Original Article

Food Insecurity and Coping Strategies Among Agro Pastoral Households: The Case of Lare Woreda, Nuer Zone, Gambella Regional State of Ethiopia

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ABSTRACT

This study was carried out to assess the household food security status and coping mechanisms in the Lare wereda of Gambella regional state of Ethiopia. The objective of the study was to investigate determinants of food insecurity status of farming rural households, to identify factors influencing rural households" food insecurity status and to find out the coping mechanism. In light of this, examinations of the demographic and socio economic characteristics of sampled households were undertaken. The necessary data were obtained through household survey, from primary data of sampled rural households. In this study, two stage probability proportional to size sampling procedure was employed to select 4 kebeles and 160 sample households out of 28 kebeles of the study areas. For the purpose, interview schedule was prepared to collect primary data from sampled rural households. Descriptive statistics and econometric model/binary logistic regression model were employed for data analysis using SPSS. The specific statistic used includes, mean, standard deviation, percentage, tables, figures and frequency distribution. In addition, t and chi-square tests were used to compare food secure and insecure sample groups with respect to explanatory variables. A binary logistic model was used to identify the determinants of food insecurity. The result of the study revealed that 66.25 % of sampled rural households in study area were food insecure on the basis of the recommended minimum calorie requirement (i.e., 2100kcal) whereas 33.75% of sampled rural household was food secure. A total of thirteen explanatory variables, 8 continuous and 5 discrete, were included in the empirical model. Out of these, six were found to be statistically significant. These variables include Household size, Age of Household head, Dependency ratio, cultivated land, Remittance and Off farm income. On other hand, sale of livestock, sale of milk and milky product, fishing, selling of fire wood,

borrow grain/cash and gathering wild fruit, were found to be more frequently practiced as mean of coping mechanism used by people in study area. The finding suggests the following set of recommendation: governmental and non-governmental institutions should devise some feasible measures such awareness creation on family planning to reduce large household size, capacity building for elderly household heads, improving agricultural technologies that enhance the productivity of land per unit area and training of agro-pastoral households on land management as well as strengthened microfinance institutions service delivery in the wereda were recommended.

Key words: Gambella, food insecurity, copping mechanism, Lare, agro-pastoral

1. INTRODUCTION

1.1. Background of the Study

As food is a basic means of sustenance, its importance at the household level is obvious. An adequate intake of quality food is a key requirement for healthy and productive life which indicates food security status of a household. A household is food secure if it can reliably gain access to food in sufficient quantity and quality for all household members to enjoy a healthy and active life (Maxwell and Frankekberger, 1992). According to FAO (2008) food security is assumed to exist "when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life". The inability of the poor to have access to needed food can be attributed to low income and inadequate food production which causes food insecurity. Food insecurity implies a temporary and a long term shortfall of adequate food for a proper diet (Ahmed, 2015; Mohamed, 2015; Webb *et al.*, 2009).

Food security matters immensely; it is a topic of keen interest to policy makers, practitioners, and academics around the world in large part because the consequences of food insecurity can affect almost every facet of society (IFPRI, 2014). For example, the food price crisis and subsequent food riots in 2007–2008 highlighted the critical role of food security in maintaining political stability. The 870 million people worldwide consuming fewer calories than they require and the myriad associated physical and mental health consequences of such deprivation make the public health importance of food security indisputable. Current estimates and future projections of food insecurity are important drivers of governmental policy and aid decisions that affect billions of people. Because a poorly nourished population is a less economically productive one, food security also matters for maximizing economic capacity (Andrew *et al.*, 2013; AUC *et al.*, 2015; FAO, 2014; UNECA, 2015). According to UNECA (2015), in 2010-2015, about 870 million people or one in eight people in the world did not consume enough food to cover their minimum dietary energy requirements. Of these people, 852million were in developing countries, making up 14.9 % of the total population of these countries. Besides, over seventy percent of the food insecure population in Africa lives in the rural areas. Ironically, smallholder farmers, the producers of over 90 percent of the continent's food supply, make up the majority (50 percent) of this population (UNECA, 2015).

Chronic food insecurity now affects about 200 million people who are suffering from malnutrition. Acute food insecurity in 2003 affected 38 million people in Africa who are facing the outright risk of famine, with 24,000 dying from hunger daily. Famines are the most visible and extreme manifestation of acute food insecurity. Out of the 39 countries worldwide that faced food emergencies at the beginning of 2003, 25 are found in Africa including Ethiopia (UNECA, 2015). As part of Africa, Ethiopia faces daunting poverty and food insecurity challenges that are worsening over time. About half of Africa's food insecure population lives in Ethiopia, Chad, Zaire, Uganda, Zambia and Somalia (UNECA, 2015).

Ethiopia with an estimated population of over 90 million is the second populous nation in Africa. Out of the total population of the country 85 percent is found in rural areas (ECSA, 2011). The country is predominantly agriculture and it plays an important role in the national economy (DiFalco and Yesuf, 2011). It accounts for about 46 percent of the total GDP, employing and supporting about 84 percent of the total population and accounts for about 90 percent of the exports (FDRE, 2008; Workneh, 2004), but its productivity and performance in terms of feeding the country's population which is growing at 2.6 percent per annum is dismal (FDRE, 2008; Habtom *et al.*, 2005).

Over the past twenty years, Ethiopia has made significant progress in improving health, nutrition, education, and other human development indicators. Life expectancy has risen dramatically, while the percentage of the population living in poverty and hunger has fallen by a third in the last ten years alone. Sustained economic growth and strong pro-poor spending have been critical to this success, supported by the commitment of development partners such as USAID to support Ethiopia's aspirations in poverty reduction (Stephen and Farmer, 2015). Yet for millions of Ethiopians, poverty, vulnerability and food insecurity remain, and are exacerbated by climate change and other shocks and stresses (AUC *et al.*, 2013; Stephen and Farmer, 2015).

In Ethiopia, food insecurity is highly prevalent in moisture deficit highlands and in the lowland pastoral and agro-pastoral areas. Even in years of adequate rainfall and good harvest, the people, particularly in lowland agro-pastoral areas, remain food insecure and in need of food assistance. Droughts have become frequent and more severe in recent years and are one of the most important triggers of malnutrition and food insecurity in the country (Dominguez, 2010; Yoseph *et al.*, 2015).

In Ethiopia, the dimensions, determinants and consequences of food security problems differ widely within the country. The Gambella region of Ethiopia is one of the regions of the country which is mostly affected by recurrent drought and food security problems (USAID, 2011). Food insecurity in rural Gambella region is subject to numerous shocks and stresses, including recurrent drought. Farmers and agro-pastoralist face higher risk than the urban household. Health and education service are very low in most rural communities, where immunization rate are little and illiteracy is over 90% (Ahmed, 2015; BoFED, 2009; Hailemariam, 2011).

To ensure sustainable food security in the country; rural development policies and strategy were also formulated. This include the rural development policy, the Rural Employment Credit Program and the Social Safety Nate Program. These policies emphasized targeted intervention for drought-prone and food insecurity areas such as Gambella region which is characterized by erratic rainfall, recurrent flash flood hazard, high incident of diseases, pests and weeds which causes food insecurity in the region and in Lare district in particular (BoFED, 2005). Therefore, this study focused on the food insecurity and coping mechanism in rural households in Lare Woreda of Nuer zone of Gambella, Ethiopia.

1.2. Statement of the Problem

Ethiopia is one of the many African countries deeply affected by food insecurity. Estimates of the portion of Ethiopia's population without secure access to food exceeds 3 million in some seasons. That means in a given year, almost 1 in 10 Ethiopians will struggle to have access to "sufficient, safe, and nutritious food" for themselves and for their families (Berhanu, 2001).

Ethiopia has been experiencing a decline in per capita income and unstable food production, which has led to raising poverty and food insecurity over the last three decades (FDRE, 2002). A fast-growing economy is reducing the number of people living in extreme poverty (from 38 percent to 29 percent over the last decade) (WFP, 2014; WFP, 2016).

Despite these positive advances, Ethiopia remains one of the world's most food-insecure countries, where approximately one in three people live below the poverty line. The 2014 Humanitarian Requirement Document (HRD) released in January by the Government of Ethiopia and the humanitarian community, estimates that 2.7 million Ethiopians will need food assistance in 2014 due to droughts and other short-term shocks (WFP, 2014). According to the current report by FAO, 10.2 million people are food insecure and if the belg rains fail, this number is expected to increase exponentially (FAO, 2016). Moreover, 2.2 million farmers and herders need immediate humanitarian agricultural production support, and crop production has dropped by 50–90% in some areas and failed completely in others. Seed reserves are critically low and the number of households requiring seed support has nearly doubled (FAO, 2016).

In many parts of Ethiopia, most households are only able to meet their food requirements for less than six months of the year. This particularly true in low land areas where rain fall is generally low and is extremely variable and unpredictable that leads to low yield and frequent crop failure (Eden *et al.*, 2009; UNICEF, 2014).

Gambella National Regional State is one of the least developed regions in all development activities of the country, but it is rich in natural resources. Though the region has diverse natural resource, due to lack of proper utilization of the resources and traditional farming systems, the majority of the population suffers from food insecurity.

The study area has international border with South Sudan. It is annually affected by different disasters (e.g. Drought, Flooding, refuge influx, ethnic conflict and External attack by Murlee tribe from South Sudan). In 2009 the total population that relied on emergency food aid was 13,418 and the number of the affected people increased every year due to different constraints that affected their livelihoods. Lare woreda is found in Gambella Agro pastoral livelihood zone which depends on livestock and crop production, fishing, and wild food collection (BoFED, 2009; FAO, 2005; Hailemariam, 2011). This zone has more natural resources compared to others livelihood zones, but different disasters exacerbated the food insecurity problem, forcing most of the people to depend on the food aid and indigenous coping mechanisms to improve their living.

Even though the economy of the study area is basically based on both crop and livestock different options were used by the people to improve their living during normal and bad years. Governments and NGOs were providing assistance to the community every year but could not bring change to the livelihood of the people.

In Lare wereda, the problem of food insecurity among agro-pastoralists is believed to be caused mainly by low and erratic rainfall. According to Hailemariam *et al.* (2011), the problem of food insecurity is mostly related to climate change which results in variation of rain-fall and then this reduces moisture situation and when the rainfall distribution varies or rainy season delays; it is likely to face food insecurity. Therefore, the main reasons that the researcher has taken this study which is food insecurity and coping strategies of agro-pastoral households of Lare wereda is that there was no studies of this type in the study area and also food security in the study area is deteriorating. Food insecurity is the real and major problem in Lare wereda. Despite this, study on food insecurity and coping strategies of agro-pastoral households was not carried out in the area before.

1.3. Objective of the Study
1.3.1 General objective
The general objective of the study was to assess the conditions of food insecurity and Coping Strategies among agro-pastoral households in Lare district of, Gambella region state.

1.3.2. Specific objectives
The specific objectives were
1.   To assess food security status of agro-pastoral households in the study area
2.   To identify determinants of agro-pastoral households' food security
3.   To characterize indigenous coping strategies adopted by agro-pastoral households to overcome food insecurity during threats in the study area
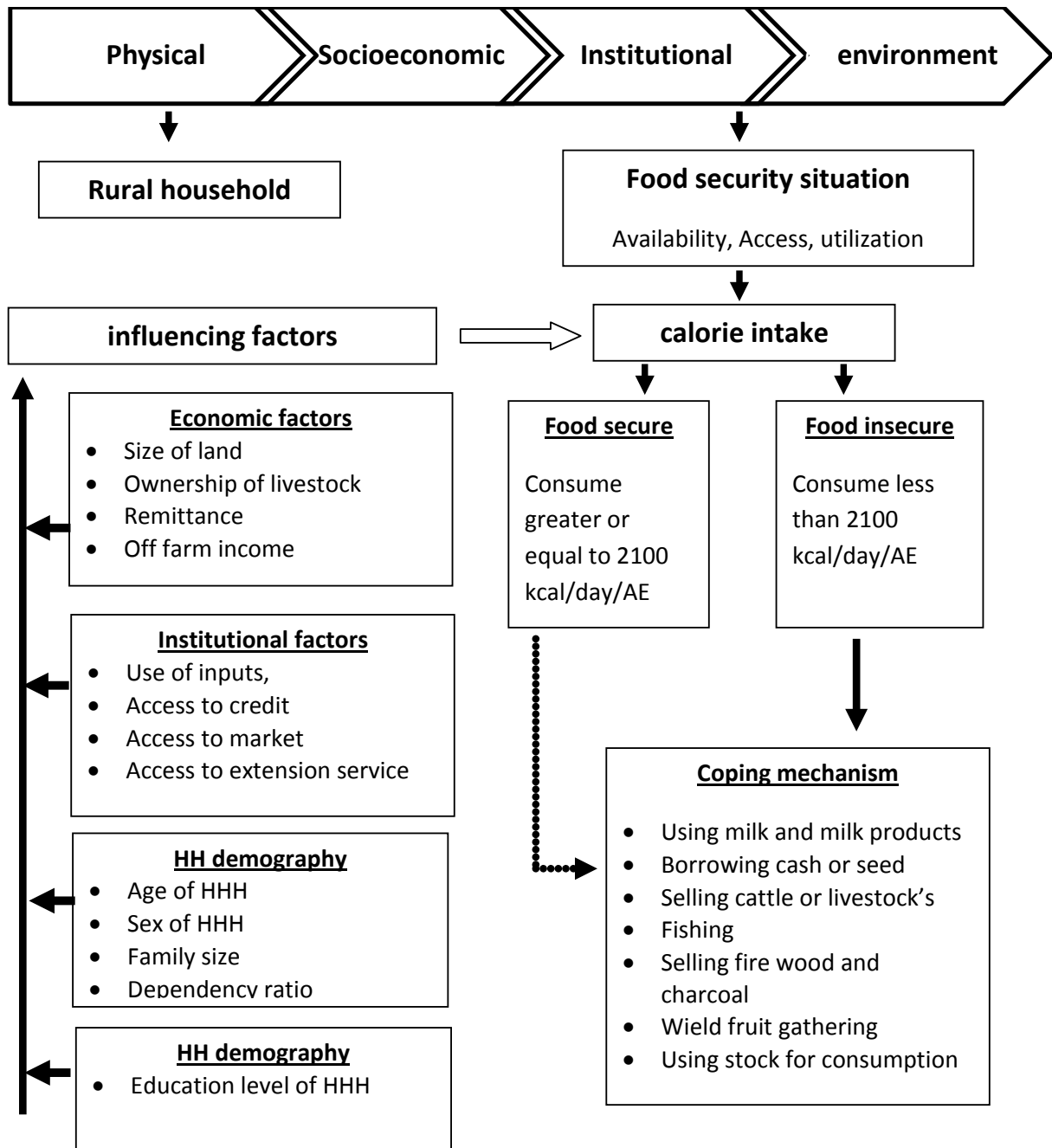
Figure 1 Conceptual framework of food security

The broken line indicates that food secured households satisfy the daily calories requirement despite they also faced some months of food deficit over the year and forced to employ coping strategies (adopted from Tewodros and Fikadu (2014) with modification)

3. MATERIALS AND METHODS

3.1. Description of Study Area

Gambella People's National Regional State (GPNRS) is located at south west Ethiopia between the Geographical coordinates 6028'38" to 8034' North Latitude and 330 to 35011"11" East Longitude, which covers an area of about 29,782.82 km2 about 3% of the nation. The Region is bounded to the North, North East and East by Oromiya National Regional State, to the South and South east by the Southern Nations and Nationalities People's Regional State and to the Southwest, West and Northwest by the Republic of South Sudan. The regional capital city is Gambella which is about 767km from Addis Ababa, the capital city of Ethiopia. The region is divided into 3 Ethnic zones (i.e. Nuer Zone, Anywuak Zone and Majang zone) and 13 administrative Districts that include one special district with 5 indigenous ethnic Groups and many highlanders. Topography is an integral part of the land surface. It influences soil formation, drainage, runoff, erosion, exposure, accessibility etc. The topography of the Region is divided in to two broad classes, i.e. the Lower Piedmonts between 500 to 1900 masl and the Flood Plains of below 500m contours (BoFED, 2009).

The CSA population projection in 2016 showed that the Region has a total population of 422,002, consisting of 220,000 men and 202,002 women; urban inhabitants number 140,000and the rural population is 282,002 (CSA, 2014). With an estimated area of 29,782.82 square kilometers, the region has an estimated density of 9.57 people per square kilometer. The average HH of the region is estimated to be 5. The main ethnicities of the region are the Nuer (46.65%), the Anywuak (21.17%), Amhara (8.42%), Kafficho (5%), Oromo (4.83%), Kambaata (1.44%), Mejenger (4%), Shakacho (2.27%), Tigrean (1.32%) and other ethnic groups predominantly from southern Ethiopia were 4.9%. According to CSA (2007), among the population aged 10 years and over, 34.4% are economically inactive and 64.4% were economically active. Based on the distribution of the age, among the male, 73.3% were economically active, while in case of female it is 55.1%.

In all zones, the percentage of economically active males was higher than females. This is true mainly because housewives are mostly engaged in activities that are not considered economic. As observed from the census data, in rural areas of Gambella region, more active persons were recorded as compared to urban (CSA, 2007). In all age groups, the economically active rate for rural is higher than urban. Specifically in the age group 10-14 years, the difference was much wider, where the activity rate was 5.9% for urban areas while it is 37.7% for rural areas. The major reasons for such variation was that in the rural areas young children rather than going to school at an early stage, get usually engaged in farm activities such as herding cattle and helping parents in weeding and harvesting.

3.2. Sources of Data Collection

The data used in this study pertain from both primary and secondary sources. This study primarily relied on primary data which were collected by using a semi-structured interview questionnaire, key informant interview and focus group discussions. Before embarking on the collection of primary data, enumerators were trained on the content of the questionnaire. To check similar understanding by all enumerators a pilot test was conducted after which some minor adjustments were made before full data collection process was started.

Secondary data were collected from the published and unpublished documents such as reports, articles and assessments from Lare townn administrative office, rural and agricultural development office, non-governmental offices. Secondary data are useful because they help to supplement primary data in a research.
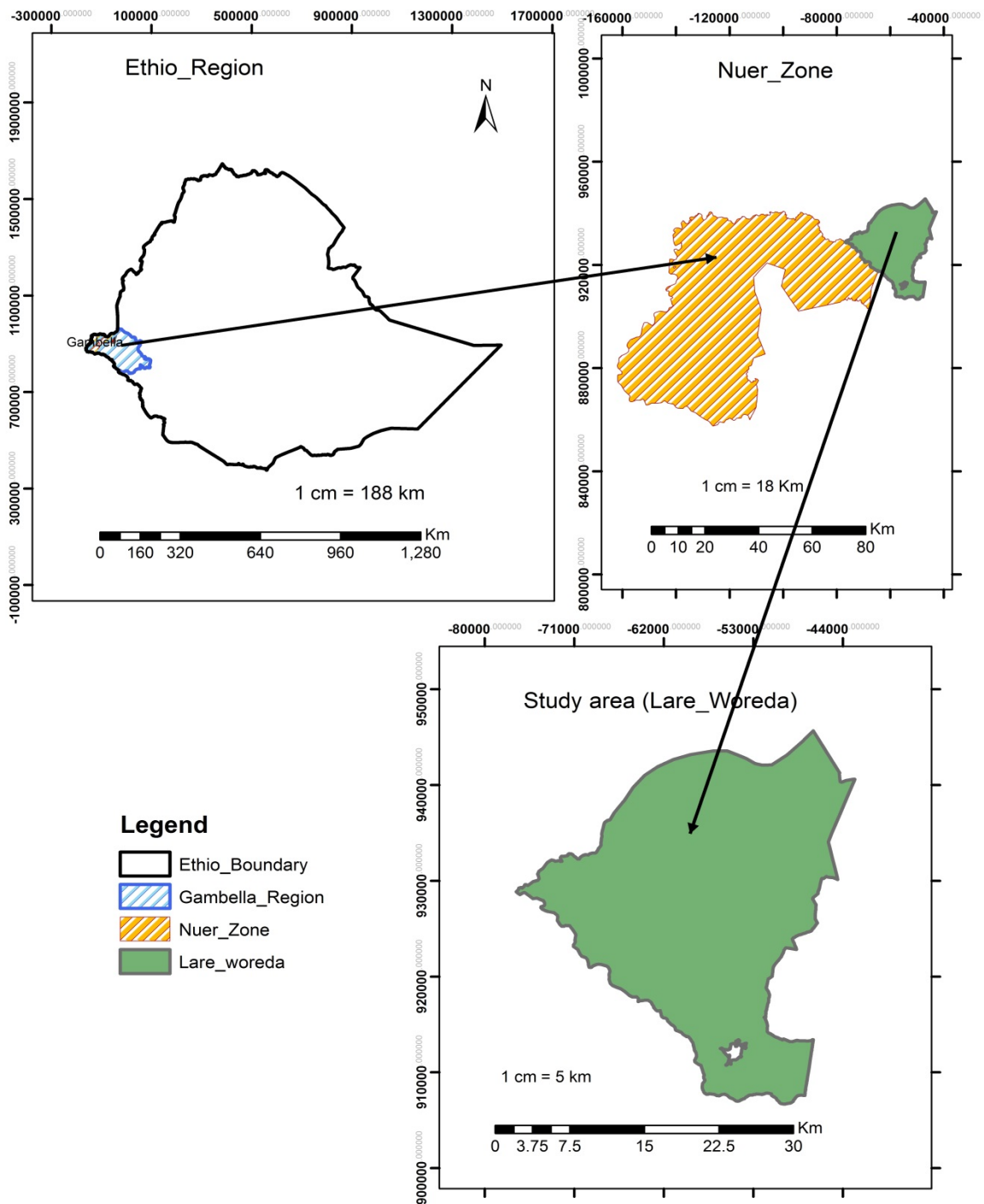
Figure 2: Study area

3.3. Sampling Technique and Sample Size

An important decision that has to be taken while selecting a sampling technique is about the size of the sample. Appropriate sample size depends on various factors relating to the subject under investigation like the time aspect, the cost aspect, the degree of accuracy desired

(Gupta and Gupta, 2002). If sample size is too small, we may fail to achieve the objectives of our analysis. But if it is too large, we waste resources. So that appropriate sample size has to be selected in order to get good representative data. In order to determine the sample size there are several formulas developed. But the simplified formula to calculate the sample size was provided by Yamane (1967) which is given by:

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

Where n is the sample size, N is the number of households and e is the level of precision.

In the process of selecting the sample, three-stage random sampling procedure was employed. Among the 13 weredas in Gambella, Lare wereda was purposefully selected because of the highest food insecurity history than other weredas. Lare wereda contains 28 kebeles from which four kebeles were selected randomly. Fallowing this, a total of 160 households were selected randomly by employing probability proportional to size.

According to CSA (2007), the total population of the Lare wereda was about 24,857 people (12231 of the total population were female and 12628 of the total population were male). The total household of Lare wereda was 4054. Similarly, the total population of the the four kebeles was about 9169 people (4495 of the total population were female and 4674 of the total population were male). The total household of the four kebeles was 1590. Ninety one percent confidence level and e = 0.075 are inserted into above Equation.

Then according to the Yamane (1967) formula the sample size of 160 households were selected randomly from the selected four kebeles. After having the total number of households in each of the four kebele households, probability proportional to size was sampling technique employed to select the sample households from the four kebeles (Annex 2).

3.4. Instruments of Data Collection

Different researchers have been using diverse instruments for qualitative or quantitative methods. They can also employ mixed instruments when using those methods at the same time based on their research or study at hand. Therefore, for this study both qualitative and quantitative research methods were used to collect the data. The study was designed to carefully and adequately gather primary data making use of questionnaire, key informant interview and focus group discussion. As well, the secondary data were collected through content or document analysis.

3.5.1. Questionnaire

Questionnaire was used as a primary instrument to collect primary data from the selected sample households from four kebeles. In this research, the investigator prepared open and close ended questionnaire for the sampled respondents. Therefore, all information about food insecurity was obtained from the head of household at origin. Data regarding demographic characteristics, socio-economic status, house and other household assets were collected using questionnaire. In addition, the households" food insecurity coping strategies were also gathered using this instrument.

3.5.2. Key informants interview

The researcher has conducted in-depth interview with the selected key informants to get deeper information on the situations of food insecurity in Lare wereda. Semi-structured interview was used. This is because semi-structures interview questions are flexible and can clarify the issue when ambiguity has occurred. Key informant interview was administered by the researcher to generate information on food insecurity, characteristics of the food insecure

households, coping strategies, and measures to be taken to ensure food security in the study area. The key informants for interview were selected from; kebele administrative council, NGO, woreda agriculture and rural development head and Lare town administrative officers. The investigator interviewed 10 individuals that have been purposively selected because of their knowledge and experience about the food insecurity and copying strategies in the study area (Annex 3).

3.5.3. Focus group discussion
The focus group discussion was used as one of the critical sources of primary data in addition to the questionnaire and key informant interview. Focus group discussion is useful for group interactions, which enables the participants get a chance to discuss the idea and share their information in relation with the intended objectives. Focus group discussion helped the researcher to get data on views and opinions of participants concerning causes and consequences of food insecurity, coping strategies, measures to be taken to improve the problem of food. Researcher attempted to interview issues concerning food insecurity, households demography and life history, number of meal per day, and coping strategies. This was helped to cross check the information collected through other methods. The researcher has selected purposively and interviewed 9 respondents from the four kebeles. The 9 respondents were selected on the basis of their knowledge about the people living the study area (Annex 3).

3.5. Methods of Data Analysis

3.5.1. Descriptive statistics
Descriptive statistics like percentages, mean and standard deviation, minimum, maximum and others were used to describe the determinants of food insecurity status in the study area based on the socio-economic, institutional, human capital and demographic situations. Statistical tests like t-test and chi-square test were also used to compare food insecure and food secure households in the study area based on different demographic, socio-economic and institutional factors.

3.5.2. Measuring food security status of the household
The household food insecurity status was measured by direct survey of household consumption. The person responsible for preparing meals was asked how much food was prepared for consumption from purchase, stock and/or gift/loan/wage over a period of seven days. In this study, a seven-day recall method was used since such a measure gives more reliable information than the household expenditure method (Bouis, 1993). According to Gulled (2006), 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.

Therefore, the consumption data collected on the basis of seven days recall method was converted into kilocalorie using the food composition table adopted from Ethiopian Health and Nutrition Research Institute (EHNRI, 1997). Then, in order to calculate the household's daily food consumption, the total household's caloric food consumption for seven days was divided by seven. The household's daily caloric food consumption per adult equivalent was calculated by dividing the household's daily food consumption by the family size after adjusting for adult equivalent using the consumption factor for age-sex categories.

Then the result was compared with the minimum subsistence requirement per AE per day of 2100 Kcal 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.

3.5.3. Coping strategies

The coping mechanisms used by agro-pastoral households were identified and analyzed using descriptive statistics tools and the local coping strategy practiced by the households in the study area were different since food insecurity conditions vary spatially and temporally.

3.5.4. Econometric method

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

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

The Binary Logit model is commonly used model. The Probit probability model is associated with the cumulative normal probability function. Whereas, the Binary Logit model assumes cumulative logistic probability distribution. The advantage of these models over the linear probability model is that the probabilities are bounded between 0 and 1. Moreover, they best fit to the non-linear relationship between the probabilities and the independent variables; that is one which approaches zero at slower and slower rates as an independent variable (X_i) gets smaller and approaches one at slower and slower rates as Xi gets large (Train, 1986).
Usually a choice has to be made between Logit and Probit models, but the statistical similarities between the two models make such a choice difficult. Gujarati (2004) illustrated that the logistic and probit formulation are quite comparable. It does not matter much which function is used except in the cases of where the data are concentrated in the tails following points. For this study the logit model was employed, though both logit and probit models may give the same result. The logistic function is used because it represents a close approximation to the cumulative normal distribution and is simple to work with. Moreover, as Train (1986) pointed out a logistic distribution (Logit) has got advantage over the others in the analysis of dichotomous outcome variable in that it is extremely flexible and easily used function (model) from the mathematical point of view and lends itself to a meaningful interpretation and relatively inexpensive to estimate. So that to address the second objectives of the study logit model was employed. The mathematical formulation of logit Gujarati (2004) is given by:

$$P_i = \frac{1}{1 + e^{-zi}} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \text{(1)}$$

Where, $Z_i = \alpha_o + \alpha_i x_i + U_i$
P_i = probability of participation

α_o=intercept

α_i= regression coefficient to be estimated

x_i= pre-intervention characteristics

U_i= disturbance term

The problem of non-linearity can be solved by creating odds ratio:

1- $\qquad$ $P_i = 1 - \dfrac{1}{1+e^{-zi}} = \dfrac{e^{-zi}}{1+e^{-zi}}$……………………………………………….. (2)

$\dfrac{P_i}{1-P_i} = e^{zi}$………………………………………………............... (3)

$L_i = \ln\left(\dfrac{P_i}{1-P_i}\right) = zi = \alpha_o + \alpha_i x_i + U_i$……………………………….... (4)

Note that L is the log of the odds ratio and is linear in parameters. The odds ratio can be interpreted as the probability of something happening to the probability that it would not happen.

4. RESULTS AND DISCUSSIONS

The survey results are presented in two categories: under descriptive and binary logistics analysis. Descriptive statistics mean, standard deviation, percentage, frequency distribution and chi- square were used and binary logistic model was used to identify food insecurity at household level of sampled households.

4.1 Demographic Characteristics of the Households

4.1.1 Household size

It was hypothesized that family size has positive relationship with food insecurity status of households. The survey result revealed that 59.3 percent of food secure households have family size of 2-4 whereas 15.10 percent of food insecure households have the same family size. 50.9 percent of food insecure and 40.7 percent of food secure households have family size of 4-8 persons. Household with large family size are more likely to be at risk of becoming food insecure. The survey result indicated that there is significant difference in mean family size at P<0.01 between food secure and food insecure in sampled households. The minimum and maximum family size of sampled households is 2 to 18 persons (Table 1)

Table 1 Distribution of sample households by household size

| HH size | Food Security status | | | | | |
	Food insecure (N=106)		Food secured (N=54)		Total	
2 – 4	16	15.10	32	59.30	48	30.00
5 – 8	54	50.90	22	40.70	76	47.50
9 – 11	32	30.20	0	0.00	32	20.00
>12	4	3.80	0	0.00	4	2.50
Total	106	100.00	54	100.00	160	100.00
t-value					6.018	***

Source: Own survey result 2015

*** Significant at less than 1% probability level; ** Significant at less than 5% probability level; * Significant at less than 10% probability level, NS=Not significant

4.1.2 Household member actively participant in farm or other income activities

The study used active participation of household members than dependency ratio because of the act that some family members who are considered dependent based on age might be involved in activities and this may contribute to food security. This study hypothesized that the large number of household members actively involved in farm or income generating activities affects the food security status of household positively. The survey result indicated that 14.8 percent of foods secure households have family size of 1-2 persons who actively participant in activities and 18.9 percent of food insecure whereas the household who have 3 - 4 persons actively participated in activities have 33.3 percent food secure households and 36.8 percent food insecure households. Majority of food secure household (51.7%) have 5 to 11 persons in household who actively involved in activities. The survey result showed that as the number persons who actively participate in activity increases, the household will be more food secure. The result of the survey showed a significant difference among household members actively participant in activities and food security status (P<0.01) (Table 2).

Table 2 House hold member actively participant in activities

member actively participant	Food insecure (N=106)		Food secured (N=54)		Total (N=160)	
	Count	Percent	Count	percent	Count	percent
1 - 2	20	18.9	8	14.8	28	17.5
3 - 4	39	36.8	18	33.3	57	35.6
5 - 6	26	24.5	22	40.7	48	30.0
7 - 8	9	8.5	3	5.6	12	7.5
10 - 11	12	11.3	3	5.6	15	9.4
more than 11	0	0.0	0	0.0	0	0.0
Total	106	100.0	54	100.0	160	100.0
t-value				4.983	**	

Source: Own survey result 2015
*** Significant at less than 1% probability level; ** Significant at less than 5% probability level; * Significant at less than 10% probability level, NS=Not significant

Table 3 Distribution of sample households by the sex of household head

	Food Security status					
	Food insecure (N=106)		Food secured (N=54)		Total (9N=160)	
Sex of the HHH	Count	Percent	Count	percent	Count	percent
Male	75	70.80	38	70.40	113	70.60
Female	31	29.20	16	29.60	47	29.40
Total	106	100.00	54	100.00	160	100.00
χ		0.003	NS			

Source: Own survey result 2015
*** Significant at less than 1% probability level; ** Significant at less than 5% probability level; * Significant at less than 10% probability level, NS=Not significant

4.1.3 Age and sex of the household heads

Sex of household head was hypothesized to be one of the variables that make a difference on the level of food security. Female headed households accounted for about 29.4 percent of the

sampled households while male headed households accounted for 70.6 percent of sampled households. The survey result indicated that 29.2 percent of food insecure households were female headed whereas, the corresponding figure for male headed households was 70.8 percent. Male headed households comprise 70.4 percent of food secure and remaining 29.6 percent food secure are female headed households (Table 3). No significant difference between sex of household heads and food security status.

Results in Table 4 show that majority of the respondents (about 33.1%) were aged between 36-50 years. This was observed in both food secured and insecure of the household heads. The age distribution indicated predominance of old population. Age may influence the food security status of the household. Young and elderly headed households are reported to be more vulnerable to food insecurity (WFP, 2009). Age between food security status of the respondents differ significantly (p<0.001).

Table 4 Distribution of sample households by age of the household head

| | Food Security status | | | | Total | |
| | Food insecure (N=106) | | Food secured (N=54) | | Total (N=160 | |
Age of the HHH	Count	Percent	Count	percent	Count	percent
18 - 35	16	15.10	32	59.30	48	30.00
36 - 50	35	33.00	18	33.30	53	33.10
51 - 65	45	42.50	0	0.00	45	28.10
66 - 78	10	9.40	4	7.40	14	8.80
Total	106	100.00	54	100.00	160	100.00
t-value					6.338	***

Source: Own survey result 2015
*** Significant at less than 1% probability level; ** Significant at less than 5% probability level; * Significant at less than 10% probability level, NS=Not significant

4.1.4 Marital status of the household heads

Marital status of sampled household heads indicated that married, divorced and widowed household head accounted for about 75, 3.13 and 21.8 percent respectively. 85.2, 5.56 and 9.26 percent of married, divorced and widowed were found to be food secure whereas, food insecure household consisted of married (69.8%), divorced (1.89%) and widowed (28.3%) (Table 5).

Table 5 Distribution of sample households by marital status of the household head

| | Food Security status | | | | | |
| | Food insecure (N=106) | | Food secured (N=54) | | Total (N=160 | |
Marital status of HHH	Count	Percent	Count	percent	Count	percent
Married	74	69.81	46	85.19	120	75
Divorced	2	1.89	3	5.56	5	3.13
widowed	30	28.3	5	9.26	35	21.88
Total	106	100	54	100	160	100
χ	8.599	**				

Source: Own survey result 2015
*** Significant at less than 1% probability level; ** Significant at less than 5% probability level; * Significant at less than 10% probability level, NS=Not significant

4.1.5 Educational level of household heads

It was hypothesis that household food insecurity and education of household head has negative relationship. Categorization of household head as literate and illiterate exhibited that 45.6 percent of household heads were literate and 54.4 percent of household heads were illiterate. Among literate household heads 48.1 percent were found to be food secure and out of 87 illiterate household heads 54.4 percent were food insecure. The survey result showed no significant difference between educational level of household head and household food security status (Table 6). This may because illiterate people put their entire life on looking for cattle and cultivate their own land whereas literate people engage partially on all these.

Table 6 Distribution of sample households by education level of the household head

	Food Security status					
	Food insecure (N=106)		Food secured (N=54)		Total (N=160)	
Educational level HHH	Count	Percent	Count	percent	Count	percent
literate	51	48.10%	22	40.70%	73	45.60%
Illiterate	55	51.90%	32	59.30%	87	54.40%
Total	106	100.00%	54	100.00%	160	100.00%
χ	0.784	NS				

Source: Own survey result 2015

*** Significant at less than 1% probability level; ** Significant at less than 5% probability level; * Significant at less than 10% probability level, NS=Not significant

4.2 Food Security Status of the Households

The households' food insecurity status can be measured by direct survey of income, expenditure and consumption. In this study, households' food or calorie acquisition/consumption per adult per day is used to identify the food secure and food insecure households. The calorie consumed by the household is compared with the minimum recommended calorie of 2100 kcal per adult per day. If the consumption/acquisition is less than the recommended amount then, the household is categorized as food insecure and if greater than, as food secure.

The households' food security status was measured by direct survey of consumption. Data on the available food for consumption, from home production, purchase and /or gift/loan/wage in kind for the previous seven days before the survey day by the household was collected. Then the data were converted to kilocalorie and then divided to household size measured in AE. Following this, the amount of energy in kilocalorie available for the household is compared with the minimum subsistence requirement per adult per day (i.e. 2100 kcal).

As a result, from all 160 respondents, 106 (66.25%) households were found food secure and 40 (33.75%) were food insecure. The minimum calorie consumed by a single adult in a day for food secure and food insecure households were 2141 and 1554 kcals, respectively and that of the maximum calorie consumed by a single adult in a day for food secure and food insecure households were 2965 and 2007 kcals respectively (Table 7). The mean calorie amounts became 2528.04 kcals for food secure and 1785.71 kcals for food insecure households. On the other hand, the standard deviation for food secure and food insecure households were found to be 261.52 kcals and 131.75 kcals respectively (Table 7).

Table 7 Amount of calories consumed by an adult in a day

Calorie consumed per AE in kcal	Food insecure (N=106)	Food secure (N=54)	Total (N=160)
Minimum	1554	2141	1554
Maximum	2007	2965	2965
Mean	1785.71	2528.03	2036.24
Std. Deviation	131.75	261.52	397.80

Source: Own survey result 2015

4.2.1 Crop production and cultivated crop land holding

4.2.1.1 Cultivated crop land holding

The survey result showed that 42.5 percent of food security household owning land size of 0.75ha and 17.0 percent of food secure household own land size 1ha. Comparing food security and food insecurity, the households having land size equal to 0.75ha and greater than 1ha is less likely to food insecure than household having land size less or equal to 0.5 ha. This result support the hypothesis that farmers who have larger cultivated land size are more likely to be food secure than those who cultivated smaller land size due to the fact that there is high possibility to produce more food. The survey result revealed that there was significant relationship among household food security status and farm land size (Table 8)

Table 8 Distribution of sample households by farm land size of sampled household head

	Food Security status					
	Food insecure (N=106)		Food secured (N=54)		Total (N=160)	
cropping land (Ha)	Count	Percent	Count	percent	Count	percent
≤ 0.5	43	40.60	10	18.5	53	31.1
0.5 to 1 ha	45	42.50	27	50.20	72	45.9
> 1 ha	18	17.00	17	32.40	35	21.9
Total	106	100.00	54	100.00	160	100.00
t-value					-6.669	***

Source: Own survey result 2015
*** Significant at less than 1% probability level; ** Significant at less than 5% probability level; * Significant at less than 10% probability level, NS=Not significant

4.2.1.2 Household food security status and irrigation

The Table below showed the distribution of sampled households" status by use of irrigation. In the survey it was observed that 18.1 % of sampled households said that they used irrigation whereas 81.3 in sampled households said that were not used irrigation. To compare the two sampled groups, 18.9 % of food insecure household said that they were used irrigation while 80.2 of food insecure households said that they were not used irrigation.

Whereas in the corresponding food secure households 16.7 % said that they used irrigation and 83.3 % of food secure households said that they did not use irrigation. Though such difference was observed between the groups, but the irrigation system that they were used was hand irrigation system, which is more traditional and they were practiced in water reserve area where part of the land is wet. The survey result exhibited No statistically

significant relationship between access to irrigation and food security status of households(Table 9).

Table 9 Distribution of sampled household by irrigation used

	Food Security status					
	Food insecure (N=106)		Food secured (N=54)		Total (N=160)	
Uses irrigation	Count	Percent	Count	percent	Count	Percent
Yes	20	18.9	9	16.7	29	18.1
No	85	80.2	45	83.3	130	81.3
No response	1	0.9	0	0.0	1	0.6
Total	106	100.0	54	100.0	160	100.0
χ	0.649	NS				

Source: Own survey result 2015

*** Significant at less than 1% probability level; ** Significant at less than 5% probability level; * Significant at less than 10% probability level, NS=Not significant

4.2.1.3 Household food security status by frequency of planting and crop types planted

The survey result showed that 1.9 % of sampled households said that they planted one a year, 79.4 % of sampled households said that they planted two times a year and 18.8 % of sampled household said that they planted three times a year. Comparing food security status of sampled households with frequency of planting, 2.8 % of food insecure of sampled households planted one time a year whereas 77.8 % of food secures sampled households planted two times a year. 22.2 % of food secures sampled household and 17.0 % of food insecure of sampled households planted three times. Households who plant more than once are more likely to be food secure than households who plant only once. However chi- square showed insignificants relationship between planting frequency (Table 10). As the households cultivate more than once, the probability of being food insecure will increase as they will have surpluses production for consumption and income generation

The survey result on crops types planted indicated that 75.6 % of sampled households planted maize,4.4 % of sampled households planted maize and bean, 6.9 % of sampled households planted maize, bean and sweet potatoes whereas 13.1 % of sampled households planted only maize and sorghum. Comparing food security status of sampled households with the crops types planted. The survey result showed that 59.3 % of food secure sampled household and 84.0 % of food insecure of sampled households planted only maize, 5.6 % of food secure sample household and 3.8 % of food insecure of sampled households planted maize and bean, 11.1 % of food secure and 4.7 % of food insecure of sampled households planted maize, bean and sweet potatoes whereas 24.1 % of food secure and 7.5 % of food insecure sampled households planted only maize and sorghum. The survey result reveal that there is significant relationship among households who planted difference variety of crops with food security status of sampled household (Table 11). This could be due to the fact that as the type of crops varies the amount of calorie gain increase as different crops has different calorie content.

4.2.1.4 Purpose of crop production

As shown in the Table 12, 68.8 % of sampled households said that they produce crops for consumptions whereas 31.3 % of sampled household said they produce crops for both consumption and marketing. The survey result revealed that most of sampled households cultivated for consumption. This may be due to large family size for those who cultivated crop for consumption and lack of awareness of market availability. The possible explanation is that most households in sampled households" uses subsistence cropping system which

mean they produce crop simply to consume and no serving, this made them vulnerable to Food insecurity.

Table 10 Distribution of sampled household by frequency of planting

Planting/ year	Food insecure (N=106)		Food secured (N=54)		Total (N=160)	
	Count	%	Count	%	Count	%
Once	3.0	2.8	0.0	0.0	3.0	1.9
Twice	85.0	80.2	42.0	77.8	127.0	79.4
Tries	18.0	17.0	12.0	22.2	30.0	18.8
Total	106.0	100.0	54.0	100.0	160.0	100.0
χ	2.079	NS				

Source: Own survey result 2015
*** Significant at less than 1% probability level; ** Significant at less than 5% probability level; * Significant at less than 10% probability level, NS=Not significant

Table 11 Distribution of sampled household by crop types planted

Crops types	Food insecure (N=106)		Food secured (N=54)		Total (N=160)	
	Count	%	Count	%	Count	%
Maize	89.0	84.0	32.0	59.3	121.0	75.6
Maize and bean	4.0	3.8	3.0	5.6	7.0	4.4
Maize bean and sweet potatoes	5.0	4.7	6.0	11.1	11.0	6.9
Maize and sorghum	8.0	7.5	13.0	24.1	21.0	13.1
Total	106.0	100.0	54.0	100.0	160.0	100.0
χ	12.719	***				

Source: Own survey result 2015
*** Significant at less than 1% probability level; ** Significant at less than 5% probability level; * Significant at less than 10% probability level, NS=Not significant

Table 12 Distribution of sampled household by the purpose of crop production

Purpose of crop production	Food Security Status of the Households					
	Food insecure (N=106)		Food secure (N=54		Total	
	Count	Percent	Count	Percent	Count	Percent
Consumption	101	95.30	9	16.70	110	68.80
Sale						
Consumption and sale	5	4.70	45	83.30	50	31.20
Total	106	100.00	54	100.00	160	100.00
χ	102.916	***				

Source: Own survey result 2015
*** Significant at less than 1% probability level; ** Significant at less than 5% probability level; * Significant at less than 10% probability level, NS=Not significant

4.2.1.5 Household food security status and use of improved seed

The survey result showed that 32.5 percent in sampled households used improved seed whereas 67.5 percent of sampled households did not used improved seed. Comparing two

groups from food secure and food insecure status, 20.4 percent of food secure sampled households used improved seed whereas 38.7 percent of food insecure sampled households used improved seed, 79.6 percent of food secure sampled household did not used improved seed on farm whereas 61.3 percent of food insecure sampled household did not used improved seed. The chi- square shows significance relationship between used of improved seed and food security status of household (Table 13). Use of improved seed will increase productivity there by insure food security

Table 13 House hold food security status by use of improved seed

Improved seed	Food insecure (N=106)		Food secured (N=54)		Total (N=160)	
	Count	percent	Count	percent	Count	percent
Yes	41	38.7	11	20.4	52	32.5
No	65	61.3	43	79.6	108	67.5
Total	106	100.0	54	100.0	160	100.0
χ	5.462	**				

Source: Own survey result 2015
*** Significant at less than 1% probability level; ** Significant at less than 5% probability level; * Significant at less than 10% probability level, NS=Not significant

4.2.2 Food security status and Livestock holding and ownership of milking cows

4.2.2.1 Livestock holding

Livestock production plays an important role in household economics in difference ways, e.g. as a source of cash income and as a source of supplementary food. Livestock provide milk, meat, fuel and manure. 95.6 percent of sampled household own livestock and 4.4 percent of sampled household didn't owned livestock. Livestock that are owned by 81.7 percent of sampled household include cattle, sheep, goat and chickens are 2,750 in number. Out of this, 51.8 percent, 14.7 percent, 13.5 percent and 20.0 percent were cattle, goats, sheep and chickens respectively. The percent share of cattle is larger than any of the other types of livestock among the sample households.

This signifies the importance of cattle in that particular are of study for purpose of milk and other products , apart the culture of that particular community admit having more cattle than others livestock as a mean of storing wealth and as protection mechanism of any risk or control of food shortage during time of stress. The survey results reveal a significance difference among ownership of livestock and food security status of household at 5 percent probability level. (Table 14)

4.2.2.1 Ownership of milking cows

Milking cows as source of income in daily based, it was believed that household with one and / or more milking cows were better food secure than those without milking cows. The survey result showed that 21.9 percent of sampled households have 1 - 2 milking cows, 20.6 percent of sampled households have 3- 4 milking cows, 24.4 percent of sampled households have 5 - 6 milking cows, 9.4 percent and 3.8 percent of sampled households have 7 - 8 and 9 - 12 milking cows, respectively 3.8 percent of sampled households have 20 - 30 milking cows and 1.3 percent of sampled households have 31 - 50 milking. With respect to wealth, household with more milking cows were more wealthier than others, but since food secure is measure in term stock harvest from field and based entirely on consumption from own harvest of

sampled households. In the study area it is common to find a household having up to 300 of cattle's and up to 50 milking cows.

The survey result revealed that 9.3 percent of food secure in sampled household owned 1-2 milking cows whereas 28.3 percent of food insecure in sampled household owned similar milking cows, 25.9 percent of food secure of sampled households owned 3 - 4 milking cows whereas 17.9 percent of food insecure sampled households owned the same, 40.7 percent of food secure household owned 5 - 6 milking cows, likewise 16.0 percent of food insecure sampled households own the same and 3.7 percent of food secure sampled households owned 9-12 milking cows likewise 3.8 percent of food insecure sampled households owned the same. The survey showed that there is significant relationship between owned milking cows and food security status of household at 1 percent probability level (Table 15).

Table 14 Distribution of sample households by ownership of livestock

	Food Security status				Total	
	Food insecure (N=106)		Food secured (N=54)			
Livestock owned	Count	Percent	Count	percent	Count	percent
1 - 2	7	6.60	6	11.10	13	8.10
3 - 4	15	14.20	4	7.40	19	11.90
5 - 6	8	7.50	2	3.70	10	6.20
7 - 8	14	13.20	5	9.30	19	11.90
9 - 12	21	19.80	10	18.50	31	19.40
13 - 19	34	32.10	7	13.00	41	25.60
20 - 30	0	0.00	11	20.40	11	6.90
31 - 64	0	0.00	9	16.70	9	5.60
No livestock	7	6.60	0	0.00	7	4.40
Total	106	100.00	54	100.00	160	100.00
χ	-6.215	***				

Source: Own survey result 2015
*** Significant at less than 1% probability level; ** Significant at less than 5% probability level; * Significant at less than 10% probability level, NS=Not significant

Table 15 Ownership of milking cows

	Food insecure (N=106)		Food secured (N=54)		Total (N=160	
milking cows holding	Count	percent	Count	Percent	Count	percent
1 - 2	30	28.3	5	9.3	35	21.9
3 - 4	19	17.9	14	25.9	33	20.6
5 - 6	17	16.0	22	40.7	39	24.4
7 - 8	12	11.3	3	5.6	15	9.4
9 - 12	4	3.8	2	3.7	6	3.8
13 - 19	4	3.8	0	0.0	4	2.5
20 - 30	4	3.8	2	3.7	6	3.8
31 - 60	2	1.9	0	0.0	2	1.3
No cow	14	13.2	6	11.1	20	12.5
Total	106	100.0	54	100.0	160	100.0
χ	-0.02	NS				

Source: Own survey result 2015
*** Significant at less than 1% probability level; ** Significant at less than 5% probability level; * Significant at less than 10% probability level, NS=Not significant

4.2.3 Food security status by source of income and expenditure

4.2.3.2 Source of income from farm activities

About 1.9 percent of sampled households said that they got their income from crop, 3.1 percent of sampled household said that they got their income from livestock, 4.4 percent of sampled households said that they got their income from fishing, 18.1 percent of sampled household said that they got their income from both crop and fishing and 72.5 percent of sampled households said that they got their from both crops and livestock. This Figure demonstrated that the highest number of sampled households said that they got their income from both crops and livestock whereas the second highest number of sampled households said that they got their income from both crop and fishing (Table 16).

The survey result (Table 16) displays that largest number of people in sampled household had their sources of income from crops production and livestock rearing. The reason why many respondents said that they got their income from both crops and livestock may be because the most important household asset and means of livelihoods for most people in the study area is crop and livestock. Livestock are main source of cash income, food as well as foundation of prestige and power in the study area. The reason why second large groups of peoples said that they got their income from both crops and fishing may be because the sampled population dwell along river bank for their entire life, hence in absent of having livestock they prepared fishing instead (Table 16).

Table 16 Source of income from farm activities

	Food Security status					
	Food insecure (N=106)		Food secured (N=54)		Total	
Source of income	Count	percent	Count	percent	Count	percent
Crop only	3	2.8	0	0.0	3	1.9
Livestock only	1	0.9	4	7.4	5	3.1
Fish only	2	1.9	5	9.3	7	4.4
Crop + fish	6	5.7	23	42.6	29	18.1
Crop + livestock	94	88.7	22	40.7	116	72.5
fish + livestock	0	0	0	0	0	0
Crop + livestock + Fish	0	0	0	0	0	0
Total	106	100.0	54	100.0	160	100.0
χ	49.018	***				

Source: Own survey result 2015
*** Significant at less than 1% probability level; ** Significant at less than 5% probability level; * Significant at less than 10% probability level, NS=Not significant

4.2.3.1 Expenditure based on source of food for consumption

Income has a dominant importance in achieving household food security especially in rural area where people depend entirely on agriculture production rather than monthly/daily earning like people in urban areas. Households in rural areas usually allocated their harvested grain and livestock products to meet food needs of their family. The sampled households were asked on the quantity and value of food they consumed for last year from their own harvest/crop produced, from purchase, from food aid and gift and also food they consumed from both owned harvest/ crop produced and purchase, food they consumed from own harvest, purchase and gifts/ food aid (Table 17).

Table 17 Expenditure based on sources of income

Expenditure	Food insecure (N=106)		Food secured (N=54)		Total (N=160)	
	Count	Percent	Count	percent	Count	percent
from own harvest / livestock	3	2.8	54	100.0	57	35.6
from purchase	7	6.6	0	0.0	7	4.4
from food aid and gift	9	8.5	0	0.0	9	5.6
from own harvest/ livestock and purchase	78	73.6	0	0.0	78	48.8
from own harvest/ livestock , purchase and gift	9	8.5	0	0.0	9	5.6
Total	106	100.0	54	100.0	160	100.0
χ	147.29	***				

Source: Own survey result 2015
*** Significant at less than 1% probability level; ** Significant at less than 5% probability level; * Significant at less than 10% probability level, NS=Not significant

The survey result revealed that 35.6 percent of sampled households consumed from their own harvest/ crop they produced for whole year, 4.4 percent of sampled households consumed said that they consumed from purchase only, 5.6 percent of sampled households said that they consumed from food aid, remittance/gifts, 48.8 percent of sampled households said that they consumed from own harvest and purchase whereas 5.6 percent of sampled household said that they consumed from own harvest/ crop they produced, purchase and food aid, remittance/ gifts. Comparing the food security status of sampled household and expenditure per households, this showed that 100 percent of food secure and 2.8 percent of food insecure sampled households consumed their own harvest/crop produced in their field per household, 6.6 percent of food insecure household consumed from purchase, 8.5 percent of food insecure sampled households consumed from food aid, remittance/gifts, 73.6 percent of food insecure sampled households consumed from both own harvest and purchase whereas 8.5 percent of food insecure sampled household consumed from own harvest, purchase, and food aid, remittance/gifts. The survey result exhibit that there is significant relationship between food security status of household and expenditure of household at 5% significant level (Table 17)

4.2.3.1 Remittance

The access to various income sources by households explains their livelihood strategies. Cash income is a form of financial asset that provide access to regular inflows of money on which households may rely on for pursuing their means to sustain life. The main contributors of income to the households were household relatives abroad and children through the social support grants attached to them in this study access to cash income from farming and non-farming sources by both food security categories of the household heads were assessed and compared.

Results in Table 18 show minority of the both food secured and insecure (above 17%) reported reliance on grants and gifts as main income source. A highly significant differences were noted in the access to the assessed cash income sources between the respondents according to chi squared test results in Table 18.

Table 18 Distribution of household heads by access to cash income sources

| | Food Security status | | | | Total | |
| | Food insecure (N=106) | | Food secured (N=54) | | | |
Remittances in br	Count	Percent	Count	percent	Count	percent
100 - 200	5	4.70	10	18.50	15	9.40
201 - 300	3	2.80	6	11.10	9	5.60
301 - 400	2	1.90	0	0.00	2	1.20
400 - 500	1	0.90	0	0.00	1	0.60
No	95	89.60	38	70.40	133	83.10
Total	106	100.00	54	100.00	160	100.00
T	-2.494	**				

Source: Own survey result 2015
*** Significant at less than 1% probability level; ** Significant at less than 5% probability level; * Significant at less than 10% probability level, NS=Not significant

4.2.4 Institutional characteristics access to input credit and extension

The Institutional characteristics considered in this study were access to credit, access to extension service and access to market. Savings and access to credit facilities forms the main category of financial production resources assessed in this study. They both reflect the efficiency of the household in functioning as a small enterprise through investments in agriculture production. Access to extension services and markets represented physical capital endowments of the respondents. Results show low levels of financial resources among the respondents. About 38 percent of respondents had access to credit facilities. Extension services were accessed by 34.4% of the respondents. This might have been contributed by respondents' participation to extension service. Access to farm inputs and selling produce was limiting (less than 33%) as shown in Table 19.

Table 19 Distribution of household heads by access to credit, extension and markets

| | Food Security status | | | | Total | |
| Access to market? | Food insecure (N=106) | | Food secured (N=54) | | | |
Answer	Count	Percent	Count	percent	Count	percent
Accesses to Input use						
Yes	34	32.10	19	35.20	53	33.10
No	72	67.90	35	64.80	107	66.90
Total	106	100.00	54	100.00	160	100.00
χ	0.156	NS				
credit Service						
Yes	41	38.70	21	38.90	62	38.80
No	65	61.30	33	61.10	98	61.20
Total	106	100.00	54	100.00	160	100.00
χ	0.001	NS				
Extension Service						
Yes	38	35.80	17	31.50	55	34.40
No	68	64.20	37	68.50	105	65.60
Total	106	100.00	54	100.00	160	100.00
χ	0.302	NS				

Source: Own survey result 2015
*** Significant at less than 1% probability level; ** Significant at less than 5% probability level; * Significant at less than 10% probability level, NS=Not significant

4.3 Determinants of Food Security

A logistic regression model was employed to identify the determinants of Food insecurity. The variables included in the model were tested for existence of multicollinearity, if any. In total, twelve independent variables were used for estimation to identify determinants of Food insecurity, among hypothesized explanatory variables that were expected to influence food insecurity on rural households in Lare district, binary logit model was estimated using a statistical package for social science known as SPSS version 20. Types, codes and definition of the variables and estimates of logit model are presented in Table 20

Before entering the variables in to the model, the multi-co linearity problems were checked in terms of variance inflation factor (VIF) for continuous and contingency coefficients for dummy and discrete variables respectively. As a rule of the thumb, when the variables having VIF values less than the cut off value (10) are believed to have no multi-co linearity problems and those with VIF of above 10 are assumed to have a multi-co linearity problem. Therefore, since, in this study, the computational results of the VIF for continuous variables confirmed the non-existence of association between the variables and were included in the model

Besides, as a rule of thumb, the threshold for contingency coefficients for dummy and discrete variables is 0.75. The values below 0.75 indicate the existence of weak association and above 0.75 indicates strong association of variables. However, the results obtained in this study regarding dummy and discrete variables were less than 0.75. Therefore, this indicated that there was no any multi-co linearity problem detected.

Moreover, the goodness of model fit was measured in terms of count R2, which works on the principle that if the predicted probability of the event is greater than 0.50, the event will occur, otherwise the event will not occur. The model result show the correctly predicted percent of sample household is 96.5%, which is greater than 0.50 (Table 21).

Additionally, the sensitivity and specificity, which correctly predicted food secure and food insecure, were found to be 96% and 89.3% respectively indicated that the model had estimated the food secure and food insecure correctly (Table 21).

Table 20 Types, codes and definition of variables in the model

Variables	Description	values
SIH	Household size	Number (continuous variable)
AGEHHH	Age of household head	Years (continuous variable)
DEPRAT	dependence ratio	Number (continuous variable)
SEXHHH	Gender of household head	Dummy (0 = female,1= male)
EDUHHH	Educational level of household head	Dummy (1 = literate , 0 =illiterate)
CROLAND	Cropping Farm land size of household	Hectare (continuous variable)
LVSTLU	Livestock holding (excluding milking cows)	TLU (continuous variable)
MARDIS	market distance	Number (continuous variable)
REMI	Remitance	Number (continuous variable)
INPUTUSE	Input use	Dummy variable(1=yes,0=no)
CREDSER	Credit servise	Dummy variable(1=yes,0=no)
EXTSER	Extension servise	Dummy variable(1=yes,0=no)

Source: Own survey result 2015

4.3.1 Results of the logistic model and Discussion of significant variables

Twelve independent variables that were hypothesized to have influence on household food insecurity in the study area were included in the model, of which six were found to be statistically significant even though the level of statistical significance for independent variables included in the model was different for individual or groups of variables and the sign of the significant parameters were as expected. The model output revealed that Household size, Age of Household head, Dependency ratio, Cultivated own land, Remittance and Off farm income were found to be statistically significant. In light of the above summarized model results, possible explanations for each significant independent variable are given consecutively as follows:

Table 21 The maximum likelihood estimates of the logit model

Variables in the Equation	B	Wald	Sig.	Odds
SIH	-24.301***	8.331	0.004	0.662
AGEHHH	0.84**	4.122	0.042	2.316
DEPRAT	-23.371***	8.051	0.005	0.51
SEXHHH	-3.15	3.264	0.071	0.043
EDUHHH	-2.81	2.335	0.126	0.625
CROLAND	-189.145***	7.559	0.006	14.223
LVSTLU	1.889	3.505	0.061	6.611
MARDIS	0.009	0.014	0.907	1.009
REMI	0.226**	7.971	0.005	1.253
OFFFRM	0.035	7.078	0.008	1.035
INPUTUSE	2.8	3.491	0.062	16.443
CREDSER	-3.729**	0.013	0.909	0.024
EXTSER	1.645	0.003	0.96	5.181
-2 Log likelihood				36.820
Pearson Chi-squared (χ2)				124.072
Correct prediction of all sample (Count R2) (%)				96.5%
Sensitivity/ Correct prediction of food secure (%)				96%
Specificity/ Correct prediction of food insecure (%)				89.3%

Source: Own survey result 2015

***,**,*= significant at 10,5,1 percent, respectively?

Table 22 Copping mechanism used by sampled household during food shortage

	Food Security Status of the Households					
	Food insecure (N=106)		Food secure (N=54)		Total (N=160)	
Copping mechanism	Count	Percent	Count	Percent	Count	Percent
Using milk and milk products	11	10.40	25	46.30	36	22.50
Borrowing cash or seed	4	3.80	0	0.00	4	2.50
Selling cattle or livestock's	35	33.00	18	33.30	53	33.10
Fishing	16	15.10	0	0.00	16	10.00
Selling fire wood and charcoal	15	14.20	0	0.00	15	9.40
wield fruit gathering	4	3.80	4	7.40	8	5.00
using stock for consumption	21	19.80	7	13.00	28	17.50
Total	106	100.00	54	100.00	160	100.00
χ	40.249	***				

5. CONCLUSIONs AND RECOMMENDATIONS

5..1. Conclusion

The study was conducted with the specific objective of examining Food insecurity situation, estimating the Food insecurity gap and severity and identifying the determinants of Food insecurity and copping mechanism at household level in rural households in Lare District of Nuer Zone in Gambella region. The research objective was realized through conducting household survey in four kebeles of the study area. Household demographics, education status, on farm income, farm land size and other data deemed to be relevant were collected, organized, analyzed and interpreted to come with possible results. The analysis employed both descriptive statistics and econometric methods. Descriptive statistics were employed to describe household characteristics with Food status. Binary logistic model was employed to specified and estimated to identify determinants of Food insecurity whereas copping mechanism was treated as an optional solution reflected from sampled households on time shocks. The sampled households were classified into food secure and food insecure groups based on kilocalorie or grain that was harvested for consumption by the households during last year 2012 cropping season. The total amount of food that were consumed by household from their own production/ harvested and total amount of food that they were consumed per household per six months were compared, if the total amount of food that was consumed from their owned production/ harvest less than total amount of food that they were consumed per six months such households were considered as food insecure, but if the total amount of food that they were consumed from their own production/ harvest was equal total amount of food that was consumed by household per six months, then such a household were considered as food secure but the next step, their grain that they consumed were converted into equivalent daily kilocalories per adult equivalent (AE) and then compared with recommended daily kcal per AE. Then, if the total daily food energy per adult equivalent of household was equal to 2100kcal per adult per a day , then such a household was considered as Food secure , otherwise Food insecure. The descriptive statistics showed the existence of a significant mean difference in expenditure and household Food insecurity status at less than 5 percent probability level between food secure and food insecure households. As a conclusion, since 80.8% of sampled household were food insecure and only 19.2% of sampled households were food secure, it may be concluded that 81% of the population in the study area always suffered with Food insecurity.

5.2. Recommendations

Based on the finding of this study, the possible policy recommendations that can be me from this study are as follows:

•   Household size have a significant and negative effect on food security status in the study area. Policy makers, governmental and non-governmental institutions should devise some feasible measures on family planning to reduce large household size that served as one among then leading causes of food insecurity in the study area. This can be carried out using continues education that encompasses all aspects of trainings that may bring attitudinal changes and targeting at reducing fertility level.

•   Age of the household head had significant impact on food insecurity. This means old household heads are less likely to be food secure. Therefore, capacity building for elderly household heads should be given more priority. Social interventions intended to help rural poor households have to give priority to aged headed household.

- The high dependency ratio from the study result calls for policy makers to focus on projects like family planning. Large family size is as aside problem for the household if the non-productive members are high. Awareness creation should be the first task to tackle this problem. Therefore organizations working on the health stream need to create strategic approach for the utilizations of family planning facilities. Since the communities in the study area are accustomed to polygamies, natural birth control and other alternatives should be assessed by considering the culture aspects of family planning facilities.

- Cultivated land is important economic factor that negatively affects household's food insecurity status in the study area. However, with an increase in population size of the district, cultivated land is becoming in short supply and the farmers are producing crop on small plot of land with lack technologies and low productivities. Improved agricultural technologies that enhance the productivity of land per unit area should be developed and training of agro-pastoral households on land management should be given a due emphasis.

- The result of this study indicated that credit played role for the household food security. Therefore, it is another area of intervention that Lare wereda administration and the regional government should strengthened microfinance institutions service delivery to the agro pastoral who are in need of it.

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