NASS Journal of Agricultural Sciences
http://ojs.nassg.org/index.php/NJAS

ARTICLE

Assessment of Household Food Security and Its Determinants in Minjar Shenkora and Ada'a *woredas* of Central Ethiopia

Mekonnen Hailu*

Food Security and Development, Agricultural Economics, Ethiopia Institute of Agricultural Research, Addis Ababa, Ethiopia

ARTICLE INFO

Article history
Received: 18 July 2022
Revised: 5 September 2022
Accepted: 20 September 2022
Published Online: 30 September 2022

Keywords:
Determinant
Ethiopia
Food security
Logistic model
Rural

ABSTRACT

Food security issues become one of the critical concerns and top priority areas for Ethiopia. This study analyzed rural households' food security status and its determinants in Minjar Shenkora *woreda* of Amhara Regional State and Ada'a *woreda* of Oromia Regional State. Data were collected from 240 randomly selected rural farm households. The study employed both descriptive statistics and a binary logistic regression model to estimate the status and determinants of households' food security, respectively. The findings indicated that the average dietary energy available for food secured households was 2,860.6 kilo calorie per day while 1,891.7 kilo calorie per day for the insecure group. According to the findings of the binary logit model, factors such as education level, farm size, livestock ownership, cooperatives membership, off-farm income and credit access have positive and significant effects on household food security. While household size has a negative and significant effect on household food security. The results recommend that interventions should target at improving rural financial services and off-farm activities that increase households' income and focusing on those most significant variables when attempting to enhance household food security.

1. Introduction

One of the key challenges in the worldwide development agendas, such as the sustainable development objectives (SDGs), is food security. It is world's greatest challenge to secure physical, social, and economic access to sufficient, safe, and nutritious food for all people at all times for an active and healthy life, in an environmentally sustainable manner [1,2]. This demonstrates its equal importance for both developed and developing countries. The vast majority of those who lack access to food reside in developing nations, including those in Asia, Africa, Latin America, and the Caribbean [3]. However, significant progress has been made in reducing hunger and poverty. Unfortunately, the number of people experiencing food insecurity has been continuously increasing, mostly due to

*Corresponding Author:
Mekonnen Hailu,
Food Security and Development, Agricultural Economics, Ethiopia Institute of Agricultural Research, Addis Ababa, Ethiopia;
Email: aklesiyamekonnen2005@gmail.com

DOI: http://dx.doi.org/10.36956/njas.v5i1.601

an increase in moderate food insecurity. Over 2.37 million individuals worldwide are currently experiencing moderate to severe food insecurity. One third (799 million) of the 2.37 billion people live in Africa, while 11.7% (267 million) live in Latin America and the Caribbean [3].

Ethiopia is one of the African nations that are frequently brought up in relation to the issue of food insecurity. Ensuring food security for today's population and generations to come is one of the greatest challenges of Ethiopia. Ethiopians consume fewer than 2100 kcal per person per day [4]. The fact that nearly one in five Ethiopians needed food assistance during the 2015–2016 drought shows both how widespread food insecurity is and how many people are at risk of developing it. Moreover, about 25% of the population still lives below the officially recognized poverty line, despite attempts to improve food security at the family level [5]. There are 26 million households, or around 20.5 percent, that are estimated to be food insecure [6]. Ethiopians living in rural areas currently rely on ongoing welfare transfer programs in excess of 20 million times [7]. Ethiopia was ranked 108 [8] in the Global Food Security Index and 173 [9] in the Human Development Index.

Several studies have found that Ethiopians have experienced prolonged periods of food insecurity, which can be attributed to a variety of factors [10-13]. Most people's "physical, social, and economic access to sufficient, safe, and nutritious food necessary to meet dietary demands and food choices for leading an active and healthy life" has been hampered by these variables. The causes of food insecurity are categorized into five categories in a detailed account: biophysical shocks or stresses, lack of access to assets for sustaining livelihoods, restrictions on livestock, access-related restrictions like a lack of opportunities, start-up funds, knowledge, and skills, and inappropriate land rights arrangements [13]. Various factors that contribute to household food insecurity in Ethiopia have also been discovered [12,14]. In light of this, the study was mainly focused on assessing rural household food security situation in Ethiopia and determinants of food security. The study offers insight into the nature of food security and its determinants, allowing researchers and policymakers interested in future research and policy implementation to use the model to address food insecurity at the household level.

The findings of this study will add to the existing of literature by identifying the factors of food insecurity in households where *tef* production and consumption are the primary sources of income and subsistence. In order to design potential interventions to address those factors, it is crucial to identify the associated attributes of household food insecurity. This study varies from the majority of other studies in that it considers *tef* as a staple meal and takes into account the significant *tef*-growing regions of Minjar Shenkora and Ada'a *woredas*. This study adds to the limited empirical evidence at the local level by assessing household food insecurity and associated factors in the study areas.

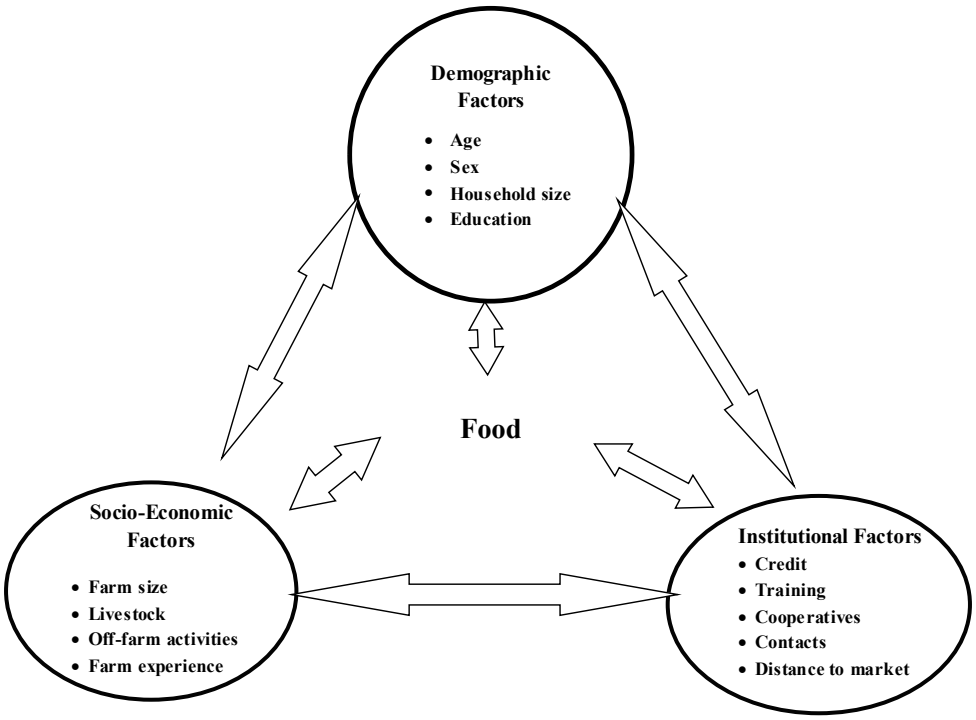

Figure 1. The association between dependent and independent variables

2. Materials and Methods

Description of the study area

The survey was conducted in Minjar Shenkora *woreda* of Amhara Regional State and Ada'a *woreda* of Oromia Regional State of Ethiopia. Minjar Shenkora is one of the *woredas* in the North Shewa Zone of Amhara Regional State of Central Ethiopia. The administrative center of the *woreda* is Arerti. It is located farther to the southern part of North Shewa Zone, and located at about 135 km southeast of the Capital city, Addis Ababa. The *woreda* is composed of a total of 30 *kebeles*, 27 rural *kebeles*, and the rest urban *kebeles*. *Tef*, wheat, sorghum, and maize are among the cereal crops and chickpea and lentil among pulses grown in the *woreda*. Ada'a is one of the *woredas* in East Shewa Zone of Oromia Regional State of Central Ethiopia. The *woreda* administrative town is Bishoftu, which is located 45 km away east of Addis Ababa. Ada'a *woreda* is a mixed farming, crop production, and livestock production area. Crops grown in the *woreda* are *tef*, wheat, barley, maize sorghum, chick pea, ground nut, root crops, and vegetables.

Data source and sampling procedures

The data for this study were obtained from both quantitative and qualitative sources. Quantitative data were collected through a household survey. A multistage sampling procedure was employed to draw sample households in the study areas. In the first stage, two *woredas*, Minjar Shenkora and Ada'a *woreda* were selected based on their *tef* production potential. In the second stage, four kebeles from high and low producing areas were randomly selected. In the third stage, representative households from each sample *kebeles* were determined by using a formula suggested by Yamane [15]. This simplified formula required sample size at 95% confidence level, degree of variability = 0.5, and level of precision = 5%. Finally, based on proportionate random sampling, 240 households were selected on the lottery method from the list obtained from respective *kebeles*.

Methods of data analysis

The study used descriptive statistics (frequency, percentage, mean, standard deviation) and Descriptive statistics (frequency, percentage, mean, standard deviation) on various indicators of food security and their determinants including socio-demographics, resource endowments, institutional services, and markets were computed. Moreover, inferential statistics (such as t-test, and Chi-square test) were used to estimate the food security status in the study areas. The Household Food Balance Model (HFBM) was also used.

The food security status is a binary outcome variable that takes a value of Y = 1 if the household is food secure, 0 otherwise. The binary logit model was used to determine the factors influencing of different explanatory variables on food security situation. The functional form of logit model can be specified as follows where P_i donates the probability of household food secure that is $Y_i = 1$ and $exp^{(Zi)}$ stands for the irrational number to the power of Z_i [16,17]. The model can be written as:

$$P_i = E(Y = \frac{1}{X_i}) = \frac{1}{1 + e^{-(\beta 0 + \beta 1 X 1)}} \quad (1)$$

For the case of explanation, Equation (1) is written as:

$$P_i = \frac{1}{1 + e^{-Zi}} \quad (2)$$

The probability that a given household farmer is decided to food secure properly is expressed as by Equation (2), while the probability of food insecure is expressed by Equation (3)

$$P_i = \frac{1}{1 + e^{Zi}} \quad (3)$$

Variable definition and measurement

Definitions and measurements of the outcome and explanatory variables are presented in Table 1.

Table 1. Definition and measurement of variables used in the analysis

Variables	Definitions and Measurement
SEX	1= if the household head is male and 0 otherwise
AGE	Age of the household head in years
EDUCATION	1= if the household head is literate and 0 otherwise
HH_SIZE	Household size in Adult equivalent
FARM_SIZE	Farm size in hectare
FARM_EXP	Farm experience in years
LIVESTOCK	Livestock ownership in TLU
OFF_FARM	1= if household engaged in off farm activities and 0 otherwise
CREDIT	1= if the household access credit and 0 otherwise
COOPERATIVES	1= if the household member of cooperative and 0 otherwise
CONTACTS	Frequency of DA contacts with farmers
TRAINING	1= if the household access to training and 0 otherwise
DIS_MARKET	Distance to the nearest market in kilometer

3. Results and Discussion

Food availability and dietary energy supply of sample households

The mean difference between food secure and food insecure households was statistically significant at ($p<0.01$). The

observation of the range (min= 1,023.8 kcal/ADE/day and max= 7,547.7 kcal/ADE/day) implies that there was a great variation among the farming households so that looking into the conditions of each households was essential.

Descriptive results of hypothesized variables

Table 3 presents a summary of the explanatory variables used in econometric estimation and tests if systematic associations between socio-demographic characteristics and the food security status of the farm households. The results show that the food secure and insecure households have a significant difference in most of the explanatory variables. For example, the mean household size of food secure households (4.1 ADE) was smaller than that of food insecure households (5.0 ADE) showing that their mean difference was statistically significant between the groups at ($p<0.01$). Likewise, the mean livestock possession for food secure households (6.2 TLU) was larger than that of food insecure households (4.9 TLU). Their mean difference in livestock ownership between the two groups was statistically significant at ($p<0.01$).

Moreover, the dummy variables demonstrate that among 90% of households headed by male, 57% of them were food secured whereas about 33% of food insecure groups. Their mean difference was statistically significant between the groups at ($p<0.01$). Similarly, results indicated that 64% of households had no access formal education. Out of this, about 24% of food secured households while 40% of food insecure groups showing that their mean difference was statistically significant between the groups at ($p<0.01$). Besides, among 70.4% of households who are member to agricultural cooperatives, about 48% belongs to food secure and 23% belongs to food insecure. Their mean difference was statistically significant between the groups at $p<0.01$.

Determinants of household food security

Table 4 shows the results of a logistic regression study that shows the association between household food security and its determinants. Out of 13 hypothesized variables, 7 were statistically most significant at less than ($p<0.1$) level of significance. Among these, education level, household size in adult equivalent, membership in agricultural cooperatives, livestock ownership and engaged in off-farm activities were mostly significant at ($p<0.01$). But, it does not mean that the remaining determinant variables had no influence on food security.

Household food security and education are inextricably linked because, especially in subsistence farming, literate farm household heads outperform illiterate counterparts in a variety of ways, yet the importance of indigenous knowledge in achieving food security should not be overlooked [13]. Our result is in line with this study because it showed that education of household head influenced household food security positively ($B = 0.290$) and significant at ($p<0.01$). The odds ratio in favor of the probability of being food secure increased by a factor of 0.914 with one year increase in the level of education. This indicates that households headed by relatively better educated were more likely to be food secure than those headed by less educated or illiterate ones. This goes in line with some previous studies which showed statistically significant and positive relationship between level of household head education and the probability of being food secure [18-20,11].

The effect of household size on food security was negative ($B = –0.712$) and statistically most significant at ($p<0.01$). By keeping other factors constant, the odds ratio in favor of being food secure decreased by a factor of 3.491 with an increase in the household size by one member. This indicates that households with larger household size are more likely to be food insecure than their counterparts. The negative association could be due to an increase in the number of family dependency ratio. This means that households having many children and old age groups may lack sufficient manpower, which eventually results in overdependence on limited household resources. This result is consistent with several previous research findings [21,22].

Livestock is a source of income through the sale of livestock and livestock products, as well as a source of supplementary food. Furthermore, livestock can be used as a coping strategy in the event of crop failure or other disasters. Households with greater livestock holdings are shown to be more food secure than those without. Our results also confirmed that the effect of livestock holdings on household food security was positive and statistically most significant at ($p<0.01$). The odds ratio ($B = 0.149$) in favor of being food secure was increased by a factor of 1.161 with an increase in livestock ownership by one TLU. This goes in line with most previous studies including [18,23].

Farm households who are members in agricultural cooperatives can easily access credit, agricultural inputs, information, and stable market outlets. This implies that households who are members in agricultural cooperatives are shown to be more food secure than those who are not. Results indicated that the effects of membership in agricultural cooperatives ion household food security was positive and statistically most significant at ($p<0.01$). The odds ratio ($B = 0.230$) in favor of being food secure was increased by a factor of 0.794 with an increase in membership in agricultural cooperatives.

Off-farm activities are important activities through which rural households get additional income to supple-

ment their livelihoods. Households who engaged in off-farm activities are less risk-averse than farmers without sources of off-farm income. Our result showed that the effect of off-farm income on household food security was positive and statistically most significant at ($p<0.01$). The odds ratio (B = 0.438) in favor of being food secure was increased by a factor of 1.039 with an increase in off-farm income by one Ethiopian Birr (ETB).

Table 2. Sample households' dietary energy supply (Kcal/ADE/Day)

Households	Minimum	Maximum	Mean	SD	Sum	Chi-square
Food insecure (n= 89)	1,023.8	2,098.5	1,891.7	272.3	172,140.6	24.387***
Food secure (n= 151)	2,104.7	7,547.7	2,860.6	860.2	423,372.5	
Pooled (N= 240)	**1,023.8**	**7,547.7**	**2,491.2**	**839.7**	**597,603.3**	

Note: *, **, and *** denotes significance level at 10%, 5%, and 1%; NS= not significant
Source: Own calculation based on field survey

Table 3. Summary statistics of explanatory variables by food security status

Variables	Food insecure (n= 89)	Food secure (n= 151)	Pooled (N= 240)	Mean Difference
Continuous Variables				t-test
AGE	45.9 (13.2)	45.2 (12.1)	45.5 (12.5)	0.705
HHSIZE	5.0 (1.9)	4.1 (1.9)	4.5 (1.9)	3.003***
FARM_SIZE	2.4 (1.6)	2.9 (2.0)	2.7 (1.9)	3.457*
LIVESTOCK	4.9 (3.1)	6.2 (4.6)	5.8 (4.2)	10.582***
CONTACT	2.5 (3.2)	3.8 (8.1)	3.3 (6.7)	1.744***
FARM_EXP	15.8 (9.5)	14.6 (10.2)	15.0 (9.9)	0.627
DIS_MARKET	10.7 (6.7)	7.1 (10.7)	10.2 (6.9)	2.355***
Dummy Variables				Chi-square
SEX (male)	32.9	57.1	90.0	2.224***
EDUC (illiterate)	40.4	23.8	64.2	1.375***
COOPERATIVE (yes)	22.9	47.5	70.4	5.044***
OFF_FARM (yes)	6.3	10.0	16.3	1.038*
CREDIT (yes)	19.6	36.7	56.3	4.681**
TRAINING (yes)	25.4	44.6	70.0	3.144*

Note: *, **, and *** denotes significance level at 10%, 5%, and 1%, t-test is estimated as a mean difference between food insecure and food secured
Source: Own calculation based on field survey

Table 4. Results of binary regression model parameters estimating the effects of determinants

Explanatory Variables	B	S.E.	Wald	Sig.	Exp (B)
SEX	–0.741	0.705	1.105	0.293	0.477
AGE	0.030	0.016	3.391	0.266	1.031
EDUCATION	0.290	0.276	10.416***	0.000	0.914
HHSIZE	–0.712	0.156	20.960***	0.004	3.491
FARM_SIZE	0.075	0.127	1.348*	0.055	1.078
FARM_EXP	0.877	0.518	2.874	0.090	2.404
LIVESTOCK	0.149	0.81	3.396***	0.003	1.161
COOPERATIVES	0.230	0.478	8.232***	0.000	0.794
OFF_FARM	0.438	0.211	12.663***	0.000	1.039
CONTACTS	0.342	1.541	2.945	0.059	0.893
CREDIT	0.146	1.461	4.636**	0.046	2.244
TRAINING	0.518	0.477	1.178	0.078	1.678
DIS_MARKET	–0.013	0.031	0.167	0.683	0.987
Constant	–1.848	1.153	0.542	0.462	0.428
Model Prediction Success (%)		Food secure		85.8	
	Food insecure		78.8		
	Overall predicted		82.9		
-2 Log-likelihood ratio for the model		174.452			
H-L model test (df = 8)		14.058 (p= 0.08)			
Nagelkerke R^2		0.63			

Notes: *** p < 0.01, ** p < 0.05, * p < 0.1; Dependent variable: =1 if the household is food secured, 0 otherwise.

4. Conclusions and Suggestion

Food security remains an issue in Ethiopia particularly in the rural households. It is one of the greatest challenges for today's population and generations to come. Hence, this study, therefore, attempted to identify the status and driving factors of household food security in Minjar Shenkora and Ada'a *woredas* of Central Ethiopia. This study indicated that about 64% of sampled households were food secure while the remaining 36% are food insecure. The empirical evidence suggests that food security of rural households is greatly influenced by various factors. There is no one-size-fits-all solution to the challenge of food security. The binary logistic regression model results showed that the household head's education level, household size, livestock ownership, membership in agricultural cooperative, incomes from off-farm activities, credit availability, and farm size all had significant effects on the probability that the household will be food secure. Hence, interventions should target at improving rural financial services, markets and off-farm activities that increase households' income and focusing on those most significant variables when attempting to enhance household food security.

Acknowledgement

I am thankful the Ethiopian Institute of Agricultural Research for their partial funding to data collection only.

Conflict of Interest

There is no conflict of interest.

References

[1] Burchi, F., Fanzo, J., Frison, E., 2011. The role of food and nutrition system approaches in tackling hidden hunger. International Journal of Environmental Research and Public Health. 8(2), 358-373.

[2] FAO, 1996. Rome declaration on world food security and world food summit plan of action. Food and Agriculture Organization.

[3] FAO, IFAD, UNICEF, WFP & WHO, 2021. The

State of Food Security and Nutrition in the World 2021. Transforming food systems for food security, improved nutrition and affordable healthy diets for all. Rome, FAO.
DOI: https://doi.org/10.4060/cb4474en

[4] Kahsay, S., Mulugeta, M., 2014. Determinants of rural household food insecurity in Laelay Maichew Woreda Tigray, Ethiopia. African Journal of Agriculture and Food Security. 2(1), 106-112.

[5] USAID, 2019. Food Assistance Fact Sheet Ethiopia; USAID: Washington, DC, USA.

[6] CSA & WFP, 2019. Comprehensive Food Security and Vulnerability Analysis (CFSVA). Ethiopia, WFP and Headquarters, WFP.

[7] Diriba, G., 2018. Overcoming agricultural and food crises in Ethiopia: Institutional evolution and the path to agricultural transformation.

[8] GFSI, 2021. Performance of countries based on their 2021 food security score. A report from the economist intelligence unit, Global Food Security Index 2021. Retrieved from http://foodsecurityindex.eiu.com/Indexi oni June 1.

[9] UNDP, 2021. Human development reports of Ethiopia. Retrieved on June 2021 from https://hdr.undp.org/en/countries/profiles/ETH.

[10] Aidoo, A., Mensah, J., Tuffour, T., 2013. Determinants of Household Food Security in the Sekyere-Afram Plains District of Ghana, 1st Annual International Interdisciplinary Conference Proceedings, pp. 514-521, *AIIC 2013*, 24-26, Azores, Portugal.

[11] Bashir, M., Schilizzi, S., Pandit, R., 2012. The Determinants of Rural Household Food security: The Case of Landless Households of the Punjab, Pakistan, Working Paper 1208, School of Agricultural and Resource Economics, University of Western Australia, Crawley, Australia.

[12] Bogale, A., Shimelis, A., 2009. Household level determinants of food insecurity in rural areas of Dire Dawa, Eastern Ethiopia. African Journal of Food and Agriculture, Nutrition and Development. 9(9), 1914-1926.

[13] Tolossa, D., 2005. Rural livelihoods, poverty and food insecurity in Ethiopia, A case study at Erenssa and Garbi communities in Oromiya Zone, Amhara National Regional State, PhD Dissertation, Norwegian University of Science and Technology, NTNU, Trondheim.

[14] Mulugeta, M., 2009. Challenges and Opportunities of Volunatry Resettlement Schemes in Ethiopia: A Case from Jiru Gamachu Resettlement Village, Nonno District, Central Ethiopia. Journal of Sustainable Development in Africa. 11(3), 83-102.

[15] Yamane, T., 1967. Statistics: an introductory analysis, 2nd ed., Harper and Row, New York.

[16] Gujarati, D.N., 2009. Basic econometrics. Tata McGraw-Hill Education.

[17] Gujarati, D.C.P., 2003. Basic Econometrics by Damodar N.

[18] Mohammed, A., Wassie, S.B., Teferi, E.T., 2021. Determinants of Smallholders' Food Security Status in Kalu District, Northern Ethiopia. Challenges. 12(2), 17.

[19] Dawit, D., Zeray, N., 2017. Determinants of rural household food security in Wolaita Zone: the case of Humbo Woreda. Journal of Poverty, Investment and Development. 32, 65-82.

[20] Guyu, F.D., Muluneh, W., 2016. Determinants of seasonal food insecurity in the green famine belt of Ethiopia: the case of households in Belo-jiganfoy district, Benishangul-gumuz region. African Journal of Food Science. 10(11), 278-291.

[21] Fekede, G., Lemma, Z., Jemal, Y., 2016. Determinants of farm household food security in Hawi Gudina district, West Hararghe zone, Oromia Regional National State, Ethiopia. Journal of Agricultural Extension and Rural. 8, 12-18.

[22] Funmilola, F.A., Patricia, O.A., 2014. Determinants of food security among low-income households in Maiduguri Metropolis of Borno State, Nigeria. Asian Journal of Social Sciences and Humanities. 3(1), 74-86.

[23] Gebre, G.G., 2012. Determinants of food insecurity among households in Addis Ababa city, Ethiopia. Interdisciplinary Description of Complex Systems: INDECS. 10(2), 159-173.