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Analysis of Factors Determining Households Food Security in Pastoral Area Oromia Region, Moyale District, in Ethiopia

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This study examined the status and determinants of rural households' food security in Moyale district of pastoral area, Oromia regional state, in Ethiopia. Both secondary and primary data were used for the study. The study was based on the survey of a total of 100 farmers randomly selected using a three-stage sampling technique. Analytical tools used include descriptive statistics, Foster-Greer-Thorbecke (FGT) model and logit model. The findings revealed that about 49.5% and 50.5% of pastoral households were food insecure and food secure respectively. Logit model analysis result showed total farm income, off-farm income and livestock holding households were the major factors positively and significantly influence food security status. However, family size negatively affects household food security in the study area. The findings suggest the following set of policy recommendation. Identifying and understanding factors that are responsible for household food security status and its determinants is important to combat food security problems at the household level. The study findings suggest that in selecting priority intervention areas, the food security strategy should consider statistically significant variables as the most important areas. **[Amsalu Mitiku et al. Analysis of Factors Determining Households Food Security in Pastoral Area Oromia Region, Moyale District, In Ethiopia. International Journal of Agricultural Science, Research and Technology, 2012; 2(3):105-110].**

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1. Introduction

Ethiopia is one of the heavily populated countries in the world with an estimated population of about 77 million out of this 85% live in the rural areas. Agriculture generates more than 40% of the gross domestic product whereas smallholder farmers produce more than 90% of the crop production of the country. The country is one of the poorest nations in the world with a per capita income of less than US$ 120 per annum and 31% of the people live under one dollar a day. The country's economic growth depends to a greater extent on the agricultural sector which is characterized by traditional smallholding and subsistence farming with an average landholding of less than one hectare (CSA, 2003).

Ethiopia has been experiencing a decline in per capita income and unstable food production, which has led to raising poverty and food insecurity over the last three decades (FDRE, 2002). About 52 percent of the Ethiopia's population is food insecure and average food consumption of approximately 1770 kilocalories per capita, which is considerably low as compared to Food and Agricultural Organization of United states/World Health Organization (FAO/WHO), recommended 2100 kilocalories per person per day (FAO, 1998). Further, the problem of food insecurity has continued to persist in the country as many rural households have already lost their means of livelihood due to recurrent drought and crop failures (Ayalneh, 2002). In many parts of Ethiopia most households are only able to meet their food requirements for less than six months of the year. This is particularly true in low land areas where rainfall is generally low and is extremely variable and unpredictable that leads to low yield and frequent crop failures (Kidane, 2003).

Similarly, earlier studies in Ethiopia it is roughly estimated that 15 million rural peoples were food insecure in 2006, out of these about 8.29 million peoples were chronically food insecure while the remaining 6.71 million were acute food insecure people (FSB, 2007). According to FDRE (2002), the causal factors of increasing food insecure caseload in the country are the interaction between environment, high population growth, diminishing landholdings, and a lack of on-farm technological innovation which led to a significant decline in productivity per household. These trends have combined with

repeated effects of drought over the years. However, causes of food insecurity in the lowlands pastoral and agro-pastoral areas are much more complex.

Despite the fact that the problem of food insecurity has big diversity and multiple dimensions, which range from the global, regional, country, local, household to individual level. Food security causation and survival mechanisms may different for different people and areas. Many things are unclear about characteristics, causation and possible remedies of hunger in modern world. A great deal of interested investigation-analytical as well as empirical is needed as back ground to public policy and action for eradicating famines and eliminating endemic under nutrition (Sene, 1981; Dreze and Sene, 1989). So far there is a little research undertaken to elicit these problems. Therefore, this study attempts to fill the gap by conducting an empirical research on problem of food insecurity in most affected pastoralist area of Ethiopia, in Moyale district.

The study has the following objectives

1. To quantify the rural household's food insecurity,
2. To assess and compare the socioeconomic characteristics of food secure and food unsecure households
3. To identify factors affecting rural household food security in the study area.
4. To come up with some policy recommendations

2. Materials and methods

2.1. Description of the Study Area

Moyle district is one of the 180 Woredas in the Oromia Region of Ethiopia. It is located at a distance of 771 Km Southwest of Addis Ababa. It is named after the administrative center of the Woreda, Moyale. It is located in the southeast corner of the Borena Zone. The altitude of this district ranges from 1150 to 1350 meters above sea level. A survey of the land in this district shows that 9% is arable, 60% pasture, 21% forest, and the remaining 10% is considered swampy, degraded or otherwise unusable. Important crops cultivated include corn, wheat, teff, barley and sorghum, sugar cane, banana and papaya are other important crops (CSA, 2008).

2.2. Sampling Procedure

In this study three-stage sampling techniques were used to generate the required primary data. At the first stage, Moyale district was selected purposively. In the second stage, 4 peasant associations were selected randomly. Finally, a probability proportional to sample size sampling procedure was employed to select 100 sample households.

2.3. Analytical Technique

Data collected were analyzed using:

(i) Descriptive statistics, (that is frequency distribution, percentage and mean), were used to analysis the socioeconomic characteristics of farming households that related to food security.

(ii) Foster-Greer-Thorbecke (FGT) model

Foster *et al*. (1984) was used in the assessment of food insecurity. The FGT model is expressed as follow:

$$FGT(\alpha) = \left(\frac{1}{n}\right)\sum_{i=1}^{q}\left[\frac{(c-y)}{c}\right]^{\alpha} \quad (1)$$

Where:

n = is the number of sample households;

yi = is the measure of per adult equivalent food calorie intake of the i^{th} household;

c =represents the cut off between food security and insecurity (expressed here in terms of caloric requirements); or c = Poverty line; when α = 0, 1 or 2, P0 = q/n.

q= is the number of food-insecure households; and α = is the weight attached to the severity of food insecurity.

FGT index provides three most commonly employed indices; head count ratio, food insecurity gap and squared food insecurity gap (Hoddinott, 2001). Head count ratio describes the percentage of sampled households whose per capita income or consumption is below the predetermined subsistence level of energy (2100kcal). The food insecurity gap measure how far the foods insecure, on average, are below subsistence level of energy or below poverty line. Squared food insecurity gap is a measure closely related to severity of food insecurity gap but giving those further away from the subsistence level a higher weight in aggregation than those closer to the subsistence level.

(iii) Specification of the model

The binary logit model was applied to estimate the effects of explanatory variables on household food security status (dependent variable). In this model the dependent variable is household food security (HFS) that is dichotomous taking a value of 1 if the household is food secure; 0 otherwise. The information, which identifies the food secure from the food insecure, was obtained by comparing the total food calorie available for consumption in the household per AE to the minimum level of subsistence requirement per AE (2100 kcal) (EHNRI, 1998). A household beyond this threshold is said to be food secured (Z_i = 1), otherwise food insecure (:Z_i = 0). The cumulative logistic probability model is econometrically specified as follows (Gujarati, 1995):

$$L_i = \ln\left(\frac{P_i}{1-P_i}\right) = Z_i = \partial + \sum_{i=1}^{m} \beta_i X_i + U_i$$

i= i= 1, 2,…., 12 (2)

Where:

L_i = is log of the odds ratio which is equal to Z_i, which is not only linear in X_i but also linear in the parameters. It shows how log odd in favor of food security change as the respective independent variable change by a unit and X_i = Vector of relevant explanatory variables; B_i = Vector of unknown coefficient; Ui = Error term.

After this, it is possible to estimate the parameters of the model by maximum likelihood function (MLE) using latest STATA version 12. The model is based on the following hypotheses:

1. Household income, livestock and land size is entitlement factors that have positive influence on food security
2. Household size is demand factor, which influence food security negatively
3. Education is a proxy variable of attitudes of households and expected to influence food security positively
4. Sex and age are demographic variables and expected to influence food security positively
5. Access to adequate credit and market information are institutional factors that have positive influence on food security
6. Distance to the market is institutional factors that have negative influence on food security

3. Results and discussion

3.1. Demographic and Socio Economic Characteristics of the Households

Table 1 showed that 78% and 22% of the households were male headed and female headed households respectively. Categorization of household based on education exhibited that 30% households are literate, while 70% are illiterate.

Table 2 shows distribution of household food security status by family size in number, age, land size, crop yield, livestock holding in TLU; total annual income and expenditure. The survey result showed that, the average age and family size of households were 46 years and 7.42, respectively. The land size cultivated by the households were 0.56 ha with the range of 0 to3 ha, this shows that the farmers are operating on small scale production. On average, the annual crop productions of households were 323.06 kg while the average livestock owned by the household were7.70 TLU. Finally, the finding indicated on average annual income per AE of sample households were found to be birr 350.94 whereas annual consumption expenditure of household were735.02.

3.2. Extent of Household Food Insecurity

Based on the cut-off of 2,100 kcal, 49% of the households were classified as food insecure and 51% as food secure. The results of the summary of the household incidence, depth and severity of food insecurity, are presented in Table 3. The results revealed that the incidence of household food insecurity was 0.49. This implies that 49% of the sampled households are not able to meet the daily recommended caloric requirement which is 2100 kcal per day per AE or food insecure. The calculated values of food insecurity gap were found to be 17.12%. These shows 17.12% of food insecure households are below the recommended daily caloric requirement level or below food poverty line. Finally, the severity of food insecurity households was 0.0847. This implies 8.47% of households are the most food insecure groups of households in the study area.

Table 1: Distribution of household food security status by sex and education level

Variables	Name	Food insecure (N=49)	Food Secure (N=51)	Total (N=100)
Sex	Female	25% (N=12)	19.23% (N=10)	22% (N=22)
	Male	75 % (N=37)	80.77% (N=41)	78% (N=78)
Education level	Illiterate	75% (N=37)	65.38% (N=33)	70% (N=70)
	Literate	25% (N=12)	34.61% (N=18)	30% (N=30)

Table 2: Distribution of household food security status by independent variables

Independent Variables	Food insecure (N=49)	Food Secure (N=51)	Sig.	t-value	Total
Family size in number	8.21	6.70	0.00***	2.85	7.42
Age (year)	45.00	48.00	0.36	-0.92	46.00
Land size (ha)	0.48	0.64	0.17	1.40	0.56
Crop yield (kg/ha)	255.42	458.33	0.00***	0.37	323.06
Livestock holding	7.31	8.07	0.63	-0.49	7.70
Annual Income (ETB)	217.17	474.42	0.00***	-2.713	350.94
Total consumption expenditure (ETB)	444.81	1002.90	0.62	0.488	735.02

Note: ***, **, and * denote a 1%, 5% and 10% level of significance, respectively

Table 3.Summary of incidence and severity of food insecurity

Type	Percent (%)
Incidence food insecurity (Head count ratio)	49.00
Depth food insecurity (Food insecurity gap)	17.12
Severity food insecurity (Squared food insecurity gap)	8.47

3.3. The Determinants of Household Food Security

To analysis the determinant of households' food security in the study area logit model was employed. The results of the regression model, including significance level, are presented in Table 5. Before fitting the models, the existences of serious problem of multicollinearity among the hypothesized explanatory variables were checked using variance inflation factor and contingency coefficients. The values of variance inflation factor (VIF) for each of the continuous variables for this study were less than 10. This implies, there was no a multicollinearity problem among all the hypothesized continuous variables included in the model. The result of contingency coefficients (C) revealed that there was no a serious problem of association among discrete explanatory variables as the contingency coefficients did not exceed 0.75. Therefore, all the hypothesized dummy variables were included in the logistic regression model.

The likelihood ratio has a chi-square distribution and it is used for assessing the significance of logistic regression. Model chi-square provides the usual significance test for a logistic model i.e. it tests the null hypothesis that none of the independent variables are linearly related to the log odds of the dependent. The result is significant at less than 1% probability level revealing that the null hypothesis that none of the independent variables are linearly related to the log odds ratio of the dependent variables is rejected. In addition, goodness of fit in logistic regression analysis is measured by count R^2 which indicates the number of sample observations correctly predicted by the model. The count R^2 is interpreted based on the principle that if the predicted probability of the event is less than 0.50, the event will not occur, and if it is greater than 0.50, the event will occur (Maddala, 1981).

The results in Table 5 indicate that the household family size negatively impact household's food security. This negative relationship shows that the probability of being food security decrease when family size increases.

Table5. Logit estimates of the determinants of household food security

Variables	Coefficient	Significance Level	Odds Ratio
Male headed HH	0.4633	0.417	1.5893
Age of HH head	0.0159	0.42	1.016
Family size	-0.3729***	0.00	0.6887
Share of dependent family	-0.1242	0.736	0.8832
Education level	0.7331	0.235	1.0008
Total farm income	0.0003*	0.006	2.0815
Total Off-farm income	0.0003	0.153	1.0003
Land holding	-0.3802	0.477	1.0003
Livestock holding	0.0462***	0.00	0.6837
Access to credit	0.8881***	0.00	1.0473
Market distance	-0.0151	0.77	2.4305
Food aid	0.0008	0.191	0.9851
Constant	-0.1674	0.903	
Pearson Chi-square		91.93***	
Log pseudo likelihood		-51.23	
Percent correctly predicted (Count R^2)		72	
Sensitivity		71	
Specificity		72	
Sample size (N)		100	

Note: ***, **, and * denote a 1%, 5% and 10% level of significance, respectively.

If all other things are held constant, for a unit increase in family size of the households the odds ratio in favor of being food secure decreased by a factor of 0.6887. Household size critically affects the household food requirement. This due to fact that most households in the study area rely on the purchase of crop production and with the high dependence on livestock, it is likely that larger households will face some difficulties in meeting their food requirements. In addition, the households with large family size, having children of non-productive age, could face the probability of food insecurity because of high dependency ratio than households with small family size. Similar results was reported by Del Ninno *et al.* (2001).

Furthermore, farm income is also important determinant of household food security: households with high farm income are likely to be food secure. This variable is found to have positive influence on the food security status of the households at 1% probability level. The finding indicated that larger income enhances the household's ability to secure

food. Thus, the possible explanation is that, households who have earned more or relatively large farm income were food secure than those who had not. Other things are held constant; the odds ratio in favor of the probability of being food secure increases by a factor of 2.0815 as households earn increase by one Birr.

Off-farm (non-farm) income represents the amount of off-farm income (non-farm) the farmer or any of the household members earned in the year. As expected, the presence of an off-farm enterprise in the household has a positive effect on its food security. Since agricultural production is vulnerable, households with off-farm activities have a better survival mechanism when the production fails. Furthermore, the income earned from off-farm activities can be used to purchase agricultural inputs and hence boost the production. The above result is similar to Ayalneh (2002).

Credit availability also has a significant positive effect on household food security: households with better access to credit are more likely to be food secure. Credit one of an important determinant of household food security: households with credit access likely to be food secure because credit adds to the financial resource of the household, for food and input procurement.

Furthermore, higher livestock size has a positive and significant effect on food security. This result could be due to the fact that livestock is used in times of production shortfalls as safety nets and households may sell a part of it to purchase inputs, such as fertilizers and pesticides. On the other hand, households with more livestock produce more milk, milk products and meat for direct consumption and owners could be more food secured. This enables the farm households to have better chance to earn more income from livestock production which enables them by increasing purchasing power of food during food shortage and could invest in purchasing of farm inputs that increase food production, and able in ensuring household food security. The result indicates that, other things held constant, the odds ratio in favor of being food secure increases by a factor of 0.0462 as the total livestock holding increase by one TLU.

4. Conclusion and Recommendations

The study revealed that 49% of the households were food insecure or not able to meet the daily recommended caloric requirement in the study area. The study identified the major factors affecting food security of households in the study area were family size, off-farm income/nonfarm, distance from market center and total farm income per AE. In other words, family size, off-farm income/nonfarm, distance from market center and total farm income per AE have a significant and positive influence on the state of household food security while family size and food security were negatively related. Based on the findings and conclusion of the study, the following policy recommendations are forwarded.

1. Proper attention should be given to limit the increasing population. This could be achieved by proper awareness creation about practicing family planning activities through integrated health and education services.
2. Improving households' off-farm/non-farm income have a significant and positive influence on the state of food security, therefore, concerned stakeholders should identify the different possible types of off-farm/non-farm activities and support with the necessary knowledge and skills of the various types of off-farm and non-farm activities that could improve their food security status.
3. Annual farm income has a positive influence on food security. Therefore, household's total farm income should be improved through promotion of better livestock management practices, improved crop varieties with full management practices, and developing small scale irrigation schemes.
4. Findings of this study showed that livestock variable appears to have negative impact on household food insecurity. This implies as livestock sector plays a great role in improving food security. Hence due emphasis should be given to improve production and productivity of this sector. Livestock production is impeded by various constraints including feed supply, disease, and, institutional and policy factors. Livestock feed shortage is a major constraint to livestock production. To increase feed availability and quality, in addition to the existing natural pasture and crop residues, some package activities are need to be introduced. New feed technologies which could be suitable for pastorals also need to be introduced. To do so, developing ways of introducing forage legumes is very important. In addition to this, introducing and familiarizing the technology of fodder banks through hay and other forms of feed conservation is so essential particularly during the dry season. Farmers should be encouraged to engage in livestock husbandry through providing with improved livestock production technologies (health service, improved breeds and feeds, *etc.*) to improve production and productivity of the sector, this will ultimately increase food security status.

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