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# Analysis of Rural Households Food Security in Western Ethiopia

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## Abstract

This study analyzed rural households' food security and its determinants in western Ethiopia. The study used a primary data collected from 276 randomly selected households using interview schedule. In addition, focus group discussion (FGD) and key informants interview were also used to obtain a qualitative primary data. As to the method of data analysis, the study employed descriptive statistics (such as mean, frequency, range and percentage) and binary logit model (BLM). The finding of the study revealed that, in the study area, 59.06% of the sampled households were food insecure and 40.94% of them were food secure. Besides, the study indicated that 86.87% of the households were vulnerable to different shocks, risks, and seasonality's and 41.67% of the households faced shortage of food. Moreover, the finding indicated that only 31.88% of the households were food self-sufficient from own production. Low productivity, climate related problems and inadequacy of cultivable land were identified as the top three main causes of food shortage and/or food self-insufficiency from own production. The estimated BLM pointed out that sex, age, access to irrigation, off-farm and non-farm income, input cost, access to credit and distance to market were significant in determining household's food security status. Therefore, policies and actions directed towards improving households' food security and reducing their vulnerability should focus on the aforementioned factors.

## Keywords

Food Security, Vulnerability, Binary Logit Model, Assosa Zone, Ethiopia

## 1. Introduction

Food insecurity and poverty are crucial and persistent problems facing the world. The number of people who are food insecure and malnourished globally

has been an escalation since 2014, reaching an estimated 815 million in 2016 from 777 million during 2015 affecting 11 percent of the global population [1]. In addition, as IFAD [2] finding indicated, around 1.4 billion poor people were living on less than US$1.25 a day, of which one billion of them reside in rural areas, where agriculture is the main source of livelihood, especially in Sub-Saharan and Southern Asia. Besides, FAO [1] report argued that food insecurity situation visibly worsened in parts of Sub Saharan Africa, south Eastern and Western Asia as the food insecurity prevalence was much compounded by droughts, floods (caused by El Nino phenomenon and climate change) and economic slowdown in the regions. Moreover, Agbola [3] conveyed that households in western African countries were vulnerable to the risks of food shortages prior to harvest, temporary marketing problems, wastages due to inadequate storage facilities, seasonal unemployment, and increases in food prices and civil strife that led to chronic poverty and food insecurity in the region.

As part of Sub Saharan Africa, Ethiopia is facing with the problems of poverty and food insecurity. A recent study figured out that about 23 million Ethiopian live under the basic poverty line and food insecurity remains a major challenge [4]. Furthermore, UNDP [5] showed that around 44.2% of children under five were malnourished and stunned mainly caused by climate change, drought and the spread of diseases. Moreover, different scholars depicted that the food insecurity and poverty incidence were higher in rural areas constituting around 30.4% of the total population live under poverty line, while merely 25.7% for the urban dwellers consuming below the minimum recommended daily intake of 2200 kcal/adult equivalent (AE)/day [1]. In addition, Hill and Porter [6] also reported that in the country 43% and 46% of the total and rural population, respectively, were vulnerable to absolute poverty, and 55% and 56% of the total and rural community, respectively, experienced different types of shocks. Porter [7] argued that the vulnerability of rural households was mainly attributed to shocks such as food price increase, occurrence of drought, crop damage and job loss that impact consumption by restricting their physical access and nutritional content of the products consumed.

Particularly, Assosa zone is characterized by the prevalence of high incidence of poverty and food insecurity. The food insecurity situation in the study area was worsened by inadequacy of technology innovation, climate change, weed infestation, insect pests, and poor field management [8]. Hence, to reverse the prevalence of food insecurity situation, the government of Ethiopia planned and implemented various long term strategies (Such as Agricultural Development Led Industrialization, Sustainable Development & Poverty Reduction Program, Poverty Alleviation & Sustainable Development Program, Growth & Transformation Plan I & II) to ensure food security and eliminate poverty through mainstreaming the Sustainable Development Goals into the Plan [5] [9]. However, to bring improvement in the food security situation in the country, [10] recommended that location specific empirical evidences should support the improve-

ment programs. Hence, this study attempted to fill the information gap by assessing the food security status, vulnerability status and the determinants of food security in the study area; that helps policy makers in designing sound and applicable policy decisions to forward an intervention and integrated efforts to combat food insecurity. Thus, it addresses what the food security status looks like and what factors affect households' food security situation in the study area. Various studies conducted in Ethiopia mainly focused on food availability and access dimension [11]-[17] and others adopted 24 hour or seven day recall method to capture the utilization dimension [18] [19] to address households' food security and its determinants. However, considering only the food availability and access measures do not fully address the actual food energy utilization by the households and the quality of the food consumed. In addition, the drawback of relying on seven-day recall method is that as a part of developing countries the majority of rural households have weak access to formal education due to that they cannot accurately respond on the types and quantities of food items consumed. The novelty of this study is that it considered households' food consumption/utilization for seven consecutive days collected using weighed records method as food energy intake is sensitive to different unforeseen factors such as religion, weather, holidays, etc., which can be captured by taking weighted data.

The rest of the paper is organized as follows: Section 2 provides the methodology employed; Section 3 presents and discusses the results; and Section 4 concludes and infers policy implications.

## 2. Methodology

### 2.1. Description of the Study Area

Assosa zone, the study area, is one of the three administrative zones of Benishangul-Gumuz Region. Administratively, the study area is composed of 7 districts, namely; Assosa district, Homosha district, Bambasi district, Menge district, Kurmuk district, Sherkole district and Odabildi-Guli district. The total population of the zone was 283,707 people, of which 144,616 and 139,091 were male and female, respectively. Furthermore, 86.28% of the population lives in rural areas [20]. Moreover, the predominant source of livelihood for the majority of the population in the area is mixed farming system *i.e.* they mainly rely on both crop production and livestock rearing.

### 2.2. Sampling Technique and Sample Size

The study employed three-stage simple random sampling method. In the first stage, three districts (namely Assosa, Bambasi and Sherkole) were randomly selected out of 7 districts in the study area. Secondly, 12 peasant associations (PAs) were randomly selected using probability proportional to the size of PAs in each sampled districts. The reason for selecting PAs was that, in the study area almost all the households relied on agriculture and the emphasis of this study was on assessing the food security of households working on agriculture. Finally, 276

sample household heads were randomly selected based on probability proportional to size of the households in the selected PAs. The selection of sample household heads in each PAs was done using lottery method. The sample size for collecting quantitative data for this research was determined by using Yamane formula [21].

$$n = \frac{N}{1 + N(e)^2} = \frac{40530}{1 + \left(40530 \times 0.06^2\right)} = 276 \quad (1)$$

where; $n$ = denotes the sample size; $N$ = denotes total number of estimated household heads (40,530) in the study area; e = denotes margin of error (6%).

## 2.3. Data Set and Collection Methods

The study utilized primary data. Primary data were collected using interview schedule through enumerators and the researchers. Particularly, primary data on the types and quantities of every food item consumed by the household head and his/her family members was collected using Weighed records method for 7 consecutive days from each sample household. The reason for collecting the data from a single household for seven consecutive days was that food security is a sensitive issue that is affected by different unforeseen factors (religious, holidays, etc.) which can be captured by taking weighed data [22]. The enumerators were trained how to conduct the interview schedule and approach the households. Besides, FGD and key informants interview were employed to supplement the research finding with qualitative information.

## 2.4. Method of Data Analysis

The data analysis for this study was conducted using STATA 13 statistical software package. The study employed descriptive statistics and econometric model to analyze the data. Descriptive statistics such as mean, percentage, frequency and standard deviation were used to assess households' food security status, vulnerability status, causes of food shortage and to provide insight into different socio-economic characteristics of the households. To analyze determinants of food security, the study estimated binary logit model. To estimate the dependence of dichotomous dependent variable on one or more independent variables, studies employ linear probability model [23], binary Logit model [11] [24] [25] or binary probit model [23] [26]. Although linear probability model is the simplest method, it is not logically attractive model, because it assumes the conditional probability increases linearly with the value of explanatory variables. Unlike linear probability model, logit and probit models guarantees that the estimated probabilities increase but never step outside the 0 - 1 interval and the relationship between probability ($P_i$) and explanatory variable ($X_i$) is non-linear. But, due to its practical applicability and soundness logit model is preferable than probit model [27] [28]. Thus, this study used binary logit model to analyze the determinants of food security. The functional form of logit model is specified as follows [29]:

$$P_i = E\left(Y = \frac{1}{X_i}\right) = \frac{1}{1+e^{-(\alpha+\beta Xi)}} = \frac{1}{1+e^{-(Zi)}} \quad (2)$$

For ease of exposition, the logit becomes a linear function of different explanatory variables:

$$L_i = \ln\left[\frac{Pi}{1-Pi}\right] = Z_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_i X_i \quad (3)$$

where: $P_i$ denotes probability of being food secure, $1 - P_i$ denotes probability of being food insecure, $L_i$ is the logit, $X_i$ is vector of relevant household characteristics and $\beta_i$ is a vector of parameters to be estimated. It should be noted that the estimated coefficients do not directly indicate the effect of change in the corresponding explanatory variables on probability ($P$) of the outcome occurring [30]. Thus, the study estimated marginal effects to indicate the effect of change in explanatory variables on probability ($P$) of the outcome occurring.

## 2.5. Definitions of Explanatory Variables and Development of Hypothesis

We included different demographic, socio-economic, institutional and other variables in our analysis. The selection of those variables is guided by previous empirical studies. Accordingly, Asfir [31] noted that technology adoption depends on nature of settlement of households and argued that native households are highly resistant to accept new technologies. However, adoption of new technologies improves agricultural production and productivity [32], which in turn reduces households' exposure to food insecurity. Besides, Baten and Khan [33] showed that female-headed households could find it difficult to gain access to valuable resource than males. Thus, due to male households' better access to different livelihood assets, this study expected that male headed households less likely to be food insecure than female households. Empirical studies [34] [35] indicated that higher years of schooling enhance households' ability to take good and well-informed production and nutritional status. Thus, it was expected to affect food security positively. Furthermore, a number of studies (e.g. [34] [36]) argued that young households' heads are stronger and energetic than elderly households. Hence, in this study, age was expected to affect households' food security negatively. Moreover, empirical studies [37] [38] argued that larger family size exerts more pressure on households' consumption than the labor it contributes to production. Therefore, in this study, it was expected to affect food security negatively. Besides, due to scarcity of resources, high dependency ratio imposes burden on the active member of household to fulfill their immediate food demands [38] [39]. Hence, in this study, it was expected to negatively effect of households' food security. Livestock are important source of food and income for rural households. Households with more livestock produce more milk, milk products and meat for direct consumption, and have better chance to earn more income from selling livestock and livestock products [18] [40]. Livestock possession mitigates vulnerability of households during crop failures and other calami-

ties [36]. Thus, owning more TLU of livestock was expected to positively affect households' food security.

Oxen and donkey serve as a source of traction power in many developing countries, thereby significantly affect household's crop production and enhance households' access to food items [38]. Accordingly, more number of oxen and donkeys owned by a household was expected to affect food security positively. Besides, empirical studies [40] [41] argued that larger size of cultivated land leads to more production and availability of food grains, and enhance food security status of households. Hence, it was expected to have positive impact on food security. Furthermore, access to irrigation enables farmers to directly produce consumable food grains and/or diversify their cropping and supplement moisture deficiency in agriculture [10]. Thus, in this study, it was expected to affect households' food security positively. Moreover, Muche and Beyene [42] concluded that higher farm income encourage households food security by enabling them to purchase different nutritious food items. Besides, studies (e.g. [36] [42]) argued that households with higher off-farm and non-farm income are less likely to be food insecure as it enables them to purchase different food items to satisfy their family needs. Thus, in this study, farm as well as off-farm and non-farm income were hypothesized to affect households' food security positively. High cost investment on farm inputs encourages households' crop production and livestock breeding [25]. In this study, it was expected to affect households' food security positively. Access to training on modern technologies (proper types and rates of fertilizer application, improved varieties of seeds, agro-chemicals, etc.) enhances households' agricultural production skills and knowledge, and production [43]. Empirical studies [16] [39] conveyed that frequent extension service enhances households' access to better crop production techniques, improved input as well as other production incentives. Therefore, in this study, both access to training and more number of extension contacts were expected to affect households' food security positively. Besides, access to credit eases the cash constraints and allows farmers to purchase inputs such as fertilizer, improved crop varieties, and irrigation facilities; which in turn enhance food production and ultimately increase household food energy intake [37]. Studies (e.g. [12] [15] argued that access to both remittance and aid are important to smooth consumption in the case of shock and shortage for the time of emergency. Thus, both access to credit as well as remittance and aid were expected to positively affect households' food security. Moreover, proximity to the market may create opportunity of more income by providing off/non-farm employment opportunities, and enable farmers to get valuable information, purchase agricultural inputs and final products required for family consumption. Therefore, it was expected to negatively determine households' food security.

## 3. Results and Discussion

### 3.1. Demographic and Socioeconomic Characteristics of Households

For this study, primary data were collected from 276 sampled household heads.

About 44% of the sampled household heads were settlers and the rest (56%) were native households. In addition, 89% of sampled farmers were male-headed households, implying that the majority of the sampled households were male-headed households. Besides, 56.43% of the households had access to irrigation, which indicates that more than half of the households had access to irrigation to produce more than once in a year in the study area. Furthermore, 52.89% of the households had access to training on issues related to agricultural production and agricultural productivity improvement during 2016/17 production year. Moreover, only 18.48% of the households had access to credit services. The result also revealed that only 5.07% of the households received remittance and aid, to cope up with the food insecurity and shortage situation in the study area (Table 1).

Regarding continuous variables, the result indicated that the mean age of the household heads was 43.88 years, with maximum and minimum being 78 and 23 years, respectively. In addition, the mean year of schooling of the households was 3.08. Furthermore, the finding of the study pointed out that the family size

Table 1. Descriptive statistics on demographic and socio-economic characteristics of the households.

| Dummy variables | Frequency (*N*) | | Percent (%) | |
|---|---|---|---|---|
| Nature of households settlement (settler) | 121 | | 43.84 | |
| Sex of household head (male) | 246 | | 89.13 | |
| Access to irrigation (Yes) | 156 | | 56.43 | |
| Access to training (yes) | 146 | | 52.89 | |
| Access to credit (yes) | 51 | | 18.48 | |
| Access to remittance and aid (yes) | 14 | | 5.07 | |
| **Continuous variables** | **Mean** | **Std. Dev.** | **Minimum** | **Maximum** |
| Age of household head (Years) | 43.88 | 10.97 | 23 | 78 |
| Education status of HH heads (years) | 3.08 | 3.62 | 0 | 13 |
| Family size (Number) | 5.58 | 3.05 | 1 | 20 |
| Dependency ratio | 0.96 | 1.07 | 0 | 5.6 |
| Total cultivated land (Hectare) | 0.957 | 0.78 | 0 | 5 |
| Livestock holding excluding oxen and donkey (TLU) | 1.79 | 1.74 | 0 | 8.35 |
| Oxen and donkey ownership (Number) | 0.58 | 0.92 | 0 | 4 |
| Total input cost (Birr) | 1087.41 | 1237.3 | 0 | 8000 |
| Farm income (Birr) | 5160.21 | 6235.05 | 60 | 39,000 |
| Off-farm & non-farm income (Birr) | 1887.07 | 3739.53 | 0 | 24,096 |
| Extension contact (Number) | 8.92 | 8.17 | 0 | 48 |
| Distance from the nearest market (Km) | 6.84 | 6.01 | 0.1 | 20 |

Source: Authors computation (2017), $N = 276$.

of the households' ranges from 1 to 20 member(s) with mean family size of 5.58 members. Moreover, the mean value of the ratio of inactive to active family members was 0.96 with the maximum and minimum being 5.6 and 0, respectively. It also indicated that, the average total cultivated land size of the households was 0.957 ha. Besides, the result revealed that the mean livestock holding (excluding oxen and donkey) of the households in terms of tropical livestock unit (TLU) was 1.79, with the maximum and minimum being 8.35 and 0 TLU, respectively. The study also confirmed that households' mean holding of oxen and donkey was 0.58. Farm income of the households ranges from Birr 60 to 39,000 with an average of Birr 5160.21 per annum. In addition, households' income from off-farm activities ranged from Birr 0 to 24.096 with an average of Birr 1887.07 per annum. Besides, the mean input cost incurred in agricultural production in 2016/17 production year was Birr 1087.41. Moreover, the mean frequency of extension contact with the farmers in the study area was 8.92 times per year, with the maximum and minimum being 48 and 0, respectively. The mean distance of households from the nearest market was about 6.84 kms with the minimum and maximum distance being 0.1 and 20 km, respectively (**Table 1**).

### 3.2. Households Food Security Situation in the Study Area

In this study, household's calorie intake per adult per day was used to identify the food secure and food insecure households. Data on the type and quantity of food item consumed by the household for seven consecutive days was collected using weighed records method and was converted to kilocalorie (kcal) and then divided to household size measured in AE and number of days. Following this, the amount of energy utilized in kcal by a household was compared with the minimum subsistence requirement per adult per day (*i.e.* 2200 kcal per adult per day [1]). As a result, from all sampled households, 59.06% of the households were found to be food insecure and the rest (40.94%) of the households were food secure (**Figure 1**). It indicated that more than half of the households were food insecure, unable to obtain the minimum recommended energy level for

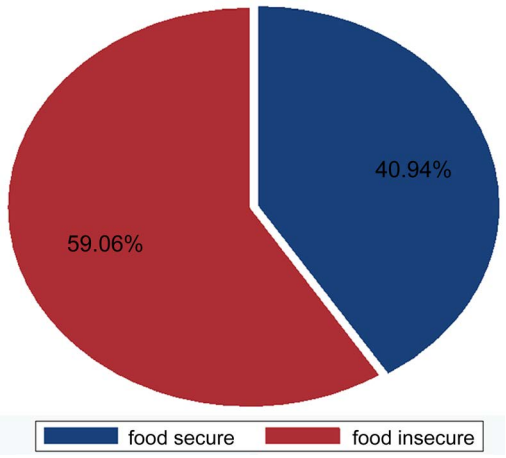


**Figure 1.** Households' food security status in the study area.

healthy and productive life, and it was attributed to the fact that, the study area is among the drought prone areas in the country as the majority of the community rely on agricultural activities to achieve their livelihood goals. Besides, in the 2016/17 production year there was outbreak of pests and other perennial crop diseases that resulted in loss of thousands of tons of crop outputs. In addition, the study area is characterized by the existence of unfavorable condition for livestock production due to the existence of livestock diseases, which ultimately affected households' food security.

### 3.3. Households Vulnerability Status in the Study Area

In the study area, households are and have been vulnerable to different types of risks, shocks and seasonality's and many studies argue that vulnerability to be associated with food security. Accordingly, this study identified that households in the study area were mainly vulnerable to the occurrence of animal and plant diseases as indicated by 50.72% of the households. The result confirms that almost more than half of the households were exposed to the risk of animal and plant diseases and since farming is the main source of livelihood in the study area, it affects the total agricultural production and ultimately affects their food security situation. Besides, the study pointed out that households were exposed to the risk of members' health problem as indicated by 14.79% of the households and again, this is also another shock that forces the households to divert their income for treating the members rather than utilizing it for food items production and purchasing. Thirdly, 10.14% of the households in the study area indicated that they were vulnerable to drought and famine, which facilitates their exposure to health problems. Shortage of rain and conflict with neighbors' were another shocks that the households were exposed. Shortage of rain, as it is a key agricultural input, imposes direct impact on total output obtained and indirectly affects households' food security through its effect on agricultural production. Generally, out of the total sampled households, 86.87% of the households in the study area were vulnerable to various shocks, risks and seasonality (Table 2). Besides, from the focus group discussions most of the participants stated that "they are and have been vulnerable to different shocks such as occurrence of

Table 2. Households vulnerability status to different incidents in the study area.

| Vulnerable to: | Frequency (*N*) | Percent (%) |
|---|---|---|
| Drought and Famine | 28 | 10.14 |
| Members health related problems | 41 | 14.79 |
| Animal and plant diseases | 140 | 50.72 |
| Shortage of rain | 16 | 5.79 |
| Conflict with neighbors | 15 | 5.43 |
| **Total** | **240** | **86.87** |

Source: Estimated result (2017), $N = 276$; Note that only 86.87% of the households where vulnerable to different shocks in the study area.

livestock diseases especially cattle diseases, plant diseases and pests, household heads and members health problem specially child illness and occurrence of drought and famine due to shortage of rain which results in decline crop and livestock yield".

### 3.4. Causes of Food Shortage and Self-Insufficiency from Own Production in the Study Area

Households in the study area were facing shortage of food, which is governed by different factors. This study identified that, in the study area, 41.67% of the respondents pointed that they faced shortage of food in 2016/17 production year and the remaining households (58.33%) reported that they were able to access sufficient food. In addition, the finding also indicated that only 31.88% of the households were self-sufficient from their own production and the rest (68.12%) were self-insufficient from homestead production (Table 3). This are attributed to different factors that affect households' agricultural production and food security directly and indirectly.

Accordingly, the study identified different causes of food shortage and food self-insufficiency from own production in the study area (Table 4). The study

Table 3. Households exposure to food shortage and self-sufficiency status form own production in the study area.

| | Food shortage occurrence | | Total | Self-sufficiency from own production | | Total |
|---|---|---|---|---|---|---|
| **Response** | **Yes** | **No** | | **Yes** | **No** | |
| **Frequency (N)** | 115 | 161 | **276** | 88 | 188 | **276** |
| **Percent (%)** | 41.67 | 58.33 | **100** | 31.88 | 68.12 | **100** |

Source: Estimated result (2017), $N = 276$.

Table 4. Major causes of food shortage and food self-insufficiency in the study area.

| Causes of food shortage and/or food self-insufficiency | Frequency ($N$) | Percent (%) |
|---|---|---|
| Low productivity | 56 | 20.29 |
| Inadequate income from alternative sources | 19 | 6.88 |
| Inadequate input usage | 16 | 5.79 |
| lack of proper utilization of income | 5 | 1.81 |
| Climate related problems | 37 | 13.41 |
| Food price inflation | 6 | 2.17 |
| Low soil fertility | 17 | 6.16 |
| lack of access to irrigation | 11 | 3.98 |
| Inadequate cultivable land | 25 | 9.06 |
| **Total** | **192** | **69.55** |

Source: Estimated result (2017), $N = 276$; note that only 192 households were facing food shortage and/or food self-insufficiency from own production.

finding indicated that 69.55% of the households faced food shortage and/or self-insufficiency from own production in the study area. Low agricultural production and productivity, which is governed by various factors such as climatic, physical, institutional, etc., factors, was identified as major cause of food shortage and/or food self-insufficiency by 20.29% of the households in the study area. Besides, 13.41% of the households indicated climate related problems such as shortage of rain, occurrence of pests and animal disease, flooding, etc., as the major causes of food shortage and self-insufficiency in the study area. Furthermore, 9.06% of the respondents confirmed inadequacy of cultivable land for agricultural production as a cause of food shortage and/or food self-insufficiency in the study area. Moreover, the study figured out that 6.88%, 6.16%, 5.79%, 3.98%, 2.17% and 1.81% of the households reported inadequacy of income from alternative sources, low level of soil fertility, inadequacy of inputs, lack of access to irrigation, food price inflation and improper utilization of income, respectively, as the major causes of shortage of food and/or food self-insufficiency from own production in the study area.

### 3.5. Determinants of Households' Food Security in the Study Area

A binary logit model was estimated to analyze determinants of households' food security. The model estimates indicated that the overall model is significant at 1% (Prob > $chi^2$ = 0.0001) as shown by the likelihood ratio test. The estimated model also revealed that, out of the 18 explanatory variables, 7 variables were statistically significant in determining households' food security (Table 5).

Table 5. Estimated binary logit model result on determinants of households' food security.

| Explanatory variables | Coefficients | Std. dev. | $P>\|t\|$ | ME (dy/dx) |
|---|---|---|---|---|
| Settlement of the HH head | −0.26 | 0.349 | 0.457 | −0.0615 |
| Sex of the HH head | 0.9515* | 0.532 | 0.074 | 0.1991 |
| Age of the HH head | −0.0382** | 0.0139 | 0.014 | −0.00813 |
| Education status of the HH head | −0.0382 | 0.311 | 0.902 | −0.00909 |
| Family size | −0.069 | 0.0607 | 0.253 | −0.0165 |
| Dependency ratio | 0.0272 | 0.147 | 0.854 | 0.00647 |
| Livestock holding | 0.1126 | 0.10 | 0.264 | 0.0268 |
| Number of Oxen and Donkey owned | 0.143 | 0.182 | 0.432 | 0.0341 |
| Cultivated land size | −0.0308 | 0.2449 | 0.90 | −0.0073 |
| Access to irrigation | 0.825*** | 0.302 | 0.006 | 0.1963 |
| Farm income | 0.0000385 | 0.00003 | 0.183 | 9.40e−06 |
| Off-farm and non-farm income | −0.000097** | 0.000044 | 0.027 | −0.000023 |
| Input cost | −0.000393** | 0.00017 | 0.023 | −0.0000935 |
| Access to training | −0.358 | 0.2978 | 0.229 | −0.0774 |
| Frequency of extension contact | 0.0141 | 0.021 | 0.503 | 0.00335 |

**Continued**

| | | | | |
|---|---|---|---|---|
| Access to credit | 1.276*** | 0.379 | 0.001 | 0.3085 |
| Access to remittance and aid | −1.105 | 0.758 | 0.145 | −0.2207 |
| Distance to market | 0.0541** | 0.0273 | 0.048 | 0.0287 |
| Constant | −0.1245 | 0.832 | 0.881 | |
| Number of observation | | 276 | | |
| LR $chi^2$ (18) | | 58.50 | | |
| Log likelihood | | −157.50 | | |
| Prob > $chi^2$ | | 0.0000 | | |
| Pseudo $R^2$ | | 0.1566 | | |

***, ** and * significant at 1%, 5% and 10% probability level, respectively.

**Sex of household head:** as expected, it was found to have positive and significant effect on households' food security at 10% significance level. From the model result, the marginal effect showed that being male-headed household increases the probability of households' food security by 19.91%. This implies that male headed households are more likely to be food secure than female headed households. This is due to the fact that, mostly male headed households have better access to different types of resources, which ultimately enables them to produce, purchase and consume diverse and nutritious products. This finding supports the finding of [44].

**Age of the household head**: it affected households' food security negatively and significantly at 1% probability level. The marginal effect of age of household head indicated that a one-year increase in the age of the household head decreases the likelihood of households' food security by 0.92%. This implies that old aged household heads more likely to be food insecure than younger ones. This is because mostly elder households have less courage to cultivate larger-size farm and become less productive than young ones, which ultimately affects their food security status through restraining production. Nugusse *et al.* [39] also reported similar finding.

**Access to irrigation:** it was found to have positive and significant effect on households' food security at 5% significance level. The marginal effect of the variable figured out that having access to irrigation increases households' probability of food security by 14.4%. This implies that households who had irrigation access are more likely to be food secure than those who had no irrigation access. This is due to the fact that irrigation helps farmers enhance their agricultural production through mitigating water stress and reducing risks of crop failures and obtains more yields; thereby reducing the risk of food insecurity among the households. This finding is in line with the findings of [10].

**Off-farm and non-farm income:** In contrary to the expectation, it affected households' food security negatively and significantly at 10% significance level. The marginal effect confirmed that a one-birr increase in the off-farm and

non-farm income of the households decreases the likelihood of households' food security by 0.002%. This indicates that households with higher off-farm and non-farm income earning are less likely to food secure than low earning households in the study area. The reason is that households who earn higher off and/or non-farm income do not use their income for either food expenditure or production of consumable products rather they prefer to make a saving to improve their future welfare at the expense of today consumption. This finding is in line with the finding of [45].

**Input cost:** it determined households' food security negatively and significantly at 5% significance level. The marginal effect, from the model estimate, revealed that a one-birr increase in investment on inputs decreases the probability of household's food security by 0.0083%. This indicates that households with higher input cost are less likely to food secure than low cost incurring households. This is because higher cost investment on inputs forces households to decrease their expenditure on food items and thereby expose households to the risk of food insecurity. This result is in conformity with the findings of [38] [46].

**Access to credit:** As expected, it was found to have positive and significant effect on households' food security at 5% significance level. The marginal effect indicated that having access to credit increases households' probability of food security by 20.3%. This implies that those households who had access to credit service have more chance of being food secure than without access ones. This is due to the fact that access to credit gives the household an opportunity to be involved in income generating activities so that derived revenue increases financial capacity and purchasing power of the household to escape from risk of food insecurity. Moreover, it helps to smooth consumption when household face with temporary food problem [15].

**Distance to market:** In contrary to the expectation, it affected food security status of households positively and significantly at 10% probability level in the study area. From the model output, the marginal effect indicated that a one-kilometer increase in the distance from the nearest market center increases the probability of household's food security by 1.12%. This implies that households living far from the market center are more likely to be food secure than those living near the market center. This is because households living far from the market center obtain little information about the market condition and thereby use their entire production for home consumption rather than bringing it to the market. The finding supports the finding of [18].

## 4. Conclusions and Recommendations

Food insecurity is and has been a persistent problem facing the majority of the Ethiopian population. Food insecurity in the form of both chronic and transitory (seasonal) is severe in the country. To reverse the situation, various studies recommended that planning different programs based on location specific empirical evidence play a key role. Thus, assessing the food security status and its de-

terminants at household level provides basic input. Accordingly, the study finding indicated that more than half (59%) of the rural households were food insecure. This implies that the incidence of food insecurity in the region was high. Furthermore, the households in the study area were vulnerable to different type of shocks and risks such as drought and famine, illness, animal and plant diseases, etc. Moreover, more than one third of the households faced food shortage in the study area—which calls for action to reverse the situation. Besides, food security status of the households was enhanced by sex of the HH heads, family Size, access to irrigation, total farm income, access to credit and distance to market. Unfortunately, age of HH head, total off-farm and non-farm income, and total input cost negatively affected households' food security in the area.

Therefore, urgent actions aimed at reducing/eliminating the incidence of food insecurity and vulnerability of the households in the study area should focus on:

- Giving emphasis to female headed households' as their access to different livelihood asset improves the food security status of the rural poor and reduces their vulnerability.
- Awareness creation and capacity building for elders should be strengthened to ensure the availability and dissemination of accurate information as it helps them to produce more and ensure food security.
- Enhancing households' access to credit services, irrigation, inputs at a reasonable price and awareness on off-farm and non-farm income utilization so as to improve their food security situation.
- Generally, critical emphasis should be given on the causes of vulnerability and food shortage such as low productivity and production, animal and plant disease, etc. factors to reverse the incidence of food insecurity in the study area.

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## Availability of Data and Materials

The data that support the findings of this study can be obtained from the authors based on request.

## Conflicts of Interest

The authors declare that they have no conflict of interests.

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## Abbreviations

kcal: kilocalorie; AE: Adult Equivalent; FAO: Food and Agriculture Organization; CSA: Central Statistical Agency; WFP: World Food Program; AZBARD: Assosa Zone Bureau of Agriculture and Rural Development; BGRDGA: Benishangul Gumuz Region Development Gap Assessment; PA: Peasant Association; HH: Household.