre sub city. To achieve these objectives the study relied more on primary data which were collected by conducting household survey from 142 randomly selected households. The study used primary and secondary sources of data. Data were analyzed using both descriptive statistics and logistic regression method. Household food insecurity causation was then examined using logistic regression model. The descriptive analysis of the study revealed that only 45.1% of the sample households were food secure and about 54.9% of the sample households were food insecure. Binary logit model was employed to study the relations between the probability of households being food insecure and household's socio-economic characteristic. The result revealed five significant variables out of the hypothesized variables. Among these significant variables total monthly income and education status were positively related with food insecurity. While the remaining significant variables such as land cultivated, dependency ratio and family size was negatively related with food insecurity status of the households in the study area.

#### **5.2. RECOMMENDATIONS**

Based on the findings of the study, the following recommendations are possible areas of intervention which might mitigate the problem of food insecurity in the sub city

1. In view of the negative impact of large family size and dependency ratio on the household's food insecurity in the study area, Gubre sub city households should be educated on the need to adopt the family planning techniques so that they may bear the number of children which their resources can accommodate. Surely, educated women are more open to discussion with their spouses on family planning issues so as to reduce average family sizes and therefore the total population and improve on the general well-being of the entire family.
2. Households in the study area have very limited room for generation of income. Hence, for these households to enhance their welfare in general and food security in

particular, they must have diversified access to income alternatives. In the face of this, provision of credit must be taken as a measure. Moreover, development strategies should be able to identify income alternatives other than agriculture.

Therefore, the regional government, zonal and district administration should have to give technical skill training and provide some credit for the sub city households in order to increase the income of the household and reduce the food insecurity status.

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## Appendix

### Summary of the Survey Questionnaire

#### General Information

Date of Interview \_\_\_\_\_ Code No \_\_\_\_\_

Peasant Association Village \_\_\_\_\_ Signature \_\_\_\_\_

1. Sex of household head: male  female
2. Age of household head (in years) \_\_\_\_\_
3. What is your literacy status? Literate  illiterate
4. Total number of family size (number) \_\_\_\_\_
5. Do you have your own land? Yes =  No =
6. If yes to question No 5, what is the total size of your land holding? \_\_\_\_\_
7. What is the total area of land you cultivated last year? \_\_\_\_\_ Timad
8. List the type of crops you cultivated and their average production (including garden crops) for the last years.
9. Is that you produce last year enough for your family? Yes =  No =
10. If yes to question 9, what amount of grain stock was transferred to this year \_\_\_\_\_ Qt.?
11. Do you own livestock? Yes =  No =
12. If yes, give details
13. Do you use oxen for your farm operation? Yes =  No =
14. If yes to question No 13. Give in number \_\_\_\_\_
15. What food items you was used for their consumption process and what amount of each food items you consumed in one week in household members \_\_\_\_\_