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## Research Article

# DETERMINANTS OF FOOD INSECURITY AMONG SMALLHOLDER FARMER HOUSEHOLDS IN ILUGELAN DISTRICT, ETHIOPIA

Belachew Dessaegn<sup>1\*</sup> and Sajitha O. G<sup>2</sup>

<sup>1</sup>Department of Rural Development & Agricultural Extension, Gondar University, Ethiopia

<sup>2</sup>Department of Rural Development & Agricultural Extension, Ambo University, Ethiopia

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### ABSTRACT

Household food insecurity is a complex, multidimensional phenomenon created by the non availability of sufficient food to meet the needs of all household members. It passes through a continuum of phases stipulated by various characteristic conditions, and of behavioral responses of household members. Food insecurity emerged as a key problem and development challenge in Ethiopia in the early 1970s and became all-encompassing in the subsequent decades. The country is characterized by its small holder agriculture and they face challenges. The land used under perennial crops and production were decreased in an alarming rate in Ilugelan district of Oromia region in last five year period of 2008-13. One out of three infants was malnourished in the district. Under this backdrop, the present study looked at the determinants of food insecurity in the Ilugelan District. A Sample of 155 small holder farmers were selected using Simple Random Sampling method from two purposively selected Kebeles namely Meta and Siba. Analytical tools included summarization, descriptive and inferential statistics. Based on the recommended daily food intake of 2,100 calorie per day as bench marks to classifying household's food insecure status, it was observed that 66.2% of them were food insecure. The estimate for the population was 57.9 to 73.2 with a standard error of 0.0386 for 95% confidence interval. Binary logistic regression model identified eight significant determinants affecting the food insecurity of farm households and they were marital status, dependency, farm size, use of inputs -fertilizer, herbicide and insecticide, land degradation and soil fertility.

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## INTRODUCTION

Food is at the heart of any development process. Household food insecurity is a complex, multidimensional phenomenon created by the non availability of sufficient food to meet the needs of all household members. Before it reaches a merciless severity of voracious starving, it passes through a continuum of phases stipulated by the characteristic conditions, and of behavioral responses of household members to these conditions sometimes resulting in psychological endorsement of hunger. Adequate food supply is only one of the many preconditions of food security, while the causes of hunger and starvation may be of other nature (Sen, 1981).

There was a paradigm shift in defining 'food security' during the World Food summit in 1996. It has been defined as a situation "when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life" (FAO, 1996). The early perspectives treated food

security as a sector specific approach at global or national level, as a 'food first' perspective and measured with objective indicators (Maxwell, 1996). However, the new perspective is a multi sector system approach with focus on nutrition outcomes (Ecker and Breisinger, 2012). The new perception is at household or individual level, as a livelihood perspective and measured with inclusion of subjective perception. This definition was reaffirmed by the World Summit of Food Security 2009 and extended that the "four pillars of food security are availability, access, utilization, and stability" (FAO, 2009). Hence household food insecurity can be defined as non availability of sufficient, safe and nutritious food for all household members, irrespective of age and sex, at all times to meet their dietary needs and food preferences for an active and healthy life. It shows the inability of the household to access and utilize required food for all members due to various factors. As Sen (1981) suggested, all household members should have the entitlement to adequate food. As a result of household food insecurity, the average per capita household consumption falls below a required minimum calorie level of

\*Corresponding author: **Belachew Dessaegn**

Department of Rural Development & Agricultural Extension, Gondar University, Ethiopia

nutrition and restrains the sustainable livelihood of households including ways to obtain food.

Sub-Saharan Africa is the most vulnerable region of the world in terms of food insecurity. The average food available per person per day estimated for the region is less than half of the world average of 2700 calories (FAO, 2004). Food insecurity emerged as a key problem and development challenge in Ethiopia in the early 1970s and became all-encompassing in the subsequent decades (MoARD, 2007). The livelihoods of more than 85 per cent of Ethiopians depend on agricultural and natural resources, particularly crop production and livestock rearing so farming is at the heart of livelihood strategies (CSA, 2002). Despite the available resources and the efforts made by governments in different times, food insecurity remained as one of the most crucial challenges in Ethiopia and has been exacerbated by recurring rainfall shocks and wars (White, 2005).

Half of the world's foods insecure people are among smallholder farmers (Gyamfi, 2006). In Ethiopia, most agriculture producers are subsistence farmers with smallholding, often broken into several plots. Ethiopian small holder farmers do not produce enough food even in good rainfall years to meet consumption requirements because of the degraded and over utilized natural resource base and erratic climate, weak agricultural policies and low institutional supports and weak market, institutional constraints such as inflexible land tenure and ethnic federalism (Devereux, 2001). Ethiopia has reasonably good resource potential both in human and natural resources for Agricultural development and diversification. However, small holder farmers hardly benefited from the state of natural resources and the extent of development of these resources.

Oromia region is the highest populous region in Ethiopia and experiences contradicting performance for the last many decades. One hand, the region is blessed with rich treasure of natural resources and endemic animal; on the other hand, it experiences drought and famine resulting in under development and food insecurity. The livelihood of the community is disturbed. Land degradation, over –grazing, farming marginal lands and high population pressures are evident (Oromia Land Use and Watershed Management Training Manual, 2004). The Ilugelan District in Oromia region falls under a suitable climatic zone to support the life of the agriculture oriented community. The area has huge economic potential to increase production because of the factors like proximity to the Gibe and Rafiso Alga River which can be used for irrigation diversion, the paved roads, and closeness to the national capital Addis Ababa. However, the livelihoods of people are affected and the area is known for chronic and transitory food insecurity.

The data from the Ilugelan District Agricultural Development Office (2014) showed that land used under annual and perennial crops in the District decreased from 90% (2008/9) to 74% (2012/13) during the past five years. The production also decreased in an alarming rate for the major cereals. The percentages of reduction in cereal production from peasant private holdings were 28%, 48%, 46%, 45% and 90% for teff, wheat, barley, maize and sorghum respectively during 2008 to

2013. There were remarkable reductions in pulse and oil crop production as well. So it is imperative that under such conditions food security will be in dilemma and the 2014 district data showed that currently one out of three children in the age group six-fifteen months were malnourished in the District. In this regard, the present research was undertaken to assess the extent of food insecurity and its determinants among the smallholder farmers in Ilugelan District, Oromia region of Ethiopia. The study is expected to serve as a major input to formulate appropriate food security policies and strategies in the study area.

## **METHODS AND MATERIALS**

### **Sampling and Sample size estimation**

Cross sectional survey research design was used to accomplish the present research. Socio-economic survey was conducted among smallholder farmer household heads in which multistage sampling technique was employed to select the respondents. Decreasing agricultural production and malnutrition among the children were used as criterion to select the Ilugelan district. Meta and Siba kebeles were selected purposively from the district to represent the district as both had good potential for agriculture and irrigation but still reported as food insecure by the district authorities.

The researcher adopted formula suggested by Kothari (2004) for determining sample size as given below

$$\text{Sample size, } n = \frac{Z^2 \cdot N \cdot p \cdot q}{(N-1)E + Z^2 \cdot p \cdot q}$$

Where  $p=0.3$  ( $p$  is approximately taken as 0.30 because one third of children in the area were malnourished as per the data from the Ilugelan District Agricultural Development Office (2014) and food insecurity in Ethiopia calculated by World Bank is 29.6 % for 2010)

$q=0.7$  (because  $q=1-p$ ),  $z=1.96$  ( $Z$  is the conventional confidence level of 95% is used to ensure a more accurate result from the sample and the corresponding table value is 1.96),  $N=500$  (The approximated smallholder households) and  $e=.06$  (the accepted margin of error, fixed at 6%). The calculated sample size was 155. The sample size was allotted as proportion to the total households of both peasant associations. The collected quantitative data was organized and analyzed by using SPSS version-20. The response rate was 97%.

Two Focus Group Discussions (FGD) were conducted to triangulate the findings. FGDs were conducted with 8-10 members selected purposively including smallholder farmer household heads, elderly person, youth and religious leaders.

### **Analytical method**

The dependent variable in this study was Household Food Insecurity (HFI). Consumption-based rather than income-based measure of HFI status was used in this study. The bundle of food items consumed by each household was listed and calorie content value was assigned based on the food consumption table by Ethiopian Nutrition and Health Research Institute (ENHRI, 1998). The total net calorie content at the household

level was converted to adult equivalence consumption to account for differences in the age-sex composition at the household level. The adult equivalence was calculated by using the methodology developed by World Health Organization considering the nutritional requirement of individuals of any age and sex (as cited in World Bank, 1986). Hence the HFI Status is defined based on the consumption per adult equivalent per day. Based on the recommended daily food intake of 2,100 calorie per day as bench mark, the households were classified as food secure (above the benchmark) and food insecure group (below the benchmark). Later Head count method was used to measure the food insecurity using the formula suggested by Adirsa *et al.*, (2008)

The binary logistic regression model was used to investigate the determinants of food insecurity among smallholder farmer households. Based on the adult equivalent consumption per day, the households were classified as food insecure (if below 2100 cal) and food secure group (if 2100 cal or above). Thus, the regress took the value '1' and '0' for food insecure and food secures households respectively. Binary logistic model is useful in estimating the probability of events based on dependent dichotomous variable (Gujarati, 1995).

## RESULTS OF THE STUDY

### Food insecurity status of the households

The household food consumption was collected and they were classified as food insecure and secure based on the recommended daily food intake of 2,100 calorie per day as bench mark. It was found that 66.2% of the households were food insecure. The estimate for the population was 57.9 to 73.2 with a standard error of 0.0386.

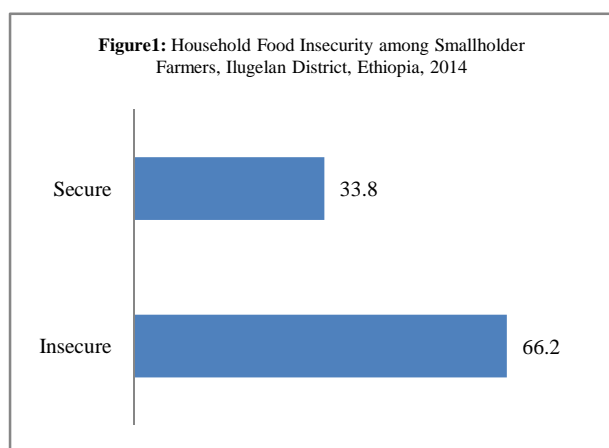


Figure 1 Household Food Insecurity among Smallholder farmers, Ilugelan District, Ethiopia

### Food Insecurity determinants

#### Socio-demographic determinants

Sex, age and education of the household heads were hypothesized as variables that determine the level of food insecurity in the smallholder farmer households. The survey results showed that 76.5% of female headed households and 61% of male headed were food insecure. Irrespective of the age group of head of households, higher level of food insecurity prevailed in the study area. The very young (head's age less than 30) families were comparatively better than all other age

groups. Food insecurity was very high (76.9%) among the families headed by middle-aged people (31-40 years) than both elder and the younger headed households. With increasing education of the household head, food insecurity was reducing in the present study. Among the illiterate people 80% were food insecure. There was significant difference ( $p < 0.005$ ) on food insecurity status in terms of the sex and education of household heads.

Table 1 Socio-demographic determinants of Food Insecurity, Ilugelan District, Ethiopia

	Secure	%	Insecure	%	Total*	%
Sex of Household head						
Male	61	61	39	39	100	100
Female	39	76.5	12	23.5	51	100
Age of Household head						
21-30	14	45.20%	17	54.80%	31	100
31-40	12	23.10%	40	76.90%	52	100
41-50	15	39.50%	23	60.50%	38	100
51+	10	33.30%	20	66.70%	30	100
Education of Household head						
Illiterate	9	19.6	37	80.4	46	100
Primary	34	38.6	54	61.4	88	100
Secondary	5	50	5	50	10	100
Higher	3	42.9	4	57.1	7	100
Secondary						
Marital status of Household head						
Unmarried	1	33.3	2	66.7	3	100
Married	39	40.2	58	59.8	97	100
Divorced	10	27.8	26	72.2	36	100
Widowed	2	13.3	13	86.7	15	100
Family size						
1-3	12	75	4	25	16	100
4-6	21	30.4	48	69.6	69	100
7-9	16	32	34	68	50	100
10+	2	12.5	14	87.5	16	100
Dependency						
less than 1	27	84.4	5	15.6	32	100
1-1.99	13	28.9	32	71.1	45	100
2-2.99	6	14.3	36	85.7	42	100
3 and more	5	15.6	27	84.4	32	100
Total	51	33.80%	100	66.20%	151	100

In addition to the hurdles brought by demise of partner, the widowed heads (86.7 %) were suffering the vulnerability of food insecurity compared to others. It was observed that the food insecurity increased with increasing household members and it was very high (87.5%) in families with more than 10 members. Dependency ratio is the ratio of the number of dependents (children below 15 years of age, disabled members and elders above 65 years of age) to the number of economically active family members (15-65 years of age). The food insecurity was very low (15.6%) among those households where the dependency was also low (less than 1 dependent for an adult). Further, the household food insecurity increased with increasing dependency. The group differences were statistically significant for household members and dependency.

#### Economic determinants

An increase in income leads to a higher dietary diversity and individuals tend to consume more high-value products such as meat, fish, milk, fresh fruit and vegetables (Regmi, 2001). But Table 2, showed that the food insecure status of the households in the study area was not changing much with respect to the annual income of the household. The ANOVA analysis with continuous data of per-capita income also confirmed that the average per capita income of food insecure households was not

significantly lower from those of the secured households. During field visits, it was observed that there had been a noteworthy change in the eating habits in terms of quantity and quality of food items, of male and female inside the same household. Hence during focus group discussion, it was highlighted and triangulated that distribution of grains for consumption is mainly controlled by male farmers or head of the households in the study area. Even though women were preparing food, they were not having an equal or sufficient access to prepared food particularly the main food, Injera as the male member in the household.

**Table 2** Economic determinants of Food Insecurity, Ilu Gelan District, Ethiopia

	Secure	%	Insecure	%	Total*	
Total annually Income						
<=10000	12	38.7	19	61.3	31	100
10001-20000	23	31.9	49	68.1	72	100
20001-30000	11	33.3	22	66.7	33	100
30000+	5	33.3	10	66.7	15	100
Occupation of Household head						
Agriculture alone	0	0	53	100	53	100
Agriculture & off farm	4	33.3	8	66.7	12	100
Agriculture & nonfarm	0	0	35	100	35	100
Agriculture, off farm & nonfarm	47	92.2	4	7.8	51	100
Total	51	33.80%	100	66.20%	151	100

It was found that agriculture income alone was not sufficient for dodging out food insecurity in the study area. Out of the total respondents, 53 were engaged solely in agriculture and all of them (53) turned to be heads of food insecure households. Engagement in off farm activities along with agriculture improved the status compared to those pure smallholder agriculturists. All those engaged in nonfarm along with agriculture also found to be completely food insecure. On the other hand, 92.2 % of the household heads engaged in all the three activities (agriculture, off farm and nonfarm) managed the problem of food insecurity.

**Access to resources**

**Table 3** Access to Resources and Food Insecurity, Ilu Gelan District, Ethiopia

	Secure	%	Insecure	%	Total	%
Farm size						
< 0.5 hectore	3	15	17	85	20	100
0.5< 1 hectore	36	34.3	69	65.7	105	100
1 hectore	12	46.2	14	53.8	26	100
Livestock holdings						
0-3	5	27.8	13	72.20%	18	100
3.1-6	28	33.70%	55	66.3	83	100
6.1-9	18	36	32	64	50	100
Access to credit						
Yes	13	31	29	69	42	100
No	38	34.9	71	65.1	109	100

The land size, livestock holdings and access to credit were studied. The mean farm sizes of food secure households (1.2 ha) was significantly higher (using t-test) than food insecure households (0.7 ha). Food insecurity was very high (85 %) among those who had very low farm size such as less than 0.5 hectares. Later, food insecurity decreased with increasing amount of land among the smallholder farmer households in the study area. Based on Jahnke (1982) the livestock population number was converted into tropical livestock unit (TLU), to facilitate comparison between the two groups. The average

TLU for food secure households (4.8) was not statically different from those of food insecure households (3.3) in the study population. Access to agricultural credit for the subsistence farmers who have little or no capital or savings to invest in farming is an important component in small farm development programs. Regardless of the access to credit facility, the households were highly food insecure.

**Agricultural input use**

**Table 4** Agricultural Input use and Food Insecurity, Ilu Gelan District, Ethiopia

Input Use	Secured	%	Insecure	%	Total	%
Fertilizer						
Yes	44	37.9	72	62.1	116	100
No	7	20	28	80	35	100
Herbicides						
User	24	42.9	32	57.1	56	100
Non-user	27	28.4	68	71.6	95	100
Insecticide						
Yes	20	46.5	23	53.5	43	100
No	31	23.7	77	71.3	108	100
Improved seed						
Yes	24	37.5	40	62.5	64	100
No	27	31	60	69	87	100
Irrigation						
Modern	7	53.8	6	46.2	13	100
Traditional	44	31.9	94	68.1	138	100

About three fourth of farmers (116) were using fertilizers in the sample. The food insecurity was less (62.1%) among those who used fertilizer compared to non-users (80.0%). The percentage of smallholder farmers who used herbicides (37%) and insecticides (28.5%) were very low compared to those who used fertilizer (76%) out of the total respondents. During field visits, it was observed that most of the farmers were removing weeds and insects in sorghum and maize farms manually. The farmers in the FGD had shown their concern that the existing technology was not effective for killing weeds and insects growing under maize and sorghum. However, the inferential analysis showed that use of fertilizer, herbicides and insecticides had significant relationship with household food insecurity among smallholder farmers in the study area.

The percentage of smallholder farmers who used high yielding variety in the sample was only 42 percent. Even though food insecurity was less (62.5%) among them compared to non-users (69%), the reduction was not statistically significant in the study population. Availability of water and type of irrigation were other key factors studied. The use of modern irrigation methods was very low in the study area. Only 13 farmers used modern methods and all others followed traditional. Among traditional irrigation users, the food insecurity was higher (68.1%) compared to those who used modern methods (46.2%).

**Access to market and extension services**

Among those reported access to extension services, 66.7% were having food insecure household and which was not significantly different from those who reported no access (65.1%) to extension services. Lack of market information compel the small holders to sell their produce for a lower price and may face exploitation by intermediaries. There were very low gap between household heads reported access to market information and those without. Distance to market was also

not related to the food insecurity of smallholder farmer households in Ilugelan district.

**Table 5** Access to market and extension services and Food Insecurity, Ilugelan District, Ethiopia

	Food secure	%	Food in secured	%	Total	%
Access to extension services,						
Yes	36	33.3	72	66.7	108	100
No	15	34.9	28	65.1	43	100
Access to Market						
Yes	18	34	35	66	53	100%
No	33	33.7	65	66.3	98	100
Distances to market						
0-2 km	6	31.6	13	68.4	19	100
2.1-5km	18	31.6	39	68.4	57	100
5.1-10km	17	38.6	27	61.4	44	100
More than 10	10	32.3	21	67.7	31	100

**Climate factors**

**Table 6** Climate factors and Food Insecurity, Ilugelan District, Ethiopia

	Food secure	%	Food in secured	%	total	%
Occurrence of Shocks						
Yes	40	30.8	90	69.2	130	100
No	11	52.4	10	47.6	21	100
Land degraded						
Yes	17	18.3	76	81.7	93	100
No	34	58.6	24	41.4	58	100
Fertility status of land						
Poor	9	12.2	65	87.8	74	100
Intermediate	20	42.6	27	57.4	47	100
Fertile	22	73.3	8	26.7	30	100

The study area was affected by repeated shocks. Maize and sorghum were the most predominant crops in smallholder farmer household in the study area. In the present study, 86 percent of respondents (130) reported problems due to the occurrence of shock at least one time during the past two year period. Among them, the food insecurity was very high (69.2%). Food insecurity was significantly lower (47.6%) among those who were unaffected by the occurrence of shocks. Land degradation is one of the key factors for the causes of food insecurity. In the present study also 93 out of 151 respondents reported that they perceived their land as degraded over the period of time. Among them food insecurity was significantly ( $p < 0.05$ ) higher (81.7%) compared to those reported 'not degraded' (41.4%). During focus group discussion, it was confirmed that environmental problems, poor farming practices, deforestation, unplanned shifting cultivation, over grazing and improper land use practice caused land degradation in the region. Further, the fertility status of the soil was classified as the household head's perception as poor, intermediate, and fertile. The food insecurity at household level was very low (26.7%) for those who responded fertility of the soil as high. It was very high (87.8%) among those who reported the fertility of the soil as very low compared to those who reported intermediate levels (57.4%). The observations were statistically significant ( $p < 0.05$ ) implying food insecurity changed with changes in soil fertility for the study population.

**Binary Logistic Regression Analysis**

The significant changes in the dependent variable (food insecurity =1, Otherwise =0) with respect to the changes in independent variables are explained below in the Table 7. The

R square of binary logistic regression is not that much accurate in explaining the impact of selected independent variables on the dependent variable like the one in linear regression. It is more an approximate value. In the present analysis, the Nagelkerke R Square was 0.684 implying that the selected predictors explained almost 70 % of variation in the food insecurity in the smallholder farmer households of the study area. The chi-square value (102.82) was significant at  $p < 0.001$  showing the appropriateness of the model used.

There is increasing concern towards the feminization of poverty in African countries. The odds ratio for sex was not significant at  $p < 0.10$  level in the present study. It implies that, household food insecurity among smallholder farmers in the study area was not varying with respect to the sex of the head when all other conditions kept constant. The household head's education is one of the significant characteristics affecting the household level food insecurity. Like sex of the household head, education also turned as an insignificant factor in determining the household food insecurity while keeping all other factors constant.

Large family size and high dependency on the working population are factors affecting food distribution and consumption in poor households. In the present study, it was observed that large family size per say was not influencing the household food insecurity in the smallholder farmer households. But one unit increase in dependency lead to a 5.8 times higher probability of food insecurity. Increasing returns by increasing farm size is an option for bringing more food security in such situation. However, the poor lack adequate land for agriculture to come out from such issue. In the present analysis it was observed that food insecurity was significantly increasing with decreasing farm size. Compared to those smallholder farmers own one or more hectors of land, the odds of food insecurity was higher among those owned 0.5-1Ha (4.8 times higher) and less than 0.5Ha (10.8 times higher).

Occurrence of shocks and degradation of land are other factors affecting the fertility of the soil and agricultural production and hence by determining the food insecurity of smallholder farmers. During bivariate analysis, also it was evident that land degradation and shocks were among the major factors related to the food insecurity status in the study area. In the multivariate analysis (binary logistic), it was found that odds of food insecurity at household was significantly higher (odds=6.22,  $p < 0.01$ ) among whose land was degraded over a period against not degraded. However, occurrence of shocks turned as insignificant when all other factors keeping constant in the present study.

Land degradation and shocks related to climate change could be controlled by appropriate agricultural inputs in the farms and which might ultimately bring down the food insecurity in the households. The odds ratios were significant and showed higher chances of food insecurity among non users of fertilizers (odds =3.62,  $p < 0.10$ ), herbicides (odds =3.91,  $p < 0.05$ ) and insecticides (odds=4.53,  $p < 0.05$ ) compared to the respective users. The soil fertility could be maintained and protected from shocks or degradation with appropriate use of inputs. In the present study, the food insecurity was very high among whose land was less fertile (odds =16.81,  $p < 0.01$ ) compared to higher soil fertility. There were 4.05 times higher chances of

household food insecurity among the smallholder farmers whose land was medium fertile compared to high fertile soil.

**Table 7** Results of Binary Logistic Regression Analysis

Variable <sup>#</sup>	B	Wald	Exp(B)
Sex (Female-1, Male-2)	-0.686	0.946	0.503
Education (years)	-0.05	0.336	0.951
Family size (Number)	-0.08	0.29	0.924
Marital Status			
(Single/Divorced/Widowed-1, Currently Married -2)	-1.784	6.63	0.168**
Dependency (Numbers)	1.766	16.778	5.849***
Farm Size (less than 0.5 Ha-1, 0.5 >1 Ha -2, More than 1Ha -3)			
Less than 0.5 Ha	2.379	5.277	10.796**
0.5 to less than 1Ha	1.572	3.807	4.816**
Use of Fertilizer (Non use -1, Use-2)	1.286	2.556	3.618*
Use of Herbicide (Non use -1, Use-2)	1.364	5.038	3.913**
Use of Insecticide (Non use -1, Use-2)	1.512	5.271	4.534**
Occurrence of Shock	0.137	0.023	1.147
Land degradation (Yes-1, No-2)	1.827	7.264	6.216***
Soil Fertility (Low-1, Medium -2, High-3)			
Low	2.822	12.809	16.81***
Medium	1.397	3.168	4.045*
Constant	-6.926	16.196	0.001***

<sup>#</sup>For all Discrete variables the last category is used as Reference group.

\*\*\*p<0.01, \*\*p<0.05, \*p<0.10

From the econometric model, the significant variables emerged as determinants of food insecurity among the smallholder farmer household in the study area were marital status, dependency, farm size, use of inputs (fertilizer, herbicide and insecticide), land degradation and soil fertility. The Hosmer-Lemeshow statistics indicates the fitness of model in a logistic regression model (if p value is greater than 0.05). The final model with all the eight determinants appropriately fits the model for food insecurity among smallholder farmer households in the study area as the significant value of Hosmer-Lemeshow statistics was higher (0.989).

## DISCUSSION AND CONCLUSION

Ethiopia is one of Africa's largest grain producers (USDA, 2012) and has Africa's highest livestock population. However, it has been food-insecure for longer period of times. Regardless of possibilities to ensure food security, it did not happen in Ethiopia and less competent in the world market even insufficient to feed family members (World Bank, 1999 and MoAFD, 2002). The country is recognized for its smallholder agriculture in nature. Hence the present study was conducted to identify the determinants of food insecurity among smallholder farmer households in Ilugelan District, Oromia region, Ethiopia.

The study found that 66.2% of smallholder households were food insecure based on the actual food consumption, which shows high nutritional deficiencies among the smallholder farmers in the region. Similar high food insecurity was evident in other studies done in the country based on the actual food consumption. It was earlier reported that, about 52% of the rural population and 36% of the urban population of Ethiopia consume under the minimum recommended daily intake of 2100 calorie per person per day (FAO, 2002). Another study identified that 47% of households were consuming below the required calories in Tigray region (Gebrehiwot, 2009).

The older the household, higher their asset ownership and get support from their children. Moreover, older heads are expected to have better access to land than the younger heads (Degefa, 2001; Jean *et al.*, 2002). Incomes of such households are likely to be higher as a result of longer stay on their public or private endeavors, following the assumptions of lifecycle hypothesis (Arene, 2008). However, food insecurity of the smallholder farmer households was not significantly ( $p < 0.05$ ) associated with the age of the household head in the present study. This may due to the small land and asset holdings, and presence of higher number of dependents (children or older) in the households headed by elder people.

Availability of food is the major factor affecting food security and other social, economic and cultural forces play a powerful role in which gender inequality demands increasing attention (Mathur, 2011). In Africa and in Ethiopia particularly, women smallholder famers are one of powerful engines and play key role in the development process to ensure food security at household and they made greater contribution to household food security than men (Frankenber, 1985). However, the male headed households tend to be more food secure than female headed households due to their historical dominance in all spheres of life including access to knowledge and resources. The higher food insecurity among female-headed households in the study area is in line with findings in many of the developing countries of the world. Availability of adult labour in male headed households (Smale and Heisu, 1997), unshared work burden including reproductive and social engagements for the woman head in female headed households are some of the reasons for higher food insecurity among female headed smallholder farmers compared to male headed. Additionally, gender inequality is present among Sub-Saharan Africa farmers in access to or control over land and productive resources (FMECD, 2013), access to fertilizer, mechanical equipment, new technologies, extension services and credit (UNDP, 2012). Gender sensitive programmes are necessary to reduce the gender gap in agriculture to come out from the food insecurity in the region.

It was unanticipated that the average income of food insecure households was not significantly lower from those of the secured households in the study area. The focus group discussion clearly brought out the gender disparities in access and control of resources in the study area. The discussion highlighted the prominent disparities unfavorable to females in the eating habits and food items of male and female inside the same household. According to traditional pattern of work distribution in the developing countries, women are primarily responsible for food selection and preparation in the households (FMECD, 2013). However, male dominance and authority in grain distribution for food preparation and consumption was reported in the present study. There was unequal access even to prepared food particularly the main staple food (Injera) among male and female members in the study population. Such gender inequality may lead to low calorie intake for female members irrespective of the per capita household income. Moreover, the use of food insecurity among female headed households as a representative measure of women's food insecurity masks the extent of food insecurity among women. However, for generalization and validation,

further study on the intra household distribution and consumption of food particularly the sex disaggregated food consumption data is required.

Food insecure households were less among secondary or higher secondary educated people compared to the less educated or illiterates. Literate households would have more capacity and ability to diversifying as well as increasing their means of income in order to reduce food insecurity. The higher percentage of illiterates among small holder farmer respondents in the study area is also of serious concern and which needs to be considered to improve the overall development of the people and region.

The average family size of the sample farmers was quite high as 6.6. Typically, large family size has significant relationship with much greater risk of poverty and food insecurity (Maxwell 1996; Ramakrishna *et al.*, 2002; Kidane *et al.*, 2005). The family size was significantly associated with the food insecurity during the bivariate analysis in the present study. Apparently, the multivariate analysis showed that number of household members was not a significant determinant of food insecurity when all others factors keeping constant. On the other hand, the high dependency levels were significantly contributing to the food insecurity. Owing to the scarcity of resources, an increase in household size especially the non-working members put pressure on consumption than production. The finding that food insecurity increases with increasing dependency ratio is in line with the finding of others like Ojogho (2010). Some possible ways of ensuring food security in the region are more enhancements of small child family norms and welfare measures for both children and elderly.

One third of the total respondents were not doing any other activities other than agriculture and all of them were food insecure. Those who engaged in off farm activities along with agriculture and the group engaged in all activities (off farm, nonfarm and agriculture) found to be food secured. It emphasizes that agriculture per say is not as such predictive in improving the food status of the smallholder farmers in the study area and heads of food secure households were engaged in multiple livelihood strategies.

Access to sufficient and suitable land is a major determinants factor for agricultural production, as well as to achieve household food security. Land is the major source of income and subsistence for the farmers, which was in short supply relative to the large family size of households in the study area. About two third of the respondents (102 out of 151) were having only half to one hectors of land. On the whole, only 17 percent of respondents had land more than 1 hector. Land size had a negatively significant relationship with food insecurity in the study area. The finding that food insecurity is decreasing with increasing farm land is in line with other studies (For eg., Fisher and Lewin, 2013). Hence, it can be concluded that non-availability of enough farmland was one of the major determinant of higher level of food insecurity in the study area. The household food insecurity was significantly lower among those who used fertilizer compared to non-users among the smallholder farmers. Farmers showed concern towards the existing technology for weeds and insects control particularly for maize and sorghum crops. This perception might prevent

them from the input use in required quantity. However, there was significant reduction in the percentage of food insecurity among the smallholder farmers, who used herbicides and insecticides compared to the non users. Hence the perception of farmers needs to be studied and addressed in the near future.

The study area was affected by repeated shocks. A study by Boussard *et al.* (2005) found that 99% of the food in Sub-Saharan Africa is grown under rain fed agriculture. Hence, food production is vulnerable to adverse weather conditions. Maize and sorghum were the most predominant crops in smallholder farmer household in the study area. A very high percentage of people reported problems due to shocks and the food insecurity was very high (69.2%) among them. The focus group discussion agreed that the worse situation aroused in the region because the farmers had followed low soil and water conservation practices. Seasonal erratic rain fall caused a severe crop failure due to early termination of the rains in February during flowering and fruiting times. The farmers in the district were also affected by frost, pest and disease, heavy ices, flooding, and crop logging. Sickness of household members was also reported as a common shock affecting the farming activities and household food security in the study area. There existed conscience agreement between focus group participants that the three fourth of the Meta households were food insecure because of flooding, erratic rainfall, soil erosion, heavy ice and crop logging. Self reliance in food supply can be achieved and disaster caused food shortage could be controlled in Ethiopia through collective efforts (CSA, 2013).

A very high percentage of people perceived their land as degraded over the time and food insecurity was significantly higher among them. The study area had been affected repeatedly by flooding. Land was degraded and affected by flooding.

## CONCLUSION

Ethiopia is one of the countries where the smallholder farming dominates the overall national economy and its population is subjected to extremely food insecure. Using binary logistic regression model, eight significant determinants of food insecurity among the smallholder farmer household in the study area were identified. They were marital status, dependency, farm size, use of inputs -fertilizer, herbicide and insecticide, land degradation and soil fertility. The final model with all the eight determinants appropriately fits the model for food insecurity in the study population. The poor smallholder farmers often face a greater burden in responding and adapting to climatic shocks due to their lack of financial services, social capital and technology. The determinants identified clearly throw light on the fact that the issue is multidimensional and hence requires holistic approach to overcome it. However difficult and multi task oriented, unless and until the needs of the farmers were adequately met, all efforts to achieve sustainable food security will be in trouble.

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