



## FOOD AND NUTRIENT INTAKE PATTERN OF THE HOUSEHOLD MEMBERS IN TWO CONTRASTING DISTRICTS OF BANGLADESH: AN EMPIRICAL STUDY

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*Received 11 November 2012, revised 24 January 2013, accepted 03 February 2013*

### ABSTRACT

This study was conducted to find out the food and nutrient intake pattern of the household members in two selected districts of Bangladesh, namely, Dinajpur and Bagerhat. Three-stage simple sampling technique was followed for selecting the 2 (two) villages from each of the selected districts. Households and household members in four selected villages were 413 (220 in Dinajpur and 193 in Bagerhat) and 1901 (984 in Dinajpur and 917 in Bagerhat) respectively was investigated. Data were collected during October – March, 2006-07. The socioeconomic conditions, food and nutrient intake pattern for the rural households of Dinajpur showed much better compared to the rural households of Bagerhat. Hence, the households of rice surplus area were socially and economically ahead and live comparatively better life than the rural HHs of rice deficit area. Intakes of protein, vitamin and minerals enriched food items mainly from fish, meat, egg, pulse, milk as well as fats & oil by the households increased with the increase of per capita monthly income and expenditures of households. While, intakes of rice increased with the lower education levels of HH head and for poor families. Food insecurity was more prevalent among female members compared to their male counterparts indicated that the females were deprived of adequate food and nutrients intake, a common situation of their rural communities.

**Key words:** Food intake, poverty, nutrients intake, rice surplus, rice deficit, recall method

### INTRODUCTION

Bangladesh is a developing country with a population of 150 million living in an area of 1, 47, 570 square kilometers. It is one of the most densely populated countries (939 people per sq. km) in the world (BBS, 2007). Per capita annual income is US\$ 482 (BBS, 2006). More than 75% of the people live in the rural areas and majority of them are dependent on agriculture with 40% of the rural households having no agricultural land (BBS, 2007). About 40% of the people are living below the poverty level (UNDP, 2006-2010). Malnutrition is one of the major public health problems of national significance in Bangladesh, affecting large numbers of children.

The household income and expenditure survey report 2005 (HIES, 2005) showed that per capita food intake of rural people of Bangladesh was about 946 gm per day, which was about 899 gm per day in 2000. It was clearly indicated that per capita food intake of rural people continuously increased over the period 2000-2005. Average calorie intake was

estimated about 2253 kcal per capita per day in 2005 and it was about 2263 kcal in 2000, showing decreasing trend over the years. Intake of protein over the years remained almost unchanged. It was found that about 54% of total protein intake came from cereals where rice alone contributed about 52%. Whereas, the other major protein contributing food items were about 14% for fish, meat and egg 7%, vegetables 8%, pulses 6% and potato 3%. These indicated that the major contributing food protein by the rural households was by fish, meat and egg.

Poverty, frequent natural disasters, and rapid population growth had contributing gradual decline in per capita nutrient intake. Traditional dietary practices have undergone significant changes in late 1930's than; the major component of the diet at the village level was rice with protein supplied by lentils, onion, bengal gram, green gram, black gram, cowpea and *khesari* etc. But the daily nutrient intake of poor people was better than that of today. During the last few decades, Bangladesh has undergone tremendous demographic, economic and

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social changes. The levels of national production have gone up along with the improvement of infrastructure facilities, rapid urbanization, social polarization, and technological changes in the productive systems, along with changes in agrarian system and in the pattern of employment in various sectors. However, the way in which the above changes have affected the nutritional status of the people of the country and still going on. Since the availability of nutritious foods to consume in required quantities and to balance the diet is one of the basic needs to reduce malnutrition, research in this direction can have a long role to play in increasing the production of nutrient dense foods, ensure their proper utilization, minimize wastage and provide food security at the household level.

Thus, the problem of adequate nutrition demands research and development activities to make effective contribution in nutrition intake. To understand the relating food consumption behavior of the selected areas of the country and also to assess the changes that have taken place in the community in the context of present scenario, a study (i) investigated the food intake pattern of the households by socioeconomic characteristics as well as by nutritional status and (ii) determined the interfamily food intake pattern by male and female members.

## MATERIALS AND METHODS

**Study area and sampling:** This research work was conducted in two ecologically contrasting districts, i.e. Dinajpur in the north-western part and Bagerhat in the south-western part of Bangladesh characterized by surplus and deficit in rice productions, the staple food of Bangladeshi people. For the sampling sixty four (64) districts of Bangladesh were divided into two categories as rice surplus districts (43) and rice deficit districts (21). Census population of 2001 and the corresponding rice production for the year 2000-01 (BCA, V3.0) were used for determining the rice surplus and rice deficit districts. The districts were selected purposively based on the following criteria:

- Dinajpur is a rice surplus and Bagerhat is a rice deficit district
- The districts are ecologically different
- The districts differ markedly in farming systems
- The livelihood pattern of the districts are different

Three-stage simple random sampling technique was followed for selecting the villages from each of the selected districts. In the first stage, two upazilas were selected from each district. In the second stage, one union was selected from each selected upazila. In the third stage, one village was selected from each union. All the households in selected villages were surveyed by using standard pretested questionnaires. Total number of enumerated

households and households members in four selected villages were 413 (220 in Dinajpur and 193 in Bagerhat) and 1901 (984 in Dinajpur and 917 in Bagerhat) respectively. Data were collected during October – March, 2006-07.

**Data collection technique:** The quality of collected data were checked and rechecked by the researcher to find out any lacking regarding information. The respondents were the household heads and their spouses (male and female guardians of the households).

**Twenty four (24) hours dietary recall method:** The most commonly used dietary intake method is the 24 hours dietary recall method (Sukhatme, 1976; Abdullah, 1976; Frances *et al.*, 1994 and Ziegler, 1996). Ziegler (1996) described the dietary data collection methodologies for obtaining food intake information to households and consumption by individuals. Essentially, the individual is asked to recall and describe the kinds and amounts of all foods ingested during a 24-hour period. The interviewer used cups, spoons, plates, and glasses etc. of different sizes for determining weights. Respondents were asked to provide information on the amount of different food items they served to their family members and consumed by them. The interviewer then compared the identified extent with the standard codes to determine the weights of the consumed food items. Dietary calculation (determine edible portion of different food items consumed) of the raw food weight that consumed by the households and as well as by the individual members were done by the help of dietician. All the cooked food items consumed were converted into raw weight of edible portion according to conversion factors for specific cooked food items developed by Ali and Pramanik (1991).

**Data management and statistical analysis:** Socio-economic, demographic and food intake data were analyzed by dBase software. *FORTTRAN* software package was used in calculating nutrients intakes of the food consumption by the household members. Statistical analysis was performed using SPSS for windows ver 16.0 (SPSS, Chicago, IL, USA). Summary statistics such as means, standard deviation etc. was computed for various comparisons. Significance tests of mean differences (t-test, F-test) on dietary and nutritional measures and other quantitative variables. Pearson's correlation coefficient was computed to identify the relationship between socioeconomic/demographic factors on food and nutrient intakes.

## RESULTS AND DISCUSSION

**Socio-demographic and economic characteristics of the hhs in two selected districts:** The socio-demographic and economic variables of the households in Dinajpur and Bagerhat are presented

in Table 1. The result showed that the mean family size for the households in Bagerhat was 4.82, which was a little higher than that in Dinajpur (4.49). The mean age of HH head in Bagerhat was about 47 years, whereas in Dinajpur, this was found nearly to be 43 years. The mean education level (years of schooling) by the HH heads in Dinajpur was obtained as 5.5 years, which was 4.2 years for Bagerhat. The average owned land and cropped land of the households in Dinajpur were about 146 and 105 decimals respectively, while in Bagerhat, these figures were about 20 and 22 decimals lower respectively. The average total monthly income for the households of Dinajpur and Bagerhat were as Tk. 5984 and Tk. 3726 respectively. Results also imply that average monthly income from cropped land (Tk. 1823) by the households of Dinajpur was about 3.6 times higher than that of Bagerhat, while, the average monthly income per household in Dinajpur from rice production (Tk. 1348) was 2.8 times higher than that of Bagerhat. Average total monthly expenditure for the households of Dinajpur and Bagerhat was about Tk. 3940 and Tk. 2682 respectively. In the case of average monthly expenditure on food items showed that the households of Dinajpur spend significantly more money (Tk. 2378/month) for the consumption of food items compared to the households of Bagerhat (Tk. 1888/month).

The above results lead to conclude that average family size and average age of HH head of rural Bagerhat are significantly higher than the rural areas of Dinajpur. The mean education level of household head and average household land size are higher for Dinajpur as compared to Bagerhat. These might be due to the fact that people in Bagerhat like to form joint family while, in Dinajpur, the usual tradition is to live a nuclear family. So it is show that economic conditions for the rural households of Dinajpur are much better compared to the rural households of Bagerhat, which might be due to the presence of income generating facilities, higher rice and vegetables production. Higher agricultural production in Dinajpur might again be attributed to the use of seeds of high yielding varieties (HYV's), higher cropping intensity, double/triple rice production in a year, multiple cropping patterns, adoption of irrigation and modern agricultural technologies for crop cultivation. On the other hand, salinity and water logging due to the shrimp cultivation by the elite classes of households are the two major constraints to higher rice and vegetables productions and that there is very little scope for off-farm income and comparative lower adoption of modern agricultural technologies.

**Average per capita daily food and nutrient intake of the rural households according to socio-economic characteristics in Dinajpur and Bagerhat:** Per capita food intake (gm/day) of the

rural households of Dinajpur and Bagerhat by food items is presented in Table 2. Per capita total food intake was found to be 989.9 gm/day in Dinajpur district and 774.2 gm/day in Bagerhat district. In Dinajpur, per day per capita cereal intake was 511.5 gm of which principal cereal food item i.e. rice intake was 473.6 gm (93%), minor cereal i.e. wheat intake was 11.6 gm and other cereals intake was 26.3 gm. Similarly, per capita per day cereal intake was 483.0 gm of which rice intake was 476.9 gm (98%), wheat intake was only 1.5 gm and other cereals intake was 4.6 gm. The consumption of roots & tubers (180.3 gm), potatoes (129.3 gm), leafy vegetables (53.2 gm), green-yellow (GY) vegetables (52.6 gm), meats (22.8 gm), fish (45.4 gm), milk & milk product (38.6 gm) and fats & oil (27.2 gm) were found to be more consumed by the households of Dinajpur district, whereas, non-leafy (NL) vegetables (68.9 gm) was consumed more in Bagerhat district as compared to the other vegetables. Results indicate that the per capita consumption (gm/day) of total food and as well as most of the individual food items were significantly higher for Dinajpur as compared to Bagerhat district. The food items that did not differ between districts were rice, pulses, fruits, eggs and sugar/gur.

Per capita nutrients intake by the households of Dinajpur and Bagerhat in table 3 found to be 2238.3 kcal in Dinajpur, whereas, in Bagerhat it was 1965.1 kcal. Per capita per day intake of protein, fat and carbohydrate were 59.9, 14.9 and 465.7, 46.2, 10.0 and 420.2 gm in Dinajpur and Bagerhat respectively. Minerals intake, were 576.0 mg calcium, 16.8 mg iron and 8.9 mg of zinc per capita and 310.3 mg calcium, 11.9 mg iron and 6.8 mg of zinc respectively in Dinajpur and Bagerhat. Per capita per day intake of vitamin A derived from animal sources was 227.0 I.U. in Dinajpur and 123.3 I.U. in Bagerhat the plant sources - carotene was 7599.6 µgm in Dinajpur and 3718.1 µgm in Bagerhat. Vitamin C intake in Dinajpur was 57.8 mg and in Bagerhat it was 46.3 mg per capita per day. The results should that nutrients intake by the rural households in Bagerhat was lower than that in Dinajpur. Intake of some of the nutrients like calcium, carotene and vitamin A in Bagerhat was found to be nearly half than those of Dinajpur district. These were the consequences of lower quantities food intake by Bagerhat than the families of Dinajpur. These lower quantities of average food consumption might be mdue to the lower economic conditions by the rural households of Bagerhat (Table 1), compared to Dinajpur.

Per capita per day total food consumption of for hard core poor, absolute poor and non-poor households were 722.8, 883.6 and 1102.9 gm respectively in Dinajpur, while in Bagerhat, these

**Table 1.** Demographic and economic characteristics of the rural households in Dinajpur and Bagerhat districts, 2006-07.

Variable	Mean $\pm$ SE		Mean difference	P Value
	Dinajpur	Bagerhat (n=102)		
Family size	4.49 $\pm$ 0.10	4.82 $\pm$ 0.10	0.01	.01828
Age of HHs head (years)	42.58 $\pm$ 0.82	46.56 $\pm$ 0.88	-3.98	.00105
*Education of HHs head (years)	5.52 $\pm$ 0.34	4.24 $\pm$ 0.31	1.28	.00711
Total earning family members	1.44 $\pm$ 0.05	1.43 $\pm$ 0.05	0.01	.91332
*Own land of HHs (Decimals)	146.45 $\pm$ 20.65	125.67 $\pm$ 15.12	20.78	.48275
*Cropped land of HHs (Decimals)	104.59 $\pm$ 14.16	81.52 $\pm$ 25.70	23.07	.41056
Total monthly income (Tk.)	5983.80 $\pm$ 286.56	3725.97 $\pm$ 117.46	2257.83	.00000
Per capita monthly income (Tk.)	1324.04 $\pm$ 51.72	804.21 $\pm$ 38.51	519.83	.00000
*Monthly income on cropped land (Tk.)	1822.87 $\pm$ 211.36	498.60 $\pm$ 76.10	1324.27	.00000
*Monthly income on rice (Tk.)	1347.60 $\pm$ 156.42	477.71 $\pm$ 71.73	869.89	.00000
Total monthly expenditure (Tk.)	3940.14 $\pm$ 157.10	2682.28 $\pm$ 102.65	1257.86	.00000
Per capita monthly expenditure (Tk.)	880.36 $\pm$ 29.20	579.10 $\pm$ 23.06	301.26	.00000
Monthly expenditure on food (Tk.)	2378.15 $\pm$ 62.83	1888.19 $\pm$ 45.82	489.96	.00000

\*Households having zero values of the variables are included to compute respective mean value.

**Table 2.** Average per capita food intake (g/day) of the rural households by food groups and by districts, 2006-07

Nutrients	Dinajpur	Bagerhat	t-value
Energy(kcal)	2238.3	1965.1	5.8**
Protein (g)	59.9	46.2	8.1**
Fat (g)	14.9	10.0	3.6**
CHO (g)	465.7	420.2	4.6**
Ca (mg)	576.0	310.3	6.5**
Iron (mg)	16.8	11.9	5.1**
Vit.A (IU)	227.0	123.3	3.0**
Carotein ( $\mu$ g)	7599.6	3718.1	4.8**
Thiamin (mg)	1.6	1.4	4.0**
Ribo (mg)	0.7	0.4	7.3**
Niacine (mg)	24.2	20.6	6.6**
Vit.C (mg)	57.8	46.3	2.2*
Zinc (gm)	8.9	6.8	9.6**
Vit.A (RE)	1342.2	660.8	5.1**

Significant at \*\* 0.01 and \* 0.05 level of probability

**Table 3.** Average per capita/day nutrient intake of rural HHs by districts, 2006-07

Food items	Dinajpur	Bagerhat	t-value
Cereal	511.5	483.0	2.4*
<i>Rice</i>	473.6	476.9	-0.26
<i>Wheat</i>	11.6	1.5	3.7**
<i>Other cereals</i>	26.3	4.6	7.1**
Root & tubers	180.3	74.6	11.8**
<i>White potato</i>	129.3	34.2	12.7**
<i>Roots &amp; tubers</i>	51.0	37.8	2.5*
Sugar	5.6	5.4	0.11
Pulses	10.6	9.0	0.64
Vegetables	125.1	123.7	0.12
<i>Leafy vegetables</i>	53.2	15.8	6.1**
<i>GY vegetables</i>	52.6	39.0	1.8 <sup>†</sup>
<i>NL vegetables</i>	19.4	68.9	-6.9**
Fruits	11.4	14.6	-0.84
Meats	22.8	4.9	4.5**
<i>Poultry</i>	13.9	4.3	2.8**
Eggs	5.4	4.9	0.36
Fish	45.4	32.4	2.6**
Milk product	38.6	5.5	7.1**
Fats & oil	27.2	10.0	10.7**
Total food weight	989.9	774.2	10.2**

**Table 4.** Per capita food intake (gm/day) of the rural households by poverty level

Food items	Dinajpur				Bagerhat			
	Hard core poor <sup>1</sup>	Absolute poor <sup>2</sup>	Non-poor <sup>3</sup>	F Value	Hard core poor	Absolute poor	Non-poor	F value
Cereal	367.5	458.5	570.6	116.2**	369.2	494.4	608.8	208.9**
<i>Rice</i>	340.1	417.0	531.5	68.0**	367.8	488.3	597.2	155.7**
<i>Wheat</i>	7.7	17.2	10.2	0.85	0.1	3.9	1.6	1.30
<i>Other cereals</i>	19.7	24.3	28.8	0.93	1.4	2.2	10.0	2.66 <sup>†</sup>
Root & tubers	117.7	162.6	203.7	11.0**	57.0	64.8	101.5	7.3**
<i>White potato</i>	93.0	121.7	141.7	3.80*	26.1	27.9	47.6	3.4*
Pulses	5.2	9.4	12.4	1.90	5.0	5.8	15.8	3.3*
Vegetables	102.1	123.8	131.5	0.75	113.2	131.0	131.3	0.71
<i>Leafy vegetables</i>	42.5	59.3	53.3	0.44	17.5	16.3	13.6	0.21
<i>GY vegetables</i>	48.2	49.6	54.9	0.11	33.7	34.4	48.1	1.3
<i>NL vegetables</i>	11.5	14.9	23.3	1.06	62.0	80.3	69.6	0.61
Meats	9.7	9.8	31.6	4.72**	5.2	4.6	4.7	0.009
<i>Poultry</i>	5.5	7.9	18.6	1.92	5.2	4.6	3.0	0.16
Egg	6.8	3.8	5.7	0.49	4.1	5.7	5.2	0.28
Fish	43.8	30.0	52.5	2.66 <sup>†</sup>	30.3	39.8	29.9	1.24
Milk product	26.1	44.4	39.3	0.89	2.1	4.4	10.1	1.96
Fats & oil	20.9	20.9	31.4	5.8**	8.0	11.6	11.4	8.06**
Total food wt.	722.8	883.6	1103	71.8**	618.5	780.9	952.1	114.5**

Average per capita per day calorie intake by the HHs <1805 K.cal<sup>1</sup>; <2122 K.cal<sup>2</sup> and ≥ 2122 K.cal<sup>3</sup>. Significant at \*\* 0.01 \* 0.05 and <sup>†</sup> 0.10 level of probability.

**Table 5.** Per capita per day nutrients intake of the rural households by districts, 2006-07

Food items	Dinajpur				Bagerhat			
	Hard core poor	Absolute poor	Non-poor	F Value	Hard core poor	Absolute poor	Non-poor	F value
Energy(kcal)	1586.7	1966.4	2519.5	208.2**	1510.2	1969.0	2495.0	326.7**
Protein (g)	43.3	49.3	68.6	48.8**	36.3	46.9	57.4	65.1**
Fat (g)	9.5	12.2	17.5	4.9**	7.9	8.8	13.3	4.1*
CHO (g)	332.8	416.5	520.4	17.1**	321.4	422.4	534.3	315.5**
Ca (mg)	456.8	455.1	658.0	4.1*	276.2	303.8	354.5	1.4
Iron (mg)	13.3	16.2	17.9	2.8	9.7	11.0	15.1	7.3**
Vit.A (IU)	162.0	189.4	259.5	1.3	99.9	113.9	156.8	0.56
Carotein (ugm)	7128.0	8034.1	7533.1	0.09	3464.7	3239.1	4323.6	0.54
Thiamin (mg)	1.1	1.5	1.8	61.7**	1.0	1.3	1.8	44.0**
Ribo (mg)	0.5	0.6	0.7	7.8**	0.4	0.4	0.6	13.9**
Niacine (mg)	17.3	21.0	27.4	102.1**	16.1	21.0	25.8	173.2**
Vit.C (mg)	49.7	55.7	60.7	1.5	39.0	46.7	54.7	1.14
Zinc (gm)	6.3	7.9	10.0	53.6**	5.4	6.8	8.5	77.7**

Significant at \*\* 0.01 \* 0.05 and <sup>†</sup> 0.10 level of probability

**Table 6.** Per capita food intake (gm/day) of the household members by sex groups and districts, 2006-07

Food group	Dinajpur			Bagerhat		
	Male	Female	t-value	Male	Female	t-value
Cereals (gm)	537.5	478.4	4.3**	496.5	448.0	3.1**
Rice (gm)	494.7	440.5	3.8**	489.2	442.9	2.9**
Wheat (gm)	14.0	11.7	0.77	1.3	2.0	-0.60
Other cereal (gm)	28.8	26.1	0.92	6.0	3.1	1.7 <sup>†</sup>
Root & tubers (gm)	188.1	170.6	2.3*	75.0	73.1	0.31
White potato (gm)	136.3	123.0	1.9*	34.8	32.2	0.64
Other roots & tubers (gm)	51.8	47.6	1.1	38.5	37.7	0.17
Sugar (gm)	6.7	6.1	0.53	5.4	4.7	0.53
Pulse & nut (gm)	11.8	11.5	0.22	14.0	13.6	0.14
All pulses (gm)	11.4	11.4	-0.01	9.4	10.0	-0.28
Vegetables (gm)	126.4	123.8	0.29	126.7	112.8	1.7 <sup>†</sup>
Leafy vegetables (gm)	52.4	54.4	-0.37	14.8	16.3	-0.54
GY vegetables (gm)	50.9	48.3	0.45	38.4	34.5	0.90
NL vegetables (gm)	23.2	21.0	0.62	73.5	62.0	1.7 <sup>†</sup>
Fruits (gm)	9.7	10.8	-0.53	12.6	14.9	-0.62
Meats (gm)	21.9	21.7	0.05	7.1	4.2	1.5
Poultry (gm)	14.1	12.1	0.69	6.1	4.0	1.2
Eggs (gm)	5.5	5.2	0.33	4.6	3.7	1.1
Fish (gm)	48.3	40.0	2.07*	35.3	30.0	2.0*
Milk and milk product (gm)	38.8	44.3	-1.05	7.2	4.0	1.2
Fats & oil (gm)	28.3	26.1	1.4	10.2	9.7	0.64
Total food weight (gm)	1028.6	943.8	3.8**	797.5	720.6	3.3**

**Table 7.** Per capita per day nutrients intake of the household members by sex groups and districts, 2006-07

Nutrients	Dinajpur			Bagerhat		
	Male	Female	t-value	Male	Female	t-value
Energy(kcal)	2339.5	2103.2	4.5**	2027.6	1815.4	3.5**
Protein (g)	62.4	56.5	3.6**	49.0	42.9	4.0**
Fat (g)	14.4	14.0	0.45	10.9	8.4	2.4*
CHO (g)	489.5	437.6	4.5**	431.6	390.2	3.1**
Ca (mg)	604.6	555.5	1.4	352.2	284.2	2.5*
Iron (mg)	17.6	16.8	0.98	12.5	11.3	1.6
Vit.A (IU)	232.8	226.5	0.23	155.5	87.4	2.0*
Carotein (ugm)	7706.8	7589.3	0.17	3293.6	3714.4	-0.83
Thiamin (mg)	1.7	1.5	3.7**	1.4	1.3	3.0**
Ribo (mg)	0.7	0.6	1.8 <sup>†</sup>	0.5	0.4	2.4*
Niacine (mg)	25.3	22.8	4.0**	21.5	19.2	3.5**
Vit.C (mg)	61.0	56.1	1.65	45.9	45.6	0.05
Zinc (gm)	9.3	8.5	3.7**	7.0	6.3	3.0**
Vit.A (RE)	1360.1	1342.4	0.15	600.9	648.2	-0.55

**Table 8.** Pearson's correlation coefficients between different socio-economic variables and average per capita/day food intake by the rural households of Dinajpur, 2006-07

Socio-economic Variables	Rice (gm)	Root & tubers (gm)	Pulses (gm)	Veget- ables (gm)	Fruits (gm)	Meats (gm)	Fish (gm)	Eggs (gm)	Milk product (gm)	Fats & oil (gm)	Total food weight (gm)
Education of HH head	-0.369**	0.005	-0.010	0.050	0.062	0.163*	0.231**	0.198**	0.380**	0.409**	0.198**
Family size	0.003	-0.052	0.094	0.025	-0.124	0.102	-0.004	-0.022	0.110	-0.002	0.059
Dependency ratio	-0.283**	-0.218**	-0.048	-0.074	-0.087	-0.024	-0.143*	-0.076	0.103	-0.246**	-0.368**
Total own land (Decimals)	0.061	0.203**	0.015	0.027	0.052	0.034	0.063	0.135*	0.261**	0.209**	0.263**
Total cultivated land (Decimals)	0.021	0.222**	0.013	0.049	-0.052	0.025	0.094	0.092	0.250**	0.173**	0.288**
Per capita monthly income (Tk.)	-0.159*	0.192**	0.001	0.139*	0.113	-0.005	0.190**	0.135*	0.390**	0.341**	0.365**
Per capita monthly expenditure (Tk.)	-0.143*	0.126 <sup>†</sup>	-0.009	0.113	0.131*	0.044	0.166*	0.123 <sup>†</sup>	0.305**	0.326**	0.338**
Per capita monthly expenditure from food item (Tk.)	-0.043	0.200**	0.069	0.157*	0.122 <sup>†</sup>	0.130*	0.124 <sup>†</sup>	0.148*	0.386**	0.427**	0.487**

\*\*Correlation coefficient is significant at the 0.01 level of probability (2-tailed).

\*Correlation coefficient is significant at the 0.05 level of probability (2-tailed).

<sup>†</sup>Correlation coefficient is significant at the 0.10 level of probability (2-tailed).

**Table 9.** Pearson's correlation coefficient between different socio-economic variables and average per capita per day nutrient intake by the rural households of Dinajpur, 2006-07

Socio-economic Variables	Energy (kcal)	Protein (g)	Fat (g)	CH (g)	Ca (mg)	Iron (mg)	Vit.A (IU)	Carotein (ugm)	Thia (mg)	Ribo (mg)	Niacine (mg)	Vit.C (mg)	Zinc (gm)
Education of HH head	0.015	0.258**	0.311**	-0.175**	0.234**	0.224**	0.375**	-0.018	0.026	0.268**	-0.075	0.124 <sup>†</sup>	0.111 <sup>†</sup>
Family size	0.034	0.110	-0.023	0.024	0.076	0.100	0.105	-0.047	0.070	0.095	0.053	-0.030	0.079
Dependency ratio	-0.395**	-0.284**	-0.056	-0.401**	-0.128 <sup>†</sup>	-0.101	0.052	0.007	-	-0.090	-	-	-
Total own land (Decimals)	0.188*	0.185**	0.313**	0.088	0.128 <sup>†</sup>	0.232**	0.198**	-0.005	0.229**	0.186**	0.077	0.179**	0.126 <sup>†</sup>
Total cultivated land (Decimals)	0.222**	0.217**	0.300**	0.127 <sup>†</sup>	0.164*	0.218**	0.197**	0.017	0.244**	0.197**	0.113 <sup>†</sup>	0.185**	0.149*
Per capita monthly income (Tk.)	0.159*	0.213**	0.289**	0.051	0.244**	0.206**	0.243**	0.053	0.198**	0.245**	0.027	0.288**	0.191**
Per capita monthly expenditure (Tk.)	0.177**	0.235**	0.190**	0.100	0.191*	0.259**	0.197**	0.045	0.224**	0.203**	0.084	0.273**	0.206**
Per capita monthly expenditure from food item (Tk.)	0.342**	0.319**	0.359**	0.219**	0.151*	0.237**	0.341**	0.124 <sup>†</sup>	0.331**	0.361**	0.211**	0.324**	0.296**

\*\*Correlation coefficient is significant at the 0.01 level of probability (2-tailed).

\*Correlation coefficient is significant at the 0.05 level of probability (2-tailed).

<sup>†</sup>Correlation coefficient is significant at the 0.10 level of probability (2-tailed).



**Table 10**, Pearson's correlation coefficients between different socio-economic variables and average per capita per day food intake by the rural households of Bagerhat, 2006-07

Socio-economic Variables	Rice (gm)	Root & tubers (gm)	Pulses (gm)	Vegetables (gm)	Fruits (gm)	Meats (gm)	Fish (gm)	Eggs (gm)	Milk product (gm)	Fats & oil (gm)	Total food weight (gm)
Education of HH head	-0.138*	0.144*	0.118 <sup>†</sup>	0.038	0.015	0.180*	0.143*	0.013	0.163*	0.341**	0.096
Family size	-0.083	0.064	0.078	-0.132 <sup>†</sup>	-0.086	0.020	-0.157*	-0.090	-0.016	-0.182*	-0.170*
Dependency ratio	-0.195**	0.021	0.101	-0.123 <sup>†</sup>	-0.039	-0.074	-0.144*	-0.087	0.064	-0.322**	-0.211**
Total own land (Decimals)	0.073	0.011	0.086	0.127 <sup>†</sup>	-0.003	0.106	0.076	0.000	0.114	0.178*	0.104
Total cultivated land (Decimals)	0.118 <sup>†</sup>	-0.048	0.034	0.061	-0.008	0.110	-0.018	-0.027	0.187**	0.068	0.081
Per capita monthly income (Tk.)	0.140*	-0.139*	0.010	0.186**	0.092	0.178*	0.185**	0.202*	0.096	0.495**	0.269**
Per capita monthly expenditure (Tk.)	0.209**	-0.139*	0.018	0.205**	0.105	0.132 <sup>†</sup>	0.146*	0.161*	0.021	0.452**	0.297**
Per capita monthly expenditure from food item (Tk.)	0.316**	0.007	0.016	0.284**	0.192**	0.290**	0.138*	0.172*	0.046	0.603**	0.508**

\*\*Correlation coefficient is significant at the 0.01 level of probability (2-tailed).

\*Correlation coefficient is significant at the 0.05 level of probability (2-tailed).

<sup>†</sup>Correlation coefficient is significant at the 0.10 level of probability (2-tailed).

**Table 11.** Pearson's correlation coefficient between different socio-economic variables and average per capita per day nutrient intake by the rural households of Bagerhat, 2006-07

Socio-economic Variables	Energy (kcal)	Protein (g)	Fat (g)	CH (g)	Ca (mg)	Iron (mg)	Vit.A (IU)	Carotein (ugm)	Thia (mg)	Ribo (mg)	Niacine (mg)	Vit.C (mg)	Zinc (gm)
Education of HH head	0.017	0.174**	0.087	-0.118 <sup>†</sup>	0.154*	0.040	0.126 <sup>†</sup>	0.064	-0.049	0.067	0.009	0.064	0.119 <sup>†</sup>
Family size	-0.131 <sup>†</sup>	-0.111	-0.142*	-0.096	-0.001	-0.035	-0.006	-0.018	-0.115	-0.079	-0.094	-0.049	-0.106
Dependency ratio	-0.177*	-0.162*	-0.007	-0.174*	-0.020	0.057	-0.074	0.104	-0.067	-0.054	-0.188**	0.022	-0.157*
Total own land (Decimals)	0.030	0.101	0.119 <sup>†</sup>	-0.009	0.098	0.055	0.032	0.026	-0.054	0.014	0.018	0.025	0.110
Total cultivated land (Decimals)	0.023	0.044	0.202**	-0.069	0.026	0.092	0.116 <sup>†</sup>	0.035	-0.013	0.051	-0.021	-0.001	0.038
Per capita monthly income (Tk.)	0.187**	0.301**	0.092	0.146*	0.127 <sup>†</sup>	0.171*	0.188**	0.133 <sup>†</sup>	0.136 <sup>†</sup>	0.146*	0.228**	0.088	0.203**
Per capita monthly expenditure (Tk.)	0.233**	0.294**	0.050	0.212**	0.083	0.113	0.124 <sup>†</sup>	0.105	0.180*	0.140*	0.266**	0.113	0.211**
Per capita monthly expenditure from food item (Tk.)	0.327**	0.440**	0.080	0.342**	0.087	0.131 <sup>†</sup>	0.209**	0.149*	.212**	0.181*	0.441**	0.204**	0.343**

\*\*Correlation coefficient is significant at the 0.01 level of probability (2-tailed).

\*Correlation coefficient is significant at the 0.05 level of probability (2-tailed).

<sup>†</sup>Correlation coefficient is significant at the 0.10 level of probability (2-tailed).

were 618.6, 780.9 and 952.1 gm. Per capita consumption of hardcore, absolute and non-poor households for cereal was 367.5, 458.5 and 570.6 gm and for rice these were found to be 340.1, 417.0 and 531.5 gm respectively in Dinajpur, while in Bagerhat, these were found to be 369.2, 494.4 and 608.8 gm for cereal intake and 367.8, 488.3 and 597.2 gm for rice intake respectively. Cereals intake (Table 4) showed the same trends that as per capita consumption of other food items by the households increased with the decrease of the poverty level.

Table 5 shows that per capita per day energy intake by the hardcore, absolute and non-poor households of Dinajpur were 1586.7, 1966.4 and 2519.5 kcal respectively, while in Bagerhat such intakes were 1510.2, 1969.0 and 2495.0 kcal, respectively. Protein intakes by the hardcore, absolute and non-poor households in Dinajpur were 43.3, 49.3 and 68.6 gm respectively, but these figures were 36.3, 46.9 and 57.4 gm in Bagerhat. The results indicate that per capita per day consumption of cereal, roots & tubers, fats & oil and total food intake varied significantly among the poverty categories in both the districts. Accordingly, per capita intakes of energy, protein, fat, carbohydrate, by the households showed significant variation among the poverty categories. Results showed that in both the districts, per capita per day food and nutrients intake by the households increased with the decrease of poverty levels of households.

Table 6 indicates the male female disparity in food intake by the family members of Dinajpur and Bagerhat. It shows that intakes of all the food items except milk & milk products, fruits and leafy vegetables by female members were less than those taken by male members in both the districts. But significant differences between male and female members were observed in intakes of cereal, rice, fish, other non-specific foods and as well as for total food intakes. In all cases male members consumed more than the females. Per capita nutrient intake shows that the females consumed lesser amount of all nutrients compared to their male counterparts in both the districts (Table 7). Intakes of calorie, protein, carbohydrate, thiamine, riboflavin, niacin and zinc were significantly higher for male members in both the districts. Similar results are found from the studies conducted in Bangladesh by Karim (2002); BIDS (2001); HKI (2001); and Ali and Ahmed (2000).

Results indicated that male-female difference in food intake in the rural households of Dinajpur and Bagerhat was remarkable and food insecurity was more prevalent among female members.

**Relationships between the socio-economic and demographic characteristics of the households with levels of various kinds of foods intake as well as nutrient intake by the rural households of**

**Dinajpur and Bagerhat districts:** The relationships between the selected variables and per capita per day food intake by the households of Dinajpur are presented in Table 8. The correlation coefficients reveal that education levels of HH head showed positive relationship with the consumption of meats, fish, egg, milk products, fats & oil and as well as for total food intake, while, it showed negative relationship with the rice consumption. Dependency ratio of HH revealed negative relationships with rice, roots & tubers, fish, fats & oil and total food intakes. HH land size (own or cultivated) showed positive relationship with the consumption of roots & tubers, egg, milk products, fats & oil and total food intake. The correlation coefficients between economic variables and intake levels of roots & tubers, vegetables, fruits, fish, egg, milk products, fats & oil and total food intake was positive. On the other hand, family size did not show any significant relationship with the per capita total food intake. Above results indicate that with the increases of education levels of HH head, HH land size, per capita monthly income and expenditures, intakes of rich food items (fish, meat, egg, milk), fats & oil and as well as total food intake by the households increases while, intakes of rice decreases.

The relationships between the selected variables and per capita per day nutrients intake by the households of Dinajpur are presented in Table 9. Per capita per day intake of protein, fat, calcium, iron, vitamin A and riboflavin by the households showed positive relationships with education levels of HH head, while, carbohydrate intake showed negative relationship. Dependency ratio of HH showed negative relationship with most of the nutrients including energy, protein, carbohydrate and calcium. The relationship of HH land size (own or cultivated land), per capita monthly income, and per capita monthly expenditure with most of the nutrients intake was positive. Results indicated that with the increase of education level of HH head, the intake of protein, vitamin and minerals by the households increased while, intake of carbohydrate decreased. Results also imply that with the increase of land size, per capita monthly income and expenditure, the intake of most of the nutrients by the household increases, while the nutrients intake decreases with the increase of dependency ratio of households in Dinajpur.

The relationships between the selected variables and per capita per day food intake by the households of Bagerhat are presented in Table 10. The results showed that education level of HH head bear positive relationship with the consumption of pulses roots & tubers, pulses, fish, meats, milk products, and fats & oil, while, it showed negative relationship with rice intake. Family size and dependency ratio of HHs respectively showed

negative relationships with rice, vegetables, fish, fats, and oil and total food intakes. Economic factors of the households showed positive relationship with the consumption of most of the food intakes except for roots and tubers. On the other hand, land size (own or cultivated land) did not show any significant relationship with the per capita total food intake. Results imply that with the increase of education level of the HH head, per capita monthly income and expenditure, intake of rich foods like fish, meat, pulse, milk, and fats & oil by the household increases, while, intake of rice decreases. Results also indicate that with the increase of family size and dependency ratio, intake of rice as well as vegetables, fish, fats & oil and total food intake by the households decreased. Since the families of rural Bagerhat are unable to produce rice and vegetables sufficiently from their own or cultivated land due to various reasons, uplift of economic conditions of households through other farm & non-farm income generating activities may play an important role to increase food intake pattern in rural Bagerhat.

The relationships between per capita per day nutrient intake by the households and the selected variables in rural Bagerhat are shown in Table 11. Education level of HH head showed positive relationship with protein, calcium and vitamin intakes by the households, while it showed negative relationship with carbohydrate intake. Dependency ratio showed inverse relationship with energy intake and as well as for protein and carbohydrate intakes. But per capita monthly income and expenditures revealed positive relationship with most of the nutrients intake by the households. Results reveal that with the increase of education level of HH head, the intake of protein, calcium and vitamins by the households increased, while, intake of carbohydrate decreased. However, most of the nutrients intake by the households increases with the improvement of economic conditions of the household. On the other hand, the nutrient intake decreases with the increase of dependency ratio of the households of rural Bagerhat.

## CONCLUSION AND RECOMMENDATION

The family size was found to be larger in rural Bagerhat compared to Dinajpur, but the mean education level of the household head and household land size were higher for Dinajpur. The economic conditions for the rural households of Dinajpur showed much better compared to the rural households of Bagerhat. This indicates better socioeconomic status of the households in Dinajpur as compared to Bagerhat. Hence, the households of rice surplus area are socially and economically ahead and live comparatively better life than the rural HHs of rice deficit area.

Per capita per day consumption of total food weight as well as most of the individual food items was higher for Dinajpur as compared to Bagerhat district. Almost all the nutrients intake by the rural households in Bagerhat was lower than those in Dinajpur, which might be due to the consequences of comparatively low food intake by the families of Bagerhat than the families of Dinajpur. The lower quantities of food intake might further be attributed to lower economic conditions of the rural households of Bagerhat, compared to Dinajpur.

Intakes of protein, vitamin and minerals enriched food items mainly from fish, meat, egg, pulse, milk as well as fats & oil and total food intake by the households increased with the increase of per capita monthly income and expenditures of households. While, intakes of rice or carbohydrate decreased with the increase of education levels of HH head. This was true for both the districts, Dinajpur and Bagerhat. The analysis shows that food and nutrients intake by rural household's increases with the decreases in dependency ratio of the households. Male-female differences in food and nutrient intake pattern in the rural households of Dinajpur and Bagerhat was remarkable. Food insecurity was more prevalent among female members. Intake of cereal (particularly rice), fish, total food and other non-specific food items as well as nutrients intake by the females was less compared to their male counterparts indicated that the females were deprived of adequate food and nutrients intake, a common situation of rural communities.

In order to improve dietary intake pattern and to ensure food security of households, recommendations that follow from this study findings are:

- Both government and non-government initiatives should be carried out to identify and introduce non-farm employment opportunity especially for the rice deficit areas. Arrangement of easy loan for undertaking Income Generating Activities (IGAs) might be help to increase income and purchasing power of the household members.
- For increasing household food security particularly, in rice deficit districts, household food production should be increased. The Department of Agricultural Extension, NGOs and research institutes should work together for development and extension of appropriate technologies for maximum utilization of crop and homestead land, use of high yielding and quality seeds of crop varieties, adoption of multiple cropping pattern and modern agricultural technologies for crop cultivation.
- For increasing consumption and meeting micronutrient requirement, establishment of kitchen garden and plantation of permanent fruit trees in the

homestead area is to be encouraged for round the year vegetable and fruit production. Similarly, poultry and cattle/goat rearing are also to be encouraged to supply animal protein in the family diet as well as to earn extra income.

- Tidal submergence and salinity tolerant rice varieties have to be cropped to be improved to increase the agricultural production particularly rice production in the southern Bangladesh. This will help to increase rice production for the rice deficit areas.

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