SOCIOLoGY | RESEARCH ARTICLE

Determinants of food security status of household in Central and North Gondar Zone, Ethiopia

Wondim Awoke¹*, Kefale Eniyew², Genenew Agitew and Belete Meseret

Abstract: In rural Ethiopian food, the security status of the household is at the most horrible stage. Ensuring food security in Ethiopia is becoming a great challenge due to different factors. Therefore, the study aimed to identify determinants of food security in the study area. A simple random sampling technique was employed to take 500 sample respondents. Both quantitative and qualitative types of data were collected. Primary data were collected through interview schedule, focus group discussion, and key informant interviews. Household Dietary Diversity Score (HDDS) was used to assess the household’s food security status and a binary logit model was employed to identify the determinants of food security status of a household. The result of the study indicated 38% of households were food secure and 62% of them were food insecure. Access to training, sex, and family size were significant at 10%. The number of oxen, off-farm, farmland size, and age were significant at 5%. However, the tropical livestock unit, livelihood diversification and household on-farm income were significant at 1%. Therefore, since majority of the households were food insecure, appropriate stakeholder selection to support household engagement in different income generating activities as well as providing a timely

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PUBLIC INTEREST STATEMENT

To be food secured, people need nutritious food to meet dietary needs at all times for proper function as well as for their overall development. However, the problems of food security in Ethiopia persist as an important challenge of development. In the process of identifying the problems and recommending possible policy actions, academicians, practitioners and communities in different parts of the country have made various attempts. This work is part of the wider endeavor towards tackling the challenges based on specific social, economic and environmental contexts. Although there are various ways of studying the issues, this paper addresses on how demographic and socio-economic factors determine the household food security in the specific area studied. The article could also serve as a source of information to context-specific intervention and trigger for further study to better understand the situation of food security.
and adequate supply of agricultural technologies should be considered to improve the existing food security situation.

**Subjects:** Development Studies; Gender & Development; Rural Development; Economics and Development

**Keywords:** Determinants; food security; dietary diversity scores

1. Introduction

Most rural communities in Ethiopia depend on agriculture (FAO, 2015) as the source of food and income (FSIN, 2017). Nevertheless, it is characterized as small scale with low productive and vulnerable to weather and production-related shocks (Bezabih et al., 2014). In 2019, the agricultural sector in Ethiopia contributed 33% of GDP and the sector remained the top-export earner for the country with close to 82% of all exports coming from it (Ethiopian Economics Association, EEA, 2021). Other current food crises in Ethiopia are the failure to invest in sufficient local food production and the collapse of pastoral livelihoods. As a result, hunger and poverty are prevalent, which leads farmers to be chronically food insecure (FAO, 2015) and around 10 million chronically food-insecure people are targeted to PSNP (FSIN, 2017).

In the developing world like Ethiopia, different challenges face rural communities to be food secured (Anderson & Elisabeth, 2015; Wiseman et al., 2010) like multifaceted variability of rainfall and temperature (MoA, 2014). Also during 2015/16, a large segment of the population in Ethiopia was vulnerable to drought as a result of food insecurity (Cochrane, 2017). To give remedy for food security problem, social protection program by the governmental and non-governmental organizations was implemented (Food Sovereignty Brief, 2013; MoA, 2014; World Bank, 2013). In addition, government and donor organizations were working together to tackle food insecurity through the “Food Security Program” starting from 2003. Not only the governmental and non-governmental organizations but also local communities tried to resolve the problem of food security through diversifying their assets, income, and activity (Barrett et al., 2001; Ellis, 2000) but the problem is still prevalent in the country particularly in the study area.

Endalel et al. (2014) researched food insecurity status and analysis of factors affecting food insecurity in households of the Farta district. However, this research varies on the location in which it was conducted. Yehuala et al. (2018) also researched West Belasa to identify the food security status of the households, its determinants, but the research focuses on productive safety net program (PSNP) beneficiaries only, and the study location was different. With different objectives and locations, Welay (2017) researches the impact of food security package loans on food insecure households' income in west Belesa.

As stated above, different empirical studies have been conducted in Ethiopia but this study was initiated due to a lack of detailed information about food security status and determinants of households. This investigation was also varying in location. Therefore, the study was conducted to generate and compile the knowledge gap on food security status and determinants of households in food-insecure areas.

2. Literature review

2.1. **Determinants of food security status**

FAO (2003) is the most commonly used definition of food security, which defines food security as “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 an active and healthy life.” Nevertheless, the food security status of the household is determined by different factors in
developing countries. According to Mannaf and Uddin (2012) determinant factors, which affect the food security of a household, were age, family size, monthly agricultural income, and food expenditure. In South Africa factors affecting rural household food security status were household income, family size, age, employment status, gender, and marital status (Sekhampu, 2013). Likewise, various studies were conducted in Ethiopia to investigate determinants of food security.

According to the empirical studies, there were socio-economic, demographic, and environmental factors, which affect the food security status of a household. A study conducted by Welderufael (2014) revealed that factors such as family size, education, consumption, employment opportunities, asset ownership, farm inputs and farm size were significant determinants of food insecurity. Age, family size, off-farm and non-farm income, access to irrigation, farm income, distance to market and access to credit affected the extent of households’ food insecurity (Sani & Kemaw, 2019). The finding of Echefi et al. (2017) also showed that the food security status of the rural households was influenced by years of education, credit access, farm size, monthly income, age and family size. Access to agricultural extension services, off-farm income, number of oxen, total land size and safety net participation were determinants of household food insecurity (Negash & Alemu, 2013). Household food insecurity was affected by family size, total income, distance from the market, total livestock holding, and losses of crops (Yehuala et al., 2018). Also investigators such as Mut (2013), Abafita and Kim (2014), and Dendir (2014) also identified tropical livestock units, number of oxen and total land size as determinants of food security status of rural households in Ethiopia, respectively.

According to WFP (2019) to measure the household food access and vulnerability to shocks, food source was used as proxy indicator. Households who depend more on purchased food was vulnerable to high food prices. According to Awoke et al. (2021), the main source of food for the farmers was own production (63.8%), purchased (17.6%), gifts from family/neighbors (0.6%) and FSP (productive safety net program/food aid) (18%) in North and Central Gondar Zones. Purchased food sources were the second-largest source of food in the study areas for the household, hence they were vulnerable to the price increase. Even though, the main sources of food were not enough (insufficient) to feed their families, the main sources of food were from farmers own production.

Ethiopia is one of the most food and nutrition insecure, suffering of famine that affects large proportion of the people (Abduselam Abdulahi, 2017). According to the Central Statistics Agency of Ethiopia (Central statistical agency of Ethiopia (CSA), 2014), more than 30% of the Ethiopian population lives below the food poverty line and cannot afford the minimum calorie intake for a healthy life. Similarly more than 8.5 million people of the country required emergency and food aid assistance. Research in food and nutrition security attracts the attention of academicians, policymakers and practitioners around the world in large part as the consequences of food insecurity affect almost every facet of society (Feleke, 2019). This reveals that the food insecurity problems of Ethiopia are very high, indicating that intervention mechanisms need to be designed through evidence-based research.

3. Materials and methods

3.1. Data source and method of data collection

Both qualitative and quantitative data were collected from primary and secondary sources. Data collection tools such as interview schedule, focus group discussion (FGD), and key informant interview (KII) were used to collect primary data. The interview schedule questionnaire was pre-tested to check its importance to collect relevant data to attain the stated objectives. Hence, a pilot study is an important step in the research process to pre-test and check the interview schedule questionnaire for appropriate data collection. It is also important to test and determine the validity and reliability of the research tools. Thus, pilot study was conducted at Wegera district that was excluded from actual data collection. During the pilot study, respondents were debriefed to test the understanding and adequacy of the questionnaires. At the time of debriefing,
respondents were asked what they understand from each question was asking. In addition, respondents were asked about the presence of words that are not understandable or any expressions, which are unacceptable or offensive. Then after questionnaires were edited, based on comments given by respondents and the revised version was finally prepared. Household Dietary Diversity Score (HDDS) indicator data were collected on household food consumption using the previous seven consecutive days reference period.

Focus group discussion and key informant interviews were used to triangulate data collected through the interview schedule. Smallholder farmers and experts (from the agricultural office and food safety net program) were included under FGD and KII. Two focus group discussions (one-group smallholder farmers and one-group experts) were held in each district with 6–11 participants. 59 and 30 individuals were participated in FGD and KII, respectively. The secondary data were collected through reviewing published and unpublished documents.

3.2. Sampling techniques and method of data analysis
A multi-stage sampling technique was employed to select study locations and sample respondents. Districts, which were included under the food security program, were purposively selected. Then, the districts were stratified into highland, midland, and lowland. Two representative kebeles (lowest administrative unit) from each district were selected purposively. From the sample frame, 500 sample respondents were selected through a simple random sampling technique. The simple random sampling method was employed to avoid biases while selecting the sample respondents. Existing sample frame and nature of data (homogeneity and heterogeneity) were the major important things to decide the number of a sample taken from each study area. From each study, kebeles’ number of sample respondents was determined proportionally to their sample size (Table 1). Hence, Kothari (2004) formula was applied to determine proportional sample size:

\[ n_J = \frac{(N_J)n}{N} \]  

where

- \( n_J \) = number of items to be taken from J stratum
- \( N_J \) = total number of items in the stratum
- \( N \) = the size of the total number of households
- \( n \) = sample size

Analyses of the data were carried out by using Statistical Packages for Social Sciences (SPSS version 20.0). Household Dietary Diversity Scores (HDDS) and econometrics models were used to analyze the data collected. The type and quantity of food items consumed by the household for seven consecutive days were collected using weighed records method. Then it was converted to a kilocalorie and then divided to household size measured in adult equivalent (AE) and the number of days. Following this, the amount of energy utilized in kilocalories by the household was compared with the minimum subsistence requirement per adult per day (i.e. 2100 kcal).

The dependent variable is a dummy variable (binary), which takes a value of zero or one depending on whether sample respondents were food secure or not. Therefore, the binary logit model was employed to identify the determinants of household food security status. Even though, binary logit and probit yield similar parameter estimates, the binary logit has an advantage over probit in the analysis of dichotomous outcome variables because it is extremely flexible and easily used. In addition, it transforms the problem of predicting probabilities within (0, 1) interval to the problem of predicting the odds of an event occurring within the real line (Hosmer, 2000).
Table 1. Shows sample area and sample respondents were taken from the total population (sample frame)

| District            | Kebele | Total population | Sample taken |
|--------------------|--------|-----------------|--------------|
| Wegera (High land) | Taga   | 1650            | 140          |
|                    | Jaje   | 1349            | 114          |
| East Belsa (Low land) | Abshika | 913             | 77           |
|                    | Shemis | 789             | 67           |
| Debate (Mid land)  | Dekoa  | 848             | 72           |
|                    | Tinsaye | 349         | 30           |
| Sum                |        | 5895            | 500          |

Source: Agricultural office (2019)

According to Gujarati (1995), the binary logit model is specified as

\[ L_i = \ln \left( \frac{p_i}{1-p_i} \right) = \beta_0 + \beta_1 X_i \]  

(2)

where \( p_i \) = the probability that \( Y = 1 \) (that a given household is not food secured);

\( 1 - p_i \) = the probability that \( Y = 0 \) (that given household is food secured);

\( L \) = the natural log of the odds ratio or logit;

\( \beta_i \) = the slope measures the change in \( L \) (logit) for a unit change in explanatory variables (\( X \));

\( \beta_0 \) = the intercept. It is the value of the log odds ratio, \( \frac{p_i}{1-p_i} \), when \( X \) or explanatory variable is zero.

If the stochastic disturbance term (\( U_i \)) is considered the binary logit model becomes

\[ L_i = \beta_0 + \beta_1 X_i + U_i \]  

(3)

Model goodness of fit were tested by Hosmer-Lemeshow test and multicollinairity problems were checked.

4. Result and discussion

4.1. Food security status

Not all people are experienced by food security status in the same way at all times even the changes have happened (Hadley et al., 2011). The households in the study area were consuming food items such as cereal crops, horticultural crops (vegetable and fruit), pulse and oil crops, and oilseed products. Besides, the households consumed animal products such as milk, meat, egg, cheese, and butter as well. After the conversion of the food items consumed to kcal/AE/day, the result of the study revealed that 190 (38%) of households were food secured while 310 (62%) of them were food insecure implied that the majority of households were food insecure (Table 2). The finding of FAO (2012) also confirmed that more than half (52%) of the rural population was food insecure. Besides, a study conducted by Sani and Kemaw (2019) revealed that more than half (53.62%) of a household were food insecure. Similarly, households with more than half (67%) were unable to meet their daily food energy requirement (Echebiri et al., 2017). However, Yehuala et al. (2018) found that 35.8% of the respondent households were food insecure, which is less than food secured households. Mota et al. (2019) also revealed that the majority (71.6%) of rural households were food insecure. In addition, the trend of feeding practice of family compared with previous was increasing 42 (8.4%), decreasing 342 (68.4%), and constant 116(23.2%). The living standard of the family compared with previous years was increasing 55 (11.0%), decreasing 303 (60.6%), and
constant 142 (28.4%). The result indicated that the majority of households’ feeding practices and living standards were decreasing as compared to the previous year. FGD and KII also support the decreasing living conditions of sample respondents as compared to the previous years. The decreasing living condition of sample respondents was caused by decreasing soil fertility and consequently a decrease in production and productivity of crop and livestock production.

4.2. Determinants of household food security status

Before entering the variables, contingency coefficient and variance inflation factor (VIF) were calculated for dummy and continuous independent variables, respectively, to check the multi-collinearity problems. The contingency coefficient value was less than 0.75 and the variance inflation factor was less than 10. The computational results of both the contingency coefficient and variance inflation factor revealed that there is no multicollinearity problem. A binary logit model was employed to identify the determinants of the food security status of the household. The dependent variable is household food security that takes a value equal to 1 if the household is unable to meet its minimum calorie requirement (2100 kcal per adult equivalent), 0 otherwise.

The goodness of fit test indicated that the model fits the data well. The Hosmer–Lemeshow test of goodness of fit also accept the null hypothesis that the model fits the data well. Consequently, the Hosmer and Lemeshow test statistic proves a significant association between the observed and the model’s prediction of a household’s food security status. In the model, fifteen explanatory variables are included based on empirical studies and the study area’s existing situation. Of which, 10 variables such as age, sex, land size, total family size, Tropical Livestock Unit (TLU), Livelihood Diversification (LD), Households Total Annual Income (HHTI), access to training, participation in off-farm activity and number of the oxen are significant predictors of food security status of sample respondents (Table 3). They were discussed in detail as follows;

**Age of household head:** The result shows that the age of household head had a positive relationship with the food security status of household and significant at 5%. This indicates that the older the household head, the higher the probability that the household would be food secure. A unit increase in the age of the household head will increase the probability of the household to be food secured by 1.05. This could be attributed to the fact that the productivity of old household heads will increase, as they get older and older. Since as age of the household head increase will increase the experience of households in agricultural production. Therefore, older people are more likely to have more farming experience and more output resulting in their families have a better probability of being food secure. This result is consistent with the findings of Sekhampu (2013). Converse to these results older households may face the challenge of declining productivity and efficiency hence result in less probability to be food security (Echebiri et al., 2017; Faustine, 2016; Sani & Kemaw, 2019). The result of FGD and KII also confirmed that older farmers have better experience compared with youth. In addition, dependent families decrease with the increasing age of households.

**Sex:** The sex of the household head had a positive relationship with the food security status of the households. In particular, the male head household had a positive impact on household food security. It was significant at a 10% probability level. The male-headed household had better food

### Table 2. Household food security status

| Food security status | Frequency | Percent |
|----------------------|-----------|---------|
| Food secure          | 190       | 38.0    |
| Food insecure        | 310       | 62.0    |
| Total                | 500       | 100.0   |

Source: Survey Data (2019)
security than a female-headed household. A unit increase in a male household will increase the probability of household food security by 2.69 with other variables being constant. The female head households, who were the main income earner, faces various challenges such as shortage of time, shortage of technologies that suit the physical condition and lack of freedom to move outside the community to perform different activities. They were also responsible for maintaining the reproductive role rather than a productive role to earn their income (Kassa & Kefale, 2018).

Since female-headed households were expected to have less food security status than their male-headed household. The result was in line with Faustine (2016). Contrary to the result, Sekhampu (2013) reported that female-headed households were better food secured than male-headed households due to better utilization of resources. As data collected through FGD female, headed households (widowed and divorced) were mostly engaging inside the house, which is tedious with less participation in outside activities due to cultural factors. As data collected KII most of the female-headed households culturally consider themselves mediocre compared with male-headed households. Also, males see themselves better than female-headed households.

**Total family size:** Family size is measured in the number of the household members who shared commonly every aspect with the household head. The result indicated that the total number of the family has negatively related to household food security status and it is statistically significant at the 10% probability level. The negative sign implies that the probability of food security decrease with an increase in family size. A unit increase in the number of the family will decrease the food security status of the household by 0.16 while other variables are held constant. A farmer having

### Table 3. Determinants of food security status of the household

| Variables              | Coefficient | Standard Error | P-Value | Odds ratio |
|------------------------|-------------|----------------|---------|------------|
| Age                    | 0.05**      | 0.03           | 0.037   | 1.05       |
| Sex                    | 0.99*       | 0.55           | 0.072   | 2.69       |
| Total family size      | -0.175*     | 0.09           | 0.051   | 0.84       |
| Total land size        | -0.66**     | 0.31           | 0.035   | 0.52       |
| TLU                    | -0.61***    | 0.08           | 0.000   | 0.54       |
| LD                     | -5.55***    | 1.56           | 0.000   | 0.004      |
| Off-farm               | 1.06**      | 0.37           | 0.004   | 2.90       |
| Non-farm               | -0.52       | 0.53           | 0.33    | 0.59       |
| On-farm                | 0.00***     | 0.00           | 0.00    | 1.00       |
| Aid                    | -0.52       | 0.34           | 0.13    | 0.60       |
| Access to training     | 0.62*       | 0.32           | 0.06    | 1.87       |
| Utilization of fertilizer | -0.07     | 0.370          | 0.84    | 0.93       |
| Farming experience     | 0.03        | 0.02           | 0.11    | 1.03       |
| Oxen                   | 0.53***     | 0.25           | 0.03    | 1.71       |
| Educational status     | -0.02       | 0.40           | 0.96    | 0.98       |
| Constant               | 9.58        | 3.77           | 0.01    | 14497.73   |

N = 500

Chi-square = 33.42***

−2 Log likelihood = 285.409

Cox & Snell R Square = 0.53

Nagelkerke R Square = 0.72

Note: *, ** and *** refers to significance at 10%, 5% and 1% probability level, respectively.

Source: Survey Data (2019)
more families may be faced with difficulty feeding their families. So, the existence of large number of family size in the household affects their wealth and tends to be food insecure as compared to households with small family size. Besides, most of the respondents were far from access to agricultural technologies for the production of ample food, which can feed more families. More number of a family with no utilization of improved technology leads to food insecurity. This result is consistent with findings of (Echebiri et al., 2017; Endalel et al., 2014; Mut, 2013; Negash & Alemu, 2013; Sani & Kemaw, 2019; Sekhampu, 2013; Welderufael, 2014; Yehuala et al., 2018). Contrary to this, Faustine (2016) concludes that more family size helps to provide more labor for production and has a positive association with the food security status of a household. As data obtained from FGD and KII, there was land scarcity with poor utilization of improved technologies (land management practices and seed and fertilizer) but there was a population increment. This implied households faced food shortages.

**Total farmland size:** The size of the land measured in the hectare that households possess is negative relation with the household’s food security status at a 5% significance level. The negative sign shows that household who own larger size farmland is more likely to be food insecure than those with relatively smaller farmland size. The result of the study indicated that as the land size holding increases by one more hectar the probability of being food secure decreases by 0.48 while other things held constant. Data collected through FGD and KII showed that farmers who own more land couldn’t modernize it and focus on increasing their farmland and face financial constraints to purchase fertilizer. They focus on extensification rather than intensification. This result indicated that increasing farmland with no utilization of improved technologies has no guarantee to improve their food security status. However, opposing the research result (Dendir, 2014; Echebiri et al., 2017; Faustine, 2016; Negash & Alemu, 2013; Welderufael, 2014) found that total farmland size has a positive association with the food security status of the household.

**Tropical livestock unit (TLU):** Household ownership of livestock has a negative association with food security status at a 1% significance level. Having more livestock is likely to be food insecure than those who have fewer livestock numbers. According to the finding, the probability of being food secured decreases by 0.46 if the household owned one more additional livestock while other things held constant. In the study area, livestock production is traditional with poor management. Farmers focused on quantity rather than the quality of livestockless food security status. Contrary to the finding (Faustine, 2016; Mut, 2013; Welderufael, 2014; Yehuala et al., 2018) TLU is positively related to the food security of the household. Also during focus group discussion, most of the participants agreed that households who have a higher size of livestock have food insecurity than those who have fewer livestock numbers since households who have less livestock are better management than more livestock. This shows that having more TLU with poor management has no pledge to be food secure.

**Livelihood diversification (LD):** The result shows that the households who decide not to diversify their livelihood were a negative relationship with the household food security status. It was significant at a 1% significance level. This implies that a unit decrease in the diversification of their livelihood food insecurity will increase by 0.996, holding all other things constant. Data obtained from focus group discussions and key informants indicated that livelihood diversification is one of the risk-minimizing strategies. Consequently, farmers who are failed to diversify their livelihood are risk-takers and less food secure. The study conducted by Welderufael (2014) also confirmed that household livelihood diversification is essential for the achievement of food security. Echebiri et al. (2017) also revealed that income diversification has a significant and positive relationship with the food security status of a household.

**On-farm income:** The result implies that the household’s on-farm income was a positive relationship with food security status and was significant at a 1% probability level. This revealed that the higher the household on farm income, the higher is the probability that the household would
be food secured. A unit increase in the level of on-farm income will increase the probability of the household being food secure by 1.000 while other things were constant. If farmers have more on-farm income, they are better food secured than the farmer who has less farm income. The finding was consistent with (Sekhampu, 2013; Yehuala et al., 2018). According to FAO (2017), ensuring regular and decent incomes for consumers are essential to achieve good nutrition, purchase healthy foods this intern helps for food security.

**Access to training**: Access to training is found to be positively related to household food security status though it is significant at a 10% significance level. This result revealed that access to training has been positive and an increase in access to training will increase the household’s food security status by 1.87 while other things being constant. The result implies that access to training may help much to improve the food security status of households. A farmer who has better access to training has better awareness about improved technologies and has an opportunity to improve their food security status. Adu et al. (2018) also confirmed that training has a positive association with the food security of the household. Moreover, access to training has a positive impact on household food security because it helps households to change and modify the agricultural knowledge, the capacity, and increase production and incomes (FAO, 2007; Stewart et al., 2015).

**Off-farm**: In this study, off-farm income refers to the income generated from natural resource products and daily laborer on other farming activities such as rent land, charcoal selling, wood and wood product selling. Involvements in off-farm activity have a positive relationship with the household’s food security status. It is significant at the 5% probability level. The positive coefficient of off-farm activity implies that a unit increase in off-farm activity engagement will increase the food security status of the household by 2.90 with other variables constant. As confirmed by focus group discussion farmers who involve off-farm activity in addition to farming have better food security status than a farmer who did not participate in the off-farm activity. As usual farming activity may not perform throughout the year. Hence, participation in an off-farm activity in free time i.e not peak time of farming is important to improve the food security status of the household. This finding is consistent with (Endale et al., 2014; Negash & Alemu, 2013). The result is divergent from the finding of (Faustine, 2016; Sani & Kemaw, 2019).

**Oxen**: It is statistically significant at a 5 percent significance level and positively related to food security status. Hence, as unit increases in oxen number will increase the food security of the household by 1.71. Farming is a major source of livelihood for rural communities in study areas. Hence, oxen were used to plow for feeding their family. Therefore, a farmer who has oxen is better food secure than a farmer who has no oxen. The finding of the study is consistent with prior findings of (Abafita & Kim, 2014; Negash & Alemu, 2013). Data collected through focus discussants also confirmed that farmers who have more oxen were better to fetch better income and better food security.

5. **Conclusion and recommendation**

Food insecurity is being a serious problem in the study area. Communities’ ability to respond challenge of food insecurity is decreasing from day today. The study result revealed that the majority of the household feeding practice and the living standard were decreasing. The result of the Household Dietary Diversity Score (HDDS) indicated that the majority of sample respondents were food insecure. Since majority of the households were food insecure, food security strategy should be designed which increases food supply, food access and strengthening emergency responses. The food security status of the household was determined by different socioeconomic factors. The binary logit model was used to identify those socioeconomic factors. They were affecting the food security status of the household either positively or negatively at different significance levels. Based on the conclusion made, appropriate stakeholder selection and strengthening linkage is an important thing to improve the existing food security situation of the household. The participation of farmers before and after the implementation of food security
improvement programs is crucial to be aware of them. In addition, those variables that affect households should be considered for the improvement of the living standard of the community. Stakeholders should design strategies to improve farmers livelihood diversification and on farm and non-farm activities engagement. Farmers who live in pocket areas of the study area were food insecure due to a lack of accessibility to improved agricultural technologies and transport. Therefore, special attention should be given to those farmers to give a timely and adequate supply of agricultural technologies.

Acknowledgements
The authors would like to thank the University of Gondar for its financial support to conduct research. The authors also thank all farmers, district and village agricultural office experts for their collaboration and interest during data collection.

Funding
This work was supported by University of Gondar (grant number S650).

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Disclosure statement
No potential conflict of interest was reported by the author(s).

Availability of data and materials
The authors can submit the data at any time based on your request. The datasets are available from the corresponding author.

Citation information
Cite this article as: Determinants of food security status of households in Central and North Gondar Zone, Ethiopia, Wondim Awoke, Kefale Eniyew, Genenew Agtew & Belete Meseret, Cogent Social Sciences (2022), 8: 2040138.

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