Determinants of Household Food Security in the Benishangul-Gumuz Region, Western Ethiopia

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Abstract

Although several efforts have been made so far to improve the overall challenges of food security, it still remains a major problem in the rural areas of Ethiopia. This study examines the food security conditions, and the variables that affect households' food security status in the study area. The study is based on a mixed method research, combining both quantitative and qualitative approaches. Probability and non-probability sampling techniques were used to generate 221 sample households. Both descriptive (percentage) and inferential statistics (Tobit model) were used to analyze the data. The result indicated that 47.96% of the respondents were food secure whereas 52.04% of the respondents were food insecure. The average distance between food insecure households and the minimum recommended calorie intake is 8.9% whereas the variation among food insecure households is 2.53%. Moreover, food security was positively and significantly related with the amount of cultivated farmland, irrigated farm size, livestock holding, grazing land, and participation in off-farm activities. On the converse, family size, dependence ratio, and distance to market had a negative and significant effect on food security status.

Keywords: Calorie intake, food insecurity index, Benishangul-Gumuz region

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1. Introduction

Food security is defined as having economic, social, and physical access to sufficient, safe, and nutritious food that meets the dietary requirements and food choices for an active and healthy life at all times (FAO, 1996; FAO et al., 2013). For everyone to be able to achieve their dietary demands for an active and healthy life, they must always have physical and financial access to enough safe and nourishing food (Lipper et al., 2009). However, the number of individuals experiencing moderate or severe food insecurity increased significantly worldwide, rising from 2.05 billion in 2019 to 2.37 billion in 2020. Nearly 40% of them experienced extreme food insecurity, which means they had either run out of food or, at worst, had gone an entire day without eating (FAO et al., 2021).

Over one in three persons lack access to sufficient food around the world. Levels of moderate to severe food insecurity also reveal ongoing and unsettling geographical disparities. As a result, in 2020, moderate to severe food insecurity affected populations in Latin America and the Caribbean, Asia, Oceania, Northern America, and Europe by 41%, 26%, 12%, and 8.8%, respectively (FAO et al., 2021). At both the severest and the least severe categories, food insecurity is still most prevalent in Africa. In 2020, 26% of Africans experienced extreme food insecurity, with about 60% of the continent's population experiencing moderate to severe food insecurity (FAO et al., 2021).

Ethiopia is one of the poorest and most food-insecure countries in Africa (Asrat & Anteneh, 2020). In this regard, there were 8.6 million people who were food insecure in 2020, up from 8 million in 2019. Moreover, acute food insecurity affected 16.8 million people in 2021 (Food Security Information Network, 2022). The presence of armed conflicts, sporadic rainfall, and invasion of desert locusts posed the biggest obstacles to achieving food security in Ethiopian (WFP & FAO, 2022). Irregular and unpredictable rainfall, land degradation, low per capita income, inadequate infrastructural development, and inadequate agricultural output have aggravated food insecurity in the Benishangul Gumuz region (Sani & Kemaw, 2019). For instance, a study by Daie and Labiso (2021) found that 67% of households in the Assosa zone of the Benishangul-Gumuz region experienced food insecurity.

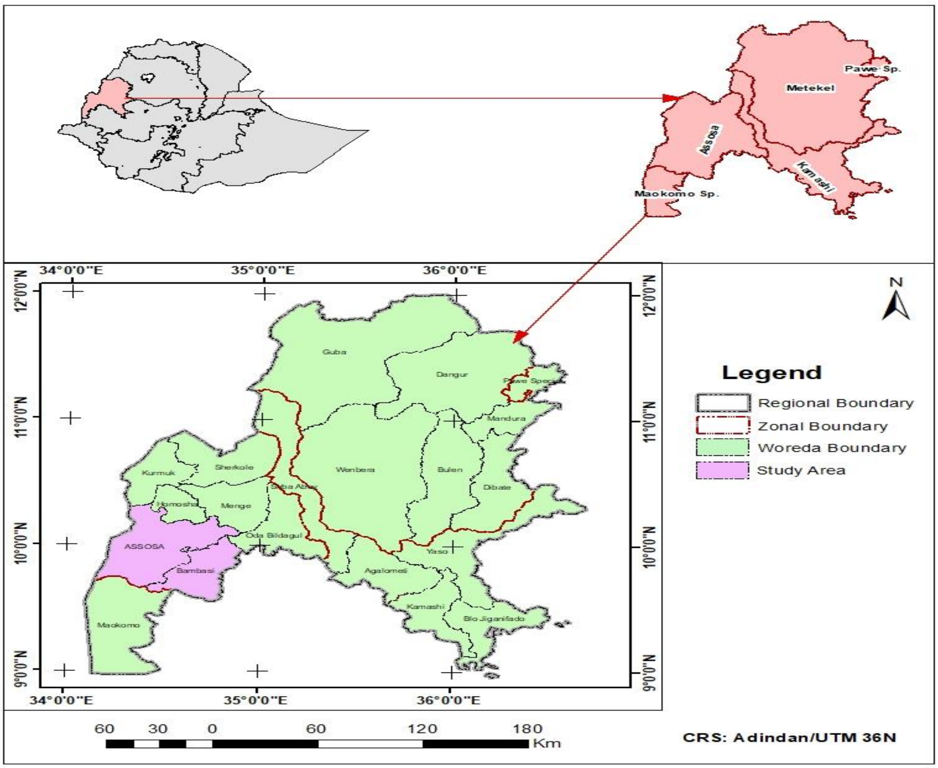
Few studies have been conducted to comprehend the state of food security and its determinants in the Benishangul-Gumuz region (Daie and Labiso 2021; Mohammed and Mohammed,2021; Tsegaw, Endris, and Assefa, 2022). Additionally, sociocultural, and economic characteristics can vary from area to area, and the factors that determine food security are particular to geographic regions, production methods, and livelihood system (Mohammed and Mohammed 2021). Therefore, the purpose of this paper is to assess the severity of the food insecurity gap as well as the food insecurity conditions within the households in Assosa and Bambasi districts. This paper also made an effort to identify the variables that influence households' food security condition in the study area.

2. Materials and Methods

2.1. Study site

The study was conducted in Bambasi and Assosa districts of the Benishangul-Gumuz National Regional State. Bambasi district is located in the region's south, between 09^{o}47 North latitude and 34^{o}47 East longitude, while Assosa district is located between 10°04′ N and 34°31′ E (Figure 1). Administratively, Bambasi district shares borders with the Oromia regional state and Mao-Komo special district in the south and southwest, and, Assosa district in the west and Oda-Buldigilu district in the northeast. Assosa district is bounded by Kurmuk and Homesha in the north, Menge in the northeast, Oda-Buldigilu in the east, Bambasi in the southeast, Mao-Komo special district in the south, and Sudan in the west (Benishangul-Gumuz Disaster Risk Management Commission, 2019) Though no current population census has been conducted in the country, the population projection for 2018 was 91,455 (49% female) and 151,075 (49.14% female) in Bambasi and Assosa districts, respectively (Central Statistical Agency, 2013). Bambasi and Assosa districts cover a total area of 472,817 and 199,941 hectares of land, respectively (Terekegn et al., 2020). The major type of livelihood activity in both areas is a mixed farming system that includes both crop production and animal rearing. The main crops produced include; maize, sorghum, finger millet, teff, soybean, Niger seed, and sesame, and the domestic animals mostly being reared are cattle, sheep, goats, donkeys, and poultry. Wild food gathering, fishing, traditional gold mining, tiny trade, and the production of charcoal are some of the auxiliary sources of income (Benishangul-Gmumuz Regional State Bureau of Agriculture, 2022).

Figure 1: Map of the study area



Source: GIS Data (2021)

2.2. Sampling techniques and sample size determination

In this study, both probability and non-probability sampling techniques were used to collect primary data. In the beginning, two districts were purposely selected, namely, Assosa and Bambasi. This is because; these districts are the largest in population, accessible to the researchers and host a huge number of settlers. Then, eight Kebeles were selected at random from the lists that were available in the districts. Finally, a systematic random sampling technique was employed to obtain respondents from the available lists of each sample kebele. To determine the number of sample respondents for this study, a formula developed by Kothari (2004) and practically tested and used by different scholars was used. Therefore, when the population is finite, its mathematical notation is given by:

$$n = \frac{Z^2 \times p \times q \times N}{e^2(N-1) + Z^2 \times p \times q} \quad (1)$$

Where: n = sample size, Z = 1.96 (confidence interval of 95%), N = population size, P = the population proportion (assumed to be 0.5), e = 5% error. For the total household size of 519 (Benishangul-Gmumuz Regional State Bureau of Agriculture, 2022), 221 sample sizes were drawn: $\mathrm{n} = \frac{(1.96)^2 \times 0.5 \times 0.5 \times 519}{(0.05)^2(519-1) + (1.96)^2 \times 0.5 \times 0.5} \approx 221$

2.3. Data sources and data collection methods

Both primary and secondary data sources were employed to generate the data. An interviewer-administered questionnaire was used to ask household heads about the total amount of grains they produced, purchased, received through aid, gift, or remittance, as well as the amount of grains they sold, distributed to others, and set aside for seed. In addition, the amount of meat, meat-based items, and poultry that household heads had consumed over the previous year was also asked. This makes it easier to determine the net amount of food and grain that was available in a given year and provides information on the household heads' food security situations.

The questionnaire was pre-tested for its validity and reliability and the necessary modifications were made to the tools of data collection after the pre-test. Four enumerators familiar with the culture and local language of the study area were employed to collect the quantitative data. The enumerators were given adequate training in advance on how to approach the study participants and conduct the interviews. Additionally, reports, books, and journals were used to gather the secondary data.

2.4. Method of data analysis

The study used descriptive statistics, the Foster, Greer, and Thorbecke (FGT) food insecurity index and the Tobit model to analyze the data gathered. Descriptive statistics like mean and percentage were employed to describe the socio-demographic characteristics of households and their level of food security. In particular, to measure the extent of food security, the net available food and grain households were computed using a modified form of a simple equation known as the Household Food Balance Model (HFBM) from the FAO Regional Food Balance Model (Tolossa, 2006). The quantity of food was calculated and converted into dietary calorie equivalents based on the food composition table compiled by the Ethiopian Health and Nutrition Institute (Ethiopia Health and Nutrition Research Institute, 2000). Then, the medically recommended levels of calorie per adult equivalent (2100 kcal/day/person for Ethiopia) were used as a cut-off point for food insecure and food secure households. Thus, respondents with daily calorie consumption greater than or equal to 2100 kcal per day were classified as food secure, while respondents with calorie consumption less than this food security threshold were classified as food insecure. Measuring food security using the calorie intake method is the most widely used technique by researchers such as (Eshetu and Guye 2021; Fikire and Zegeye 2022; Mohammed, Wassie, and Teferi 2021).

According to recent studies, post-harvest losses for main crops in Ethiopia were estimated to be around 15% on average (Befikadu 2018; Godebo 2020; Mohammed and Tadesse 2018) while farmers saved 5% of the total amount of crops they produced for seed (Abi & Tolossa, 2015). A modified household food balance model employed in this analysis is given by:

$$NF = (GP + GB + FA + GG + MP + DP) - (HL + GR + GS + GV) \quad (2)$$

Where, NF= Net food available (kilogram/household/year), GP = Total grain production (kilogram /household/year), GB = Total grain bought (kilogram/household/year), FA = Quantity of food aid obtained (kilogram/household/year), GG = Total grain obtained through gift or remittance (kilogram /household/year), MP=Meat, meat-based products and poultry (kilogram /household/year), DP = Dairy and dairy-based products (kilogram/household/year), HL = Post-harvest losses due to grain pests, disasters, thievery, etc. (kilogram/household/year, GR = Quantity of grain reserved for seed (kilogram/household/year), GS = Amount of grain sold (kilogram/household/year), and GV = grain given to others (kilogram/household/year).

The prevalence, depth, and severity of food insecurity were also calculated using the Foster, Greer, and Thorbecke (FGT) food insecurity index. This methodology provides a definable indicator of both food insecurity and poverty (Foster and Shorrocks 1988). The model is crucial for understanding the causes of change in food insecurity as a result of changes in the components, especially in food security analysis. Thus, in this study, the model allows us to estimate the three food insecurity indicators: the headcount of households below the food security line, the length of the kilocalorie gap between the food insecure and the line, and the precise distribution of kilocalories among the households that are food insecure (squared food insecurity gap). Accordingly, Foster, Greer, and Thorbecke (1984) measure used in the estimation of food insecurity index components is given as:

$$FGT(\alpha) = \frac{1}{n}\sum_{i=1}^{q}[(c - y_i)/c]^{\alpha} \quad (3)$$

Where; FGT (α) is the FGT food insecurity index; $n =$ is the number of sample respondents; $y_{i=}$ is the measure of food kilocalorie intake of the i^{th} household; $c =$ represents the cut-off between respondents with food security and those with food insecurity (expressed here in terms of caloric requirements of 2100 kcal); q =is the number of food-insecure respondents, and is the weight given to the severity of food insecurity. When it comes to model estimation, the indicator is the headcount ratio (incidence) when the weight associated with $\alpha = 0$, the food insecurity gap (depth of food insecurity) when $\alpha = 1$, and the squared food insecurity gap when $\alpha = 2$.

Additionally, the Tobit model was employed to identify the factors that contribute to the degree of food insecurity among respondents in the research area. The Tobit model is a member of a group of economic methods known as censored regression models (Wooldridge, 2002). Tobit is a better model than the standard list square model when a certain dependent variable is considered to be censored (2100 kcal/AE/day in this study) for certain data and a continuous value for the other observations (OLS) (Amore & Murtinu, 2021). The coefficients from the analysis may not necessarily converge to the "actual" population parameters as the sample size increases since OLS offers inconsistent estimates of the parameters (Long, 1997). Thus, in this study, the dependent variable was a censored variable in which it assumed a constant or threshold value of 2100 kcal/AE/day for food-secure households and the actual energy intake in kilocalories for food-insecure households. Suppose that Y_i is observed if the latent variable $Y_i < 2100$ kcal and is not observed if $Y_i > 2100$ kcal. Then the observed Y_i will be defined as:

$$Y_i = \begin{cases} Y_i^* = \beta x_i + u_i & if \ \ Y_i^* < 2100\, kcal \\ 2100\, kcal & if \ Y_i^* \geq 2100\, kcal \end{cases} \tag{4}$$

Where; Y_i the observed variable Y_i^* is the latent (unobserved) variable, x_i is a vector of explanatory variables, u_i is a vector of error terms and β is a vector of parameters to be estimated.

2.5. Definition and measurement of variables

The threshold value is used by the household food balance model (HFBM), which assesses the degree of food security (2100 kcal). The assumption is that the household is food secure if the total food energy consumption is greater than or equal to the threshold value, and that the household is food insecure if the total food energy intake is less than the threshold value (equation 4). Besides, the choice of potential independent variables which can affect the extent of households' food security in the study area was based on the experience of previous studies and economic, social, cultural, or political factors. Therefore, the major variables that are expected to influence household food security and their specific hypotheses are explained in Table 1.

Table 1. Definition, measurement and expected sign of variables

Variables	Definitions and Measurement	Expected sign
Sex	1= if the household head is male, 0=otherwise	+
Age	Age of the household head in years	+/-
Household size	The number of persons in a household.	-
Sex ratio	Ratio of the female members to the male members	-
Dependency ratio	Ratio of inactive labor force to active labor force	-
Literacy status	1= if the household head is literate, 0= otherwise	+
Cultivated farm size	Cultivated farm size in hectare	+
Irrigation farm size	Cultivated irrigation farm size in hectare	+
Livestock holding	Livestock ownership in TLU	+
Access to grazing	1=if the household head has access to grazing, 0=otherwise	+
Participation in off-farm activities	1=if the household head has participated in off-farm activities, 0=otherwise	+
Access to credit	1=if the household head has access to credit, 0=otherwise	+
Distance to the market	Distance to the nearest market in kilometer	-

3. Results and Discussions

3.1. Socio-demographic characteristics of respondents

The primary data were collected from a total of 221 sampled respondents. Out of the total respondents, 71.5% were from male-headed households and the remaining 28.5% were from female-headed households (Table 2). The mean age of the respondents is 36 years. The majority (72%) of the respondents was found in the age category of 19–39 years, and the least (3.6%) were in the age group above 60 years. The structure of the marital status of the household head indicates that out of the total sample respondents; the majority (75.1%) were married, while the remaining; 13.6%, 6.8%, and 4.5% of the respondents were single, divorced, and widowed, respectively. Furthermore, the majority (55.2%) of the respondents had a household size falling between 3 and 5 members, with a mean size of 4.58. Concerning the educational status, the majority (56.1%) were illiterate (are not able to read and write), while the remaining 43.9 % were literate. Regarding annual income earned from different livelihood activities, 16.3% of the households earned less than 10,000 Ethiopian birr. The majority (57.5%) of households earned between 10,000 and 20,000 Ethiopian birr, with a mean value of 15815.44 Ethiopian birr.

Table 2: Socio-demographic characteristics of respondents (N=221)

Variables	Category	Frequency	(%)	Remark
Sex	Female	63	28.5	
	Male	158	71.5	
Age	19-39	159	72	Mean=36
	40-60	54	24.4	
	Above 60	8	3.6	
Marital status	Single	30	13.6	
	Married	166	75.1	
	Divorced	15	6.8	
	Widowed	10	4.5	
Household size	< 3	42	19	Mean=4.58
	3-5	122	55.2	
	≥ 6	57	25.8	
Literacy status	Illiterate	124	56.1	
	Literate	97	43.9	
Annual income (Ethiopian birr)	< 10000	36	16.3	Mean=15815.44
	10000-20000	127	57.5	
	>20000	58	26.2	

Source: Own computation (2022)

3.2. Households' food security situations

The amount of energy utilized in kilocalories by the household was compared with the minimum subsistence daily calorie requirement level (i.e. 2100 kcal/day). The finding revealed that the main food energy source in the study area was production of different food grains, which accounted for 81% of the total available food calories, followed by domestic purchases that covered 16% of a calorie per capita. Food aid and remittances contributed only 3% of the total available food calories. Accordingly, maize, sorghum, millet, and okra (locally called 'Kenkes') are found to be the staples most frequently consumed in the study areas. Additionally, according to the results of the HFBM calculation, 106 sampled households (47.96%) were determined to be food secure, whereas 115 sampled households (52.04%) were found to be food insecure (Table 3).

Table 3. Summary of households' food security situation in the study area

HFBM	Count	Percent
Food secure households	106	47.96
Food insecure households	115	52.04
Total	221	100

Source: Own computation (2022)

3.3. Extent of Household Food Insecurity

The severity of food insecurity was evaluated using the Foster, Greer, and Thorbecke's (FGT) food insecurity index. As a result, the headcount ratio from the food insecurity index revealed that the incidence of food insecurity was 52.04%, meaning that 52.04% of the households were actually experiencing food insecurity, which is defined as not being able to obtain the minimal amount of calories necessary for subsistence. Besides, the food insecurity gap, which is a measure of the depth of food insecurity, pointed out that each food-insecure household needed 8.9% of the daily caloric requirement to bring them up to the recommended daily caloric requirement level. In order to overcome the issue of food insecurity, households must typically get 8.9% of the daily basic calorie requirement. Therefore, 186.9 Kcal/AE/day of additional food energy would be required on average to move households out of food insecurity. Additionally, the FGT food insecurity index's squared food insecurity gap result showed that the respondents' food insecurity level was 2.53% severe (Table 4).

Table 4: FGT food insecurity index results on the extent of food insecurity

FGT measures	Percent (%)
Headcount ratio (Incidence of food insecurity)	52.04
Food insecurity gap (Depth of food insecurity)	8.9
Squared food insecurity gap (Severity of food insecurity)	2.53

Source: Own computation (2022)

3.4. Determinants of the extent of households' food insecurity

As discussed in the methods section, the Tobit model was used to analyze the determinants of the extent of household food insecurity situations in the study areas. The Tobit model regression output for both categorical and continuous variables is presented in Table 5. The model as a whole fits much better than an empty model, according to the likelihood ratio chi-square, which is 131.25 and has a p-value of 0.0000 (i.e. a model with no predictors). Besides, the model estimate revealed that out of the 12 explanatory variables, 8 variables were found to have significant effect on households' extent of food security (Table 5). Tobit regression coefficients are interpreted in the same way as OLS regression coefficients, except that the linear effect is on the uncensored latent variable rather than the observed outcome (McDonald & Moffitt, 1980). The results of the Tobit model were discussed in detail as follows;

Household Size: The result indicated that household size has affected households' extent of calorie intake (food security) negatively at a 1% level of significance. The coefficient of household size revealed that with one extra person added to a household, there is a 56.8 decrease in the households' calorie intake while other variables remain constant. This indicates that larger household sizes tend to be more food calorie deficient than smaller household sizes. This may be households that rely on scarce resources would experience food insecurity as a result of growing household sizes. This result is consistent with a study conducted by Mohammed and Mohammed (2021), who reported that having an additional family member reduces the likelihood of being food secure by about 17.97%. The result is also in line with the findings of this study by Sani and Kemaw (2019) who found that the likelihood of a household experiencing a food energy intake shortage increased by 1211% with one additional member in the household.

Dependency ratio: The regression analysis result showed that the dependency ratio has a negative effect on households' calorie intake (food security) at a 5% level of significance. The result implies that a unit increase in dependency ratio leads to a 403.44 decrease in households' calorie intake while keeping other factors in the model constant. The possible explanation could be the existence of less active labor force in a household leads to a rise in dependent family members, higher consumer spending, and a decreased capacity to feed the household. This result is consistent with recent findings reported by Mengistu and Kassie (2022); Owoo (2021) and Samim et al. (2021). For instance, Samim et al. (2021), revealed that for each incremental unit in the dependency ratio size, the likelihood that a household will be food secure decreases.

Cultivated farm size: Cultivated farm size is positively related to households' extent of calorie intake (food security) at a 5% level of significance. Keeping other variables constant, for a one-hectare increase in cultivated farm size, there is a 49.8 increase in households' calorie intake. This indicates that households that had large farm sizes are less likely to be food insecure than those that had small or no farm sizes. This result is consistent with the findings of Diramo et al. (2018), who revealed that each additional hectare of arable land will increase a household's food security status by a factor of 0.68. In addition, in line with this study, the research of Habtewold (2018) in the Oromia region found that increasing farm size by one hectare increased the likelihood of being food secure by 1.39 times. In contrast, the findings of Awoke et al. (2022) indicated that as the land size holding increased by one more hector, the probability of being food secure decreased by 0.48 in the central and north Gondar. This result was justified by the fact that farmers spent resources by concentrating on increasing their farmland rather than employing more advanced agricultural technologies.

Irrigation farm size: Irrigation farm size influenced extent of food energy intake positively at a 5% level of significance. For a one hectare increase in irrigation farm size, there is a 400.3 increase in households' calorie intake, while other things remain constant. This is because households that have access to irrigation farms can produce twice to three times per year, which can increase the yields of crops. This result is in line with those of Jambo et al.(2021), who revealed that households that participated in small-scale irrigation increased the daily calorie intake by 643.76 than those that did not have the option to do so.

Livestock size: The model result indicated that livestock size is positively related to households' extent of calorie intake (food security) at a 5% level of significance as postulated. The finding implies that for a unit increase in the tropical livestock unit (TLU), there is a 17.4 increase in households' calorie intake at citreous perilous. This implies that households having a larger number of tropical livestock units (TLU) can have a better food security status in the study areas. This result is supported by Melese and Alemu (2021), who have shown that the probability of being severely food secure increases by 26.6% as the number of oxen increases by one. Similar findings were made by Tsegaw et al. (2022), who revealed that a unit increase in livestock in tropical livestock unit can raise households' dietary diversity food scores by 4.36%.

Access to grazing: Access to grazing is positively related to households' extent of calorie intake at a 1% level of significance as postulated. The extent of calorie intake was 193 points higher for households that had better access to grazing land than for those that had not. This finding is consistent with the results of Hadush (2018), who reported that grazing scarcity has a negative impact on household welfare and food security by affecting livestock production directly, crop or off-farm income due to labor reallocation, or time leisure consumption directly.

Participation in off-farm activities: Participation in off-farm activities influenced households' extent of calorie intake positively and significantly at a 1% significance level. This implies that the predicted value of households' extent of calorie intake is 189.4 points higher for households that have participated in off-farm activities such as petty trade, traditional gold mining, collecting and selling of firewood, and charcoal, and others. This result is consistent with the research of Endiris et al. (2021), which showed that rural farmers who participated in off-farm activities had higher household food security status compared to those do not participated.

Distance to market: Distance to market influenced households' extent of calorie intake negatively at a 1% level of significance. The result showed that an increase in distance to the market may lead to a decrease in households' calorie intake while keeping other variables constant. The implication is that households that are closer to the market are more likely to be food secures than those far from it. This result agrees with the findings of Akukwe (2020) who found that households who live near a market on a regular basis are more likely to be food secure than those who live far away. Similarly, Fikire and Zegeye (2022) revealed that a household that is located one kilometer away from the market has decreased the probability of food security by 4.6% as compared to households that were nearby the market.

Table 5. Results of the Tobit model on determinants of extent of food insecurity (N=221)

Explanatory variables		**Coefficients**	**Std. Err**	**t-statistics**
Sex	Male	54.69523	63.43859	0.86
Age		-2.017357	2.75864	-0.73
Household size		-56.81816	17.78654	-3.19***
Sex ratio		28.25628	77.80481	0.36
Dependency ratio		-403.4446	161.6928	-2.5**
Literacy status	(Literate)	40.05506	59.41146	0.67
Cultivated farm size		49.8261	20.31163	2.45**
Irrigation farm size		400.2874	206.5396	1.94*
Livestock holding (TLU)		17.44559	8.347625	2.09**
Access to grazing	(Yes)	193.0736	61.0884	3.16***
off-farm activities	(Yes)	189.4157	70.54177	2.69***
Access to credit	(Yes)	57.53145	61.3808	0.94
Distance to market		-6085.15	1380.412	-4.41***
Constant		2208.165	185.3766	11.91
Sigma		346.7788	24.23777	
		No. of Obs.	221	
		LR chi2(16)	131.25	
		Prob> chi2	0.0000	
Log likelihood =-876.54452		Pseudo R2	0.0697	
Observation summary		115 uncensored observations		
		106 right-censored observations at calorie intake >= 2100		

*, **and *** denotes statistically significant level at 10%, 5% and 1% respectively.
Source: Own computation (2022)

4. Conclusion

In this research, the severity of household food insecurity (which measures variation in among food insecure households), the incidence of food insecurity, and the food insecurity gap (the average distance between food insecure households and the minimum recommended calorie intake) have been analyzed in the selected districts of the Benishangul-Gumuz regional state. The main food energy source in the study areas was the production of different crops: maize, sorghum, millet, and fruits and vegetables such as mango, papaya, avocado, and okra (locally called "Kenkes"). But, eliminating or reducing food insecurity continues to be a challenge for rural communities in the study areas. The study indicated that more than half of the surveyed rural households (52.04%) were unable to get the minimum daily energy (2100 kcal) requirement. Besides, the food insecurity gap (8.9%) and the severity of food insecurity (2.53%) were also high in the study areas. Moreover, the food insecurity status of the household was determined by different socio-demographic and economic factors. Hence, the estimated Tobit model results revealed that family size, dependency ratio, and distance to market had affected households' extent of calorie intake (food security) negatively whereas cultivated farm size, irrigation farm size, livestock holding, access to grazing land, and participation in off-farm activities had positive correlation with households' extent of calorie intake (food security).

Policy Implications

As the study indicated, irrigation and cultivated farm size were positively related to households' extent of calorie intake in the study areas. Thus, the construction of additional small-scale irrigation schemes, the provision of sufficient inputs, and improving households' technical skills to enhance agricultural production and productivity are essential. In addition, participation in off-farm activities influenced households 'calorie intake positively in the study area. Thus, the concerned government and non-government organization should develop interventions to improve farmers' involvement in off-farm activities intended to improve household food security situation. Several studies, including this one, have found that having a larger family increases the likelihood of food insecurity. As a result, raising awareness about effective family planning is important for ensuring food security.

Authors' contributions

Aweke Aysheshim: Data collection, Analysis, Investigation, Writing-original draft.

Desalegn Yayeh: Supervision, Conceptualization, Methodology, Reviewing and editing.

Messay Mulugeta: Supervision, Conceptualization, Reviewing and editing.

Conflict of interest declaration

The authors have declared no conflicts of interest. The authors agree with the article's contents and have no financial interests to disclose.

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