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Full Length Research Paper

Causes of household food insecurity in Wolayta: Southern Ethiopia

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The objective of this paper is to examine the causes of food insecurity in Wolayta. This question is of interest since it has been argued that there is no problem of underdevelopment that can be more serious than food insecurity. The study showed that the majority of the rural households (74.2%) are food insecure. A binary logistic model is used to determine the factors, which influence households' food security status. The results obtained from the analysis indicate those households with large family sizes, large dependents, and young heads were food insecure. Besides livestock ownerships, farm inputs, employment in off farm sectors and value own consumption were the determinants of household food security. This finding strongly supports that input access by the poor, promotion of family planning; enhancing livestock packages, facilitation of credit service, creation of off farm opportunities, delivery of food aid for emergency needy groups, can mitigate food insecurity in the study area.

Key words: Causes of food insecurity, binary logit, Wolayta, Ethiopia.

INTRODUCTION

Ethiopia is one of the world's poorest countries with indicators suggesting low levels of development. Many Ethiopians live in conditions of chronic hunger with both a low average daily energy supply (FDRE, 2002; Tassew, 2008). It has been plagued with food insecurity for decades (Kaluski et al., 2001; Amdissa, 2006; Beyene, 2008). In the ranking of countries on the prevalence of food energy deficiency, from highest to lowest; Ethiopia is the leading insecurity level by 76.4 % (Smith et al., 2006). A combination of factors has resulted in serious and growing food insecurity problem in Ethiopia, affecting as much as 45% of the population (FSCB, 2004). The problem is worsening, despite massive resources invested each year into humanitarian aid and food security programs (Frankenberger et al., 2007).

One stark indicator of the precariousness of food security in Ethiopia is the rising dependence on foreign food aid (Berhanu, 2004). Food aid has kept people alive, but done nothing to address the causes of food insecurity (EC, 2009; UNOCHA, 2005). Over the course of the last decade, Ethiopia has received an average of 700,000 million ton of food aid annually, and the figure has risen dramatically in recent crisis years (since 1996, the quantity of food appealed for has multiplied by 4.5, while the number of beneficiaries has multiplied by 6). The unpredictable timing and level of relief resources flowing through the emergency channel means there are few opportunities to do more than addressing humanitarian needs (UNDP 2009).

There is no problem of underdevelopment that can be more serious than food insecurity (World Bank, 1986). The majority of Ethiopians lives in rural areas and confronts similar challenges in securing sufficient food, but given the topographic and biophysical variation throughout Ethiopia, seasonal undernourishment varies across geographic space and time.

Access to sufficient food and nutrients is essential for

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household welfare, as well as for accomplishing other development objectives. Households with insufficient access to food often face other challenges related to food insecurity including poor health and a decline in productivity. These challenges can often create a vicious circle whereby households are unable to produce enough food, even in good years, because they are battling chronic health issues and are unable to work to their full potential (Schmidt and Dorosh, 2009).

Similar to other food insecure areas of the country, Wolayta, is well known for its fertility, population pressure and food insecurity. A rise in the rural population, particularly in the last 30 years, has resulted in an increased number of land claimants, some of which have used forests, steep mountain land or grazing land to establish their homesteads. Many others among the rural youth are landless. During times of food stress, the term "green famine" is often used to describe the situation. Specifically, in Boloso Sore, over 80% of the population is considered poor. The number of chronically food insecure population aided by safety net program for the past years was about 33,657 households (BoARD, 2007).

This research, therefore, was proposed with the aim of generating location specific data on food security in Wolayta and this would contribute to literature gap and inform policy makers at micro and macro level.

Objectives of the study

Measures describing food insecurity and food insufficiency have become important tools for policymakers, advocacy groups, and researchers. In designing a program to address food insecurity, it is also necessary to determine the immediate and root causes of the problem. Therefore, the general objective of the study is to analyze the situation of food security in the study area in order to forward policy options to mitigate the challenge.

Specific objective

1. To determine the status of food security in Wolayta
2. To identify the household level causes of food insecurity in the study area
3. Describe typical characteristics of food insecure households

LITERATURE REVIEW

Food security concepts

Food security is a concept that has evolved considerably over time. Most definitions of food security vary around that proposed by the World Bank (Maxwell, 1996); wherein, food security defined as access by all people at all times to enough food for an active, healthy life (World Bank, 1986).

The essential elements in this definition are the *availability* (adequate supply of food); *access* through home production, purchase in the market or food transfer; *stability*, when availability and access are guaranteed at all times; and *utilization* which refers to the appropriate biophysical conditions (good health) required to adequately utilize food to meet specific dietary needs and security, as the balance between vulnerability, risk and insurance; and time (Maxwell and Frankenberger, 1992; EC, 2009).

Food availability means that sufficient quantities of appropriate, necessary types of domestically produced food, commercial imports or food aid are consistently available to individuals or are within reasonable proximity to them. At the national level, it is the sum of domestic food stocks, net commercial imports, food aid, and domestic production. Individuals have sufficient access to food when they have "adequate incomes or other resources to purchase or barter to obtain levels of appropriate foods needed to maintain consumption of an adequate diet/nutrition level". Finally, adequate food utilization is realized when "food is properly used, proper food processing and storage techniques are employed, adequate knowledge of nutrition and child care techniques exists and is applied, and adequate health and sanitation services exist" (USAID 1992).

Gradually, the concept of food security took on a more subjective meaning than at the outset, integrating the quality and diversity of needs from one individual to another, respect for local eating habits beyond a purely quantitative approach. Food security is a multidisciplinary concept, which includes economic, political, demographic, social, cultural and technical aspects (EC, 2009).

Food insecurity, on the other hand, is a situation that exists when people lack secure access to sufficient amounts of safe and nutritious food required for normal growth and development and an active and healthy life (WFP, 2004). It is a dynamic phenomenon: its impact varies depending on its duration, its severity, and the local socioeconomic and environmental conditions (EC, 2009). Chronic food insecurity means that a household runs a continually high risk of inability to meet the food needs of household members. In contrast, transitory food insecurity occurs when a household faces temporary decline in the security of its entitlement and the risk of failure to meet food needs is of short duration (World Bank, 1986).

Food security indicators and measures

Hoddinott (1999; 2002) noted the fact that there are

approximately 450 indicators of food security and it is difficult to measure food security. In line to Hoddinot`s argument, Maxwell (1995) pointed out that defining and interpreting food security, and measuring it in reliable, valid and cost effective ways, have proven to be stubborn problems facing researchers.

According to Maxwell and Frankenberger (1992), food security indicators are generally categorized in to two main categories: '*process*' and '*outcome*' indicators. *Process* indicators are divided in to two: indicators that reflect food supply and indicators that reflect food access. *Outcome* indicators are used to measure the status of food security at a given point in time and grouped into direct and indirect indicators. Direct indicators of food consumption include actual food consumption rather than to marketing channel information or medical status. The indirect indicators include storage estimates, subsistence potential ration and nutritional status assessment (Alison and Slack, 1999). However, there is no fixed rule as to which method to employ due to the diversified characteristics of food insecurity and the different level of consideration. The decision to rely on a particular method usually depends on resource and time constraints, objectives of the study, availability of data, type of users and degree of accuracy required (Debebe, 1995).

The focus in household food security is on how members of a household produce or acquire food throughout the year (FAO, 2003). At the household level, food security is measured by actual dietary intake of all household members using household income and expenditure surveys (Saad, 1999). However, expenditure is more reliable than income data (Smith et al., 2006; Tassew, 2006). Using a survey data, the minimal standard of living is proxy by the level of consumption expenditure that will enable the household or individual to attain the basic needs. Accordingly, the cost of basic need was calculated based on data of the lowest income quartile in order to measure household food security and to calculate the cut off point beyond which a household is food secure or not.

Causes of food insecurity in Ethiopia

Globally, the emerging causes of food insecurity include; declining world food stocks, price volatility in the food and energy market, demographic growth, changing food habits, urban growth, the boom in biofuels, climate changes that affect production, above all, the links between the financial markets and speculation within agricultural futures markets (EC, 2009). Poor land policies and management practices, which lead to land degradation and deforestation, contribute to increased flood disasters in sun Saharan Africa.

The causes of food insecurity are both temporary and structural. Food insecurity can result from the deterioration of food production capacity or lack of income to purchase adequate food. The government of Ethiopia have witnessed that a combinations of factors, such as adverse changes in climate; draught, poor technology, soil degradation, and inefficient water management are the major factors for poor agricultural performance in Ethiopia (Berhanu, 2001; Berhanu, 2004; FAO, 2009), and policy induced, as well as program implementation problems have resulted in serious and growing problems of food insecurity in Ethiopia. Since the country is dependent on agriculture, crop failure usually leads to household food deficit. The absence of off-farm income opportunities, and delayed food aid assistance, poor access to credit, lack of access to inputs, leads to asset depletion and increasing levels of destitution at household level (FDRE, 2002; 2003).

The government of Ethiopia (FDRE, 2003) has framed the overall causes of food insecurity in the country as lack of access to input, lack of information, lack of access to credit, lack of access to technology, limited access to basic services, land degradation and decreased productivity, lack of income generation activities and alternatives (Figure 1).

Devereux (2010) indicated that food insecurity in Ethiopia derives directly from dependence on undiversified livelihoods based on low-input, low-output rainfed agriculture. Ethiopian farmers do not produce enough food even in good rainfall years to meet consumption requirements. Food accessibility was also limited due to a weak subsistence-agriculture-based economy, depletion of assets, absence of income diversity and a lack of alternative coping mechanisms. Food intake adequacy was rarely achieved due to food shortages, improper diet and poor sanitary conditions (Kaluski et al., 2001).

Empirical evidences have also shown that many factors are responsible for household food insecurity. For instance, Abebaw (2003), from a case study of Dire Dawa, investigated that family size, annual income, amount of credit received, irrigation use, age of household head, status of education, cultivated land size, livestock ownership and number of ox owned to be the most determinants of food insecurity. The work of Tesfaye (2005) from Oromia has shown family size, number of oxen owned, use of chemical fertilizer, size of cultivated land, farm credit use, total annual income per adult equivalent, food consumption expenditure, livestock owned, and off-farm income per adult equivalent to be the major causes of food insecurity. Shumete (2009) also summarized the causes of food insecurity as, population growth and scarcity of resources, small landholding, low level of farmers education, lack of good-governance, participation and empowerment; inappropriate production systems and marketing services, drought and variability of rainfall, politics and ethnic conflicts: urban expansion, lack of access to credit services and income opportunities, lack of access to health services, and cultural factors.

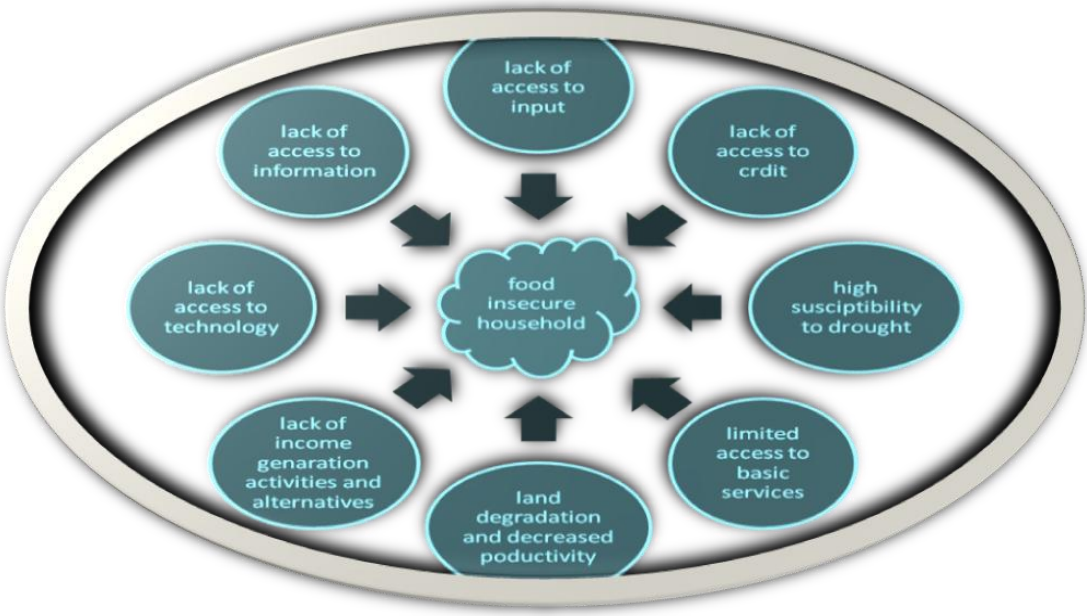

Figure 1. Causes of food insecurity.

RESEARCH METHODOLOGY

Location of the study area

Wolayta is located at about 380 km south of Addis Ababa in Southern Nations, Nationalities and Peoples' Region (SNNPR). The area is characterized by small landholdings supporting high populations. Boloso Sore is one of the 12 districts of Wolayta (Figure 2). There are two ecological zones in Boloso Sore, namely midland (86.4%) and highland (13.6%). With rainfall dispersed throughout the year into two main rainy seasons and one small season. The area receives an annual rainfall of 1,551 mm and the mean maximum and minimum daily temperature are 25.4 and 13.4°C (BoFED, 2005). The total population of Boloso Sore is 196,614 of which 96,341 are men and 100,273 women, with population density per square Km of 637. Out of the total population, 92% lives in rural areas (CSA, 2007).

Data

In this study, two stage stratified sampling technique was used. In the first stage, the district was classified in to two ecological zones; the highland and the midland and one Peasant Association from highland and three Peasant Associations from midland were selected. In the second stage, 120 households were randomly drawn using probability proportional to size sampling technique (PPS).

Primary data on household socio-economic characteristics were collected from sample households using structured interview schedule. Secondary data from Boloso Sore bureau of agriculture and rural development and zonal finance and economic development were used.

Descriptive statistics, such as mean, percentage, t-test and chi square test were used. In order to decide on the major causes of food insecurity, binary logistic regression was used. Data analysis was conducted using Statistical Package for Social Sciences (SPSS) version 13.

Binary logit specification

The assumption is that the probability of being in a particular food security status is determined by an underlying response variable that captures the true economic status of the household.

Following Gujarati (2004), the functional form of logit model is specified as follows: The logistic model (the log-odds ratio) takes the form:

$$Pi = E(Y = 1/Xi) = \frac{1}{1+e^{-(\beta_0 + \beta_i \chi_i)}} \quad (1)$$

For ease of exposition, the probability that a given household is food insecure is expressed as:

$$\rho_i = \frac{1}{1+e^{-(Z_i)}} \quad (2)$$

Probability for not food insecure is 1-P_i:

$$\text{Thus, } \frac{P_i}{1-p_i} = \frac{1+e^{z_i}}{1+e^{-z_i}}. \quad (3)$$

is the ratio of the probability that a household was food insecure to the probability of that it was food secure.

The natural log of Equation (3) is:

$$L_i = \ln\left[\frac{P_i}{1-P_i}\right] = Z_i = \beta_o + \beta_1\chi_1 + \beta_2\chi_2 + \ldots + \beta_n\chi_n. \quad (4)$$

Where Pi= is a probability of being food insecure ranges from 0 to

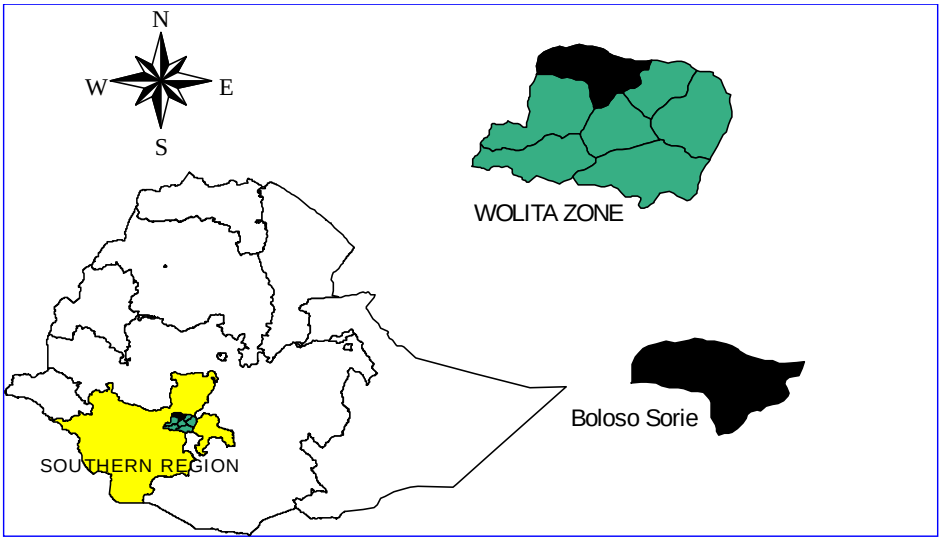

Figure 2. Location of the study area.

1; Zi = is a function of n explanatory variables (x) which is also expressed as:

$$Z_i = \beta_o + \beta_1\chi_1 + \beta_2\chi_2 + ... + \beta_n\chi_n \quad (5)$$

β_o is an intercept; $\beta_1, \beta_2, ...\beta_n$ are the slopes of the equation; L_i = is log of the odds ratio, which is not only linear in Xi but also linear in the parameters; X_i = is vector of relevant independent variable.

If the disturbance term (Ui) is introduced, the logit model becomes:

$$Z_i = \beta_0 + \beta_1\chi_1 + \beta_2\chi_2 + ...\beta_n\chi_n + \bigcup_i .. \quad (6)$$

Prior to the estimation of the logistic regression model, the explanatory variables were checked for the existence of multicolinearity. Variance Inflation Factor (VIF) was used to measure the degree of linear relationships among the continuous explanatory variables and contingency coefficient was used to check multicollinearity among discrete variables.

Following Gujarati (2004), VIF is defined as:

$$VIF(\chi_J) = (\frac{1}{1 - R_J^{\ 2}}) \quad (7)$$

Where: Xj = the jth quantitative explanatory variable regressed on the other quantitative explanatory v variables; R^2j = the coefficient of determination when the variable Xj regressed on the remaining explanatory variables.

If the VIF of a variable exceeds 10, that variable is said to be highly collinear and it can be concluded that multicolinearity is a problem (Gujarati, 2004).

The contingency coefficients are computed as follows:

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

Where, C= coefficient of contingency, χ^2 = a Chi-square random variable and n = total sample

FINDINGS OF THE STUDY

Food security status

In this study, food security is defined as the extent to which a total household expenditure per Adult Equivalent (AE) meets its subsistence requirement. Accordingly, a food poverty line, a threshold level of consumption expenditure below which an individual is considered to be food insecure was established. The minimum expenditure for food items basically consumed by the lowest income quartile in the study area was found to be 395.3 Birr per AE and that of non food component was Birr 107.97 per AE (Tables 1 and 2, respectively), which gives a threshold of 503.1 Birr beyond which the household is food secure. The proportion of households with an average total expenditure per AE, which is less than the minimum level, is 74.2%. If the state of food security had been limited to attainment of the caloric requirement, only 395.3 Birr per AE would have been required per AE per year and about 65.8% would not meet the minimum requirement. The composition of food poverty indicated that 78.6% of the household consumption expenditure belongs to food, which is above the national average, (67%, MoFED 2002) and the rest 21.4% is that of non food. A high proportion of the budget being allocated to basic food consumption is still an indication that people in rural areas are food insecure. Maize shares about 52% of households' consumption expenditure and contributes 64.6 Kcal to households' diet. This might imply that extension packages targeted towards improving maize

Table 1. Food poverty based on the lowest income quartile.

Food items	*Mean Kcal Per gram of food	Gram consumed per AE per day	Kcal consumed per day per AE	Kcal per day per AE	Kcal share (%)	Mean price per kg (Birr)	Value of poverty line per year	Expenditure share
Maize	3.45	302.4	1043.3	1420	64.6	1.37	205.8	52.1
Sweet potato	1.37	122.5	167.80	228.5	10.4	0.27	16.40	4.2
Enset (*Kocho*)	2.11	118.0	248.90	338.9	15.4	0.50	29.30	7.4
Taro	1.03	109.0	112.30	152.8	6.90	0.60	32.50	8.1
Coffee	1.10	12.00	13.200	17.90	0.80	160	95.40	24.1
Salt	1.70	18.00	30.600	41.70	1.90	1.78	15.90	4.1
				2200			**395.3**	

* EHNRI, 2000.

Table 2. Subsistence non-food expenditure.

Expense type	Mean value of expenditure (ETB)
Health care	21.00
Clothing and foot wear	43.78
Schooling and stationary	22.15
Social and religious	10.86
Land tax	10.00
Total	107.79

productivity will make significant contribution to food security in the area. Root crops (potato and sweet potato) have a substantial contribution.

Households do not allocate all of their income on food. Rather, there are other non food essentials to household members to lead healthy life. Some of these preferences specific to the study area were presented in Table 2. The result showed that clothing, schooling and health care are the major sources of non food expenditure in order of expenditure magnitude.

The consumption expenditure analysis showed that the mean per capita consumption expenditure of the sample households during the study period is found to be 335.00 Birr per AE. The food secure households have more than double mean expenditure (606.06 birr) than the food insecure ones (240.59 birr per AE). This data shows that the majority of food insecure (27.5 and 38.3%) households have the lowest consumption expenditure. The problem is not only inadequate production, but also many people are poor to buy available food from the market to buffer food shortage. Food is always available for those who can afford it. Thus, inadequate income is the correlate. The mean difference between annual expenditures of the two groups is significantly different at a probability level of less than 1% (Table 3).

Food security status is statistically different among the four PAs at < 1% probability level with more number of food secure households reported in Achura (> 50% of the households) and the largest proportion of food insecure households were found in the Afama Mino (> 80%), which attributed to the fragmentation of land holding due to population pressure.

Causes of household food insecurity

Household's perspectives

In order to identify the major causes of household food shortage, the correlate of seasonal food insecurity, the sample households were asked to respond to each question set for this purpose by rating as first, second and third causes of food deficit. Accordingly, *Shortage of oxen* (76.7%), *lack of farm input* (75.8%) and *land shortage* (65.8%) were found to be the major causes of household food shortage. Specifically, the food insecure households reported that *land shortage*, *lack of input* and *shortage of oxen* are the major causes for food insecurity from sample households' perspectives (Table 4). Although, Ethiopian farmers have been encouraged to adopt utilization of farm inputs, poor farmers fail to use expensive inputs since they do not afford the cost.

In general, the traditional farming practice and poor performance that have greatly affected the sustainability of production and erratic rainfall have made the study area more vulnerable to food insecurity. Insect and pest

Table 3. Summary statistics of food security status of households.

Expenditure range (AE)	Food security status (%)		Total	t (p-value)
	Food insecure	Food secure		
<200	27.5	0	27.5	-13.93 (0.000***)
201-400	38.3	0	38.3	
401-600	8.33	18.33	26.7	
601-1434	0	7.5	7.5	
Below 503.1	74.2	25.8	100	
Below 395.3	65.8	34.2	100	
Sample pas				**χ^2 (p-value)**
Yukara	11.7	5.8	17.5	11.350 (0.007***)
Dangara Madalcho	9.2	6.7	15.9	
Achura	10.8	11.7	22.5	
Afama Mino	36.7	7.5	44.2	

***, **, Significant at < 1 %, and 5 % probability level respectively; PA: peasant association; AE: adult equivalent.

Table 4. Causes of food shortage by sample households.

Causes of food shortage	Food security status (%)		
	Food insecure	Food secure	Total
Shortage of oxen	59.17	17.5	76.7
Lack of farm input (seed and fertilizer)	60	15.8	75.8
Land shortage	63	13.3	65.8
Crop failure due to pest and diseases	52.5	5.0	30.8
Poor market functions	7.5	1.7	9.2
Livestock disease	4.0	1.7	5.8

infestation is another important biological factor that has been negatively affecting and limiting agricultural production in the study area. The study also ensured that the official months of food shortage include, January, February, March, April, May, and June, and called food aid months.

Giving special emphasis to oxen ownership, out of the total sampled households (48.3%) did not have ox, 34.2% have one ox and 9.2% have two oxen (Figure 3). Ox rental is not a common practice in the area. Instead, a farmer with one ox or a pair of oxen, but not sufficient compared to cropland size, usually exchange the ox or oxen with another household on alternate working days. Thus, of the total households who did not have oxen 63.1% used hoe/ spade to plough their farm, 15.3% used exchange of human labours with oxen power and about 21.6% of them were supported by the community to plough their farm plots.

Descriptive statistics

This part will present the summary of discrete and continues variable in relation to food security status. It seems there is no statistical disparity with gender, input use, extension contact and off farm employment regarding food security level. However, close examination of the data shows that among the discrete variables, there is a visible disparity between food secure (FS) and food insecure (FI) proportion of households with respect to their access to farm input, extension contact and off farm income sources. Credit use is found to be significant cause of food insecurity at less than one percent probability level (Table 5).

The t test has showed that family size, land size and livestock holding in TLU and number of Oxen owned were significantly different at less than 10% probability levels between food secure and insecure households. Food insecure households have more family members by at least one adult equivalent member. Land size and livestock are larger for food secure households than food insecure and it is significant at less than 10 and 1% probability levels, respectively (Table 5). This implies land access is everywhere an acute problem, there is no longer any scope for village headmen to allocate new land to families, and farm size declines with each successive sub-division at inheritance. Livestock holding highly determines the status of food security. Households

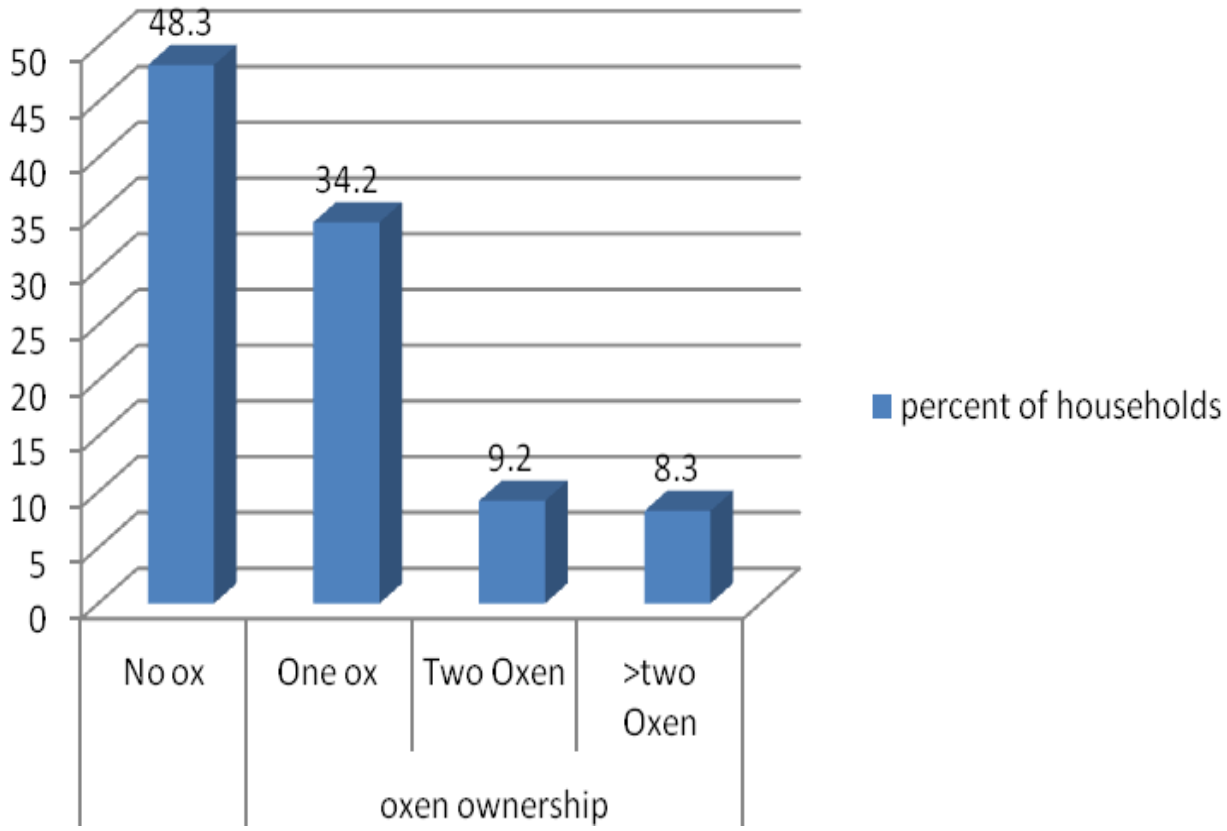

Figure 3. Oxen ownership by households.

Table 5. Summary of discrete variables.

Variable	FS	FI		p-value
	%	%	χ^2	
Sex Of Head				
Male	69.47	30.53	0.274	0.601
Female	36	64		
Used farm input	65	35	0.308	0.362
Get extension contact	68.6	31.4	0.1	0.92
Received credit	67.3	32.7	8.429	0.004***
Off farm employment	33.33	66.67	0.027	0.87

*Significant at 1% probability level, FS, food secure; FI, food insecure.

with more number of livestock were less likely to be food insecure. The value of own consumption (home production) is highest for food secure households than the counterparts and it is significant at less than 1% probability levels. The indication is that households capable of producing large proportion of their consumption are food secure. Thus, enhancing own productivity can greatly contribute to food security.

Comparison of mean income earning from off farm employment and annual farm income showed that off farm income is highest by 124.5 birr for food insecure households, whereas annual farm income earning for food secure households was two folds of food insecure households. The annual income difference is statistically significant at less than 5% probability level. This implies that the food secure households have more income power to access food from market (Table 6).

Typical characteristics of food insecure households

Drawing conclusion from food insecurity causes, descriptive statistics and the econometric analysis presented in Table 6, the typical characteristics of food insecure households in the study area is framed as shown in Figure 4. Accordingly, the peculiar characteristics of food insecure households own less than 0.4, 0.5, and 2 ha of farm land, oxen and tropical livestock units, respectively. Food insecure households also possess more than halve dozens of family size and large number of dependents than the counterparts. Crop production risks, such as crop failure due to pests and diseases, shortage of farm technologies like seed and fertilizer (due to financial constraints) and lack of alternative income sources were the major features of food insecure households.

Table 6. Summary statistics for continuous variable.

Food security status		Mean	SD	t	P value
Age of household head	FI	33.18	8.92	-1.366	0.175
	FS	35.71	10.46		
Education of head	FI	0.84	1.07	-0.623	0.534
	FS	0.97	1.1		
Family size	FI	6.16	2.5	1.741	0.086*
	FS	5.37	2.22		
Land size	FI	0.41	0.37	-1.676	0.096*
	FS	0.54	0.46		
Tropical livestock unit	FI	2.07	2.03	-4.046	0.000***
	FS	3.91	2.86		
Number of oxen owned	FI	0.48	0.62	2.625	0.010**
	FS	0.83	0.75		
Distance to market	FI	2.36	2.16	-0.481	0.632
	FS	2.57	2.56		
Value of own consumption	FI	554.89	482.01	-4.827	0.000***
	FS	1375.99	995.93		
Annual income in AE	FI	462.31	672.86	2.162	0.033**
	FS	861.49	1353.64		
Off farm income	FI	532.02	684.37	-0.932	0.353
	FS	407.17	681.69		

****, **, *Significant at 1% < 5 and 10% probability levels, FS, food secure; FI, food insecure; ETB, Ethiopian Birr, SD, standard deviation.

Determinants of food security

Before entering the variables, contingency coefficient was calculated. Contingency coefficient value ranges between 0 and 1, and as a rule of thumb variable with value below 0.75 shows weak association and value above it indicates strong association of variables. Since the value for dummy variables was less than 0.75 that did not suggest multicollinearity problem (Table 7) (Appendix Table 1).

Similarly, variance inflation factor of less than 10 are believed to have no multicollinearity and those with VIF of above 10 are subjected to the problem. The computational results of the variance inflation factor for continuous variables confirmed the non-existence of association between the variables and were included in the model (Apendix Table 2).

The likelihood ratio has a chi – square distribution and it is used for assessing the significance of logistic regression. Model chi – square provides the usual significance test for a logistic model, that is, it tests the null hypothesis that none of the independents are linearly related to the log odds of the dependent. It is an overall model test which does not assure the significance of every independent. The result is significant at less than one percent probability level revealing that the null hypothesis that none of the independents are linearly related to the log odds of the dependent is rejected.

Additionally, goodness of fit in logistic regression analysis is measured by count R^2, which works on the principle that if the predicted probability of the event is greater than 0.50, the event will occur, otherwise the event will not occur. The model result show the correctly predicted percent of sample household is 90%, which is greater than 0.50.

The sensitivity, which correctly predicted food insecure is 93.9% and that of specificity, which correctly predicted food secure is 81.6%. This indicates that the model has

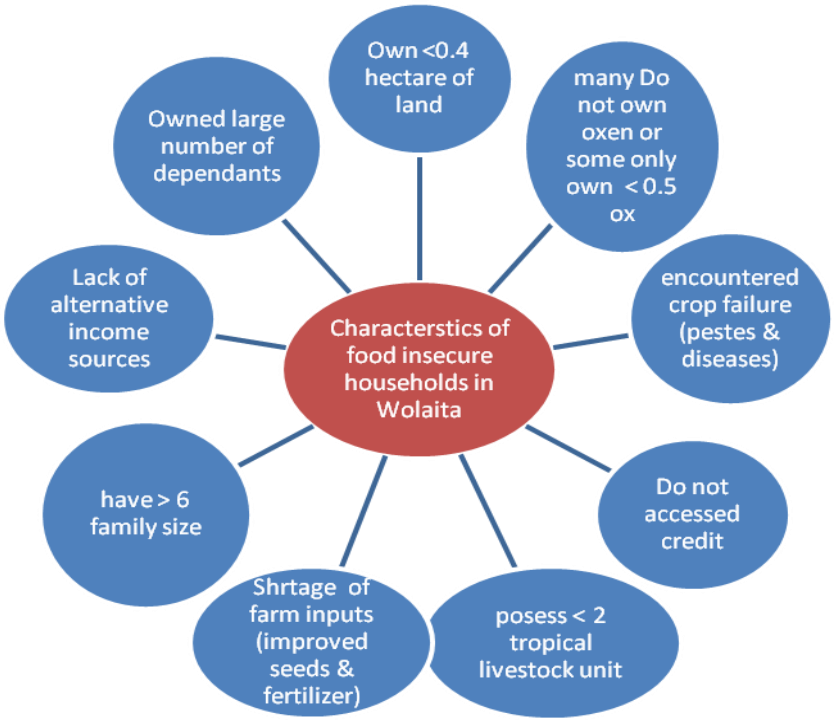

Figure 4. Typical characteristics of food insecure households in the study area.

Table 7. Variable definition.

Code	definition	Measurement	Type
FS	Food security status	1=Food insecure, 0=Food secure	Dummy
SEXHH	Sex of household head	1=Male, 0=female	Dummy
AGEHH	Age of household head	In years	Continuous
EDULEVEL	Education of household head	In years	Continuous
FAMLSIZE	Family size	In number	Continuous
LANDSIZE	land size	In hectare	Continuous
TLU	Livestock owned	TLU	Continuous
INPUSE	Input use by the household	1=Yes, 0=N0	Dummy
EXTCONT	Extension contact to the household	1=Yes, 0=N0	Dummy
CREDUSE	Credit use by the household	1=Yes, 0=N0	Dummy
DISNEARM	Distance to the nearest market centre	Km	Continuous
OFFEMP	Off farm employment	1=Yes, 0=N0	Dummy
OWNCONS	Value of own consumption	Birr	Continuous
DPRATIO	Dependency ratio	number	Continuous

estimated the food insecure and food secure correctly.

DISCUSSION

Among 13 independent variables, binary logit estimation revealed that 8 were statistically significant (Table 8).

Age of household head is significant at 5% probability level in explaining food insecurity. The sign of the coefficient of change in age of the household head showed a negative relationship with food insecurity. As age of the household head increase, the likelihood of being food insecure decreases by 0.858. This indicates that livestock and asset ownership depletes with

Table 8. Logistic estimates of food insecurity causes.

Variables	B	S.E.	Wald	Sig.	Exp(B)
SEXHH	-0.197	0.986	0.04	0.842	0.822
AGEHH	-0.154	0.06	6.63	0.010**	0.858
EDULEVEL	-0.795	0.514	2.394	0.122	0.452
FAMLSIZE	1.799	0.44	16.703	0.000***	6.041
LANDSIZE	-0.815	1.054	0.598	0.439	0.443
TLU	-0.915	0.289	10.062	0.002***	0.4
INPUSE	-2.313	1.008	5.26	0.022**	10.101
EXTCONT	-1.283	1	1.645	0.2	0.277
CREDUSE	-1.708	0.888	3.696	0.055*	0.181
DISNEARM	-0.206	0.169	1.483	0.223	0.814
OFFEMP	-3.827	1.273	9.044	0.003***	0.022
OWNCONS	-0.004	0.001	17.805	0.000***	0.996
DPRATIO	3.558	1.852	3.689	0.055*	0.029
Constant	7.511	3.015	6.205	0.013	1828.3
Pearson Chi-square				92.404***	
-2 Log likelihood				57.436	
Sensitivity				93.9	
Specificity				81.6	
Percent correctly predicted (Count R^2)				90	
Sample size				120	

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

generation. The finding is consistent with a priori expectations.

The coefficient for family size has a positive sign and statistically different from zero at 1% level of probability, indicating that this variable was the cause of food insecurity. Other things remaining equal, the odds ratio in favor of food insecurity increases by a factor of 6.041 as household size increases by one. This case shows that as the number of family size increases, family food demand also increases.

Livestock holding (in TLU) is negatively and significantly related to the probability of being food insecure. The negative relationship is explained by the fact that households with large herd size have better chance to earn more income from livestock production. 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 ensuring food security at household level. The implication is that the probability of being food insecure decreases by a factor of 0.400 for households owning livestock. Evidence has shown that, livestock numbers were severely diminished during the Derg regime (Pound and Ejigu, 2005). Currently, they are limited by a lack of grazing facilities, as land is ever more intensively used for arable production, which provides the staple foods necessary for family subsistence.

Input use (seed and fertilizer) has a significant and negative influence on the probability of being food insecure. The possible explanation is that those farmers who use input are more likely to be food secure than those who have no access to it. If other factors are kept constant, the odds ratio in favor of being food secure increases by a factor of 10.101 as a farmer use more units of inputs. However, poor farmers can only afford a small amount of fertilizer and seed.

Likewise, participating in credit use in these localities contributes in diminishing the probability of being food insecure by a factor of 0.181 other things kept constant. This implies that credit utilization will enhance the capacity of rural households to access labor and input for productivity improvement or food when the need arises. Moreover, credit is important source of investment on activities that generate income for farm households.

Off farm employment crates an opportunity to raise household's income. People living in households mainly engaged in off farm activities like petty trade, are more likely to be food secure since off farm employment negatively correlate with the probability of being food insecure. Of farm employment in the study area is mainly petty trade and wage, which aid people to escape poverty. Due to the decline in soil fertility and consequent reduction in farm productivity and income, farming families are more reliant on off- farm activities to provide

food and income.

The value of foods from own production (own consumption) has a negative relation with the probability of being food insecure at less than 1% probability level. Keeping other factors constant, a unit changes in the value of own consumption will reduce the probability of food insecurity by a factor of 0.996. This implies that own produce has a significant contribution to achieve food security at household level.

The result for dependency ratio showed that in a household where adults or productive age groups are higher than the non-productive age groups, the probability of the household to be food insecure would be less, provided that the area provides good working atmosphere and production potential. The higher the number of the dependants in the household (individuals whose ages are less than 15 years and greater than 65 years), the higher the probability of the household to be food insecure. A unit change in dependency ration will increase the chance of households to be food insecure by a factor of 0.029, keeping other factors constant. This supports the argument that population pressure elsewhere is a threat to food security.

Contrary to expectation, size of land holding does not seem to be important in any of the specifications. An explanation for this may lie on the importance of the quality of land and/or lack of complementary agricultural inputs. Moreover, there is no much difference between households with respect to land size holding.

SUMMARY

There is no problem of underdevelopment that can be more serious than food insecurity that has an important implication for long term economic growth of low income countries. Ethiopia has been plagued with food insecurity for decades. The problem is worsening, despite massive resources invested each year into humanitarian aid and food security programs. Food insecurity in the long run may cause irreparable damage to livelihoods of the poor, thereby reducing self-sufficiency.

The research objectives were realized through conducting household survey on 120 randomly selected households from four PAs of the study area. The sample households were classified into food secure and food insecure groups based on expenditure value of meeting recommended daily allowance (RDA) of 2200 kcal. Accordingly, the cost of basic need poverty line, which was constructed based on data from the lowest income quartile was 503.1 ETB per adult equivalent (AE) per year. This line was then used as a threshold in which the aforementioned values declare success of food security and food insecurity otherwise. The proportion of households with an average total expenditure per AE, which is less than the minimum level, is 74.2%. If the state of food security had been limited to attainment of the caloric requirement (only 395.3 Birr per AE per year would have been required), about 65.8% would not meet the minimum requirement.

Econometric results show that age of head, family size, and number of livestock, input use, credit use, and off farm employment, value of own consumption and dependency ratio are significant to explain the likelihood of a household being food insecure.

RECOMMENDATIONS

Understanding the causes and level of food security would help policy makers to design and implement more effective policies and programs for the poor and thereby helps to pave way to improve food security. In this respect, this study provides a base and point of departure for similar studies in the future. Therefore, the following recommendations were made in order to benefit those who need to intervene with the issue under consideration:

1. Land shortage and fragmentation is perceived to be the major cause of food insecurity in Wolayta, even it will be a continuing challenge in the future. Therefore, mechanism should be devised to divert surplus labor from land to non land intensive production systems like small enterprises or a way forward for resettlement should be sought.
2. The fact that family size and dependency ratio cause food insecurity, attention has to be given to limit the increasing population in the study area. This can be achieved by creating sufficient awareness to effect family planning in the rural households. Even thought 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.
3. Targeting direct distribution of food and food for work to needy families during the harshest time of the year is inevitable task. However, gradual graduation of food insecure households should be improved through minimization of dependency and disincentives.
4. Grass-roots organizations with ability to bring credit supply together, the resources, technology and knowledge, must be supported and strengthened in order to enhance food shortage coping mechanisms.
5. Timely delivery of inputs and long term credit service facilitation is mandatory to rise up technology use by small holders and then improve productivity to enhance their food security level. Improving productivity through input delivery would enhance the value of own consumption at household level. Provide extension support in order to improve cash crop alternatives.
6. Livestock sector development should be a priority to help alleviate food insecurity since livestock number and oxen ownership were significant causes of food security. In this aspect, livestock development packages must be introduced and promoted.

7. Rural households in the study area have very limited alternative sources of income. Hence, for these households to enhance their welfare in general and food security in particular, they must have diversified access to income alternatives. The findings of the study therefore lend support to the view that the off farm sector (petty trade, wage access through establishing industries) could be a viable option to reduce food insecurity among the rural-agricultural households.

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APPENDIX

Table 1. Collinearity statistics.

Variable	Tolerance	VIF	R^2
AGEHH	0.672	1.448	0.309
EDULEVEL	0.794	1.259	0.206
FAMLSIZE	0.591	1.691	0.409
LANDSIZE	0.603	1.658	0.397
TLU	0.536	1.866	0.464
DISNEARM	0.905	1.105	0.095
DPRATIO	0.825	1.211	0.174
OWNCONS	0.737	1.357	0.263

Table 2. Contingency coefficients.

Variable	SEXHH	INPUSE	EXTCONT	CREDUSE	OFFEMP
SEXHH	1				
INPUSE	0.144	1			
EXTCONT	0.132	0.311	1		
CREDUSE	0.067	0.264	0.131	1	
OFFEMP	0.043	0.147	0.246	105	1