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**SOCIO-ECONOMIC DETERMINANTS OF THE VARYING LEVELS OF FOOD
INSECURITY AMONGST THE HAOR (OX-BOW LAKE) RESIDENTS IN
BANGLADESH**

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SOCIO-ECONOMIC DETERMINANTS OF THE VARYING LEVELS OF FOOD INSECURITY AMONGST THE HAOR (OX-BOW LAKE) RESIDENTS IN BANGLADESH

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Abstract

The study examines levels and determinants of food insecurity at households in the haor areas of Bangladesh. Three levels of food insecurity (normal, moderate and severe) were examined by analysing households' responses on the availability of and access to food. Results show that 45%, 29% and 19% of the households suffered from 'normal', 'moderate' and 'severe' food insecurity, respectively. Significant inverse association exists between the risks of food insecurity with landholdings, head's education and income of the household. Policy implication includes investments in education, employment and income generation activities, support to build assets and land and tenurial reforms.

Key Words: Haor areas; food insecurity; socio-economic determinants; logistic regression; safety net program.

I. Introduction

Although the total food supply in the world is assumed to be sufficient to feed its growing population (Islam, 1995), food security became a top priority concern for the governments because of the shortages in cereal production and dramatic rise in the prices of food throughout the world (Vocke and Allen, 2008). It is true that the number of people living in extreme poverty has declined by more than half, falling from 1.9 billion in 1990 to 836 million in 2015 (UN MDG, 2015). But a large numbers of people are still living below the

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poverty line. An estimated 51%, 40% and 17% of the total population in Sub-Saharan Africa, South Asia and East Asia are believed to be poor (Krishna 2013). Food security was linked to food supply at the regional, national or world level and was simply considered as a shortfall in supply in comparison to the demand. Although there are several definitions of food security, Maxwell and Frankenberger (1992) succinctly defined food security as "secure access at all times to sufficient food for a healthy life" which captures all the elements of food security outlined above. The World Food Summit of 1996 highlighted three most important considerations in order to ensure food security. These are: availability of sufficient amount of food, stability in the supply of food and access to nutritious food (FAO, 1996). The poor, especially the ultra poor, suffer from food insecurity basically because of the lack of purchasing capacity and fewer opportunities to have easy access to available food. The landless people living in the third world countries are the main victims of food insecurity because of multiple reasons. These landless people are mostly forced to become day laborers who are dependent on casual or occasional employment for their livelihood (Kazal et al., 2006). In fact, seasonal variation in agricultural activities and limited scope of employment in the non-agricultural sector largely lead millions of poor to suffer from chronic as well as transitory food insecurity.

Food insecurity has in fact been reduced in Bangladesh compared to the situation prevailed in 1970s. But it is far from being over. More than 60 million people are still found to be suffering from chronic hunger in Bangladesh which is exceptionally high by any standard (Kazal *et al.*, 2006). In fact, Bangladesh has the third largest number of poor population in the world after China and India (UNDP, 2005). Climatic and demographic changes may also adversely affect food security in Bangladesh (Mishra and Hossain, 2005). However, the level of food insecurity is particularly high in the haor areas (i.e., ox-bow lake) of Bangladesh

where people face frequent natural disasters and live in uncertainty and are often forced to depend on money lenders or food lenders for survival (Amin and Farid, 2005).

Haor, a bowl-shaped large tectonic depression, becomes an extensive water body in the monsoon and remains dry in the post-monsoon period. In Bangladesh, haors are located in the north-eastern region of Bangladesh covering an area of 1.99 million ha and accommodating about 19.37 million people (CEGIS, 2012). There are about 373 haors in the districts of Sunamganj, Habiganj, Netrokona, Kishoreganj, Sylhet, Moulavibazaar and Barhmanbaria covering an area of 859,000 ha or 43% of the total haor area of Bangladesh (CEGIS, 2012). Haor regions also have distinctive hydrological characteristics with annual rainfall ranging from 2200–5800 mm and flash flood is identified as the main disaster which destroys the primary sources of livelihoods (i.e., agriculture and fisheries), thereby, making the haor residents highly vulnerable to the vagaries of nature (CEGIS, 2012; Talukder, 2014). In the haor region, the cropped land becomes completely inundated for 6–7 months in a year and strong wave action adds to the vulnerability of the haor residents as it can potentially wash away the land and poses a major threat to many villages in the haor (HILIP, 2011). Boro rice is mainly cultivated in the dry winter season and in the wet season the area becomes a floodplain suitable for fisheries only (Kashem et al., 2013; Kazal et al., 2010). Therefore, high seasonality of the haor-based economy forces its residents to remain out of work for an extended time (roughly 6 – 7 months in a year) and as a result they suffer from serious level of food and livelihood insecurity.

Moreover, the communication infrastructure is poorly developed in these haor areas with submersible rural roads providing some connectivity during the dry season and boats being the main source of communication during the flood season (HILIP, 2011). Therefore, the poor communication network and lack of physical, financial and social infrastructures constrains most of these people to access off-farm economic activities to earn their livelihood

as a substitute of and/or compliment to their traditional occupations of agriculture and fisheries. Furthermore, the government, NGOs and international development agencies have not extended their interventions in terms of transfers and economic activities to a satisfactory level in these under-privileged areas (Kazalet *al.*, 2010). Therefore, the combination of all these factors made food insecurity as a part and parcel of the daily life of these haor residents. The government of Bangladesh has just begun to place emphasis on developing these haor regions and recently formulated a Haor Master Plan for 20 years (2012–2032) with three phases: short term (2012–2017), medium term (2018–2022) and long term (2023–2032) (CEGIS, 2012). The plan is mainly to be financed by government's own resources with possible support through private-public partnership in the future (not really identified), which makes it immediately vulnerable to lose in competition for funds from the government's budget which is already limited anyway. The plan aims to achieve the same six national development goals, i.e., economic development, food security, standard of living for the people, poverty alleviation, public health and safety and protection of the natural environment (CEGIS, 2012), although the challenge in these haor areas are not only different but unique due to its hydro-ecological and socio-economic characteristics.

A number of studies (e.g., Amin and Farid, 2005; Dash, 2005; Halder and Mosley, 2004; Hossain, 1989; Kundu, 2004; Radhakrishna and Ravi, 2003; Rahman and Khan, 2005; Rahman, Haque and Talukder, 2005; Rahman et. al., 2009; Talukder and Quilkey, 1991) focusing on different aspects of food insecurity which identified lack of economic and social access to safe and nutritious food items to meet daily dietary need as the major reasons for food insecurity. These studies also found that a lack of employment in a particular locality can create a situation of food insecurity through trimming down income, the key to enable economic access to food. Small scale studies conducted specifically in haor areas (e.g.,

Talukder, 2014; Kashem *et al.*, 2013; Sarma, 2010) also noted high level of food insecurity, poverty and landlessness including vulnerability to natural disasters by the haor residents.

The overall situation of food security in Bangladesh has always been fragile because of constant and steady gap between supply (availability) and demand (need) of major food grains due to many reasons, such as inadequate production, improper distribution, lack of food aid and importing capacity (MWCA, 2006). However, the aforementioned studies did not adequately address the range of factors influencing different levels of food security which may be differentially related to lack of physical, social and economic access and employment.

Given the dearth of information regarding the status and factors influencing varying levels of food security, particularly for the haor residents, the main objectives of this study are to: (a) examine the different levels of food insecurity of the households living in the haor areas; and (b) identify the range of socio-economic factors influencing these different levels of food insecurity of the households. The main contributions of this study to the existing literature are as follows. First, the study has addressed the issue of food security of the people living in haor areas which are one of the most disadvantaged pockets in Bangladesh and there is serious dearth of information about their livelihoods. Second, it has used a large sample covering all the six regions where haors are mainly located. Third, it applied a quantitative approach which enables us to generalize the underlying structural relationships between different levels of food insecurity and socio-economic factors to other areas with similar characteristics. The main purpose of this study is to provide an in-depth understanding of the issues of food insecurity and coping strategies undertaken by the people living in haor areas, so that the policy makers and other relevant stakeholders can devise appropriate strategies and development programs to address the situation.

II. Methodology

Sampling strategy and the data

Information needed to adequately address food insecurity at the household level is complex. Different research methods, such as, standard set of questions, scoring method, survey method etc. were developed to measure the extent of household food insecurity. For example, Bickel *et al.* (2000) used a twelve-month recall based survey with questions encompassing all aspects in relation to household level food insecurity which was then converted into a composite score based on the responses. Frongillo *et al.* (2003) adopted almost a similar approach to measure the situation of food insecurity and a detailed qualitative investigation was used *a priori* to develop the survey instruments. After reviewing the findings of different investigations, Coates *et al.* (2003) developed a comprehensive survey methodology including questionnaire design and scoring devices for estimating the extent of food insecurity in Bangladesh, which seems to be very effective to have an in-depth understanding of food insecurity. Rather than using traditional questionnaire method, they suggested to include questions of multidimensional nature with regard to food insecurity. This study, therefore, adopted both quantitative and qualitative components in line with the one proposed by Coates *et al.* (2003) to have an in-depth understanding of the varying levels of food insecurity and various socio-economic factors influencing them.

The data were collected from six haor-dominated districts of Bangladesh: Sunamgong, Sylhet, Moulvibazar, Habiganj, Kishoreganj and Netrokona districts. The study applied a cluster-sampling design where haor-attached villages were counted as clusters. A total of 30 clusters were covered in the survey. Thirty clusters are regarded as statistically representative sample of a population by internationally recognized survey designs, such as WHO's EPI cluster sampling design (Turner *et al.*, 1996). The clusters were selected using systematic probability proportionate to size (PPS) sampling procedure. Since the numbers of haors are different in the six districts, a stratified random sampling with proportional allocation was adopted to estimate the number of haors from each district (stratum). About 135 households from each cluster were then selected for interview and the study finally covered 4065 households in total, which is large given the sparse nature of the location of villages in these haor areas characterized with serious level of underdeveloped transport infrastructure and

accessibility. The household level data were collected using face to face interview method with a structured questionnaire by a well-trained group of data collectors. The survey questionnaire was pre-tested in another location prior to launching the main survey and subsequent modifications were made as appropriate.

Analytical Techniques

The study measured the level of food security by analyzing and assessing data provided by the respondents as well as by estimating income of the surveyed households. The predictors or factors influencing food insecurity was determined by using a multiple binary logistic regression model.

The Multiple Binary Logistic Regression Model

Amongst the limited dependent variable models, logistic regression model is widely used because of its capability to identify risk factors and also to predict the probability of success. The linear logistic regression model can be written as

$$\log_e \left[\frac{\pi(X_i)}{1 - \pi(X_i)} \right] = \beta_0 + \beta_1 X_i \quad (1)$$

where $\pi(X) = E(y_i | X)$ stands for the conditional probability that $Y=1$ given X and the model can be written as

$$\pi(X_i) = \frac{e^{\beta_0 + \beta_1 X_i}}{1 + e^{\beta_0 + \beta_1 X_i}} \quad (2)$$

The aforementioned simple linear logistic regression model in Eq (1) can be extended to a multiple logistic regression model by considering a set of p independent variables represented by the vector $X' = (X_1, X_2, \dots, X_p)$. The multiple logistic regression model can be written as:

$$\log_e \left[\frac{\pi(X_i)}{1 - \pi(X_i)} \right] = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \dots + \beta_p X_{pi} \quad (3)$$

III. Results and Discussions

The first section presents the results and discusses the extent and intensity of food insecurity of the haor households and the second section discusses the predictors of food insecurity.

Extent and intensity of food insecurity

Three questions were asked to the respondents to understand the level of food insecurity of the people living in the haor areas. This was scaled as normal (had been anxious about sufficient food), moderate (took less than 3 meals a day) and severe (slept with hunger) according to the responses. However, there were another category who had sufficient food and not felt food insecurity though it was only 6.5% households (Table 1). It assessed by perception approach because like to gauge the level of food insecurity as perceived by those who actually went through the experience of hunger. Eliciting perception of people is important since perception is viewed to contain goals including those achieved and those yet to be achieved and, hence, is looked upon as a guiding concept of behaviour and/or decision-making (Gengaje, 1996). Table 1 shows the responses regarding different levels of food insecurity with respective frequency and intensity. At first, the respondents were asked whether they had been anxious about sufficient food during the three months prior to the survey. About 45% of the respondents revealed that they were anxious about food deficit in their households. Among them, three-fifths claimed they faced problems sometimes and about 29% faced the same problem in most of the time.

The respondents were further asked whether they had to take less than three meals in a day. About 33% of them agreed to face that kind of food insecurity. They reported that the moderate food insecurity situation occurred most frequently for 10%, sometimes for 57.5% and suddenly for 32.5% of the cases (Table 1). While the respondents were asked about whether they were bound to sleep with hunger during the last three months prior to the survey, nearly one-fifth of them agreed to have experienced the situation (Table 1). Such severe food insecurity situation was faced very often by about 8%, often by 24% and suddenly by 68% of the cases. It should be noted that data were collected during the months of Feb – May which is the dry season and relatively better days in the annual cycle of

vulnerability of the haor residents. Therefore, the responses are unlikely to be biased positively towards exaggerating perception of food insecurity.

Table 1: Distribution of households by degree of food security

Status of Food Insecurity	No. of Households	% of Households	Frequency of Insecurity (%)		
			Very often	Sometimes	Sudden
Were anxious about sufficient food (normal food insecurity)	1825	44.9	28.7	60.3	11.0
Were bound to take less than three meals in a day (moderate food insecurity)	1191	29.3	10.0	57.5	32.5
Were bound to sleep in hunger (severe food insecurity)	784	19.3	7.8	24.0	68.2
No food insecurity	265	6.5	-	-	-
Total sample	4065				

The extent of food insecurity was also analyzed according to the occupation of the household head, landholdings, location (district) and economic condition of the study households. The results were presented in Table 2. The incidence of food insecurity for the wage labour households were estimated at 56.7%, 41.6% and 27.2% for normal, moderate and severe scales, respectively, while the corresponding levels for agricultural households were estimated at 36.8%, 19.5% and 11.9% (Table 2). A wide variation in the extent of food security was observed according to the occupation of the household head. Table 2 clearly shows that the incidence of food insecurity was highest for the wage labour households, followed by the fisherman households for all categories of food insecurity (i.e., normal, moderate and severe). Conversely, food insecurity is lower for the households with agricultural, businessman and serviceholder as heads.

On the basis of the landholdings, the incidence of food insecurity at all the levels was found to decline monotonically with the increase in the size of landholdings of the households. Consequently, the highest incidence of food insecurity was observed for the households having no land at all, followed by the households with a tiny 1-10 decimals of land and so forth. The normal, moderate and severe levels of food insecurity for the landless households were found to be 65.4%, 49.8% and 33.9%, respectively. Conversely, the corresponding

figures were only 14.5%, 5.4% and 2.1% for the households with landholding size of 200 decimals or more (Table 2).

Table 2: Status of food security in the last 3 months according to the occupation of household head, landholdings and location (district)

Status of Food Insecurity	% of households suffered from various types of food insecurity				
Occupation →	Agriculture	Business and Service	Fishing	Wage labourer	Other
Were anxious about sufficient food	36.81	30.73	51.75	56.71	46.28
Were bound to take less than three meals in a day	19.53	18.06	31.82	41.55	32.94
Were bound to sleep in hunger	11.87	12.10	20.98	27.22	23.99
Total	1331	537	286	1319	592
Landholdings →	None	1-10 decimal	11-49 decimal	50-199 decimal	200+ decimal
Were anxious about sufficient food	65.35	51.06	44.66	38.10	14.52
Were bound to take less than three meals in a day	49.75	35.57	27.83	18.91	5.39
Were bound to sleep in hunger	33.91	23.66	19.74	10.92	2.07
Total	404	1847	618	714	482
District →	Sunamgonj	Other Districts of Sylhet		Kishoregonj	Netrokona
Were anxious about sufficient food	45.14	38.99		55.61	36.07
Were bound to take less than three meals in a day	34.69	26.20		31.62	20.37
Were bound to sleep in hunger	23.50	16.97		17.10	10.92
Total	1349	813		1088	815
Economic and Poverty Status (Self ranking) →	Extremely Poor		Poor		Non-poor
Were anxious about sufficient food	72.05		49.29		19.48
Were bound to take less than three meals in a day	54.46		32.28		7.71
Were bound to sleep in hunger	41.47		20.28		3.30
Total (n)	762		2122		1181
Economic and Poverty Status (CBN Method) →	Poor (Below upper poverty line)			Non-poor (Above upper poverty line)	
Were anxious about sufficient food	53.21			38.63	
Were bound to take less than three meals in a day	36.67			23.74	
Were bound to sleep in hunger	23.11			16.40	
Total (n)	1748			2317	

Figure 1 shows the incidence of food insecurity at different scales in different locations (districts). The households of Netrokona district were better off, having the lowest rates of incidence of all types of food insecurity. The levels of food insecurity was somewhat

fluctuating in other locations. Other than the normal level of food insecurity, the highest incidence of food insecurity was found for the households of Sunamgonj district and the rates were 34.7% and 23.5% for the moderate and severe food insecurity, respectively followed by 31.6% and 17.1% for the households of Kishorgonj district (Appendix Table A1). The normal level of food insecurity were recorded at 45.1% and 55.6% for Sunamgonj and Kishorgonj districts, respectively. With respect to overall level of food insecurity, the households of the Sunamgonj district are worse off followed by those of Kishoregonj district.

The extent of different scales of food insecurity was also analyzed according to the economic condition of the households, measured by both Cost of Basic Needs and self-ranking methods⁴ (Table 2). The percentages of the poor households suffering from all types of food insecurity were found to be remarkably higher than those of the non-poor households, measured by both the methods, i.e., from self-ranking of the households as well as from the comprehensive CBN measure of poverty.

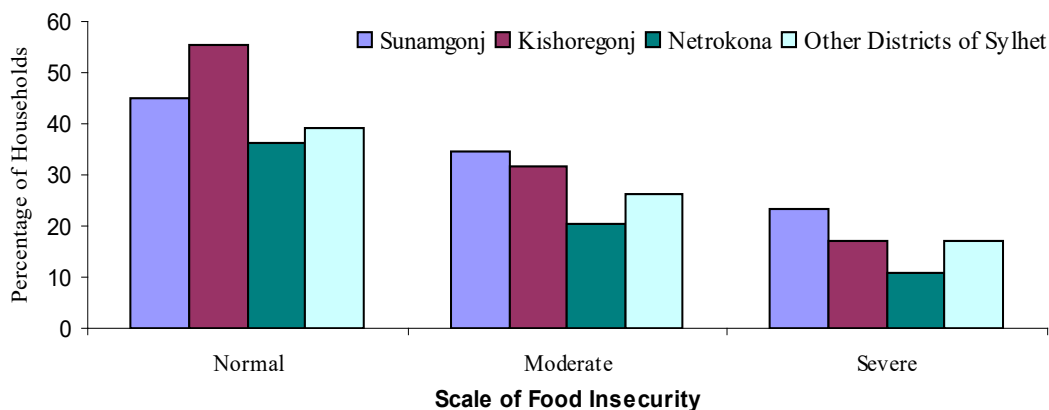


Figure 1: Status of Different Scales of Food Insecurity by Location (District)

Table 2 clearly shows that the frequency of extreme level of food insecurity (i.e., bound to sleep with hunger) decreases systematically with improvements in self-ranking assessment of

⁴For details of the CBN method used in this study, please see Kazalet. *al.* (2010)

poverty from extreme poor to non-poor as well as from those below the poverty line to those above the poverty line as demarcated by applying CBN measure of poverty. Such similarity in responses clearly provides an indication that information generated from household's own perception is not very different from information that can be generated from a more robust and established method, such as, CBN method of measuring poverty. In particular, about 53% of the poor households (measured by CBN method) reported that they suffered from normal food insecurity in contrast with 38.6% of the non-poor households. The findings of the study is almost analogous with the another disadvantages areas Chittagong Hill Tracts in Bangladesh (Majumder *et al.*, 2012). The differentials of the percentage of people suffering from all types of food insecurity was highest between the extremely poor and non-poor households.

Causes of food insecurity

The respondents were asked about the reasons of their food insecurity. They mentioned different underlying causes of their food insecurity as shown in Figure 2. About two-thirds of the respondents identified landlessness as the prime cause of their food insecurity. The other major causes identified by about half of the respondents were mono-crop cultivation, seasonal unemployment and natural calamities. About one-third of the respondents also identified the damage of crop caused by unexpectedly earlier heavy downpour and landslide of stones as a considerable cause of food insecurity. The findings reinforce the general conclusions drawn from limited scale studies conducted in selected haor areas of Bangladesh by Talukder (2014), Kashem et al. (2013) and Sarma (2010).

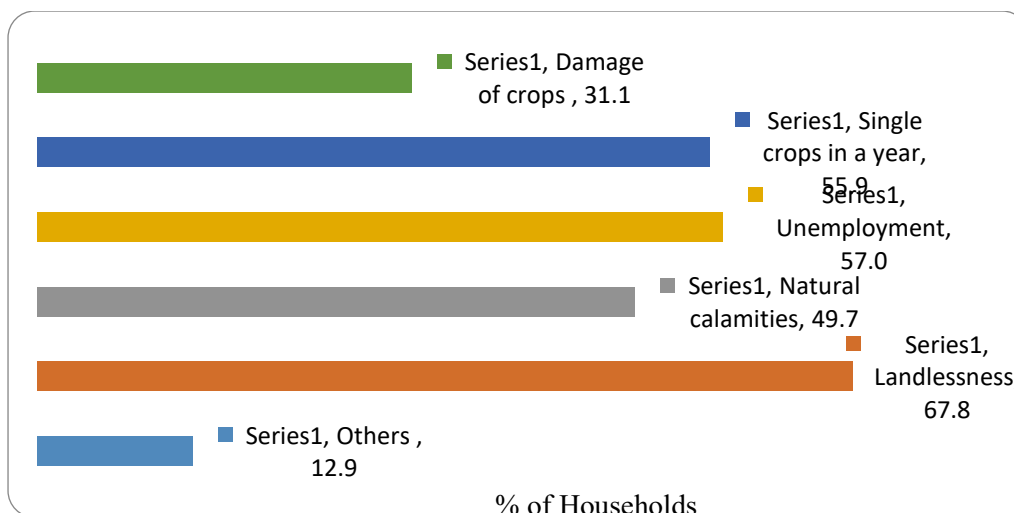


Figure 2: Main Reasons for Households' Food Insecurity

Determinants of food insecurity

Proper identification of the determinants of food insecurity is of utmost importance for drawing policy implications to address the issue. This section discusses the socio-economic determinants of food insecurity using the multiple binary logistic regression model presented in Eq (3). The binary dependent variables are constructed based on the perception of the household heads response to the three distinct questions defining three scales of food insecurity discussed in Section 3.1. These led to the development of three models corresponding to normal, moderate and severe level of food insecurities. On the basis of univariate and descriptive analysis (presented in Section 3.1), all the three models considered the following covariates or factors: amount of landholding, occupation of the head, educational level of the head, asset score, income, debt status, access to safety net programs, location (district) and dependency ratio of the household⁵.

The parameter estimates of the regression model including the measure of relative risk to identify the determinants of normal, moderate and severe food insecurity were presented in Appendix Table A1. The relative risks of each of the three binary models were presented in

⁵Though the food security levels were found to vary according to the housing condition and family size, however these two variables were dropped in multivariate analysis due to multi-collinearity problem and poor causality. It is very likely that dependency ratio and family size are multi-collinear and housing condition has poor causality to household food insecurity.

Table 3 for a succinct overview of the outcome. The results indicated that almost all the predictors considered for the logistic regression models have significant effect on different levels of food insecurity. High variation was observed in relative risks of each determinant amongst different models (Model 1 to Model 3) which were developed according to the severity of the food insecurity. The variation in the impacts of the selected predictors on different levels of food insecurity with respect to relative risks is presented as follows.

Landholdings:

Land is the most important factor of production, especially in the agricultural sector. As such landholdings facilitate food security by influencing household's crop production capacity leading to increased internal food availability and enhanced access to external food supply through generating income from sale proceeds of the surplus production. The findings revealed that the risk of food insecurity was found to increase very significantly with the decrease of the landholdings of the households for all the three models – normal, moderate and severe (Table 3). In general, it was observed that the risk became more than double for the households of each descending category of landholdings than the reference category (medium landholding) in all the models.

Table 3: Determinants of food insecurity (Model 1= Normal food insecurity, Model2= Moderate food insecurity, Model3= Severe food insecurity)

Variables	Relative risk for different levels of food insecurity		
	Normal food insecurity	Moderate food insecurity	Severe food insecurity
Constant	0.08***	0.05***	0.03***
Landholding			
Medium land owner [®]	1.00	1.00	1.00
Marginal land owner	2.11***	2.06***	3.01***
Functionally landless	2.42***	2.60***	4.55***
Absolutely Landless	2.87***	3.58***	5.70***
Occupation of the HH			
Business and Service [®]	1.00	1.00	1.00
Agriculture owner	1.47***	1.33**	1.20
Fisherman	1.76***	1.58***	1.53**
Agriculture Labour	2.08***	2.03***	1.55*
Non- Agriculture labour	1.81***	2.12***	2.02***
Others (House wife/Unemployed/Student)	1.97***	2.09***	2.08***
Education of the HH			
Above 8 years schooling [®]	1.00	1.00	1.00

4-8 years of schooling	1.23	1.46	1.10
1-3 years of schooling	1.53**	1.68*	1.40
No education	1.65***	1.79**	1.48
Asset Score	0.96***	0.95***	0.93
Household income			
Very poor income (\leq BDT.36000) [®]	1.00	1.00	1.00
Poor income (BDT.36001-60000)	0.95	0.78***	0.79**
Moderate income (BDT.60001-96000)	0.71***	0.65***	0.71***
Rich income (BDT.96001+)	0.46***	0.39***	0.57***
Debt status			
Did not receive loan [®]	1.00	1.00	1.00
Received loan	2.79***	2.45***	2.40***
Safety nets program			
Didn't receive help [®]	1.00	1.00	1.00
Received help	1.32***	1.19**	1.23**
District			
Sunamgonj [®]	1.00	1.00	1.00
Other Districts of Sylhet Division	0.74***	0.60***	0.46***
<i>Kishoregonj</i>	2.14***	1.09	0.65***
<i>Netrokona</i>	0.61***	0.40***	0.28***
Dependency ratio			
Total (n)	1825	1191	784

Note: [®] Reference category;

Exchange rate: USD 1 = BDT 69.04 in 2009 (BB, 2010)

* Significant at 1% level ($p < 0.01$);

** Significant at 5% level ($p < 0.05$);

*** Significant at 10% level ($p < 0.1$)

The findings indicated that marginal landholding households had 112% more risk of normal food insecurity and 200% more risk of severe food insecurity than the households having medium land. The results also indicated that the absolutely and functionally landless households had significantly more risk of food insecurity than the medium landholding households. In comparison with the households having medium landholding, the risk was found to be 5.7 times greater for severe, 3.6times for moderate, and 2.9times for normal food insecurity, respectively, for the absolutely landless households (having only homestead land or no land). In other words, farm size is significantly positively related to household food security which conforms with the results of Faridi and Wadood(2010) and Majumder *et al.* (2012) for Bangladesh and with Kidane *et al.* (2005) and Babatunde *et al.* (2007) for Ethiopia and Nigeria, respectively. This may be due to the ability to produce surplus or diversify the crop portfolio by large farmers.

Occupation of the household head

The occupation of the head plays an important role on household food security, as different occupations have different impacts on types of food security. Among several occupational groups, the risk of food insecurity was found lowest to be for the households whose heads were involved either in service or in business. The findings of Model-1 indicated that the risk of normal food insecurity was double for the households whose heads were agricultural labourer in comparison with that of business and service. It is to be mentioned that 19% of the heads of surveyed households are agricultural labourer, 14% non-agricultural labourer and 33% farmers. The risk of moderate food insecurity was found to be almost double for the households whose heads were agricultural labourer, non-agricultural labourer and unemployed/house-wife in comparison with that of the households whose heads were involved in business and/or service. The findings of Model-3 indicate that the risk of severe food insecurity was highest for the households whose heads were non-agricultural labourer and unemployed/house-wife. The findings indicate that households whose heads were farmers had 47% higher risk of normal food insecurity, 33% higher risk of moderate food insecurity and 20% higher risk of severe food insecurity compared to the reference group. It was revealed that all the wage earning categories are suffering from higher degree of food insecurity which conforms with the results of Faridi and Wadood (2010) who noted that the household head as daily wage earner in both agricultural and non-agricultural sector are the worse in terms of food security.

Education of the household head

Education influences food security of the household in many ways. Sometimes by impacting income (the key to economic access to food security) and sometimes by providing knowledge and building rationality regarding household food preparation and distribution related to food consumption dimension of food security. Though 4-8 years of schooling of household heads

exert no significant impact on food insecurity in comparison with the reference group (households with heads having more than 8 years of education), but '1-3 years of schooling' and 'no education' did impact significantly on the risk of food insecurity at normal and moderate levels (Table 3). The results obviously show that the risks of food insecurity were significantly higher by 65% and 79% for the normal and moderate scales for the households whose heads had no education compared to those with education level of 8 years and above. Further, the risk of food insecurity increased by 53% and 68% at normal and moderate levels for the households whose heads had 1-3 years of schooling in comparison with the reference group. Faridi and Wadood (2010) noted that there is a clear link between education and food security because it is assumed that the household heads with higher level of human capital are less likely prone to suffer from food insecurity. From the above findings, it can easily be inferred that the risk of food insecurity declines for the household as the education level of the household head improves.

Gross annual income of the household

Income is the key factor for economic access to food both at the household and individual levels. The findings of the study showed that all the categories of income (poor income, BDT 36,001-60,000; moderate income, BDT 60,001-96,000; and rich income, BDT 96,001+) significantly exert positive impact on reducing risk of household food insecurity at all scales (normal, moderate, and severe) in comparison with the reference category (very poor income households, \leq BDT 36,000). Households with poor income have about 22% and 21% less risk of being food insecure in moderate and severe scales respectively than those with reference category (very poor income households); while 'rich income-group' households are 54%, 61% and 44% less risky of being food insecure at the normal, moderate and severe levels than the reference category, respectively. The upshot is that food insecurity diminishes

sharply with the increase in income level of the household, i.e. food security is gradually improving at an increasing rate as household income increases.

Debt status

Debt is assumed to relieve financial constraints in the short run and can also improve the financial condition in the long run if used in productive investment mainly through augmenting stream of income. However, the result of the study explores that the households who received debt were 2.4 times in risk of suffering from severe food insecurity than those who did not receive loan (Table 3). In case of normal food insecurity, the risk was found to be 2.8 times higher for the households who received loan than the reference category. This finding contradicts with the efficacy of loan to eradicate food insecurity even though it could happen in the short run. It might be that the amount of loan was too few to somehow save the debtors' lives at only subsistence level.

Safety-net program

Safety-net program of food aid is mainly provided to the targeted beneficiaries at the time of crisis to cushion them from food insecurity. The finding shows that the beneficiary households under the program were about 32% and 22% more vulnerable to normal and severe food insecurity, respectively than those households who did not get any help from the safety net programs (Table 3). The reason behind this result might be that the most of the help-receiving households were mainly ultra-poor and they were the primary victims of food insecurity. This result is in contrast with Faridi and Wadood (2010) who noted that food security is likely to be relatively higher for the recipients of the safety net programs, but that largely depends on the effectiveness of these programs. Further, the programs were insufficient to pull out the beneficiaries effectively out of food insecurity.

Geographic location

Geographical location-specific features do impact on the livelihood which was confirmed in this study. The results revealed that the food insecure people in haor areas of other districts of Sylhet division were about 26% less at risk than those in reference district (Sunamgonj), while the food insecure haor people in Netrokona district were 40% less at risk than the reference category. On the other hand, the odds of normal food insecurity are 2.1 times greater for Kishoregonj district in comparison to Sunamgonj district.

Asset score and dependency ratio

Two other continuous variables were used as predictors in this study. These are asset score and dependency ratio. Both exerted positive and significant impact on food insecurity in all levels. The findings showed that the likelihood of facing normal, moderate, and severe food insecurity by the haor households were 0.96, 0.95 and 0.93 times less, respectively, for one unit increase in asset score. Dependency ratio also exerts significant impact on food insecurity at all levels. The likelihood of facing normal, moderate and severe food insecurity are 1.15, 1.12 and 1.11 times greater, respectively, in response to one unit increase in dependency ratio.

IV. Conclusions and Policy Recommendations

The principal objective of this study is to examine varying levels of food insecurity and identify their socio-economic determinants in the haor regions which are high vulnerable and marginal areas of Bangladesh. The focus was to analyse the issue based on the respondents' own assessment and perception of food insecurity. Results revealed that 44.9% of the 4065 surveyed households suffered from normal level of food insecurity. This was followed by 29.3% and 19.3% of the households suffering from moderate and severe level of food insecurity, respectively. Food insecurity was found to be highest for the wage labour households followed by the fisherman households for all category of food insecurities. On the

other hand, food insecurity was found to be lower for agriculture, businessman and serviceholder households. The difference between the level of food insecurity between the extremely poor and non-poor households were found to be very high for all categories of food insecurity. Overall, the households of Sunamgonj district are in worse position in terms of the incidence of food insecurity followed by those of Kishoregonj district. Mainly four reasons were identified as responsible for food insecurity in the haor areas. These are landlessness, monoculture practice, seasonal unemployment and natural hazards. Results also revealed that the amount of landholding, head's occupation, head's education, gross annual income, asset and dependency ratio are the dominant determinants of food insecurity at the household level in the haor regions.

A number of policy implications can be drawn from the results of this study. First, investments in needed to create employment and/or income generation opportunities throughout the year, with particular emphasis during the lean season. Second, investments in enhancing education targeted at the households of the haor areas. Third, government and non-governmental organisation to deliver support programs aimed at building up tangible assets for the households. And fourth, land and tenurial reforms aimed at consolidating landholdings to an optimal size to generate sufficient income from land.

Although the challenge to realize all these policy measures are formidable, there is an urgent need to address high level of observed food insecurity of these highly vulnerable haor population who are most often neglected and left out from various development interventions undertaken by the government, NGOs and other stakeholders. The Haor Master Plan (2012–2032) developed by the government of Bangladesh is a step in the right direction but its effective implementation and success remains to be seen.

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Appendix Table A1: Estimated regression coefficients and associated statistics from Logistic Regression Model for identifying the predictors of various types of food insecurity

Covariates	Normal food insecurity	Moderate food insecurity	Severe food insecurity
	Coefficient	Coefficient	Coefficient
Constant	-2.549***	-2.981***	-3.516***
Landholding			
Medium land owner [®]	-	-	-
Marginal land owner	0.748***	0.722***	1.101***
Functionally landless	0.883***	0.956***	1.516***
Absolutely Landless	1.053***	1.275***	1.741***
Occupation of the HH			
Business and Service [®]	-	-	-
Agriculture owner	0.384***	0.287**	0.186
Fisherman	0.566***	0.460***	0.427**
Agriculture labor	0.732***	0.708***	0.435***
Non- Agriculture labor	0.591***	0.749***	0.701***
Others (House wife /Unemployed /Student)	0.676***	0.738***	0.733***
Education of the HH			
Above 8 years schooling [®]	-	-	-
4-8 years of schooling	0.209	0.381	0.099
1-3 years of schooling	0.425**	0.518*	0.333
No education	0.500***	0.579**	0.389
Asset Score	-0.043***	-0.053***	-0.072***
Household income			
Poor income(BDT ≤36000) [®]	-	-	-
Moderately poor income (BDT 36001-60000)	-0.050	-0.244***	-0.234**
Moderate income(BDT 60001-96000)	-0.340***	-0.439***	-0.342***
Rich income(BDT 96001+)	-0.770***	-0.950***	-0.570***
Credit status			
Did not receive loan [®]	-	-	-
Received loan	1.025***	0.894***	0.876***
Safety nets program			
Didn't receive help [®]	-	-	-
Received help	0.280***	0.177**	0.204**
District			
<i>Sunamgonj</i> [®]	-	-	-
Other Districts of Sylhet Division	-0.308***	-0.506***	-0.761***
<i>Kishoregonj</i>	0.762***	0.085	-0.438***
<i>Netrokona</i>	-0.497***	-0.918***	-1.270***
Dependency ratio	0.139***	0.117***	0.107***
Model diagnostics			
Log likelihood	4749.565	4193.696	3424.116
Wald Chi-squared	843.280	723.379	562.446

Note: [®] Reference category;
 * Significant at 1% level (p<0.01);
 ** Significant at 5% level (p<0.05);
 *** Significant at 10% level (p<0.1)