ORIGINAL ARTICLE

Food Security Status and its Determinants Among Rural Households of Tach Gaint District, North West Ethiopia

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Abstract

Food security is a challenge facing all countries, especially those in Sub-Sahara Africa. Ending hunger, achieving food security, and improving nutrition are the Nations' 2030 core goals which Ethiopia is striving to attain. Therefore, assessing rural household food security contributes to this effort. Accordingly, the present study intended to investigate the determinants of rural food security at the household level in Tach Gaint district, South Gondar Zone, Amhara region. The study employed a cross-sectional research design composed of both quantitative and qualitative research approaches. It used a random sampling technique to select sample households. Household surveys, key informant interviews, and focused group discussions were conducted to collect primary data. A total of 200 households were covered by the questionnaire survey. Data were analyzed using descriptive and inferential statistics. The study revealed that nearly half of the sampled households were food insecure. The binary logistic regression results showed seven out of twelve explanatory variables: sex, household size, livestock number in Tropical Livestock Unit, farmland size, oxen number, age, and credit access as determinants of household food security. In conclusion, the determinants of food security are complex and call for multifaceted interventions. Such efforts should include resettling food insecure households where better land resources are available, establishing skill training centers for farming households, enhancing rural credit services, and expanding and improving family planning services.

Keywords: *Food Security, Livelihood Strategies, Dietary Energy, Household*

Introduction

Food security is a situation that exists when all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food that meets their dietary needs and food preferences for active and healthy life (Jemal et al., 2018).

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Food security is one of the major world agendas of today in several contexts. The majority of food insecure and hungry people in the global context live in Sub-Saharan Africa (30%), Asia and the Pacific (16%), Latin America and the Caribbean (9%) and North Africa (8%) (Mequanent et al., 2014). In 2017, about 124 million people in 51 countries faced food security problems (Mebratu, 2018).

Ethiopia lies within one of the most food-insecure regions in Sub-Saharan Africa (Belete, 2017). More than half of Africa's food insecure population live in Ethiopia with a large number of its population living at subsistence levels and are dependent on-farm production highly vulnerable to severe droughts (Dagninet and Adugnaw, 2020). In the country, food insecurity remains a major development challenge due to the synergetic effects of land degradation, rapid population growth, and climate change. The production volume of food grain crops as well as the per capita food production has shown tremendous fluctuations throughout the 1980s resulting in severe food shortage in the country (Kedir, 2017). Over eight million individuals in rural areas of Ethiopia are estimated to suffer from chronic food insecurity, and many more suffer from transitory food insecurity (Sisay et al., 2018). Even in years when rainfall is favorable, it is estimated that around 4 to 5 million Ethiopians depend on food aid indicates that food insecurity is deep-rooted in Ethiopia (Achenef et al., 2018). The famine also had depleted their assets to deal with the famine, which left them even more vulnerable to future crises. The inadequate quality and quantity of food supply to the household members affect the nutritional status of the community. Also, it limits the growth and development of young children and infants, increases adolescent school absenteeism, lowers educational attainment, and affects psychosocial interaction (Prosekov et al., 2018).

In Ethiopia, nearly 33 million people suffer from chronic undernourishment and food insecurity (Dagninet and Adugnaw, 2020). Most of the regions' areas are included under the Safety net program to rehabilitate the farmers' living standards and solve their food insecurity problem (Mesfin, 2014). Amhara region is also part of this program. However, the region is still characterized by the persistence of food security problems and is highly in need of better intervention.

The South Gonder Administrative Zone in North-Western Ethiopia is one of the food insecure areas of the country. Among the 18 districts of the zone, seven are food aid beneficiaries; one of these districts is *Tache Gaint* district (South Gonder Zone Agriculture Office, 2020). Most people in this district are either seasonally or chronically food insecure. A significant number of poor households are depending on food aid, making the district one of the largest beneficiaries of Safety net programs for more than a decade. The causes of food insecurity in the study area could be related to demography, erratic rainfall, soil degradation, and poorly endowed assets. Due to these challenges, farming households in the district could not fulfill the food requirement and create additional assets for their family.

So far, various studies have been conducted on the determinants of food security in different parts of Ethiopia (Yenesew et al., 2015; Seid, 2016; Ambachew and Ermiyas, 2016; Tamarat, 2017; Demeke and Deresse, 2020; Nigusie et al., 2020). But the findings have been mixed and conflicting. So, this study makes an important addition to the existing literature as the issue of food security is dynamic that needs up-to-date data. This is mainly because socio-cultural, political, and economic features in rural settings might change over time. Furthermore, despite the claim that the regional government has given special emphasis to agricultural development strategies and food security programs, and is making efforts to improve the food security situation of the country with the continued assistance provided by NGOs, food insecurity in the study area continues to grow. So, it is

based on the existing high prevalence and recurrence of food insecurity that this research was conceived. The research aims to analyze determinants of food security among rural households in *Tache Gaint* district.

Review of Related Literature

The Evolution of Food Security Concerns

The issue of food security came to the fore in the 1970s, and at the 1974 World Food Conference in Rome, the first explicit acknowledgment was made that this issue concerned the whole of mankind (Napoli, 2011).

Every man, woman, and child has the inalienable right to be free from malnutrition and hunger to develop fully and maintain their mental and physical faculties. Accordingly, the eradication of hunger is a common objective of all the countries of the international community (Napoli, 2011). Now there are thoughts to be almost 200 definitions of food security (Smith et al., 1993) which is a clear indication of differing views and approaches to the problem; but, the definition that has acquired the broadest acceptance is the used at the World Food Summit (WFS) in November 1996:

> *"Food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food which meets their dietary needs   and food preferences for an active and healthy life."*

Based on duration, food security analysts have identified two types of food insecurity: chronic and transitory (Mebratu, 2018). Chronic food insecurity is long-term or persistent and occurs when people are unable to meet their minimum food requirements over a sustained period. On the other hand, transitory food insecurity is short-term and temporary and occurs when there is a sudden drop in the ability to produce or access enough food to maintain a good nutritional status.

Food Insecurity Situation in Ethiopia

Food insecurity has been affecting Ethiopia for the last many years. The determinants of food security differ at different levels i.e. from global to regional and national to household and individual levels because food security is deemed to be a multidimensional phenomenon (Alem-meta and Singh, 2018). According to FAO (2015), an estimated 7.6 million of the rural population are currently considered chronically food insecure, meaning each year they are relying on resource transfers to meet their minimum food requirements. Over the past four years between 2.2 and 6.4 million additional people were food insecure (FAO, 2015).

 Among the major causes of food insecurity, drought risk remains one of the key drivers of food insecurity in Ethiopia. Since 1950, 12 major drought-induced food security crises have occurred. According to (Alem-meta and Singh, 2018), once every 3 or 4 years is a drought year in Ethiopia. Environmental degradation is also a critical factor that aggravates soil los, and deforestation, all of which affect food security. In addition, rapid population growth, rural-urban migration and conflict can contribute to food insecurity (Kedier, 2017).

MATERIALS AND METHODS

Description of the Study Area

The study was carried out in *Tach Gaint* district which is located in the South Gondar Zone of Amhara region of Ethiopia. *Tach Gaint* is bordered on the South by the *Bashilo* river which separates it from the South Wollo Zone, on the West by *Simada*, on the north by *Lay Gaint,* and on the East by the *Checheho* river which separates it from the North Wollo Zone. The district is located 200km North-East of Bahir Dar city, the regional capital. Tach Gaint district lies between 110 22' - 110 4' N latitude and 280 19'_ 280 43' E longitudes. It has an altitude range of 1500-2800masl. Mean minimum and maximum annual temperature ranges from 13oc to 27oc. The mean minimum and maximum annual rainfall range from 900 to 1000mm per annum. There are three agro-ecological zones in the district, namely-kola (tropical) which covers 23.5%, *Woina Dega* (subtropical) which covers 63.5%, and *Dega* (temperate) which covers 13%. The district has 15 rural *Kebeles* and one town: A*rb Gebeya.* The district is characterized by an erratic rainfall pattern, with rainfall distributed over the growing season (mid-June to end-September) (District Agricultural Office, 2020). Based on the 2007 national census conducted by the Central Statistical Agency of Ethiopia (CSA), this district has a total population of 101,956. *Tach Gaint* has a population density of 123.54, which is less than the Zone average of 145.56 persons per square kilometer.
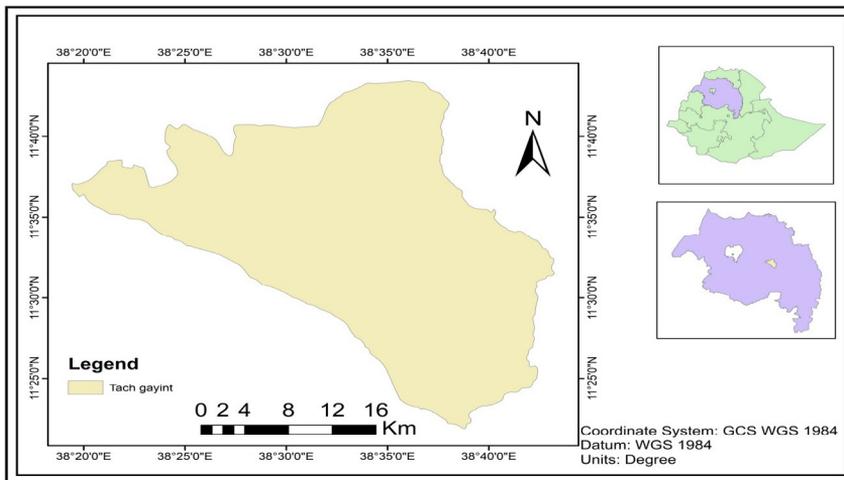

Figure 1 Map of the study area

Study Design, Sample Size Determination and Sampling Techniques

The study employed a cross-sectional research design and follows both quantitative and qualitative research approaches. This is because of the fact that using both qualitative and quantitative approaches can avoid the limitation of using a single approach (Slee, 2006).

Tach Gaint district was selected purposively for the study because of the researchers' prior knowledge of the area. Furthermore, the district is one of the chronically food-insecure districts in the South Gonder administrative zone.

First to make the size of the sample manageable and to get a representative sample from 18 rural Kebeles, all the *Kebeles* were stratified based on their agro-ecological zone (*Kolla, Dega* and Woyna-Dega) from which, one Kebele was randomly selected from each agro-ecological zone. The assumption is that in similar agro-ecological zones households share similar livelihood opportunities and constraints.

For sampling, Kothari's (2004) sample size determination formula was employed.

$$n = \frac{NZ^2PQ}{d^2(N-1) + Z^2PQ}$$

Where;

n=total sample size

N= total number of sample households

Z=standard normal deviation at the required confidence level that corresponds to 95% confidence interval equal to 1.96

d=the level of statistical significance (allowable error) (0.05)

P= the proportion in the target population estimated to have characteristics being measured (from previous studies in other comparable countries i.e. 0.8 from Solomon, 2011)

Q=1-P   i.e. 1-0.8=0.2

Finally, a total of 220 households were sampled for a questionnaire survey from the three rural kebeles using a proportional stratified random sampling technique based on the sampling frames obtained from the rural kebele offices: Bete –Yohanes (Dega) (50), Agate (Woyna-Dega) (95), Benat (Kolla) (75).

Data Sources and Data Collection Techniques

In this study, both primary and secondary sources were used. The primary data were generated by employing a household survey, asking the respective households directly regarding food security issues. Nine enumerators were recruited based on their educational level and prior experience in data collection. Then, training was given to them on the contents of the questions, ethical issues, and general approaches to data collection. Key informant interviews (KIIs) were also held with the district administrators, development agents, community elders living in the sample kebeles, workers in disaster preparedness and prevention office. Similarly, a focus group discussion (FGDs) was held with selected literate and elder farmers.

 In addition, secondary data relevant to the research work were collected from relevant regional, zonal and district office of the agriculture, and from Food Security and Disaster Prevention and Preparedness Office.

Sample Respondents Response Rate

Of the total number of sample respondents, about 91% (200) provided fully completed returns, but 9% (20) of the sample respondents were not available during the survey work due to different social problems. Therefore, this analysis was done based on 200 sample respondents who provided fully completed returns.

DATA ANALYSIS

Based on the nature of the variables measured to analyze the collected data, both descriptive and inferential statistics were employed. The data gathered through the survey questionnaire was coded, edited and entered into a statistical package for social science (SPSS 20.0 for windows) software. Accordingly, frequency distribution, percentage, mean and standard deviation were used to describe the household characteristics. Moreover, Independent sample t-test, One Way ANOVA and Chi-square test were used to see whether there was an association or difference between household food security situation and the different independent variables. The Binary logistic regression model was also used to identify the determinant variables influencing households' food security.

Binary Logistic Regression Model

In this study, binary logistic regression model was employed, with the dependent variable being the dichotomous variable of whether the household is food secure coded (1) and food insecure coded (0) to analyze the factors affecting household food security. Binary logistic regression model was preferred due to its capability to predict a dichotomous response variable based on a mix of continuous and dichotomous predictor variables. Also, it does not take into consideration normal distribution of independent variables. Besides, the binary logistic model is remarkably flexible, and it is unlikely that any alternative model provided a better fit for binary response variables with a powerful predictive power and is more appropriate for transformation (Norusis, 1994).

Description and Measurement of Explanatory Variables

Determinants of food security, which is a dependent variable in this study, was measured in four steps. Firstly, food supply at the household level was determined by compiling a food balance sheet for each sampled household. The following variables entered in the balance sheet as own production of grain (+): grain purchases (+), grain received as gifts/remittance (+), grain borrowed (+), and grain received from hiring in for labor (+), post-harvest grain losses (-), cereals given out for hiring in labor (-), cereals given out for sharing oxen (-) and repayment of crop borrowings (-), and grain used as seed (-). Post-harvest loss (including storage loss) and part of the crop used as seed for the next planting season was estimated at 10% and 6%, respectively (Zenebe, 2012). Adult equivalent unit calculated from WHO (1985) was employed in this study. Besides, the conversion factor was employed to convert the available grain to total kilocalories available for each household. Secondly, the food supply at the household level calculated in step one was used to calculate kilocalories available per person per day for each household. Thirdly, following WHO (2011), 2100 kilocalories per person per day was used as a measure of calories required to enable an adult to live a healthy and moderately active life. Fourthly, the difference between kilocalories available and kilocalories demanded by a household was used to determine the food security status of households whose available perception kilo calories were found to be greater than their demand were regarded as food secure and were coded as 1, while households experiencing a kilocalorie deficit were coded as 0.

Table 1. Description and measurement of explanatory variables

Variables	Variable nature	Measurement of variables
Sex of household head	Dummy	1 = male, 2 = female
Age of household head	Continuous	Year
Education level of household head	Dummy	1= literate, 0=illiterate
Livestock ownership	Continuous	TLU
Farm size	Continuous	Hectare
Credit access	Dummy	1 yes, 0 otherwise
Household size	Continuous	Number
Distance to market	Continuous	Km
Dependency ratio	Continuous	Number
Oxen number	Continuous	Number
Engagement in off/non-farm activities	Dummy	1=engaged; 0=not engaged
Utilization of modern agricultural input	Dummy	1=utilize; 0=not utilize

RESULTS AND DISCUSSION

The study result in table 2 describes the overall sampled household head. Most of the representative households are male-headed households (82%), while the remaining are female- headed households (18%). The average family size of the households is estimated to be 5.5. The mean age of the household was estimated to be 55 years. Concerning the educational status of the household heads, more than half of them were unable to read and write.

Regarding the livestock ownership of the households, Livestock production plays an important role both in the crop producing and pastoral areas of the study area. The average livestock ownership of the households in terms of tropical livestock units was estimated 6.00 TLU (table 2). Landholding is also the other important base of the households' economic diversification. Land is by far the most important productive resource in agriculture. Fertility status, location, and other attributes of land in association with its size made it a binding resource in agriculture (Tegegne, 2020). The average farmland holding for the whole sampled households was 1.1 ha which was less than the regional average (1.16 ha) and the national average (1.37 ha) (Tegegne, 2020).

Table 2. Socio-economic and household characteristics of sampled households

Variables	Minimum/maximum	Mean
Age	30/80	55
Family size	1/10	5.5
TLU	0/ 12	6
Landholding	0/ 2.2	1.1
Variables	Category	Percentage
sex	Male	82%
	Female	18 %
Education level	Literate	15%
	Illiterate	85%

Source:-Survey result

Food Security Status of the Households

This study entirely depended upon sample households' calorie intake to categorize households as food secure and food insecure. The WHO (2011) has set the minimum subsistence food requirement per adult equivalent (AE) per day 2100 kcal. Households that consume below this minimum requirement were grouped as food insecure whereas those who consume above the standard were grouped as food secure. Thus, the mean kilocalorie of the whole sample households was 1975.4 with a standard deviation of 484.6. The minimum and maximum mean kilocalories of households were also found to be 680 and 3700. Of the total households, about 47% were found to be food insecure. Though Ethiopia has planned to eradicate extreme poverty for all people everywhere by 2030, still nearly half of the sampled households in the study area were found to be food insecure. The study also revealed that about 35%, 46%, and 58% of the households based in Bete –Yohanes (Dega), Agate (Woyna-Dega) and Benat (Kolla) respectively, were found to be food insecure. One Way ANOVA was run to see whether or not there was a significant relationship between the three groups. The result depicted that there was a statistically significant difference between the three agro-ecological zones at $P<0.001$.

 FGDs and KIIs back up the findings, claiming that rainfall distribution in Dega is better than in Woyna-Dega and Kolla, resulting in higher livestock and agriculture yield. Dega had better livestock dispersal than the other zones due to better grazing.

Determinants of Household Food Security

The binary logistic regression was used to regress the dependent variable (food security) against twelve independent variables to identify the determinant factors for household food security. Out of the total predictor variables, seven were significant at 1% and 5%, significance levels. The predictive efficiency of the model showed that out of the 200

households included in the model 175 (87.5%) were correctly predicted. The model also correctly predicted 90.4% of the food-insecure households and 84.9% of the food secure households in their respective categories. This showed that the model is fit for further analysis.

The Omnibus test of the model coefficient has Chi-square value of 174.856, which was strongly significant (at P< 0.001) indicating that the predictor variables selected have a high joint effect in predicting the status of household food security. The Cox and Snell and Nagelkerke R-square values of the model were 0.583 and 0.778, respectively. Hosmer-Lemeshow test result also reported Chi-square value of 7.143 with P- value of 0.521. This P- value showed that there was no difference between the observed and the model predicted values, and hence, estimates of the model fit the data at an acceptable level. The value of VIF and tolerance indicated that all the continuous variables have no multicollinearity problems. The value of contingency coefficients showed that discrete variables have low association.

As revealed in table 3, analysis of logistic regression result depicted that seven variables; sex of the household head, household size, livestock number in TLU, farmland size, Oxen number, credit access, and age of the household head which were found to be statistically significant in predicting the dependent variable.

Sex of the household head: male-headed households were found to be better food secure than female headed ones. The regression results also showed a strong relationship. The possible justification for this could be male-headed households can participate more actively in any livelihood activities than female-headed households. The Chi-square test indicated that there was a significant difference between food security and sex of the household head at P< 0.001. Likewise, the mean kilocalorie intake of male and female household heads was computed and the result was obtained 2100.9 and 1383.7 with a standard deviation of 381.4 and 486.1, respectively. Independent sample t-test was run to see whether or not there was a significant difference between the mean kilocalorie intake of male and female-headed households. The result showed that there was a statistically significant difference between household heads at P< 0.001. The result is consistent with the works of Mesfin (2014), but inconsistent with the findings of Alemeta & Singh (2018).

Family size: family sze was considered and hypothesized as one of the potential variables that would have due contribution to food insecurity. From the total number of sampled respondents, the over whelming majority (60%) of them had a family size of 4-6. The remaining 17% and 23% had a family size between 1-3 and 7-10, respectively. The binary logistic regression result indicated that there was a statistically significant relationship (at P<0.05). The odds ratio also revealed that a unit increased in the number of family size, the probability of households being food secure decreased by a factor of 0.196. The reason is that in an area where households depend on less productive agricultural lands, increasing household size results in increased demand for food. However, this demand would not be matched with the existing food supply, so it would ultimately end up with food insecurity. This finding conforms to the findings of Muhamd & Steven (2012), Mesfin (2014), Ahmedet et al. (2017).

Livestock ownership: livestock production plays an important role both in the crop producing and pastoral areas of the study area. Livestock holding in terms of average tropical livestock units for the total sample households was 2.28 TLU with a standard deviation of 0.5. The maximum amount of livestock holding in terms of total tropical livestock units was six and the minimum was zero TLU. The larger the number of livestock

owned, the more likelihood that a household would be food secure. As livestock ownership increased by one unit (TLU), the odds of being food secure increased by a factor of 4.938. This is due to the fact that livestock, in addition to contributing to subsistence needs and nutritional requirements, as well as crop production through the provision of manure, also serves as a source of wealth that can be disposed of in times of need, particularly when the household's food stock deteriorates. The outcome is consistent with Abafita and Kim (2014), Muhammed and Ram (2012), Belete (2017) findings.

Landholding size: this is found to be positively associated with the chance of households being food secure (at P<0.001). As farmland size increased by one unit (in ha), the odds ratio of being food secure increased by a factor of 10.866. The possible justification is that farm households who had larger farm sizes had a better chance to produce more, diversify the crop they could produce and get a larger volume of crop residues. This result is supported by the findings of Mequanent et al (2014), Oyetunde and Olagunju (2019), Tegegne (2020). The result was also consistent with FGD and KIs participants with the survey result, and they explained that food-insecure households were characterized by nil or smaller farmlands than food-secure households.

Oxen ownership: this has a positive and significant relationship with food security at (P<0.001). Other variables being constant an increase in the number of oxen by one unit, household's food security increased by the odds ratio of 9.716. The possible explanation is that households with more oxen would have sufficient draught power and could produce more crops unlike those who are ox less. The result is consistent with the findings of Ahmed (2015) and Debebe et al (2020). KIs and FGD stated the difference between oxen ownership of the food secure and food insecure households owning to the vital role of oxen to carry out production which is the prime activity in the study area. Therefore, households who could own a pair of oxen or implement repeated plowing and prepare their farmland in a good manner and get better yield too and are food secure.

Table 3. Logistic Regression Result on Determents of Food Security

Predictor Variables	B	S.E.	Wald	Sig.	Exp (B)
Sex of the household head	1.922	0.711	7.301	0.007**	6.835
HH size	-1.630	0.689	5.591	0.018*	0.196
Dependency ratio	-1.008	0.949	1.130	0.288ns	0.365
Livestock in TLU	1.597	0.633	6.358	0.012*	4.938
Engagement in non/off farm Activity	0.618	0.653	0.895	0.344ns	1.855
Utilization of modern agricultural inputs	1.132	0.699	2.624	0.105ns	3.103
Farm size	2.386	0.745	10.263	0.001**	10.866
Oxen number	2.274	0.699	10.578	0.001**	9.716
Credit access	1.222	0.308	15.739	0.000**	1.295
Distance from the market Center	-0.982	1.243	0.624	0.430ns	0.375
Educational of HHHs	-0.208	1.080	0.037	0.847ns	0.812
Age of HHHs	-1.654	0.670	6.095	0.014*	0.191
Constant	5.394	2.550	4.473	0.034*	220.106

*Significant at 0.05, **significant at 0.01, ns=not significant

Age of the household head: Most of the household heads were found in the age group 41-50 which is 36% while the number of respondents in the two extreme age groups (>70 and < 30) was quite small. Age of the household head showed a positive relationship with food security which was statistically significant (at P<0.05) probability level. This means that an increase in the age of the household head increases the likelihood for the household to become food secure. This happens because as rural households acquire more and more experience in farming operations, accumulate wealth and use better planning, they have better chances to become food secure. The result is in line with the findings of Tegegne (2020), Seid (2016).

Credit access: credit for consumption or purpose of agricultural inputs like improved seeds, chemical fertilizers, etc. improves the food security status of households. In the study area, about 37% of the respondents used credit as observed during the field survey. Credit was hypothesized to have a positive influence on food security. In agreement with the hypothesis, its coefficient came out to be positive and significant (at P<0.001). This might be because households who have got the opportunity to receive credit would build their capacity to produce more through purchase and would use of agricultural inputs. It would also be possible for the households to spend the credit on some other income-generating activities so that the income from these activities would put households in a better status to escape from being food insecure. The result is consistent with the findings of (Debebe et al., 2020), (Mebratu, 2018).

CONCLUSION

Transitory and chronic food insecurity in Ethiopia in general, and the study area in particular, are the most recurring challenges, and the ends of these predicaments need detailed investigation and immediate interventions. Thus, this study examined the determinants of food security in the rural farm households of the Tach Gaint district in North West Ethiopia. The result from the descriptive analysis indicates that nearly half of rural households are food insecure. The Binary logistic regression model analysis identified that the rural household food security was affected positively and significantly by sex of the household head, household size, livestock number in TLU, farmland size, oxen number, and credit access.

 Given the prevalence of food insecurity rural farm households found in the study area, increasing agricultural output is crucial to addressing the issue. As a result, national and regional governments, as well as non-governmental organizations (NGOs), have to work to improve agricultural productivity, strengthen skill training centers, expand rural credit services, expand and improve different family planning techniques, and possibly relocate farming households to other parts with better land resources in the region.

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