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Dimensions and Determinants of Food Insecurity among Rural Households in Ethiopia

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Abstract:

Ethiopia is among the poorest countries in the world, with very low human development indicators, ranked 174th out of 188 countries. The main objective of this thesis was to identify the determinants of food insecurity among rural farm households, to measure the rural farm household's food insecurity status and its severity and to analysis food insecurity dimension in the study area. The primary data were collected through structured questionnaire from four kebeles with a total sample household of 165. In the descriptive statistics such as standard deviation, percentage, mean, and t-value, were used to analysis the data and inferential statistics such as linear regression analysis, and logistic regression analysis. The descriptive statistics revealed a significant mean difference at an acceptable significance level between the food secure and food insecure households. A binary logit econometric model has identified seven out of thirteen variables included in the model as significant. Household size per AE, number of oxen owned, dependence ratio, annual crop production, cultivated land and distance from agricultural office and annual consumption per AE were found to be significant determinants of food insecurity in the study area. The head count ratio computed by FGT model revealed that 53.3 percent of sample households were food insecure. The food insecurity gap and severity were 13.5 and 6 percent respectively.

Keywords:1 *Poverty, 2 Food Insecurity, 3 Severity, 4 Descriptive Statistics, 5 Logit Model*

1. Introduction

In Ethiopia there is Rapid increasing population growth challenged achievement of food security and poverty reduction efforts. Food insecurity is a great challenge to realize equitable economic development and livelihoods. vulnerability, drought, disaster risk, acute and chronic food insecurity, harvest failure, unpredictable weather, output price fluctuations, shift from relief to recovery and long term sustainable economic development are some of the major issues to be addressed (Abdela,2015).

In addition to the above factors are those who have inadequate or no land and oxen, have many children, are female-headed, reside in drought affected areas, and are located further market places (Ahimed et al, 2014). Food insecurity drives directly from dependence on undiversified livelihood based on low inputs and low output rain fed agriculture. These out comes correspond broadly to chronic, cyclical and transitory food insecurity (TFI) and all are endemic in Ethiopia. According to Devereux and Sharp (2006) the extent of food insecurity in Ethiopia in recent years has become alarming and its coverage in drought periods has reached as high as 45% of the population.

The 1984 famine in Ethiopia, which was one of the causes of focus for the studies and literatures in the food security area, takes everyone back to the journey the country passed. Even today, despite many efforts, the country is at the bottom of the ladder in human development index. This is indicative that the problem is still not well addressed and it has been a challenge to ensure food security (Beyene,2014).

Efforts targeting to deal with and struggle problems of food security should start from the rural households as the livelihood of the majority of the rural population, mostly depend up on agricultural output which is sensitive to natural and manmade disaster. On the other extreme it seems a paradox to hear that Ethiopia is the fastest growing country in the world. Withstanding the worst drought, Ethiopia registered 8.0 percent real GDP growth rate in 2015/16 which was much higher than 1.4 percent average for Sub-Saharan Africa. The economic growth was broad based with industry growing 20.6 percent, services 8.7 percent and agriculture 2.3 percent during that period and has exhibited a gradual structural shift (NBOE, 2015).Though agriculture still remained a dominant sector, while it is also being reported that in Human Development Index (HDI) Ethiopia is at the lower level. Thus it is wise to investigate areas where Ethiopia is performing good or bad. This enables the country target and prioritizes areas which need immediate intervention. "….. an accurate assessment of food insecurity, in terms of identifying who the food insecure are as well their number, location and the underlying causes of food insecurity will enable stakeholders to design appropriate interventions" (WFP, 2014). Due to the importance of food security for the country development and growth, in this study we analyze the determinants of food security in rural farm households.

The food security problem in the study area is high. As the mainstay of the economy in the area is agriculture, which is mainly rain- fed, where rain-fall is erratic and drought is prevalent. Low agricultural productivity, poverty and land degradation are critical and closely related problems in the region. Severe environmental degradation problems, mainly soil erosion, nutrient depletion and recurrent drought constrain on agriculture production in the area and the number of people affected by serious food shortage and that needed assistance in the year 2017 are about 61488 persons(SGZADO ,2019).

There are scant information on the dimension and determinants of food insecurity. Moreover, updating the required information from different socioeconomics setting will facilitate the process of eliminating food insecurity and measure level and dimension of household food insecurity. This study will fill such knowledge gaps identifying the determinants of food insecurity in the household level and to predict policy recommendation.

2. Methodology

2.1. Sampling Procedure and Sample Size Determination

A multi-stage random sampling method was used to select the sample respondents. In the first stage, south Gondar zone would be purposively selected. In the second stage, 4 woredas from 13 woredas were purposely selected. Consequently, one Kebele from each woredas would be purposely selected. In the third stage, 165 representative farm households were randomly selected for interview. During this process, the list of household heads in each kebele was used to make random selection of the farmers. The level of precision is 7%, then appropriate sample size was the sample size determine from both food secure and food insecure (Yamane, 1967). Is given by

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

Where, n =sample size N =Size of population e = desired significance level

On average 41 respondents from each districts and 7% desired significance level; the appropriate sample size was 165 households by using probability sampling size techniques.

2.2. Methods of Data Analysis

In this study, both descriptive and econometric methods were used to analyzing the data from farmers.

2.2.1. Descriptive analysis

Descriptive statistics is one of the techniques, which were used to summarize data and collected from the respondents.

2.2.2. Econometric analysis

The logit and the probit models are the most commonly used models when the dependent variable happens to be dummy (Liao, 1994; Maddala, 1989& Gujarati, 2004). In estimating the logit model, the dependent variable was household food insecurity for which takes a value 0, if the households were food insecurity and 1 other wise. Mathematically the logit model formulated as

Pi= E(Y=1/Xi) =$\frac{1}{1+e^{-(Bo+BiXi)}}$

Let denote Z_i=Bo +Bi Xi

Then pi=$\frac{1}{1+e^{-Zi}}$ =$\frac{e^{Zi}}{1+e^{Zi}}$

Z_i= Bo+ ∑ Bi Xi +µi

Where e is the base of the natural logarithm,

Xi represents the i^{th} explanatory variable

Pi is the probability that a household is being food secure given xi and
Bi is parameters (coefficient) to be estimated.
Where i=1, 2, 3------n (number of observations)
B o =intercept
μ_i= disturbance term or error tem or stochastic variable. The probabilities of household does not food security or probabilities of household food insecurity is given by

1-pi= $\frac{1}{1+e^{Zi}}$

$\frac{pi}{1-pi} = \frac{1+e^{Zi}}{1+e^{-Zi}}$

When we take natural logarithm in both sides of the equation

$\ln\left(\frac{pi}{1-pi}\right) = \ln\left(\frac{1+e^{Zi}}{1+e^{-Zi}}\right) = Z\text{i}$

Z_i **=B0+∑ Bi Xi +**μ_i

Li=Z_i**=B0+∑ Bi Xi +μi**

Li = is log of the odds ratio, which is not only linear in Xi but also linear in the parameters. Where the odds ratio is simply the ratio of probability of being food secure to the probability that it would be food insecure.

Incident of food insecurity (head count measure):
Head Count Index (Incident of food insecurity) is defined as the proportion of the population whose measured standard of living is less than the food security line.

Food insecurity Gap index (depth of food insecurity):
The food insecurity gap index indicates the depth of food insecurity, which is, the difference between the food security line and the mean income of the food insecure expressed as a percentage of the food security line (Foster, Greer and Thorbecke, 1984).

Severity of food insecurity:
This depicts the severity of food insecurity by assigning each individual a weight equal to his/her distance from the food security line.

2.5. Definition of Variables and Working Hypothesis

Table 1 **Description of Dependent and Independent variable used in logit Model**

Variable	Description	Types	Measurement Values	Expected Sine
HHFI	Household Foc Insecurity (Dependent)	Dummy	1 if the household is food secure and 0, otherwise	
SEXHH	Sex of household head	Dummy	1=male,0=female	Positive/Negative
AGEHH	Age of household head in years	Continuous	Number of years	Positive/Negative
FAMESIZE	Family size in adult equivalent	Continuous	Man equivalent	Negative
EDULEVEL	Educational levels of household	Dummy	1 if the household is illiterate and 0, otherwise	Positive
DPR	Depends ratio	Continuous	Adult equivalent	Negative

MRTST	Marital status	Dummy	If 1,married 0 otherwise	Positive/Negative
LANDCULT	Cultivated land size in hectare	Continuous	Hectare	Positive
TOTCROPP	Annual total crop production income	Continuous	Kilogram	Positive
TLU	Livestock owned in tropical unit	Continuous	TLU	Positive
NUMOX	Number of oxen owned	Continuous	Number	Positive
DISFROMA	Distance from agricultural service	Continuous	Kilometer	Negative
TOFNFI	Total off-farm income/yr	Continuous	Birr	Positive
TOTINCOM	Total monthly	Continuous	Birr	Positive
CONSUMPT	Total monthly consumption per adult equivalent.		Birr	Positive

3. Results and Discussion

3.1. Demographic and Socio-Economic Characteristics of the sample households

Age of the respondents: The mean household age for the food insecure and secure is 45.56 and 43.2 years, respectively. The overall mean age of the household heads for the study area stands at 44.08. This result, which disagrees with the expectation, might be explained by the fact that the elderly household heads are more reactive to the changing production environment and the wealth of experience in the farming system. It is, therefore, found from the study that increased age of households' heads implies increased risk of food insecurity.

Table 2 .**Distribution of sample household by age**

Age of household head	Food secure (81)		Food insecure(84)		Total (165)		t-value
	Number	Percent	Number	Percent	Number	Percent	
20-35	25	30.8	18	21.4	43	26.1	
36-50	39	48.1	37	44	83	50.3	
>50	17	21.1	29	34.6	46	23.6	
Total	81	100	84	100	165	100	-1.37***
Mean	43.2		45.56		44.08		
Minimum					20		
Maximum					80		

Sex of household head: From the 165 respondents 28(17 %) were female headed respondents whereas 137 (83%) were male headed household respondents. Among the food secure households 13 (16.1%) were female headed and 68(83.9%) were male headed households while the food insecure households 15(17.9%) and 69 (82.1%) were female and male headed households respectively. It was hypothesized that male-headed households are more likely to be food secure than female-headed ones, because female-headed households have less working experience that leads them to provide their lands for share cropping.

Table 3. **Distribution of sample household heads by sex of household heads**

Sex	Food secure(81)		Food insecure(84)		Total(165)		X^2-value
	Number	Percent	Number	Percent	Number	Percent	
Male	68	83.9	69	82.1	137	83	
Female	13	16.1	15	17.9	28	17	
Total	81	100	84	100	165	100	-1.34***

Family Size in Adult Equivalent (AE): The mean household size in AE for food insecure and secure households are 5.17 and 4.94, respectively. The overall mean is 5.02; ranging from 1 to 8.85. The result is agree with a prior expectation that a household with high family size in AE is exposed to high risk of food insecurity when resources for food production are scarce and no alternative employment opportunities.

Table 4.**Distribution of sample household by family size in AE**

Family size in AE	Food secure(81)		Food insecure(84)		Total(165)		t-value
	Number	Percent	Number	Percent	Number	Percent	
≤3.5	26	32.1	26	31	52	31.5	
3.51-6	43	53.1	42	50	85	51.6	
6.01-8.5	10	12.3	15	17.9	25	15.1	
>8.5	2	2.5	1	1.1	3	2.2	
Total	81	100	84	100	165	100	-2.28***
Mean	4.94		5.17		5.02		
Minimum Maximum	1 8.85		1.5 8		1 8.85		

Household head educational status: It was found out that 63.8 percent of the sample households were illiterate and 22.37 percent only read and write, 7.24 percent attended first cycle primary education, followed by second cycle primary education (6.6 percent). But the survey result indicated that the mean difference between food secure and food insecure household heads was found to be statistically insignificant (upto10% significance level). This might explain why education did not bring a difference in the food security status. Therefore, the result which disagrees with the expectation might be explained by the fact education is an important determinant factor for asset building and improving the livelihood status of farmers in farm household.

Table 5.Distribution of household head by educational status

Status of Education	Food secure(81)		Food insecure(84)		Total (165)		t-value
	Number	percent	Number	percent	Number	percent	
Illiterate	49	60.5	50	59.5	99	60	
Read and write	17	21	21	25	38	23	
Primary education	8	9.9	6	7.1	14	8.5	
Secondary education	7	8.6	7	8.4	14	8.5	
Total	81	100	84	100	165	100	-1.17*
Mean					1.625		

Household food security and marital status

Marriage is established with a view of helping each other and married people pool their resources and also reduce cost that would have been spent separately. In the survey result sample household heads indicated that married, divorced, widowed and single household head accounted for about 67.9, 17, 9.7 and 5.4 percent respectively. 67.9, 16, 9 and 4 percent of married, divorced, widowed and single households were found to be food secure whereas food insecure households consisted of married (67.8%), divorced (17.9%), widowed (8.3%) and single(4.9%). The result of the survey showed no significant difference ($p > 0.10$) among the marital status with respect to household food insecurity.

Table 6 .**Household food security and marital status** .

Marital status	Food secure (81)		Food insecure (84)		Total (165)		t-value
	Number	Percent	Number	Percent	Number	Percent	
Married	55	67.9	57	67.8	112	67.9	
Divorced	13	16	15	17.9	28	17	
Widowed	9	11.1	7	8.3	16	9.7	
Single	4	5	5	6.1	9	5.4	
Total	81	100	84	100	165	100	-0.57*

Dependency ratio Accordingly, it was hypothesized that households with larger dependency might be vulnerable to food insecurity. Consequently, the survey result showed that the mean dependency ratio exhibit a statistically significant difference between the food secure and insecure at 5 percent probability level of significance. The mean dependency ratios of the food insecure and secure were 0.686 and 0.45, respectively. The overall mean dependency ratio is 0.56 per household. The data show that, 60.8 percent of the food insecure and 56.8 percent of the food secure were having a DPR of less or equal to 1. This difference in proportion is, however, higher in the upper DPR category for the food insecure households than the food secure though there is statistically significant difference between the food secure and insecure household groups.

Table 7.**Distribution of sample household by extent of dependency ratio**

Dependence ratio	Food secure(81)		Food insecure		Total		t-value
	Number	Percent	Number	Percent	Number	Percent	
≤1.0	46	56.8	51	60.7	97	58.8	
1.01-1.5	27	33.3	28	33.3	56	34	
1.51-2	6	7.4	3	3.5	8	4.8	
>2	2	2.5	2	2.5	4	2.4	
Total	81	100	84	100	165	100	-2.05**
Mean	0.45		0.686		0.56		
Std .Deviation					0.605		
Minimum					0.13		
Maximum					3		

3.2. Farming System and Resources

In farming households, productive resources, such as land, livestock and crop production, were the major variables that determine household food security..

Cultivated land size: It was hypothesized that farmers who have larger cultivated land are more likely to be food secure than those with smaller cultivated land (Ehrlich et al., 1993). The foundation or the survey result showed that the mean differences were exhibit a statistically significant difference between food secure 2.19 and food insecure1.19. The overall average land holding is found to be 1.83 ha. However, there is variation among the sample households with regard to landholding, which ranges from 0.25 to 5.00 ha. As shown in Table 5, 18.8 percent of the respondents own less than or equal to 0.5 ha; 22.4 percent own 0.51 to 1.00 ha; 18.8 percent own 1.01 to 1.50 ha and 22.4 percent own 1.51 to 2.00 ha,10.9 percent own 2.o1to 2.5 and 6.7 percent greater than2.5ha of land.

Table 8. **Comparison of cultivated land among food secure and insecure groups**

Cultivated Land holding in ha	Food secure(81)		Food insecure(84)		Total(165)		t-value
	Number	Percent	Number	Percent	Number	Percent	
≤0.5	9	11.1	22	26.2	31	18.8	
0.51-1	10	12.3	27	32.1	37	22.4	
1.01-1.5	12	14.8	19	22.6	31	18.8	
1.51-2	25	30.9	12	14.2	37	22.4	
2.01-2.5	15	18.5	3	3.5	18	10.9	

>2.5	10	12.4	1	1.4	11	6.7	
Total	81	100	84	100	165	100	2.30***
Mean	2.19		1.19		1.83		

Number of Livestock Holdings in TLU

The mean livestock population owned by the total sampled households was 4.89 TLU (tropical livestock unit) see appendices 3. The average livestock owned by food secure household was 5.8 TLU and food insecure household was 3.25 TLU. From this result there was insignificance difference between food secure and food insecure household in livestock holding in terms of TLU. Therefore, the survey result which disagrees with the expectation might be explained by the fact that a higher possession of livestock increase the probability to be food secure.

Table 9.**Household food security status and Number of livestock holding in TLU**

HHFS & Number of livestock	Food secure(81)		Food insecure(84)		Total(165)		t-value
In TLU	Number	percent	Number	Percent	Number	percent	
HH have no livestock	4	4.9	6	7.1	10	6.1	
≤1.5	7	8.6	16	19	23	13.9	
1.51-3	18	21.4	22	26.2	40	24.2	
3.01-5	21	25.9	29	34.5	50	30.3	
>5	31	39.2	11	13.2	42	25.5	
Total	81	100	84	100	165	100	-1.16***
MEAN	5.8		3.25	3.25	4.89		

Household food security status and Number of oxen: The survey result showed that 17 percent of the sample households own no ox; 40.6 percent own one ox, 40.6 percent own a pair of oxen and 1.8 percent own more than two oxen during the survey. Mean difference was tested to check whether or not oxen ownership makes significant difference between the food secure and insecure household groups. The result agrees with *a priori* expectation, as mean ownership of ox or oxen was found to be statistically significantly different between the food secure and insecure households at 1 percent probability level of significance Table 10.Shows that the mean oxen ownership for the food insecure and food secure households was 1.29 and 1.9, respectively. The overall mean was 1.68 oxen per household.

Table 10. **Distribution of oxen ownership and food security status**.

Ownership Of oxen	Food secure(81)		Food insecure(84)		Total(165)		t-value
	Number	percent	Number	percent	Number	Percent	
no oxen	7	8.6	21	25	28	17	
one ox only	15	18.6	52	61.9	67	40.6	
a pair of oxen >two oxen	56 3	69.1 3.7	11 -	13.1 -	67 3	40.6 1.8	
Total	81	100	84	100	165	100	6.12***
Mean	1.9		1.29		1.69		

Household food security status and Annual crop production in kg /AE : The overall average crop production was 344.5 kg; it ranges from a minimum of 100 kg to a maximum of 1200 The result agrees with *a priori* expectation, as mean crop production was found to be Institution and Farmers' Multi Service Cooperatives). Out of the total 165 interviewed households 56 (37.3%) were statistically significantly different between the food secure and food insecure household at 1 percent probability level of significance. The average crop production food secures households 454 kg and food insecure households 248.9 kg per adult equivalent per year Kg. Therefore, this variable was hypothesized to influence food security positively.

Table11**. Annual crop production per Adult Equivalent(AE).**

Annual crop production In kg/AE	Food secure(81)		Food insecure(84)		Total(165)		t-value
	Number	percent	Number	percent	Number	Percent	
≤150	-	-	8	9.9	8	5.3	
151-300	15	21.13	51	63	66	43.42	
301-450	27	38	21	25.9	48	43.42	
>450	19	26.8	1	1.23	20	13.2	
Total	71	100	81	100	152	100	2.78***
Mean	454		248.9		344.5		
Minimum					100		
Maximum					1200		

Distance to nearest office of agricultural extension: Households nearer to office of agricultural extension center have better chance to improve household food security status than who do not have a proximity to office of agricultural extension centers. Proximity to office of agricultural extension centers was measured in kilometer. The mean distance to the nearest to office of agricultural extension of sampled households of food secure was 1.89 km and food insecure was 3.12 km. The overall mean distance to office of agricultural extension was 2.43 km.

Table 12**. Distance to nearest office of agricultural extension.**

Distance/km	Food secure(81)		Food insecure(84)		Total(165)		t-value
	Number	percent	Number	percent	Number	Percent	
≤1.5	41	50.6	24	28.6	65	39.4	
1.51-3	32	39.5	20	23.8	52	31.5	
>3	8	9.9	40	47.6	48	29.1	-2.30**
Total	81	100	84	100	165	100	
Mean	1.89		3.12		2.43		

Household annual income sources per Adult Equivalent (2018/19 production year)

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, the survey result showed that the mean difference between food secure and food insecure household statistical in significant level. The average total incomes source per adult equivalent earned by sample respondents was about Birr 4976.6 with maximum earnings of up to Birr 16800/AE. The average total income of the food secure households was Birr 6161.2 /AE, while that of food insecure household was of Birr 3938.2/AE in the year 2008/09.

Table 13.**Household annual income per AE (2018/2019 production year)**

annual Income Category(Birr) per AE	Food secure(81)		Food insecure(84)		Total(165)		t-value
	Number	percent	Number	Percent	Number	percent	
≤ 1500	4	4.9	9	10.7	13	7.9	
1501-3000	9	11.1	19	22.6	28	17	
3001-4500	13	16.1	27	32.2	40	24.3	
4501-6000	18	22.2	21	25	39	23.6	
>6000	37	45.7	8	9.5	45	27.2	
Total	81	100	81	100	152	100	1.08*
Mean	6161.2		3938.2			4976.6	
Minimum						331.8	
Maximum						16800	

Total annual household consumption per AE: The major source of food consumption of households includes livestock and their products, crop production, vegetable, fruit and food aids. The mean of the whole sampled household food consumption was 3425.4 Birr per year per AE while the average food consumption of food secure households was 4489.3 birr and food insecure household consumed 2492.9 per year per AE. The survey result was statistical significance at 5 percent significance level the difference between food secure and food insecure household. The result agrees with *a priori* expectation, that households increasing consumption with increasing food security status.

Table 14.**Total annual household consumption per AE**

Annual consumption In birr per AE	Food secure(81)		Food insecure(84)		Total(165)		t-value
	Number	Percent	Number	percent	Number	percent	
≤1000	-	-	10	11.9	10	6.1	
1001-2000	5	6.2	24	28.6	29	17.6	
2001-3000	14	17.3	23	27.4	37	22.4	
3001-4000	24	29.6	15	17.9	39	23.6	
>4000	38	46.9	12	14.2	50	30.3	
Total	81	100	84	100	165	100	2.14**
Mean	4489.5		2492.9		3425.4		
Minimum						190.8	
Maximum						9290.9	

3.3. Differentiation in households' food security across agro-ecological zones

The result shows that, during the year under investigation 48.68 percent of the 76 sample households in the highland, 51.22 percent of the 41 sample households' from mid-highland, and 65.71 percent of 35 sample households in the lowland were food insecure as measured by per capital kcal available to the household. The study result reveled that food security status of a household in the study area declines as one moves from highland to low land agro-ecological zones.

Table15**. Food security status by agro-ecological zone**

Agro-ecological zones	Food secure (81)		Food insecure(84)		Total(165)	
	Number	Percent	Number	Percent	Number	percent
Highland	42	51.8	38	45.2	80	100
Mid-highland	23	28.4	22	26.2	45	100
Lowland	16	19.8	24	28.6	40	100
IN the Zone	81	46.7	84	53.3	165	100

3.4. Dimensions of household Food Insecurity Situation

In order to classify into two groups, demarcation point or line is required to have single measuring yardstick in food insecurity analysis. These indices are incident of food insecurity (head count ratio), depth of food insecurity index (average normalized poverty gap), and Severity of food insecurity index (average squared normalized poverty gap).

Incident of food insecurity (head count ratio): The incidence of food insecurity indicates the share of the population that cannot reach certain established threshold level, which is 2100 kcal/day/AE in the case of Ethiopia. Data from the sample households were analyzed for the incidence of food insecurity within the study area revealed that 53.3 percents of the sample households were food insecure.

Depth of food insecurity (average normalized poverty gap): The result showed that the mean aggregate consumption shortfall relative to the minimum subsistence daily allowance across the sample household members

(in AE) were 13.5 percent. That is, on average of 271 kcal per day per AE would be needed to lift out each food insecure household in that woreda.

Severity of food insecurity (average squared normalized poverty gap). The interpretation is that 6 percent of the total 152 sample household members were in a severe food insecurity situation. The possible reason for the variability in the severity of food insecurity across agro-ecological zone might be attributed to the difference in severity of environmental factors such as drought and limited institutional support for the productivity growth.

3.4. Results of the Econometric Model

3.4.1. Factors affecting the probability of being food insecure

The model output that household dependence ratio (DPR) was significant at10 percent probability level. Household family size in AE (FAMSIZE AE), cultivated land (TLU) and Number of oxen owned (NUMBER OX) were found to be significant at 5 percent probability level and Total annual crop production per AE (TOTCROPP), distance from agricultural office (DISFROMAGR), and household annual consumption per AE (CONSUMPT) were found to be significant at 1 percent probability level.

Household family size in AE (FAMSIZE AE):

The possible reason is that with existing high rate of unemployment and less employment opportunity coupled with low rate of payment, an additional household member shares the limited resources that lead the household to become food insecure.

Household dependence ratio:

The higher the number of nonproductive age groups (i.e., individuals whose ages are less than 15 and greater than 64 years) as compared to the number of productive age groups in the household, the higher the probability of the household to be food insecure. The interpretation of the result shows that if other things are held constant, the odds ratio in favor of the probability of food insecurity increases by a factor of 0.008 as the dependence ratio household increases by one.

Size of Cultivated Land:

It implies that the probability of being food secure increases with increases cultivated land size. The interpretation of the result shows that if other things are held constant, the odds ratio in favor of the probability of food security increases by a factor of 65 as the total cultivated farm size increases by one hectare..

Household annual crop production per AE

This variable refers to the total income from crops products in kg. The incomes generated from these activities are the main sources of farmers' food. The interpretation of the result shows that if other things are held constant, the odds ratio in favor of the probability of food security increases by a factor of 1.02 as the crop production of household's increases by one kg.

Number of Oxen Owned:

The more the number of oxen available to households the larger is the probability of being food secure. The positive sign of this variable indicates the contribution of this resource towards ensuring food security. The interpretation of the result shows that if other things are held constant, the odds ratio in favor of the probability of food security increases by a factor of 5.45 as the farm household's oxen holding increases by one.

Distance from agricultural office:

Households who are access to agricultural extension services through development agents may have different opportunities to utilizing some modern/traditional technologies that may increase their agricultural productivity and negative relation to the food security status that is increasing distance decreasing food security. The logit result of this study was statistical significant between food insecurity and distance to the nearest agricultural extension office. The odds ratio in favor of the probability of being food insecure was increase by factor of 0.64 as increase distance from agricultural office by one

Kilometer other things remaining constant.

Food Consumption Pattern:

The major source of food consumption of households includes livestock and their products, crop production, vegetable, fruit and food aids. This variable has negative sign of influence on the probability of being food insecure and highly significant (at 1% probability level). The odds ratio implies that, other things are held constant, the odds ratio in favor of the probability of being food insecure decreases by a factor of 1.as the value of own food consumption increases by one Birr.

Table 2 **Maximum Likelihood Estimates of the logit Model and the Effects of explanatory variables on Probability of being food insecure.**

Variable	Coefficient	Robust Std. Err	Z-ratio	P>|t|	Odd ratio
SEXHH	-3.2	2.33	-1.38	0.168	0.04
AGEHH	-0.0799	0.09	-0.9	0.366	0.92
FAMSIZE AE	-2.7	1.2	-2.27**	0.023	0.07
EDULEHH	-1.1	1.04	-1.06	0.289	3.01
DPR	-7.2	3.97	-1.81*	0.071	0.008
MRTSTHH	-0.472	1	-0.45	0.655	0.62
LANDCULT	4.2	2	2.09**	0.036	65
TOTCROPP	0.02	0.008	2.64***	0.008	1.02
TLU	-0.695	0.599	-1.16	0.144	0.5
NUMBER OX	8.478	3.99	2.12**	0.034	4808
DISFROMAGR	-0.45	0.31	-2.46***	0.009	0.64
TOTINCOM	4.8	0.0097	1.08	0.996	1.01
TOTCOSUMPT	0.0009	0.0002	4.29***	0.000	1.02
CONSTANT	-3.89	0.79	-4.88	0.00	4.27
LR Chi-square					118.85
-2Lolikelihood					-79.05
Sample size					165
Prob>chi^2					0.000
pseudoR^2					0.844

***, **,* Represent level of significance at 1%, 5 % and 10% respectively

4. Conclusions and Recommendations

4.1. Conclusion

The gap and severity of food insecurity were estimated to be 13.20 and 6 percent respectively. Considering the daily recommended 2100 kcal per adult equivalent, average resource needed to bring food insecure households to daily subsistence requirement amounted to 271 kcal.

Seven out of fourteen variables namely family size per adult equivalent, Dependence ratio, annual crop production per AE, number of oxen, cultivated land, annual off-farm income per household and annual consumption per AE were found to be statistically significant with the hypothesized sign as determinants of household food insecurity in the study area.

4.2. Recommendations

Based on the findings of this study the subsequent recommendations are

- Creating sufficient awareness to effective family planning in the rural households that decrease in birth rate and increase in length birth spacing resulted in smaller household size.
- Improving production and productivity of agriculture has strong tied with farming research, extension and education that increases crop diversification to reduce crop failure, Drought resistant, and short maturing crop varieties and improved farm implements, introducing better farm animal breeds and conservation-based plants and forage development that can decrease the vulnerable households from recurrent food shortfalls.
- Physical and biological soil conservation measures should be used to make possible households to sustain their food security status or to decreases food insecurity rather than expanding the land size.
- Attack food insecurity through increased investments for employment creation opportunities that taps on the working age structure that looks as idle labour resource in the rural areas.

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