

Dimensions of Food Insecurity and Its Determinants: The Case of Smallholder Farmers in Assosa District, Western Ethiopia

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Abstract: Most of the African countries including Ethiopia are often characterized by problems of food insecurity. Despite several efforts made so far to improve the overall food insecurity situation, the challenge is still prevalent problem in Ethiopia. Hence the study was designed with the main objectives of examining the dimension of food insecurity and identifying its determinants in Assosa district of Western Ethiopia. In order to attain these objectives, data were collected from 138 randomly selected households in four randomly selected kebeles of the district. Besides, data was collected using household survey, focus group discussions (FGDs), and key informant interviews. Data was analyzed using both descriptive statistics and econometric methods. On average, female headed households were more food insecure than male-headed households. Among the four pillars of dimension of food security are availability, access, utilization and stability. The smallholder Farmers at study area are mainly characterized by problem of food availability and accessibility. The result of the binary logistic regression revealed that sex of household, education level of household, farm income, off-farm income, distance to market access to agricultural services used and number of oxen has had substantial negative impact on food insecurity of the rural households. Other significant variable namely, age of household head was found to exert a positive impact on food insecurity. Food security issues at the Assosa district require more in-depth and continued study outputs and proper use and implementation of the information gained as the area is found to be influenced by several, interlocked and site specific dimensions and determinants that, of course, require immediate and coordinated attention from different stakeholders.

Keywords: Food Insecurity, Determinant, Dimension, Causes, Households, Binary Logistic

1. Introduction

1.1. Back Ground of Study

Ethiopia has been the largest recipient of food aid in Sub-Saharan Africa [7]. Large proportion of the population has been under nourishment over the past one and a half decades. Although the proportion of the population in under nourishment reduced from 69 percent in 1994/95 to 35 percent in 2013/14 [7], it still remains at an undesirable level.

The major causes for the slow growth rates of agriculture include various factors such as unfavorable climatic conditions, undeveloped infrastructures and predominantly traditional production system. Ethiopia exists within one of the most food-insecure regions in the world, with a large

number of its population living under subsistence levels and dependent on farm production with highly vulnerable to severe droughts. The smallholder peasant sectors are the most important agricultural subsector in the country. The production volume of food grain crops as per capital food production has shown fantastic location throughout the 1980s thus resulting in severe food deficiency in the country. The focus on large farms and western technology in agricultural policies for national food sovereignty has meant that rural economic development has been neglected [8]. Many rural households have lost their means of livelihood due to recurrent soil erosion and crop failures. This, therefore, calls for measures to systematically address the problem of food shortage in the country.

Dione J [3] Shows that food security is an income matter,

either in the form of own food production or from non-agricultural activities such as employment to get food through the market. The primary objective of the millennium development goals by the United Nations, conceived at the threshold of the new millennium in 1990s, was to ensure individual development for all [9]. The goals were the eradication of poverty, hunger, and generation of more employment. The evaluation of the outcomes of the decade long global efforts has provided evidence that the United Nations has only partially been capable to achieve these goals. This has necessitated the creation and implementation strategies for Sustainable Development Goals 2, which is slated to be achieved by 2030 [9].

Ethiopian government and international donors are applying different kinds of responses to food insecurity to achieve food self-sufficiency and decrease food aid dependency [13]. Regardless of large resources invested each year by the Government and its partners to diminish food insecurity, both prolonged and transitory food insecurity problems unceasing at the household level [5].

The prevalence of food insecurity and related vulnerability is generally high in rural parts of Ethiopia, where 79% of the population live [12], with rain-fed subsistence farming dominating agricultural production. Drought expanded even to the formerly rainfall sufficient areas and leading to reduction in productivity and crop yield loss [2]. According to [14], most of the severe food crises were caused by a combination of several factors and are often interconnected. The most common causes of food insecurity in the world were: poverty trap, lack of investment in agriculture, drought, agricultural problems, climate change, war and displacement, unstable market and food wastage. Similarly, [6] food security strategy acknowledges the multifaceted and complex nature of food insecurity in Ethiopia. The adverse climate change, combined with high population pressure, environmental degradation, technological, and institutional factors have led to a decline in the size of per capita landholding causing a severe food insecurity problem in the country [6]. Assosa district faces with extreme soil erosion due to in appropriate farming practice coupled with cultivation and overgrazing of hillsides and steep slopes [16]. Soil erosion leads to reduce soil fertility which in turn reduces agricultural production. Therefore, of all the challenges facing Ethiopia, ending chronic food shortages and rural poverty and achieving enhanced livelihood and long-term food security in an environmentally and socially sustainable manner is the most pressing agenda for the country [4]. A district could be included in the Productive Safety Net Program when confirmed by experts that there prevails chronic food insecurity situation. Assosa District has been classified as one of the food insecure districts found in Assosa zone in 2018. Based on data obtained from Assosa zone food Security-Disaster Preparation and Prevention office (2018), due to recurrent food shortage, the number of food aid receivers' in the district increased from 25 thousand in 2015 to more than 40 thousands in 2019. According to the same source, the Assosa district is the most food insecure

area, demanding food aid for more than 21% of the population. Furthermore, soil erosion which leads to decreasing fertility of soil, food shortage and distress is widely increasing in the study district. Off-farm and non-farm opportunities to improve the livelihood of farmers and their families are restricted. With ever-increasing number of population and recurrent soil erosion the household food security situation is deteriorating in the study area.

1.2. Statement of Problem

In Ethiopia food shortage has aggravated the already poor economy of the country. Both chronic and transitory problems of food insecurity are widespread and severe in both rural and urban areas of the country [1]. In Assosa district soil erosion has led to decreasing fertility of soil and limited efforts to recycle crop residue or organic matter in to the soil. These have resulted in costly investment by smallholder farmers in chemical fertilizer so as to produce enough food for their subsistence requirement. Based on data obtained from Assosa zone food Security-Disaster Preparedness and Prevention office (2018) Assosa district is categorized as a chronically food deficit district of Assosa zone (personal communications). As a result a large food aid is distributed annually during several food shortage years. Agriculture in the rural part of Assosa district is fundamental but the district has no so much fertile soil. As the soil fertility is low thereby making the district unsuitable for subsistence food production. As a result, preparation and implementation of different kinds of policies to improve the livelihoods of rural people in Assosa and food security situation needs specific information on the problems of food- insecurity. The problem of food security takes particular forms in its extent, dimension and determinant at different level of researchers' analysis at different areas. However, in the Assosa district, there are no such studies conducted on issues related to the issue. Besides, food insecurity related challenges, e g., productivity reduction and increased dependence on food aid (safety-net) were increasing. In view of the biophysical, socioeconomic, and cultural peculiarities of the study area, investigating the causes, status and dimensions of food insecurity is crucial. Furthermore, the study site is one of the soil erosion prone districts with the majority of the kebeles are supported by the Productive Safety Net Program (PSNP). Therefore, examining the dimensions and determinant of food insecurity of the Assosa district is vital for generating information to be used by development agents, local administration, researchers and other interested actors as information sources. This study is essential because it contributes in providing information that will enable effective measures to be under taken so as to improve and bring successes in food security status in the district. Furthermore the study will contribute in enhancing knowledge as to where and how to intervene in minimizing challenges related to food insecurity by the different stakeholders (governments, private and non-government organizations). It will also contribute to scientific knowledge in the field area for use as reference and will identify gaps for

recommend for further studies.

To fill these gaps and contribute towards tackling food insecurity problems in the locality, updated information on food insecurity, dimension and determinants are crucial. Consequently, this study was undertaken in Assosa district, western Ethiopia to address the aforementioned problems by addressing the following objectives.

1.3. Objective of Study

1.3.1. General Objective

The general objective of the study is to examine the dimensions of food insecurity and its determinants by smallholder farmers in Assosa district of western Ethiopia.

1.3.2. Specific Objectives

- 1) To examine the dimension food insecurity by small holder farmers
- 2) To identify the determinants of food insecurity

2. Research Methodology

2.1. Description of the Study Area

Assosa district is located western part of Ethiopia, and is 663 km from Addis Ababa. Its altitude ranges from 580- to 1544m. a. s. l and its geographical land escape (agro-ecology) is divided into lowland and mid altitude with an annual rainfall of 850 to 1200mm. Agriculture is the pillar of the household economy, intensively carried out by those who have land and livestock. Crop production and animal husbandry are major activities. Agricultural products are consumed at home and partly sold to earn cash to meet other household needs, such as school fees, and contribute to social affairs such as Ekub, Edir, etc. Assosa district has total population of 92,687 among them 75224 of households are under food insecurity according to data obtained from Assosa zone food Security-Disaster Preparation and Prevention office (2018).

2.2. Data Collection Methods

2.2.1. Sampling Producers and Sample Size

In this study a multi-stage sampling technique was employed to select sample households from population. In the first stage, out of the 7 district of Assosa zone, Assosa district (which has 72 kebeles) are food in secured and made targets according to Assosa zone agriculture office and hence Assosa district was selected purposely. In the second stage, four Kebeles were selected purposively from the 72 kebeles of Assosa district, specifically more food insecure kebeles based on their level of food insecurity (households that cannot feed their household members for ≥ 6 months during the previous year). These four sample Kebeles are selga 20, selga 22, selga 23 and selga 24. In the third stage, from these kebeles, 138 sample foods in secured households were selected randomly based on probability proportional to the size of the households in these selected Kebeles.

2.2.2. Sample Size Determination Procedure

According to Hussey (1997), no survey research can ever believe to be free from an error or provides 100% precision and error limit of less than 10% and confidence level of higher than 90% can be considered as acceptable. In this study, it is planned to take 8% level of precision in order to get the sample size which represents a true population. To determine the required sample size [15] was used. Hence, where n - sample size; N - total food in secured population of the four kebeles and e - level of error (8%) used. Following the formula out of 1216 households, 138 households were selected randomly for this survey.

$$n = \frac{1216}{1+1216(.08)^2}$$

$$n = \frac{1216}{1+1216(0.0064)}$$

$$n = \frac{1216}{1+7.7824}$$

$$n = \frac{1216}{8.7824} = 138$$

2.2.3. Sources of Data Collection

For this study primary and secondary data sources were used. The primary data were collected by using different data collection methods including household survey, focus group discussions, and key informant interviews. The secondary data were obtained from reports of government institutions, Publications document, and different websites.

Household survey-The household survey was administered on 138 randomly selected households. Both open and closed ended questions were used for the household survey. The closed-ended questions were used for scoring and quantification of responses. The use of open-ended questions would allow respondents to have control over their responses rather than agreeing or disagreeing with questions posed by the researcher. Hence it would help respondents to freely express their views and opinions on the questions.

To enable high 'response rate' from the respondents, five data collectors were hired, trained in the administration of interviewing skills, collecting and conducting relevant, valid and reliable data-collection exercise. This has helped the researcher to address as many households as possible, use time and finance efficiently and allowed the researcher the space to record responses promptly.

Focus group discussions -The focus group discussions conducted with representatives of the community of four kebeles. They were conducted to draw opinion of those individuals who represent the community including women and male groups. It was done in order to triangulate points of view of participants. The Focus Group discussion helped to elicit qualitative data to supplement and complement both quantitative and qualitative information provided by the interview guides. The number of participants in each focus group ranged from 6 to 10 persons. For this discussion, an average of one hour session was used in each kebele. In each kebele two independent focus group discussions of elders and women groups were conducted.

Key informant interviews—A total of twelve key informant interviews were conducted to share their experiences and opinions about food insecurity situation of the people in the study area. These informants were experts and leaders of different offices including woreda agriculture and natural resource offices, elders, model farmers, women and kebele authority's representatives and Agricultural Development Agents. To collect the necessary data for the study, checklists, also referring to as standardized interview were used.

2.3. Method of Data Analysis

2.3.1. Descriptive Statistical

The quantitative data were organized, summarized and analyze by descriptive statistics, using SPSS software. Descriptive statistical methods were used to analysis the data by comparing and cross-checking to assure the validity of the data. The descriptive analysis made use of tools such as mean, percentage, standard deviation and frequency distribution to summarize the data. Inferential statistics were also employed to compare the food secure and food insecure household groups in respect of some explanatory variables.

2.3.2. Qualitative Data Analysis

Qualitative data analysis involves the identification, examination, and interpretation of patterns and themes in textual data and determines how these patterns and themes help answer the research questions at hand. The qualitative data (non- numerical and information) were incorporated into analysis which supports the numerical finding to establish a clear and credible links between the qualitative and quantitative information in the final analysis.

2.3.3. Econometric Analysis

Based on the specific objective of the research, the factors that affect food insecurity were examined. In this regard, econometric analysis was used to identify determinants of food insecurity and estimate the severity of food insecurity. In this regard, the effect of demographic and socioeconomic characteristics on food insecurity are important and variables such as household size, household head age, sex, education, dependency ratio, access to various services, access to credit service, access to employment, asset possession, fertilizer use, availability of land to be cultivated, and food aid are among the variables considered in this study.

In this study, dependent variable Y (the household food insecurity) is dichotomous variable taking value of 1 if the household is food in secured and 0 otherwise. In the case where dependent variable is dichotomous, probability regression model is the most fitting to study the relationship

between dependent and independent variables [10]. Therefore, in this study binary logit model was selected for its simplicity and less complication of its interpretation.

Then, following [10] logit model is specified as follows:

$$P_i = E(Y=1/X_i) = \frac{1}{1 + e^{-(\beta_0 + \beta_i X_i)}}$$

Before execution of the logit model, the explanatory variables were tested for the presence of multi-collinearity where the explanatory variables are highly correlated [11]. In this study, variance inflation factor was used to identify the degree of linear relationship between the explanatory variables.

3. Results and Discussion

3.1. Demographic and Socio-Economic Characteristics of Respondents

3.1.1. Age of Household Head

The result in table 1 shows the mean age of sample household heads was 61.81 with standard deviation of 17.03. It shows that there is variation in the mean age of the food secure and food insecure households. That is, the mean age of food insecure households was 66 years, and that of the food secure households was 42 years. The result showed that there is significant difference at 1 percent probability level, indicating that the older households were more food insecure due to requiring labor forces to crop production.

3.1.2. Dependency Ratio

The mean dependency ratio of sample household heads was found to be 2.11 with standard deviation of 1.50. The mean of dependency ratio between food insecure and secure households was 2.15 for food insecure and 1.93 for the food secure households. The result showed that there is insignificant difference at 10 percent probability level. This shows that the households with large dependency ratio tend to be more food insecure than those with small ratio.

3.1.3. Family Size

The average family size of sample households was found to be 1.76 ranging from 2 up to 20 members with a standard deviation of 0.83. The average family size varies between food insecure and secure households, which are 1.9 for food insecure with a standard deviation 0.83 and 1.08 for the food secure households with standard deviation 0.27. This means food insecure households were characterized by big family size in the study area.

Table 1. Distribution of sample households by Age Dependency Ratio and Family Size.

Food insecurity status	Statistics	Age	Dependency Ratio	Family Size
Food insecurity	N	112	112	112
	Mean	66.40	2.15	1.9
	SD	14.56	1.51	.83
Food security	N	26	26	26
	Mean	42.04	1.93	1.08
	SD	12.15	1.48	.27

Food insecurity status	Statistics	Age	Dependency Ratio	Family Size
Total households	N	138	138	138
	Mean	61.81	2.11	1.78
	SD	17.03	1.5	.83
	t-value	-3.5920*	-0.6682	-0.0768

*Age is Significant at less than 1% probability level

Source: - Survey result

3.1.4. Sex of Household

The result in table 2 shows that the majority (68.84%) of the sample respondents were male-headed, while 31.16% were female-headed. The result indicates that about 34.82% and 65.18% female-headed and male-headed households, respectively, were food insecure. Similarly, about 84.62% male-headed and 15.38% female-headed households were food secure. The chi-square result of this variable is found to be statistically significant at less than 1%. This means that there is a significant relationship between sex and food insecurity status. This is the fact that female-headed households are usually constrained by resource ownership.

3.1.5. Marital Status of Households

As shown in Table 2 below, majority of the households (76.09%) were married. This indicates that there are more married sample households than unmarried households. The result of this variable indicates 73.21% of married and 26.79% of unmarried households were food insecure. Likewise, about 88.46% of married and 11.54% of unmarried households were food secured. The chi-square result of this variable is statistically insignificant at 10%. This means that there is an insignificant relationship between marital status and food insecurity. The result shows that married households are more of food secure than unmarried households.

Table 2. Distribution of sample households by sex and marital status.

Sex of HH	Food in secured		Food secured		Total HH		χ^2
	Frequency	Percent	Frequency	Percent	Frequency	Percent	
Male	73	65.18	22	84.62	95	68.84	10.7160*
Female	39	34.82	4	15.38	43	31.16	
Marital status							
Married	82	73.21	23	88.46	105	76.09	2.6962
Unmarried	30	26.79	3	11.54	33	23.91	
Total	112	100	26	100	138	100	

Sex is * Significant at 1 percent probability level Source: own survey result

3.1.6. Education HHH

As shown in Table 3, majority households (85.50%) did not attend formal education. On the other hand, about 19.23% and 12.50% of the households who attended formal education were more food secure and food insecure, respectively. Similarly, about 87.50% and 76.92% illiterate households were more food insecure and food secure, respectively. The results indicate that literate household heads were more food secured. This could be due to the fact that literate households appropriately use agricultural input such as fertilizer and improved seeds, and get relatively good production.

Table 3. Distribution of households by status of education.

Education level	Food insecure HH		Food secured HH		Total HH	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
Uneducated	98	87.5	20	76.92	118	85.50
1-8 Grade	14	12.5	5	19.23	19	13.77
9-12 Grade	-	-	-	-	-	-
Above diploma	-	-	1	3.85	1	.73
Total	112	100	26	100	138	100

Source: survey result

3.1.7. Access to Credit

Households obtained credit both in cash and kind from private and Governmental institutions. As shown in Table 4, majority of households (80.45%) did not have access to credit service. On the other hand, about 86.61% of households who did not have access to credit were food insecure. Similarly, about 13.39% of the households who had access to credit service become food secure. This might be

due to the fact that household's heads that have credit access could purchase agricultural input to increase agricultural production.

3.1.8. Access to Improved Seed Use

The result shows that majority of the households (63.04%) have access to improved seed use (Table 4). This survey indicate that 11.54 and 42.86% of food secure and food insecure households respectively do not have access to

improved seed use, while 88.46% and 57.14% of the households who have access to improved seed use were food secure and food insecure, respectively. This shows that the use of improved seed potentially contributes to increase in productivity and reduce downward fluctuation in production due to the potential characteristics of improved seeds in resisting pests and diseases, as well as their ability to tolerate adverse weather conditions.

3.1.9. Access to Agricultural Extension Service

The result in table shows that 54.35% of households had access to agricultural extension service, whereas, 45.65% did not

have access. This indicates that from the households who do not have access to agricultural extension service about, 26.92% and 50% were food secure and food insecure, respectively. Similarly, about 73.08% and 50% of the households who have access to agricultural extension service become food secure and food insecure, respectively. The results reveal that farmers having access to agricultural extension service can improve agricultural productivity since it may be used to transfer technology, support rural adult learning, and assist farmers in problem-solving and getting farmers actively involved in the agricultural knowledge and information system.

Table 4. Distribution of sample households by access of improved seed used, Access Agri/Exte/ service and Access to credit used.

Access to agricultural extension service	Food insecurity		Food security		Total	HH
	Frequency	percent	Frequency	Percent	Frequency	Percent
Access	64	57.14	23	88.46	87	63.04
No access	48	42.86	3	11.54	51	36.96
Access Agri/Exte/ service						
Access	56	50	19	73.08	75	54.35
Not access	56	50	7	26.92	63	45.65
Access to credit used						
Unaccess	97	86.61	14	53.85	111	80.45
Access	15	13.39	12	46.15	27	19.55
Total	112	100	26	100	138	100

Source: survey result

3.1.10. Fertilizer Use

Fertilizers replace the nutrients that crops remove from the soil. Most of households in the study area used fertilizers, such as, di-ammonium phosphate (DAP). It is used for agriculture to improve crop yields; about 87.5% of the food insecure households and 92.31% food secure

households were applying chemical fertilizers on their farmland. However, from the total interviewed households, about 11.69% were not applying chemical fertilizers, and 1.45% of them were food secure because they used natural compost product.

Table 5. Distribution of sample households by fertilizer use.

Fertilizer	Food in secured HH		Food secured HH		Total HH	
	Number	Percent	Number	Percent	Number	Percent
Applied	98	87.5	24	92.31	122	88.41
Not applied	14	12.5	2	7.69	16	11.59
Total	112	100	26	100	138	100

Source: survey result

Farm Size

From the total household, about 96.4 % cultivate less than or equal to two hectares; and only about 3.6% of them cultivated greater than two hectare (Table 6). From a total food insecure farm households, over two-third (70.54%) cultivated less than one hectare and 29.46% of them cultivate

more than one hectare. About 80.8% food secure farm households cultivate more than one hectare and the remaining (19.2%) cultivate less than one hectare. This indicates that small farm size landholding households were more food insecure than households who own big land holding.

Table 6. Distribution of sample household heads by cultivated land.

Cultivate land in hectare	Food in secured HH		Food secured HH		Total Change	
	Frequency	Percent	Frequent	Percent	Frequency	Percent
< 1	79	70.54	5	19.23	84	60.87
1-2	31	27.68	18	69.23	49	35.51
>2	2	1.78	3	11.54	5	3.62
Total	112	100	26	100	138	100

Number of Oxen

The result shows that in the study area, the households have owned two Oxen, one Ox and the others Ox-less. Out of

total about 42.75 percent of sample households are ox-less and only 22. 47 percent of the sample respondents own two oxen. And the other remaining sample households are only

one ox. This result indicates that about 53.85 percent and 15.18 percent of respondents who own two oxen are food secured and food insecure, respectively. The sample

households who have more oxen are more food secured because they cultivate their land more effectively.

Table 7. Distribution of sample household heads by number of Oxen.

Number of Ox	Food in secured HH		Food secured HH		Total Change	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
Ox-less	58	51.79	1	3.85	59	42.75
One Ox	37	33.03	11	42.30	48	34.78
Two Oxen	17	15.18	14	53.85	31	22.47
Total	112	100	26	100	138	100

Income from Safety Net

As shown in Table 5, the statistical analysis result shows that 94.65 and 96.15 percent of sample households head were food in secured and food secure, respectively. These households are those who receive below or equal to 600 birr income from safety net. The other remaining 5.36% and 3.85% of households head were food insecure and food secure respectively. These are households who earn greater than 600 birr income from safety net. This indicates that income from the safety-net contributes to reduction of food insecurity.

Agricultural Income

Household's income in the study area is not only depends on the agriculture and the relative price attained by the farmers for agricultural product and livestock products, but also on the time of sale and type of off farm activities a household performs. In the study area, as it was observed from the survey results the relative share of income from cereal crop to the total annual household head income was the biggest. Hence, cereal production was the most important

source of income in the study area. It was followed by livestock production, off-farm activities and vegetables production, respectively. Most of food insecure sample household earned annual farm income equal to 1500 birr. This result shows that 44.93% and 55.07% of the food security and food insecurity sample households earned annual farm income equal to 1500 Br, respectively. While 76.92% of the food secure sample farmers earn annual farm income greater than 7001 Ethiopian birr and only 1.78% of the food insecure earn the same amount.

Income from None Farm

Off-farm income includes non-agricultural wage, self-employment income, petty trading, charcoals and wood selling, and handicraft. The household survey result shows that 44.93% of the sample households have off-farm income and 55.07% do not have off-farm income (Table 6). Similarly, majority (73.08 %) of the food secured households have off-farm income (Table 6). This indicates that off-farm income can increase agricultural productivity and may lead to food security.

Table 8. Distribution of sample households based on their Access to Productive Safety Net Program, income from agriculture and income from non-farm.

Income from safety net	Food in secured HH		Food secured HH		Total HH	
	Number	Percent	Number	Percent	Number	Percent
≤600	106	94.65	25	96.15	131	94.93
>600 Agricultural income	6	5.36	1	3.85	7	5.07
≤1500	70	62.5	1	3.85	71	51.45
1501-4000	30	26.79	2	7.69	32	23.18
4001-7000	10	8.93	3	15.39	13	9.43
≥7001	2	1.78	20	76.92	22	15.94
Income from none farm IFNF used	43	36.39	19	73.08	62	44.93
IFNF not used	69	61.61	7	26.92	76	55.07
Total	112	100	26	100	138	100

Source: survey result

3.2. Major Causes of Households Food Insecurity

The results obtained from households survey, focus group discussions and key informant interviews identified major causes of food insecurity. These are lack of agricultural input, lack of credit, shortage of oxen, Lack of agricultural mechanization, Infertility of soil, lack of training on the agricultural technology and problem of soil erosion. Among them problem of soil erosion and lack of training on the agricultural technology are found to be the major causes of food insecurity over the time. Food insecure and food secure household head accounted 23.22% and 23.08% as indicated in table 9 and show that problem of soil erosion as the first and

most persistent problem of food insecurity, respectively. Soil infertility is the main limiting factors of food crop production. On the other hand, famine often results in rises in the prices of food crops, and most household heads depend only on their production lack purchasing power to purchase food crops to satisfy the requirements of their family members. Besides, soil erosion aggravates the cause of food insecurity of the area. The infertile soil along with lack of agricultural input usually causes agricultural productivity losses. 17.86 percent and 16% of the respondents stated that food insecurity is closely associated to lack of training on the agricultural technology and infertility of soil. Hence, because of the soil erosion problem, agricultural production has lowered to unexpected rate and shortage of

agricultural input; they have no enough products to consumption for their family. The results obtained through household survey

and key informants identified that from June to August most of the households were food insecure.

Table 9. Distribution of sample households by Causes of household food insecurity.

Causes	Food insecure HH		Food secured		Total	HH
	Frequency	Percent	Frequency	Percent	Frequency	Percent
Infertility of soil	18	16	4	15.38	22	15.94
Lack of agricultural mechanization	12	10.71	5	19.23	17	12.32
Lack of credit	12	10.71	3	11.54	15	10.87
Problem of soil erosion	26	23.22	6	23.08	32	23.19
Shortage of oxen	14	12.5	1	3.85	15	10.87
Shortage of agricultural input	10	8.9	3	11.54	13	9.42
Lack of training on the agricultural technology	20	17.86	4	15.38	24	17.39

3.3. Dimensions of Food Security

Food security occurs when all persons at all times have physical, social and economic access to adequate, safe and nutritive food to meet their nutritional needs and food favorites for an active and healthy life. The 4 pillars of food security are: food availability, access, utilization and stability.

3.3.1. Food Availability (Monthly)

About 65.4% of the food secure sampled households face food shortage only for one month (August) and the remaining

(34.6%) have enough food for the last year to feed their family. Out of the sampled households, food insecure accounts to 36.6% for five to six months, and the rest 63.4% for seven or more months (Table 10). The food insecure months in the study area were starting continuously from January up to August, whereas the food secure months were September, October, November and December because of harvesting time. During this survey, the households were food insecure minimum for one month and maximum for eight months. The result shows that household heads were cultivating their product only once a year.

Table 10. Distribution of households by the number of months of food insecurity, 2021.

Months	Food Availability	Food insecure HH		Food secured HH		Total HH	
		Frequency	Percent	Frequency	Percent	Frequency	Percent
0		0	0	9	34.61	9	6.52
1		0	0	17	65.39	17	12.32
5		14	13.39	0		14	10.15
6		27	24.11	0		27	19.57
7		64	54.47	0		64	46.38
8		7	6.25	0		7	7.25
Total		112	100	26	100	138	100

Source: field survey

3.3.2. Food Access by Households

Out sample households 79.71% of food in secured households supplements their food consumption from safety net program, and 18.1% of food secured households consumed food produced from their land. The other

remaining 1.45 percent and 0.72 percent food insecurity households consumed food from purchase and daily labor force receptively. This result indicated that most of the households were food insecure because of their access to consume food from safety net program.

Table 11. Distribution of sample household heads by food access.

Access food	Food in secured HH		Food secured HH		Total HH	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
Safety net	110	98.21			110	79.71
Land cultivate			25	96.15	25	18.12
Purchase from market	2	1.79			2	1.45
Daily labor wage			1	3.85	1	0.72
Total	112	100	26	100	138	100

3.3.3. Food Utilization

In study area households used agricultural product, such as Animal product, vegetable and cereal crops for consumption. Table 12 shows that out of total sample households, 67.39% were used cereal crops such as maize, Teff, Sorghum and others for consumption. While 11.59% and 21.02% utilized

Animal products and Vegetables respectively for consumption. This survey indicates that most of the households use the same variety of agricultural product for daily consumption, which has substantial influence on the maintenance of their balanced diet.

Table 12. Distribution of sample household heads by Food utilization.

Food Utilized	Food in secured HH		Food secured HH		Total HH	
	Frequency	Percent	Frequent	Percent	Frequent	Percent
Animal Product	8	7.14	4	15.38	16	11.59
serial crop	80	71.43	15	57.69	93	67.39
Vegetables	24	21.43	7	26.93	29	21.02
Total	112	100	26	100	138	100

Source: survey result

3.3.4. Stability over Time

Out of the total sample households 6.5%, 22.5% and 71% were obtaining food overtime, seasonal food insecurity and chronic food insecurity respectively. About 12.5 and 87.5% food in secured households face seasonal and chronic food

insecurity respectively (Table 13). This showed that most of households in the study area were under chronic food insecurity due to decreasing fertility of soli, infrastructure and government support among others.

Table 13. Distribution of sample household heads by food Stability over time.

Stability	Food in secured HH		Food secured HH		Total HH	
	Frequency	Percent	Frequent	Percent	Frequent	Percent
Obtain food through the year	0	0	9	34.62	9	6.53
Seasonal food insecurity	14	12.5	17	65.38	31	22.47
Chronic food insecurity	98	87.5	-	-	98	71
Total	112	100	26	100	138	100

Source: survey result

The four pillars of dimension of food security addressed by the study are: food availability, access to food, utilization and stability over time. Among these pillars, the smallholder farmers at study area are mainly characterized by food availability and accessibility.

3.4. Determinants of Food Insecurity

This subsection presents the results of the logistic

regression analysis which was run to analyze the determinants of the probability that a household will be food insecure as indicated in the model specification. Binary logistic effect estimations were done to make thorough analysis of the model predictors. The odd ratio is used in the interpretation of the analysis results. This variable is indicated as follows.

Table 14. Logistic model result by Determinant food insecurity.

Variable	Coef	Std. err	P> Z	Odd/ Ratio
Age	.1273535	.049283	0.010***	1.135818
Sex	-5.004052	2.326465	0.031**	.0067107
Dependency	.137574	.3270736	0.674	1.147487
Education	-4.187561	2.494363	0.093***	.0151833
Fsize	-.280106	.1907633	0.142	.7557036
Msstatus	.7705784	1.312488	0.557	2.161016
Axcredit	.5541093	1.699956	0.744	1.74039
IFSTNet	.0326859	.0125196	0.009*	1.033226
INFNFarm	-3.532032	1.775987	0.047**	.0292454
TINFAgri	-.0003421	.0002015	0.090***	.999658
Dtmarket	-1.389397	.6368063	0.029**	.2492256
Cultland	.6424148	.9088013	0.480	1.901066
Firtlizer	-1.971438	4.42447	0.656	.1392565
AAEXS	-2.733517	1.503652	0.069***	.0649903
Oxen	-3.355766	1.290609	0.009*	.0348827
Constant	14.82633	7.687096	0.054	
1% Significance	** 5% Significance *** 10% Significance			
No of observation=138,	LR chi2 (15)=104.81, Prob>chi2=0.000, Pseudo R2=0.4848, Log likelihood = -14.371673			

Sex of household- Sex of the respondents was negatively and significantly associated with food insecurity at 5% level of significant. The negative sign shows that male headed households were more food secure than female headed households, holding other factors constant. That is, male

headed households are less likely to be food in secured at a probability of 0.0067 than their female counterparts. The possible description is the fact that male has more access to production resources like land than females.

Safety Net Program -It is one of the household income, the

households get it from food aid in-kind or in cash. It is positively and significantly related with food security of the rural household at less than 1% probability level. The positive association implies that households that participate in productivity safety net program are more likely to be food secure. The possible description was that the program delivered additional income for the households with which they bought foods from the market when their stock was low and thus ensuring food security for their family. Other variables remaining constant, an increase in income from safety net by 1 Birr, increase the probability of the food security of households by 1.033226 units.

*Age of household headed-*It had significant at 10% probability level and positive association with the household's food insecurity status. The positive sign shows that the probability that the household was food insecure increased as the age of the household head increases. Other variables remaining constant, increased in the age of the household head by 1 year, increased the probability that the household was food insecure by 1.135818.

Number of Oxen- Oxen is the main source of traction power among rural households in the study area. It is negatively and significantly associated at less than 1% with the probability of being food insecure. Other variables remaining constant, when the number of oxen owned by a household increased by 1, the probability that the households food insecure decreased by 0.0348827. The possible justification was that households with more oxen have a better production capacity of households in subsistent agriculture of the area and less dependent on borrowing or hiring oxen.

*Distance to market-*As expected, distance to market affected household's food insecurity negatively and significantly at 5% probability level in the study area. Other variables remaining constant, one kilometer increase in market distance increase the probability of food insecurity by 0.24592256. This implies that those household nearer to the market are less likely to be food insecure.

Educational status- Education status of a sample household had negative and significant association with the household food insecurity status at 10% level of significance. When the level of education increased by one unit, households are more likely to be food secured by 0.0151833. This result indicates that education contributes for household food security enhancement because educated household heads are usually experienced family planning programs and they limited their family size when compared with others who have no or less education background.

Access to agricultural extension service- Access to agricultural extension services had negative and significant relationship with the household food insecurity status. It is negative and significant at less than 10 percent level of probability. The inverse relationship is an indicator of its influence to attack food insecurity. The possible explanation is that those farmers who had applied modern inputs along with various packages of scientific agricultural practices according to agricultural extension service were less likely to become food insecure than those households who had no or

little access. Other variables remaining constant, the odd ratio of food insecurity decrease by factors of 0.16, when the household has access to agricultural extension services.

Agricultural income - As projected, agricultural income determined households' level of food insecurity negatively and significantly at 10% significance level. The marginal effect pointed out that 1 birr increase in farm income, within food insecure households, decreased the probability of their energy intake deficit by 0.999658. This indicated that higher farm income producing households were less likely to energy scarce than low farm income earning households in the study area. This is because higher farm income supports the farmers to purchase food items which in turn support them to increase their food energy intake status.

*Income from non-farm-*Off-farm income includes non-agricultural wage, self-employment income, petty trading, charcoal and wood selling, and handicraft. The result in table shows that food insecurity is negatively and significantly related with non-farm income at 5% significance level. From the model output, the marginal effect pointed out that a one birr increase in non-farm income decreased the probability of their energy intake deficiency by 0.0292454. This could be recognized to the fact that income produced through off-farm activities may not simple for food security investments or purchase of food crops for bridging the food shortage of their households.

4. Conclusions and Recommendations

This study has analyzed the dimension and determinants of food insecurity in the rural farm households of the Assosa district of western Ethiopia.

The findings showed that the majority, 81.16% of the sampled households, were food insecure during the period of the survey. Male-headed households are more food secured 84.62% than female-headed households 15.38%. The study addressed the four pillars of dimension of food security area such as food availability, access to food, utilization, and stability over time. Among these pillars, the smallholder farmers at study area are mainly characterized by food availability and accessibility. Principally, the households' food is made available or achieved through smallholder farming. The findings show that food insecure households mainly experience- food unavailability in the months of January, February, March, April, May, June, July and August. Whereas the food available months are September, October, November and December because harvesting in the area takes place in this period.

The study has found that out of the total sampled households, 67.39% often utilized cereal crops, such as maize, Teff, and (sorghum for their daily consumption. This indicates that most of the households use few and the same variety of agricultural products in their daily consumption, Furthermore, the study has found that Out of the total sample households 79.7% food insecure households rely on safety net program. Thus most of the households are food insecure and are forced to access the food they consumed from the safety net program. The implication is that food insecurity

continues to affect the communities in the study area, Assosa district. On the other hand, the findings show that the severity of the food insecurity is increasing over the last recent years. That is, the severity of food insecurity is increasing from year to year mainly due infertile soil for agricultural production and continued climate change. The food insecurity situation of the study area is extremely difficult and alarming and needs an urgent response.

The results of the binary logistic regression confirm that the food insecurity of the households in the study area is affected by diverse demographic and socioeconomic factors including age of household head, sex of household, education level of household, income from safety net, farm income, off-farm income, distance to market, access to agricultural service used and number of Oxen were key determinant causes of rural household food insecurity.

This study presented important information, justification and findings concerning the determinants of food insecurity status of smallholder farmers in Assosa district. The following recommendations are made based on the main findings of the study and literatures reviewed.

The number of oxen owned by a household has a direct relation with food security. Thus, while short-term solutions still call for more oxen to be available for households, long-term solutions should encourage introduction and adaptation of improved technologies and agricultural mechanization as weather variability and shortage of animal forage can also limit sustainable use of oxen in the area.

Households who have access to extension service have got more chance of being food secure. This calls for provision of well strengthened and timely extension services.

The Productive Safety Net Program is found to be an option in saving life and sustaining households during food insecure periods. It is significant and positively associated with food security status of the rural households. The possible explanation was that the program provided additional income for food insecure households with which they purchased foods from the market when their stock was very low and thus ensuring food security for their family. The aid is for short term and may create dependence and requires a proper monitoring and follows up. Therefore, the Government and other stakeholders should take into account ensuring sustainable long-term food security by supporting households through agricultural inputs, promoting saving and credit services, and employment opportunities.

The sex of the households was significant and has negative relationship with food insecurity. This indicated that female headed households are more food insecure than male-headed households. Therefore, they require special treatment and this should be taken into account during design and implementation of whatever development programs in general and household food security programs in particular. This means, attention should be given by government and other responsible organizations to female headed households in the design and implementation of household food security programmes.

Distance from the market has a negative and significant

effect on food insecurity. Hence, the government should create suitable situation for market services. The local and regional governments can improve the role of market access for food security by establishing required infrastructure for urban-rural networking.

Finally, food security issues at the Assosa district requires more in-depth and continued study outputs and proper use and implementation of the information gained as the area is found to be influenced by several, interlocked and site specific dimensions and determinants that, of course, require immediate and coordinated attention from different actors.

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