

The Role of Livestock for Food Security: The Case of Erer District, Somali Regional State, Ethiopia

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Abstract: This study was undertaken in the *Erer* district of Somali Regional State, Ethiopia, with the primary objective of identifying factors affecting food security in general and the contribution of livestock to food security in particular. Demographic and socio-economic data were collected from 120 sample households in order to identify the potential role of livestock on food security. The households' calorie acquisition per adult equivalent per day was used to identify the food security level of the households. Tobit regression model were used in order to identify the potential factors affecting food security of the households. The result shows that the majority of the households (58%) was food insecure and only 42% of the households are food secure. Among 14 explanatory variables included in the model, of which age of household head, off farm income, livestock holding in tropical livestock unit, total farm income, distance to veterinary service, distance to market and remittance received have found significant impact on food security condition of the households. All those food security determinants have a direct impact on livestock production. Livestock holding has significant positive effect on food security level of the households. It might be related to the direct contributions of livestock to food for consumption and the indirect use of livestock as a buffer to mitigate the impact of drought shocks; particularly small ruminants play a significant role in smoothing income fluctuations and food deficit in the region. In addition, camel has advantage over small ruminates on provision of continuous milk throughout the year for household consumption as well as for sale. Hence, livestock sector are the major component and should consider as an entry point for any development intervention to improve households' food insecurity condition in the study area. During food insecurity season different coping mechanisms were practiced by households, among them selling of livestock, borrowing cash/food from relatives or friends, reducing meal size/frequency of meal eaten, receiving food aid and working as a daily laborer were identified the in order of importance.

Key words: Household Income • Small Ruminants • Camel • Tobit Model

INTRODUCTION

Ethiopia is believed to have the largest livestock population in Africa. The country has 60.4 million cattle, 31.3 million of sheep, 32.7 million goats and 1.4 million camels [1]. This livestock sector has been contributing considerable portion to the economy of the country. The direct contribution of livestock to GDP is estimated to 17% of GDP and 39% of the agricultural GDP. This rises to about 21% of the national GDP and 49% of the agricultural GDP, if the contribution of processing and marketing (35.6 billion) is taken into account. If the

indirect contribution in organic fertilizer and traction (37.8 billion) is taken into account the contribution of livestock to the GDP will rise to 25.3% [2].

According to the Shaprio *et al.* [2] lowland areas of the country have 28% cattle, 42% sheep, 70% goat and 100% of camel. Hence, most of livestock resources are concentrated in lowland parts of the country. In line to this live animal and meat exports probably constitute about a fifth of all of Ethiopia's exports [3]. This means pastoral output underpins almost all of Ethiopia's live animal and meat exports. Likely, Somali regional state is considered as one of the higher livestock potential

areas in the country. The Region is estimated to have 23.6 million heads of livestock comprising of cattle (20%), sheep (33%), goat (36%), camel (10%) and equines (1%). The Somali livestock sector is principally export oriented. Somali Livestock is mainly exported to the Middle East and neighboring Kenya [1, 3, 4]. Hence, livestock is a major source of livelihood base for the population of Somali Region especially in pastoral and agro pastoral production systems, which are less suited for crop production [5].

However, pastoral and agro-pastoral livelihood systems in the lowlands of the country are among the most vulnerable to the impacts of climate change and variability [6, 7]. Over the past several decades due to changing climatic condition, their livelihood systems were affected by repeated droughts, famine and epidemics and it resulted to losses of productive assets and increasing household food insecurity [8, 9].

In pastoralist areas, livestock are central to both financial and social capital. Financial capital is held primarily in the form of livestock and loans and gifts of animals and animal products are the basis for social ties within and between individuals and families. Therefore, the use and protection of livestock assets is critical to enable pastoralists to survive drought and rebuild their assets after drought [7]. To reduce the incidence of food insecurity, different development programs of the government and NGO's need to in cooperated livestock development issues and adaptive learning from the coping strategy of the household specific to the region. However, the sustainability of the pastoral mode of production has been significantly undermined due to inappropriate interventions [10] and many development interventions are with the understanding of settlement and cultivation [11]. To this end, understanding how livestock support to food security in the region and how efficiency could be improved, is essential for improving the livelihoods of pastoral and agropastoral producers. Absence of such understanding will cause for failure of achieving sustainable development interventions particularly to pastoral and agropastoral regions [12].

Hence, programs should be supported by location specific empirical evidences related to food security [13]. Therefore, the primary objective of the study was to identify the food security condition of the household by analyzing food consumption of the sampled households and to identify determinants of food security of the households in general and the contribution of livestock to food security in particular.

MATERIALS AND METHODS

Study Area: The project was carried out in pastoral and agro-pastoral area of Somali Regional State, Erer district. The area is characterized by arid and semi-arid lowlands. The semi-arid lowlands are predominantly occupied by pastoral and agro-pastoral population whose livelihood is mainly dependent on range livestock production. The population is mainly Somali ethnic group and some Oromo ethnics groups. Erer is the third largest of the six districts in the Shinile zone of Somali regional State. The district is characterized by arid and semi-arid lowlands with the majority (42%) constitutes pastoralists whereas agro-pastoralists and sedentary agriculturalists constitute 24% and 34%, respectively [14].

Altitude of the area ranges from 200m in the southern/central parts, to 1,800m in Jijiga Zone; medium altitudes consisting of hilly terrain and plateaux are found in parts of Shinile Zones. Annual rainfall is ranges from 150 to 1,000 mm per year. Temperatures range from 19°C (Jijiga Zone) to 40°C (the southern zones, particularly the Shabelle, Dawa and Ganale river basins); northern Shinile Zone gets very hot between May and August [15]. The vegetative cover of the land is quite poor. Exposed rock with scattered shrubby vegetation occupies almost 60% of the area followed by exposed sand/soil with a belt of woodland along the intermittent rivers. There are three main rivers namely Erer, Gota and Hurso in the district. An irrigation scheme is practiced at farm level in agropastoral and mixed crop-livestock production system and they are mostly growing cereal and horticultural crops [14].

Sampling Procedure: From Somali regional state, Erer district is purposively selected due to accessibility and security condition of the area. From the study district, four rural *kebeles* (Bila, Gota, Asbuli and Aydora) were selected purposively due to the accessibility and security condition of the area. First, household heads from the selected rural *Kebeles* who have livestock were identified in a preliminary survey. Following these, a total of 120 sample respondents were randomly selected from each *kebeles* using probability proportional to size approach.

Data Collected: A survey was conducted to collect all the necessary information on relevant variables from sample respondents using a semi-structured questionnaire.

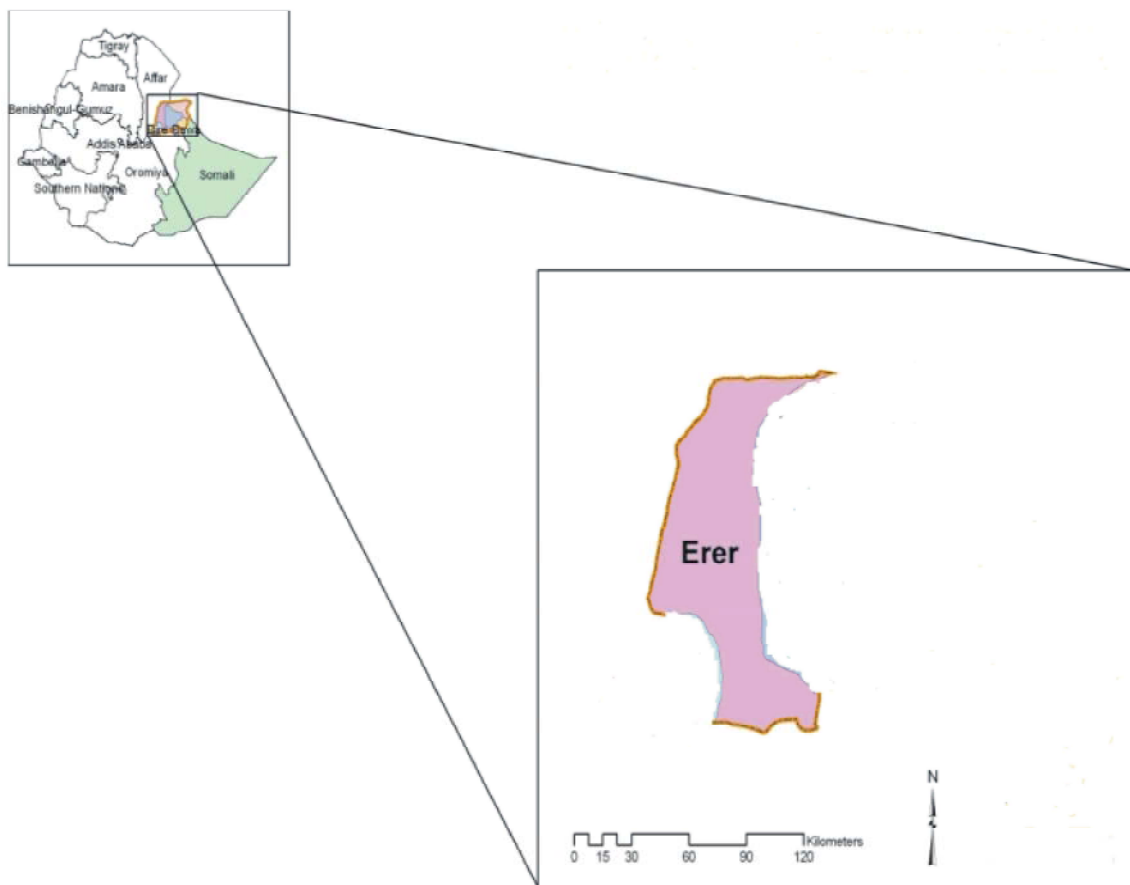


Fig. 1: Study area/Erer district

Survey questionnaire was developed and conducted after a pre-test was made and modified based on the feedback from the respondents. Enumerators were recruited based on their educational background and their ability in writing and speaking the local language. Appropriate training was given to the enumerators about the method of data collection and the contents of the questionnaire. Secondary information that could supplement the primary data was collected from published and unpublished documents from different sources.

Data on the explanatory variables for this study includes data on the types and amount of food consumed by the household, household demographic, socioeconomic, institutional and environmental factors that are identified as factors affecting the food security in different regions by different studies and those which are specific to the region itself. More specifically, it include household size, age of the household head, level of education, livestock types and number of livestock owned (the herd size was converted into livestock units (TLU)

based on Storck *et al.* [16], total land owned, off-farm activities, per capita production, animal management, feeding and health care, production and marketing, distances to veterinary services (accessibility of services), distance to markets, access to credit and extension service and use of improved pastures and coping strategies practiced by the household during food insecurity. The households' calorie acquisition per adult equivalent per day was used to identify the food security level of the households.

Method of Data Analysis

Measuring Food Security Status: Descriptive statistical analysis using calorie consumption at household level was employed to determine the percentage of the households who are food secure or insecure. The type and amount of food consumed by the household was collected for the past seven days by using recall methods. The principal person responsible for preparing meals is asked how much food was prepared for consumption over

a period of time. After accounting for processing, this is turned into a measure of the calories available for consumption by the household using the nationally standardize [17] and Food composition table manual [18]. Data on available food for consumption, from home production, purchase and /or gift/loan/wage in kind for the last seven days before the survey day was collected. This 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.

After that the data collected using seven days recall method, were converted to kilocalorie using the food composition table manual [18]. Then the converted data were divided to household Adult Equivalent (AE). Following this, the amount of energy in kilocalorie (kcal) available for the household was recorded. Then the results were compared with the minimum subsistence requirement per AE per day (i.e. 2100 kcal). This means that the value of minimum amount of energy (2100kcal/AE/day) was used as a threshold beyond which the household is said to be food secure and if below, food insecure.

Determinantes that affect household food security condition were identified using an econometric model as follow;

Model Specification: The dependent variable is descript consists of two outcomes, 1 or 0 [19], therefore, the Tobit model was applied for analyzing factors influencing the intensity of food security (Equation 1). This model is chosen because, it has an advantage over other model (Logit and Probit Models) in that and it can reveal both the probability of food security and the intensity of being food insecure.

The Tobit model can be defined as:

$$Y_i = \begin{cases} Y_i^* = \beta X_i + U_i & \text{if } Y_i^* > 0 \\ 0 & \text{if } Y_i^* \leq 0 \end{cases} \quad (1)$$

$i = 1, 2, \dots, n$

where, Y_i = the observed dependent variable (being food security)

Y_i^* = the latent variable which is not observable

X_i = vector of factors affecting food security and intensity of food security

β = vector of unknown parameters

U_i = residuals that are independently and normally distributed with mean zero and a common variance σ^2 .

Note that the threshold value in the above model is zero. This is not a very restrictive assumption, because the threshold value can be set to zero or assumed to be only known or unknown value [20]. The Tobit model shown above is also called a censored regression model because it is possible to view the problem as one where observations of Y_i^* at or below zero are censored. The model parameters are estimated by maximizing the Tobit likelihood function given by the following formula [20, 21].

$$L = \prod_{Y_i > 0} \sigma f(Y_i - \beta X_i / \sigma) \prod_{Y_i^* \leq 0} F(-\beta X_i / \sigma) \quad (2)$$

where, f and F are respectively the density function and cumulative distribution function of $Y_i^* = 0$, means the product over those i for which $Y_i^* > 0$.

It may not be sensible to interpret the coefficients of Tobit in the same way as one interprets coefficients in an uncensored linear model. Hence, one has to compute the derivatives to predict the effects of changes in the exogenous variables.

- The marginal effect of an explanatory variable on the expected value of the dependent variable is given by:

$$\partial F(Z) / \partial X_i = F(z) \beta_i \quad (3)$$

where $\beta_i X_i / \sigma$ is denoted by z

- The change in the probability of being food secure as independent variable X_i change is given by:

$$\partial F(Z) / \partial X_i = f(Z) \beta_i / \sigma \quad (4)$$

- The change in intensity of food security with respect to a change in an explanatory variable among food secure households is:

$$\partial (Y_i / Y_i^* > 0) / \partial X_i = \beta_i [1 - Z f(Z) / F(Z) - (f(Z) / F(Z))^2] \quad (5)$$

where, $F(Z)$ is the cumulative normal distribution of Z , $f(Z)$ is the value of the derivative of the normal curve at a given point (i.e., unit normal density). Z is the z- score for the area under normal curve, β is a vector of Tobit maximum likelihood estimates. The Tobit model is applied to analyze the factors that determine the intensity of food security using STATA version 12 [22] software.

Estimation Procedure: Before estimating the Tobit models, it multicollinearity test was done among the explanatory variables. For this particular study Variance Inflation Factor (VIF) and condition index (CI) were used for continues variables. The larger the value of VIF_i, the more troublesome it is. As a rule of thumb, if the VIF of a variable exceeds 10 (this will happen if R_i² exceeds 0.95), that variable is said to be highly collinear [19].

Following Gujarati (1995), the VIF_j is given as:

$$VIF(X_j) = \frac{1}{1 - R_j^2} \quad (6)$$

where, R_j² is the coefficient of determination when the variable X_j is regressed on the other explanatory variables.

Condition indices (CI) are given by the following formula.

$$CI = \sqrt{\frac{\text{Eigenvalue(maximum)}}{\text{Eigenvalue(minimum)}}} \quad (7)$$

A condition index greater than 15 indicates a possible problem and an index greater than 30 suggests a serious problem with multicollinearity.

Similarly, there may be also interaction between qualitative variables, which can lead to the problem of multicollinearity. To detect this problem, coefficients of contingency were compounded. The contingency coefficient was compounded as follows:

$$C = \sqrt{\frac{\chi^2}{n + \chi^2}} \quad (8)$$

where, C is coefficient of contingency, χ^2 is chi-square test and n = total sample size.

A goodness of fit measure is a summary statistic indicating the accuracy with which a model approximates the observed data. Since the dependent variables of the models were qualitative, accuracy was judged in terms of the fit between the calculated probabilities and observed response frequencies, likelihood ratio index (LRI) and log-likelihood function.

Description of Independent Variables: For this study 14 independent variables were hypothesized to be analyzed by both descriptive statistics and econometric analysis. Out of these variables 12 were continues and 2 were discrete (Table 1).

Variables and Working Hypotheses: Different variables were expected to affect household food security status in the study area. The major variables expected to have influence on the household to be food secure or not are explained below.

The Dependent Variable of the Model: The household food security status is a discrete variable representing the status of household food security. It was represented in the models by 1 for food secure and 0 for food insecure household. The information to categorize households into two groups was 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 variable was used for binary Tobit regression.

The Independent Variables of the Model: The independent variables expected to have association with food security status were selected based on available literature. The hypotheses of the study with respect to each one of the regressors is presented below:

Table 1: Description of independent variables

Variable Code	Variable Type	Variable Definition and measurement
FAMESIZEAE	Continuous	Family size in adult equivalent
AGEHH	Continuous	Age of household head in years
SEXHH	Dummy	1, if the household head is male; 0, otherwise
DR	Continuous	Number of HH age < 15 and > 65
EDULEVEL	Dummy	1, if read and write, 0 for illiterates
CLANDSIZE	Continuous	Cultivated land size in hectare
TFODAID	Continuous	Food aid given in Birr
TTLU	Continuous	Total livestock holding in TLU
NUMOX	Continuous	Number of oxen owned in number
RMT	Continues	Remittance receive in birr
DISMRKT	Continuous	Market distance from their home in Km
OFFINCOM	Continuous	Total off-farm/non-farm income/yr earned in Birr
TFARINCOM	Continuous	Annual total farm income in Birr
DISVET	Continuous	Access to veterinary services from home in km

Family Size in AE (FAMESIZEAE): This is the total family size that lives together under the same household adjusted to AE. The existence of large number of family members with limited resources could affect the food security status of the household. This is due to increasing demand for food with limited food supply. Evidence in the literature indicates that larger family size have negative impact on food security [23, 24]. Therefore, the expectation was that family size and food security status are negatively related.

Age of the Household Head (AGEHH): Rural households mostly devote their time or base their livelihoods on agriculture. The older the household head, the more experience he/she has in farming and weather forecasting. Moreover, older persons are more risk averters and mostly they intensify and diversify their production activities. As a result, the chance for such household to be food secure is high. Study conducted by different authors [23, 24] indicates that age of the household head has significant effect on food security. In light of this, it was hypothesized that age of the household head and food security are positively correlated.

Sex of Household Head (SEXHH): Women farmer may need a long adjustment period to diversify their income sources fully and become food secure [23, 25]. Labor factor plays a great roll in the study area. Due to the lack of labor in female headed households, they are forced to rent their land as a share crop. Hence, male headed households are in a better position to pull labor force than the female headed ones. Moreover, with regard to farming experience and access to technology males are better than female farmers. So sex of the household head is an important determinant of food security. Therefore, it was hypothesized that male-headed households are more likely to be food secure. Zero code was attached to female headed and one for male headed households.

Dependency Ratio (DR): This is the ratio of children under age 15 and old age of above 64 to total family (total dependency ratio) expressed in terms of AE. The existence of large number of children under age of 15 and old age of 65 and above in the family could affect the poverty status of the household. This is due to the fact that the working age population (active labour force *i.e.*, 15-64 years) supports not only themselves, but also additional dependent persons in the family. Thus, the family relatively with higher number of dependent family members has a direct relation with food insecurity status of the household.

Level of Education (EDULEVEL): Education equips individuals with the necessary knowledge of how to make living. Literate individuals are very ambitious to get information and use it. As agriculture is a dynamic occupation, the conservation practices and agricultural production technologies are always coming up with better knowledge. So if the household head is literate he will be very prone to accept extension services and any other income generating activities. Mequanent and Esubalew [24] indicated that level of education has significant effect on food security. On the contrary [26] reported that level of education has no significant effect. This study was hypothesizing that education level to have a positive impact on food security.

Size of Cultivated Land (CLANDSIZE): Losses of farm land to other uses because of population pressure and limits to the amount of suitable new land that can be brought in to production is one of the constraints of food production. Having more cultivable land was strongly associated with 11.4% of being food secure [26]. Mequanent and Esubalew [24] reported that land size has positively significant on household food security condition of the households. This variable represents the total cultivated land size of a household in hectare. It was hypothesized that farmers who have larger cultivated land are more likely to be food secure than those with smaller area.

Total Food Aid (TFODAID): Food aid is given as a coping strategy to food insecurity in the study area. Food aid can develop a dependency behavior among households which in turn will reduce farmers' motivation towards food self-sufficiency. Therefore, food aid was expected to have a negative relation to food security. The amount of food aid given was measured in Birr. According to Abebaw [27] food aid has no significant effect on food security.

Livestock Owned in Tropical Livestock Unit (TTLU): Livestock holding refers to the total number of livestock holding of the farmer measured in tropical livestock units (TLU). Livestock production constitutes a very important component of agricultural economy, a contribution that goes beyond direct food production to include multipurpose uses such as skins, fiber, fertilizer and fuel, as well as capital accumulation. Furthermore, livestock are closely linked to the social and cultural lives of farmers for whom animal ownership ensures varying degrees of sustainable farming and economic stability [28]. Mequanent and Esubalew [24] indicated that TLU has

positively significant effect on food security condition of the household. Therefore, it was expected that a higher possession of livestock increase the probability to be food secure.

Number of Oxen Owned (NUMOX): Oxen are the most important means of land cultivation and basic farm assets. Households who own more oxen have better chance to be food secure than others. This is because oxen possession allows undertaking farm activities on time and when required. Mequanent and Esubalew [24] and Abebaw [27] have shown that this variable has a positive and significant effect on food security. The number of oxen available to the household is, therefore, hypothesized to enhance the probability of being food secure.

Remittances /Relative Economic Support (RMT): Support from relative or friends in terms of money helps the household to cope up food deficit season and similarly where most households in the study area are benefiting from, due to the supporting each other deeds of the Somali culture. It is of great importance in determining the food security status of the agro-pastoral households. As indicated by Guled [29], remittance has relative economic support from abroad and within the country is positively related to the food security status of the household.

Distance from Market Center (DISMRKT): Proximity to market centers create access to additional income by providing off-farm/non-farm employment opportunities, easy access to inputs and transportation. It was, therefore, expected that households nearer to market center have better chance to improve household food security status than who do not have a proximity to market centers. Proximity to market centers was measured in kilometer. According to Moroda *et al.*[26] distance to input and outputs markets was found to have a strong negative influence on the food security situation of the households; i.e., a unit increase in distance from input and output markets increases the probability of being food insecure with 14%.

Off-Farm/Non-Farm Income(OFFICOM): This represents the total amount of off-farm and non-farm income (in Birr) the farmer or any of the household members earned with in the year. Agricultural production may not be the rural household's only source, or even their most important source of income. Many authors [23, 24, 30-32] showed that off/nonfarm activities has positive influence on

food security condition of the household as a multiple livelihood strategies. Hence, it was expected that the availability of off-farm/non-farm income is positively associated with household food security status.

Total Farm Income (TFARINCOM): This variable refers to the total income from crops and livestock products in Birr. The incomes generated from these activities are the main sources of farmers' food. Therefore, this variable was hypothesized to influence food security positively. Similarly, Moroda *et al.* [26] has shown that this variable has positive on food security of the households.

Total Annual Income (TINCOM): This is an important variable in explaining the characteristics of food secure and food insecure households, in that those who have earned relatively larger income could be food secure. The larger income has positive impact on the probability of being food secure [26]. The possible explanation is that, households who earn more cash income including off-farm/non-farm income have high chance of securing food than those who have not. Therefore, it is expected that total annual income and food security are positively related.

Distance to Veterinary Service (DISVET): This variable is continuous and represents a consequence of disease occurrences due to less access to veterinary services. Almost in all areas of pastoralist inhabited localities it is thought that there is high prevalence of animal diseases. Veterinary services and facilities are very limited. As a result, it is expected that longer distance to veterinary service resulted to less accessibility to vet services and it increase the probability of animal disease incidences and my cause loss of animal due to death. As a result it will deteriorate the livelihood of the pastora and agropastoralists and it will have positive impact in aggravating food insecurity condition of the area. According to Hussein and Janekarnkij [33] conducted in Jigjiga District of Ethiopia, reported that access to veterinary services was found to have a positive and significant impact on household food security.

RESULTS

Measuring Food Security Status of the Households: Food security status of the household is presented in Table 2. According to the result, 58% sample households were found to be unable to meet the minimum subsistence energy requirement per AE per day, 2100 kcal and only

Table 2: Food Security status of sample household heads by sex and Rural Kebeles

Rural Kebeles	N total	Food security status				Sig.	
		Insecure		Secured			
		N	%	N	%		
Bila ¹	37	29	78.4	8	21.7	0.014	
Gota ¹	24	10	41.7	14	58.3		
Total	61	39	63.93	22	36.07		
Asbuli ²	27	13	48.1	14	51.9		
Aydora ²	32	18	56.3	14	43.75		
Total	59	31	52.54	28	47.46		
HH sex	Female	17	12	70.6	5	29.4	0.202
	Male	103	58	56.3	45	43.7	
Total		120	70	58.3	50	41.7	

Source: Survey result; ¹= Agropastoralist; ²= pastoralist

Table 3: Distribution of continuous variables by food security status, Mean (SD)

Variable	Food insecure	Food secured	Sig.
HH head Age	40.4 (10.10)	44.94 (12.89)	0.034**
Family size by AE	5.09 (2.09)	4.35(1.58)	0.028**
Dependency ratio	1.33 (0.95)	1.33 (0.95)	0.553
Cultivated land size (ha)	0.929 (1.35)	0.6500 (1.051)	0.289
Crop production (kg)	497.93 (1117.23)	133.01 (263.534)	0.025**
TLU	19.38 (56.03)	34.85 (36.15)	0.0338**
Ox (number)	1.414 (4.43)	1.72 (4.88)	0.531
Income from livestock, birr/year	7124.74 (8921.49)	9101.54 (8533.92)	0.037**
Total Farm income	8456.60 (9020.83)	10722.94 (10614.73)	0.021**
Off/non farm income, birr/year	1236.57 (2968.48)	2051.20(3322.53)	0.051*
Food aid (birr)	218.87 (550.29)	174.74 (342.84)	0.289
Remittance (birr)	208.571 (698.39)	1030.00 (1966.47)	0.000***
Distance to vet. service (km)	31.04 (35.67)	26.24 (34.09)	0.051*
Distance to market (km)	23.94 (65.15)	19.39 (28.143)	0.102*

Source: Survey result

42 percent households were found to meet their energy requirement. The result (Table 2) showed that there is significant different ($P < 0.01$) among sampled *rural kebeles* for food security statuses of the households, sampled pastoralistes are more secured than agropastoral. This result could related to the more number of livestock owned and nearby distance to cross boarder market for live animal sell could creates an opportunity to being food secured for pastoralists than agropastoralistes. Sex of the household does not have significant impact on being food secured.

Age of the Household Heads: The mean age of the household was found to be 42.31 years old (Table 3). The maximum age observed was 76 where as the minimum was 20 years old. The statistical analysis revealed that there was significant difference ($P \leq 0.05$) in the mean age of the household head between food secure and food

insecure household heads. This finding was positive to the prior expectation, which argued as the age of the household head increases since he/she can acquire more knowledge and experience as a result he/she would be less prone to be food insecure. This result indicates that as the age increases the household experience on the different production system will be increased, therefore the food security condition of the household will be increasing.

Family size measured in adult equivalent was hypothesized as one of the potential variables that have negative contributions to food security. The current result (Table 3) revealed that there was a significant difference ($P \leq 0.05$) between food secure and food insecure sample household groups for family size in adult equivalent. The mean family size of sample households in adult equivalent was found to be 5.09 and 4.35 for food insecure and food secure households respectively.

From any other productive resources land is by far the most important resource in agriculture. The fertility status, location and other attributes of land in association with its size made it a binding resource in agriculture. In the study area, depending on the survey result there was no significant difference ($P < 0.05$) in the mean cultivated land size between the food secure and food insecure households (Table 3). The mean farm size of food secure and food insecure households was found to be 0.65 ha and 0.93 ha, respectively. This average cultivated land size is below the national average of 1.53 ha, which is said to be sufficient to produce household food requirement.

Food secured households has small size of land as compared to the food insecure households (Table 3). This reason may be due to unavailability of suitable cultivable land for crop production in the study areas, since size of land is not the only factor for production but accessibility in terms of seed, distance from homestead and fertility of the land is more important for productivity. This result does not support the hypothesis that farmers who have larger cultivated area are more likely to be food secure than those with smaller land area due to the fact that there is high possibility to produce more food.

The survey result demonstrated that the difference between two sample household groups regarding livestock holding in terms of TLU is significant at 5 % probability level (Table 3). Food insecure households own less TLU (19.38) than food secure ones (34.85). This clearly shows that still livestock has a good contribution to food security condition regardless of major livestock production constraints like livestock diseases and feed shortage in the study area.

As the information obtained from sample respondents indicates that most of the household (93%) do not use oxen for farming operation rather they use hand plough. The remaining ones cultivate their land using oxen either by contributing labor or by coupling. Moreover, the result revealed that there is no significant difference between the two groups with regard to ox ownership. This less variability between the two groups could correlate with the cost of maintaining an ox or its less importance for farm operation in the study area.

The difference between food secure and insecure households for crop production, were statistically significant ($P \leq 0.05$). As indicated in the Table 3, food insecure households produce more crop than secured ones. This result may be due to the reason that even if the overall average crop production was 345.88 kg,

however, the total crop production per adult equivalent was 97.23 kg, which is less than the minimum subsistence requirement recommended by the national food security strategy.

The result showed that the contribution of crop production for food security in the study area is minimal. The major crops grown in the study area are sorghum and maize (cereals), mango, papaya, lemon and orange and chat (perennials). More than 80 percent of sample households do not have land for vegetable and perennial crop production. However, as revealed from the survey result 59.2 percent households in the study area own land for cereal production. Moreover, from the total cereal land 95 percent of the total farm size is allotted for sorghum and only 5 percent is shared by maize. All of the sampled households produce crop by irrigation. However, almost all the agro-pastoralists in the study area were not use agricultural inputs like fertilizer and improved seeds.

In the pastoral and agro-pastoral areas like Erer where agricultural products do not fully meet the needs of the households therefore, the off-farm activities are the most appropriate alternative to improve the level of food security. The most common off/non farm activities are daily laborer, livestock, grain, vegetable, chat trading, fire wood and charcoal sale. The income from such activities greatly improves the households' food security entitlement potential in the study area especially during time of stress ($P \leq 0.05$). According to the respondents, the purpose of this income was for the purchase of food grain, cloths and medicine, expenditure for the household and purchase of livestock, however, majority of the households use these incomes for food expenditure.

Sometimes when households run out of their own product, they attempt to entitle themselves to the food they want through purchase. However, households mostly fail to do so due to the fact that income from other sources is not sustainable and hence they depend on relief food aid. The current study hypothesized that households who received more aid will be more likely to escape from being vulnerable to food insecurity than those who received less. The result shows that the food aid received by the two household groups had revealed no significant difference ($P > 0.05$). The statistical insignificant difference between the food secure and food insecure household groups may be due to small amount of aid given because of the mitigation problem and the food aid was distributed without discriminating the two groups and some times for all with no participation in employment generation schemes (EGS) program.

In this study, remittances refer only to economic support from relatives in terms of money sent to the household. In the study area pastoralists and agro-pastoralists have a culture which encourages helping each other. According to the study result (Table 3), the economic support from relatives in terms of money given to the respondent households is hypothesis in improving the food security status of households. The money provide for the respondents are ranged from 1000 to 9000 birr. About 45.8 % of the respondent households got economic support from their relatives. Moreover, there was significant difference in the mean amount of remittance received by the two sample household groups ($P \leq 0.001$). The survey result is in full agreement with the hypothesis made in this research at the outset, which depicted that households receiving more remittance have a less chance to be food insecure than those households receiving less amount of remittance.

Proximity to the different services has significant effect on food security condition and utilization. Since in the study area almost all households does not get any extension services in terms livestock and agricultural services, distance to different services not includes the extension and credit services. From different services market and veterinary services are statistically significant. Therefore, it was hypothesized that the nearer to the various services, the better probability of being food secure. The average distance to veterinary clinic was 28 km (Table 3). The result of this study showed that the mean difference between food security and insecure households shows statistical significant ($P \leq 0.05$) for distance to veterinary services.

Proximity to market center creates access to additional income by providing off/non-farm employment opportunities and easy access to inputs and transportation. It was, therefore, expected that households nearer to market center have better chance to improve household food security status than who do not have proximity to market centers. The overall average distance to market was approximately 22.3 km. The result showed that distance to market between food secured and insecure households was statistically significant at less than 10 percent probability level. This result is in line with the hypothesis.

There are no significant different on sex of the household head on being food secure. Accordingly, the statistical analysis showed that there is no significant difference between food insecure and secure households

for the mean dependency ratio (Table 4). The difference between the two sample groups of food secured and insecure households with regard to education level shows non statistical significant (Table 4).

The variable food security was used as a dichotomous dependent variable, with an expected mean value of 1, indicating the probability of being food secure, 0 otherwise. Generally, there were 14 explanatory variables included in the model analysis. In order to identify the most important factors from the hypothesized potential variables to influence food security, binary Tobit model was used.

The maximum likelihood estimates of Tobit model shows that the household food security status is determined by the interaction of several potential socio-economic factors. To check measure of goodness of fit in regression analysis, the likelihood ratio test (LR) that follows a chi-square distribution with degree of freedom (DF) equal to number of explanatory variables included in the model (Gujarat, 2003). Accordingly, the chi-square computed shows that, the model was significant at 5 % significance level. This indicates that the null hypothesis stating the coefficients of explanatory variables less the intercept are equal to zero was rejected and the alternative hypothesis of non- zero slope was accepted.

Additionally, goodness of fit in logistic regression analysis is measured by count R^2 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 60.8 percent which is greater than 0.50. The sensitivity, correctly predicted food insecure is 80.0 percent and that of specificity, correctly predicted food secure is 74.7 percent. This indicates that the model has estimated the food insecure and food secure correctly.

Major Problems in the Pastoral and Agro-pastoral Production Systems: As indicated in Table 6, incidence of drought (70%) followed by feed shortage (31.43%), water shortage (25.7%), distance to market (18.6%) and conflict (11.4%) are among the first major prioritized problems mentioned by sampled households in the study area.

Availability and quality of feed affect livestock production. Even though there are no quantitative and updated data on livestock population in the pastoral areas, the population tends to decline with shrinkage and

Table 4: Food security status of the household by sex and education level

Discrete variables		Food insecure, %	Food secured %	
Sex of HH heads	Female	70.6	29.4	n.s.
	Male	56.3	43.7	
Education level of HH heads	Illiterate	58.85	41.12	n.s.
	Read and write	53.85	46.15	

n.s = non significant effect at >

Table 5: Results of the Tobit model

Variable	Estimated Coefficient	t-ratio	Sig.
Constant	1836.347	4.604	0.0000
FAMESIZEAE	-46.485	-0.800	0.4235
AGEHH	15.594	1.750	0.0400**
DR	51.807	0.570	0.5688
SEXHH	218.248	0.976	0.3288
EDULEVEL	201.044	0.884	0.3769
CLANDSIZE	-44.969	-0.622	0.5336
NUMOX	-11.490	-0.424	0.6719
TTLU	1.309	1.383	0.0070***
OFFICOM	0.3812E	1.364	0.01005***
TFARINCOM	0.171	2.450	0.0103***
DISVET	-9.552	-2.612	0.0090***
DISMRKT	-7.419	-2.043	0.0410**
TFODAID	-0.1669	-0.871	0.3837
RMT	0.173	0.252	0.0600*

Source: Survey result

Note: *= significant level at 10%; **= significant level at 5%; ***= significant level at 1%

Pearson chi-square 107.81

Log likelihood 105.5

Prediction success (count R2) 60.8

Sensitivity 80.0

Specificity 74.7

Sample size 120

Table 6: Prioritized problems in the production system based on the response of the sample household heads

Items	Prioritized problems in the production systems (%)		
	1 st	2 nd	3 rd
Drought	70	2.5	2.5
Market Problem	18.57	10.8	20.8
Animal diseases/ Vet service	4.29	19.17	20.8
Feed shortage	31.43	13.3	7.5
Water shortage	25.71	12.5	7.5
Gully formation	4.29	13.3	0.83
Human diseases	5.71	5	8.3
Less access to extension service	2.86	4.17	10
food shortage	4.29	8.3	2.5
Conflict	11.43	3.3	3.33
Unavailability of pure water	0	1.67	4.17
Shortage of cultivated land	1.43	3.3	0.83
low price of animal/product	1.43	0	4.17
Shortage of knowledge for cultivation	0	0	2.5
Crop diseases and pests	0	1.67	0.83
No education center	0	0	1.67
No road facility	0	0	0.8
No credit service	0	0	0.83
Shortage of knowledge to manage animals	0	0	0

degradation of the range resources and frequency of recurrent drought. The key respondents mentioned that previously, before 30 years ago, mobility was a key in order to make best use of water and grazing and as a result we can use the maximum livestock productivity in these dry lands and which could be the major reasons for the depletion of the pasture/ grass and contributes more in aggravating poverty in the area. However, now our traditional shifting system of grazing land and pasture during different seasons is limited to specific areas due to tribal conflicts. Therefore, access to feed becomes the most prominent problem in such area. As a result overgrazing of vegetation in specific area is the only option and in turn it causes for encroachment of unwanted plant species and more bare land becomes created.

The other big problem mention by respondents is gully formation creates big canals. This condition leads to the soil to loss its mineral and it affect the composition of pasture that recover after rainy season. This condition affects the land coverage potential and composition of pasture that recover after the rainy season. This thing is happen mostly in the *Asbuli* and *Aydora* pastoral *kebeles*. In these areas, there are no any organizations which were working on soil bending to solve this problem. Moreover, deforestation is also other problem that aggravate for soil erosion. The society use tree for charcoal production especially *Erer* district is known for their major supplier of charcoal to Dire-Dawa town. In general the entire problems mentioned above have direct and indirect impact on availability of feed. Generally, there is a shift in vegetation composition from natural pasture to shrubs and bushes, caused for the corresponding shift in livestock composition from grazers to browsers, even in some other areas bare land were observed. Accordingly, feed shortage has a direct impact on declining per capita livestock holdings due to mortality as well as per capita production and consumption. To minimize this problem the households use different coping mechanisms during feed deficit such as feed of crop residue (by purchasing or from their farm), purchase of industrial by products from Dire Dawa food complex, herd splitting, migration for searching of feed. Finally, when the feed shortage becoming more severe, they will forced to sale some of their animals.

In agro-pastoral areas the main problem they mention is shortage of water for their crop. In the study area like rural *kebele* of *Bila* and *Gota*, the agro-pastoralists use irrigation water that comes from *Erer and Gota river*, however, the distribution of water to each farm in this area in not fear. For instance, the households live in the upper

stream and the state farm have more chance to use more water for their farm than the households who live on the lower stream. The large and small farms have equal chance for irrigation water due to that there is a water logging problem in the area is created. The distribution of water per farm is two days per month. Therefore, according to the respondents, the frequency of water as well as the amount of water is the main problem for the production of crop in the study area.

Accessibility refers to entitlement of food primarily through production, purchase, trade, exchange and claims. It is influenced by market factors and the price of food as well as by purchasing power related to livelihood situation. As indicated by the respondents (Table 6) there are different market problem, due to different reason such as there is no specified market days in most of the rural *kebeles* for their product, as a result producers/pastoralist and agro-pastoralist exposed their product to the market to sale it by chance if they get purchaser; the other problem is that there is no also specified market place to sale live animals due to that the agro/pastoralist sale their product by travelling a long distance to get reliable consumer. The households in the *Erer* district were use the market place of *Meisso* and *Beki* which is found in *Afdem* district but due to conflict with Oromo ethics group, they only use *Beki* market. This creates a problem of market saturation as all of the livestock sellers supply to this market by then it result to the low price of livestock. The other options the pastoralists use to decrease this problem are they supply to Dire Dawa and cross boarder market to *Dijbouti*. However, in this case the animals are emaciated due to long distance track; by then the households earn low income.

In the case of crop and fruit sale, those problem are similarly true, while the other problem is that the market monopolized by few traders and middle men (5 in number), to purchase products from the agro-pastoralist. This indicates that there is oligopolistic market structure. It forces the producer to sale their product by low price. This may be the cause for the low contribution of crop to food security even if there is high product in the household. The other problem is that the government state farm in *Erer* is also produce fruit and which creates problem on the farmers. This is because the state farm and the farmer supply their product at the same time to the market. Therefore, due to the market saturation, the price of the product decreases. This all condition has direct effect on decreasing the purchasing power of the agro-pastoralist and it may be the reason why most of the agro-pastoralists are failed to be food secured.

Table 7: Major coping strategies of households in percentage

Coping mechanism	Total number of households (120)	
	N	%
Sale of asset	9	7.5
Sale of crop	3	2.5
Sale of animals	110	91.7
Reduce size / frequency of meal	48	35.0
Migrate to other area/relatives	20	16.7
Receive food aid	25	20.8
Borrow cash/food from friend/relatives	67	55.8
Sale of fire wood	16	13.3
Work as daily laborer	20	16.7

Source: Survey result

In Agro/pastoral areas availability of food is mostly affected by indirect factors such as animal diseases, input access, feed and water availability. According to key informants, water for livestock in the study area can be obtained at about six hours walking distance. Most of the livestock types reared in the area are watered every third or fourth day interval and the water is available at about one to two meters depth by digging in the sandy dry river beds.

Livestock disease is a major constraint to livestock production and a cause of food insecurity among agro/pastoral communities. The wide prevalence of diseases results in high rates of morbidity and mortality. As per the information get from the sample respondents, there is a shortage of development agents that are worked in the study areas. In some rural *kebeles*, like *Asbuli* and *Aydora*, there are no development agents (DA's) found at all level, even in other areas which have DA's, they do not provide any extension services. Instead they are mostly used the "fire brigade" approach where they provide services mostly on project basis and/or in cases of requirements instead of permanent extension service rendering system.

Coping Strategies During Food Shortage Season:

Coping strategies or mechanisms are a special component of livelihood strategies which people used to pass at times of decline in food availability. The respondents in the study area indicated that local coping mechanism during food deficit season could vary from sale of low domestic resource to distress migration depending on the intensity of crises (Table 7).

Then pastoral and agro-pastoralists are thus increasingly practicing crop production diversification (annual and perennials) and livestock diversification in combating household food insecurity.

Crop diversification including production of various crop varieties such as potato, maize and tomato were growing during short rainy season to meet their subsistence needs, while cash crop such as chat is grown for households cash need. Livestock diversification is one of the major coping strategies both in the crop producing and pastoral households in the study area. Diversification could improve household's dietary intake though consuming animal products as well as crops and also it improve the average number of meals consumed per day.

The kinds of animals reared in the study area include cattle, sheep, goats, donkeys, camels and chicken (Table 8). A vast majority of the households surveyed rear diversified animals in order to generate income (91.7%) as of coping mechanisms used during season of food shortage (Table 7). Small ruminants are reared for meat production both for home consumption and for sale. Moreover, they are the first to be sold during a serious of food shortage season as immediate income source.

The current result (Table 8) indicates that total livestock population owned by the sample respondents was 7879 in number. Out of this, 71.6 percent, 16.8 percent, 7.6 percent, 2.2 percent and 0.2 percent were goat, cattle, camel, Donkey and chicken, respectively. In both food secure and insecure households percent share of goat are larger than any other livestock among the sample households. This signifies those small ruminants are important over others both as a store of wealth and as check or control of food shortage during time of stress in the study area. In pastoral area shoats and camels are the first preference to keep at household in the study area. This is because sheep is preferred for their fat as a food during dry season while camel has varies advantages for the households through providing milk continuously throughout the year even during drought season, used for transport (even they can rent it for the cross boarder material transportation) and used as social expenses. One sample respondents said that '*a person who do not have camel as like full of guilty*'. This is because if the person is clash with other clan and if he is guilty, the only animal they use for compensation is camel.

Livestock provide sound hedging against risk of food insecurity. Accordingly, among the sample households, 91.7% of households involved in the sales of animals (mostly small ruminants) to acquire food whenever there is a shortfalls in food supply (Table 7). To this end, when food produced is fully consumed (agro-pastoralists) and or no cash reserve is available to purchase more of it (agro/pastoralists), animal products and/or live animals are sold to buy food for the household.

Table 8: Average number of livestock holding by sample households

	Food insecure		Food secured		Total	
	N	%	N	%	N	%
Total Animal in number						
Oxen	99	2.6	86	2.1	185	2.3
Calves	61	1.6	81	1.9	142	1.8
Heifer	38	0.9	80	1.9	118	1.5
Cow	541	14.1	344	8.5	885	11.2
Goats	2546	66.6	3095	76.3	5641	71.6
Sheep	73	1.9	49	1.2	122	1.6
Camel	363	9.5	233	5.7	596	7.6
Donkey	89	2.3	85	2.1	174	2.2
Poultry	14	0.4	2	0.05	16	0.2
Total	3824	100.0	4055	100.0	7879	100.0

Source: Survey result

According to key informants indicates that the most commonly practiced coping strategies at household level that are sequentially used during the severe food crisis time, is sale of small ruminants/animal product, borrow crop/money from friend or relatives followed by shifting to off-farm and non-farm incomes, sale of large ruminants, sale of assets and eventually, if the crisis becomes more severe, they will forced to migrate to their relatives or other areas.

In the current study (Table 7) also identified that borrowing cash and /or food from better off neighbors (55.8%), reducing size/ frequency of meal (35%), receiving food aid (20.8%), working as a daily laborer (16.7%) and migration (16.7%) were the major coping mechanisms practiced by sampled households against food shortage season. Accordingly, 13.3%, 7.5% and 2.5% of the sampled households practiced sale of fire wood, sale of household asset and sale of crop, respectively, as a coping mechanism to cope up with the risks of food shortage and/or food insecurity. However, the current analyses according to the respondents have shown that, coping strategies have distinct patterns. All farmers were not equally vulnerable to drought or food insecurity, they responded in different ways. For instance, among the sample households a few of them were found to have been practicing to cope serious food crisis by reducing frequency and size of meals (usually adults receive one meals, in the morning) and in the afternoon they chew *chat* and drink “*hojjaa*” to stimulate and enables themselves abandoning a practice of eating during the day time (Table 8). *Hojjaa* is a traditional drink which made from mixing and boiling of water, milk and coffee husk.

DISCUSSIONS

Fourteen independent variables that are hypothesized to have positive effect on household food security in the study area were included in the model, of which seven were found to be statistically significant. Such statistically significant variables for the model output are age of household head (AGEHH), off farm income (OFFICOM), livestock holding in TTLU, total farm income (TFINCOM), distance to veterinary service (DISVET), distance to market (DISMRKT) and remittance received (RMT). In light of the above summarized model results possible explanation for each significant independent variable are given consecutively as follows:

HH Head Age (AGEHH): Age of household head was significantly ($P \leq 0.05$) affect food security status of the household in the study area. This implies that, as the household head increases in age by one year, the intensity of being food secure increases by 1.75%. This means more aged they are more likely to be food secure than the young households. The possible explanation for this would be as the age of the household head increases since he/she can acquire more knowledge and experience as a result he/she would be less prone to be food insecure and also as the age increases the household experience on the different production system will be increased. Similarly, Mequant and Esubalew [24], Aragie and Genanu [32] reported that household age has significant positive effect on the household food security condition and similar author explained that long experience often matters to exploit indigenous practices and incorporate into development interventions to make

agriculture moving forward. Thus, interventions that enable aged households to share their lifelong experiences to younger household heads need to be devised and implemented. In contrary to this in Pakistan Bashir *et al.* [34] found that an increase of one year in the age of household head decreases the chances of a household to become food secure.

Family Size (AE): Family size has a negative association with food security of the household in the study area ($P>0.05$). This explaining an increase of an additional member of the household by one adult equivalent decreases the chances of food security by 0.82 times. The current result was similar with what Bashir *et al.* [34] and Mequanent and Esubalew [24] who indicated that probability of being food secure decrease with an increase in family size.

Education Level: Educational status of the household head had positive association with household food security with non significant different. In line to this Bashir *et al.* [34] found education level increases the chances of a household to become food secure and similarly, the same author in other study [35] indicated that level of education increases the odds of a household to become food secure by 21 times compared to having no education. Other studies have also pointed out the positive effect of education on decreasing chances of household food insecurity [23, 24].

Livestock Owned (TLU): The relationship between the numbers of livestock holding in tropical livestock unit with food security turned out to be positive and highly significant ($P\leq 0.01$) in the study area. The positive sign of slope coefficient indicates that when livestock owned increase by one TLU, the intensity of a household to become food secure increase by 1.383%. The possible explanation for this result is that as herd size being a pastoralist's resource endowment, those sample agro-pastoralist/pastoralists with large herd size have better chance to earn more income from livestock product and live animal sale [36]. This in turn enables them to purchase the required amount of food and non food items when there is a shortage of resources in deficit season. According to the respondents, household who have small ruminant and camel have more capacity to resist hard time. Similarly the report of Speranza [37] and Bekele *et al.* [36] indicated that livestock diversification

was a major factor affecting household food security. Therefore, households who have large number of diversified livestock (ox, cow, heifer, calf, donkey, goat, sheep and chicken) they become in better position to be more food secured than households who have few livestock. Moreover, livestock serve as source of food (milk and milk products, meat, egg) which have important nutritional values that contributes to healthy life. It also serves as accumulations of wealth so that used as a coping strategy during hard times, especially when food stock in the household deteriorates. Accordingly, Mequanent and Esubalew [24], Aragie and Genanu [32] showed that livestock holdings had significantly positive impacts on food security status of the households. Similarly, Doti [38] explained that large herd size certainly contributes to food security through food supply, source of income, as a hedge against risks and as a means of capital accumulation that can be exchanged for food in times of deficit.

Off/Non Farm Income (OFFICOM): As expected, off farm income shows a positive and significant effect on household food security at 10% significance level. The positive sign of slope coefficient indicates that when off-farm income earnings increases by one Birr, the intensity of a household to become food secure, increase by a factor of 1.36. The likely explanation is that those households who had access to different off farm income opportunities (from sale of fire wood, charcoal and trading) are less likely to become food secure than those who don't have enough access to off-farm income. This indicates that the success of households and their members in managing food insecurity is largely determined by their ability to get access to off-farm job opportunities in the study area. In this regard, households engaged in off-farm activities are better endowed with additional income to purchase food. Similarly different authors [23-24], Mequanent *et al.* and Kabsay and Messay and Aragie and Genanu [30-32] reported that households who are engaged in various off farm and non-farm activity are likely increased the household food security. Households with off-farm activities (28.9 %) had significant impact on food security condition of the household. which may indicate the role of alternative income sources in alleviating food insecurity in the study area, while reducing the pressure on livestock off-take [36].

Total Farm Income (TFARINCOM): The survey result showed a positive relation between farm income and food security and the coefficient is highly significant at one percent probability level. For the sample households, major source of total farm income is an agricultural activity get from crop production and animal rearing. Majority of income earned from livestock production and this income goes to food expenditure improving accessibility of enough food. This result was in agreement with empirical works of Abebaw [27].

The result indicates that as farm income increases by one Birr, holding other variables constant, the intensity of food security increases by a factor of 2.450. The result corresponds with the prior expectation and the possible explanation is that income determines purchasing power of the household with the prevailing price so that those households having higher income are less likely to become food insecure than low income households. Similarly Bashir *et al.* [35] also found a positive impact of income on food security.

Distance to Veterinary Service (DISVET): The relationship between the distance to veterinary services and food security turned out to be negative and significant at less than 1% probability level. This is an indication that if the households are in long distance from veterinary clinic by one km, it reduces the risk of food insecurity by a factor of 2.612. This is in agreement with the hypothesis that the short distance to veterinary services is likely to play a role in determining the state of food security at household level. This can be justified by the fact that getting veterinary services will decrease the number of animal died and also it can sustain the productivity of the animals if they are in a good health condition. The probable reason is that an increase in livestock mortality would result in a lower number of animals. This implies reduced income and a declining in home food production, eminently contributing to food insecurity. This clearly shows the importance of controlling different diseases in the area. Indirectly according to the current report, an increase in number of animals will significantly improve the food security condition of the households in the study area.

According to the respondents, unavailability or low veterinary services are another problem that aggravates the number of death animals. As indicated previously, the households on average travel 28 km to get veterinary services and it also has significant effects on

the households to being food secured. In the study areas there was CAHWS (community animal health workers) However, due to drugs supply shortage and few number of CAHWS in the area, they could not able to work efficiently to cover the large area. Similarly, the result of Hussein and Janekarnkij [33] indicated that access to veterinary service was found to have positive influence on food security condition of the household. In case of veterinary services, distance is not the only constraints but shortage of community animal health workers (CAHWS), veterinary staff and also shortage of drug supply in the area. There is also a need of critical evaluation on the performance of CAHWS and strengthen the positive elements for the smooth operation and sustainability of CAHWS. Livestock extension should be promoted and it is prefer to be in the form of commodity targeted packages.

Distance to Market (DISMRKT): Market distance has been found to be negatively related with food security and significant ($P \leq 0.05$). The result was related with the expectation that households nearer to market centers had better chances to be food secure than those who are away from market centers. When distance to market increases by one unit, food security status will increases by a factor of 2.043 times. Similarly, Aragie and Genanu [32] reported that distance from input market has significant impact on food security condition of the household in north Wollo zone. Accordingly, Moroda *et al.* [26] distance to input and outputs markets was found to have a strong negative influence on the food security situation of the households; i.e., a unit increase in distance from input and output markets increases the probability of being food insecure with 14%.

Remittances Received/Birr (RMT): The results of the survey revealed that the variable under consideration is positively related and significant at less than 10 percent probability level with food security. Holding other things constant, food security increases by a factor of 0.252 as the amount of remittance received increases by one unit. The possible explanation is that remittance improves the purchasing power of the household to escape from risk of food insecurity and it gives the household an opportunity to be involved in different income generating activities. This might be due to the fact that households who have got the opportunity to receive more remittance would build their capacity to produce more through purchase.

The current result is in line with the report of Guled [29] and Sisay and Edriss [39] who indicated that income from remittance and gift were found to be significant determinants of food security.

Constraints in the Pastoral and Agropastoral System:

The losses of productive assets and increasing household food insecurity due to drought have become defining features of lowland poverty in Ethiopia [40]. Recurrent drought, the exorbitant land degradation, feed and water shortage, market problem and tribal conflicts are the chronic threats to the pastoral and agropastoral livelihood in the study area. Similar to the current study, Sara and Mike [40] identified that these entire problems mentioned are the critical constrained in most pastoral and agro-pastoral areas of Somali, Afar and Borena zones of Ethiopia. Accordingly, Simon and Gezu [41] also indicated that conflict is the sever problem in the Shinile zone of Somali pastoral and agro-pastoral area.

Coping Mechanism: The Somali herders experience different coping mechanisms during food insecurity season as a result of recurring droughts causing huge losses of assets and it also affect their livelihoods [14]. The current study, selling of livestock, borrowing cash/food from relatives or friends, reducing meal size/frequency of meal eaten, receiving food aid, working as a daily laborer were identified in order of importance as the main coping mechanisms against food insecurity. Similarly, different authors [42-44] also identified different coping strategies that are practiced in different production system in Ethiopia. Therefore, livestock sale is the most practices coping mechanism in the study area. Hence, it calls for policy strategy to consider livestock integrated interventions as livelihood based in the study area.

CONCLUSION AND RECOMMENDATIONS

Age of household head has a positive and significant effect on food security status of the households in the study area. This may be explained by the fact that as the age of the household head increases he/she can acquire more knowledge and experience and as a result would be less prone to food insecurity. Therefore, capacity building for young household heads should be given.

Farm income have positive relationship on food security of the household. However, the positive contributions of farm income are mainly earned from livestock production than crop income. Among the

livestock shoat and camel are the most preferable species in most households as an income source and household consumption. Hence, camel and shoats are the major animals that should give due attention in livestock policy plan and prioritized in the livestock development programs in the study area.

Cultivated land size was found to be insignificant contribution on being food secured. This indicates that land size is not a limiting factor for food security rather physical and biological conservation measures will enable the land to be productive rather than expanding the land size. Generally, soil and water conservation activities, such as gully treatments, establishment of nurseries and a forestation/reforestation are highly recommended.

Availability of irrigation water in the study area could take as an opportunity to answer for policy options to engage agropastoralist on crop production. However, to involve them in full capacity, problem of irrigation water distribution should be resolved through capacitating community managed water distribution program.

The positive and significant impact of off/ non farm income on food security of the household indicates the needs of diversified income source for the household to save their livestock rather than selling them during food deficit season. It calls for developing appropriate policies and strategies on how to involve food insecure households in an alternative off/ nonfarm activities.

Remittance has a positive relation on being food secure. The purchasing power of the households does not only increase by having large numbers of livestock but also if the household get remittance from friends/relatives. Hence, it calls for development practitioner to build up or strength financial institution on how to involve the food insecured households to different credit access.

Livestock has significantly positive contribution on household food security condition in the study area. Development intervention related with food security in the study area should not neglect the paramount important role of livestock's have. Hence, this suggested that livestock should consider as one of the main policy option in development plan of the practitioner to improve food insecurity status of the household in the study area.

Distance to veterinary service and market has negative impact on food security condition of the household. Hence, it call for development strategy on provision of adequate veterinary services, like by establishing drug supply centers with in some distance interval in the district and there should be also training of additional CAHWS.

From different problems encountered in livestock development sector market was the main problem mentioned. Hence, this condition suggests designing development strategy for livestock sector through developing specific place for livestock marketing. In addition, to this there should be establishment of pastoralist livestock market cooperative with providing the cooperative members in basic business skills and cooperative management. There should be a program that promotes an increase diversity of animal herds that are less dependence on drought-vulnerable species.

Shortage of livestock feed also other problem mentioned by households in the study area. Low and declining pasture production in the study area could be caused by land degradation problem and inadequate institutional supports. Land degradation in the form of soil erosion and also gully formation are the main problems observed in the study area. It might be caused by deforestation for coal production, overgrazing and limited adoption of soil and water conservation practices. Therefore, focus has to be given for range land management efforts and starting from the very strengthening of the existing traditional shifting grazing system of pasture management practices to modern range land resource utilization techniques required for sustainable use of the resources and improve the wellbeing of the pastoral communities.

In general, almost all food security determinants that have significant impact on food security of the households also have a direct relation on livestock production. Hence, livestock sector are the major component and should consider as an entry point for any development intervention to improve households' food security condition in the study area. Improving livestock productivity and production is crucial to accelerate growth and ensure food security. Hence, livestock has significant policy implications for where to focus development efforts in the study area. Livestock sale is the most practices coping mechanism in the study area. Hence, it calls for policy strategy to consider livestock integrated interventions as livelihood based in the study area.

The most commonly practiced coping strategies at household level that are sequentially used during the sever food crisis time is sale of small ruminants/animal product, borrow food/money from friend or relatives followed by shifting to off-farm and non-farm jobs, sale of large ruminants, sale of assets. If the crisis is more serious, they will force to migrate to their relatives or other

areas. Hence, strengthening early warning system also protects the households from extreme adjustment mechanisms that practiced to escape from food insecurity. Furthermore, early warning of climatic events could alert households, to be prepared and avoid important losses of livestock due to death and or sale them with low price. Hence, there also need to have integrated overall development programs with the local coping strategies.

Incidence of conflict in the study area is the major treat that limit the households from the use of resource and infrastructure. Hence, different conflict resolution methods should be considered, that has a long-term approach and has strong linkages with pastoral and agro-pastoral livelihoods should be practiced.

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