Determinants of Rural Households' Food Insecurity Status and Associated Coping Strategies in Enebsie Sar Mider Woreda, East Gojjam Zone of Amhara National Regional State, Ethiopia

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Abstract

This cross-sectional study aims at identifying the determinants of rural households' food insecurity status and associated coping strategies in Enebsie Sar Mider Woreda. Both probability and non-probability sampling procedures were used to draw the 351 sample households. Food security index was constructed by Consolidated Approach for Reporting Indicators (CARI) console model with four food insecurity indictors i.e., food consumption score, food energy shortfall, food expenditure share and livelihood asset depletion. The determinants of household food insecurity were analyzed using ordered logistic regression model with maximum likelihood estimation method. The result shows that only 0.3% were food secure, 35.3% were marginally food secure, 51% were moderately food insecure and the remaining 13.4% were severely food insecure. The regression result shows that household size, aid and being female household head had significant and positive association with household food insecurity status while farm income, rainfall shock, livestock ownership, educational status of household heads, uses of farm inputs, credit access, oxen ownership, and farmland size had significant and inverse association with food insecurity status of rural households in the study area. To check the severity of food insecurity, households coping experiences were analyzed and most of the sample households were found to practice crises and emergency coping strategies. The study concludes that the problem of food insecurity is pervasive in the study area and recommends provision of family planning, adult education and tailored training for farmers, better access to credit, affordable farm input and appropriate livestock package such as livestock insurance.

Keywords: food insecurity, coping strategies, households, rural Ethiopia

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1. Introduction

Despite hopes that the world would emerge from the COVID-19 pandemic in 2022 and food security would begin to improve, world hunger has grown by about 150 million since the outbreak of the COVID-19 pandemic and it is estimated that between 702 and 828 million people were affected by hunger in 2021. According to food security and nutrition report of 2022, globally more than 2.3 billion people were moderately or severely food insecure in 2021, or nearly 30 percent of the global population (FAO, IFAD, UNICEF, WFP and WHO, 2022).

In the last one year, Africa showed the highest increase in households with moderate or severe household food insecurity. According to the State of Food Security and Nutrition in the World (SOFI) 2022 report, hunger affected 278 million people in Africa in 2021, which is estimated to be 20.2 percent of the total population. Among these, 260.6 million and 136.4 million were residing in Sub-Sahara and East Africa, respectively (FAO, IFAD, UNICEF, WFP and WHO. 2022).

Ethiopia is one of the Sub-Saharan African countries where the problem of food insecurity has become one of the defining features of the country (Mohammed et al, 2021). Even though Ethiopia has made important development gains over the past two decades, **poverty,** food insecurity and malnutrition are still major concerns across the country. For instance, currently an estimated **20.4 million** people require food support (WFP, 2022).

The challenges of household food insecurity in most rural areas of Ethiopian remained a formidable socioeconomic agenda for the Ethiopian government. Among the regions of Ethiopia, Amhara National Regional State (ANRS) is one of the severely affected regions of the country. The region is the second populous region with agriculture being the main economic activity. The intensive use of agricultural land in the region has led to the recurrent occurrence of drought, and this has resulted in 14.8 percent of the rural households being chronically food deficient (UNICEF, 2018).

According to previous studies conducted in Amhara region (such as Hugo,2002), East Gojjam zone along the Blue Nile River valley was found to

be chronically food insecure. Among them, Enebisie Sar Mider *Woreda* was one of the food insecure areas in the zone. Similarly, Ejiga (2006) identified this *woreda* as food insecure. In addition to these, based on Enebsie Sar Mider *Woreda* agriculture and rural development office report (2016), an estimated 66.3% of the *Woreda* rural population was food insecure and recipient of food aid from government and other humanitarian organizations.

Food insecurity is complex and has multidimensional causes. Despite the complexity of the problem, previous studies on food insecurity in Ethiopia focused on determining the level of households' food security status by using single food security indictors like calorie availability, per capita food expenditure and daily meal intake frequency. The present study used a combination of four multidimensional food security indicators. The findings of the study contribute to fill the gaps in measurements of food household security status, classifying households into four ordered food security levels by measuring with transparent indicators that are consistent with internationally accepted food security concepts. In addition, to observe the stability and severity of households' food security problem in the study area, the study included coping strategies of households at time of food insecurity. The study answers the following major research questions: what is the proportion of food insecure households? What are the key determinants of household food insecurity in the study area? And, what strategies do households in the study area employ to cope up with or mitigate food insecurity?

2. Reviews of food insecurity and households coping strategies

Theoretically, food security as a concept was originated in the mid-1970s in the discussions of international food problems at the time of global food crisis. The initial focus was mainly on food supply problems of assuring the availability and to some degree the price stability of basic foodstuffs at the international and national levels (ODI, 1997).

Food security is a multi-dimensional phenomenon. According to the reaffirmed official definitions of food security declared on the World food Summit in 2009, food security has four dimensions and is achieved when all availability, access, stability and utilization dimensions are fulfilled at the same time (FAO.2009).

Food security assessments should consider different coping strategies of communities and households and answer the questions ―who is applying the coping strategy and how well is it working? Coping strategies are activities that people choose 'as ways of living through difficult times brought on by some sort of shock to their normal means of livelihood and way of living' (IFRC,2006).

According to WFP (2015), household coping strategies can be grouped into three broad categories: *Stress strategies*, such as borrowing money or spending savings which indicate reduced ability to deal with future shocks due to a current reduction in resources or increase in debts. ***Crisis strategies***, such as selling productive assets, directly reduce future productivity, including human capital formation. *Emergency strategies*, such as selling arable land, selling last productive female animals which affect future productivity, but are more difficult to reverse or more dramatic in nature.

Empirically, there are various studies carried out on food insecurity and coping strategies in Ethiopia (Tewodros, 2014; Ahmed et al, 2018; Awoke et al, 2022). The most prominent tool used in measuring food insecurity of households in these studies was kilo calorie. According to the study conducted by Dube et al (2018) in Shalla District, West Arsi Zone of Oromia Region, out of the total surveyed households, 62% were food insecure while 38% were food secure based on the minimum recommended calorie requirement of 2200 kcal/day/AE.

By taking the recommended calorie requirement as indictor of food security level, Tewodros (2014) also conducted a study in Mareko Woreda of Guraghe Zone in Southern Region and found that 62 % of sample households were food insecure. The households' food insecurity gap and severity computed using Foster, Greer and Thorbecke (FGT) indices were 8.5% and 1.4%, respectively. On the other hand, Awoke et al (2022) applied Household Dietary Diversity Score (HDDS) to assess household food security status in Central and North Gondar Zone of Amhara regional state, and the result of the study indicated 38% of households were food secure and 62% of them were food insecure.

The other study conducted by Fikire et al (2022) in North Shewa Zone, Amhara Region of Ethiopia showed that a total of 482 (60.55%) sample

households were food insecure in the study area based on the food security threshold of 2200 kcal/day/AE. Since food security problem is complex phenomena and has deferent causes at deferent places, previous studies conducted in deferent regions of Ethiopia lacks the incorporation of different food security indicators.

In working towards a more comprehensive understanding of what it means to be food insecure, a multidimensional food insecurity index can lead to better understanding and policy-making, as is argued in the poverty context (Finn et al, 2013). It is well established that food security is too complex phenomenon to be captured by a single indicator and needs to be treated as a multidimensional concept, but it is very hard to give recognition to such multidimensionality in measurement (Ryan and Leibbrandt, 2015). The newly adopted approach which is referred to as the Consolidated Approach for Reporting Indicators of Food Security (CARI) by WFP has many indictors to address the multidimensionality problems of household food insecurity (WFP.2015). Furthermore, to get more convincing result, food security assessments should consider different coping strategies of communities and households and answer the questions ―who is applying the coping strategy and how well is it working‖? Coping strategies are activities that people choose as ways of living through difficult times brought on by some sort of shock to their normal means of livelihood and way of living (IFRC.2006).

The determinants of food insecurity at national or regional and household level are quite complex. It is a combination of both natural factors and manmade processes. Higher temperatures and humidity are known to reduce yields of agricultural crops and tend to encourage weed and pest proliferation (Chijioke *et al*. 2011, Sibrian R., 2008 & HLPE 2012). Abera & Zeller (2009) assessed the impacts of rainfall shock in the farm household food security in Ethiopia and found out that rainfall shock significantly affects food security. In sub-Saharan Africa, household food security is significantly affected by rapid population growth, unsustainable farmland management practices, rising food prices, widespread epidemics, technology stagnation, continuous civil strife and conflicts (Taddesse and Belay, 2004; Degefa, 2005; FAO *et al*., 2015, Habyarimana, 2015). The study conducted by Feleke *et al*. (2003) in the southern part of Ethiopia, technology adoption, farming system, farm

size, land quality, household size, off farm income and wealth were considered to be determinants of food security, and all except wealth and off farm income were found to be significantly determining food security. A study conducted by Bogale & Shimelis (2009) revealed that age of the household head, cultivated land size, livestock ownership, total income of the household irrigation and amount of credit received have negative and significant effect on household food insecurity status. On the other hand, family size had positive and significant effect. Another study found that household size and age of the household head had positive and significant effect on household food insecurity status; whereas, educational status of the household head, asset possession, credit access and access to employment have negative effect (Girma, 2012).

3. Data and Methods

3.1. Data source and method of collection

The sources of data were both primary and secondary. A cross-sectional data were collected from three rural Kebeles with different agroecology. The sampling procedure followed was both statistical and judgmental. The case study area of Enebsie Sar Mider district was purposively selected, because the area has been frequently affected by food insecurity problem. A multistage stratified random sampling method was used to draw the sample respondents. The sample size was determined by Yamane (1967:886) formula given below:

$$\eta = \frac{\mathrm{N}}{1+N(\mathrm{e})\hat{}2} = \frac{2{,}842}{1+2842(0.05)^2} = 350.64 \approx 351 \qquad (1)$$

Where $\boldsymbol{\eta}$ is the sample size, $\boldsymbol{N}$ is the total number of households in selected "kebeles", and $\boldsymbol{e}$ is the level of precision. Data were collected from both male headed and female-headed households. Among the total sampled households, 269 were male headed and 82 were female headed.

3.2. Household food security index development

The index was developed by using consolidated approach for reporting indicators of food security index (CARI). This new model is an approach addressing the multiple dimensions of food security with transparent

indicators, which are consistent with internationally accepted food security concepts. The CARI console model supports the combining of the available food security indicators in a systematic and transparent way to establish the population's overall food security outcome, which is the food security index (FSI). The development of food security index comprises of the following relevant food security indictors.

a) *Food consumption score (FCS):* The FCS was used as a proxy indicator of household food security based on the weighted frequency (No. of days in a week) of intake of eight different food groups prior to being surveyed. This score has captured both quality and quantity of food consumed by households. The score was captured as,

$$FCSi = a_1x_1 + a_2x_2 \ldots\ldots + a_8x_8 \quad (1)$$

Where *i* is individual household, 1----8 indicates food groups, *x* is frequency of one food group consumed by surveyed households and *a* is weight of each food groups.

b) *Energy shortfall indictor (ESI):* It was an important indicator of consumption status and the main indictor of food availability and access dimensions. In this case, kilocalorie intake was used as an input to evaluate the household's status of food consumption. The energy shortfall indictor of each surveyed household was captured by net household food balance method as,

$$ESI_i = P + b + a + o \quad (2)$$

Where *i* is households 1, 2… 351, *P* is own production, *b* is purchased products, *a* is aid and *o* is other sources.

c) *Food expenditure share (FES):* The 'food expenditure share' indicator was essentially constructed by dividing the total food expenditures by the total household expenditures. However, an important caveat is that both the denominator and numerator should include the value of non-purchased foods consumed. The measure of economic vulnerability was concerned chiefly with how much (proportionately) of the household's total expenditures is directed to non-food items. To this end, the indicator is appropriate for classifying households with different food-acquisition patterns.

$$\text{FES} = \frac{\text{food monthly}}{\text{food monthly+non food monthly}} \quad (3)$$

d) *Asset depletion indictor (ADI):* The livelihood coping strategies indicator was derived from a series of questions regarding the household's experience with livelihood stress and asset depletion during the 30 days prior to the survey.

Responses were used to understand the stress and insecurity faced by households and describes their capacity regarding future productivity. All strategies were classified into three broad groups, including stress, crisis and emergency strategies.

Once all the available food security indicators in the console have been converted to the 4-point scale, the overall food security classification for a household was calculated as.

$$\text{Households Current Status Domain(CS)}; \quad \mathrm{CS_i} = \frac{\mathrm{FCS_i}+\mathrm{ESI_i}}{2} \quad (4)$$

$$\text{Households Coping Capacity Domain(CC)}; \quad \mathrm{CC_i} = \frac{\mathrm{FES_i}+\mathrm{ADI_i}}{2} \quad (5)$$

Thus, the individual household (i) food security status is the average of current status and coping capacity domain as;

$$\text{Household food security index(FSI)}; \quad \mathrm{FSI_i} = \frac{\mathrm{CS_i}+\mathrm{CC_i}}{2} \quad (6)$$

3.3. Econometric model specification

After identifying each household's food security status, the next step was using it as dependent variable to determine the factors which affect households to fall in different levels: food secure, marginally food secure, moderately food insecure and severely food insecure. Ordered logit model, which is the generalization of the logistic regression model, was used to identify the possible factors where there are several ordered possible categories that the dependent variable can fall (j+1 choice). The probability of i^{th} household fall into in j^{th} category was a function of

$$pij = p(household\ i\ \ falls\ in\ to\ catagory\ \ j)$$

Where P was the probability, i was the individual household and j was the category (i.e. food secure, marginally food secure, moderately food insecure, and severely food insecure).

$$P_{i1} = log\frac{P_1}{1-P_1} = log\frac{p_1}{p_2+p_3+p_4} = a_1 + \beta' x \ \ = e^{a_1+\beta' x}$$

(1)

$$P_{i2} = log\frac{P_1+P_2}{1-P_1-P_2} = log\frac{p_1+p_2}{p_3+p_4} = a_2 + \beta'x = e^{a_2+\beta'x}$$

(2)

$$P_{i3} = log\frac{P_1+P_2+P_3}{1-P_1-P_2-P_3} = log\frac{p_1+p_2+p_3}{p_4} = a_3 + \beta'x = e^{a_3+\beta'x}$$

(3)

$$P_{i4} = log\frac{P_1+P_2+P_3+P_4}{1-P_1-P_2-P_3-P_4} = \log(P_1 + P_2 + P_3 + P_4) = a_4 + \beta'x = e^{a_4+\beta'x}$$

(4)

$$P_1 + P_2 + P_3 + P_4 = 1\ and \quad \log(P_1 \ldots + P_K) = log\frac{P_1\ldots+P_K}{1-P_1\ldots-P_K} = a_k + \beta'x \qquad (5)$$

Thus, the model can be specified as

$$Y_{j=K(1\ldots4)} = a_{K+}\beta_1x_1 + \beta_2x_2 + \beta_3x_3 + \beta_4x_4 + \beta_5x_5 + \beta_6x_6 + \beta_7x_7 + \beta_8x_8 + \beta_9x_9 + \beta_{10}x_{10} + \beta_{11}x_{11} + \beta_{12}x_{12} + \beta_{13}x_{13} + \beta_{14}x_{14} + \varepsilon_i \qquad (6)$$

Where Y_j is the dependent variable (food security status of households), a_K is an intercept ß$_1$, ß$_2$ ------ ß$_{14}$ are slopes of the equation in the model $\boldsymbol{\varepsilon_i}$ is error term for unforeseen variables during the study session.

4. Results and discussions

4.1. Analysis of food insecurity indictors

The CARI console classification of households into four food security level was made by converting each food security indictors into 4-point scale and taking the mean value of the current status and livelihood coping capacity domain of indictors. The food consumption indictor of household food

security status shows that 51.6% of the sampled households consumed acceptable food groups. However, the consumption patterns of households from eight food group show that cereals and tuber products were the dominant source of food in the form of "Injera". The food energy shortfall indictor of household's food security status shows that 37% of sampled households had consumed more than 2,750-kilo calorie per day per person, which was greater than the minimum calorie requirement. Households categorized under low vulnerability (<50) shows that, relative to food expenditure, most of household's monthly expenditure was allotted to nonfood items like shoe, cloth, education and other service. 67.2% of households were categorized under very high vulnerability threshold (>75) showing that households' monthly expenditure was mainly allotted to food items rather than nonfood items. From the total sampled households, 44.4% practiced crisis coping strategies, indicating that insecure households were apparently selling their productive asset for consumption.

Table 1. The result of CARI console (Food security index) in Enebsie Sar Midr *Woreda* (n=351)

Domains		Household Food Security Indicators	Food secure (1)	Marginally Food Secure (2)	Moderately Food insecure (3)	Severely Food insecure (4)
Household current status	Food Consumption score	Food consumption Group	*Acceptable** 51.6%	-	*Borderline** 48.1%	*Poor** 0.3%
		Food energy shortfall	*≥ 2,750** 37.0%	*< 2,750≥ 2,200** 20.8%	*< 2,200≥ 1,650** 24.5%	*< 1,650** 17.7%
Coping Capacity	Economic Vulnerability	Food Expenditure	*<50** 2.0%	*50-65** 11.4%	*65-75** 19.4%	*>75** 67.2%
	Asset depilation	Households coping strategy categories	*not adopted** 12.5%	*stress** 14.8%	*crisis** 44.4%	*emergencies** 28.8%
Food Security Index (FSI)			0.3% (n=1)	35.3% (n=124)	51.0% (n=179)	13.4% (n=47)

*Source: Own survey result, 2017; * thresholds; table color & design adopted from WFP (2015)*

Table 1 indicates that, one household may be food secure by a single indictor but not others, which shows the convenience of the model. From the total sample, only 0.3% of the households were grouped under food secure category. Households categorized under this level show that they could meet essential food and non-food needs without engaging in typical coping strategies. On the other hand, 35.3% of households were grouped under marginally food secure level indicating that they have had minimally adequate food consumption without engaging in irreversible coping strategies but unable to afford some essential non-food expenditures. Moderately food insecure households were 51% of the sampled households. Households grouped under this category have had significant food consumption gaps, or marginally able to meet minimum food needs only with irreversible coping strategies. Finally, the remaining 13.4% of sampled households were grouped under severely food insecure level showing that they have had extreme food consumption gaps, or had extreme loss of livelihood assets that would lead to food consumption gaps, or worse.

4.2. Descriptive analysis of explanatory variables

Several household characteristics that are expected to correlate with food insecurity and coping strategies are included in this study. The descriptive statistics revealed many interesting findings (Table 2). At *woreda* level, the average age of household head is about 50 years. On average, there were 4.26 household members and slightly over 29% were had dependents. In terms of farmland ownership, around 53% of households and 46% had farmland size of 3.25 and between 3.25-10 "*timad*", respectively. The data on oxen ownership of households showed that 50.14 % had only one ox, 27.92% had two oxen and the remaining 21.94% had no ox. The livestock ownership in terms of Total Livestock Unit (TLU) of farm households indicated a minimum of zero and maximum of 5.75 units with a total mean value of 0.9 livestock per household.

Table 2. Descriptive statstics for continuous explanatory variables, Enebsie Sar Mider *Woreda* (n=351)

Variables	Households Food Insecurity Status						
	Food Secure	Marginally Food secure	Moderately Food Insecure	Severely Food Insecure	Total		t-value
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Min(Max)	
Age of household head	42(-)	51.06(14.18)	49.67(13.68)	49.76(10.37)	50.16(13.44)	22(90)	169.68
Household Size	1.88(-)	3.41(1.57)	4.49(1.57)	5.70(1.14)	4.26(1.69)	0.72(8.24)	364.06
Dependency Ratio	0(-)	27.13(23.80)	29.96(18.46)	32.58(22.45)	29.22(21.08)	0(100)	67.42
Farm land Size	2(-)	3.83(1.58)	3.14(1.90)	2.23(1.27)	3.28(1.79)	0(10)	84.34
Number of Oxen	0(-)	1.27(0.66)	1.02(0.73)	0.70(0.51)	1.06(0.70)	0(2)	31.44
Livestock ownership	0(-)	1.03(1.1)	0.86(0.96)	0.74(0.93)	0.90(1.01)	0(5.75)	184.91
Farm income	330(-)	327.43(208.55)	174.52(192.04)	5.83(22.83)	206.39(212.75)	0(1170)	395.56
Aid Received	300(-)	276.09(347.97)	453.95(490.58)	1032.13(382.73)	468.09(490.07)	0(1500)	218.47

Source: Own survey result, 2017, (SD) = standard deviation, Min= minimum, Max= Maximum

Table 3 indicates the distribution of household food security status by categorical variables. The result indicated that 77% of the respondents were males. Besides, 93% of the respondents were illitrate. In terms of credit access and farm input users around 34% were credit service beneficiaries and 89% were better farm input users. The majority of rural households were concentrated in the highland and midland parts of the woreda. Among the sampled households, 68.38% had no off-farm income for the last one year and 78% were affected by bad rainfall distribution.

Table 3. Distribution of household food security status by categorical variables, Enebsie Sar Mider *Woreda*, Amhara region (n=351)

		Household's Food Insecurity Status				
Description of variables	Category	Food Secured	Marginally Food Secured	Moderately Food Insecure	Severely Food Insecure	X^2 (Chi square)
Sex of HH	Male	1	93	135	40	
	Female	-	31	44	7	2.52
Education level HH	Higher Education	-	2	-	-	
	Secondary Education	-	7	-	-	29.92
	Primary Education	-	12	4	-	
	Illiterate	1	103	175	47	
Credit Access	Access	1	63	37	20	
	No access	-	61	142	27	33.00
Rainfall Situation	Bad	-	67	159	47	
	God	1	57	20	-	70.02
Off farm Income	No Income	-	67	129	44	
	Income	1	57	50	3	28.94
Uses of Farm Inputs	Non User	-	7	29	4	
	User	1	117	150	43	8.67

Source: Own survey result, 2017

4.3. Determinants of rural households' food insecurity status

The ordered logit maximum likelihood (ML) estimator of *b* is that the value of *b* that maximizes the likelihood function (L). For mathematical convenience, we often take the log of the likelihood, called the log-likelihood function (log L). Following the calculus rules of maximization, we differentiate the log-likelihood function with respect to the unknown and equate the resulting derivative to zero. The resulting value of the estimator is called the maximum likelihood estimator. The odds ratios of ordered logit are the proportional odds ratios for the ordered logit model. Ordered logit model estimates a single equation (regression coefficients) over the levels of the dependent variable. The change in levels in food security status and interpretation of the coefficients in odds signifies that we are comparing the households who are in groups greater than *k* versus those in groups less than or equal to *k*, where *k* is the level of the response variable. In this study, the dependent variable food insecurity is coded as follows: code 1 is used for food secured households, 2 represents marginal food secured households, 3 denotes moderately food secured households and 4 is assigned for severely food secured households and the sign of the regression coefficients would be interpreted accordingly. The proportional odds ratio (parallel lines assumption) and other relevant diagnostic tests such as multicollinearity and heteroskedasticity have been checked for the robustness of the regression result.

Table 4. Estimation result of Ordered Logit regression, Enebsie Sar Mider *Woreda* (n=351)

Variables	ML estimate	Std. Err.	z	P	Odds Ratio
Age of household head	0.0106525	0.0111459	0.96	0.339	1.010709
Household size	0.8345112	0.1084981	7.69	0.000***	2.303688
Dependency Ratio	0.0047594	0.0066695	0.71	0.475	1.004771
Farm land size (timad)	-0.1976979	0.0968574	-2.04	0.041**	0.8206177
Number of oxen	-0.5212518	0.2331885	-2.24	0.025**	0.5937768
Livestock ownership	-0.4507865	0.1512377	-2.98	0.003**	0.6371268
Farm income (birr)	-0.0042016	0.0008265	-5.08	0.000***	0.9958072

Aid received (2017)	0.0009497	0.0003318	2.86	0.004**	1.00095
Education status of household head	-1.489465	0.5155576	-2.89	0.004**	0.2254932
Sex of household head (base: male)	0.7743812	0.3178878	2.44	0.015**	2.169249
Uses of Farm input (base: no use)	-1.138213	0.4335191	-2.63	0.009*	0.3203911
Off-Farm Income (base: No)	-0.3866988	0.3069295	-1.26	0.208	0.6792956
Credit access (base: No access)	-0.9533887	0.2875601	-3.32	0.001**	0.3854327
Rain fall Situation (base: Not favourable)	-1.792099	0.378659	-4.73	0.000***	0.1666101

Number of observations= 351

LR chi2 (14) =298.68,

Log likelihood = -200.58181

Prob> chi2 = 0.0000

PseudoR2 = 0.4268,

*Marginal effect (dy/dx);

Prob. outcome 1 Y=.00006562

Prob. outcome 2 Y=.23199436

Prob. outcome 3 Y=.74408532

Prob. outcome 4 Y=.02385469

Source: Own survey result, 2017 *P<0.1; **P<0.05;***P<0.01

The parameter estimate for household size is significant and it had positive association with household's food insecurity status. The result indicates that households having more members had a disadvantage to enhance their food security level. The findings of previous studies are mixed. The result concurs with studies of Feleke et al (2003) and Tsegay (2009) in Ethiopia and Anna (2014) in Tanzania. However, it contradicts with the findings of Abera and Zeller (2009), a study conducted in rural parts of Ethiopia and Toulmin (1986) conducted in rural Mali. The result suggests that having larger household size results in increased dependency ratio, creating burden on the economically active members of the households and thereby aggravating food insecurity problems of the households.

The parameter estimate of household farm income is significant at less than 1% (p=0.000) and has negative association with households food insecurity status. The result indicates that households having more farm income would have better household food security status.

Rainfall status had significant negative association with food insecurity status (p=0.000). The study conducted by Demeke (2011) assessed the impacts of rainfall shock on farm household food security status in Ethiopia and found that rainfall shock significantly affected food security status. The result reaffirms empirical studies in the topic that favourable rainfall conditions are indeed assoicated with better food security outcomes in farming highly dependent on rain-fed agriculture like ours.

The parameter estimate of farmland size appeared to be significant determinant of rural household's food insecurity at less than 5% significance level (p=0.041) and has inverse association with food insecurity status. The larger the farmland size, the more likelihood of becoming food secure. The reason behind this is that the household either can cultivate the land to obtain more production or may rent it out to people in short of cultivable land to generate more income to the household.

Oxen ownership is another most important determinant of rural household's food security at less than 5% significance level (P=0.025) and shows negative relationship with food insecurity. The results of this study, like similar other studies, proved that oxen ownership is one of the prominent factors for determining the status of household food security in the rural areas of the district. That is, households who own larger numbers of oxen are more probable to be food secure than those with lesser or no oxen. The result is line the crucial imporance of oxen in smallholders' agriculutre is which highly dominated by oxen plough technology. The study conducted by Tsegay (2009) in Tigray region has proved that oxen ownership is the main factor to determine households food security status.

Livestock ownership is also another source of income for rural households and expected to have negative relationship with household's food insecurity status. Accordingly, the ordered logit regression result showed that it is significant determinant at less than 5% (p=0.003) and has negative relationship with food insecurity. This implies that having more livestock asset improves household's food security. Livestock ownership is a means of

coping at time of food insecurity and a source of cash to purchase like grain, oil, cloths, metal sheet to build corrugated iron house and other debt repayments.

Aid is another determinant of food security. Aid is one of coping mechanism provided by government and/or other nongovernmental humanitarian organizations at time of food insecurity and it found to affect households food insecurity status positively at less than 5% significance level(P=0.004). The result showed that households that receive aid are the most food insecured ones confirming that governments targeting of food insecured households is done rightly.

The parameter estimate of educational status of household head is significant determinant at less than 5% significant level (P=0.004) and negatively associated with households food insecurity. This implies that a household with higher educational status are less vulnerable to food insecurity. This is because literate farmers can read instructions and easily understand how to use fertilizers, pesticides, animal drugs etc. and they can easily implement new agricultural technologies. The result is supported by the study conducted by Anna (2014) in Tanzania and Tsegay (2009) conducted in Ethiopia.

Sex of the household head is another significant factor food insecurity at less than 5% significance level (P=0.015) and being female household-head is positively associated with households food insecurity. The positive relationship reflects that households headed by males are relatively food secure than female headed households. This is consisent with literature and empirics in developing countries where female heads do not have equal access for credit, land, and other important economic variables and social networks.

Uses of farm inputs is also another significant factor at less than 5% significance level (P=0.009) and has negative relationship with food insecurity. The uses of farm input by itself can be affected by many factors like price, access and educational status of the users. The negative association implies that a household that are not user of farm inputs would be more vulnerable to food insecurity. Finally, the parameter estimate of credit access is significant at less than 5% significance level (P=0.001) and negative relationship with food insecurity. The result indicates that credit access has a

paramount important in improve food security status of households in the study area.

4.4. Household coping strategy

a) Consumption based coping strategies: - To analyze the severity of food insecurity in the study area, consumption based coping activity data were collected from each sampled household one week prior to the survey date. The household's response shows that, most of the activities were practiced in low land area, and occasionally at high land and middle land area. Table 5 shows the responses of households and the frequency of practicing single coping activity within a week. The response revealed that nearly 69% of sampled households practiced a coping strategy of reducing the number of meals eaten per day.

Table 5. Consumption based coping strategies, Enebsie Sar Mider *Woreda* (n=351)

Consumption based Coping activities	Coping frequency (within 7 Days) by households			
	Never Happened	Every day	2-4 days	5-6 days
Relied on less preferred, less expensive food	121	44	89	97
Borrowed food or relied on help from friends or relatives	248	19	33	51
Reduced the number of meals eaten per day	109	66	85	91
Reduced portion size of meals	131	59	76	85
Reduction in the quantities consumed by adults/mothers for young children	129	61	79	82
Sent household members to eat elsewhere	337	0	5	9
Went an entire day without eating	351	-	-	-

Source: Own survey result, 2017NB: Multiple responses existed hence column tallies may exceed 351

b) Livelihood based coping strategies (asset based):- The livelihoods-based coping strategies were used to better understand longer-term coping capacity of households. The asset based coping activity has three distinctive ordered levels, at each level there are different activities undertaken by households for the last one year and/or last month prior to the survey date.

Table 6. Livelihood- based coping strategies in Enebsie Sar Mider *Woreda* (n=351)

Livelihood coping category	Livelihood coping activities	Households	(%)
Stress Coping behavior	Sold household assets/goods (radio, furniture, refrigerator, television, jewelry etc..)	11	3.1
	Spent savings	154	43.9
	Borrowed money/food from a lender, from bank	116	33.0
	Sold more animals (non-productive) than usual	146	41.6
	Reduced non-food expenses on health (including drugs) and education	193	55.0
Crises Coping behavior	Sold productive assets or means of transport (sewing machine, wheelbarrow, bicycle, car, etc..)	131	37.3
	Withdrew children from school	35	35.0
Emergency Coping behavior	Sold house or land	80	22.8
	Sold last female animals	50	14.2
	Begging	13	3.7

Source: Own survey result, 2017

N.B: Multiple responses existed hence column tallies may exceed 351 and 100% respectively

5. Conclusion and recommendations

5.1. Conclusion

The study has examined the rural household's food security status and identified the main determinants of food insecurity and coping strategies practiced by rural households at time of food insecurity in Enebsie Sar Mider woreda. The finding indicated that the sampled households' food dietary diversity was very poor, mostly composed of "Injera" and its condiments. Most of the sampled households had consumed below the minimum recommended kilocalorie per day per person. Households were highly vulnerable to food price shock as their monthly food expenditure was greater than nonfood expenditures. The index result revealed that food insecurity problem existed in the study area in terms of multi food security indictors. From the total sampled households, 0.3% were food secure and 35.3% were marginally food secure, 51% of the households were moderately food insecure and the remaining 13.4% of the households were severely food insecure. The econometric model results indicated that being female household head, household size, and aid affected food insecurity positively while farmland size, ox/oxen ownership, livestock ownership, farm income, credit access, uses of farm input, conducive rainfall situation and educational status of household heads were found to significantly contribute to the food security status of households. It is also concluded that, at time of food insecurity, most of the sampled households had adopted both long and short-term coping strategies. The most popular long-term coping strategies were selling more animals (non-productive) than usual, reducing non-food expenses on health, selling productive assets or means of transport, spent saving, borrowing money/food from a lender, from bank, sold house or land, sold last female animals. Whereas, the short-term coping strategies were relied on less preferred foods, borrowed food or help from friends or relatives, reduced portion size of meals. Finally, it can be concluded that, in Enebsie Sar Mider *Woreda* there was significant food shortage for the last one year and the government response to food insecurity was limited to short term food aid only.

5.2. Recommendations

Based on the results of the study, the following points were identified as important areas of interventions for improving food security status of households in the study area:

- As larger household size is found to aggravate food insecurity of households, promotion of family planning programs should be done in the study area.
- Adult education and tailored trainings for farmers should be introduced to meaningful impact the food security of households in the study area.
- The government and other stakeholders need to work towards enabling rural households to access credit at fair price (interest rate) by considering the return from credit. Besides, the government and the lender should convince and strictly follow up the households to use the credit amount for asset development activity rather than using it for the purchase of food items and other extravagant purposes.
- The government and other stakeholders have to provide farm inputs at affordable price. Currently the price of farm input, like inorganic fertilizer, improved animal species are too high for rural households. If the government can do this, rural households may be motivated to adopt modern agricultural inputs.
- As oxen are the main drafting power for farm households, the government and other stakeholders shall support farmers to have oxen through providing credit to purchase oxen, or start livestock insurance to maintain their assets or shall provide other plough machine by the means of affordable rent or any other substitutive technology.

- Finally, female headed households shall be supported to have better access to resources, economic and social assets such as participation in social work (Debo) and other income generating activities.

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