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Household Food Security Status and Coping Strategies in *Humbo Wereda*, Snnprs, Ethiopia.

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ABSTRACT

Important rural food security interventions can effectively either be formulated or be implemented through in-depth analysis of the food security status of the rural households. Therefore, this study was conducted to measure rural households' food security status, determinants that could potentially affect the households' food security status, and to find out the coping strategies during food shortfall. In order to achieve these objectives, 141 respondent rural households were selected randomly following probability proportional sampling procedure. Primary and secondary data were used. The data regarding household determinants were analyzed using descriptive statistics like mean, standard deviation, percentage and frequency distribution. Inferential statistics such as t-test and chi-square (χ^2) tests were also used to describe characteristics of food secure and insecure groups. The survey result shows that about 71.6% and 28.4% of sample respondents were food secure and insecure respectively. Besides, the average and squared food insecurity gap among the food insecure households were found as 24.6% and 11.3% respectively. Additionally, the level of food insecurity analysis shows that about 13.4%, 5%, and 10% of the total sample households were found to be marginally, moderately, and severely food insecure respectively. A binary logistic regression model resulted six significant variables at less than 10% probability level among 12 variables. These were sex and age of the household heads, dependency ratios, household size in AE, livestock ownership in TLU, and fertilizer utilization. The model estimate correctly predicted 94.3% of the sample cases, 97% food secure and 87.5% food insecure. On the other hand, reduction of meal, borrowing cash or grain, receiving food aid, working as a daily laborer, sale of livestock, fire wood, charcoal, wild grass (as a forage), and household assets, were found to be more frequently practiced coping strategies. Finally, there is a need to strengthen the link between rural development and food security programs, give attention for old aged and female headed households in interventions, limit population size through integrated health and education services, strengthen household asset building programs, introduce appropriate livestock packages, formulate effective policy to create off farm employment opportunities, facilitate utilization of fertilizer, and making the credit institution responsive.

Key words: Food security; Humbo; binary logistic regression model.

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1. INTRODUCTION

According to [1], in 2010-2012, about 870 million people or one in eight people in the world did not consume enough food to cover their minimum dietary energy requirements. Of these people, 852million were in developing countries, making up 14.9 % of the total population of these countries. Besides, over seventy percent of the food insecure population in Africa lives in the rural areas. Ironically, smallholder farmers, the producers of over 90 percent of the continent's food supply, make up the majority (50 percent) of this population.

Chronic food insecurity now affects about 200 million people who are suffering from malnutrition. Acute food insecurity in 2003 affected 38 million people in Africa who are facing the outright risk of famine, with 24,000 dying from hunger daily. Famines are the most visible and extreme manifestation of acute food insecurity. Out of the 39 countries worldwide that faced food emergencies at the beginning of 2003, 25 are found in Africa including Ethiopia [2]. As part of Africa, Ethiopia faces daunting poverty and food insecurity challenges that are worsening over time. About half of Africa's food insecure population lives in Ethiopia, Chad, Zaire, Uganda, Zambia and Somalia [3].

Additionally, sub-Saharan African populations face a number of causes that challenge the struggle against food insecurity. Within the region, progress towards improving human welfare is constrained by the high prevalence of hunger, malnutrition, and wide-spread poverty. Not surprisingly, African countries have collectively made the least progress towards achieving the Millennium Development Goal of reducing hunger by half by 2015. In fact, Africa is the only region in which levels of hunger increased in recent decades [4], and currently, close to one third of its population lives in chronic hunger [5]. On the whole, these constraints can have deleterious consequences for human development in the region. They also underscore the fact that there are still significant challenges to achieving food security in sub-Saharan Africa. At the same time, these challenges are not insurmountable. Progress towards the goal of food security requires new efforts to develop appropriate interventions for mitigating its causes and consequences for populations at risk. For these efforts to succeed, policy makers need to develop a comprehensive understanding of the causes that results in food insecurity in sub-Saharan Africa in the coming decades.

Food is one of the most basic needs for human survival. Access to it is a basic human right. Moreover, the pursuit of the Millennium Development Goal to cut hunger by half by 2015 requires a sound understanding of the related food security issues like definitions, causes, determinants, indicators and the like [6]. From many definitions according to [7] well accepted definition used of food security is 'it exists when all people, at all times, have physical, social and economic access to sufficient food which meets their dietary needs and food preferences for an active and healthy life.'

Food insecurity continues to be a major development problem across the globe, undermining people's health, productivity, and often their very survival. Efforts to overcome the development challenges posed by food insecurity necessarily begin with identifying the causes at household level [6]. This is due to the fact that identification of household behaviors relating to food access serves as a critical building block for the

development of policies and programs for helping vulnerable populations, the effective targeting of assistance, and the evaluation of impact.

Thus, understanding the causes of food insecurity is of primary importance in choosing appropriate interventions for addressing it. Hence, the causes are [6] usually far ranging, from unfavorable climatic conditions, economic shocks, political instability, and HIV/AIDS through poverty and unequal distribution of food within households. People employ and follow different mechanisms against food insecurity. [8] defined livelihood diversification as the process by which people construct a diverse portfolio activities and social support capabilities in order to maintain or improve their ability to make a living. Livelihood diversification activities are commonly categorized on the basis of their roles as mechanism for coping, adaptation and accumulation [9]. Any person reacts to any unfavorable occurrences in life. The behavior also is changed to face against calamities. So, this study was aimed at assessing and analyzing the possible causes and determinants of food insecurity at household level and the strategy that the people practice to cope up with it.

2. METHODOLOGY

2.1. The study site

Wolaita Zone is located at about 380km South of Addis Ababa at the central part of Southern Nations, Nationalities and Peoples' Regional State (SNNPRS).

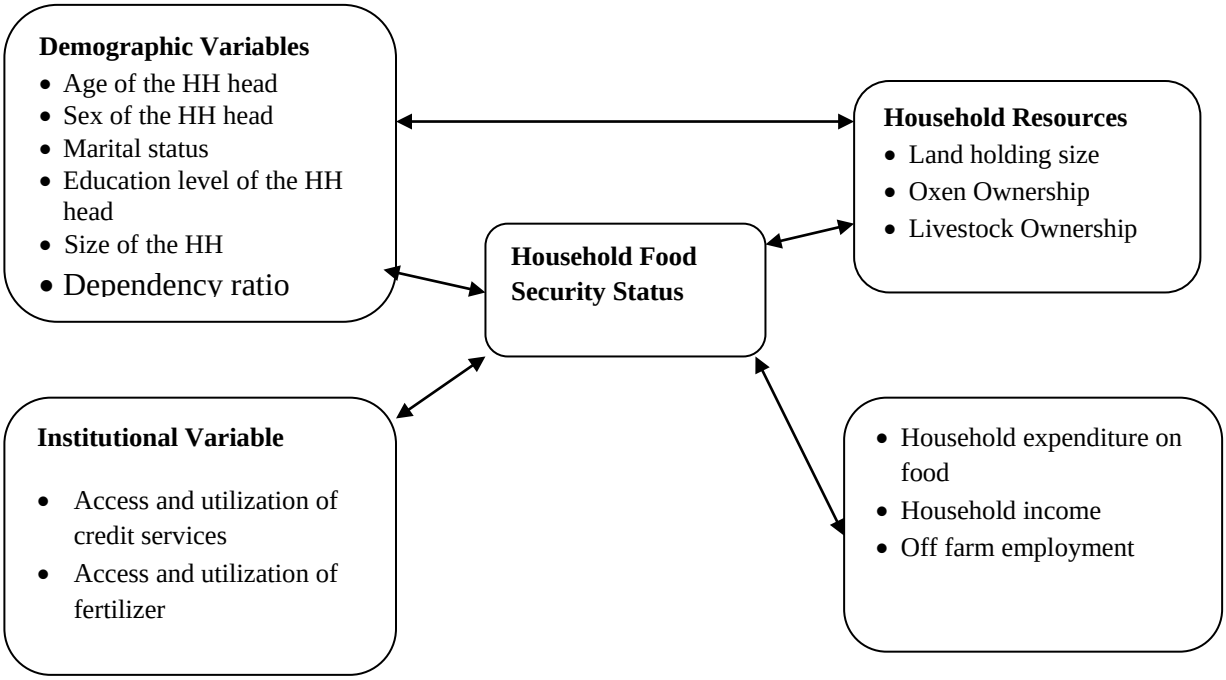

Figure 1. Conceptual framework to identify the potential variables which influence household food security status.

It is one of the 13 administrative Zones of the region and bordered on the south by *Gamo Gofa* Zone, on West by *Dawro* Zone, on Northwest by *Kembata* Zone, on North by *Hadiya* Zone, on Northeast by the Oromiya Region, and on East by *Sidama* Zone.

Wolaita Zone is divided in to 13 lower *Wereda* level administrations. [10] the area of *Humbo Woreda* is 86,646 hectare, of which 35,057 hectare cultivated land, which consist of 40.46%, 1,010 hectare cultivable land (1.16%), 8,585 pastoral land (9.9%), 24,845 hectare bush land and shrub land (28.64%), 12,000 hectare (13.8%) is covered by water, and 5,149 hectare of land accounts for other type of usage.

Humbo Wereda, as part of the *Wolaita* Zone, located in the Great Rift Valley, is bordered on the south by Lake Abaya which separates it from the Oromiya Region, on the southwest by the *Gamo Gofa* Zone, on the west by *Offa*, on the north by *Sodo* Zuria, on the northeast by *Damot Weyd*e, and on the east by the *Bilate* river which separates it from the Sidama Zone. The administrative center of *Humbo* is *Tebela.*

2.2. Data and data sources

The data collected for this study were mainly quantitative while qualitative data was also collected separately. The qualitative data collected was intended to find out the extent and severity of food insecurity status. The primary data sources were obviously the sample respondent households' heads, which were selected randomly following stratifying *Kebeles* based on agro-ecology. On the other hand, the secondary data sources are those data, which were collected from different *Wolaita* Zone and *Humbo Wereda* Agricultural Coordination offices respectively.

The quantitative data collected for this study were the type amount of food consumed by the household, data on the household demographic characteristics, the range of coping strategies practiced by the household during food insecurity, resource endowment especially type of house and livestock ownership, access to credit, and so on.

2.3. Sampling technique

A three step sampling method was used to select the sample households. First, the rural *Kebeles* were stratified based on the two *Kolla* and *W/dega* agro-ecologies of the *Wereda*. Secondly, simple random sampling method was administered to select two rural *Kebeles* from each stratum. Then at last, proportional probability sampling (PPS) technique was used to select sample households from selected four rural *Kebeles.*

2.4. Sample size determination

The number of sample households was determined based on the [11] formula. This required estimation of tolerable error margin as 0.05 allowing 95% confidence level. Hence, the formula is stated below.

$$n = \frac{z^2 pqN}{e^2 (N-1) + z^2 pq}$$

Where: n= the minimum number of sample size within the range of acceptable error margin.

N= the total number of households in the four selected RKAs (1600 hhs)

z= confidence level (95%) and which is 1.96

e= acceptable error margin (0.05)

p= proportion of sampled population (0.11)

q= estimate of the proportion of population to be sampled (0.89)

Based on the above equation, the minimum numbers of sample households selected were 138. Therefore, including 10 interview schedules as a contingency, 141 interview schedules which accounted about 95% response rate was obtained.

2.5. Method of data collection

Primary data collection was conducted using survey by means of structured interview schedule for the quantitative part of the data. The interview schedule was pre-tested among the non-sampled respondents of matching characteristics and on the results; it was revised accordingly. The qualitative data was found from the discussion with eight focus group members who were supposed to have clear insight about the overall context of the *Wereda*. Besides, personal interview was also conducted with the *Wereda* disaster prevention and preparedness officers.

Four enumerators who have adequate knowledge about the area and well acquainted with the culture and language were recruited. They were trained theoretically as well as practically on the methods of data collection and contents of the interview schedule.

2.6. Method of data analysis

2.6.1. Analysis of food security status

The source of food for the households might be of different types like own production, loan, gift as aid, and purchase and so on. The food items and quantities obtained and consumed by the sample households were converted into their respective caloric contents based on [12] using seven days recall method to find out food security status of the households. After converting the household size into adult equivalent (AE), the converted calorie consumption was divided into pre found adult equivalent and seven to find out a single day's calorie consumption per a single adult equivalent. This is given as:

$$HFSi = \frac{Total\ net\ calorie\ consumed\ by\ a\ household}{Household\ size\ in\ Adult\ equivalent}$$

Where: HFS_i is Household Food Security of the i^{th} household and i=1, 2, 3…141.

Therefore, based on the HFSi value, the households' food security status was determined that those households whose HFSi is greater or equals to 2100 kcals per day were generalized as food secured and the others were concluded as food insecure.

From the above findings, the head count ratio could be calculated as: IFI= *m/ n* x 100 where, IFI is Incidence of Food Insecurity, *m*=Number of food insecure households and n=the total sample size.

2.6.2. Analysis of food insecurity gap

Food insecurity gap of i^{th} food insecure household (FIGi) is defined as:

$$\text{FIGi} = \frac{TCRi - TCCi}{\text{TCRi}}$$

Where, TCRi=Total Calorie Requirement for *ith* food insecure household and TCCi denotes the Total Calorie Consumption by *ith* food insecure household. Total Food Insecurity Gap (TFIG), which indicates the depth of food insecurity among the food insecure households, is expressed as:

$$TFIG = \sum_{i=1}^{m} \frac{FIGi}{m}$$

Finally the Squared Food Insecurity Gap (SFIG), which indicates severity of food insecurity among the food insecure households, is given as:

$$SFIG = \sum_{n=1}^{m} \frac{(FIGi)2}{m}$$

2.6.3. Analysis of the severity level of food insecurity

The calorie intake shortfalls were estimated based on the nutritional reference level (2100kcals/day/adult). According to [13], the calorie consumption estimates can be used directly to categorize the degree of severity of food insecurity as follows.

Table 1. Level of food security

Food security status	Calorie consumption per person per a day
Food secured	Above 2100 kcals
Marginally food insecure	Between 1800 kcals and 2100 kcals
Moderately food insecure	Between 1500 kcals and 1800 kcals
Severely food insecure	Below 1500 kcals

Source: [13],

Thus, this study also used the above categories to estimate the head count ratio and the degree of food insecurity at the *Wereda.*

2.6.4. Analysis of household variables

To identify the potential household variable which can affect the household food security status, both descriptive and econometric models were used. Descriptive statistical methods such as frequency, percentage, mean, and standard deviation were used. For categorical variables, a chi-square test was used to test for association. A t-test

was used to examine the mean difference between food secure and food insecure households with respect to certain continuous variables.

2.7. Model specification

Usually a choice has to be made between Logit and Probit models, but the statistical similarities between the two models make such a choice difficult. [14] illustrated that the logistic and Probit formulation are quite comparable. It does not matter much which function is used except in the cases of where the data are concentrated in the tails following points. For this study the Logit model is selected, though both Logit and Probit models may give the same result. The logistic function is used because it represents a close approximation to the cumulative normal distribution and is simpler to work with. Moreover, as [15] pointed out a logistic distribution (Logit) has got advantage over the others in the analysis of dichotomous outcome variable in that it is extremely flexible and easily used function (model) from the mathematical point of view and lends itself to a meaningful interpretation and relatively inexpensive to estimate. So that to address the second objectives of the study Logit model was employed.

Following [18] the cumulative logistic probability function is specified as:

$$Pi = F(Zi) = F[\alpha + \sum(BiXi)] = [\frac{1}{1+e^{-[\alpha+\sum(BiXi)]}}] \text{ ---------- (1)}$$

Where:

e represents the base of natural logarithms (2.718)

xi represents the i^{th} explanatory variable

Pi is the probability that a household is being food secure given xi,

α and βi are regression parameters to be estimated

Interpretation of the coefficients will be understandable if the logistic model can be written in terms of the odds and log of odds [17]. The odds ratio is the probability that a household would be food secured (Pi) to the probability that it will be food insecure (1 - Pi).

$$(1-P) = \frac{1}{1+e^{zi}} \text{ ---------- (2)}$$

And putting using natural logarizm:

$$Zi = Ln\left(\frac{Pi}{1 - Pi}\right) = \alpha + \beta 1x1 + \beta 2x2 + \text{---} + \beta nxn \text{ ---------- (3)}$$

Where:

Zi represents is a function of explanatory variables xi

α is the intercept

β‘s are the slope parameters in the model

3. RESULTS

3.1. Household food security status

Household food security status is the application of food security concept at family level, with individuals in the household as the focus of concern. Therefore, the household food security status can be measured by different methods. However, different authors preferred consumption based measurements than others due to different reasons. The first reason argued is that the questions organized are of retrospective than prospective [18], it better capture long-run welfare, and it better reflects household's ability to meet their basic needs [19], it is less vulnerable to seasonality and life-cycle [20], the reliability of income data in subsistence farming where record keeping is limited is always questionable [21] almost all amount of income being invested only on food items by the rural and urban poor, and so on.

Thus, the household food security status was measured based on food amounts consumed by the household with in a specified period of time in past, i.e. seven days recalling method. The data regarding the amount of foods consumed by the household with in the past seven days was converted into the calorie amount. Then the amount of calorie consumed by a single adult equivalent was determined.

The required amount of calorie intake per adult per a day for an active and a healthy life to differentiate food secure and food insecure households vary depending on different literatures. However, 2100 kcals a day was used as a minimum threshold level to be compared with the households' consumed energy per adult per a day. Therefore, the households whose calorie consumption/acquisition equal or greater than the threshold amount, they were categorized as food secure and food insecure otherwise.

As a result, from all 141 respondents, 101 (71.6%) households were found food secure and 40 (28.4%) were food insecure. The minimum and maximum calorie consumed by a single adult in a day for food insecure households were 437 and 2077 kcals and that of the food secure households were 2117 and 10756 kcals respectively. Therefore, the mean calorie amounts became 3283.9 kcals for food secure and 1592.575 kcals for food insecure households. Consequently, the standard deviation for food insecure and food secure households were found to be 491.94 kcals and 1238.95 kcals respectively.

Table 2. Amounts of calories consumed by an adult in a day

Calorie consumed per AE in (kcals)	Food secure (N=101)	Food insecure (N=40)	Total (N=141)
Minimum	2117	437	437
Maximum	10756	2077	10756
Mean	3283.9	1592.575	2438.238
Standard Deviation (SD)	1238.95	491.94	1322.604

Source: Own survey result.

3.2. Headcount ratio

The head count ratio measures the proportion of the households who faced the shortfalls of 2100 kcals per person per a day. Based on the threshold calorie requirement, i.e. 2100 kcals per a day per an adult, the study found that 101 and 40 households were food secure and food insecure respectively from the total 141 sample households. Meanwhile, this finding indicated that on average 71.6% households could meet the minimum threshold daily energy requirement and 28.4% households were found consuming less than the minimum calorie requirement.

3.3. Food insecurity gap

The food insecurity gap measures the mean depth of food insecurity among the food insecure households. It is the mean proportion by which the food security status of the food insecure households falls below the minimum level of calorie requirement. The result of this study indicated that food insecure households are 24.6% far off from the minimum level of calorie requirement i.e. 2100 kcals.

The squared food insecurity gap measures the severity of food insecurity among the food insecure households. It gives more weight to the average calorie shortfalls of the most food insecure of the food insecure households. Thus, it measures the squared proportional shortfalls from the minimum level of calorie intake. The drawback of this index of food insecurity, according to [22], is that it is not easy to interpret. However, it can be said that the severity of the food insecurity in *Humbo Wereda* is about 11.3% (Table 3).

Table 3. Food Insecurity Indices

Calorie consumed per AE in (kcals)	Value
Head count ratio	28.4%
Average food insecurity gap	24.6%
Squared food insecurity gap	11.3%

Source: Own survey result.

3.4. Level of food security among the rural households

The calorie intake shortfalls are estimated based on the nutritional threshold level (2100kcals/day/adult). The level of food insecurity, according to [13], measures the calorie consumption directly by categorizing the degree of severity of food insecurity. Thus, the result of this survey is depicted in table 4.

Based on the level of food insecurity, 101 (71.6%) of the sample households were found to be food secure and the other 40 (28.4%) are found food insecure with different severity levels. Out of 40 food insecure households, 19 (13.4% of the total sample households and 47.5% of the food insecure households) households were marginally food insecure, seven (5% of the total sample households and 17.5% of the food insecure households) are moderately food insecure, and 14 (10% of the total sample households and 35% of the food insecure households) households were found to be severely food insecure.

Table 4. Level of food insecurity

Food security status	Calorie consumption per person per a day	Survey result (on households)	
		Number	%
Food secured	Above 2100 kcals	101	71.6
Marginally food insecure	Between 1800 and 2100 kcals	19	13.4
Moderately food insecure	Between 1500 and 1800 kcals	7	5
Severely food insecure	Below 1500 kcals	14	10
Total		141	100

Source: Own survey result.

3.5. Descriptive results

The age of the total sampled households ranged from 23 up to105 years and the over all mean age value is 45.18 years. The age of food secure household heads ranged from 23 up to 97 years having the mean age value of 42.06 years while on the other hand the age of the food insecure household heads ranged from 30 up to 105 with the mean age value of 53.05 years. In addition, the p value of the t-test was found to be 35.603. Therefore, it was significant at less than 1% probability level when compared independently with food security.

Among the 141 sample households, the number of female headed households and male headed households are found to be 18 and 123 in numbers and covers 12.766% and 87.234% respectively. Out of 18 female headed households, 11 which account 61% of all females are food insecure where as 7 accounting 39% are food secure. On the contrary, among the 123 male headed households, only 29 (23.6%) and 94 (76.4%) found food insecure and secure respectively. The chi-square result 10.886 shows that it was significant at less than 1% probability level when looked independently with food security status.

The result obtained regarding marital status of the household heads shows that the majority of the sample households were married. That is about 89.1% of the food secure and 90% of the food insecure households were married respectively. However, there is slight variation among the widowed households from both categories. Thus, about 6.93% and 10% from food secure and insecure households respectively were found widowed. When independently observed with food security status, the chi square (χ^2) results 1.933. This implies that it was affecting the households' food security status significantly at less than 10% probability level.

The average household member sizes of the total sample, food secure and insecure households were 6, 5.5 and 7.175 respectively. However, using household members' age and sex, cumulative households' AE was calculated using conversion factors. Therefore, the mean AE of the food secure and food insecure households were 4.643 and 6.0915 respectively. Since AE has a direct relationship with household size, the result showed that the households who have more household members were found food insecure. The standard deviation in the food secure and food insecure households were found to be 1.913 and 2.323 respectively. When the AE cross

tabulated to see the independent effect with food security status, it was found as significant at less than 1% probability level.

The educational level of the sampled household heads was categorized under five intervals like no any level, from grade 1-4, from grade 5-8, from grade 9-10, and above grade 10. The results reflected that number of the households from the food insecure households, 4% of the food secure group and 2.84% of all respondent household heads were illiterates. Only (3.3%) of the food secure households heads have completed grade twelve. The majority of households from both food secure and insecure households lie under from grade 1-4 educational level. About 63.37% of food secure households and 95% of food insecure households had an educational level which ranges from grade one to four.

The dependency ratio is the ratio of household members whose age below 15 and above 64 years of age to the number of persons in the age group 16 - 64 years (active labor force). The mean dependency ratio of food secure households was 0.4 and that of food insecure households was 0.54. This shows that almost more than half of the household members in the food insecure household were dependents. The standard deviation for the food secure and food insecure households were 0.2004 and 0.1656 respectively. The result of the t-test showed that it its high significance at below 1% probability level.

The oxen ownership per household ranged from zero to 2. The total numbers of oxen owned by the households were 143 and on average a single household had about 1.014 oxen. About 87% and 72.5% of the total oxen possessed by the food secure and insecure households respectively, only 1% of food secure households possessed half part of a single ox, while about 2.5% of food insecure households possessed half part of a single ox. On the other hand, 70.3% of food secure households got one oxen; while about 42.5% of food insecure households had the same number of oxen. Also about 15.8% of food secure, 27.5% of food insecure households and 23.8% of all respondents got no ox at all.

The total livestock possessions by the respondent households were converted following [23] conversion factor in to their respective TLU values. Therefore, the result when summed up for all respondents in TLU was 402.351. The total livestock number possessed by the food secure households in TLU was 351.77 and the average livestock number in TLU was 3.4829. And the total TLU for food insecure households was 50.581 and the average livestock number in TLU was 1.2645. There was a variation among the respondents with regard to TLU possessed which ranged from zero to 9.42 TLU per household for all respondents.

The cultivated land holding of all the respondent households ranged from 0.125 hectare to 5 hectares. The total land size for food secure and insecure households were about 112.75 and 18.99 hectares respectively. Therefore, the mean cultivated land size of food secure and food insecure households were 1.1163 and 0.47475 hectares respectively. The majority of food secure households accounting about 76.2% were possessed less than one hectare implies that the area had a related problems regarding land scarcity. On the other hand, almost 75% of food insecure households possessed less than half of the hectare and the result showed that almost all food insecure households owned less than one hectare of cultivating land.

Table 5. Summary of descriptive statistics for continuous variables

Variables	Food secure (N =101)		Food insecure (N = 40)		Total sample (N =141)		t-values
	Mean	S.D	Mean	S.D.	Mean	S.D.	
Age (years)	42.06	13.692	53.05	15.67	45.18	15.068	35.603***
Household size (AE)	4.643	1.913	6.0915	2.323	5.054	2.132	28.144***
Dependency ratio	0.377	1.96498	0.609	2.30738	0.443	0.200	26.275***
Oxen ownership	1.025	0.5403	0.988	0.7552	1.01	0.606	19.861***
Livestock (TLU)	3.50	1.917	1.2645	0.885	2.854	1.96	17.268***
Land size	1.1163	0.99	0.47475	0.24	0.934	0.892	12.443***

***Significant at less than 1% probability levels.
Source: Own survey result.

Table 6. Summary of descriptive statistics for discrete variables

Variable		Food secure (N=101)	Food insecure (N=40)	χ^2 value
Sex	Male	94	29	10.886***
	Female	7	11	
Educational Status	Illiterate	4	0	15.655***
	grade 1-4	64	38	
	grade 5-8	25	1	
	grade 9-10	6	0	
	>grade 10	2	1	
Marital Status	Married	90	36	1.933*
	Divorced	4	0	
	Widowed	7	4	
Credit Utilization	Formal	43	19	0.748
	Informal	30	9	
	Both	21	9	
	No	7	3	
Fertilizer utilization	Users	97	15	60.101***
	Non users	4	25	
Off/non employment	Participant	66	19	3.182***
	Non p	35	21	

*** and * are significant at less than 1% and 10% probability levels respectively.
Source: Own survey result.

The availability of off farm employment opportunities support the households' food security status thereby increasing the income of the households. Though the findings from this study it shows the off farm employment opportunities in *Humbo Wereda* were limited to daily labor of different types with small wage rates, it had also a

positive link with the household food security status. That is about 65.35% and 35.65% of the food secure households were found to have experience of participation in off farm employment and have no any experience respectively. On the hand, about 47.5% and 52.5% of the food insecure households had participated and had not participated respectively in off farm employment to get additional income so as to improve their calorie consumption. Besides, when its relation with the household food security status was observed independently, the chi-square (χ^2) result supports the above notion.

3.6. Econometric analysis

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

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

Moreover, the goodness of model fit was measured in terms of count R^2, which works on the principle that if the predicted probability of the event is greater than 0.50, the event will occur, otherwise the event will not occur. The model result show the correctly predicted percent of sample household is 94.3% %, which is greater than 0.50.

Additionally, the sensitivity and specificity, which correctly predicted food secure and food insecure, were found to be 97% and 87.5% respectively indicated that the model had estimated the food secure and food insecure correctly.

3.7. Out put of the binary logistic regression model

Out of 12 independent variables which had been assumed to be significantly related with the status of food security status of the households, the estimation revealed from binary logistic regression that six variables were found statistically significant (Table 7).

Table 7. Logistic estimates of determinants of household food security status

Variables	Coefficients (B)	S.E	Wald statistics	Odds ratio	Significance level
Constant	-0.749	3.490	0.046	0.473	0.830

Age HH	-0.066	0.030	4.910	0.936	0.027**
Sex HH	5.306	2.150	6.090	201.479	0.014**
Marital status	0.898	1.019	0.776	2.455	0.378
Household size (AE)	-0.610	0.235	6.763	0.543	0.009***
Dep. Ratio	-5.404	2.996	3.255	0.004	0.071*
Education level HHH	0.086	0.620	0.019	1.090	0.890
Land holding size	0.522	0.791	0.434	1.685	0.510
LS ownership (TLU)	1.074	0.431	6.222	2.928	0.013**
Participation in off farm employment	0.731	0.963	0.575	2.076	0.448
Oxen ownership	0.041	0.720	0.003	1.042	0.955
Fertilizer utilization	3.032	1.107	7.501	20.734	0.006***
Credit utilization	-0.336	0.414	0.660	0.714	0.417
- 2 Log likelihood				44.114	
Pearson Chi-squared (χ^2)				124.072	
Correct prediction of all sample (*Count* R^2) (%)				94.3	
Sensitivity/ Correct prediction of food secure (%)				97	
Specificity/ Correct prediction of food insecure (%)				87.5	

*** Significant at less than 1% probability level; ** Significant at less than 5% probability level; * Significant at less than 10% probability level.

Source: Model output.

4. DISCUSSION

Age of the household head was significant at less than 5% probability level and showed negative relationship in explaining the household food security status. Which means, as the age of the household head increases by a single year, keeping other factors remain the same, the likelihood of the households being food secure decreases by a factor of 0.936. This finding contradicts the assumption that when the heads age advances, they were expected to have stable economy and food secure than younger heads. This shows that the household heads who are at the range of active working age engage in different off farm activities and get income to be invested to improve their household food security status.

Sex of the household head was found significant at less than 5% probability level in explaining the status of household food security. The coefficient for sex of the household head showed a negative relationship with food security status. That means male headed households have the higher probabilities of being food secure than their female counterparts. Therefore, if other factors are constant, the probabilities of female household heads to be food secure decrease by a factor of 201.479. This can be reasoned out that male household heads better engage in any productive activities so as to food secure their households than female heads.

Household size in AE was significant at less than 1% probability level in explaining the household food security status. It showed a negative relationship with food security status. This reveals that the negative effect of the increased number of household members in AE on food security status of the household. Therefore, if other factors are constant, an increase of a single adult equivalent reduces the households' likelihood of being food secure by a factor of 0.543. This indicates existence higher demand for food as the family member increases

thereby affecting the households' food security status.

Household dependency ratio was found to be significant at less than 10% probability level and had a negative relation with food security status. This showed that in a household where adults or productive age groups (household members aged under the age range of 15 up to 65 rears) are higher than the non-productive age groups, the probability of the household to be food secure would be high. Therefore, an increase in a unit dependency ratio will decreases the households' probability of being food secure by the factor of 0.004 if other factors remain the equal.

Livestock holding (in TLU) is significantly related at less than 5% probability level and the odds ratio in favor of being food secure increase by a factor of 2.928 when other factors remain constant. The positive relationship implies that households who possess large herd size had higher probabilities of being food secure since they can earn more income from livestock production and get opportunity to consume animal products. This in turn enables them to purchase food when they are in short of their stock, and invest in purchase of farm inputs that increase food production, and thus better positioned in ensuring food security at their household level.

Fertilizer utilization was found to be significant at less than 1% probability level. It is positively related with food security status. The possible explanation is that those households who use fertilizer were more likely to be food secure than those who did not make use of it. If other factors are kept constant, the odds ratio in favor of being food secure increases by a factor of 20.734. However, there are households who use fertilizer under the recommended amount, in this study, regardless of the amount of input being used, focuses only whether households use or not.

The coping strategies are practices that a household take as a decision to mitigate and escape during shortfall of food availability and access. So, there are about 14 strategies being practiced by the households in the past as a reaction against food shortage. Among all households, 53.5% of the households receive food or money as aid, 42% of households reduce meals especially breakfast and lunch, 39.7% of the households borrow money to buy food, 36.2% households sell livestock (poultry first, sheep and goats next, and cattle at last) in exchange of money so as to buy food, 34.75% of the households participate in different forms daily labor in the nearby *Tebela* town to earn different amount of wages, 27.7% were engaging themselves in the forests in search of natural resources that they can make money from the sale of it, and 22% of the households sold the household assets. Other strategies that were employed by the household at severe food shortfall periods are summarized below in table 8.

At the severe food insecurity occasions, 8.5% households are involved with seasonal labor migration, 3.5% consume less preferred foods (especially the bottom tuber part of *Enset/*false banana*)*, 5.7% households borrow grain to be returned double at the next harvesting season, 0.71% households send their children to relatives, about 0.71% of the households rent their economic assets like land, 8.5% households seasonally migrate to the nearby business areas like *Amibara* Agricultural Development centers at Wolaita and Arba Minch, and 1.4% households drop their children from school.

Table 8. Types of household coping strategies during severe food shortfalls

	Practiced Strategies	Food secure (N=101)		Food insecure (N=40)		Total (N=141)	
		Number	Percent	Number	Percent	Number	Percent
1.	Work as a daily laborer	12	12	37	92.5	49	34.75
2.	Receive food aid	21	20.8	33	82.5	54	53.5
3.	Migrate to work (seasonal)	6	6	6	15	12	8.5
4.	Reduction of meal	24	23.8	35	87.5	59	42
5.	Sell of livestock	15	14.9	36	90	51	36.2
6.	Sell of household assets	8	8	23	57.5	31	22
7.	Sell of fire wood, charcoal, wild grass as a forage	10	10	29	72.5	39	27.7
8.	Borrowing money to purchase food	26	25.7	30	75	56	39.7
9.	Eating less preferred food	1	1	4	10	5	3.5
10.	Dropping children from school	0	0	2	5	2	1.4
11.	Begging	1	1	3	7.5	4	2.8
12.	Borrowing grain	1	1	7	17.5	8	5.7
13.	Sending children to relatives	0	0	1	2.5	1	0.71
14.	Become daily labor	0	0	1	2.5	1	0.71

Source: Own survey result.

Even if the society perceive begging as a taboo or forbidden practice, after consuming all the options, 2.8% of the households employed food begging at the better offs and even serve to get food.

5. CONCLUSIONS

The result of this study showed 71.6% and 28.4% of the sample households were found to be food secure and food insecure respectively. The mean food insecurity gap and squared food insecurity gap of the food insecure households were 24.6% and 11.3% respectively. Besides, 47.5%, 17.5% and 35% of the food insecure households were marginally, moderately and severely food insecure respectively.

This study also indicated that when the old aged and women headed households had negative impact on food security status. This means older household heads and female headed households have lesser probabilities of being food secure than others. Therefore, they require special treatment and they should be taken in to account during the design and implementation of whatever rural development programs in general and food security projects and programs in particular.

Household size and food security status had been strongly and negatively related. Therefore, decisions and measures need to be implemented in order to reduce the increasing population pressure regarding food security status in the study area. Thus, this could be done by having proper and strong awareness creation activities through integrated health and education services as far as the issue is concerned. This means that, it could be done through making different family planning alternatives available in the study area and a proper training and

awareness creation activities have to be conducted in order to make the family planning activities effective so as to limit the growing family size. Even though every individual has a natural right to multiply himself with his willing partner, this right should be with the ability to furnish his descendants with all the necessary or basic needs, especially food.

When there are more members of the household who could not actively engaged in different productive businesses adversely affect the household's food security status. The finding of this study proved the logic true in that the households whose dependent (aged below 15 and above 64 years) household members are more were highly positioned to be food insecure. Therefore, targeting direct distribution of food and food for work to needy families during the harshest time of the year is inevitable task. However, there has to be clear framework to facilitate a gradual graduation of food insecure households should be employed through minimization of dependency and disincentives.

Livestock ownership affected significantly and related positively with food security status. The possession of more livestock assists the households in combating food shortfall confrontation through the sale of live animals and their products as exchange so as to buy food. The households also could improve their household food security status by consuming the animal products like milk, cheese, butter, and egg. Therefore, appropriate livestock packages need to be introduced and promoted in the study area.

As a household determinant, regardless of the amount, fertilizer utilization, generally, was found to be very significant and had a positive relation with food security status. By default, it is understood that farm inputs like fertilizers, seeds, insecticides and others increase production and productivity. This in turn increases own consumption thereby results in improved household food security status. This study found that, it had defects with regard to timely delivery by the suppliers and following the recommendation application. Therefore, strong awareness creating campaign need to be organized by the *Wereda* office of agriculture in order to make the rural households understand the benefit of using the recommended amount per area of land in the study area. Besides, timely delivery of inputs facilitation is mandatory to rise up technology use by small holders and then increase production and improve productivity, hence, to see households food secured.

About 27.7% of the respondent households engaged in forests in search of natural resources that they can make money from the sale of it indicated that the contribution of food insecurity in depleting natural resources and in addition, 22% of the households sell their household assets against food shortfalls. Therefore, these call for the introduction and effective implementation of participatory management of natural resources complementing the creation of appropriate off/non-farm employment opportunities and the need to strengthen the household asset building project.

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7. REFERENCES

[1] FAO, The State of Food and Agriculture, Rome.

[2] Clover J., 2003. Food Security in Sub-Saharan Africa, a review paper.

[3] Ramakrishana G. & Demeke A., 2002. An Empirical Analysis of Food Insecurity in Ethiopia: The Case of North Wollo. Africa Development 27 (1&2).

[4] Sanchez A, 2005. Cutting World Hunger in Half. *Journal of Science,* 357-359.

[5] Lobell D., 2008. Can we beat the heat? Improving food security in a changing climate. Wood Instirute for the Environment, Stanford University.

[6] Lisa C. Smith and Ali Subandor, 2007, Measuring Food Security Using Household Expenditure Surveys, International Food Policy Research Institute, Washington DC.

[7] FAO, 1996. Rome Declaration on World Food Security and World Food. Rome.

[8] Ellis F., 1998. 'Household Strategies and Livelihood Diversification ', *Journal of development studies, Vol 35, No 1: 1-38*

[9] Carswell G., 2000. Livelihood diversification in southern Ethiopia. IDS working paper 117.

[10] Wolaita Zone Socioeconomic Profile, 2005. Wolaita Soddo, Ethiopia.

[11] Kothari, C.R. 2004. Research Methodology: Methods and Techniques (2nd ed.). New Delhi: Wisley Eastern.

[12] Ethiopian Health and Nutrition Research Institute/EHNRI/, 2000. Kilo Calories of Different Food Groups.

[13] Devereux, S., 2006. Distinguishing Between Chronic and Transitory Food Insecurity in Emergency Needs Assessments, Institute of Development Studies, Rome.

[14] Gujarati, D.N., 1988. Basic econometrics. Second edition. McGrew-Hill Inc, New York.

[15]Train, K., 1986. Qualitative choice analysis: Theory, econometrics and an application to automobile demand. The MIT Press, London.

[16] Pindyck S. and Rubinfeld, L., 1981. Econometric models and economic forecasts. Second edition. McGrew-Hill, New York.

[17]Hosmer, D.W., and S. Lemeshow, 1989. Applied logistic regression. A Wiley-Inter science publication, New York.

[18] John H., 2001, Method for Rural Development Projects, Choosing Outcome Indicators of Household Food Security. International food policy research institute, Washington DC.

[19] FAO, 2002. The State of Food Insecurity: Report 2002 Food and Agricultural Organization, Rome

[20] CSA, 2005. The 2005 National Statistics, Addis Ababa.

[21]Gulled Abullahi, 2006. Food Security and Coping Strategies of Agro-Pastoral Households in Awbare Woreda, Somali Region, Ethiopia. An M. Sc. Thesis presented to the School of Graduate Studies of Alemaya University, Alemaya.

[22] Sen, A., 1981. Poverty and Famine: An Essay on Entitlement and Deprivation; Oxford, Clarendon press.

[23]Storck, H., Bezabih Emana, Berhanu Adnew, A. Borowiccki and Shimelis W/Hawariat, 1991. Farming systems and resource economics in the tropics: farming system and farm management practices of smallholders in the Hararghe highland. Vol.11, Wissenschaftsverlag Vauk, Kiel, Germany.