

## **LIVESTOCK AND POULTRY REARING BY SMALLHOLDER FARMERS IN HAOR AREAS IN BANGLADESH: IMPACT ON FOOD SECURITY AND POVERTY ALLEVIATION**

**K. M. Mostafizur Rahman<sup>1\*</sup>**  
**Md. Jamal Hossain<sup>1</sup>**  
**M. Shihab Rana<sup>2</sup>**

### **ABSTRACT**

This study aims at assessing the potentiality of increasing livestock and poultry rearing by smallholder farmers in *haor* areas to improve food security condition and poverty alleviation of people. This study was carried out in 200 smallholder farmers rearing livestock in two upazilas (sub-district), namely Juri of Moulvibazar and Madan of Netrokona district. Both descriptive and functional analysis have been carried out. Result reveals that the average annual family income was BDT 254323 where average annual family expenditure was BDT 235775. Average daily per capita consumption of rice and all food items respectively are 397g and 1149g. Daily per capita calorie and protein intakes are respectively 2445 Kcal and 82g respectively of the *haor* people. People consume almost all 12 categories of food items and average household dietary diversity score is 11.85. Multinomial logistic regression suggests that increase of family size results in the corresponding decrease of food security condition and increase in expenditure on food items increases food security condition.

**Key words:** Livestock and Poultry, *haor* area, food security and poverty

### **I. INTRODUCTION**

Livestock rearing in Bangladesh is an integral agricultural activity among most rural households, particularly landless, marginal and small landholders. It has significant positive impact on equity in terms of income, employment and poverty reduction in rural areas. Apart from its multi-faceted roles in socio-economic development, the livestock sector constitutes about 17 percent of agricultural gross domestic product and provides nutritionally rich food to many people in both rural and urban areas (BBS, 2015). About 44% of human daily intake of animal protein comes from livestock products. Furthermore, it plays a pivotal role in the rural socio economic system as

---

<sup>1</sup> Department of Agricultural and Applied Statistics, BAU, Mymensingh, Bangladesh

<sup>2</sup> Former MS Student, Interdisciplinary Institute for Food Security, BAU, Mymensingh, Bangladesh

maximum households directly involved in livestock. It has created job opportunity for more than 6 million people. Small animals like sheep, goat and poultry are largely kept by the land scarce poor households for commercial purposes due to their low initial investment and operational costs required. Empirical evidence shows that livestock rearing has a positive impact on equity of income and employment for resource-poor rural households (Ali, 2007; BIRTHAL & Ali, 2005; BIRTHAL & Singh, 1995, Rao *et al.*, 2003; Singh & Hazell, 1993).

Goat rearing is an integral part of many farming systems in Bangladesh. The goat is probably the only animal which in Bangladesh is managed for multiple end uses: meat, hides, milk and manure. It provides one of the main sources of income for the farmers of Bangladesh. It is a major contributor of protein and fat and often the goat enterprise can help farmers to overcome an unforeseen crisis, which demands immediate finance. Cash income from the goat is utilized in different sub-sectors of the farm. At present in the South-West region of Bangladesh goats are found abundantly, but there is little reliable information regarding their potential and true role in rural development. Cattle fattening for beef production have become an important business of the small farmer in Bangladesh. In few areas of Bangladesh, a small scale commercial beef fattening program has already been started.

Milk production is dependable and important source of income for the rural poor where resources are limited and unemployed people are enormous. Production and marketing of milk are largely controlled by the small farmers. Demand for animal based products such as milk, meat and eggs has significantly increased due to sustained growth in income, urbanization, change in food preferences, increased awareness on nutritional food intake and nutrition education. In order to meet the emerging demand for livestock based products both in domestic and global markets, there is a renewed necessity to enhance livestock production and productivity especially per capita milk production.

Poverty, food insecurity and malnutrition are the usual phenomena in the *haor* areas of Bangladesh. Poverty is the root cause of food insecurity. Livestock is one of the substantial livelihood components in the *haor* area. Although the area is blessed with wonderful landscape and water resources, it bears some inbuilt characteristics like natural and human induced calamities (flash flood and upstream water flow), lacks of diversified resources to feed the vast population, connectivity, a very few enterprises to support livelihood, vulnerability, underdeveloped market, lacks of interventions from the government, NGOs and international development partners, nutrition education, health and sanitation, prevalence of diseases. The diverse poverty and food insecurity are prevailing severely in the *haor* people of Bangladesh. Considering these issues, the overall objective of the study was to assess the status of food security and livelihood of the people living in *haor* area. The specific objectives of the study were: (I) to estimate the income generated from livestock and poultry in the study area; and (II) to assess the food security status of the selected sample.

## II. MATERIALS AND METHODS

### Study Area and Data

Two *haor* districts namely Netrokona and Moulvibazar was selected purposively for this study. Accordingly, Madan Upazilla of Netrokona district and Juri Upazilla of Moulvibazar district were selected. Primary data were collected from the farmers rearing livestock and poultry with direct interview method through structured pretested questionnaires. Total 200 households were selected randomly using simple random sampling technique from the study area and data were collected with trained enumerators. Data from 100 households of Madan in Netrokona district and another 100 farm households in Juri Upazilla of Moulvibazar district were collected. Two FGDs were conducted to collect qualitative and comprehensive information. Two Key Informant Interviews (KII) were conducted where Upazilla Livestock Officers were Key Informants.

### Analytical Technique

Both descriptive and statistical analyses were carried out in this study. Descriptive analysis especially tabular analyses were performed along with calculation of averages, percentages and ratios of some indicators such as per household's income, per household's income from livestock, poultry and their products, per capita food consumption, calorie and protein intakes, share of livestock and poultry income to total income. Financial analysis was carried out on livestock and poultry enterprises. Thus profitability of rearing chicken (both broiler and layer), duck, pigeon, cattle (both for milk and beef), goat and buffalo (both for milk and meat) were estimated.

Poverty indices were estimated using Foster-Greer-Thorbecke (FGT) method, such as Direct Calorie Intake (DCI) method and Cost of Basic Needs (CBN) methods. To estimate poverty index on the basis of CBN method, poverty line was estimated. The DCI method was used to calculate the incidence of poverty where population or household falling below a threshold calorie intake was considered as poor. A person, whose daily calorie intake was less than 2122 Kcal, was considered to be in the 'Absolute Poverty'. Similarly, a person having daily calorie intake less than 1805 Kcal, was considered to be in the 'Hard Core Poverty'. 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

Multinomial logistic regression model was used to examine the factor affecting food insecurity in the study area where food security level was categorized as  $Y=0$  for food insecure case where per capita 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.

### III. RESULTS AND DISCUSSION

#### Socioeconomic and Demographic Profile of Farm Households

Middle aged persons were found to be the heads of farm households, average age was 44.59 years and farming experience was 24.37 years where average education of the heads of farm households was calculated 3.70 years of schooling at the aggregate level. Number of uneducated male varied significantly ( $F=4.78^*$ ) among the study areas. Average family size was 6.39 persons with significant variations among upazilas ( $F=4.24^*$ ) which deviated from national average. The highest family size was observed in Juri upazila (6.74 persons) and the lowest was in Madan upazila (6.03 persons). Literacy rate and dependency ratio were 48 percent 0.69 respectively at aggregate level. Literacy rate was the highest (49%) at Madan upazila and the lowest (47%) was at Juri upazila. Dependency ratio was the same (0.69) at both upazilas (Table 1).

**Table 1. Socioeconomic and demographic profile of farm households**

Variables	Upazila (Sub-district)			F-value
	Juri	Madan	Total	
Age	44.98 (14.75)	44.19 (12.77)	44.59 (13.77)	0.16
Education	3.39 (3.70)	4.02 (3.44)	3.70 (3.59)	1.55
Experience of farming	25.00 (15.30)	23.75 (14.53)	24.37 (14.89)	0.35
Number of educated male	1.87 (1.46)	1.64 (0.92)	1.76 (1.22)	1.77
Number of uneducated male	1.90 (1.32)	1.55 (0.90)	1.72 (1.14)	4.78*
Number of educated female	1.35 (1.10)	1.30 (0.86)	1.32 (0.99)	0.13
Number of uneducated female	1.62 (1.33)	1.54 (0.89)	1.58 (1.13)	0.25
Family size	6.74 (2.99)	6.03 (1.70)	6.39 (2.45)	4.24*
Literacy rate	0.47 (0.21)	0.49 (0.17)	0.48 (0.19)	0.58
Dependency ratio	0.69 (0.13)	0.69 (0.14)	0.69 (0.14)	0.07

Note: Figures in the parentheses indicate standard deviations. \*\* and \* indicate significance at 0.01 and 0.05 probability level, respectively.

It was observed that people mostly women reared livestock at the homestead area where area under livestock rearing was 2.01 decimal of land at the aggregate level. It was also found that majority of people reared large ruminant and poultry. However, some of farm households were found to rear small ruminant like goat and sheep. Number of large ruminant, small ruminant and poultry birds per farm were respectively 1.78, 0.28 and 47.39 at the aggregate level. The number of large ruminant and birds

(1.88 and 59.85) observed in Madan upazila were more compared to that in Juri upazila (1.67 and 34) (Table 2). Women were found to rear livestock especially poultry mostly for domestic consumption.

**Table 2. Area under livestock rearing and number of animals and birds per household**

Variables	Upazila (Sub-district)			F-value
	Juri	Madan	Total	
Area under livestock rearing	1.94 (1.95)	2.09 (1.87)	2.01 (1.90)	0.33
Rent of housing	188.96 (177.85)	130.66 (145.83)	159.81 (164.83)	6.43*
No. of large ruminant	1.67 (1.61)	1.88 (1.34)	1.78 (1.48)	1.00
No. of small ruminant	0.30 (0.87)	0.27 (0.80)	0.28 (0.84)	0.06
No. of birds	34.93 (79.09)	59.85 (146.84)	47.39 (118.29)	2.23

### Income and Expenditure of Farm Households

It was observed that livestock sector generated the highest yearly family income and it was BDT 74030 at the aggregate level with significant variation among upazilas ( $F=7.91^{**}$ ). The higher livestock income was found in Madan upazila (BDT 90836) and the lower was in Juri upazila (BDT 57224). The second important sector was crop sector especially rice production followed by labor selling and service sector respectively at the aggregate level. Annual family incomes from rice production, fisheries, transport, business, service, labor selling, government and other sectors were respectively BDT 51166, BDT 22172, BDT 14545, BDT 18770, BDT 23625, BDT 39852, BDT 299 and BDT 9865 at the aggregate level. People received some money from the government under the social safety net programs (SSNP). There was elderly allowance, widowed allowance and school stipend from the government. However, coverage of SSNP was very poor. Total income per farm was the highest in Juri upazila (BDT 258144) and the lowest in Madan upazila (BDT 250501) whereas the total income per farm at the aggregate level was BDT 254323. The ratio of livestock income to total income was 0.48 (Table 3).

**Table 3. Yearly income of farm households from all sectors in BDT**

Variables	Upazila (Sub-district)			F-value
	Juri	Madan	Total	
Rice production	42838 (48236)	59493 (101502)	51166 (79704)	2.20
Livestock and poultry	57224 (76074)	90836 (92204)	74030 (85979)	7.91**
Fisheries	22307 (67351)	22037 (29288)	22172 (51802)	0.00
Transport	18290 (31813)	10800 (29016)	14545 (30601)	3.03
Business	25130 (51434)	12410 (38984)	18770 (45965)	3.88*
Service	34250 (113726)	13000 (43076)	23625 (86434)	3.05
Labor selling	45073 (47793)	34630 (49240)	39852 (48682)	2.32
Government donation	412 (2352)	185.00 (1158)	299 (1853)	0.75
Others	12620 (24076)	7110.00 (13687)	9865 (19727.97)	3.96*
Total income	258144 (142762)	250501 (137808)	254323 (140006)	0.15
Ratio of livestock income to total income	0.56 (3.60)	0.40 (0.61)	0.48 (2.58)	0.20

Note: Figures in the parentheses indicate standard deviations. \*\* and \* indicate significance at 0.01 and 0.05 probability level, respectively.

From the study, it was observed that yearly average households' expenditure per farm in 13 different cost sectors was BDT 235775. The cost sectors were food, clothing, education, treatment, purchase or repairing of house, purchase of savings certificate, purchase of livestock, purchase of vehicle, purchase of ornament, water and sanitation, festival, electricity and gases, and others and the corresponding expenditures were BDT 171164, BDT 9869, BDT 9285, BDT 10775, BDT 9825, BDT 132, BDT 5071, BDT 3525, BDT 820, BDT 1835, BDT 9450, BDT 3172 and BDT 853 at the aggregate level. The cost items (food and festival) varied significantly among upazilas. It was found that food cost was the largest cost item, which was 72.59 percent of total expenditure (Table 4). This result conformed to other studies (Rahman and Sousa-Poza, 2010; Rahman and Islam 2012).

**Table 4. Yearly family expenditure for different cost components in BDT**

Variables	Upazila (Sub-district)			F-value
	Juri	Madan	Total	
Food expenditure	182013 (61556)	160314 (54994)	171164 (59228)	6.91**
Clothing	9941 (7256)	9796 (6586)	9869 (6912)	0.02
Education	8150 (9303)	10419 (16654)	9285 (13503)	1.42
Treatment	11785 (14612)	9765 (12337)	10775 (13526)	1.12
Purchase/repair of housing	10495 (9185)	9155 (21614)	9825 (16578)	0.33
Purchase of savings certificate	72 (452)	192 (1275)	132 (956)	0.79
Purchase of livestock	6693 (18971)	3450 (11777)	5071.25 (15833)	2.11
Purchase of vehicle	4300 (13584)	2750 (12097)	3525 (12853)	0.73
Purchase of ornament	940 (4287)	700 (5366)	820 (4846)	0.12
Water and sanitation	2075 (2064)	1595 (2061)	1835 (2071)	2.71
Festival	7000 (5116)	11900 (11105)	9450 (8968)	16.06**
Electricity and gasses	3063 (1789)	3281 (1755)	3172 (1771)	0.76
Others	716 (1694)	991 (1813)	853.50 (1755)	1.23
Total expenditure	247243 (89663)	224307 (76777)	235775 (84049)	3.78

Note: Figures in the parentheses indicate standard deviations. \*\* indicates significance at 0.01 probability level.

### Food Consumption Status of Farm Household

People of *haor* areas consumed 20 food items. Rice was the main food item for the people followed by leafy vegetables, potato, wheat, meat, fish and milk respectively. The average daily per capita consumptions of rice, wheat, puffed rice, chira, potato, leafy vegetables, pulse, oil, meat, fish, egg, onion, garlic, chili, turmeric, ginger, other spices, milk, sugar and fruits were respectively 397g, 57g, 30g, 24g, 130g, 145g, 30g, 32g, 65g, 52g, 16g, 34g, 8g, 11g, 6g, 6g, 9g, 49g, 18g and 30g at the aggregate level. However, Table 15 shows that there were significant variations in the daily per capita consumptions of rice, chira, fish, other spices and sugar and among the areas as evidenced by significant F-values. Daily per capita consumption of all food items was higher in Madan upazila (1175.76g) compared to that in Juri upazila (1123.06g). The

overall daily per capita food intake was 1149.41g (Table 5). The results are similar to some other studies done by Rahman and Sousa-Poza (2010) and Rahman and Islam (2012).

### **Intake of Calorie by Farm Households**

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 1289.55 Kcal daily per capita at the aggregate level with a little variation among upazilas. Wheat was the second highest per capita calorie supplier (183.46 Kcal) at the aggregate level followed by oil (137.75 Kcal), potato (119.36 Kcal), pulse (99.21 Kcal), puffed rice (97.50 Kcal), meat (88.10 Kcal), chira (79.21 Kcal), sugar (67.93 Kcal), fish (54.89 Kcal), vegetables (43.50 Kcal), milk (32.19 Kcal), egg (27.96 Kcal), chili (27.12 Kcal), fruits (26.42 Kcal), turmeric (17.60 Kcal), onion (15.64 Kcal), ginger (14.65 Kcal), other spices (11.65 Kcal) and garlic (11.58 Kcal), respectively. The total daily per capita calorie intake from all food items was 2445.35 Kcal at the aggregate level. The daily per capita calorie intake was higher in Madan upazila (2482.28 Kcal) and compared to that in Juri upazila (2408.42 Kcal) (Table 6). The results conformed to some other studies done by Rahman and Sousa-Poza (2010) and Rahman and Islam (2012).

### **Intake of Protein by Farm Households**

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 81.93 g, which was relatively higher than that 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 (19.84 g) followed by that of meat (12.96 g), vegetables (12.34 g), oil (8.06 g), wheat (6.85 g), pulse (6.03 g), fish (5.18 g), potato (2.59 g) and egg (1.91 g), respectively. The daily per capita protein intake was higher in Madan upazila (82.39 g) compared to that in Juri upazila (81.47 g) (Table 7).



**Table 5. Daily per capita consumption of different food items**

Food consumption	Upazila (Sub-district)			F-value
	Juri	Madan	Total	
Rice	371.37 (100.02)	422.20 (131.52)	396.78 (119.29)	9.46**
Wheat	62.37 (40.85)	50.88 (49.70)	56.62 (45.74)	3.19
Puffed rice	32.59 (20.64)	27.41 (19.60)	30.00 (20.25)	3.32
Chira	31.14 (29.03)	17.61 (19.02)	24.37 (25.40)	15.19**
Potato	123.15 (49.33)	136.32 (66.05)	129.74 (58.52)	2.55
Vegetables	145.02 (55.45)	145.39 (65.72)	145.20 (60.65)	0.00
Pulse	31.89 (18.23)	28.42 (16.58)	30.15 (17.46)	1.98
Oil	32.32 (15.68)	32.20 (11.91)	32.26 (13.89)	0.01
Meat	67.04 (31.59)	62.52 (33.94)	64.78 (32.78)	0.95
Fish	43.58 (19.93)	59.99 (37.74)	51.79 (31.21)	14.80**
Egg	14.95 (6.57)	16.82 (7.83)	15.89 (7.27)	3.34
Onion	31.40 (13.41)	35.85 (18.58)	33.63 (16.32)	3.77
Garlic	8.19 (4.63)	8.71 (3.89)	8.45 (4.27)	0.71
Chili	10.91 (5.11)	11.99 (4.50)	11.45 (4.84)	2.52
Turmeric	5.87 (3.03)	5.41 (3.37)	5.64 (3.20)	1.04
Ginger	6.19 (3.45)	6.17 (3.09)	6.18 (3.26)	0.00
Other spices	10.35 (5.37)	7.86 (5.66)	9.10 (5.64)	10.26**
Milk	43.40 (32.17)	54.16 (45.11)	48.78 (39.45)	3.78
Sugar	20.16 (12.08)	16.27 (8.14)	18.21 (10.45)	7.12**
Fruits	31.16 (25.34)	29.58 (23.65)	30.37 (24.46)	0.21
All food items	1123.06 (253.01)	1175.76 (291.08)	1149.41 (273.30)	1.87

Note: Figures in the parentheses indicate standard deviations. \*\* indicates significance at 0.01 probability level.

**Table 6. Daily per capita calorie intake of different food items**

Food consumption	Upazila (Sub-district)			F-value
	Juri	Madan	Total	
Rice	1206.96 (325.06)	1372.14 (427.44)	1289.55 (387.71)	9.46**
Wheat	202.07 (132.36)	164.85 (161.03)	183.46 (148.20)	3.19
Puffed rice	105.93 (67.09)	89.08 (63.71)	97.50 (65.80)	3.32
Chira	101.19 (94.36)	57.22 (61.83)	79.21 (82.56)	15.19**
Potato	113.30 (45.38)	125.42 (60.76)	119.36 (53.84)	2.55
Vegetables	43.50 (16.64)	43.6172 (19.72)	43.56 (18.19)	0.00
Pulse	104.91 (59.97)	93.51 (54.54)	99.21 (57.46)	1.98
Oil	138.01 (66.94)	137.49 (50.85)	137.75 (59.29)	0.00
Meat	91.17 (42.96)	85.03 (46.15)	88.10 (44.58)	0.95
Fish	46.19 (21.13)	63.59 (40.01)	54.89 (33.08)	14.80**
Egg	26.32 (11.56)	29.6 (13.77)	27.96 (12.79)	3.34
Onion	14.60 (6.24)	16.67 (8.64)	15.64 (7.57)	3.77
Garlic	11.23 (6.34)	11.93 (5.33)	11.58 (5.85)	0.71
Chili	25.85 (12.12)	28.41 (10.67)	27.12 (11.46)	2.52
Turmeric	18.32 (9.45)	16.88 (10.51)	17.60 (9.99)	1.04
Ginger	14.68 (8.17)	14.62 (7.32)	14.65 (7.74)	0.00
Other spices	13.25 (6.87)	10.05 (7.24)	11.65 (7.22)	10.26**
Milk	28.65 (21.23)	35.75 (29.78)	32.19 (26.04)	3.77
Sugar	75.18 (45.04)	60.69 (30.36)	67.93 (38.99)	7.12**
Fruits	27.11 (22.05)	25.73 (20.57)	26.42 (21.28)	0.21
All food items	2408.42 (533.27)	2482.28 (576.18)	2445.35 (554.98)	0.89

Note: Figures in the parentheses indicate standard deviations. \*\* indicates significance at 0.01 probability level.

**Table 7. Daily per capita protein intake of different food items**

Food consumption	Upazila (Sub-district)			F-value
	Juri	Madan	Total	
Rice	18.57 (5.01)	21.11 (6.58)	19.84 (5.97)	9.46**
Wheat	7.51 (4.94)	6.16 (6.01)	6.85 (5.53)	3.19
Puffed rice	1.63 (1.03)	1.37 (0.98)	1.50 (1.01)	3.32
Chira	1.56 (1.45)	0.88 (0.95)	1.22 (1.27)	15.19**
Potato	2.46 (0.99)	2.72 (1.32)	2.59 (1.17)	2.55
Vegetables	12.33 (4.71)	12.36 (5.59)	12.34 (5.16)	0.00
Pulse	6.38 (3.65)	5.68 (3.32)	6.03 (3.49)	1.98
Oil	8.08 (3.92)	8.05 (2.98)	8.06 (3.47)	0.00
Meat	13.41 (6.32)	12.51 (6.79)	12.96 (6.56)	0.95
Fish	4.36 (1.99)	6 (3.78)	5.18 (3.12)	14.80**
Egg	1.79 (0.79)	2.02 (0.94)	1.91 (0.87)	3.34
Onion	0.38 (0.16)	0.43 (90.22)	0.40 (0.20)	3.77
Garlic	0.43 (0.24)	0.46 (0.21)	0.45 (0.22)	0.71
Chili	0.17 (0.08)	0.19 (0.07)	0.18 (0.08)	2.52
Turmeric	0.59 (0.30)	0.54 (0.34)	0.56 (0.32)	1.04
Ginger	0.32 (0.18)	0.32 (0.16)	0.32 (0.17)	0.00
Other spices	0.31 (0.16)	0.24 (0.17)	0.27 (0.17)	10.26**
Milk	0.87 (0.64)	1.08 (0.90)	0.98 (0.79)	3.77
Fruits	0.28 (0.22)	0.27 (0.21)	0.27 (0.22)	0.21
All food items	81.47 (19.41)	82.39 (21.04)	81.93 (20.20)	0.11

Note: Figure in the parentheses indicate standard deviations. \*\* and \* indicate significance at 0.01 and 0.05 probability level, respectively.

### Poverty Estimation

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 29% and hard core poverty was 13% in the study areas on the basis of DCI method. Based on DCI method it was observed that absolute poverty was higher in Juri upazila and based on CBN method the absolute poverty was higher in Madan upazila. Absolute and hard core poverty were estimated to be 30.5% and 21.5% at the aggregate level on the basis of CBN method (Table 8).

**Table 8. Incidence of poverty of people in haor area**

Upazila	DCI method		CBN method	
	Absolute poverty (%)	Hard core poverty (%)	Absolute poverty (%)	Hard core poverty (%)
Juri	33	13	29	21
Madan	25	13	32	22
Total	29	13	30.5	21.5

### Factor Affecting Food Insecurity

As mentioned earlier, people produced rice, vegetables, potato, pulse and women reared livestock and poultry. They also got milk from large ruminants and eggs from poultry. As the people produced most of the food items for their domestic consumption, they consumed those food items daily and frequently. However, they did not produce a few food items like oil and spices which were purchased from the local markets. It was observed that people consumed almost all 12 categories of food items and average HDDS was 11.85. 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 probability of food insecurity could be increased significantly by 6.14 times ( $p < 0.01$ ) whereas with 1 unit increase in education on an average the probability of food insecurity could be increased significantly by 1.19 times ( $p < 0.05$ ). On the other hand, it showed that with 1 unit increase in weekly family food expenditure, on an average, the probability of food insecurity could be decreased significantly by 0.99 times ( $p < 0.01$ ) (Table 9). Result also revealed that with 1 unit increase in family size on an average the probability of relative food security could be increased by 2.54 times ( $p < 0.01$ ) compared to food secure condition. On the other hand, it showed that with 1 unit increase in weekly family food expenditure on an average the probability of relative food security could be decreased by 0.99 times ( $p < 0.01$ ) compared to food security condition (Table 9). Thus, it implied that increase of family size had negative impact on food security whereas increase of weekly cost on family food had positive impact on food security.

**Table 9. Factor affecting food insecurity in the *haor* area**

Three level of food security	Independent variables	Coefficient	Asymptotic S. E.	Wald	Significance level	Odds Ratio (OR)
Food insecure	Constant	-3.98**	1.375	8.39	0.01	
	Family size	1.81**	0.29	36.98	0.00	6.14
	Land size	-0.001	0.001	0.74	0.39	0.99
	Education	0.170*	0.08	4.06	0.04	1.19
	Weekly family food expenditure	-0.003**	0.001	28.33	0.00	0.99
	Per capita monthly income	0.00	0.00	0.00	0.99	1.00
Relatively food secure	Constant	-2.70**	1.04	6.81	0.01	
	Family size	0.93**	0.19	24.64	0.00	2.54
	Land size	-0.002	0.01	2.46	0.12	0.99
	Education	0.002	0.06	0.01	0.97	1.00
	Weekly family food expenditure	-0.001**	0.00	12.15	0.00	0.99
	Per capita monthly income	0.00	0.00	0.06	0.80	1.00

Reference category is food secure

#### IV. CONCLUSION

The aim of the study was to determine the contribution of livestock in food security and poverty in *haor* areas of Bangladesh. The benefit which is expected from the livestock sector is based on increased production of milk, meat and egg to meet the nutritional demand, enhancing employment and overall benefit to national economy. Results reveal that livestock sector generated the highest yearly family income in the *haor* area. The ratio of livestock income to total income was found 0.48. Livestock was the main protein sources and reduced poverty in the study area. As livestock income is a major component of total income in the *haor* areas, policy should be developed by the government to make the enterprise more attractive and stable to the farmers by providing incentives in terms of bank credit with minimum interest rate, subsidies to feed, medicine, treatment, support services, development of pasture or grazing land for free grazing of livestock. Some programmes should be aimed at improving the grazing land resources in the *haor* area for sustainable livestock development and income from livestock enterprises. Benefits can be derived through breed upgradation; developed feed resources; improved health care system of animals and poultry; establishment of milk, meat and poultry processing industries for processing of livestock products and improved marketing system, etc. Poultry and dairy enterprises are less affected by natural calamities. Normally *haor* women are more vulnerable and victim of climate and environmental changes in terms of income and food security. Policy should be designed to use scare land, material inputs and human resource to produce varieties of crops, livestock and their products with a view to generating sustainable output and income in the *haor* areas.

**REFERENCES**

- Ali, J. (2007). Livestock sector development and implications for rural poverty alleviation in India. *Livestock Research for Rural Development*, 19(2).
- BBS (2015). Bangladesh Bureau of Statistics 2010. Ministry of Planning, Government of the People's Republic of Bangladesh.
- Birthal, P. S. and Ali, J. (2005). Potential of livestock sector in rural transformation. In R. Nayyar and A. N. Sharma (eds) *Rural Transformation in India: The Role of Non-farm Sector*. New Delhi: Institute for Human Development and Manohar Publishers and Distributors.
- Birthal, P. S. and Singh, M. K. (1995). "Structure of rural income inequality: A study of Western Uttar Pradesh. *Indian Journal of Agricultural Economics*, 39(2): 168-175.
- Rahman, K. M. M., Virchow, D. and Badiuzzaman (2017). Vegetable Production in Flood Prone and River Erosion Areas in Bangladesh: Impact on Income and Food Security of People. *Journal of the Patuakhali Science and Technology University*, 8(1): 1-14.
- Rahman, K.M.M. and Islam, M.S. (2012). Nutritional Status and Food Security of Farm Households under Different Land Use Patterns in Bangladesh. *Bangladesh Journal of Nutrition*, 24-25: 49-64.
- Rahman, K.M.M. and Sousa-Poza, A. (2010). Food consumption and nutritional status of vulnerable people rearing livestock in Bangladesh. *The Bangladesh Journal of Agricultural Economics*, 33(1 & 2): 41-56.
- Rao, K. P. C., Bantilan, M. C. S., Rao, Y. M. and Chopde, V. K. (2003). Strategic Assessments and Development Pathways for Agriculture in the Semi-Arid Tropics. Policy Brief No. 4. Patancheru, Andhra Pradesh, India: International Crops Research Institute for the Semi-Arid Tropics.
- Singh, R. P. and Hazell, P. B. R. (1993). Rural poverty in the semi-arid tropics of India: Identification, determinants and policy interventions. *Economic and Political Weekly*, 28(12&13): A-9 - A-15.