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Food Security, Self-sufficiency and Nutrition Gap in Bangladesh

by

R K TALUKDER*

Food security and self-sufficiency status of Bangladesh has been examined using both time series and cross section data. The aggregate and per capita food availability in the country improved over the past years, resulting from increased domestic production and improved food management. However, about 40 per cent people were consuming food below the absolute poverty line food intake. The analysis showed that in relation to standard nutritional norm of food intake, Bangladesh virtually remained a surplus producer of foodgrains from the year 1999-2000. In reality, however, Bangladesh remained a net importer of foodgrains as indicated by the levels of apparent consumption and overall utilisation. Estimates for 2005-06 showed that nutrition gap was of substantial magnitude. Elimination of the nutrition gap would call for adoption of appropriate food intervention measures based on critical analysis of the existing and potential food intervention programmes.

I. INTRODUCTION

Food security and self-sufficiency are the two key issues often discussed in the context of food policy in Bangladesh. While attainment of self-sufficiency does not necessarily ensure food security, the notion of food security may not necessarily call for attaining self-sufficiency through domestic production of food. However, in view of the size of the food production sector in the national economy and the subsistence nature of the production system, achievement of self-sufficiency through increased domestic production of foodgrain has special significance in the specific context of Bangladesh.

The notion of food self-sufficiency itself has several connotations. According to the prevailing notion, self-sufficiency is understood as domestic production

* Professor, Department of Agricultural Economics, Bangladesh Agricultural University, Mymensingh. The author is grateful to an anonymous referee for making valuable comments on an earlier draft.

equivalent to aggregate requirement corresponding to certain stipulated per capita consumption requirement of foodgrains. Whether or not this requirement corresponds to standard nutritional norm is not very precisely known. Defining self-sufficiency in terms of alternative nutritional norm of food intake would lead to several outcomes which need to be comprehended in formulating the goal of food self-sufficiency.

An important consideration in attaining food security in Bangladesh would perhaps be minimisation of "nutrition gap" which represents the aggregate difference between nutritionally adequate consumption requirement and actual consumption of the undernourished population. The magnitude of the nutrition gap needs to be estimated for designing targeted food intervention programmes. The government of Bangladesh has been implementing a number of food intervention programmes to minimise the nutrition gap. These programmes vary in their use of resources on the one hand and in the nature and extent of effectiveness on the other. These aspects need to be analysed for selection of cost-effective means of improving food security in the country.

This paper deals with analysis of the food security and self-sufficiency issues in Bangladesh. The levels of self-sufficiency have been examined corresponding to alternative nutritional norms of food intake. Attempts have also been made to assess the magnitudes of nutrition gap corresponding to alternative nutritional norms. Finally, the prevailing food intervention measures have been reviewed and their effectiveness has been examined.

II. FOOD SECURITY SITUATION IN BANGLADESH

Food security is defined as access to adequate and safe food by all people at all times for maintaining an active and healthy life. While aggregate food supply and availability are important aspects of food security, the concept is more precise at the individual level because the fundamental spirit of food security is to ensure individual-specific food requirement. The dynamics associated with inter- and intra-individual variation in requirement is also an important consideration in food security analysis. A useful food security scheme will have to take account of the risk and uncertainty factors associated with production, availability, distribution and consumption of food. This section of the paper deals with examination of the comprehensive food security situation in Bangladesh in relation to three broad aspects of food security, namely, availability, access and utilisation.

II.1 Availability of Food

Availability of food is determined by domestic production, external trade and the efficiency of distribution through market and other channels. Bangladesh has

made steady progress in the expansion of domestic food production. Total foodgrain production increased from less than 10.0 million tons in the early 1970s to more than 27.0 million tons in 2005-06. This growth in production has been achieved through expansion of irrigation facilities, spread of modern varieties and increase in cropping intensity. There has also been substantial improvement in the availability of food. As can be seen in Table II, per capita availability of foodgrain increased steadily over the past 10 years, and the overall availability increased from 161.0 kg/capita in 1994-95 to 192.2 kg/capita in 2005-06. Per capita per day availability also increased from about 15 ounces to more than 18 ounces during the period.

Table I also shows that under the given assumption of per capita requirement, net domestic production started exceeding total requirement of foodgrains from 1999-00, and in 2005-06 there was a surplus production of more than 1.0 million tons. The same table also shows that private sector import of foodgrains was 2.3 million tons in 2005-06. In fact the country has been importing foodgrains to the extent of more than 2.0 million tons each year over the past years. Table II shows that import of foodgrains constituted about 10 per cent of total availability even in the normal years of production.

This co-existence of import with apparent surplus production is indeed a matter of paradox and is perplexing for the food planners in the country. It would be quite sensible to assume that the total domestically produced and imported grains are actually used in the country. The critical factors which govern supply-utilisation balance of food are population of the country,[1] assumption about per capita requirement,[2] estimation of total production,[3] and allowance for seed feed

[1] According to BBS, for example, mid-year population for 2005-06 (January 2006) is 141.8 million (BBS 2007). The United Nations Population Fund, however, reported Bangladesh population in 2006 at 144 million.

[2] In preparing national food budget, the conventional practice is to assume per capita foodgrain requirement of 16 ounces or 454 grams per day. In the Household Income and Expenditure Survey 2005, per capita foodgrain intake (including rice and wheat products) is estimated at 17.25 ounces or 489 grams. However, if per capita availability (e.g. 18.60 ounces for 2005-06) as shown in Table I is taken as the apparent consumption and hence per capita requirement, national food requirement would be inflated by substantial magnitudes.

[3] The controversy between BBS and DAE estimates of production is well known. However, serious discrepancy is found even within BBS estimates. The annual crop estimate of BBS records *aman* rice area at 5.43 million hectares in the fiscal year 2005-06. The Agricultural Sample Survey 2005, also done by the BBS, estimated *aman* area at 4.25 million hectares. This reflects a discrepancy of about 28 per cent in the *aman* area estimate.

and wastage.[4] Serious attention needs to be given to possible revision of assumptions in respect of these variables.

Instability is another major feature of the food security situation in the country. Because of floods, droughts, cyclones and other natural calamities, national agricultural production varies from year to year. At the village and household levels, availability is aggravated by annual variation in purchasing power, with the consequence that household food security is very unstable. Bangladesh experiences two major periods of food shortages in a year: one during September–October (before *t. aman* harvest) and the other during March–April (before *boro* harvest). During these periods, stocks of the subsistence and deficit farmers are generally exhausted, food prices are at their highest but agricultural wages are generally at the lowest. All these factors contribute to reduced food security during these periods.

Trends in Production and Long Term Outlook

As has been evident from Table I, net domestic production of foodgrains (rice and wheat) increased from 16.27 million metric tons in 1994-95 to 24.54 million metric tons in 2005-06, and consequently annual food gap reduced from more than 3 million tons in 1994-95 to 1.5 million tons in 2005-06. In fact, with the stipulated requirement criteria, Bangladesh became self-sufficient in foodgrain production from 1999 to 2000.

In the relatively long run context, food self-sufficiency status of Bangladesh will be determined by a number of interrelated factors such as growth of population and income, and the resultant change in food consumption patterns. Relative profitability and comparative advantage in production of crop and non-crop food items will also be important determinant of production of a particular food crop. Bangladesh has achieved moderate success in checking population growth. The annual growth of population declined from around 3.0 per cent in the 1960s to 1.5 per cent by the end of 1990s. In spite of the declining growth rate, population of the country is projected to increase from 120 million in 1995 to 173 million in 2020.

[4] The conventional practice is to use seed, feed and wastage (SFW) at 10 per cent of gross production. One FAO estimate showed SFW allowance of 12.5 per cent for rice and 20 per cent for wheat in Nepal, and 11.5 per cent for rice in Sri Lanka (FAO 1977). Agricultural experts in Bangladesh suggest SFW allowance of at least 12 per cent for rice and wheat in the country.

TABLE I
FOODGRAIN (RICE AND WHEAT) AVAILABILITY AND REQUIREMENT IN BANGLADESH

Year	Net production (000 m. tons)	Aggregate consumption requirement (000 m.tons)	Food gap (000 m.tons)	Private import (000 m.tons)	Public distribution (000 m.tons)	Internal procurement (000 m.tons)	National availability (000 m.tons)	Per capita availability	
								Kg/ year	Ounce per day
1	2	3	4=3-2	5	6	7	8=2+5+6-7	9	10
1994-95	16270	19702	3432	1013	1573	277	18579	161.00	15.09
1995-96	17150	20033	2883	850	1795	422	19373	165.50	15.47
1996-97	18303	20364	2061	237	1392	616	19316	157.20	15.18
1997-98	18598	20696	2098	1149	1621	616	20752	166.00	16.04
1998-99	19632	21027	1395	3200	2273	781	24324	188.30	18.19
1999-00	22416	21358	-1058	1234	1900	967	24583	190.60	18.42
2000-01	24082	21694	-2388	1063	1774	1088	25831	197.20	19.02
2001-02	23315	22020	-1295	1289	1460	1053	25011	188.10	18.18
2002-03	24025	22351	-1674	2966	1435	952	27474	203.50	19.66
2003-04	24698	22700	-1998	2483	975	843	27313	199.36	19.27
2004-05	23520	13032	- 488	2980	1367	899	26968	194.01	18.75
2005-06	24541	23364	- 1177	2264	1245	945	27105	192.23	18.60

Note: Aggregate consumption requirement is based on average per capita requirement of 16 ounces per day for the mid year population.

Source: BBS and unpublished data from FPMU, Ministry of Food, GoB.

TABLE II
SHARE OF FOODGRAIN IMPORT IN THE TOTAL AVAILABILITY

Year	Public import			Private import	Total import	Import as % of total availability
	Aid	Commercial	Total			
1994-95	935	620	1555	1013	2568	13.82
1995-96	743	841	1584	850	2434	12.56
1996-97	618	112	730	237	967	5.02
1997-98	549	249	798	1149	1947	9.38
1998-99	1235	777	2012	3200	5212	21.42
1999-‘00	870	0	870	1234	2104	8.56
2000-01	492	0	492	1063	1555	6.02
2001-02	511	0	511	1289	1800	7.20
2002-03	254	0	254	2966	3220	11.72
2003-04	289	29	318	2480	2798	10.24
2004-05	290	101	391	2980	3371	12.50
2005-06	194	103	297	2264	2561	9.50

Source: FPMU: Database on Food Situation, MoFDM, Dhaka.

Hossain and Shahabuddin (1999) showed a projection of total requirement of major food items under alternative development scenarios. The “business as usual (BAU)” scenario assumed a growth rate of national income at 4.5 per cent, while a growth rate of 6.5 per cent was assumed under “accelerated growth” scenario. According to the projections, Bangladesh would require about 35 million tons of foodgrains in the year 2020 under both BAU and accelerated growth scenarios. Should Bangladesh meet this consumption requirement through domestic production, this would have to be done under conditions of declining availability of two crucial resources such as land and water. However, it is believed that substantial improvement can be achieved by minimising the “yield gap” which is estimated at around 1 ton of rice per hectare. The production performance of foodgrains over the recent past years suggests that Bangladesh would be able to attain this target of foodgrain production.

However, there are prospects of Bangladesh’s crop agriculture being turned into a diversified one with increased production of high-value non-rice crops, both for domestic market and exports. Such phenomena would inevitably replace some rice land by non-rice crops. Thus the future strategy of food production in Bangladesh will have to be designed to achieve the goal of increased production of both rice and non-rice crops with lesser availability of land, water and other

resources. This will require enhanced thrust in the generation and dissemination of high yielding technologies of rice and non-rice crops.

II.2 Access to Food

It has been evident that increased domestic production supplemented by imports and overall food management contributed to relatively adequate availability of food at national level over the recent past years. However, as has been mentioned, the fundamental spirit of food security is to ensure availability and consumption of food at individual level. The overall productivity of the producers may be low or their income levels may be insufficient to enable them to purchase the necessary foods from the market at the ruling prices. Households may also lack the necessary asset or access to credit to overcome the periods of hardship. They may also remain outside the food assistance programmes that would provide them with cash or kind income to supplement their food acquisition capacity.

Poverty Profiles and Access to Food

Food security at household level is closely linked with poverty. These poverty and food security problems are massive, with approximately 40 per cent of the population lacking the resources to acquire enough food and consequently remaining below the poverty line. Table III shows the incidence of poverty from 1991-92 to 2005, as measured by the cost of basic need (CBN) method. The two levels of poverty measures used in the CBN method are "upper poverty line" and "lower poverty line." The incidence of poverty falling under both upper and lower poverty line decreased from 1991-92 to 2005. Both rural and urban poverty decreased during the period. Using the upper poverty line, the incidence of poverty at national level was estimated at 56.6 per cent in 1991-92 and 40.0 per cent in 2005. This represented a 16.6 percentage points decline during the period. On the other hand, using the lower poverty line, the incidence of national poverty decreased from 41.0 40 per cent in 1991-92 to 25.1 40 per cent in 2005, representing a reduction of 15.9 percentage points during the period.

Regional Differences in the Incidence of Poverty

The HIES 2005 showed poverty profile of the country disaggregated by six divisions of the country. Table IV shows the incidence of poverty for six administrative divisions with rural-urban break down for 2000 and 2005. The estimates of the head count rate using the upper poverty line showed that in 2005 Barisal division had the highest incidence of poverty, estimated at 52.0 per cent, followed by Rajshahi (51.2 per cent) and Khulna (45.7 per cent). On the other hand, Dhaka Division had the lowest incidence poverty at 32.0 per cent.

TABLE III
HEAD COUNT RATE OF INCIDENCE OF POVERTY, 1991-92 TO 2005 (CBN METHOD)

Residence	Upper poverty line				Lower poverty line			
	2005	2000	95-96	91-92	2005	2000	95-96	91-92
National	40.0	48.9	50.1	56.6	25.1	34.3	35.1	41.0
Rural	43.8	52.3	54.5	58.7	28.6	37.9	39.4	43.7
Urban	28.4	35.2	27.8	42.7	14.6	20.0	13.7	23.6

Source: BBS (2007a).

The lower poverty line estimates for 2005 showed that Chittagong division had the lowest incidence of poverty of 16.1 per cent, followed by Dhaka and Sylhet divisions with poverty levels of 19.9 per cent and 20.8 per cent respectively. The striking feature was the remarkably lower urban poverty of Chittagong and Dhaka, estimated at 8.1 per cent and 9.6 per cent respectively. This may be attributed to higher income earning opportunities and higher incidence of government and non-government interventions with various safety net programmes in these two metropolitan city areas.

The relatively higher incidence of poverty in the Rajshahi region apparently contradicts with the fact that Rajshahi is the highest surplus producer of foodgrains in the country. However, the production pattern in the region is characterised by concentration of production in the hands of relatively small number of large land holders whose surplus products are channeled out of the area through internal trade. This situation corroborates the importance of demand side consideration in the determination of food security.

Consumption Pattern of Food and Nutrients

Consumption of food and nutrients is the real indicator of access to food by different socioeconomic groups of people. A picture of consumption of all foods, as obtained from the successive household income and expenditure surveys, is presented in Table V. It appears that per capita daily consumption of all foods increased from 1991-92 to 2005 for rural, urban and all households. However, per capita consumption for the year 2000 was lower compared to the consumption for the preceding and succeeding survey years both for rural and urban and for all households.

TABLE IV
REGIONAL INCIDENCE OF POVERTY AS MEASURED BY CBN METHOD

Region/ Division	Per cent of population below poverty line					
	2005			2000		
	National	Rural	Urban	National	Rural	Urban
Upper poverty line						
Barisal	52.0	54.1	40.4	53.1	55.1	32.0
Chittagong	34.0	36.0	27.8	45.7	46.3	44.2
Dhaka	32.0	39.0	20.2	46.7	55.9	28.2
Khulna	45.7	46.5	43.2	45.1	46.4	38.5
Rajshahi	51.2	52.3	45.2	56.7	58.5	44.5
Sylhet	33.8	36.1	18.6	42.4	41.9	49.6
Bangladesh	**40.0**	**43.8**	**28.4**	**48.9**	**52.3**	**35.2**
Lower poverty line						
Barisal	35.6	37.2	26.4	34.7	35.9	21.7
Chittagong	16.1	18.7	8.1	27.5	30.1	17.1
Dhaka	19.9	26.1	9.6	34.5	43.6	15.8
Khulna	31.6	32.7	27.8	32.3	34.0	23.0
Rajshahi	34.5	35.6	28.4	42.7	43.9	34.5
Sylhet	20.8	22.3	11.0	26.7	26.1	35.2
Bangladesh	**25.1**	**28.6**	**14.6**	**34.3**	**37.9**	**20.0**

Source: BBS (2007a).

TABLE V
PER CAPITA DAILY FOOD INTAKE (GRAMS) IN DIFFERENT SURVEY YEARS

Year	Per capita food intake (gram)		
	National	Rural	Urban
2005	948	946	952
2000	893	899	871
1995-96	914	911	931
1991-92	886	878	938

Source: BBS (2007a).

The pattern of intake of calorie and protein for rural, urban and all households is presented in Table VI. It is important to note that per capita calorie consumption slightly decreased from 1991-92 to 2005 for rural, urban and all households. Per capita protein consumption, however, remained constant during the period also for all categories of households. It is important to note that the levels of per capita

calorie and protein consumption were well above the absolute poverty line calorie (2122 kcals) and recommended level of protein (58 grams) intakes respectively.

TABLE VI
PER CAPITA CALORIE AND PROTEIN INTAKES OF HOUSEHOLDS IN DIFFERENT SURVEY YEARS

Survey Year	Calorie intake (Kcal/cap/day)			Protein intake (gram/cap/day)		
	National	Rural	Urban	National	Rural	Urban
2005	2239	2253	2194	63	62	65
2000	2240	2263	2150	63	62	65
1995-96	2244	2251	2209	65	64	68
1991-92	2266	2267	2258	63	62	65

Source: BBS (2007a).

Against this relatively comfortable level of average consumption, there exists a serious disparity in food intake for the disaggregated classes of people. Table VII shows per capita daily food intakes of selected monthly household expenditure groups of households as obtained from the Household Income and Expenditure Survey 2005. Per capita daily food consumption of the lowest expenditure group was about half the consumption of the highest expenditure group for rural, urban and all households of the country. The disparity was more pronounced for urban than for rural households, with lowest expenditure group of urban households consuming as low as 622 grams compared to 1,403 grams consumed by the highest expenditure group. Assuming that food consumption is directly proportional to calorie consumption, the upper expenditure groups of households were consuming excessive calorie compared to the physiological norm of calorie intake.

TABLE VII
PER CAPITA DAILY FOOD INTAKE BY MONTHLY HOUSEHOLD EXPENDITURE GROUPS OF HOUSEHOLDS

Monthly household expenditure group (Tk.)	Per capita food intake (gram)		
	National	Rural	Urban
Less than 750	727	744	622
1500 – 9999	791	796	760
10,000 – 12999	1198	1249	1094
Above 20000	1432	1478	1403

Source: BBS (2007a).

Compositional Changes in Food Consumption

As has been observed in Tables V and VI, although total food consumption increased from 1991-92 to 2005, total calorie intake slightly decreased during the period for all classes of households. This phenomenon may be attributed to compositional changes in food consumption. This may have taken place in the form of substitution of less calorie-intensive for more calorie-intensive foods. Table VIII shows that per capita consumption of cereal foods dominated by rice decreased for rural, urban and all households during the period. On the other hand, consumption of potato, vegetables, milk/milk- products, edible oil, meat and fish increased during the period. Figure 1 shows that while total food consumption increased, consumption of rice decreased from 1991-92 to 2005.

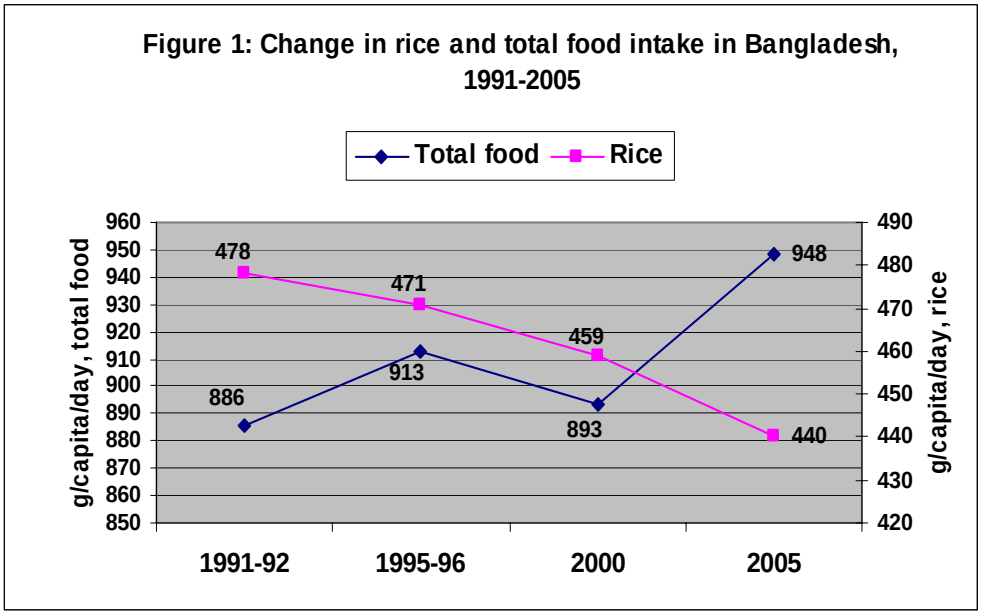
II.3 Utilisation of Food

Improving availability of and access to food are necessary but not sufficient conditions to ensure that people will be secured of food for leading an active and healthy life. In recent times there has been increasing concern over utilisation of food which is governed by a number of factors such as peoples' food preference, general health condition and the overall environment under which food is prepared and consumed. All these factors have an impact on the absorption of food and the consequent nutritional status of people.

TABLE VIII
PER CAPITA FOOD INTAKE BY FOOD ITEMS AND RESIDENCE

Food items	Per capita daily intake (grams)					
	2005			2000		
	National	Rural	Urban	National	Rural	Urban
Cereals	469.2	485.6	419.3	486.7	502.8	422.4
Rice	439.6	459.7	378.5	458.5	478.8	377.7
Potato	63.3	61.9	67.5	55.0	54.7	58.4
Vegetables	157.0	156.5	158.7	140.5	140.1	137.9
Pulses	14.2	12.7	18.6	15.6	15.0	19.0
Milk/milk prod.	32.4	31.0	36.6	29.7	29.0	32.6
Edible oil	16.5	14.3	22.9	12.8	11.3	19.1
Meat, egg	20.8	17.6	30.7	18.5	15.4	31.0
Fish	42.1	39.7	49.6	38.5	37.8	40.9
Spices, candy	53.4	50.2	63.1	50.0	48.5	56.1
Fruits	32.5	32.4	32.9	28.4	26.5	35.6
Sugar/gur	8.1	7.5	9.7	6.9	6.4	8.8
Miscellaneous	38.2	36.9	42.5	10.0	10.2	8.9
Total	947.7	946.3	952.1	893.1	898.7	870.7

Source: BBS (2007a).



Source: Data from the Household Income and Expenditure Survey 2000 and 2005.

Consumption of different levels and composition of food satisfies instant and apparent hunger and meets physical, social and psychogenic needs. A more important objective of food consumption is to improve and/or maintain nutritional status. A relatively greater volume of food may mean lower level of nutrition, while the same volume consumed by different persons may yield varying levels of nutrition depending on what composition of food people eat, given their status of health and sanitation, and other physical and socioeconomic environment.

Food preference plays an important role in the determination of nutritional outcome of food intake. Food items generally have two types of characteristics: objective and subjective. Nutrient content of food is generally considered as objective characteristics. Subjective characteristics comprise a wide range of aspects such as taste, size, shape, volume, color, aroma etc. The social value attached to consumption also falls within the range of subjective characteristics.

If, for the same quantity of food (containing the same amount of nutrient), some people pay more than others, the former group would be considered to have preferred subjective as opposed to objective characteristics of food. Such preferences are reflected through "quality" or "prices-paid" elasticity which represents the difference between "expenditure-income elasticity" and

"quantity-income elasticity." This "quality elasticity" generally reflects peoples' preference for subjective characteristics of a commodity. Empirical evidence from India (Shah 1983) and Bangladesh (Talukder and Quilkey 1991) revealed that in choosing broad range of food items people, even the low-income ones, showed substantial degree of preference for quality, and thereby paid more for the subjective characteristics of food.

This behaviour has implications for food security in that food and income transfer programmes are generally designed to improve nutritional status of the poor people. But if people, out of their preference for quality or subjective characteristics, pay more for the same quantity or buy less for the same money, the phenomenon leads to leakage of some kind from programme point of view. From consumers' point of view, it leads to lesser nutritional welfare and hence lesser food security.

Apart from food preference, improper processing and cooking, lack of proper sanitation and incidence of parasitic and other diseases may seriously affect utilisation of whatever food people acquire through their entitlement. Dietary imbalance and unavailability of micro-nutrients are also among the major factors responsible for poor nutritional outcomes. High consumption of cereals, but low intake of edible oils, vegetable and fish may result in low level of absorption of micro-nutrients and high level of anemia and other deficiencies. As for anemia, for example, an average woman of 55 kg has 50 per cent probability of developing iron deficiency if she gets less than 25 mg and 25 per cent probability if she gets less than 32 mg iron per day. Since the average intake is between 24 and 30 mg per day, it is not surprising that between 32 and 62 per cent of all non-pregnant women are anemic (Ninno and Dorosh 1998). All these aspects of food intake pattern represent a kind of food insecurity.

III. FOOD SELF-SUFFICIENCY: CONCEPTUAL ISSUES

Food self-sufficiency is defined in a number of ways. One notion of self-sufficiency is the situation of autarky in which all imports and exports are ruled out and the market-determined demand is met from domestic production. The other notion of self-sufficiency implies a level of production which meets not only the market-related effective demand, but also the nutritional requirement of the population. Again, while some notions of food self-sufficiency imply self-sufficiency of foodgrains, others relate to self-sufficiency of all or broad range of food items. Yet another notion, which can be related to the last one, implies "food self-reliance" in which food imports such as wheat can be paid for by producing and exporting other high-value agricultural commodities (Clay *et al*. 1989).

The last interpretation of self-sufficiency may be important for more than one reasons. First, in spite of significant progress in foodgrain production over the past two decades, long run prospect of foodgrain production does not look very promising, particularly because of land and water constraints. In fact, in the long run Bangladesh may enjoy greater comparative advantage in the production of high-value exportable crops rather than rice and wheat. Second, future pattern of demand for food in Bangladesh will change with rising incomes and increasing urbanisation. This is likely to act as a stimulus to the intensified production of non-cereal foods such as livestock, fish, fruits and vegetables. However, with the emerging rise of food prices in the global context, attaining self-sufficiency in the production of staple food such as rice would deserve special consideration in the specific context of Bangladesh.

Some Alternative Notions of Self-sufficiency

Several notions of self-sufficiency, particularly in respect of production of foodgrains, are outlined here. In Figure 2, D and S represent domestic demand and supply curves respectively. In relation to world price Pw, quantity demanded is Q_3 and quantity produced and supplied domestically is Q_1, such that Q_3-Q_1 quantity is imported. If the policy goal is to reach a situation of autarky where no import and export is permitted, quantity demanded and supplied reaches Q_2 as indicated by the intersection of the demand and supply curves at point e. This quantity corresponds to the domestic equilibrium price P_d. Such a policy would reduce aggregate consumption by Q_3-Q_2, and would aggravate the undernutrition situation in the country.

An important issue is to determine the level of aggregate consumption requirement consistent with the nutritional norm of food intake. If it is assumed that Q_2 level of food intake is consistent with nutritional norm, the self-sufficiency policy would call for increase of domestic production upto Q_2 by shifting the supply curve to S_1 as shown in Fig 3. This new supply curve intersects the original demand curve at point e which ensures domestic production and consumption of Q_2 quantity of grains.

Figure 4 presents a situation where aggregate consumption requirement corresponding to a stipulated nutritional norm of food intake is less than what would have been demanded under free trade at the world price. In relation to the original supply and demand curves, total quantity supplied and demanded at the world price are Q_1 and Q_3 respectively. The stipulated consumption requirement is Q_2 which is produced and supplied domestically as indicated by intersection of the new supply curve S_1 with the original demand curve D at point e.

Figure 5 depicts a situation in which aggregate consumption requirement corresponding to the stipulated nutritional norm exceeds quantity demanded at the world price. In relation to the original supply and demand curves, quantity supplied and demanded at the world price are Q_1 and Q_2 respectively. The stipulated consumption requirement is Q_3 which is produced domestically by shifting the supply curve to S_1. This self-sufficiency level production is obtained through intersection of the new supply curve with the original demand curve at point e, corresponding to the domestic equilibrium price P_d.

The situations depicted above are based on certain assumptions about the demand curve, nature of shift of the supply curve and behaviour of the world price. These variables may change over time and across circumstances. The demand curve may shift due to changes in income, population, and tastes and preferences of consumers. The world price may vary due to changes in global trade environment. The nature and extent of supply shift may also be different due to changes in weather and other technical factors. The point made here is that a stipulated consumption requirement is met through domestic production under varying trade and price regimes.

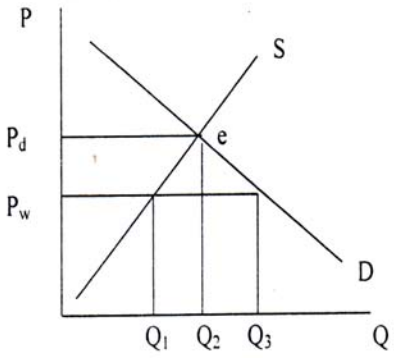


Fig 2 n Market-determined quantity to be consumed consul and produced domestically fall short of short (quantity demanded at the world price price

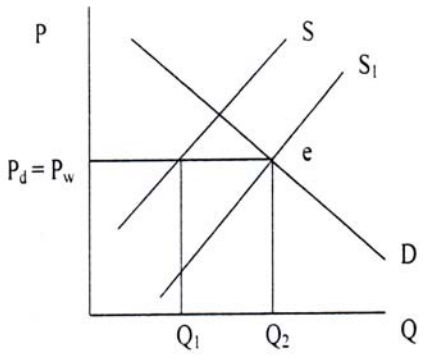


Fig 3 St ity to be consumed and pr tically coincides with quantity demand at the world price

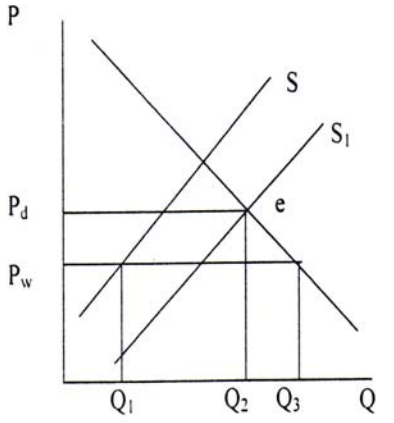
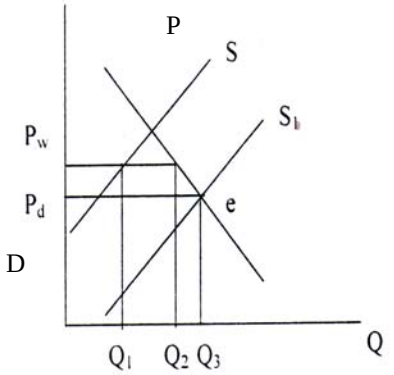


Fig 4 ılated quantity to be consumed and produced domestically fall short of quantity demanded at the world price.



D D

Fig 4. Stip **Fig 5** y to be consumed and p nestically exceed quantity demanded at the world price

In Bangladesh, food self-sufficiency is generally understood as attaining domestic production up to the level of some administratively determined average per capita consumption requirement (16 ounces or 454 grams of foodgrains per day). Whether or not this requirement corresponds to the nutritional norm is a complex issue involving judgment on cut-off point of nutritional requirement and dietary composition.

IV. NUTRITIONAL NORMS OF FOOD INTAKE AND ANALYSIS OF FOOD AND NUTRITION GAP

IV.1 Complexities Associated with Determination of Nutritional Norm

Determination of energy requirement for human body is one of the most complex and controversial issues in the nutritional literature. Energy requirements not only vary according to age, sex, body size/weight, activity levels and climatic conditions, there are also complexities involving inter- and intra-individual variations in requirement. Most of the current debates center round the notion of a fixed requirement as a cut-off point for measuring the level of undernutrition and poverty.

A large body of literature suggests that energy requirement of persons of the same age, sex, body weight and activity level is not a fixed number, and even the requirement of the same person maintaining the same body weight and activity level varies from day to day. Sukhatme and Margen (1982) stated that the energy balance of a person maintaining the same body weight and performing the same level of activity is a stationary stochastic process with mean zero. Human body possesses some physiological autoregulatory mechanism for controlling appetite and energy expenditure so that variations in intake within certain homeostatic limits are automatically adjusted through variations in the efficiency of utilisation of the energy intake. Bennett and Gurin (1982) also argued that the energy balance of human body is regulated by an internal control system rather than by conscious management of food intake. This implies that defining undernutrition in terms of food intake falling below a corresponding fixed energy requirement is not very appropriate.

Calorie Intake Norms for Bangladesh

Several sources estimated per capita calorie requirement in Bangladesh following the FAO/WHO guidelines. The Institute of Nutrition and Food Science (INFS) of Dhaka University, in its Nutrition Survey Report of 1981-82 (Ahmad and Hassan 1983), estimated per capita calorie requirement of 2273 kcals per day for all age, sex and activity levels, apparently for the rural people of Bangladesh. Knudsen and Scandizzo (1982) estimated average per capita per day calorie

requirement of 2020 kcals for Bangladesh. Chen (1975), however, using quite rigorous methodology to account for climate, activity level, pregnancy and lactation allowances, calculated energy requirement of only 1589 kcals per capita per day. The Bangladesh Bureau of Statistics (BBS), in its Household Income and Expenditure Survey Reports of 1995-96, 2000 and 2005 constructed two poverty lines—absolute poverty line and hardcore poverty line - correspondent to two levels of calorie intake: 2122 kcals and 1805 kcals respectively per capita per day. The INFS, in its Nutrition Survey Report of 1995-96, calculated energy requirement of 2039 kcals per capita per day for the average people of all age, sex and locations of Bangladesh (Jahan and Hossain 1998). Thus there are considerable variations in the estimates of requirement, and one would require some kind of value judgment in selecting a particular level of requirement.

Foodgrain Requirement Corresponding to Calorie Intake Norms

One of the important uses of calorie intake norm is to determine per capita and hence national food requirement and set the target of food self-sufficiency consistent with nutritional norm. In view of the overwhelming weight of foodgrains in the overall diet of the people, the national food requirement in Bangladesh is conventionally identified with total foodgrain requirement. With a given per capita calorie requirement, corresponding per capita and hence national foodgrain requirement can be determined by deriving total foodgrain calories from total calorie intake and then converting the derived foodgrain calories into foodgrain quantities (rice and wheat), after accounting for due proportions of each in the foodgrain calories.

A series of estimates of per capita and hence national foodgrain requirement corresponding to alternative levels of per capita calorie requirement are presented in Table IX. As is evident from the table, estimates of national foodgrain requirement of 21.95 million metric tons corresponding to per capita calorie requirement of 2039 kcals set by INFS almost coincides with the foodgrain requirement norm of 16 ounces per day, as used by the national planning authority in Bangladesh. This level of calorie intake is also consistent with the calorie intake norm used by Knudsen and Scandizzo for Bangladesh. Also, calorie intake of 2039 kcals compares fairly well with calorie intake norms of other developing countries such as India, Pakistan, Indonesia and Sri Lanka (Knudsen and Scandizzo 1982).

TABLE IX
PER CAPITA AND NATIONAL FOODGRAIN REQUIREMENT CORRESPONDING TO ALTERNATIVE LEVELS OF CALORIE REQUIREMENT

Source of calorie estimate	Per capita daily calorie requirement (kcals)	Per capita daily foodgrain requirement (ounces)	National foodgrain requirement for 2000-2001 (000 metric tons)
BBS 1998:			
Absolute poverty line calorie	2,122	16.8	22,856
Hardcore poverty line calorie	1,805	14.4	19,461
INFS 1998 (Jahan and Hossain 1998)	2,039	16.2	21,945

Note: National foodgrain requirement for 2000-2001 has been estimated using mid-year population of 131 million for the year.

Source: Own calculations using data from BBS (1998), Jahan and Hossain (1998) and other sources.

If per capita calorie requirement is set at 1805 or 2039 kcals or somewhere between the two and foodgrain requirement corresponding to each are taken as the requirement or consumption consistent with the nutritional norm, then the available evidence indicates that the prevailing average level of consumption is almost consistent with the nutritional norm of requirement.

IV.2 Food Gap

A picture of domestic production, requirement in relation to varying levels of nutritional norms and the corresponding food gaps over the past 10 years, is presented in Table X. Assuming per capita foodgrain requirement of 2,122 kcal as the nutritional norm, Bangladesh remained substantially food-deficit upto 1998-99, marginally food-deficit in 1999-2000, marginally food-surplus upto 2003-04 and again marginally food deficit upto 2005-06. With calorie requirement of 2,039 kcal as the norm, Bangladesh remained substantially food-deficit upto 1997-98, marginally food-deficit in 1998-99 and continued to remain marginally food surplus from 1999-2000. Food requirement corresponding to calorie requirement of 1805 kcal revealed Bangladesh to be marginally food-deficit upto 1995-96, marginally food surplus in the next three succeeding years and substantially food surplus from 1999-2000.

Thus on the basis of the selected alternative calorie requirement norms, Bangladesh became and continued to remain self-sufficient in foodgrain production from the year 2000-2001.

TABLE X
DOMESTIC PRODUCTION, REQUIREMENT AND FOOD GAP IN RELATION TO ALTERNATIVE CALORIE INTAKE NORMS IN BANGLADESH

Year	Gross domestic production (000 m.t.)	Net production (000 m.t.)	Requirement (000 m.t.) corresponding to			Food gap (000 m.t.) corresponding to		
			2,122 kcals	2,039 kcals	1,805 kcals	2,122 kcals	2,039 kcals	1,805 kcals
1994-95	18,078	16,270	20,762	19,980	17,678	4,492	3,710	1,408
1995-96	19,056	17,150	21,110	20,315	17,975	3,960	3 ,165	825
1996-97	20,337	18,303	21,460	20,652	18,272	3,157	2,359	-31
1997-98	20,664	18,598	21,809	20,987	18,569	3,211	2,389	-29
1998-99	21,813	19,632	22,158	21,323	18,866	2,526	1,619	-766
1999-00	24,907	22,416	22,507	21,659	19,164	91	-757	-3,252
2000-01	26,758	24,082	22,856	21,945	19,461	-1,226	-2,137	-4,627
2001-02	25,906	23,315	23,205	22,331	19,758	-110	-984	-3,557
2002-03	26,995	24,025	23,553	22,667	20,055	-472	-1,358	-3,970
2003-04	27,442	24,698	23,902	23,002	20,552	-796	-1,696	-4,146
2004-05	26,133	23,520	24,251	23,338	20,649	731	- 182	- 2,871
2005-06	27,268	24,541	24,600	23,674	20,946	55	- 867	- 3,595

Source: Own estimate using data from BBS, Jahan and Hossain (1998) and other sources.

It should, however, be mentioned that the outcomes are based on certain assumptions about the proportion of foodgrain-calorie in the total calorie intake. In the present exercise, this proportion has been assumed to be 78 per cent which was the actual proportion revealed from the Household Expenditure Survey 1995-96. If, with further change in consumption pattern, the proportion of foodgrain-calorie in the total calorie intake declines, total foodgrain requirement corresponding to all levels of calorie requirement will also decline. Such changing pattern, other factors not changing unusually, is likely to reduce the gap between requirement and production of foodgrains in the country and thereby enhance the status of self-sufficiency in the production of foodgrains. However, as has been shown before, in spite of the surplus status, Bangladesh imports about 2.0 million tons of foodgrains annually. Assuming that the "production" and "population" estimates are correct, the paradox reflects that people, on an average, consume more foodgrains than what is required from nutritional point of view.

IV.3 Nutrition Gap

Although the average per capita calorie intake remains above the calorie intake norm as identified in the paper, a large segment of population of the country remain calorie-deficient and hence undernourished even in relation to the low per capita calorie requirement of 1805 kcals per day. If total foodgrain requirement corresponding to a calorie intake norm is determined for the calorie-deficient group of people and their aggregate actual consumption is deducted from the aggregate requirement, the magnitude will represent the extent of nutrition gap. Thus nutrition gap may be defined as the aggregate shortfall in consumption of the undernourished from the aggregate requirement with respect to a given nutritional norm.

In Figure 3, dDm and sSm are the aggregate market demand and Supply curves respectively for foodgrain (rice, for example). Intersection of these two curves at point E indicates the equilibrium price P_0 at which total quantity transacted is Q_0. However, at this level of aggregate consumption some people will be unable to fulfill the minimum nutritional requirement of food from the market source. If it is assumed that at a very low price people can sufficiently meet their nutritional requirement of food from the market source and at high prices the difference between nutritionally consistent demand for food and market determined consumption of food widens, the situation can be explained with the help of a social demand curve.

In the figure, dDs represents the social demand curve which indicates that at a very low price P_s, people can buy nutritionally adequate food Q_s from the market source such that the difference between market and social demand disappears, as indicated by point e on the dDm/dDs curve. As the price goes up, the difference between quantity demanded according to market demand and quantity required to maintain some defined nutritional standard widens.

Let us assume that aggregate consumption of Q_r quantity is consistent with nutritional requirement of food. This quantity corresponds to point K on the social demand curve dDs, corresponding to price P_0. According to market demand, total quantity consumed at P_0 price is Q_0 which corresponds to point E on the marked demand curve dDm.

Thus quantity $Q_0Q_r = (OQ_r\text{-}OQ_0)$ is the nutrition gap which represents the aggregate difference between requirement and consumption of the undernourished. Assuming that the remaining population are adequately nourished, the magnitude also represents the aggregate difference between consumption and requirement of the whole population. If the additional consumption is to be financed by a price subsidy, then in relation to the market demand, the price is to be reduced from OP_0

to OP_r. The cost to the treasury of increasing consumption from OQ_0 to OQ_r by reducing price from OP_0 to OP_r is represented by the area EFJK.

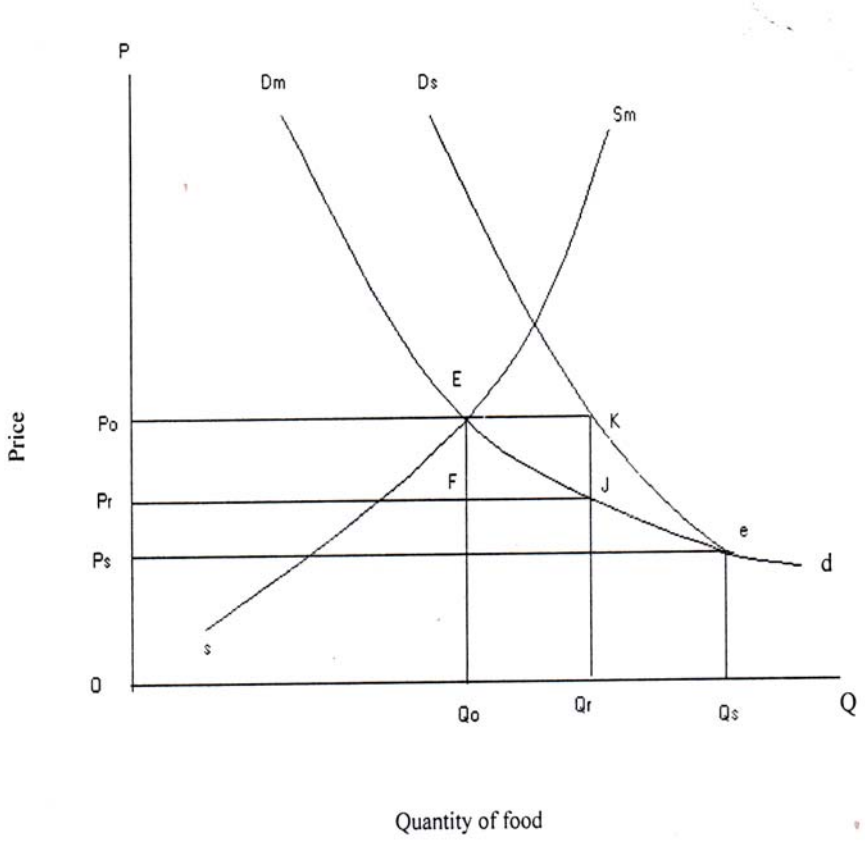


Figure 5. Market Demand, Social Demand and Nutrition Gap.

The magnitude of nutrition gap was estimated for the year 2005-06 with foodgrain as the commodity. The total quantity of foodgrain represented the sum of rice and wheat quantities. The price of foodgrain was taken as the weighted average of rice and wheat prices.

Estimation of nutrition gap required information on requirement of foodgrain corresponding to alternative nutritional norms and actual consumption of foodgrain by the undernourished population. The actual per capita consumption of the undernourished was taken from the 1985-86 Household Expenditure Survey which reported per capita consumption of foodgrain of the undernourished to be 400 grams per day. The HIES of 2005 reported that 40.0 per cent and 19.5 per cent people were poor corresponding to per capita daily calorie requirement of 2,122 kcals and 1,805 kcals respectively. These proportions were used for determining nutrition gap corresponding to calorie requirements of 2,122 kcals and 1,805 kcals for the year 2005-06. For determining nutrition gap corresponding to calorie requirement of 2,039 kcals, it was assumed that 35 per cent people of the country fell below calorie intake of 2039 kcals/cap/day.

The magnitudes of nutrition gap corresponding to the alternative levels of calorie requirement for the year 2005-06 are presented in Table XI. In terms of foodgrain, nutrition gap corresponding to calorie requirement of 2,122 kcals was 1.58 million tons for which the money value was Tk. 24,743 million. Nutrition gap corresponding to calorie requirement of 2,039 kcals was estimated at 1.08 million tons of foodgrains for which the money value was Tk. 16,850 million. Nutrition gap corresponding to calorie requirement of 1,805 kcals was, however, not of substantial magnitude, and was estimated at 0.07 million tons of foodgrains valued at Tk. 1,145 million in 2005-06. Thus total calorie shortfall of the undernourished population with respect to intake of 1,805 kcals was of marginal magnitude.[5]

TABLE XI
NUTRITION GAPS CORRESPONDING TO ALTERNATIVE LEVELS OF CALORIE REQUIREMENT (2005-06)

Measuring criteria	Nutrition gap corresponding to calorie requirement of		
	2122 kcals	2039 kcals	1805 kcals
Foodgrain (000 mt)	1578	1081	73
Taka (million)	24743	16950	1145

Note: The Taka magnitude of nutrition gap was calculated by multiplying the quantity of foodgrain by the annual weighted average price of course rice and wheat.

[5] In arriving at such conclusion it should be mentioned that in estimating nutrition gaps, consumption of the undernourished was assumed to be 400 grams of foodgrains. To the extent that actual consumption of the undernourished fell below 400 grams of foodgrains, the nutrition gaps for the reference groups of population may have been underestimated.

IV.4 Food Intervention Programmes and Minimisation of Nutrition Gap

Elimination of nutrition gap through food intervention measures is obviously a difficult task. Bangladesh, since its inception in 1971, inherited a Public Food Distribution System (PFDS), designed to improve food consumption of the poor and undernourished population. The system has since then undergone lot of changes. An important dimension of change has been the linking of the food assistance programmes with development activities involving training and credit, and building of infrastructures which could improve lives of the whole communities. Thus food assistance could be used not only for meeting the instant food need of the poor, but for making an impact on alleviation of poverty in the medium and long run.

The government intervenes in a number of ways to relieve the nutritional stress of the poor people. Through its open market sale (OMS) operations, the government attempts to depress seasonal price likes, thereby relieving consumer stress in the lean seasons. The major targeted food programmes include Food for Work (FFW), Vulnerable Group Development (VGD), Vulnerable Group Feeding (VGF) and Rural Maintenance Programme (RMP). Some of these programmes allow consumers to purchase foodgrains at subsidised prices, some deliver commodities free and others deliver cash either free or for work. The cost of running the programmes and the benefits received by the target households depend to a large extent on the methods in which the programmes are implemented.

An earlier study by Ahmed *et al.* (1994) showed that among the prevailing programmes RMP was most cost-effective in delivering income to the vulnerable households. Being the "cash for work" programme, it did not entail any commodity handling and delivered 1 Taka income to the target households at a cost of Taka 1.2. The ration channels, which operated with high rate of system leakage and involved high cost of commodity handling, required as high as Taka 6.6 to transfer Taka 1 to target beneficiaries. The FFW, like the ration channel, involved commodity handling; but because of relatively lower system leakage, it required Taka 1.8 to Taka 2.4 to deliver Taka 1 to the targeted households. The potential programmes such as "food stamp" and "cash transfer" also appeared to be good performers, requiring Taka 1.7 and Taka 1.3 respectively to deliver 1 Taka benefit to the target households.

The preliminary findings of a recent study, also by Ahmed *et al*. (2007), provided evidence of varying types of impacts of a number of innovative programmes such as Income Generating VGD (IGVGD), Food Security VGD (FSVGD), Food for Asset creation (FFA) and RMP. The study assessed the operational performance of transfer delivery, impacts of programme participation

on food security, livelihood and gender-related outcomes, and cost-effectiveness of transfers. The results showed that participation in IGVGD, FSVGD, FFA and RMP raised per capita per day calorie consumption by 45, 66, 23 and 35 kcals respectively for every 1 Taka transfer to the households. The programme transfers also reduced extreme poverty by 20 per cent points for IGVGD, 30 per cent points for FSVGD, 15 percentage points for FFA and 16 percentage points for RMP participant households. As regards cost-effectiveness, the results showed that the full costs of increasing monthly household income by 100 Taka per programme beneficiary were Taka 53 for IGVGD, Taka 47 for FSVGD, Taka 272 for FFA and Taka 99 for RMP. Thus the FSVGD, which is a combination of food and cash transfer, performed better in all aspects than the other programmes.

These results would provide useful guidelines in prioritising programmes. However, it needs to be mentioned that the programmes reviewed above are the specialised programmes run mostly by the donor agencies. While the results would provide useful guidelines for designing public food distribution programmes, fresh assessment also needs to be made of the prevailing public food distribution programmes such as VGD, VGF and other food- and cash-based programmes being contemplated to be introduced.

In designing public food programmes, the development impacts of the programmes need to be weighted properly. From food consumption and nutritional point of view, food distribution would be preferred because payment in the form of food is likely to contribute directly to consumption of food and nutrient, while cash payment would contribute to food/nutrient consumption through marginal propensity to consume food. One can also argue that payment in food does not necessarily ensure food consumption as the recipients may resort to the practice of arbitrage and thereby obtain cash through resale of grains. There is also the question of food preference related to cash transfer as people, even of the low-income strata, are found to substitute high-cost for low-cost sources of calorie in purchasing food out of their incremental income.

Thus minimisation of nutrition gap through cost-effective means is a complex job which needs to address the issues of proper identification of beneficiary groups, methods of handling grains, leakage of various kinds, valuation of benefits, peoples' food preference and the related considerations. All these aspects need to be incorporated in the integrated analysis for designing programmes to improve food security in the country.

V. CONCLUSIONS AND POLICY IMPLICATIONS

Total and per capita availability foodgrains increased in Bangladesh over the past years and the country could be considered to have remained in moderately

comfortable position in terms of per capita and hence total food intake. However, distribution of intake suggests that 40 per cent of people cannot fulfill their minimum requirement of food and hence remain poor. Moreover, per capita intake of all foods of the lowest expenditure group remained almost half the intake of the highest expenditure group.

According to the prevailing notion of requirement, Bangladesh has remained marginally surplus producer of foodgrains over the past years. This status is also suggested by the nutritional norm of food intake. However, actual consumption/use exceeds net domestic production, indicating a deficit status as reflected by the levels of import. This situation calls for pursuing a number of alternative courses of policy options. One is to rationalise the existing level of consumption and prepare national food budgets by assuming the apparent level of consumption as the requirement. The other is to revise the population and production statistics, and also the per capita requirement figures for arriving at different production/supply-utilisation balance. All available nutritional indicators suggest that Bangladeshi people should consume lasser foodgrains than what they consume now. While serious motivational efforts would be required to induce people to consume lesser foodgrains, congenial production and market environment would also have to be ensured to induce people to diversify production and consumption of non-rice foods.

It has been revealed that substantial nutrition gap exists with respect to requirement of foodgrains corresponding to absolute and hardcore poverty line criteria. Various government and non-government efforts are under way to minimise the gap between requirement and consumption of food of the undernourished population. Although the government distributes about 1.5 million tons of foodgrains annually through different channels, distribution through targeted channels is not adequate to meet the needs of the poor. Both government and non-government efforts should be strengthened to undertake more food and cash based programmes to enhance food security in the country. Design and implementation of programmes need to take into consideration the criteria for selection of the undernourished, size of the undernourished population and selection of cost-effective means in the implementation of the programmes. More researches need to be undertaken for quantifying the magnitude of nutrition gap and devising cost-effective means for elimination of the gap.

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