Bangladesh J. Agric. Econs. XXXV, 1&2(2012) 177-187

Research Note

SOCIOECONOMIC FACTORS INFLUENCING FOOD SECURITY STATUS OF MAIZE GROWING HOUSEHOLDS IN SELECTED AREAS OF BOGRA DISTRICT

Maksuda Mannaf*

Md. Taj Uddin

Abstract

The study was conducted to elucidate the determinants of food security among the maize growing rural households of Bogra district. Data were collected from 60 farmers, who were selected using a stratified random sampling method. The sample farmers were classified as small (0.51-1.00 ha), medium (1.01-3.00 ha) and large (above 3.00 ha) according to their possession of land. To collect data, a questionnaire was administered through face-to-face interviews. Data were analyzed using descriptive statistics, food security index and logit model. The results of the study revealed that almost all rural households in Bogra district were food secured. It was checked by using recommended minimum calorie requirement (i.e., 2122 kcal). Based on the results, 20 (33.33 percent) households were found to be food insecured while the rest 40 (66.67 percent) households were food secured households. Thus, only 20 (33.33 percent) of the sampled households could not get the minimum and above recommended calorie level, i.e., 2122 kcal per capita per day. The results of logit model indicated that four variables out of eight have influence on household's food security condition. The factors influencing household food security were found to be age of household head, household size, monthly agricultural income and food expenditure. The results of logit model showed that a unit increase in food expenditure will increase the probability of the household being food secure, households with older heads are more food insecure, household food security decreases with increasing household size, and increased income of household's ensure food security status.

I. INTRODUCTION

Bangladesh has a population of 150 million and is growing at a rate of 1.4 per year (SFYP, 2011). Provision for food for all, is therefore, a real challenge and Bangladesh may have to depend on imported food to ensure food security. During the last two decades, safety net programs were extensively used to channel food to the landless unskilled poor. This effort has added to the government policy of poverty reduction. In fact, poverty has dropped from 56.6 % in 1991/92 to 31.5 % in 2010. During the period, percentage of undernourished people declined from 35 to 30 with improvements in child and maternal mortality (SFYP, 2011).

* The authors are respectively Lecturer, Department of Agricultural Economics and Policy, Sylhet Agricultural University, Sylhet and Professor, Department of Agricultural Economics, Bangladesh Agricultural University, Mymensingh, Bangladesh.

Bangladesh has made significant progress in food production. The increase in food production has been neutralized by the absolute increase in demand for food due to growth of population. For that reason, the country remained as a low income food deficit country with an average food grain import of 2 million tonne since 1990/91. An estimated 27 million ultra-poor people survive on less than 1805 kcal per day and risk losing life and livelihoods to recurrent natural disasters. This is compounded by an increasing disparity in income distribution and high prevalence of malnutrition among women and children. Although poverty has declined in Bangladesh during the last decade, the country has third high number of hungry people in the World (SFYP, 2011).

In Bangladesh, the traditional crop including rice and wheat seems quite unable to meet the nutritional requirements to the increasing population. Therefore, the policy makers are facing difficulties to formulate policies regarding the solution of the malnutrition issues. Availability of, access to and utilization of food are the major three dimensions of food security at household level and accordingly food policy is gradually becoming more complex with the inclusion of these dimensions. However, maize is one of the oldest and most important crop in the World. It is the highest yielding grain crop having multiple uses. It scores first among the cereals in terms of yield but in terms of area and production, it ranks third followed by rice and wheat. It is introduced as relatively new crop in the cropping patterns of Bangladesh especially, in the northern region. Every year approximately 1.2 million tonne maize is utilized of which only 42% is produced by the country and remaining is imported from other countries (BBS, 2011).

Maize has an enormous market potential. The country‘s poultry industry continues to expand and there is also a growing demand for maize for that industry. More than 90% of maize is used as poultry feed and the remaining portion is used for fish culture and human consumption. Maize can be considered as an alternative food to introduce food crop diversity, dietary variety and to address issues of food security. Maize based subsistence cropping patterns have been used to diversify the rice-wheat cropping system with success in several parts of the World (Ali *et al.*, 2008). Demand for maize is increasing day by day in the World as well as in Bangladesh due to its diversified uses. If the rigid food habit is to be diversified from rice to maize, it would probably be possible to reduce food shortage to a great extent. The country has a great potentiality to improve and expand the maize production. Farmers producing maize are not completely aware of the benefits of maize cultivation. They are not interested to invest for maize cultivation as they do not have proper information on maize farming and marketing processes.

However, different studies have been conducted to determine the factors affecting food insecurity, self sufficiency in food production such as: Wadood and Faridi (2010) investigated the determinants of household food security situation in

Bangladesh. The paper showed that different household characteristics seemed to be strongly correlated with food security indicator which might be helpful in identifying the food insecure households. Oluyole *et al.* (2009) examined the food security status of cocoa farming households of Ondo State, Nigeria. Sikwela (2008) accomplished a research on determinants of food security in the semi-arid areas of Zimbabwe. The main objective of this study was to investigate the determinants of household food security using a logistic regression model. Seid (2007) identified the problem of food insecurity and its determinants in rural households of the Amhara Regional State of Ethiopia. Haile *et al.* (2005) examined the determinants of households' food security using a logistic regression procedure and Talukder (2005) examined food security and self-sufficiency status of Bangladesh using both time series and cross section data.

This study addresses the factors both quantitative and qualitative which influence food security status of the farmers using logistic regression model. Moreover, this study would be able to give latest information regarding the factors affecting current food security status. Keeping these in views, the specific objectives have been set in the study as: (i) to estimate the extent of food security status of maize farmers; and (ii) to identify the factors that influence the farm household's food security status.

II. METHODOLOGY

Although maize is grown all over the Bangladesh, the district Bogra is one of the important regions where it is grown quite extensively. Therefore, on the basis of higher concentration of maize production, five villages namely Boga, Rogunathpur, Vootbare, Gopalnagar and Charkadhaho under Dhunat upazila of Bogra district were purposively selected for the study. A reasonable size of sample to achieve the objectives of the study was taken into account. The farmers were classified as small (0.51-1.00 ha), medium (1.01-3.00 ha) and large farmers (above 3.00 ha) according to their possession of land (Zaman *et al.*, 2010). By considering all the circumstances, total sample size was 60, among which 40 were small, 12 were medium farmers and 8 were large farmers. The farmers were selected by using stratified random sampling method.

Analytical techniques

To identify the factors influencing the food security status of farming households, two stages of analysis were done. At first a food security index (Z) was constructed and food security status of each household was determined based on the food security line using the recommended daily calorie intake approach and then a logit model was used to estimate the food security status of households as a function of a set of independent determinants. A household whose daily per capita calorie intake up to 2122 kcal was regarded as food secure and those below 2122 kcal

regarded as food insecure households. The mathematical representations are as follows:

$Z_i = Y_i/R$

Where,

Z_i = Food security status of ith households which take values of 1 for food secure households or 0 for food insecure households;

Y_i = Daily per capita calorie intake of ith household; and

R = Recommended per capita daily calorie intake.

Based on the household food security index (Z), the Logit model was estimated to identify the determinants of food security. The implicit form of the model was as follows:

$Z_i = \beta Q_i + U_i$

Where,

Z_i = the food security status of ith household;

Q_i = Vector of explanatory variables;

U_i = Error term; and

β = Vector of parameter estimates.

The independent variables are captured as:

Q_1 = Household size (number);

Q_2 = Educational level of household head;

Q_3 = Age of household head (in years);

Q_4 = Agricultural income (in Tk. /month);

Q_5 = Farm size;

Q_6 = Share of food expenditure out of the total expenditure;

Q_7 = Dairy cattle (number); and

Q_8 = Non-farm Income (in Tk. /month).

Additionally, the food insecurity gap, the surplus index and the headcount ratio of food security were calculated for the sample households based on food security line.

Surplus or Shortfall Index

The tool was used to measure the extent to which a household is food secure or insecure. The index (Seid, 2007) is given as:

$$P = \frac{1}{N} \sum_{j=1}^{m} Gj$$

$Gj = (Xj - L)/L$

Where,

P = Surplus/shortfall Index;

L = Recommended daily per capita requirements (2122 Kcal.);

Gj = Calorie deficiency faced by household J;

Xj = Per-capita food consumption available to household J;

N = Number of households that are food secure (for surplus index) or food insecure (for shortfall index).

H = q/n

Where,

H = Head -count index;

n = Population size; and

q = Number of individuals below food poverty line.

III. RESULTS AND DISCUSSION

Food security index

To measure household food security, a food security index was constructed. Daily per capita calorie consumption was estimated by dividing the estimated daily calorie supply to the household by the household size (Babatunde *et al*., 2006). Household calorie availability was estimated using food nutrient composition. Table 1 shows that daily per capita calorie intake from different food items was the highest among large farmers followed by medium and small farmers. The average per capita calorie intake of small farmers was 2108.64 kcal which is lower than the recommended daily calorie intake i.e., 2122 kcal per day.

Table 1: Calorie Intake from Different Food Items by Family Members of the Households (Kcal/day/capita)

Food items	Small farmers	Medium farmers	Large farmers
Rice	1780.01	1943.63	1701.31
Wheat or atta	28.71	29.29	74.57
Fish	19.25	35.70	64.44
Egg	9.18	12.68	62.56
Pulses	21.34	23.65	39.33
Vegetables	69.21	78.62	73.07
Beef	1.85	4.97	18.04
Milk	1.80	12.21	21.14
Sugar or gur	4.52	7.52	11.64
Spices	13.80	14.60	22.57
Edible oil	168.14	190.71	185.16
Average	2108.64	2269.97	2491.05

Source: Author's calculation based on field survey, 2012.

Based on this above mentioned information, food security index (Z) was calculated for small, medium and large farmers. Additionally, the food insecurity gap or the surplus index (P) and the head count ratio (H) of food security were calculated for the sample households based on the food poverty line. The food insecurity gap measures the extent to which poor households are found insecure and the surplus index measures the extent by which food secure households exceeded the food poverty line. The head count ratio (H) measures the percentage of population of household that are food insecure or secure. This measure has the advantage of being easy to interpret, but it tells us nothing about the depth of severity of poverty. Table 2 presents the food security indices for different categories of farmers.

Table 2: Food Security Indices for Different Categories of Farmers

Categories of farmers	Food security indices	Food secure households	Food insecure households	All
Small farmers	Food security index (Z)	1.05	0.91	0.98
	Percentage of households (%)	55.00	45.00	100.00
	Per capita daily calorie availability	2241.29	1946.50	2108.64
	Food insecurity gap/surplus index (P)	0.05	-0.08	-
	Head count index (H)	0.55	0.45	-
Medium farmers	Food security index (Z)	1.09	0.95	1.07
	Percentage of households (%)	83.33	16.67	100.00
	Per capita daily calorie availability	2318.81	2025.78	2269.97
	Food insecurity gap/surplus index (P)	0.09	-0.05	-
	Head count index (H)	0.83	0.17	-
Large farmers	Food security index (Z)	1.17	-	1.17
	Percentage of households (%)	100.00	-	100.00
	Per capita daily calorie availability	2491.05	-	-
	Food insecurity gap/surplus index (P)	0.17	-	-
	Head count index (H)	1.00	-	-

Source: Author's calculation based on field survey, 2012.

Based on the recommended daily calorie intake of 2,122 kcal, it is observed that 55 percent of the households were food secured in case of small farmers and 45 percent households were food insecure. The food security index for small farmers was 0.98; the value of this index was 1.05 and 0.91 for food secure and food insecure households. Average calorie intake of food secured households was 2,241.29 kcal which is higher than the national average calorie intake. On the other

hand, average calorie intake of food insecure households was 1,946.50 kcal which is lower than the national average calorie intake (HIES, 2010).

The food security gap or surplus index shows that the food secure households exceeded the food poverty line by 5 percent, while food insecure households fell short of the required calorie intake by 8 percent. Results of the analysis showed that medium farmers who cultivate maize in the study area could be classified as food secure, given the fact that only 17% of the sampled households were unable to meet the recommended calorie intake of 2122 kilocalories per capita per day. About 83% of the households were food secure who were able to meet the recommended daily per capita calorie requirement of 2122 kilocalories. The surplus index (P) shows that the food secure households exceeded the calorie requirements by 9 percent, while the shortfall index shows that the food insecure households fell short of the recommended calorie intake by 5 percent. On the other hand, large farmers are food secured in the study area. The average calorie intake of food secured households was 2,491.05 kcal which is higher than the national average calorie intake. The value of the food security index was 1.17. The surplus index (P) shows that the food secure households exceeded the calorie requirements by 17 percent.

Determinants of food security in the study areas

A logit model was estimated to elicit the factors influencing current food security status of households. Eight explanatory variables were identified to be major determinants of food security in this study. These were monthly agricultural income, non-farm income, food expenditure, dairy cattle, farm size, household size, age of household head, and education level of household head. All the factors were a priori expected to have a positive impact on food security status of households.

Description of the variables specified in the logit model

The model used the various household resources as the factors influencing food security and their anticipated effects on rural household's food security are presented here:

Among the potential factor(s) influencing households' food security, household size (Q_1) is one factor expected to have influence on food security status of a household. According to the theoretical as well as empirical evidences in the previous works in developing countries like Bangladesh, subsistence agricultural production with limited participation in non-agricultural activities, large household size exert more pressure on consumption than the labour it contributes to production. The per capita food availability declines as family size increases due to population growth. Hence, large family size is more likely related to being food insecure in a household.

Educational level of the household heads (Q_2) could also have an influence on the food security status of the households. Educational attainment by the household head could lead to awareness of the possible advantages of modernizing agriculture by means of technological inputs; enable diversification of household incomes which, in turn, would enhance households' food supply. In the survey, most of the household heads were found to be illiterate. Therefore, instead of putting the household heads the grade level they have completed, it is better to classify them based on their status of being literate and illiterate. Thus, households led by educated heads take a value of 1 while those who are illiterate take a value of 0.

The age of a household head (Q_3), as other demographic factor, was also tested for any association with food security. The assumption here was the higher the age of the head, the better the food security situation as there may be more options of making food available from both agricultural and non-farm opportunities.

Agricultural income (Q_4) refers to the sum total of the earnings of the household in a month from agricultural activity. The income is expected to boost household's food production and also access to more quantity and quality food. The expected effect of this variable on food security is positive.

Farm size (Q_5) is the total farm land cultivated by the farm household measured in hectare. The larger the farm size, the higher the production level. It is, thus, expected that households with larger farm size are more likely to be food secure than those with smaller farm size. The expected effect on food security is positive.

Food expenditure (Q_6) is the total amount of money spends for food consumption. The expected effect of this variable on food security is positive.

Livestock possession (Q_7) is also expected to reduce food insecurity. Particularly the ownership of livestock forms the cornerstone of farm economy in the rural households. Here, an attempt was made to see the differences brought by the number of livestock available to a household's food security.

Employment in off-farm and non-farm activities or non-farm income (Q_8) has a paramount significance to diversify the sources of farm households' livelihoods. It enables farmers to modernize their production by giving them an opportunity for applying the necessary inputs, and reduces the risks of food shortage during periods of unexpected crop failures. From this perspective, it was attempted to see any significant difference existing between households who worked in off-farm activities and those who did not.

Determinants of food security status among maize farming households

The result of logit regression is presented in Table 3. The result shows that the model was suitable for explaining the determinants of the food security status of farm household. Four out of eight variables included in the model were significant in explaining the variation in food security situation of households in the study areas. These variables are: age of household head, household size, agricultural income and food expenditure.

Table 3: Estimates of the Logistic Regression of Determinants of Food Security Status of Farm Households

Variable	Coefficient	Standard Error	Level of Significance	Exponential of coefficient or odds ratio
Constant	1.308	6.495	0.840	3.6999
Farm size	0.002	0.004	0.551	1.002
Age of household head	-0.314	0.143	0.028**	0.730
Household size	-0.480	0.247	0.047**	1.614
Educational level	0.470	1.93	0.807	1.601
Agricultural income	0.002	0.001	0.030**	0.999
Non-farm income	-0.001	0.001	0.314	1.002
Food expenditure	0.002	0.001	0.072*	1.002
Livestock possession	0.084	0.596	0.888	1.087

Source: Author's calculation, 2012.

*Note: ** indicates significant at 5% level, * indicates significant at 10% level*

Age of household head

The result shows that the age of household head has a negative coefficient that was significant at 5 % level. This indicates that the older the household head, the lower the probability that the household would be food secure. A unit increase in the age of household head will reduce the probability of household to be food secure by 0.730. This could be attributed to the fact that the productivity of old household head will decline as they get old thereby has impact on their food security status. This result is in consonance with Babatunde *et al.* (2007) who claimed that increase in age decreases food security.

Household size

Household size has a negative coefficient which was significant at 5 percent level. That means a unit increase in household size will reduce the probability of household to be food secure by 1.614. Hence, increase in household size would lead to decrease in the food security status of the household. This result is expected because increase in the member of household means more people are eating from

the same resources, hence, the household members may not be able to take enough food when compared to a situation with smaller household size, thus increasing the probability of the household to be food insecure. The result is in line with the findings of Babatunde *et al.* (2007), Seid (2007) and Oluyole *et al*., (2009).

Monthly agricultural income

The result implies that household's monthly agricultural income was positive and significant at 5 % level. This indicates that the higher the household income, the higher is the probability that the household would be food secure. A unit increase in the level of income will increase the probability of household to be food secure by 0.999. This could be expected because increased income, other things being equal, means increase access to food. The finding was supported by the research results of Babatunde *et al.* (2007) and Seid (2007).

Food expenditure

Food expenditure has a low but positive coefficient that was significant at 10% level. A unit increase in food expenditure increases the probability of household to be food secure by 1.002. This indicates that the higher the amount of food expenditure i.e., the higher the amount of taka spend on food purchase, the higher the likelihood of food security. It is similar with the findings of Babatunde *et al.* (2007) and Seid (2007).

IV. CONCLUSIONS

Based on the empirical evidence emanating from the analysis, it can be concluded that household food security decreases with the increase in age of household heads; and household food security increases with the increase in household monthly income. Food security analysis showed that a unit increase in food expenditure will increase the probability of the household being food secure; and household food security decreases with the increase in household size. The study reveals that the demographic and socioeconomic factors influenced the food security status of maize growing farmers. Among the 60 sampled rural households, 20 (33.3 percent) households were found to be food insecure while the rest 40 (66.7 percent) households were food secured households. Thus, only 20 (33.3 percent) of the sampled households could not get the minimum and above recommended calorie level, i.e., 2122 kcal per capita per day. About 33.33 percent of the sample households were food insecure yet they still survived. This could mean that there could be other factors or determinants that contribute to household food security that might not have been taken by the logistic regression. Since agricultural income is the main source to feed rural households, mechanism should be strength to increase productivity by increasing labour and land productivity through providing these chronically food insecure farmers with modern agricultural inputs (seed) and productive asset on subsidy base until they recover. Development of small-scale

irrigation should be given a priority, because rural households follow subsistence agricultural activities that solely depend on rain. The dairy cattle enterprise has to be improved by providing better animal health care because it increases productivity as well as it also used as coping mechanism for food insecurity problem. Finally, it could be recommended to undertake an in-depth analysis of mitigation measures of food insecurity which are within the reach of poor farm households in the study area.

REFERENCES

Ali, M.Y., Waddington, S.R., Hodson, D., Timsina, J. and Dixin, J. (2008). Maize-Rice Cropping Systems in Bangladesh: Status and Research Opportunities. Mexico, D.F.: CIMMYT.

Babatunde, R.O., Omotesho, O. A. and Sholotan, O. S. (2007). Factors influencing food security status of rural farming households in North Central Nigeria*, Agricultural Journal*, 2(3): 351-357.

BBS (2011). *Statistical Yearbook of Bangladesh*, Ministry of Planning, Government of the People's Republic of Bangladesh, Dhaka.

Haile, H.K., Alemu, Z.G. and Kudhlande, G. (2005). Causes of Household Food Insecurity in Koredegaga Peasant Association, Oromiya Zone, Ethiopia. Working paper, Department of Agricultural Economics, University of the Free State, South Africa.

HIES (2010). *Preliminary Report on Household Income and Expenditure Survey*, Bureau of Statistics Division, Ministry of Planning, Government of the People's Republic of Bangladesh, Dhaka.

Oluyole, K.A., Oni, O.A., Omonona, B.T. and Adenegak, O. (2009). Food Security among Cocoa Farming Households of Ondo State, Nigeria, *ARPN Journal of Agricultural and Biological Science.* 4(5): 7-13.

Seid, F.F. (2007). Food Insecurity and Its Determinants in Amhara Region. M.S. thesis, Department of Economics, Addis Ababa University, Ethiopia.

SFYP (2011). Sixth Five Year Plan of Bangladesh, Bangladesh Bureau of Statistics, Statistics Division, Ministry of Planning, Government of the People's Republic of Bangladesh, Dhaka.

Sikwela, M. M. (2008). Determinants of Household Food Security in the Semi-Arid Areas of Zimbabwe: A Case Study of Irrigation And Non-Irrigation Farmers in Lupane and Hwaner Districts. M.S. thesis, Department of Agricultural Economics and Extension, University of Fort Hare, Republic of South Africa.

Talukder, R. K. (2005). Food Security, Self-Sufficiency and Nutrition Gap in Bangladesh. *The Bangladesh Development Studies*. 30(3 & 4):35-62.

Wadood, S.N. and Faridi, R. (2010). An Econometric Assessment of Household Food Security in Bangladesh. *The Bangladesh Development Studies*, 30(3): 97-111.

Zaman, S., Siddique,S. U., Faruque, M.A., Paramanik, M.R., and katoh, M. (2010). Consumption and Trends of Household Agro Forestry in Bangladesh: A Case Study in Dinajpur District. *The Journal of Sustainable Development*, 6(10):1-6.