



Measuring food and nutrition security of enclave people of Kurigram district in Bangladesh

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ABSTRACT

This study aims at assessing and analyzing the core food security indicators to enhance food and nutrition security of enclave people. A survey was conducted using structured questionnaire covering 120 households. Primary data were collected during July to December 2018. Middle aged persons are found to be the heads of households, average age is 48.87 years, family size is 4.38 persons, average education of household's head is 3.55 years of schooling and dependency ratio is 0.67. The total value of family assets before enclave exchange was BDT 124752 and after enclave exchange it becomes BDT 178177. Their total land area before and after enclave exchange are respectively 75.85 and 77.60 decimal. Average annual family income is BDT 114799. Total income increases significantly with the increase in income from agriculture and labor selling activities. The yearly family expenditure increases significantly with the increase in food expenditure and total land size. The annual family expenditure is BDT 134363. Average daily per capita consumptions of rice, potato, vegetables and all food items are respectively 417.59, 75.35, 114.06 and 792.06 g. Daily per capita calorie and protein intakes are respectively 1788 kcal and 55 g which are relatively lower compared to the national level. People consume almost all 12 categories of food items and average household dietary diversity score is 11.50. Food security decreases with the increase in family size and increases with the increase in food cost. Absolute poverty is 89% and hard-core poverty is 55% on the basis of direct calorie intake method. Absolute and hard-core poverty are 68% and 52% respectively on the basis of cost of basic needs method. As a policy option, the government should support and take the development initiatives of people, enhance food security status and upscale the nutrition condition of people living in the enclave.

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Introduction

An enclave is a portion of territory of one state surrounded by territory of another state or enclave means the discontinuous portion or landmass of one country separated from the mainland and surrounded by politically alien territory. There are a good number of enclaves all over the world including Bangladesh and India, which were created for a variety of historical, political or geographical reasons. Bangladesh is a South Asian country having more than 165.55 million people living within a small area of 1,47,570 km² (The Independent, 2019). Within the country, 98% people identify themselves as Bengali and the rest are known as indigenous minorities. Bangladesh has a per capita income of US\$1,751 and GDP real growth rate 7.86% (Bangladesh Economic Review, 2018). There are a total

number of 162 territories within Bangladesh and India, which are commonly known as 'Chitmahal' in Bengali which means the land disconnected from the mainland. There are 111 Indian enclaves inside Bangladesh and 51 Bangladeshi ones inside India.

Maximum Indian enclaves are located in the north-west part of Bangladesh. These enclaves are located in four districts in Bangladesh. The number of enclaves in Lalmonirhat, Panchagarh, Kurigram and Nilphamari are respectively 59, 36, 12 and 4 Dashiarchara enclave which is also a biggest Bangladeshi composite enclave, administered as part of Phulbari Upazila in Kurigram district, lies within the Indian province of West Bengal. The enclave has an area of 1742.5 Sq ft with a resident population of almost 11000 people.

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In 2015, India and Bangladesh ended one of the world's greatest geographical border oddities. The two countries formally exchanged 162 tracts of land totaling 24,270 acres where 60,000 people are living. A total number of 47,000 people on the Bangladeshi side and some 14,000 on the Indian side were finally given the right to make a choice: stay where they have lived for generations with official citizenship of the country that will absorb them or return to their country of origin (Aljazeera America, 2015). The people of enclaves are facing various types of problem including security, health, nutrition, education and communication also. Before this exchange, they had no identity and official citizenship. The enclave-dwellers were denied access to local haat (periodic village markets) and to buy and sell articles and thus the enclave people in particular were often pushed under economic blockade. They were treated as most disadvantage community in both countries.

Ensuring food security for all is one of the major challenges that Bangladesh faces today (Nath, 2015). Household food security is defined as access by all people at all times to enough food to ensure an active, healthy life (Maxwell et al., 2000). FAO (1996) defined the objective of food security as assuring to all human beings the physical and economic access to the basic foods they need. This implies three different aspects: availability, stability and access. Poverty refers to forms of economic, social and psychological deprivation among people arising from a lack of ownership and control of or access to resources for the attainment of a required minimum level of living. It is a multidimensional problem involving a deficiency of income, consumption, nutrition, health, education, housing etc. In Dashiarchara enclave about 49% people belongs to extreme poverty. Until 2015, government and other non-government services could not enter there for upholding their living standard (World Bank, 2005).

The overall objective of the study was to estimate livelihood status, food consumption and nutrition intakes, and food security status of people living in Dashiarchara enclave. The specific objectives were (i) to identify the livelihood status of Dashiarchara enclave dwellers, (ii) to determine the food consumption, calorie and protein intakes and food security status of the people living in enclave, (iii) to identify the major problems faced by the enclave people, and (iv) to suggest some policy implications for greater food security and better livelihood.

Materials and Methods

Data

The research was based on primary data, collected from the enclave of Dashiarchara, Kurigram in Bangladesh. The sample farm households were selected using simple random sampling technique. Data were collected through direct interview method with the trained enumerators

including researchers. Structured questionnaires were used for recording the information. Total sample size was 120. Data were collected during July to December 2018.

Analytical techniques

Descriptive statistics

Some descriptive statistical analyses like average, standard deviation, per capita income, food production and consumption, education and health status, tables, charts, diagrams were performed.

Modeling and inferential statistics

Some statistical models relating to food production and consumption were estimated encompassing essential explanatory variables to characterize different food security indicators. Multiple regression analyses with linear and log linear models were performed. Specifically, income, expenditure, consumption and nutrition functions were estimated in both linear and log linear forms. In addition, logistic regression and multinomial logistic analyses were carried out. To measure poverty indices Foster-Greer-Thorbecke (FGT) method was used (Foster et al., 1984). Accordingly, poverty indices were calculated using Direct Calorie Intake (DCI), poverty line estimation or Cost of Basic Needs (CBN) methods. Daily per capita calorie intake was calculated on all food items using food conversion ratios. A person whose daily per capita calorie intake is less than 2122 kcal is said to be under the absolute poverty line. On the other hand, a person whose calorie intake is less than 1805 kcal is said to be under hard core poverty line. Furthermore, some statistical tests such as t and F tests were carried out to draw valid inferences. Statistical software SPSS was used to analyze the data.

Household income function

Linear income function

$$Y_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + U_i$$

Log-Linear income function

$$\ln Y_i = \beta_0 + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + \beta_4 \ln X_4 + \beta_5 \ln X_5 + \beta_6 X_6 + U_i$$

Where Y = Total household's income (BDT) from all sectors in a year, X_1 = income from agriculture, X_2 = income from labour selling, X_3 = total land size (decimal), X_4 = family size, X_5 = age of farmer (year) and X_6 = Education (year of schooling), Note: education is used without log in the log-linear model. Similar functions were formulated and estimated for food consumption, calorie and protein intakes.

Poverty estimation

The Bangladesh Bureau of Statistics (BBS) used the following semi-log or exponential model to estimate the poverty line:

$$\ln Y = \beta_0 + \beta_1 X + U$$

Where Y = per capita monthly expenditure (food and non-food), X = per capita per day calorie intake, U = disturbance term.

Binary logistic regression model

Let Y be a dichotomous dependent variable say food security where Y = 1, the household is food secured and Y = 0 otherwise. Let X be an independent variable, the form of logistic regression model (Gujarati, 2007) is

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

And

$$1 - p = p(Y=0/X) = \frac{1}{1 + e^{\beta_0 + \beta_1 X}}$$

$$\therefore \text{Logit } L_1 = \log \left[\frac{p}{1-p} \right] = \beta_0 + \beta_1 X$$

For more than one independent variables-

$$\text{Logit } L_1 = \beta_0 + \sum_{i=1}^k \beta_i X_{i1}$$

l = 1, 2, ... k, and i = 1, 2, ..., n

Table 1. Socioeconomic and demographic profile of households

Variables	Mean	SD
Age of Family Head	48.87	13.17
Education of Family Head	3.55	3.95
Male member	1.61	0.75
Female member	1.55	0.74
Children	1.23	0.99
Family size	4.38	1.60
Male employed member	1.26	0.46
Female employed member	0.06	0.27
Total employed member	1.32	0.48
Total unemployed member	3.05	1.48
Dependency ratio	0.67	0.14
Total land before enclave exchange	75.85	130.69
Total land after enclave exchange	77.60	138.56

Table 2. Value of family assets before and after enclave exchange (BDT)

Assets name	Before enclave exchange (BDT)		After enclave exchange (BDT)	
	Mean	SD	Mean	SD
Cattle/buffalo	58041.67	141018.29	49250.00	51452.72
Goat/sheep	1377.50	4277.05	2345.83	8120.36
Poultry	593.17	1725.39	600.42	581.81
Rickshaw/cycle/motorcycle	4915.83	13004.41	6441.68	18660.85
Tractor/deep tube well	-	-	5125.00	31365.71
Furniture	16795.83	10077.53	21425.00	26525.92
Building-house	35881.67	18272.53	84441.67	257577.59
Radio/TV	-	-	416.67	2273.65
Refrigerator	-	-	233.33	2556.04
Mobile phone	1356.25	852.00	2989.17	2397.43
Others	5450.00	13885.39	4908.33	10342.86
Total	124751.92	156561.30	178177.10	311474.92

Note: SD means standard deviation.

Multinomial logistic regression model

In case of multinomial logistic regression Y had three values, like Y=0 for food insecure case where per calorie intake was less than 1805 Kcal, Y=1 for relatively food secure case where per capita calorie intake was less than 2122 Kcal but more than 1805 Kcal and Y=2 for food secure case where per capita calorie intake was more than 2122 Kcal. Like logistic regression, multinomial logistic regression model was estimated considering food secure case as reference category.

Results and Discussion

Household profile

The average age of family head was 48.87 years, where average education of the head of households was calculated as 3.55 years of schooling. The average number of male, female and children of households were respectively 1.61, 1.55 and 1.23. The average family size was 4.38 persons. The average male and female employed members were 1.26 and 0.06. The dependency ratio was 0.67. Land was the most important input of production and economic variable for the farmers.

Table 3. Yearly family income function

Variables description	Linear model		Log-Linear Model	
	Coefficient	Standard error	Coefficient	Standard error
Intercept	-10936.498	30779.05	10.506**	0.652
Income from agriculture	0.649**	0.14	0.007	0.012
Income from labour selling	0.693**	0.18	0.001	0.010
Total land size	236.638**	69.95	0.219**	0.046
Family size	3395.876	3868.27	0.358**	0.120
Age	555.988	456.1	-0.109	0.167
Education	4874.599**	1602.2	0.006	0.013
Adjusted R ²	0.63		0.39	
F-value	34.23**		13.72**	

Table 4. Yearly expenditure function

Variables description	Linear model		Log-Linear Model	
	Coefficient	Standard error	Coefficient	Standard error
Intercept	-4223.67	37747.03	1.29	1.32
Yearly expenditure of food	2.53**	0.59	0.89**	0.13
Total land size	717.76**	72.97	0.14**	0.03
Family size	-1502.51	6598.29	0.14	0.11
Age	-516.07	571.29	-0.005	0.11
Education*	-4192.66*	2031.37	-0.004	0.01
Adjusted R ²	0.77		0.73	
F-value	79.56**		64.99**	

Education* is always without log.

Table 5. Daily per capita food consumption, calorie and protein intakes of farm households

Food items	Food consumption (g)		Calorie intake (kcal)		Protein intake (g)	
	Mean	SD	Mean	SD	Mean	SD
Rice	417.59	85.16	1357.17	276.77	20.88	4.26
Wheat	4.72	11.02	15.28	35.69	0.57	1.33
Potato	75.35	24.72	69.43	28.27	1.50	0.61
Meat	13.87	32.87	18.04	43.88	2.65	6.45
Fish/dry fish	24.17	15.74	25.62	16.68	2.42	1.57
Milk	31.22	24.82	20.61	16.38	0.62	0.49
Egg	29.01	19.03	51.06	33.50	3.48	2.28
Soybean oil	12.21	10.38	52.12	44.31	3.05	2.59
Mustard oil	27.62	10.67	9.11	3.52	6.08	2.35
Onion	17.39	10.18	8.09	4.73	0.21	0.12
Garlic	3.76	5.45	5.15	7.46	0.19	0.29
Chili	10.58	3.50	25.08	8.30	0.17	0.056
Turmeric	1.55	0.64	4.85	1.99	0.16	0.06
Ginger	0.94	1.36	0.87	1.26	0.05	0.07
Other spices	0.30	0.41	0.39	0.52	0.01	0.012
Pulse	13.93	5.82	45.84	19.13	2.79	1.16
Salt	9.20	4.01	35.82	29.42	0.00	0.00
Sugar	9.60	7.89	-	-	-	-
Vegetables	114.06	58.11	34.22	17.44	9.69	4.94
Fruits	11.16	13.88	9.71	12.07	0.10	0.12
All food items	792.06	169.75	1788.46	333.35	54.64	12.12

It was observed that household's average land before and after enclave exchange were respectively 75.85 decimal and 77.60 decimal (Table 1). The value of family assets has been presented in Table 2.

Household income

Study of income of the people showed that enclave dwellers earned income from nine sectors. These were rice production (*Aman* and *Boro*), vegetable production,

farm forestry, livestock, fishing, non-agricultural activities, social safety net programs, labour selling and other activities. Farmers produced vegetables at the homesteads and cultivable lands. However, they produced crops especially Amon and Boro rice in the enclave area. Women reared poultry and livestock to support their livelihoods. Poultry egg is the cheapest source of nutrition for the enclave people. Farmers caught fishes on the government owned rivers and canals under the common property right for their own consumption and earned money by selling them. As there was no small scale or large scale industry, employment opportunity was very scarce and livelihood was not sustainable. Some people migrated to Dhaka and Chittagong for jobs.

It was observed that rice production sector generated the highest yearly family income and it was BDT 37942. The second important sector was labor selling followed by non-agricultural activities and other activities respectively. Annual family incomes from vegetable production, farm forestry, livestock, fishing, non-agricultural activities, labor selling, and other activities were respectively BDT 9883, BDT 2067, BDT 3552, BDT 875, BDT 15625, BDT 18433, and BDT 15125. People received money BDT 11296 from the government under the social safety net programs (SSNP). There were elderly allowance, disable allowance, widowed allowance, open market sell, vulnerable group feeding (VGF), vulnerable group development (VGD), general relief (GR) and school stipend from the government. However, coverage of SSNP was very poor. Total annual family income was observed to be BDT 114799. However, total income was significantly increased with the increase in income from agriculture (rice production, vegetable production, farm forestry, livestock rearing and fisheries), labor selling, total land size and education (Table 3).

Household expenditure

It was observed that yearly average households' expenditure in 13 different cost sectors was BDT 134363. The cost sectors were food, clothing, treatment, education, purchasing/repairing house, festival, furniture purchasing, livestock, poultry, vehicle, land cultivation, mobile expenditure and others. Food cost (BDT 51242) was the largest cost component which was 38.14 percent of total expenditure followed by cost of purchasing/repairing house, cost of land cultivation, cost of education, cost of clothing, cost of festival, cost of treatment, cost of livestock, cost of others, cost of vehicle, cost of mobile expenditure, cost of furniture and cost of poultry and the corresponding expenditures were BDT 23813, BDT 15325, BDT 10119, BDT 7758, BDT 7300, BDT 6865, BDT 5933, BDT 1710, BDT 1611, BDT 1307, BDT 1005 and BDT 374. The yearly family expenditure was increased significantly with the increase in food expenditure and total land size where total expenditure was decreased with the increase in education (Table 4).

As mentioned earlier food expenditure was the highest cost component. Yearly family expenditure was relatively higher than family income where the difference between income and expenditure was found to be negative.

Food consumption and nutritional intake of households

Intakes of food according to different food items by the households per capita per day have been presented in Table 5. People of Dashiarchara enclave consumed 20 food items like rice, wheat, potato, meat, fish/dry fish, milk, egg, etc. Rice was the most important staple food in terms of the highest per capita daily consumption. The overall daily per capita food intake was 792.06 g (Table 5).

Rice is major calorie supplier for the people of the country. That is, food is dominated by rice. It was observed that rice alone generated 1357.17 Kcal daily per capita. Potato was the second highest daily per capita calorie supplier (69.43 Kcal) followed by soybean oil (52.12 Kcal), egg (51.06 Kcal), pulse (45.84 Kcal), sugar (35.82 Kcal), vegetables (34.22 Kcal), fish/dry fish (25.62 Kcal), chili (25.08 Kcal), milk (20.61 Kcal), meat (18.04 Kcal), wheat (15.28 Kcal), fruits (9.71 Kcal), mustard oil (9.11 Kcal), onion (8.09 Kcal), garlic (5.15 Kcal), turmeric (4.85 Kcal), ginger (0.87 Kcal) and other spices (0.39 Kcal). The total daily per capita calorie intake from all food items was 1788.46 Kcal (Table 5). The daily per capita calorie intake was significantly lower compared to the national level.

Protein is an important nutrient in human diet. Lack of protein in diet retards growth and development of health and causes numerous diseases. Food items which provide more protein to people are costlier than other food items providing less protein. Maintaining good health is an indicator of food security. In the food security arena, food means nutritious food. Overall daily per capita protein intake was 54.64 g, which was relatively lower than that had been shown by Rahman *et al.* (2017), which observed that overall daily per capita protein intake by farm households was about 67 g. Rice supplied the highest amount of protein (20.88 g) followed by that of vegetables (9.69 g), mustard oil (6.08 g), egg (3.48 g), soybean oil (3.05 g), pulse (2.79 g) and meat (2.65 g), respectively (Table 5). As mentioned earlier, household's total food items were grouped into 12 groups to estimate household dietary diversity scores (HDDS). It was observed that the average HDDS was 11.50.

Daily per capita food consumption was increased with the increase in total land size and decreased with the increase in family size. The daily per capita food consumption functions in linear and log-linear forms were well fitted to data as evidenced by significant F values (Table 6). Unlike daily per capita food consumption, daily per capita calorie intake was increased with the increase in per capita rice consumption and total land size and decreased with the increase in family size (Table 7). The results are

similar to some other studies conducted by [Rahman and Sousa-Poza \(2010\)](#), [Rahman and Islam \(2012\)](#) and [Rahman and Schmitz \(2007\)](#). From daily per capita protein intake functions, it was observed that daily per capita protein intake was increased significantly with the increase in per capita rice, meat, milk, egg, fish consumptions and total land size and decreased with the increase in family size. More specifically, a 1 percent increase in per capita rice consumption increased the per capita protein intake by 0.46 percent. Similarly, a 1 percent increase in per capita meat, milk and egg consumption together increased per capita protein intake by 0.05 percent whereas a 1 percent increase in per capita fish consumption increased per capita protein intake by 0.02 percent and a 1 percent increase in total land size increased per capita protein intake by 0.04 percent. However, a 1 percent increase in family size reduced daily per capita protein intake by 0.27 percent ([Table 8](#)).

Poverty indices estimation

The estimated poverty line

The estimated model is

$$\ln Y_i = 6.932^{**} + 0.000421^{**} X_i,$$

where X_i is the threshold per capita per day calorie intake.

$$\text{Adjusted } R^2 = 0.092, \quad F = 13.076^{**}$$

Absolute poverty line

$$\begin{aligned} \ln Y_i &= 6.932 + 0.000421 X \\ &= 6.932 + 0.000421 \times 2122 \\ &= 7.825362 \\ Y &= \text{Exp}(7.825362) \\ &= \text{Tk. } 2503.29 \end{aligned}$$

Thus, absolute poverty line is Tk. 2503.29

Hard core poverty line

$$\begin{aligned} \text{Again, } \ln Y_i &= 6.932 + 0.000421 X \\ &= 6.932 + 0.000421 \times 1805 \\ &= 7.691905 \\ Y &= \text{Exp}(7.691905) \\ &= \text{Tk. } 2190.54 \end{aligned}$$

Thus, hard core poverty line is Tk. 2190.54

Poverty is the root cause of food insecurity. Poverty levels have been measured on the basis of Direct Calorie Intake (DCI) method using head count ratio and Cost of Basic Needs (CBN) method through poverty line estimation. It was observed that absolute poverty was 89% and hard-core poverty was 55% in the study area on the basis of DCI method. Absolute and hard-core poverty were estimated to be 68% and 52% on the basis of CBN method.

Estimation of binary and multinomial regression models

The results of binary logistic regression explained that with 1 unit increase in family size the likelihood of food security of the people could be decreased significantly by 0.069 times. Again, it also showed that with 1 unit increase in weekly cost of all food consumption, on an average, the likelihood of food security of the people could be increased significantly by 1.005 times ([Table 9](#)). However, effects of monthly per capita income, total land size and education had no effect on food security condition. Thus, it showed that an increase in the family size resulted in the corresponding decrease of food security condition whereas an increase in the weekly cost on all food items resulted in the corresponding increase of food security condition of people.

The multinomial logistic regression was estimated using three levels of food security where reference category was food secure. The multinomial logistic regression revealed that with 1 unit increase in family size on an average the likelihood of food insecurity could be increased significantly by 53.55 times ($p < 0.01$). On the other hand, it showed that with 1 unit increase in weekly family food expenditure, on an average, the likelihood of food insecurity could be decreased significantly by 0.99 times ($p < 0.01$) ([Table 10](#)).

Again, it revealed that with 1 unit increase in family size on an average the likelihood of relative food security could be increased by 8.43 times ($p < 0.01$) compared to food secure condition. Thus, it implied that increase of family size had negative impact on food security. On the other hand, with 1 unit increase in weekly family food expenditure, the likelihood of relative food security could be decreased by 0.996 times compared to food secure condition.

Social safety net programs (SSNP) of government and developmental partner's initiatives

In every country there are some social safety net programs (SSNP) to safeguard the vulnerable or marginalized people those who are lacking of income and less access to food, nutrition, water and sanitation. The Bangladesh Government also has some social safety net programs like Food for Work (FFW), Cash for Work (CFW), Vulnerable Group Feeding (VGF), Vulnerable Group Development (VGD), Elderly Allowance (EA), Disable Allowance (DA), Widowed Allowance (WA), Pregnant Women Allowance (PWA), Cash for Education (CFE) or School Stipend (SS), Lactating Mother Allowance (LMA), and Test Relief (TR). However, it was observed that VGD, EA, WA, and DA were existed in the Dashiarchara enclave in Kurigram of Bangladesh. It was observed that 111 households out of 120 households received benefits under different social safety net programs. Under VGF program 109 households out of 120 households received rice and amount of rice received

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was 30kg in a month per household. It was also observed that 3 households out of 120 households received benefit under WA program and average money received was BDT 500 in a month. Similarly, only 4 households out of 120 households received benefit under DA program and average money received was BDT 500 in a month whereas 41 elderly people out of 120 households received benefit under EA program and average money received was BDT 700 in a month.

The major problems faced by the enclave inhabitant

The people of Dashiarchara enclave had a wrong idea about nutritional food that only the rich food provided high nutrition. This was because of lack of knowledge about food nutrition. People did not know that the

seasonal vegetables and fruits, small fishes were full of nutrition. They had no idea that washing vegetable after cutting would lose food value. Even they were not aware of proper cooking system. Education level in the study area was low. The main problem they faced to go to the school was that the condition of the roads was very bad. All the community members were in unison that their children were getting all the facilities but those were not enough compared to the children of mainland. Enclave dwellers faced communication problem. They were not well connected to each other through road and high ways systems. Many roads were not well constructed and somewhere needed some culverts and bridges as well.

Table 6. Daily per capita food consumption function

Variables description	Linear model		Log-Linear Model	
	Coefficient	Standard error	Coefficient	Standard error
Intercept	989.28**	81.13	6.58**	0.48
Yearly income	0.00	0.00	0.06	0.04
Total land size	0.30*	0.15	0.06**	0.02
Family size	-70.44**	12.04	-0.45**	0.06
Age	0.89	1.20	0.06	0.07
Education*	3.81	4.66	0.001	0.005
Adjusted R ²	0.34		0.47	
F-value	8.18**		13.71**	

Education* is always without log.

Table 7. Daily per capita calorie intake function

Variables description	Linear model		Log-Linear Model	
	Coefficient	Standard error	Coefficient	Standard error
Intercept	546.43**	89.607	3.36**	0.24
Rice consumption	3.35**	0.129	0.73**	0.03
Total land size	0.341**	0.084	0.03**	0.07
Family size	-45.61**	9.627	-0.05**	0.03
Age	-.447	0.878	-0.05	0.03
Education*	3.273	3.292	0.001	0.002
Adjusted R ²	0.93		0.93	
F-value	201.74**		177.18**	

Education* is always without log.

Table 8. Daily per capita protein intake function

Variables description	Linear model		Log-Linear Model	
	Coefficient	Standard error	Coefficient	Standard error
Intercept	14.75**	5.11	1.12*	0.43
Rice consumption	0.07**	0.008	0.46**	0.07
Meat, milk, egg consumption	0.11**	0.02	0.05**	0.01
Fish consumption	0.22**	0.04	0.02**	0.01
Total land size	0.02**	0.01	0.04**	0.01
Family size	-1.65**	0.51	-0.27**	0.04
Adjusted R ²	0.72		0.66	
F-value	62.62**		47.51**	

Table 9. Binary logistic regression estimates of the effects of different determinants on food security

Independent variables	β	Asymptotic S.E.	Wald	Significance level	Odds Ratio (OR)
Family size	-2.680**	0.740	13.133	0.000	0.069
Total land size	-0.002	0.006	0.135	0.713	0.998
Education	0.064	0.095	0.451	0.502	1.066
Weekly family food expenditure	0.005*	0.002	5.892	0.015	1.005
Per capita monthly income	0.000	0.000	0.211	0.646	1.000
Constant	3.106	1.652	3.533	0.060	22.330

Table 10. Multinomial logistic regression estimates of the effects of different determinants on food security

Three level of food security	β	Asymptotic S.E.	Wald	Significance level	Odds Ratio (OR)
Food insecure					
Constant	-6.611**	1.964	11.325	0.001	53.552
Family size	3.981**	0.850	21.951	0.000	1.001
Land size	0.001	0.006	0.043	0.836	1.029
Education	0.029	0.106	0.074	0.786	0.992
Weekly family food expenditure	-0.008**	0.002	11.378	0.001	1.000
Per capita monthly income	0.000	0.000	0.501	0.479	
Relatively food secure					
Constant	-2.647	1.693	2.445	0.118	8.425
Family size	2.131**	0.769	7.671	0.006	1.003
Land size	0.003	0.006	0.226	0.634	0.904
Education	-0.101	0.098	1.061	0.303	0.996
Weekly family food expenditure	-0.004*	0.002	3.087	0.079	1.000
Per capita monthly income	0.000	0.000	0.097	0.756	

Reference category is food secure

Medical and hospitalization facilities were still an issue for the people of Dashiachara enclave. The people of the locality suffered for emergency treatment and hospitalization. They were dependent upon the doctors and hospitalization facilities of nearest Upazila Phulbari. It could be identified as crucial factor for them. Banking facility was another crucial factor for them. They needed to get the bank services from Phulbari Upazila, which was a difficult for them in their living.

Conclusion

The enclave dwellers struggled a lot earlier for their rights towards nationality and better living opportunities. Today they are very happy because they are citizen of Bangladesh although the area is not much developed yet. But they feel relieve for their achievement after the decades of struggles on achieving nationality as Bangladeshi and every aspect of livelihood opportunities and development. The outcome of the study may have socio-economic contributions about considerable resource allocations and identification of the influential factors of poor livelihood and food security may help for making recommendation to improve present scenarios and to assist the government in designing and searching for new policy. NGO's can work on their sustainable livelihood approach & development so that the Chitmohol (enclave) people can contribute in every sector of growth in Bangladesh. Moreover, the current study could be a guideline for the further research on enclave people. As per findings, 55% people belong to extreme poorer group. The government should support their

development, enhance food security condition and upscale the nutrition of people living in the Dashiarchara enclave. The following recommendations are suggested:

Recommendations

In field level, community-based nutrition education programs, social marketing projects, health, water and sanitation campaigns should be launched by the government agency and the NGOs, for making people aware of nutritional food, better health and livelihood. Government's social safety net programs on various dimensions should be extended and implemented in the area in a sustainable manner to ensure food and nutrition security of people living there. Total budget for social safety net programs should be increased. Moreover, government should seek for financial assistance from development partners to meet financial requirements for its social safety net programs.

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