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INTRA-HOUSEHOLD FOOD SECURITY STATUS AMONG ULTRA-POOR COMMUNITIES IN MYMENSINGH DISTRICT

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ABSTRACT

Recent global agenda including Sustainable Development Goals (SDGs) highlight the importance of addressing food security, especially among the ultra-poor communities at the intra-household level. Ensuring food security would continue to be a major challenge among South-Asian countries like Bangladesh. Although Bangladesh has achieved sufficiency in food production but food security is remaining a challenge in rural areas and some clusters in urban areas. This study was conducted to explore the household food security among the ultra-poor communities at Phulpur and Tarakanda upazilas of the Mymensingh district in Bangladesh. The sample size consisted of 150 households. The binary logistic regression model was used to determine the socio-economic factors influencing food security. The wife's (primary female) education was found to be positively, while husband's (household head) occupation was found to be negatively associated with the food security status of the selected households. Considering 1805 kcal, 56.7% of the sample households were food secure, and considering 2122 kcal, 42% were food secure. This study also revealed indicative disparities in food security within households. Policies should address these issues.

Keywords: Intra-household, food security, ultra poor

I. INTRODUCTION

Poverty and food security are important agenda for most of the cluntries in the world including Bangladesh and are closely related to Sustainable Development Goals (SDGs) (1 and 2) that the Governments have to monitor. Food security at the household level is closely linked with poverty (Pérez-Escamilla, 2017). Approximately, half of the population lack resources to acquire enough food and consequently remaining below the poverty line (FAO, 2020). A report presented jointly by the European Union, the Food and Agriculture Organization of the United Nations (FAO), and the UN World Food Program (WFP) finds that around 113 million people in 53 countries experienced acute food insecurity in the world's most severe food crises in 2018, compared to 124 million in 2017 (FAO *et al.*, 2020). However, the number of people in the world facing food crises has remained well

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over 100 million in the last three years (from 2016 to 2018), and the number of countries affected has risen (FSIN, 2019). Fewer people are living in extreme poverty around the world, but the decline in poverty rates has slowed, raising concerns about achieving the goal of ending poverty by 2030. About 3.4 billion people still struggle to meet basic needs (World Bank, 2018).

Globally, the majority of the poor live in rural areas and mainly depend on agriculture. About 76% of the developing world's poor live in rural areas, well above the overall world population share living in rural areas, which is only 58% (Ravallion et al., 2007, World Bank, 2014). In terms of population, Bangladesh is one of the largest lower middle-income countries of the world (UNDP, 2019). Currently, in Bangladesh 13% of its population is not having enough food to meet their minimum daily diets (FAO *et al*., 2020). From 2010 to 2016 poverty has reduced substantially from 31.5% to 24.3% consideringthe upper poverty line (HIES, 2016). However, not all the divisions of Bangladesh improved equally from the poverty situation.The estimates of Head Count Rates (HCR) by divisions using the upper poverty line in HIES 2016 reveal that the Rangpur division has the highest incidence of poverty (HCR) at 47.2%, followed by Mymensingh division at 32.8%. The rural poverty gap at the lower poverty line in Mymensingh division was 6.2, second highest among the eight divisions of Bangladesh (HIES, 2016). The present government has targeted to reduce the poverty rate to 15% by 2021. Various microfinance programs are taken to help the poor as well as to reduce the food insecurity and poverty of the country.

Few studies of food security have focused on intra-household relations involving wife's and husband's socio-economics characteristics, household size, and poverty in low-income communities (Aurino, 2016; Kakai, 2000). Moreover, the results found from those studies are not straight forward and sometimes contradict to each other. Understanding of such socio-demographic characteristics at the bottom (lower administrative) level is essential for policymaking. By using the binary logistic regression model household income, age of household head, and the level of education of household heads were found as the significant determinants of food security (Ali *et al.*, 2016). Rahman *et al*. (2020) idientified family size and food expenditure as determinants of food security. Mode of employment was another important factor of food security (Sarket *et al*., 2019). Nyamwanji (2016) revealed the importance of socio-demographic characteristics of the respondents on food security including age, level of education, household size, and main occupation. Men's control over resources such as cash income has a negative influence on household food security while women's non-involvement in decision making on ensuring food-management imparts negatively household food security (Nymawanji, 2016). Meyer (2016) found a positive relationship between household size and poverty in eleven of the twelve low-income communitiesin the Northern Free State region in South Africa. Afera (2015) found that the total family size and dependency ratio had a significantly positive association with the poverty of the household. Meanwhile, farm size, total livestock owned, value of the asset, educational status of

the household head, access to credit, and access to off-farm income were found out to have negative associations with the household's poverty status.

As ensuring food security and agricultural development in Bangladesh is almost synonymous, it is important to know the household food security of farmers, who produce foods to feed the whole nation. In general, the concern regarding food security is analyzed at the national level which compares the availability and requirement of food grains. Therefore, it is important to understand the food security status at the farm level, especially at the intra-household level of the ultra-poor. Considering these issues, the present study aims to figure out the socio-economic factors influencing the food security of the ultra-poor at the intra-household level.

II. MATERIALS AND METHODS

Data

This study is based on both primary and secondary data. Secondary data has been used to identify the study area. Primary data were collected in a field survey by face to face interviews to examine the intra-household food security status of the ultra-poor communities (extre poverty prone areas indified in HIES, 2010) in Mymensingh district. A multi-stage sampling technique was used for providing the primary data from Mymensingh district. Firstly, two sub-districts namely, Phulpur and Tarakanda were selected randomly within the poverty prone sub-districts as indicated in the HIES 2010 in Mymensingh district. From each of the selected sub-districts, one village was selected randomly. Finally, within the selected village a circular systematic sample (approx.. 75) of households was selected. In this process a random start was taken between 1 to N and subsequent units were selected at equal interval after arranging the units in a circular way. This overcomes the situation when N is not multiple of sample size n. The total sample size became 150 (78+72) households. Data were collected during 2 September to 17 September, 2018.

Measure of Food Security-Direct Calorie Intake

Food security can be measured in many ways. We used the direct calorie intake (DCI) method for the comparability with other national studies. The direct calorie intake (DCI) method estimates the per capita calorie intake at the household level and individual level. In this method, the household level food consumed during the last three days in a household is first averaged and afterward, the average content of food per day per household was converted into kilo calorie (using conversion factors suggested by FAO). The amount of calorie intake was then converted into per capita per day. According to this method, the members of a household are considered food insecure if their average calorie intake falls below a certain level (HIES, 2010). In Bangladesh, ‘absolute food insecure’ is defined as an average intake of less than 2,122 kcal per capita per day, while, ‘extreme food insecure’ refers to an average below 1,805 kcal per capita per day (Imam *et al.*, 2018; HIES, 2010). The approach assumes a value of 0.5 for household members less than 15 years (children) of age

and one for those above 15 years (adult). For example, a household with four adult members will have an adult equivalent value of 4 while, a household with two children and two adult members will have an adult equivalent value of 3 {(2+ (0.5*2) = 3} (Akerele *et al*., 2018).

Measure of Poverty-Cost of Basic Needs

Poverty can be estimated by using several approaches. The study estimated poverty based on the Cost of Basic Needs (CBN) method. In the CBN method, the poverty line (PL) indicates the average level of per capita expenditure at which persons can meet basic food and non-food needs. However, the upper poverty line (UPL) can be computed as adding the food and upper non-food allowances, while the lower poverty line (LPL) constitutes adding the food and lower nonfood allowances (HIES, 2016). In Bangladesh, absolute poverty is defined as the households whose per capita expenditures are below the UPL, whilst hard-core or extreme poverty refers to the households whose per capita expenditures are below the LPL. From Mymensingh district BDT 1276 was considered for LPL while, BDT 1497 was considered for UPL (World Bank, 2013).

Measure of Dietary Diversity Scores (DDS)

Dietary diversity scores are the number of distinct food groups consumed by a household during the week prior to being surveyed by the HIES. Each food group represents a special class of nutrients, and a higher DDS indicates greater diversity of food intake and better quality diets. The DDS estimates a household's economic ability to consume a set of nutritionally diverse food items. Customarily, food consumption is recorded over a period of 24 hours, and the food tally is used to calculate the household dietary diversity score (FAO, 2013). A higher DDS implies a more diversified portfolio of food intake and a higher quality diet. Thus, this measure can be used as a relatively simple indicator for the micronutrient adequacy of households' diets.

Logistic Regression Model

Several studies attempted to identify the determinants of food security at the household level mostly using logistic regression models (Mahajan and Joshi, 2011; Faridi and Wadood, 2010; Lawal *et* al., 2008; Haile *et* al., 2005; Abegaz, 2017). The use of the binary logistic regression model is popular to investigate the response of the food security questions. Logistic regression measures the relationship between a categorical dependent variable and one or more independent variables. When the dependent variable is dichotomous, in general, the logistic model expresses a qualitative dependent variable as a function of several independent variables, both qualitative and quantitative.

Binary Logistic Regression Model

Let, Y be a dichotomous dependent variable, say food security status taking values 0 and 1 and suppose that Y=1, if the household is food secure and Y=0, if food insecure.

Also let X be an independent variable say, income. Then the form of a binary logistic regression model is:

$$P = p(Y = 1 / X) = \frac{e^{\beta_0 + \beta_1 X}}{1 + e^{\beta_0 + \beta_1 X}}$$

$$\text{And, } 1 - P = p(Y = 0 \mid X) = \frac{1}{1 + e^{\beta_0 + \beta_1 X}}$$

Then a transformation of P known as the logit transformation and is defined as:

$$\text{g(x)=logit P} = \log\left[\frac{P}{1-P}\right] = \beta_0 + \beta_1 X$$

There are many desirable properties of this transformation g(x). The logit, g(x) is linear in its parameters. It may be continuous and may ranges -∞ to +∞. Depending on the range of x for more than one independent variable the model can be generalized as:

$$\text{g(x)=logit}(P_i) = \beta_0 + \sum_{l=1}^{k} \beta_l X_{il} \quad \text{l=1, 2,…, k; and i=1, 2,…, n.}$$

III. RESULTS AND DISCUSSION

Food security is an important aspect that should be assessed properly since it is a factor of poverty alleviation, improvement of nutritional status, and improvement of the level of education. Our initial analysis suggests that 56.7% of the sample households were food secure (less than 1805 kcal basis) in the survey area, while 42% of the sample households were food secure (less than 2122 kcal basis).

The study found that about 28 percent of households were absolute poor (UPL) and approximately 19 percent were extreme poor (LPL). Considering the lower poverty line by CBN method the incidence of poverty were 17.6 and 18.3 for national and rural level, respectively (HIES, 2016). On the other hand, by using upper poverty line the incidence were 32.8 and 32.9 for national and rural level, respectively. The estimated percentage of poor at LPL was more, while it was less at UPL, in the survey areas than the national estimated average.

Determinants of Households Food Security

The binary logistic regression model was used to estimate the effects of different socio-economic and demographic variables on household food security status by the calorie intake method. The explanatory variables used in the study were the age of husband, husband's occupation, husband's education, wife's age, wife's education, household size, access to electricity, child-adult ratio (children were considered as less than 15 years of age) and child male-female ratio.

Table 1: Food security status by socio-economic and demographic characteristics of the surveyed households (less than 1805 kcal)

Characteristics	Total	Food secure (%)	Food insecure (%)
Husband's age (p=.097)			
≤ 25	39	53.8	46.2
26-30	58	46.6	53.4
31-35	32	68.6	31.4
36-above	21	71.4	28.6
Husband's occupation (p=.128)			
Agriculture	62	66.1	33.9
Formal job	20	45.0	55.0
Others	68	51.5	48.5
Husband's education (p=.234)			
Illiterate	87	57.5	42.5
Primary	45	62.2	37.8
High School	18	38.9	61.1
Wife's age (p=2.42)			
≤ 25	95	51.6	48.4
26-30	36	63.9	36.1
31-above	19	68.4	31.6
Wife's education (p=.392)			
Illiterate	41	53.7	46.3
Literate	109	57.3	42.2
Access to electricity (p=.345)			
No	24	62.5	37.5
Yes	126	44.4	55.6
Child adult ratio (p=.076)			
>1	35	68.6	31.4
0-1	115	53.0	47.0
Child male female ratio (p=.04)			
0-.5	106	51.9	48.1
≥ 1	44	68.2	31.8

Note : Rows sum to 100%; p values are based on chi-square tests; child adult ratio= (no. of child/no. of adult); child male female ratio= (no. of male child/no. of female child)

Table 1 reveals the relationship between food security status and different socioeconomic and demographic characteristics of the surveyed households. Both food secure and food insecure households were considered using less than 1805 kcal. Husbands aged 36-above years were experiencing the highest food security (71.4 percent), while for the age group 26-30 it was the lowest (46.6 percent). The husband's occupation and education did not have any significant association with

food security. Note that husband refers to the household head and wife refers to the primary female in a household.

Table 2 represents the estimates of the effect of socio-economic and demographic characteristics on food security based on less than 1805 kcal. The occupation was an important factor that influenced the food security status. In this study, as a determinant of food security husband's occupation was found negatively significant (at 10 % level). The main occupation of the household's head of these areas was agriculture. The result shows that households engaged in other jobs (business or integrated) were .522 times less likely to be food secured than the household engaged in agriculture. The result indicates that among the hard-core food insecure households being involved in agriculture somewhow has more the access to food (own production) compared to households involved in other professions. More precisely, the cost to access food is less among those involved in agriculture than the others. Furthermore, farmers may consume their own produces without incuring the market level (higher) price which is the case for others not involved in agricuture. Bangladesh should target self-sufficiency in food grains production to satisfy domestic demand in normal production years (Saha *et al*., 2016).

Table 2: Binary logistic regression estimates of the effects of different socio-economic and demographic characteristics on food security (less than 1805 kcal) in rural Mymensingh district

Independent variables	Coefficients (β)	Standard error (SE)	Odds ratio (OR)
Age of Husband's (r:≤25)			
26-30	-.505	.436	.603
31-35	.358	.536	1.431
36-above	.309	.652	1.362
Husband's occupation(r:Agriculture)			
Company job	-.744	.582	.475
Others(business or integrated)	-.650*	.392	.522
Husband's education (r : Illiterate)			
Literate	-.129	.383	.879
Household size	.123	.382	1.131
Constant	.268	.634	1.307

Note: Level of Significance: *p<.10, **p<.05, ***p<.01

Table 3 reveals the relationship between food security status and different socio-economic and demographic characteristics of the surveyed households by considering the upper poverty line (less than 2122 kcal). The education of the husbands seemed to have a positive association with food security status. Food security was highest among husbands who belong to the primary education level (46.7 percent). However, food security was least among husbands belong to the high school level (16.7 percent). Wive's education has a significant association with food

security. About 45.9 percent of the households having literate wives were food secured. The wife's age did not have any significant association with food security.

Table 3: Food security status by socio-economic and demographic characteristics of the surveyed households (less than 2122 kcal)

Characteristics	Total	Food secure (%)	Food insecure (%)
Husband age (p=.606)			
≤ 25	39	35.9	64.1
26-30	58	39.7	60.3
31-35	32	50.0	50.0
36-above	21	47.6	52.4
Husband occupation (p=.399)			
Agriculture	62	48.4	51.6
Company job	20	40.0	60.0
Others (business or integrated)	68	42.0	58.0
Husband education (p=.066)			
Illiterate	87	44.8	55.2
Primary	45	46.7	53.3
High school	18	16.7	83.3
Wife's age (p=.791)			
≤ 25	95	40.0	60.0
26-30	36	44.4	55.6
31-above	19	47.4	52.6
Wife's education (p=.083)			
Illiterate	41	31.7	68.3
Literate	109	45.9	54.1
Access to electricity (p=.578)			
No	24	41.7	58.3
Yes	126	42.1	57.9
Child adult ratio (p=.240)			
>1	35	48.6	51.4
0-1	115	40.0	60.0
Child male female ratio (p=.136)			
0-.5	106	38.7	61.3
≥ 1	44	50.0	50.0

Table 4 represents the estimates of the effect of socio-economic and demographic characteristics on food security based on less than 2122 kcal. These findings are consistent with the findings of the previous study at least in terms of direction of the effects of independent variables (Lawal et al., 2008). Education may help rural people to be easily adaptable to new ideas, technology and thinking that may help to improve household living standards and food security status. Note that though not significant, husband's education is negatively associated with food security. Education (at high school level) in rural context may not have significant variations on

employment/income consequently on food security, rather it may restrict the access to low grade jobs resulting a risk to achieve food security. On the contrary, significant effect of wives'education implies awareness of food behaviour and better food management at household level. It has less to offer in terms of employment opportunity in rural areas. In this study, as a determinant of food security wives' education levels were found positively significant (at 10 % level). Households with literate wives were 2.232 times more likely to be food secured compared to households with illiterate wives. Bimerew and Beyene (2014) found that as rural households continue in upgrading their education level, the likelihood of the household being food insecure will decrease. Besides, children of mothers with primary or higher education seems to have a higher probability of food security when compared to children of mothers with no education (Ali et al., 2019).

Table 4: Binary logistic regression estimates of the effects of different socio-economic and demographic characteristics on food security (less than 2122 kcal) in rural Mymensingh district.

Independent variables	Coefficients (β)	Standard error (SE)	Odds ratio (OR)
Age of Husband's (r:≤25)			
26-30	.150	.461	1.162
31-35	.979	.764	2.662
36-above	.921	1.309	2.513
Husband's occupation(r:Agriculture)			
Company job	-.275	.662	.759
Others(Business or integrated)	-.356	.433	.700
Husband's education (r : Illiterate)			
Literate	-.525	.424	.591
Age of Wife (r: ≤ 25)			
26-30	-.386	.661	.680
31-above	-.353	1.311	.703
Wife's education (r : Illiterate)			
Literate	.803*	.449	2.232
Household size	-.062	.141	.940
Access to electricity (r: No)			
Yes	-.023	.512	.977
Child adult ratio (r :>1)	-.103	.532	.902
0-1			
Constant	-.866	1.106	.421

Note: Level of Significance: *p<.10, **p<.05, ***p<.01

Intra-household Disparities in Food Security

For the poor households having meals together has implication on the health of the members, especially among the female members. Traditionally, women in rural households use to have meal at the end when number of food items as well as quality

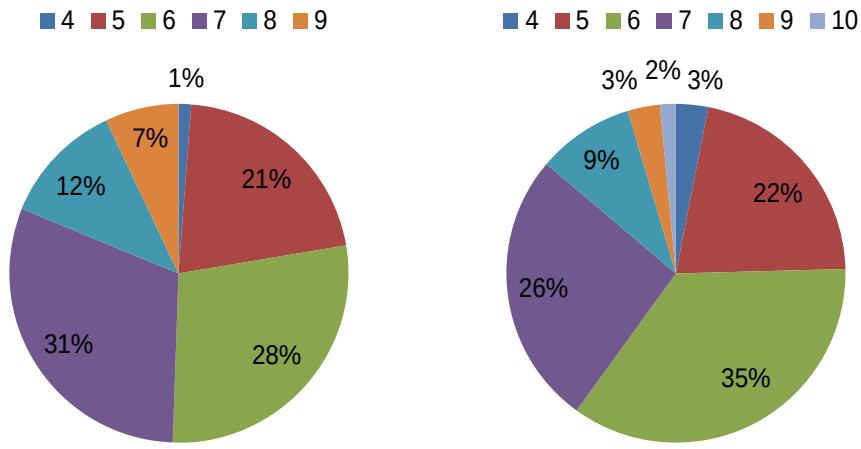
reduced (Kakai, 2000). Table 5 reveals that per capita calorie intake was significantly higher among those who were food secured and had meal together (2644.6 kcal). Probably food sharing and less food wastage are the mains reasons behind this.

Table 5: Mean comparison between per capita per day calorie intake by food consumption behavior (taking food together) and food security status

Per capita per day calorie intake			
Criteria	N	Mean	Standard Error
Food insecure and have meal together	31	1426.9	48.7
Food secure and have meal together	55	2644.6	181.9
Food insecure and don't have meal together	34	1508.4	36.1
Food secure and don't have meal together	30	2529.0	137.4
Total sample size	150	2112.3	86.2

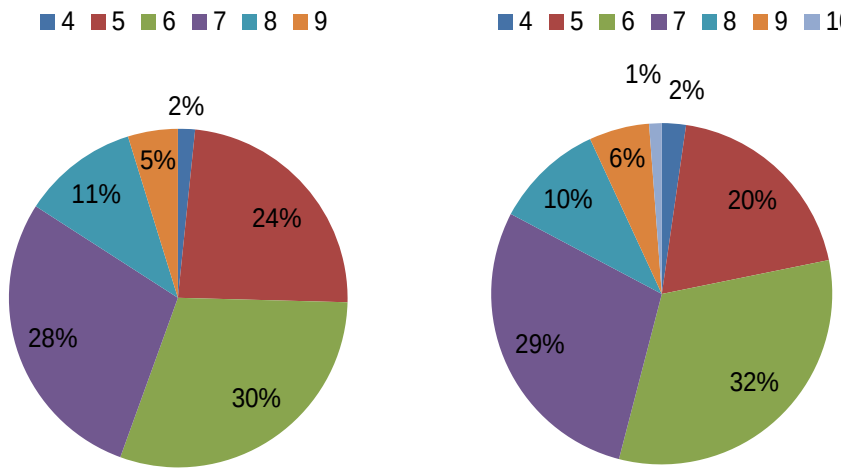
There have been differences in dietary diversity score (DDS) between food secured and food insecure groups when 1805 kcal was considered to calculate food security. Though the dietary diversity score ranges from 4 to 10 in both the groups, maximum households in the food secure group consumed 7 food items (31%. Among the food insecure households, maximum households seemed to have 6 food items (35%) (Figure 1).

However, when food security was measured by 2122 kcal both the food secure (30%) and insecure groups (32%), showed that maximum households consumed 6 food items, the former being slightly lower. This was followed by 7 food items in the same order, and 28% of the food secure households consumed 7 food items, while, 29% percent of the food insecure households consumed 7 food items (Figure 2). Interpretation of the difference in DDS between the food secure and insecure groups is somewhat complex, which should be explained by the amount of each item consumed. Because, even though dietary diversity score was high, the total calorie consumed may be less than that of lower dietary diversity score. Furthermore, we anticipate that within household the dietary diversity score may vary between age and sex groups.



Food secured Food insecured

Figure 1: Households dietary diversity score on food security status (less than 1805 kcal)



Food secured Food insecured

Figure 2: Households dietary diversity score on food insecurity status(less than 2122 kcal)

Table 6: Mean comparison between daily per capita calorie intake and child adult ratio

Per capita per day calorie intake			
Child adult ratio	N	Mean	Standard Error
>1	35	2033.9	83.90
0-1	115	2136.1	109.6
Total	150	2112.3	86.2

The average per capita calorie intake, though not significant, was less for the households with more children compared to the households with more adults. This was in line with the expectation (Table 6). However, considering the expected calorie intake for children as suggested by dietary guidelines (USDA and USDHHS, 2010) indicates that children were treated well compared to adults. A study by Kakai (2000) revealed that children were fed earlier than other members indicating good calorie intake among the children.

Table 7: Mean comparison between daily per capita calorie intake and child male-female ratio

Per capita per day calorie intake			
Male-female Ratio	N	Mean	Standard Error
0 -.5	106	2140.3	116.3
≥1	44	2044.9	89.9
Total	150	2112.3	86.2

Furthermore, Table 7 indicates that on an average, households with more child female members were consuming more calorie than households having more child male member (though not significant). This was completely opposite as observed in the national context where families with more female members were anticipated to have less as normally they have their meal mostly after the male members (Kakai, 2000). An in depth study may be designed to explore this further considering food preferences by sex, management of leftover foods and sex preference in food didtribution within households.

Overall, our study revealed that there was a likelihood of disparity in food security status within the households which was mainly due to food consumption behavior, timing, practice and subtle prevalence of sex preference. A systematic study to explore more should be carried out.

IV. CONCLUSION AND POLICY IMPLICATIONS

Food security has been an important policy issue over the few decades in Bangladesh. Interventions in the country so far is general in naure, except some safetynet programs. Recent surveys (HIES 2016; HIES 2010) reveal that there have been pockets of poor (and ultra poor) communities spreading in different corners of the

country, which need special attention in terms of achieving goals related food security. This study examined the determinants of food security of the ultra-poor household in rural households in Bangladesh using binary logistic regression. The results indicate that our study population being residents in the rural areas are suffering from food insecurity and require immediate policy intervention. This study identified several factors that were associated with the household's food security using the binary logistic regression model. When food security is measured using households per capita consumsion less than 1805 kcal, it appeared that husband age, child-adult ratio, and child male-female ratio have significant association with food security and, when food security is measured at less than 2122 kcal, it revealed that husband age, education, wife education have significant association with food security.

Among the upazilas under Mymensingh division, Phulpur and Tarakanda upazilas have been identified as the poorest upazilas. These upazilas have underlying causes, which may be somewhat different than other upazilas, for such poor condition. Specific interventions should be taken to address the food security issue in the region. Policy formulation should be based on the determinants of food security, especially education, occupation, child adult ratio, child male female ratio. More specifically, there should be programs to increase education level (in terms of enrolment) and awareness on food consumption behaviour to increase DDS (in teems of nutrition campaign). Alternative employment opportunities should be introduced providing related skill training and easing the access to resources. Intra-household food insecurity sould be properly addressed within the nutrition programs and family planning programs by properly disseminating the dietary requirement of individuals (of either sex, and children , adults and elderly) within households. The interventions should bring changes in resource mobilization and food consumption behaviour. These factors have the potentials to bring a massive change in food security because food security goes beyond the access to food but its utilization (food consumption behavior) too. Currently, in the study areas a persistent level of lower educational status (also illiteracy) among the household members is evident and this seems not effective to bring any rapid change in poverty as well as food security situations. So, skilled-based higher education should be promoted to overcome the situation. There was distinctive difference in dietary diversity between poor and non-poor households. Furthermore, this study revealed intra-household disparity in food security to some extent. The government should run dedicated programs to ensure food security of the households of the rural areas by properly adderessing the intra-household disparities.

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