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Assessment of Food Insecurity and Coping Mechanisms among Pastoral Households of Afar National Regional State: The Case of Chifra District, Ethiopia

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Abstract

Inspired by the current vulnerability of pastoral households, this study was carried out in Chifra district of Afar National Regional State; Ethiopia, with specific objectives of assessing the status of food security, the local food insecurity coping strategies employed by different food security status groups and identifying the major determinants of food insecurity. In order to achieve these objectives cross-sectional data on demographic and socio-economic characteristics, and institutional aspects were collected from 120 households that were drawn by a multi-stage sampling procedure from 3 randomly selected Pastoral Kebeles through structured interview schedule and focus group discussion during January and February 2011. The main tools of analysis for this study include descriptive and inferential statistics and binary logit econometric model. Results of descriptive and inferential statistics indicate that using the calorie intake approach, 65.8% of sample respondents were food insecure, while 34.2% were food secure. Further analysis showed that sale of sheep and goats (shoats), reducing number and size of meals; seasonal migration (some of the family members), receiving food aid and borrowing cash or food from neighbors or relatives were the frequently practiced coping strategies by pastoralists of the study district. On the other hand, analysis of the logistic regression model resulted in eight statistically significant variables affecting the food security status of the sampled households in the district. Family size, age of household head, dependency ratio, livestock disease incidence were causing food insecurity whereas sex of household head, herd size, income from livestock production and non-farm income were working against food insecurity. The study recommends that appropriate policy measures be taken towards limiting dependent population size through integrated and accessible health and education services, improving the contribution of the pastoralist women through trainings that could help remove cultural barriers and supporting the livestock sector through proper forage development as well as extended veterinary service and disease control programs.

Key words: Pastoral household; food insecurity; coping mechanisms; Chifra district; Ethiopia

Introduction

Over the past, millions of dollars have been set aside by governments, donors, international aid agencies, and multi-lateral development bodies in many countries of the world to address the problem of food insecurity. Despite the many efforts on food security, there are still millions of food insecure people around the world many of which are living in developing countries particularly in Africa (FAO, 2006).

The developing world shares the highest proportion (one-third) of people suffering from chronic hunger. In 14 countries of the developing world, 35% or more of the population were chronically undernourished in the years of 2001 up to 2003 (FAO, 2006). Sub-Saharan Africa accounts for 13% of the population and 25% of the undernourished people in the developing world.

In Ethiopia food insecurity is highly prevalent in moisture deficit highlands and in the low-lying agro-pastoral areas. Even in years of adequate rainfall and good harvest, the people, particularly in lowland agro-pastoral areas, remain food insecure and in need of food assistance. This clearly reflects the deeply entrenched poverty and food insecurity situation in the country (Workneh, 2004).

Pastoral areas in Ethiopia are located in the North-eastern, Eastern, South-Eastern, Southern, and South-western part of the country (MoFED, 2002). Livestock are the major source of food (milk and meat), income, and employment for the pastoralists. However, the pastoral production system and in particular the food security and livelihood situation has been largely threatened because of different man-made and natural catastrophes. Some of the major risks and challenges the pastoral communities in the country are facing include: expansion of sedentary agriculture; expansion of agricultural projects; expansion of national parks inside the rangeland; emergence and expansion of agro-pastoralism; encroachment of unwanted invasive plant species; conflict over rangeland resources; and recurrent drought (Beruk, 2003).

Some 10 million semi-nomadic people depend primarily on grazing, herds of cattle, camels, and goats, and are concentrated mostly in the dry lowland areas of Afar and Somali. Human development indicators and poverty among this group are worse than elsewhere in the country, and the nomadic people have proven difficult to reach with traditional services (MoFED, 2006).

According to Guinand (2000), the Afar region is one of the poorest and least developed regions of Ethiopia, neglected by national development efforts. The recurrent drought, chronic food insecurity and famine in Afar region are of major concern by the federal and regional government and humanitarian organizations (Phipottet *al.*, 2005). Also according to UN (2007), the food security situation in the region is of great concern.

Losses of livestock due to drought coupled with the deteriorating terms of trade against pastoralists worsened food insecurity in many parts of the Afar region. Pastoralists have become vulnerable to food insecurity due to failure of the main rainy season (*Karma*) and also due to the cumulative effect of the past drought and other triggering factors (Phipottet *al.*, 2005). The degree of food insecurity reached its climax in 2002/03 because of the intensified drought (Bekele, 2009). Poor performance of the rains coupled with the delay in transfer of safety net resources has exacerbated the situation (UN, 2007).

The region has been heavily dependent on external food aid since 1984 with increasing number of people requiring food aid. In 2004/2005 the needy population has grown to 560,000 (45 % of the population). However the status of food insecurity and the associated factors which are precipitating food insecurity and livelihood vulnerability are not well documented in the study area, imposing difficulty in responding favorably to solving the current problems among the pastoralists of the Afar region.

On the other hand, most of the past studies on food insecurity focused on farmers that practice mixed farming in the central part of Ethiopia and the lowland areas which constitute about 60% of the country's area have not been very well addressed. Hence this study is a good starting point to assess the food insecurity situation and coping mechanisms of pastoralists in the lowland and marginalized areas of Ethiopia.

Therefore, this study tries to shed light on food insecurity among pastoralists by assessing the status and the link between food insecurity and key explanatory variables that possibly trigger the food security status of pastoral households in *chifra* district, one of the most vulnerable areas of Afar National Regional State, Ethiopia.

Materials and Methods

The study district, Chifra, is found in zone one (*Awsi Resu*) of the Afar Regional State which is located South-West of the regional capital city (Semera) along the main road of Mille to Woldiya. It is about 162 km from Semera and bordered on the south by Mille, on the West by the Oromiya Zone of Amhara Region, on the North by the Administrative Zone four (Fantena Resu), and on the East by Dubti. The total land area of the district is about 173,374 ha of which a large area is rangeland (APARDB, 2006). The district has an estimated total population of 91,080 (making about 8% of the total population of the region) where 50,861 are males and 40,219 are females live in this district (CSA, 2007).

Chifra is characterized as arid and semi-arid agro-ecological area, where livestock production is the main occupation of the community. The mean annual temperature of the area is about 29°C and the average annual rainfall is between 400 and 600 mm (APARDB, 2006). The rainfall is bimodal with erratic distribution.

The altitude ranges between 550-1,100 m above sea level and most of the rangelands of the study district fall below 850 m above sea level. The dominant soil types in these areas are black, sandy, vertisols and deposits of silt and fine sand particles occur in the plain areas where cultivation is practiced (APARDB, 2006). The topography is generally lowland plains with hilly escarpment in the western edges that is neighboring Amhara region.

The study area consists of 19 *Kebeles* of which 13 are pastoralists, which entirely depend on livestock production and the remaining 6 *Kebeles* are agro-pastoralists practicing both farming and extensive livestock rearing. The total livestock population of the district is about 1,129,710 of which cattle are 352,316; sheep 342,286; goat 306,720; camel 126,340; donkey 1,771 and chickens 277 (APARDB, 2006). Live animals, especially cattle, goats and sheep are the main marketable output of the pastoralists. The total area coverage of the pastoralists is 130,030.5 ha (WARC and APARI, 2007).

A multi-stage sampling procedure was applied to select the required number of sample units. First, Chifra district was purposively selected for its accessibility to transportation and general representation of the pastoral environment. Then, three *Kebeles* were selected randomly from a total of 13 *Kebeles* of the district where pastoralism has been well established. Finally, a total sample of 120 Pastoral household heads was selected randomly using Probability Proportional to Size (PPS) sampling technique.

The required data was generated from both primary and secondary sources using pre-tested questionnaire and study guide respectively. The study was supported by qualitative data that was obtained from Key informants interview and focus group discussion.

Methods of Data Analysis

Measuring food security status

The households' food security status was measured by direct survey of household consumption. Therefore, the consumption data collected on the basis of seven days recall method (see Bouis, 1993) were converted in to kilo-calorie using the food composition table manual adopted from Ethiopian Health and Nutrition Research Institute (EHNRI, 1997). Then, in order to calculate the households' daily caloric intake, the total households' caloric intake for the last seven days, which was adjusted for most recurring seasonal variations, was divided by seven. The household's daily caloric intake per adult equivalent was calculated by dividing the household's daily caloric intake by the family size after adjusting for adult equivalent using the consumption factor for age-sex categories (Zegeye, 2009).

Subsequently, the calculated daily calorie intake was compared with the minimum daily subsistence requirement in adult equivalent of 2,200 Kcal which is set by the Ethiopian Government (FSS, 2002) to establish food security status of households.

Accordingly, this minimum daily subsistence requirement was used as a cut-off point to separate food secure and insecure households in which case the household meeting at least this minimum level was classified as food secure and food insecure otherwise.

Setting the analytical framework

The logit model was used to identify determinant factors that influence food insecurity of the households. It was used to evaluate the relationship between the probability of food insecurity of the household that takes either of the two discrete values of 1 for food insecure households and 0 for food secure households and the hypothesized determinant factors.

The logistic distribution function for assessing factors determining the food security status of the households can be specified, following Gujarati (1995), as: -

$$p_i = \frac{1}{1 + e^{-Z_i}} \quad (1)$$

Where: p_i is the probability that a given household is food insecure.

e represents the base of natural logarithms (2.718) and

Z_i is a function of explanatory variables X_i , $i = 1 \dots m$ which may be expressed as:-

$$Z_i = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \dots + \beta_m x_m \quad (2)$$

The odds defined as the ratio of the probability that a household being food insecure p_i to the probability that food secure $(1-p_i)$ may be represented by the following relationships.

$$\left(\frac{p_i}{1 - p_i} \right) = \frac{1 + e^{Z_i}}{1 + e^{-Z_i}} = e^{Z_i} \quad (3)$$

Where, $(1 - p_i) = \frac{1}{1 + e^{Z_i}}$

And, $\frac{p_i}{1 - p_i} = \frac{1 + e^{Z_i}}{1 + e^{-Z_i}} = e^{\beta_0 + \sum_{i=1}^m \beta_i x_i} \quad (4)$

Taking the natural logarithms of the odds ratio in equation (4) will result in what is known as the logit model which can be given by the following relationship.

$$\ln \left(\frac{P_i}{1 - P_i} \right) = \ln \left[e^{\beta_0 + \sum_{i=1}^m \beta_i x_i} \right] = Z_i \quad (5)$$

Thus the final logit model has the form:

$$Z_i = \beta_0 + \sum \beta_i x_i + U_i \quad (6)$$

Where, β_s are parameters to be estimated by the model. The intercept (β_0) tells the log-odds in favor of food insecurity of the household when all the independent variables are kept constant.

Results and Discussion

Household food security status

Results of analysis of the food security status of the pastoral households based on the recommended daily calorie intake of 2,200 kcal indicate that from all respondents 79 (65.8%) were food insecure and the remaining 41 (34.2%) were food secure (Table 1). The average per capita calorie intake in the area was found to be 2,062.88 kcal which is lower than the national average of 2,200 kcal. Tests of mean difference between food insecure and food secure households shows that there was statistically significant difference between the two groups at 1 percent probability level ($t = 9.87$). This would imply that the difference is real and that, considering the context that most (65.8%) of the sampled pastoralists are food insecure (as they could not meet the nationally recommended daily calorie intake of 2,200kcal) the study area could be regarded as food insecure.

Table 1: Energy available per adult equivalent per day in kcal among sample households

Energy available per AE in (kcal)	Food Secure (N=41)	Food insecure (N=79)	Total (N=120)	t- value
Minimum	2220.85	1025.54	1025.54	9.87***
Maximum	2814.23	2189.99	2814.23	
Mean	2393.12	1891.48	2062.88	
Std	143.20	308.18	355.28	

Note:***Significant at 1 percent probability level

Source: Field survey, 2011

Household coping mechanisms

Pastoral households of the district respond to the problems caused by seasonal and drought related food insecurity in different ways, which result in trade-offs between current and future consumption. The survey result revealed that the majority (97.5%) of sampled households relied on sale of small animals, during the time of food shortage. Sale of small animals was found to be important for the two groups. Consequently, all of the food secure and 96.2% of the food insecure households were found to be involved in sale of small animals.

The second and third most important coping mechanisms considered by pastoral households, both food secure and food insecure, of the district were reducing number of meals and size of meals. These strategies were practiced by 92.7% and 85.4% of food secure and 97.5% and 94.9% of the food insecure households respectively. This result was also verified through focus group discussion indicating that at the initial stage of food shortage only adults practiced reduction of the daily food portions both in size and number of meals and during extended period of food shortage, children are also forced to skip and reduce food as coping strategies.

Another strategy includes seasonal migration, which could be regarded as a production system and drought coping and mitigation mechanism for pastoralists. The study result indicated that 92.4% of food insecure and 80.5% of food secure households were using this coping strategy. Such a strategy considers that some of the family members particularly women, children and the elderly would remain in one place whilst young men take the herds to seek pasture opportunistically. The fifth strategy pertains to the households' reliance on relief assistance. The percentage of food insecure and food secure households, who practiced this method during food shortage, was 98.7% and 65.9% respectively.

Empirical results of factors influencing the food insecurity of pastoral households

The result of the logit regression is presented in Table 2. The model was statistically significant at 1% level indicating that the model is useful to estimate relationships between the hypothesized explanatory variables and the dependent variable. The estimation result also showed that the model correctly predicted 95% of all the cases, 97.5% of the food insecure group and 92% of the food secure group. This indicates that the model has adequately considered the variation in estimating the relationship in terms of the variables considered.

Table 2 shows that 8 out of the 11 variables included in the model are statistically significantly related with the state of food security. These variables are family size, age of household head, dependency ratio, Herd size, non-farm income, income from livestock production, sex of household head and livestock disease incidence and are explained as follows.

Family Size: this variable was found statistically significant (at 1 percent probability level) and has positive association with the household food insecurity. The positive sign shows that the probability to be food insecure increases as household size in adult equivalent increases. The possible explanation is that households with large number of family members could face the probability of food insecurity because of high dependency burden created as a result of sharing available limited resources.

Age of Household Head: this variable was found to be positive and significant at 1 percent probability level implying that, an increase in the age of the household head increases the likelihood of the household to be food insecure. The possible explanation

for this would be that, as age of the household head gets older, the burden on availability of labour force would increase and the household may have to carry out livestock production and other income generating activities causing vulnerability to food insecurity.

Dependency ratio: this variable was found to have positive effect at 5 percent probability level in determining the household food insecurity. The positive sign indicates that being food insecure increases as dependency ratio increases. The way of life in the pastoral areas promotes large family size which could expose the family to have high dependency ratio and possibly be food insecure than those who have small family size who could have low dependency ratio.

Herd Size: this variable was significant at 1 percent probability level and has negative association with household food insecurity. The negative relationship indicates that the probability of being food insecure decreases as the households' livestock ownership increases. This is possibly because livestock are important assets and source of income for the pastoral households. The possible explanation is that households who own large livestock number produce more milk, milk products and meat for direct consumption at times of shortfall in food. Specifically, the shock-absorption capacity of the pastoral households is directly related to their livestock holding.

Non-farm income: this variable affected households' food insecurity negatively and significantly at 10 percent probability level. The negative relationship shows that those households with non-farm activities may earn more income to improve their living condition. The likely explanation is that those pastoralists who have access to non-farm income opportunities are less likely to become food insecure than those households who had no or little access as the additional money could play a buffering role in time of shortage.

Income from livestock production: this variable was found to inversely and significantly influence the probability of being food insecure (at 1 percent probability level). The possible explanation is that as livestock resources are the mainstay of the local economy, pastoralist households who managed to earn more cash income from sale of livestock and their products are better-off. Thus, such households would have better probability of getting out of food insecurity compared to their counterparts.

Sex of householdhead: this variable was found to have a significant (at 5 percent significance level) and negative association with household food insecurity. The result implies that male-headed households are in a better position in escaping out of food insecurity than the female-headed ones. The possible explanation could be that, in view of the strong cultural setting, the social position of men in the pastoral areas is more powerful as compared to women to access social capitals and command over productive resources. In the study area strict gender relations of production define livestock ownership and control. Despite their heavy burden and responsibility for

domestic and other economic activities, women do not have command over the major livestock types (cattle and camels) and their role is limited to donkeys and small ruminants.

Livestock disease incidence: this variable was significant at 1 percent probability level and correlated positively with food insecurity. The positive relationship indicates that for an additional unit in the number of livestock lost as a result of various disease incidences there is an increase in probability of the pastoralists to fall in to food insecurity. This is because those pastoralists who face the incidence of livestock diseases, could lose a significant portion of their income for treating sick animals and productivity and income losses could lead to food insecurity.

Table 2: Estimates of the logistic regression of determinants of food insecurity of Pastoral households

Variables	Coefficients	Odd Ratio	Significance
Family size	1.810	6.112	0.004***
Age of household head	0.174	1.190	0.006***
Dependency ratio	2.409	11.122	0.019**
Herd Size	-0.540	0.582	0.005***
Non-farm income	-0.012	0.988	0.097*
Income from livestock production	-0.001	0.999	0.005***
Distance from market center	-0.204	0.816	0.183
Sex of household head	-2.666	0.070	0.034**
Livestock disease incidence	2.703	14.923	0.004***
Educational status of household head	-1.895	0.150	0.367
Herd diversification	1.061	2.888	0.427
Constant	-8.845	0.000	0.215
Pearson Chi-square (12)	115.877***		
-2log Likelihood Ratios	38.235		
Correctly Predicted (<i>count R</i> ²) ¹	95		
Sensitivity ²	97.5		
Specificity ³	90.2		
Sample size	120		

1. Based on 0.5 cut value

2. Correctly predicted food insecure group based on 0.5 cut value

3. Correctly predicted food secure group based on 0.5 cut value

Note:***, ** and * are significant at 1%, 5% and 10% probability level, respectively

Source: Model output of survey data

Food insecurity is a reality for hundreds of millions of people around the world, with the most affected countries being those in East Africa. In Ethiopia, the problem of food insecurity is exacerbating around pastoral areas due to the influence of a number of socio-economic and environmental factors. Results of this study show that, in spite of the fact that pastoralists undergo a number of food insecurity coping strategies they have remained increasingly vulnerable to the situation as none of the strategies were enough to combat food insecurity. Therefore, improvement of the existing coping strategies and introduction of new means of mitigation and escaping of food insecurity are important.

Considering the factors involved in determining the status of food security of households the positive impact of large family size and dependency ratio on the household's food insecurity could be ameliorated through practical education on family planning techniques that would help households decide on the optimum number of children to bear in relation to that their resources can accommodate. However, natural birth control and other alternatives should be carefully considered within the framework of the overriding culture and religion of the communities. The fact that pastoralists in the district rely on livestock production as their main livelihood would enable them to be food secure either through the income earned from selling the livestock or direct impact on individual nutrition through the consumption of milk by household members, especially children. On the other hand, the prevalence of livestock diseases was threatening the pastoralists' livelihoods. According to the survey result pastoralists were unable to access the veterinary services as they are located at inaccessible places. Hence, necessary effort should be made to improve the production and productivity of livestock through provision of improved water supply points, introduction of timely and effective artificial insemination services to up-grade the existing breeds, launching sustainable and effective forage development program, provision of training on how to improve their production and productivity and improving the marketing conditions. Improving animal health services is important not only to protect the productive assets of pastoralists from diseases, but also play a pivotal role in the promotion of livestock trade, which is regulated by animal health certification system and which is becoming increasingly strict. To this effect, strengthening veterinary services, in both the public and private sectors, and training of community based animal health workers from pastoralist communities are so important to enhance the pastoralists' capacity of controlling livestock diseases.

As a result of the longstanding cultural norms (taboos) that deprived women's active role in the sector female-headed households is food insecure and very poor. Hence recognition of the problem of lack of empowerment of the pastoralist women is one of the most important areas upon which future intervention has to be made. Therefore, interventions in socio-economic sector should be preceded or simultaneously done with interventions (such as trainings) that can bring attitudinal changes in the pastoral communities and improve empowerment of women in terms of resource control and decision-making are sought at various levels.

In spite of the fact that livestock income plays an important role in reducing household's food insecurity, the level of income obtained from such activities is limited due to pastoralists' limited access to institutional support to escape the threats of drought. As evidence to this fact the study identified that the pastoralists rely on loans from relatives and friends, based on trust to meet their basic family requirements during food shortage. However, the existing informal credit system is not accessible to most of the borrowers in times of emergency needs. Hence, the introduction of formal credit system that addresses pastoralists' scenario and help them come out of the threats of drought through saving and acquiring favorable credit is essential.

Age of the household head and being women headed household had positive impact on food insecurity. This means old household heads and female headed households (widows) are more likely to be food insecure due to lack of capacity to run business. Therefore, capacity building for older household heads and female headed households should be given more priority. In addition, interventions intended to help pastoralists have to give priority to old aged and female headed households.

Finally, considering the fact that non-farm income of the sample households significantly affected households' food insecurity negatively, pastoral households in the district should be assisted to diversify their sources of income so that they may be able to cope with the prevailing problem and meet at least their minimum food requirement particularly during the drought season.

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