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Food and Nutritional Security in Bangladesh: Going beyond Carbohydrate Counts

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Abstract

The progress towards achieving household nutritional food-security in Bangladesh has remained slow. So far the food security is cereal-based (mainly rice) and food basket has not yet diversified towards high nutritive/ quality food. This article has examined the expenditure inequalities in the dietary pattern and incidence of poverty in Bangladesh by using household income, expenditure and food consumption survey data. Results have shown wide-spread inequalities in income and expenditure distribution. Among food items, the inequalities have been found very low for cereals and high for livestock and horticulture commodities and various types of fish species in both rural and urban areas. The analysis of food poverty, its depth and severity has revealed a typical hidden poverty that could not be brought up by analyzing economic poverty. The food poverty has been found high for pulses, horticulture and livestock commodities among both economically rich and poor households. Fish, livestock, horticulture and pulses sectors should be accorded high priority to diversify the dietary pattern towards high quality food and improve the nutritional food-security of households in Bangladesh.

Introduction

Food security and food insecurity are the terms used to describe whether or not all people at all time have physical and economic access to sufficient, safe and nutritious food for a healthy and active life (World Food Summit, 1996). Food security is multi-dimensional and its major components are:

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(a) availability of food, (b) access to food, (c) quality or nutritional adequacy of food, and (d) utilization of food. Food security is an essential foundation for meeting various Millennium Development Goals (MDGs) related to hunger, child mortality, mental health, disease, gender equality and primary education (Gill *et al*., 2003; UN Standing Committee on Nutrition, 2004). Availability of sufficient food at the country or local level does not mean that all people within that geographic unit are food secure. Food security implies that food intake must be adequate in both qualitative and quantitative terms. However, the issue of quality of diet has received little attention in the food-security debate at all levels. It is argued that continuing to improve access to carbohydrates when they are no longer limiting factor, will lead to increasing food utilization by the poor (Gill *et al*., 2003; Ferro-Luzzi, 2002).

Bangladesh is at the cross-roads in its efforts to achieve food security for its people. Over the past 30 years or so, Bangladesh had made significant achievement in foodgrain production and food availability. But, increases in cereal production have not been accompanied by significant rises in the availability of other foods. The emphasis of country's food self-sufficiency drive has been on carbohydrate production (through rice and wheat) to the neglect of other macronutrients (proteins and essential fats) and all other micronutrients (Gill *et al*., 2003). Today, though people in Bangladesh are not dying of hunger, more people are becoming stunted with reduced mental and physical capacity. Malnutrition is one of the major public health problems in the country. Child Nutrition Survey 2000 has revealed that only 11.5 per cent of the pre-school age children in the country are nutritionally normal (i.e., not malnourished) (BBS and UNICEF, 2002). Normal diet of Bangladeshi people is also seriously imbalanced; carbohydrates contribute nearly 74 per cent to the total dietary energy and 57 per cent by protein (BBS, 2003).

This paper has examined the food-security status of people for both rural and urban areas in Bangladesh, focusing on three broad categories of food security indicators: (a) inequality in income and consumption expenditure by food types, (b) income poverty (income inadequacy for which we have considered expenditure as a proxy of income), and (c) food poverty (nutritional inadequacy of dietary pattern in which we have considered both the cost of 'balanced nutritional food-basket', also called 'normative food-bundle', and the actual consumption of individual food items within the food-basket. The inequality has been analyzed at three stages, (i) income-expenditure, (ii) expenditure on major food groups, and (iii) fish consumption expenditure by species groups. The poverty has been analyzed at two stages, (i) economic (objective) measure of poverty, based on income-expenditure, and food-poverty, based on the required total cost of food-basket; and (ii) subjective

measure of food poverty, based on the actual consumption of individual food-item recommended in the nutritional food-basket for an adult equivalent person. The main hypothesis tested was that the expenditure inequalities on carbohydrate-rich food (cereals, i.e. rice and wheat) were very low with very high expenditure share of household food budget. However, inequalities among the expenditure on other food-items are widespread and therefore, a high degree of food poverty prevails in Bangladesh even within the high-income group, which is not food secure in terms of its specific food consumption patterns in relation to the nutritional normative food-bundle. The following specific questions have been addressed in this paper:

- What are the inequalities in (a) total income and expenditure, (b) expenditure on different types of food-items, and (c) expenditure on different categories of fish?
- What adjustments in the food-basket take place to substitute the short-fall required to total amount of food and food-poverty of specific food-item in it?, and
- What is the specific importance of economic poverty in maintaining food security, especially in relation to the occurrence of 'nutritional food consumption poverty' in the non-poor income group?

Data and Methodology

Data

The paper used the data of *Household Income and Expenditure Survey (HIES) 2000*, conducted by the Bangladesh Bureau of Statistics following a multi-stage random sampling framework (for details, *see* BBS, 2003). The data were collected from 7,440 households residing in both rural and urban areas and analyzed to estimate the income-expenditure inequalities and economic and subjective poverty by rural, urban and broad economic classes of households in Bangladesh.

Methods

(A) Measures of Expenditure Inequality

The Gini ratio (G), which is a summary statistical estimate of the Lorenz curve distribution, is a simple measure of inequality in the population (Gini, 1912; Sen, 1973). Following Pyatt *et al.* (1980), the Gini ratio decomposition was carried out among the food groups to identify the major sources of inequalities.

We have calculated Gini ratio and Gini decomposition to the total expenditure of households and expenditure on specific food groups in the normative food-bundle. The Gini ratio was measured based on Equation (1) (*see*, Sen 1973):

$$G = \left(1 + \frac{1}{n}\right) - \left(\frac{2}{n^2 m} \times \sum_{i=1}^{n} r_i y_i\right) \qquad \ldots(1)$$

where,

n = Sample size

m = Mean expenditure of the sample

r_i = The ith rank of the household in descending order with regard to per capita expenditure, and

y_i = Expenditure of the household in the corresponding i^{th} rank.

Gini decomposition (*Gd*) was calculated using Equation (2) (*see*, *Pyat et al., 1980*):

$$Gd = \sum_{j=1}^{n} S_j R_j G_j \qquad \ldots(2)$$

where,

S_j = Share of the jth source to the total expenditure

R_j = Correlation ratio of the covariance of total expenditure with the expenditure from the source, and

G_j = Gini ratio (G) of the income from the source.

(B) Measures of Poverty

In this study, both economic (objective) measure of poverty, and subjective measure of food poverty techniques have been applied to examine the nutritional food security of the people in Bangladesh.

Economic Measure of Poverty

The cost of basic need (CBN) approach is most common in poverty analysis. It takes into consideration per capita cost of food basket (called normative food-bundle) to estimate food poverty (FP) and the cost of other basic needs (health, education, clothing and housing) to estimate non-food poverty. This approach was followed using the total food and non-food expenditure as the threshold income or expenditure required to maintain the minimum standard of living for a person. Many research studies have used

Foster, Greer and Thorbecke (FGT) index to identify the incidence, depth and severity of poverty (Sen, 1976; Foster *et al*., 1984). The CBN approach was applied using three aspects, viz. headcount index (HCI), poverty gap index (PGI) and square of poverty gap index (SPGI). The commonly used analytical techniques for these three different indices are as follows:

(i) Incidence of FP and non-food poverty, or the poverty rate based on headcount index (HCI) is measured as the percentage of population below the expenditure (or other user defined) threshold poverty line (the cost of minimum standard of living of a person for food and non-food expenditure), where $P=q/n$ is the headcount poverty ratio (q is the number of people below the poverty line and n is total population);

(ii) Depth of poverty (i.e. intensity) indicates how far the expenditure of a person is below the poverty line, and is measured by the poverty gap index (PGI), an aggregation of the depth of poverty (mean of proportional distance from the poverty line), where Z is the poverty line and Y_i is the person's expenditure, then I is Z-Y_i the ratio of average expenditure shortfall to the poverty line which is referred to as the expenditure gap (g_i) of the poor, i.e. poverty gap which is also called depth of poverty; and

(iii) Severity of poverty, as measured by the square of poverty gap index (SPGI), is an aggregation with weights (mean square ratio of distance proportion from the poverty line).

These three measures of poverty can be denoted by P_0 for HCI, P_1 for PGI and P_2 for SPGI. Foster *et al.* (1984) had developed a common mathematical framework known as the FGT measures of poverty index covering all the three measures of poverty (P_0, P_1 and P_2). The short-form of FGT index of poverty is (Foster *et al.,* 1984) given by Equation (3):

$$P_a = \frac{1}{n}\sum_{i=1}^{q}\left(\frac{z-y_i}{z}\right)^a \qquad \ldots(3)$$

where,

n = Number of households

z = Poverty threshold expenditure (i.e. expenditure as proxy of income)

q = Number of poor households

y_i = Expenditure of the ith poor household, and

a = Parameter that reflects society's weight.

Here, I ($y_i < z$) is an indicator function (equal to 1 when expenditure is below the poverty line, and 0 otherwise). Poverty incidence, intensity/depth (poverty gap) and severity correspond to a = 0, 1 and 2, respectively.

Subjective Measure of Food Poverty

The CBN method of FP measures considers the cost of total consumption of all food items, based on the recommended normative food bundle which provides a minimum level of calorie and protein to an adult person (i.e. the cost of FP threshold in the economic measure). However, it does not provide insights into the actual consumption of specific food items relative to the recommended normative food bundle. The subjective measure of food poverty (SFP) is based on a disaggregated pattern accounting for the actual quantitative consumption of specific food items, for which SFP threshold differs for one food item to another, based on the recommended standard nutritional diet of an average adult person 'for an active and healthy life' as, mentioned by Reutlinger (1985). Instead of the objective (economic) measure which includes aggregated cost and income-expenditure, this SFP measure could be appropriate for FP in view of food security, and by and large, it could bring to the surface the hidden nutritional hunger that causes malnutrition and morbidity of both income poor and non-poor. In this study, the SFP was measured using the difference between actual amount of food consumption (Q) and its recommended level for nutritional standard thresholds (R) of different items (j) for an average adult equivalent person. The SFP of food j for a person can be expressed by Equation (4):

$$SFP_j = \begin{cases} 1, if\,(Q_j < R_j) \\ 0, if\,(Q_j \geq R_j) \end{cases} \qquad \ldots(4)$$

Simply, the food poverty on food item j exists if Q is less than R. Since the consumption data were collected at the household level, the quantity of food items suggested in the balanced nutritional food basket of an adult person was taken into consideration. The SFP_j based on the per capita food consumption of item j can be calculated by the subjective food poverty index (SFPI) for the theoretical SFP using formula (5):

$$SFPI_j = \sum_{j=1}^{N} \frac{1}{N} SFP_{ij} \qquad \ldots(5)$$

where, N is the total number of households. Here, the jth food item for $SFPI_j$ was the proportion of households which consumed below the amount required to maintain calorie, protein and nutritional requirements, where a specific food-item category constituted the sum of amounts from number of food types. For example, rice, wheat, maize, etc. represented 'cereals food item j'. Similarly, different kinds of pulses (lentil, mungbean, gram, etc.) represented 'pulses food item j', several types of fish species belonged to the 'fish item' and this process was applied for all other food items. The

estimate of $SFPI_j$ rate directly corresponds to the same calculation method as mentioned in Equation (3) for HCI and it will be HCI_j for head count $SFPI_j$ when $a = 0$ in the case of specific food item j. Correspondingly, its sensitive measures are also based on the approaches mentioned for PGI and SPGI measures of income poverty, which will be $SFPGI_j$ and $SSFPGI_j$ when $a = 1$ and $a = 2$ for depth and severity of $SFPI_j$, representing the proportional gap of actual consumption from the threshold of specific food item, respectively.

Results and Discussion

Income Inequalities and Expenditure Distribution

The per capita income in the year 2000 was more than two fold in urban (US$432) than rural (US$192) households in Bangladesh (Table 1). In the case of per capita expenditure, it was almost double in urban (US$342) as compared to rural (US$179) households. More than two-thirds income was derived from the non-agriculture sources in both rural and urban households. Of the total expenditure on food, the rural households spent 56 per cent and urban households spent only 43 per cent. The saving ratio and non-food expenditure were significantly high in the urban than rural households. The inequalities in income (0.426) and expenditure (0.354) were higher among urban than rural households (0.357 and 0.273, respectively). While taking into account the demography of households, the per capita income and expenditure inequalities were computed and it was found that income inequality was slightly higher as compared to the expenditure in both rural and urban households. The overall inequalities (0.488) in non-agricultural income of the households were much higher compared to those in agricultural income (0.215). The inequality in household expenditure on non-food commodities was more prominent than food expenditure in both rural and urban areas. Among the non-food expenditure of households, inequalities were high in expenditure for transportation, followed by education, housing and healthcare (ranges from 0.667 to 0.350). Thus, the living standard differs much more for the household with higher income from non-farm sources compared to food consumption pattern among the sample households. Therefore, an increase in income and reduction in its inequality would have an efficient influence to reduce inequality in non-food expenditure.

The relative contribution to the household income inequality for non-farm income was 75.3 per cent in the rural and 87.0 per cent in the urban areas. On the other hand, the *pseudo*-Gini ratios for household non-food

Table 1. Income and expenditure inequality in rural and urban households in Bangladesh: 2000

Sources of annual income and expenditure	Rural			Urban			All		
	Absolute share (%)	Pseudo-Gini ratio	Relative contribution to inequality (%)	Absolute share (%)	Pseudo-Gini ratio	Relative contribution to inequality (%)	Absolute share (%)	Pseudo-Gini ratio	Relative contribution to inequality (%)
Sources of income									
Agriculture	38.1	0.232	24.7	12.2	0.457	13.0	25.8	0.215	13.3
Non-agriculture	61.9	0.435	75.3	87.8	0.422	87.0	74.2	0.488	86.7
Per household (US $)	999.6	0.357	100.0	1905.5	0.426	100.0	1291.8	0.417	100.0
Per capita (US $)[a]	191.9	0.365		432.2	0.465		240.6	0.442	
Sources of expenditure									
Food expenditure	56.4	0.188	38.8	43.0	0.200	24.3	50.4	0.206	31.0
Non-food expenditure	43.6	0.383	61.2	57.0	0.471	75.7	49.6	0.467	69.0
Per household (US$)	881.2	0.273	100.0	1524.4	0.354	100.0	1088.6	0.336	100.0
Per capita (US $)[a]	178.7	0.293		341.6	0.381		211.7	0.359	

Source: Authors' estimates, derived from HIES (2000)

Note: [a] Per capita Gini-ratio while others are Pseudo-Gini ratios in the respective sources.

expenditure have shown a wide difference between rural (0.383) and urban (0.471) areas and its relative contributions to expenditure inequalities were 61.2 per cent and 75.7 per cent in the rural and urban areas, respectively. These results are in confirmative to several past studies that with an increase in non-agricultural income and non-food expenditure had respectively reduced poverty and improved the livelihoods, but, at the same time, had increased income-expenditure inequality (Wodon, 1999; Hossain *et al.*, 2002). Nevertheless, this phenomenon would lead to greater disparity of income and expenditure among poor and non-poor households. The income and expenditure disparity may be reduced to a great extent by increasing wage-income of labour in general, and developing the rural non-farm sector to increase employment.

Consumption Inequalities of Food-basket

The overall consumption pattern of food items by rural and urban households during the period 1983-84 to 2000 has been depicted in Appendix I. In this sub-section, it has been investigated using the method of inequality analysis on consumption expenditure of different food-items in which rice and fish were the major food items and dominating source of calories and proteins for Bangladesh population. Rice and wheat together contributed 74 per cent and 57 per cent to the total per capita calorie and protein intake, respectively and the fish contributed about 78 per cent and 62 per cent to the total intake of animal protein for the poor and rich, respectively (BBS, 2003).

The food items were separated into the groups of plant and animal origin and were further disaggregated by food-items to estimate the expenditure inequalities within the food-basket. Food from the plant origin was further sub-grouped into cereals (rice and wheat were the major), pulses, edible oils, vegetables and tubers, fruits, sugar and *gur*, and spices, while food-items of animal origin were grouped into milk and milk products, meat and eggs, and fish. Fish being a heterogeneous commodity to the people in terms of perception, quality and types, was considered to conduct expenditure inequality analysis by major types of fish.

The per-capita expenditure based on *pseudo*-Gini ratios for each of the food items presented in Table 2, revealed wide spread inequalities in both rural and urban areas. Altogether, the inequalities in food consumption expenditure of plant origin were low (0.142) as compared to those of animal origin (0.372), but these differred among the food items in both the food groups. In both the sources of food, the inequality pattern in food consumption expenditure among rural and urban households was observed to be almost

Table 2. Inequality and its decomposition by food items in rural and urban households in Bangladesh: 2000

Food item	Rural			Urban			All		
	Expenditure share (%)	Pseudo-Gini ratio	Relative contribution to expenditure inequality (%)	Expenditure share (%)	Pseudo-Gini ratio	Relative contribution to expenditure inequality (%)	Expenditure share	Pseudo-Gini ratio (%)	Relative contribution to expenditure inequality (%)
Plant origin food items	75.4	0.140	55.2	67.6	0.132	44.7	72.5	0.142	50.2
Cereals	46.1	0.095	22.9	35.2	0.064	11.4	42.0	0.081	16.5
Pulses	3.1	0.205	3.3	3.7	0.171	3.2	3.3	0.216	3.5
Edible oils	4.0	0.196	4.1	4.6	0.209	4.8	4.2	0.222	4.5
Vegetables & tubers	10.4	0.138	7.5	9.9	0.104	5.2	10.2	0.136	6.8
Spices	6.9	0.193	7.0	7.2	0.178	6.4	7.0	0.202	6.9
Fruits	2.9	0.397	6.0	4.5	0.388	8.7	3.5	0.428	7.3
Sugar & gur	2.0	0.431	4.4	2.6	0.395	5.1	2.2	0.438	4.7
Animal origin food items	24.6	0.350	44.8	32.4	0.341	55.3	27.5	0.372	49.8
Milk & milk products	3.4	0.448	8.0	4.4	0.427	9.5	3.8	0.458	8.5
Meat & eggs	7.7	0.469	18.9	12.3	0.390	24.1	9.5	0.472	21.8
Fish	13.4	0.256	17.9	15.6	0.277	21.6	14.2	0.282	19.5
Total food expenditure (US$/household/year)	479.4	0.192	100.0	611.1	0.199	100.0	521.9	0.206	100.0

Source: Authors' estimates, derived from HIES (2000)

similar. Notably, and as expected, the inequality was very low in the consumption of cereals (0.081) because of staple food and higher amount of consumption without much difference among the people that reflected the nature of high dependency on carbohydrate for energy and protein. The inequality of vegetables and tubers (0.136) was also low, as homestead and backyard production is eaten adequately by most of the people in rural areas and they often ignore its actual price in the market. The inequalities of other food items were found moderate in spices (0.202), pulses (0.216), edible oils (0.222) and fish (0.282); and high in fruits (0.428), sugar and *gur* (0.438), milk and milk products (0.458), and meat and eggs (0.472). Even though the inequalities in the consumption expenditure were low for cereals and moderate for fish, but the inequality decomposition analysis revealed that their contribution was 22.9 per cent and 17.9 per cent, respectively in the rural households and 11.4 per cent and 21.6 per cent, respectively among the urban consumers. These were the two major food sources available all over the country that were consumed by most of the households and were reflected in their higher food expenditure budget compared to other commodities. The expenditure share of meat and eggs was also found relatively higher compared to many other food-items.

In the process of this consumption expenditure and inequality analysis, it was found that a few food types within a food-item were adequately consumed and also used higher budgetary share across the food-items. Thereby, it is expected that production and price of a few food types need to be considered in the national agricultural development policy, technology development and investment. Particularly, rice and fish are the most common foods in the diet of Bangladesh people and their availability and distribution at the affordable price must remain as the prime national policy objective to make the poor consumer food-secure. At the same time priority should be accorded to high nutritive/quality of food production and increase in the income of poor people to attain the nutritional household food-security.

Expenditure Inequalities by Types within Fish-items

Fish forms an important part of Bangladesh diets and provides over two-thirds of the animal protein intake. Fish being the heterogeneous product, its consumer preferences vary across species. This section provides an insight of the expenditure inequalities within fish food-item using the data of specific fish-types, which was another dimension of inequality analysis on quality of food. Poor consumers generally consume low-price species; it is of great significance to know inequalities in the consumption pattern of fish types in order to set the research priorities for species specific to attain twin objectives — income generation and nutritional security of the poor in

Bangladesh. The *pseudo*-Gini ratios of fish consumption expenditure by fish types are given in Table 3. Though the inequality of aggregated fish consumption expenditure was found moderate (0.282 in Table 2), data revealed that the fish consumption inequalities ranged widely, from 0.120 to 0.678 across species, and the inequality pattern was same in both rural and urban areas.

The low level of inequalities in the consumption were found for those types of fishes that had low market price. A majority of Bangladesh population is poor and lower-middle class and fish is one of their main foods. However, these consumers rely largely on low-price fish (i.e. Chinese carps and small- and assorted-fishes, such as *Puti/tilapia/nilotika*, other fishes, and dried fish). The expenditure inequality of dry fish was the lowest (0.120), followed by Chinese carps (0.225), assorted/small fish (0.242) and *Puti/tilapia/*

Table 3. Inequality in expenditure of fish consumption by fish-types (species group) in Bangladesh: 2000

Species group	Expenditure share (%)	*Pseudo*-Gini ratio	Relative contribution to expenditure inequality (%)
Hilsha (Illish)	13.6	0.594	21.0
Indian carps[a]	14.8	0.504	19.5
Pangas/boal/iar	3.4	0.678	6.0
Magur/shing/koi (live fish)	3.9	0.561	5.8
Chinese carps[a]	8.1	0.225	4.8
Sail/gazal/taki (live fish)	5.6	0.320	4.7
Puti/tilapia/nilotika	12.9	0.255	8.6
Mola/dhela/chapali/batasi	8.9	0.307	7.2
Shrimp/prawn/*chingri*	2.7	0.542	3.9
Dry fish/*shutki*	4.2	0.120	1.3
Tengra/byain	3.6	0.354	3.3
Seafish	4.1	0.394	4.3
Baila/toposhee	1.0	0.414	1.1
Kholisha	1.1	0.330	0.9
Other assorted/small fishes	11.9	0.242	7.6
Total fish expenditure (US$/household/year) of household and Gini	74.3	0.382	100.0
Per capita fish expenditure (US$/capita/year) and Gini	14.1	0.418	

Source: Authors' estimates, derived from HIES (2000)

Note: [a] Indian carps were *rui/ruhu, katla, mrigal, kalibous,* etc.; and Chinese carps were *silver, grass, mirror,* etc.

nilotika (0.255), respectively. Altogether it shared about 33 per cent of the total fish expenditure and 21 per cent relative contribution to the total inequalities in fish consumption.

Indeed, expenditure inequalities were found very high for *hilsha (illish),* Indian carps, *pangas/boal/iar, magur/shing/koi,* shrimp/prawn/*chingri*, and *baila/toposhee* and *Magur* (catfish)/*shing/koi* fish. Normally, these fish types fetch much higher price in the market and become quite expensive when these are marketed as fresh and live. The expenditure decomposition analysis by fish types showed that *hilsha* (21%) and Indian carps (20%) were the main two fishes contributing very high to the expenditure inequalities of fish. The findings indicated that though the poor people depended on the fish for animal protein, they had only limited affordability for the good quality fish.

Incidence of Poverty

In the subsequent sections, we have computed two types of poverty incidences, as stated in the methods: (i) the incidence of economic/objective poverty by using threshold of CBN measure of food and non-food economic poverty considering expenditure as proxy of income, and (ii) the incidence of subjective food poverty (SFPI) using threshold of specific food-item recommended in the nutritional food-basket for an adult equivalent member (AEM, conversion factor was taken form Ali, 2002). People below the per capita income (i.e. expenditure) poverty line threshold are economically poor; and the people who consume less than the recommended amount of specific food-item in the food-basket of 2200kcal, are subject to SFPI poor by each food-item.

Economic (Objective) Measure of Poverty

The cost of normative food-bundle is the food-poverty (FP) threshold line and the cost of minimum (basic) non-food expenditure is the non-food poverty threshold line, and sum of these two lines is the poverty threshold line of the CBN approach that is called as direct economic and objective measure of poverty. The incidences of expenditure and total food and non-food poverties were measured by following the headcount index (HCI), which is determined as the percentage of population below poverty threshold lines, i.e. P_0 when a =0, and the depth and severity of poverty when a =1 and a =2, respectively in Equation (3).

The CBN approach of income/expenditure-based poverty thresholds were Bangladesh currency Taka 7,436 (US$ 142.62), in which food and non-food poverty thresholds were Taka 4,964 (US$ 95.21) and Taka 2,472

(US$ 47.41), respectively and the threshold of the extreme poor was Taka 4,231 (US$ 81.15). For the extreme and moderate poor, poverty threshold was estimated based on the cost of an 1800-kcal (US$81.15) and 2100-kcal (US$95.25) food-baskets, respectively. Based on per capita expenditure decile, the households were classified qualitatively into four groups — bottom-40% (poor), middle-40% (vulnerable), and the ninth decile and top-10% (rich). It was found that the livelihood of the bottom-40% primarily depended on the wage labour and small-scale agriculture; and that of the top-20% mainly depended on trade-business and services.

Based on the objective measure, the incidence of food and non-food poverties has been presented in Table 4. The results have revealed that considering the actual expenditure, 40.5 per cent (53 million) of the country's population was poor in which around 6 per cent (8 million) was extreme poor in the year 2000. The poverty incidences of food and non-food, in both rural and urban areas, were found to be extremely serious for the bottom-40%. Over 90 per cent of them had to face regular food deficiency and about 80 per cent could not meet the basic expenditure on non-food essentials. Thus, a large section of population in Bangladesh was found to be food insecure and was facing poor quality livelihoods as revealed by high non-food poverty incidences for the bottom-40%. The poverty incidences were about three-times higher among the rural households than the people living in the urban areas. The extreme-poor population in the urban areas was 46 per cent poor among the bottom-40% households as compared to 100 per cent in the rural areas, which indicated a better situation of the urban poor than the rural poor. It might be a good reason for rural to urban migration of the poor people. However, the bottom-40% of the country's households were very poor, considering their expenditure level (one-fourth of a dollar per day) in the context of household economy in Bangladesh. However, the depth and severity of poverty was somewhat higher in the rural than urban area, although it was low considering the national scale.

Subjective Measure of Food Poverty

The measure of subjective food poverty, as mentioned in Equations (4) and (5), deemed the same estimating approach of Equation (3) to estimate the HCIs, the gap and squared of the gap of SFP for the specific food-item in recommended food-basket. Table 5 shows the SFPIs thresholds on 2200-kcal recommended for specific food-item in the food-basket of an AEM which was used to compute HCIs of SFPIs and provides an insight into the depth (SFPGI) and severity (SSFPGI) of subjective food poverty.

The existing consumption pattern for rural and urban consumers was observed far away from the recommended level of food-basket, except for

Table 4. Economic (objective) poverty indices based on CBN approach in rural and urban areas of Bangladesh: 2000

Dimensions of poverty	Head count index of poverty (%)					
	Rural		Urban		National	
	Bottom 40%	All cases	Bottom 40%	All cases	Bottom 40%	All cases
Head count index (HCI)						
Food and non-food poverty						
Food poverty	96.7 (46.4)	52.2 (104.1)	61.7 (41.5)	24.4 (149.1)	90.9	46.6
Non-food poverty	89.1 (21.9)	45.4 (74.6)	38.6 (22.6)	14.3 (192.5)	80.3	39.1
Extreme and moderate poverty						
Extreme poor	17.5	7.1 (68.3)	3.9	1.4 (64.1)	13.7	5.9
Moderate poor	82.5	39.4 (113.0)	42.4	15.5 (116.1)	80.0	34.6
Total poor	100.0	46.5	46.2	16.9	93.7	40.5
Depth of poverty (PGI) of the poor		25.5		21.7		23.8
Severity of poverty (SPGI)		9.1		7.0		8.4

Source: Authors' estimates, derived from HIES (2000)
Figures within the parenthesis show per capita annual expenditure (in US dollar).

cereals and fish. Both recommended (2200-kcal and 1900-kcal) and actual food consumption trends from 1983-84 to 2000 have been shown in Appendix I. The results have shown that the rural people consumed more rice, while the urban people consumed a little higher of all kinds of non-cereal foods. The total calorie-intake was relatively low among urban areas mainly because of the low consumption of cereals and they may not require high level of calories because of their life-style. The long-term changes in food consumption and gap in the existing and recommended food-baskets have been shown in Table 5. A perusal of Table 5 revealed a high degree of deficiency in the consumption of high quality food commodities by both rural and urban households. These households were unable to procure healthy affordable food. The consumption pattern in the years 1983-84 and 2000 confirmed that the diversification towards pulses, horticulture and livestock commodities had not yet taken place. However, more diversification and food substitution processes were noticed among urban households, particularly towards edible oils and fats, fruits, meat and eggs and fish in the

year 2000 compared to that in 1983-84. In the rural areas, rice was the major food commodity for food substitution compared to other food-stuff in the urban area. Thus, the average recommended calories were being achieved through excessive consumption of cereals, which could not provide essential micro-nutrients for a healthy and productive life. Moreover, people living in poverty were often not able produce or buy enough diversified good quality food and were leading to high incidence of subjective food poverty.

The changes in the food-consumption pattern are the pervasive and will definitely move towards high-quality food commodities in the long-run with the increase in income, urbanization, and perceptions of consumer regarding food quality, safety and health (Kumar and Dey, 2006). It is likely that the demand for non-cereal food commodities would grow faster, as predicted by Kumar *et al*. (2006). Demand for vegetables and fruits would each grow to 2-3 million tonnes, milk and fish to 3-4 million tonnes each, and meat and eggs to 1-1.5 tonnes by the year 2025.

The SFPIs for specific food-item were the food-deficit incidences of the people for the year in 2000, measured by using 2200-kcal standard food distribution, given in Table 5. Therefore, SFPI thresholds are different for each food-item. Its incidences based on the SFP approach considering the specific food-item consumption of an AEM across economically poor and non-poor households in rural and urban areas are shown in Table 6. The SFPI of cereals was not a big concern as it was significantly low compared to that of other food items. Moreover, Bangladesh had achieved cereal-based food security through increasing domestic production and keeping price to affordable limit of the poor people. A large section of population was deficit in high quality food consumption like pulses, horticulture and livestock commodities. Except cereals, the SFPIs were in the range of 47 per cent for fish to 99 per cent for pulses among the poor; and these were 13 per cent to 95 per cent, respectively for the non-poor groups in both rural and urban areas.

According to the approach of FGT index (Foster *et al.,* 1984), the depth of subjective food poverty measures how far the consumption of a household is below the recommend amount of specific food-item which is the SFPGI. The severity of SFPGI is measured by the square of SFPGI. The SFPGI and SSFPGI of the SFPIs were computed across economic poor and non-poor groups and have been shown in Table 6. The results have revealed that the depth (22%-90%) and severity (14%-85%) of SFPIs of the economically poor households across rural and urban areas were very high, except in cereal consumption, followed by vegetables and tubers. Besides, the depth and severity of SFPIs for the economically non-poor households was high for the pulses, sugar and *gur*, fruits, and milk and milk products,

Table 5. Per cent difference in actual per capita consumption over recommended food-basket in rural and urban areas of Bangladesh: 1983-84 and 2000

Source of food items	Recommended[a] food basket (g/capita/day)*	National		Rural		Urban	
		1983-84	2000	1983-84	2000	1983-84	2000
Plant origin	772	-14.0	-1.0	-14.2	0.0	-14.5	-5.3
Cereals	408	16.7	19.6	18.4	23.3	3.9	5.4
Pulses	58	-74.1	-72.4	-82.8	-74.1	-62.1	-65.5
Oils & fats	15	-53.3	-6.7	-53.3	-20.0	-33.3	40.0
Vegetables	233	-38.2	-11.2	-39.9	-11.6	-23.6	-10.3
Sugar & *gur*	29	-82.8	-69.0	-82.8	-72.4	-82.8	-58.6
Fruits	29	-41.4	3.4	-41.4	-3.4	-27.6	34.5
Animal origin	102	-38.2	-14.7	-39.2	-19.6	-23.5	3.9
Milk	58	-58.6	-50.0	-60.3	-51.7	-39.7	-46.6
Meat & eggs	15	-26.7	26.7	-33.3	0.0	46.7	113.3
Fish	29	-3.4	34.5	0.0	34.5	-27.6	48.3
Total	874	-9.4	5.4	-10.1	5.6	-5.3	4.5
Total (g/capita/day)	874	792	921	786	923	828	913
Kilo-calorie in the food-basket	2200	2102	2240	2113	2263	2020	2150

Source: Bangladesh Bureau of Statistics, *Report on Household Income and Expenditure Surveys* (various issues), and author's estimation from HIES 2000 data.
Note: [a] Data used for SFPI thresholds (details presented in Appendix I).
*based on 2200-kcal

revealing that a large population, even non-poor, had not achieved nutritional food-security in their dietary pattern. Appendix II shows the SFPIs by broad economic group of households in the rural and urban areas of Bangladesh.

The estimates of SFPIs revealed a common general trend in both rural and urban areas, viz. the higher the income; lower the incidence of SFPIs (*see* Appendix II). The SFPI was significantly low in cereal consumption (in which rice was the dominant staple food) than in other food-items across the expenditure groups. In general, SFPIs for pulses, sugar, fruits and milk and milk products were very high across all groups, including high-income group. The SFPI rates for oils as well as meat and eggs consumption were significantly low for the higher-income groups in the urban areas. The SFPIs in other cases of food consumption depicted an alarming trend of food insecurity in Bangladesh, even for the non-poor higher-income group. The SFPIs ranged from 50 per cent to 99 per cent in the rural and 45 per cent to 99 per cent in the urban areas for the bottom-40% (i.e. poorest) of the

household. The SFPIs of the richest (top-10%) households were high for pulses (89.6%), followed by sugar (61.2%), milk (45.5%) and fruits (42.2%) in the rural areas. Similar high incidence trends were found in the urban areas, but the incidence was low for fruits and high for vegetables

Table 6. Subjective food poverty indices (SFPI) of economically poor and non-poor households based on HCI and its depth and severity by food item in rural and urban areas of Bangladesh: 2000

Food-item by poverty indices	Subjective food poverty indices (%)				All cases
	Rural		Urban		
	Non-poor	Poor	Non-poor	Poor	
Head count index (SFPI)					
Cereals	3.3	8.0	18.1	21.3	8.2
Pulses	94.1	98.9	95.3	99.0	96.3
Oils	35.2	79.5	16.2	70.2	49.6
Vegetables & tubers	31.1	54.4	38.1	65.1	42.1
Sugar & *gur* (molasses)	80.6	96.9	78.4	98.7	86.9
Fruits	59.6	80.8	44.4	76.3	65.5
Milk & milk products	66.7	91.9	69.7	94.7	77.5
Meat & eggs	44.0	78.8	21.8	74.8	54.2
Fish	12.7	47.0	16.4	59.2	27.6
Depth of food poverty (SFPGI)					
Cereals	0.5	1.8	2.7	4.7	1.5
Pulses	59.7	74.1	54.9	71.5	64.6
Oils	8.9	33.2	4.7	25.7	17.8
Vegetables & tubers	6.8	16.3	8.7	17.7	11.0
Sugar & *gur* (molasses)	57.3	84.9	52.4	89.9	67.8
Fruits	45.0	68.6	30.2	65.0	52.0
Milk & milk products	54.2	81.9	56.5	87.9	66.0
Meat & eggs	29.0	59.6	13.2	50.9	38.5
Fish	4.8	22.1	5.9	27.9	12.2
Total (except spices)	1.0	6.0	2.3	11.3	3.4
Severity of food poverty (SSFPGI)					
Cereals	0.1	0.8	0.8	1.8	0.5
Pulses	43.3	59.9	35.8	55.1	48.6
Oils	3.4	17.8	2.1	12.4	8.8
Vegetables & tubers	2.3	7.0	3.0	6.9	4.3
Sugar & *gur* (molasses)	48.1	78.7	43.0	84.6	59.8
Fruits	39.6	63.6	25.5	59.8	46.8
Milk & milk products	49.4	77.3	50.7	84.7	61.2
Meat & eggs	24.0	52.1	10.4	41.8	32.7
Fish	2.9	14.1	3.1	17.7	7.6
Total (except spices)	0.2	1.9	0.5	3.7	1.0

Source: Authors' estimates, derived from HIES (2000)

consumption. It appears from the SFPI rates that food consumption was somewhat diversified among the richest 20%-households in the urban areas.

Concluding Remarks

The consumption expenditure analyses on total food, food-items and sub-food-items and the subsequent inequality analysis by these three groups have provided an insight into the strengths and weaknesses of food security in Bangladesh. Wide-spread inequalities in expenditure distribution are evident in the study. Among all the food items, the per-capita expenditure based *pseudo*-Gini ratios have been found very high in fruits, sugar, milk and meat; and the relative contribution to the expenditure inequalities has been high in milk, meat, fish and cereals compared to other commodities. Though the expenditure inequality has been found moderate for fish as a group, the results have clearly shown high inequality in the consumption of most of the fish species group, except for some low-value fish, such as Chinese carps, small and assorted fishes like *Puti/telapia/nilotika*/others, and dried fish.

Objectively, income poverty in Bangladesh still remains high compared to that in some other Asian countries; and subjectively, food poverty has been found more of disbanding nature among the food-items of nutritional standard food-basket. The findings of this study have revealed that an increase in household income might reduce poverty incidence and increase in consumption expenditure (including high-nutritive/quality food), but that would not be sufficient to maintain good health and nutritional food-security. Among 40.5 per cent income-poor in the total population, about 15 per cent have been starving and most of them live in the rural areas. On the other hand, results from the SFP method have revealed divergence of food-poverty incidences (in some cases more than 60%) considering the consumption of different food items. It has also been found that food-poverty incidences are more acute and diverse among income-expenditure groups in both rural and urban areas for all food-items, except cereals. The empirical evidence has shown that the high degree of food security remains around cereal consumption. But the incidence, depth and severity of poverty have been noted high for other nutritionally high quality food-items (including pulses, sugar, fruits, fish and livestock food commodities). The occurrence of high rates of SFPIs for non-cereal commodities among the non-poor is of great concern to the policy planners for evolving strategies with regard to nutritional food-security. That indicates the people of the country need to go beyond cereals (carbohydrate) consumption where a large section of population is nutritionally food-insecure (hidden hunger) for most of the nutritive and micro-nutrient rich food-items.

Due to low level of income, supply and knowledge constrains, the nutritional food-basket for a large population in Bangladesh has not yet diversified towards pulses, fish, fruits and livestock products. The sectoral development within agriculture should be accorded high priority with multiple objectives, viz. diversifying agriculture production and consumption, raising income and employment of the poor, providing knowledge on nutritional food commodities to make the poor food secure and to attain nutritional food-security of the people in Bangladesh.

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Appendix I

Recommended nutritional food-basket and changes in consumption (g/capita/day) of major food-items in Bangladesh: 1983-84 to 2000

Source of food items	Recommended food basket		1983-84			1991-92			2000		
			Rural	Urban	All	Rural	Urban	All	Rural	Urban	All
Calorie intake (kcal)	2200	1900	2113	2020	2102	2267	2258	2266	2263	2150	2240
Plant origin	772	744	662	660	664	744	744	744	772	731	764
Cereals	408	394	483	424	476	517	463	509	503	430	488
Pulses	58	28	10	22	15	17	22	18	15	20	16
Oils & fats	15	10	7	10	7	9	16	10	12	21	14
Vegetables	233	256	140	178	144	176	209	181	206	209	207
Sugar & *gur*	29	29	5	5	5	9	11	9	8	12	9
Fruits	29	29	17	21	17	16	23	17	28	39	30
Animal origin	102	29	62	78	63	64	91	68	82	106	87
Milk and milk products	58	—	23	35	24	19	23	19	28	31	29
Meat & eggs	15	—	10	22	11	12	20	14	15	32	19
Fish	29	29	29	21	28	33	48	35	39	43	39
Miscellaneous	—	—	62	90	65	33	61	37	69	76	70
Total	874	773	786	828	792	841	896	849	923	913	921

Source: Bangladesh Bureau of Statistics, *Report on Household Income and Expenditure Surveys* (various issues: 1991, 1998, and 2001), and author's estimation from HIES 2000 data.

Appendix II

Incidence of subjective food-poverty among the broad economic groups of households based on per capita expenditure ranking in rural and urban areas of Bangladesh: 2000

Food items by rural-urban areas	SFPIs by broad economic groups of households (%)				All cases
	Bottom-40%	Middle-40%	Ninth decile	Top 10%	
Rural					
Cereals	8.5	3.3	2.9	4.8	5.5
Pulses	99.0	96.5	91.9	89.6	96.4
Oils	82.0	47.4	24.2	14.3	55.8
Vegetables & tubers	56.2	36.9	26.6	18.8	41.9
Sugar & *gur* (molasses)	97.6	88.8	74.5	61.2	88.2
Fruits	81.8	67.4	54.7	42.2	69.5
Milk & milk products	92.7	76.2	61.7	45.5	78.4
Meat & eggs	80.3	56.1	34.0	20.8	60.2
Fish	49.5	18.4	8.4	5.2	28.7
Total (except spices)	38.4	10.8	5.3	5.0	20.8
Urban					
Cereals	16.3	16.8	22.1	29.2	18.6
Pulses	98.6	96.1	95.9	86.7	95.9
Oils	52.1	13.3	5.8	1.7	25.4
Vegetables & tubers	53.7	37.1	36.6	33.0	42.6
Sugar & *gur* (molasses)	97.5	79.7	64.9	55.5	81.8
Fruits	72.4	46.6	22.8	14.4	49.8
Milk & milk products	90.7	71.2	57.4	46.2	74.0
Meat & eggs	59.1	20.6	5.4	1.2	30.8
Fish	45.4	13.2	9.1	5.5	23.7
Total (except spices)	43.7	18.3	10.7	9.9	25.8

Source: Authors' estimates, derived from HIES 2000.