Determination of Food Availability and Consumption Patterns and Setting up of Nutritional Standard in Bangladesh

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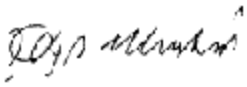

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Executive Summary

The genesis of this study originates in policy concerns raised in discussions between the Government of Bangladesh represented by the Ministry of Food, and food and nutrition experts drawn from academia, NGOs and development partners.

Consumption

The core focus of the study is on consumption and calorie-food intake with the objective of determining calorie-nutrient needs of a dynamically changing population in the context of rapid growth. A key objective of this study was to estimate these requirements in a methodologically sound manner to derive nutritional standards for a diverse and rapidly urbanizing population.

The findings with regard to consumption intakes and requirements appear dramatic:

- Around 67 percent of the people are engaged in light and below light activity – this is also reflected in the labour force survey figures which show that around 65 percent of the population are not economically active (housewives and students).
- Bangladeshis are on the average energy deficient. Children below 10 years of age (both boys and girls) and men age ≥ 10 years are more deficient in energy than women.
- Individuals involved in more than vigorous activity are more deficient in energy. Those who are involved in light activity are on average surplus in energy intake while the others who are involved in moderate to vigorous activity are deficient in energy.
- Diets are mostly cereal-based and on average 74-76 percent of the total calorie intake is still derived from cereals. Animal food contribution to total calorie is very low.

Average calorie intake was found to be low at 1894 kcal derived from 684 gm of food consumed. This compares with estimated requirements based on PAL and desired body weights at just under 2200 kcal. The intake estimates are likely to have been affected by floods and seasonality.

Food Supply Issues

Bangladesh has done well with regard to food production, especially rice production. With the exception of vegetables, most other crops have suffered a set-back, raising serious concerns about dietary balance and malnutrition. On the positive side, fish, meat and poultry products have expanded rapidly, but not at a rate that was fast enough to make these more affordable to the poor. Currently the Ministry of Food assumes a per capita per day cereal target of 16 oz., which many consider inflated. Nor does this make sense from a purely nutritional perspective where cereal based calories should not be more than say 55-60 percent (unlike 74-76 percent reported in this study).

Despite the high per capita per day norm used in estimating food needs of the country, a healthy surplus is regularly posted, even without taking into account food imports by both the public and private sector. This ‘surplus’ has not been able to stem the food-price led inflation witnessed in recent years. It is likely that arithmetic and economic accounting of supply-demand/ needs are not intrinsically compatible, calling into question the whole approach of food accounting frameworks that are in vogue.

Rice production estimates appear to be reliable suggesting that the crop-cutting method used by BBS is accurate in estimating gross production. There are however, serious problems with production estimates of the minor crops.

A figure of 5-7 percent is suggested to account for seed, feed and wastage for rice. It was not possible to validate data on non-rice food crops or foods from animal sources; nor was it possible to suggest a SFW figure for these items.

Projected supply of rice and wheat for 2015 was estimated at 31 million MT. Supply projections for other food items have also been provided.

The Demand Side

Bangladesh has been experiencing rapid GDP growth and rising average incomes which has pushed up the demand for food. Given the higher income elasticity of non-cereal foods compared to e.g. rice, the demand for items like fish, meat, milk and eggs are likely to rise more rapidly. Thus, if the growth rate is sustained, the medium term demand for food may look very different than what it is today, with major shifts away from cereals. The nature of the growth process and the degree to which it is inclusive will have a major impact on the nature and magnitude of future food demand.

An econometric model to explore food demand has been developed and tested using HIES 2005. For necessities such as, rice, vegetables, edible oil, and spices, income effects tend to be small. However, for most other commodities these are significant. Estimates of high income elasticity found for most food items suggest that policies that lead to higher income levels among different income groups would foster higher levels of consumption for these commodities. High income elasticity implies that spiralling of prices of most of the food items would severely hurt the consumers.

It appears that wheat is no longer an inferior good; it has high price responsiveness both in the rural and urban areas.

The estimates of cross-price elasticity indicate strong substitution effects, implying that public intervention in the market for one food item may lead to considerable impact on markets for other food items, which may adversely affect allocative efficiency in markets for some foods.

Finding an accurate scenario of the dynamics of demand for food items is rather difficult as future demand pattern hinges on tastes, prices, and income. We projected demand for 2010, 2015 and 2020 by taking into account only changes in income. This may introduce some bias in our estimates but this is not expected to be substantial.

Demand for foodgrains is expected to reach 37.55 million MT with rice 35.35 million mt and wheat 2.20 million MT under the low income growth scenario, rising to 40.22 million MT under the high growth income scenario, in 2015. This clearly suggests a significant supply-demand gap in 2015 for cereal foods, although these figures are likely to err very much on the high side.

Access to Food

Major changes are taking place in both rural and urban Bangladesh that are likely to have profound implications for access: Crop agriculture is being replaced by non-farm activities; tenant farms are increasing dramatically; migration out of the countryside is taking place on an unprecedented scale; gender ratios are changing and a demographic transition is almost on us as the bottom of the population pyramid consisting of children are now coming of age and entering into the labour market.

Food security indicators developed show that 7 percent of households face acute distress with regard to food access on a regular basis while up to 30 percent suffer such conditions ‘sometimes’ – marking them out as potentially highly vulnerable. In addition some indicators portray a situation of chronic under-consumption and worries about food access suffered by 12-15 percent of households regularly with up to 30 percent having to confront the problem ‘sometimes’.

In terms of factors determining access, factors that are usually held up as being important include income, government transfers, assistance from NGOs or friends, credit, remittance flows and employment. Another dimension is related to weather or market shocks that disrupt normal livelihoods and incomes or production, leading to loss of access to food.

A core set of basic variables have been identified that have a clear bearing on access: rice price, income, rural-urban location and 'division'. A number of others have also been identified that may have a bearing (but requires further exploration), including remittances (both domestic and foreign), safety nets and land-holding (including tenancy).

Perceptions and Knowledge

A concerted approach to improve awareness among men, especially with regard to the importance of adequate nutrition for pregnant and lactating women, and children, is likely to be very useful.

Seasonality, natural disasters and high price of agricultural products and lack of direct market access has contributed to the vulnerability of the farmers. For the non-farming households, land ownership, lack of industrial or permanent jobs, dependence on low-skilled irregular self-employment, and price hike of food items have put huge pressure on their financial ability to afford nutritious food for their families.

Food consumption trends are similar among women of different regions. Women in all groups including pregnant, lactating, teenage and adult women experience poverty and hunger harder than their male counterparts. This observation from the FGD is not fully corroborated by the findings from Chapter 4, where male calorie deficits (despite a larger share of consumption) were found to be higher. The two types of findings are not really contradictory but will need to be carefully interpreted and assessed.

Women are well aware of their nutritional needs and that of their male earning members, children and the elderly. But they nevertheless remain the most vulnerable, especially during and after pregnancy. The safety net programs like VGD/VGF/widow allowances, which aim to feed the poorest and the most vulnerable do not appear to have been very useful. Thus, the major policy focus here must be to carefully identify and target these groups at risk with an appropriate programme of nutritional interventions.

Future Outlook

The food situation in Bangladesh today is deeply worrying. Although recent trends in agricultural growth rates have been satisfactory, inflationary pressures have plagued the sector resulting from unstable global markets and domestic fertilizer and power crises. In addition, the anti-corruption campaign of the government, the floods of 2007 and the impact of cyclone SIDR has compounded the crisis by causing risk perceptions to be heightened and thus, leading to a quiet panic in food markets. Under the circumstances, the short-term outlook from the point of view of food consumption and nutrition is expected to be difficult. In the longer term, food demand is expected to rise at a faster rate than domestic production, so that by 2015 the country would need to be able to procure a lot of food – largely through imports rather than aid. Given trends in world food, feed and energy markets the implications of a much larger import bill for food should give us some pause. It is important therefore to initiate urgent strategies to raise agricultural growth rates and increase export earnings/remittances, if the looming challenge is to be met successfully.

CHAPTER 1

Introduction and Methodology

1.0 Introduction

The genesis of this study originates in concerns raised in discussions between the Government of Bangladesh represented by the Ministry of Food, and food and nutrition experts drawn from academia, NGOs and donor agencies like the WFP. The study therefore is clearly embedded in policy concerns that have been clearly articulated, leading to the design of a TOR that has proved to be complex, bold and challenging.

Consumption

The core focus of the study is on consumption and calorie-food intake with the objective of determining calorie-nutrient needs of a dynamically changing population in the context of rapid growth. While poverty and malnutrition levels in Bangladesh are acute, there is a dearth of good quality information about calorie-nutrient intake requirements, and *inter-alia*, about critical variables like Physical Activity Levels (PAL) and BMR or Basic Metabolic Rate, suitably disaggregated by age-sex or occupations (Yusuf and Islam, 2005). Thus, a key objective of this study is to estimate these requirements in a methodologically sound manner so that the results can be used to derive nutritional standards for our diverse and rapidly urbanizing population that is entering into a new demographic transition. A related objective is to clearly establish critical benchmarks that would need to be systematically addressed to close the food-nutrition gap in order to nurture the emergence of a healthy population with commensurate height-weight configurations, over the next two decades (Chapter 4).

The nutritional status of the Bangladeshi population is deemed to be poor with around 30 percent of the population undernourished, 40 percent of children under 5 being stunted or underweight, and another 15 percent experiencing wasting resulting in high rates of child and infant mortality (CMNS 2005). Thus, the costs of hunger and malnutrition are high in terms of reduced productivity, foregone incomes, premature death and disability, and poor intellectual development (Anriquez, et al 2005). It is thus imperative that the government explicitly set a nutrition standard for the country with a view to attaining population norms related to desirable height and weight for the country as a whole and for special groups like children and lactating mothers.

The central theme of consumption and dietary energy requirements is complemented by examining a number of closely related issues: First, it re-examines the whole question of food supply, taking into account both cereal and non-cereal food, with a view to explore to what extent projected requirements are likely to be met from domestic availability. Secondly, the study focuses on demand (as opposed to requirements) to enable assessment of supply-demand-requirement discrepancies that are inherent in the Bangladesh context. This exercise will then help policy makers to adopt measures on the basis of a clear understanding of emerging realities in terms of market conditions on the one hand and in terms of the need to reach quantitative targets based on food-calorie-nutrient goals. Third, the question of access is raised in order to (a) establish the status of food insecurity in its many dimensions, and (b) to identify factors that promote food access. The final component of the study relates to knowledge, attitude and practices, especially of the more vulnerable segments of the population. Some of these issues are taken up for further discussion below.

Food Supply Issues

Bangladesh has done well with regard to food production, especially rice production. Excellent growth rates have been achieved, mainly through irrigation and modern rice varieties cultivated in the *boro* season.[1] However, most other crops have suffered a set-back, including wheat, pulses and oilseeds. With the exception of vegetables, non-rice crops have fared badly in recent years, raising serious concerns about dietary balance and malnutrition. On the positive side, fish, meat and poultry products have expanded rapidly, but not at a rate that was fast enough to make these more affordable to the poor (Shahabuddin, Q. (2003); Hossain, M. (2001)).

The obsession with rice and cereals is evident amongst policy makers in Bangladesh. There also seems to be an implicit desire to raise per capita calorie benchmarks (and thus cereal intake recommendations) to levels that would seem to be difficult to justify. Thus currently the Ministry of Food assumes a per capita per day cereal target of 16 oz., a figure that many consider inflated.[2] Nor does this seem to make sense from a purely nutritional perspective where cereal based calories should not be more than say 55-60 percent (unlike 76-80 percent that is typical in the Bangladeshi diet – see Yusuf and Islam, 2005 and chapter 4 of this study).

It is also noteworthy that despite the high per capita per day norm used in estimating food needs of the country, a healthy surplus is regularly posted, even without taking into account food imports by both the public and private sector. This seems to sit at odds with high food prices and the food-price led inflation that has been witnessed in recent months and years. It is likely that arithmetic and economic accounting of supply-demand/ needs are not intrinsically compatible, calling into question the whole approach of food accounting frameworks that are in vogue. It is difficult to see how such accounting can actually aid in effective policy-making.

Another gaping failure of the market relates to the supply of safe, bio-secure foods. However, there are enormous problems of monitoring, enforcement and incentives that make it difficult for these to be addressed. Institutional design is of key importance, and a strategy of encouraging market evolution in a way that solves these basic problems is needed. There is a view that such a process is already underway (through the rise of supermarkets and massive wholesale-retail operations seen in some poor countries). In a country like Bangladesh this would generate more inequality and also result in a trade-off with food security, at least in the short and medium term (Murshid, K.A.S., 2006)

Prospects for the future of agriculture look mixed: easily accessible sources of growth have become exhausted; future growth will increasingly have to be underpinned by a more sophisticated system of research-management and knowledge inputs into agriculture. While there is much reference to the "productivity gap" (difference between farm yields and experimental plots), closing this gap will require very concerted efforts and appropriate incentives. The good news is that such incentives may be forthcoming as global trends in food prices seem to be poised to escalate at unprecedented speed. Given the outward orientation of Bangladesh agriculture, farmers are likely to be rewarded. The problem is that the vast majority of the poor who produce little or no food, and are heavily dependent on the market, may find that their entitlements are eroding quickly. Such a scenario is already unfolding on the international stage, signaling perhaps a paradigmatic shift in the global, and therefore the national food regimes of countries like Bangladesh – a development that policy makers and researchers need to watch very carefully.

Adopting a somewhat longer-term approach, the problem of global warming and its implications for food supply, food security, poverty and malnutrition also needs to be underlined. It has become increasingly

[1] The *boro* season begins around November-December and ends in May-June.

[2] There appear to be moves afoot to raise this amount to 17 oz. because of the apparent disconnect between "sufficient' food available and high market prices signaling shortages.

clear that the reality of global warming is already upon us, and an integrated, appropriately sequenced strategy to deal with its multi-level effects and repercussions need to be designed. An assessment of the impact on Bangladesh's agriculture would be a good way to start.

Supply side issues are examined in Chapter 2.

The Demand Side

Demand side issues have become increasingly important in the context of not only trends in the world food economy (and rising prices) but also because of rapid growth in GDP, changing demographic patterns, and rising personal incomes and tastes. Bangladesh has been experiencing rapid GDP growth and rising average incomes which has pushed up the demand for food. Given the higher income elasticity of non-cereal foods compared to e.g. rice, the demand for items like fish, meat, milk and eggs are likely to rise more rapidly. Thus, if the growth rate is sustained, the medium term demand for food may look very different than what it is today, with major shifts away from cereals. The underlying, unstated concern here is with inequality and poverty: if the incomes of the poor rises only sluggishly, their corresponding demand for higher quality, more nutritious food will falter as they try to optimize on low-cost, cereal-based calories. Thus the nature of the growth process and the degree to which it is inclusive will have a major impact on the nature and magnitude of future food demand (Shahabuddin, Q. and Zohir, S. 1995).

An econometric model to explore food demand has been developed and tested using HIES 2005 (Chapter 3).

Access to Food

Access issues are important for policy and there is a need to explore this from a number of perspectives. These include variables at the individual and household level, and those at the community level. Thus skill, education, age-sex etc. are important variables to be considered along with assets, land, tenancy conditions, incomes and health status. At the community-level safety nets, social networks, infrastructure, credit, remittances and location could be important determinants of access, further mediated by agro-ecological conditions faced.

Major changes are taking place in both rural and urban Bangladesh that are likely to have profound implications for access: Crop agriculture is being replaced by non-farm activities; tenant farms are increasing dramatically; migration out of the countryside is taking place on an unprecedented scale; gender ratios are changing and a demographic transition is almost on us as the bottom of the population pyramid consisting of children are now coming of age and entering into the labour market (Hossain, M. 2007).

The question of food security status and access are addressed in Chapter 5.

Consumption Preferences and KAP

Food consumption is also mediated by habit, tradition and indigenous knowledge. Some of this knowledge is likely to be positive while certain habits or traditions may militate against good practice. It is therefore important to know what kind of 'knowledge, attitude, practices' are prevalent in Bangladesh with regard to food intake, and whether there are strong differences in KAP across regions, age-groups, gender or socio-economic strata. The moot question here is whether KAP is a constraint to healthy food habits or consumption. This is the focus of Chapter 6.

Utilization

It is usually important to refer to the problem of utilization of food in discussions of food security. This is clearly very important although not very well understood. Very few studies seem to have addressed this

problem head-on, and what is known appear to be anecdotal or conjectural. The present study is no exception and can be flawed for ignoring this important dimension of food security. A proper study however would be needed, designed specifically with the objective of clinically determining utilization rates and patterns in the population. It would seem to require medical-clinical expertise rather than expertise in the social sciences to address this research question.

2.0 Methodology

Given the diverse focus of the study, each component had to be treated differently in terms of the methodological approach adopted. These are discussed in detail separately in the relevant chapter. Treatment of supply and demand was generally based on secondary data, mainly from the various rounds of the HES.

Supply Side

Alternative data sources were compiled to attempt to validate BBS production data for different food crops as well as to cross-check assumptions with regard to seed-feed-wastage. This was combined with evidence generated from interviews of farmers, traders and millers in locations across Bangladesh. While much of the data used was secondary, some primary data on production, yield and seed-feed-wastage was also available from the BIDS-Maxwell 2007 survey conducted under this study.

An attempt was also made to forecast different crop-food items using simple linear prediction methods to estimate production for 2015.

Demand Side

Past studies have tended to rely on the use of the 'seemingly unrelated regression' (SUR) procedure to estimate demand due to several reasons (see chapter 3). This study uses the Linear Approximation of the Almost Ideal Demand System (LA/AIDS) model by Deaton and Muellbauer (1980a, b) as it has enjoyed great popularity in applied demand analysis. The projection estimates are based on income elasticities ignoring price elasticities, and are therefore expected to err on the high side, and may thus be treated as an upper limit of food demand in the terminal periods.

Dietary Energy Intake and Requirements

Reliable estimates of DEI and DER are rare in Bangladesh. An attempt was made to generate the appropriate data that would enable estimation of these. As such, field surveys across Bangladesh were conducted to monitor consumption through actual measurement, to obtain height-weight data of all members of selected households, and observe PAL over a 24 hour period. Two separate surveys were conducted: a survey of 1200 households chosen randomly from urban and rural areas (from a total of 60 wards/*mouzas*) using HES 2005 as the sample frame, for measuring consumption and PAL through recall. A sub-set of 120 households (from 12 *mouzas* or wards) were derived at random from this set (10 percent) for food-intake measurements using actual weighing methods and monitoring of PAL of all members through direct observation. A total of around 400 observations were obtained from the 120 households – a number that is deemed to be 'adequate'. (List of selected wards and *mouzas* is appended).

Consumption Patterns and Preferences

The study made use of qualitative methods to capture knowledge, attitude and practices (KAP) affecting food choices and preferences, and in turn impacting on nutritional status of individuals and households. It was also important to able to understand knowledge flow-dynamics with regard to food and nutrition, and alternative crisis coping mechanisms in play. Focus Group Discussions (FGDs) were employed to assess

these dynamics, focusing in particular at vulnerable groups such as pregnant and lactating women. The geographical coverage, spanning all divisions, ensured that a wide-range of socio-economic factors have been taken into account.

Annex Tables

Table 1A.1: List of Sample Mouzas: Weighment Method

Sl. #	Upazila	Union	Mouza	RMO
1	Sadar	Charaikhola	Kismat Charaikhola	1
2	Mithapukur	Emadpur	Faridpur	1
3	Sadar	Ward-6	Chelopara	2
4	Jibon Nagar	Jibon Nagar	Umapur	1
5	Lohagara	Noagram	Kalagachhi	1
6	Khalishpur	Ward-7	Uttar Khalishpur	2
7	Sadar	Rmkantapur	Bethulia	1
8	Kalihati	Balla	Kamanna	1
9	Sadar	Ward-4	Majdair (Part A)	2
10	Sadar	Ward-2	Purba Medda	2
11	Chatkhil	Ramnarayanpur	Sobahanpur	1
12	Sadar	Pathali Machhua	Pathali Machhuakhal	1

Table 1A.2: FGD Locations

Districts	Group	Area	Location
Rangpur	Adult women	Gangachara	Kuthipara, Madhay Gangachara
	Pregnant women	Gangachara	Kuthipara, Madhay Gangachara
	Lactating women	Gangachara	Kuthipara, Madhay Gangachara
	Unmarried Teenagers	Gangachara	Kuthipara, Madhay Gangachara
	Married Teenagers	Gangachara	Kuthipara, Madhay Gangachara
	Non-Farmers	Gangachara	Kuthipara, Madhay Gangachara
	Farmers	Gangachara	Kuthipara, Madhay Gangachara
Kustia	Adult women	Kustia Sadar/ Kumarkhali	Sewriya, Chapra
	Pregnant women	Kustia Sadar/ Kumarkhali	Sewriya, Chapra Ward-1
	Unmarried Teenagers	Kustia Sadar/ Kumarkhali	Sewriya, Chapra
	Married Teenagers	Kustia Sadar/Kumarkhali	Sewriya, Chapra
	Lactating women	Kustia Sadar/ Kumarkhali	Sewriya, Chapra
	Non-farmers	Kustia Sadar/ Kumarkhali	Sewriya, Chapra Ward-1
	Farmers	Kustia Sadar	Dustopara, Jagoti, Khajanagar
Tangail	Adult women	Delduar	Pathrail
	Pregnant women	Delduar	Pathrail
	Unmarried Teenagers	Delduar	Pathrail
	Married Teenagers	Delduar	Pathrail
	Lactating women	Delduar	Pathrail
	Non-farmers/ Tatis	Delduar	Pathrail bazar

Districts	Group	Area	Location
Sylhet	Adult women	Srimongol	Sahahjahanpur, Shib bari, Ashidul
	Lactating women	Srimongol	Sahahjahanpur, Shib bari, Ashidul
	Pregnant women	Srimongol	Songowana, Ashidul
	Unmarried Teenagers	Srimongol	Sahahjahanpur, Shib bari, Ashidul
	Married Teenager	Srimongol	Finlay tea garden, Kahiar Char
	Adult women Garden Workers	Srimongol	Finlay tea garden, Kahiar Char
	Male Non-farmer/ tea garden workers	Srimongol	Finlay tea garden, Kahiar Char
	Farmers	Srimongol	Shib bari, Ashidul
Cox's Bazar	Adult women	Cox's Bazar sadar,	Kolatoli , Municiple area, Ward-no-3
	Lactating women	Cox's Bazar sadar,	Jhilonjha
	Pregnant women	Cox's Bazar sadar,	Kolatoli , Municiple area, Ward-no-3
	Unmarried Teenagers	Cox's Bazar sadar,	Muhuripara, Ringroad,
	Married Teenagers	Cox's Bazar sadar,	Saikat para
	Non farmer men/ Fisherman	Cox's Bazar sadar,	Saikat para
	Women fishling collectors	Cox's Bazar sadar,	Saikat para
Narayanganj	Adult women	Rupganj	Noapara, jamdani BISIC area
	Pregnant women	Araihajar	Jhaugara
	Lactating women	Rupganj	Noapara, jamdani BISIC area

Table 1B: List of Sample Mouzas: Recall Method

Sl. #	District	Upazila	Union	Mouza	RMO
1	Panchagar	Boda	Benghari Banagram	Dabarbhanga	1
2	Rangpur	Badarganj	Ramnathpur	Dakshin Ramnathpur	1
3	do	Kawnia	Kawnia Balapara	Harishwar	1
4	Kurigram	Sadar	Bhogdanga	Madhabram	1
5	Gaibandha	Sadullapur	Faridpur	Nayanpur	1
6	do	Sadar	Ward-1	David Co. Para	2
7	Bogra	Kahalu	Jamgaon	Jamgaon	1
8	Joypurhat	Sadar	Ward-5	Purba Debipur	2
9	Naogaon	Manda	Tentulia	Tentulia	1
10	Nawabganj	Sadar	Ward-3	Gabtala	2
11	Natore	Sadar	Ward-8	Tebaria	2
12	Pabna	Sadar	Sadar	Ataikolala	1
13	Kushtia	Sadar	Ward-8	Paschim Aruapara	2
14	Meherpur	Gangni	Shaharbati	Bhamradaha	1
15	do	do	Dhanikhola	Joginda	1
16	Jessore	Jhikargachha	Gadkhali	Barbakpur	1
17	Narail	Sadar	Ward-4	Aladatpur	2
18	Khulna	Rupsa	Sreefaltala	Badhal	1
19	Bagerhat	Kachua	Raripara	Bhandarkola	1
20	Pirojpur	Mathbaria	Tikikata	Sener Tikikata	1
21	Barguna	Patharghata	Charduani	Tafalbaria	1
22	Jhalokathi	Sadar	Ward-6	Basanda	2
23	Patuakhali	Sadar	Ward-7	Power House	2
24	do	Bauphal	Daspara	Bahir Daspara	1
25	Barisal*	Agoiljhara	Gaila	Gaila	1
26	Sariatpur	Zanzia	Naodoba	Paschim Naodoba	1
27	Faridppur	Char Bhadrasan	Char Bhadrasan	Char Bhadrasan	1

Sl. #	District	Upazila	Union	Mouza	RMO
1	Cox's Bazar	Sadar	Ward-9	Baharchhara Forest	2
2	Chittagong	Patiya	Ward-9	Uttar Gobindarakhi	2
3	Rangamati	Sadar	Ward-4	ADC Colony	2
4	Feni	Sadar	Fazilpur	Purba Shibpur	1
5	Chandpur	Faridganj	Dakshin Rupsha	Char Mandail	1
6	do	Haziganj	Uttar Rajargaon	Rajargaon	1
7	do	Matlab	Uttar Nayargaon	Kachiara	1
8	Brahmanbaria*	Sharil	-	Bhunshar	1
9	Moulvibazar	Sreemangal	Ashidron	Sungail	1
10	Sylhet	Sadar	Ward-7	Jalalabad	2
11	Hobigonj	Madhobpur		kalikapur	1
12	do*	chunarghat	Bhimkhali	Noagaon	1
13	Kishoreganj	Bhairab	Ward-3	Panchabati with FL	2
14	do	Tarail	Damiha	Hasla	1
15	Mymensingh	Sadar	Ward-17	Baghmara	1
16	Sherpur	Sadar	Char Sherpur	Cher Sherpur	2
17	Jamalpur	Melandaha	Ward-8	Molikadahdhngha	2
18	do*	Sadar	Shorippur	Mirjapur	1
19	Gazipur	Sadar	Mirzapur	Baroipara	1
20	Narsingdi	Sadar	Ward-4	Madhya Kandapara	2
21	Narayanganj	Rupganj	Daudpur	Beldi	1
22	do	Sonargaon	Kanchpur	Kanchpur	1
23	Munshiganj	Sadar	Ward-1	Matpara	2
24	Dhaka	Savar	Dhamsana	Baipal	1
25	do	Dhamrai	Sutipara	Chhoto Kalampur	1
26	do	do	Gangutia	Nalai Bara	1
27	Khagrachhari	Panchhari	Panchhari	Pujgang	1

CHAPTER 2

The Food Supply Regime

2.0 Introduction

This chapter takes a fresh look at the food supply situation in Bangladesh. The question of supply is dependent on domestic production and net imports (including aid imports) and in addition draws attention to the notion of 'availability' for human consumption. Thus gross production plus imports would need to be adjusted for seed, feed and wastage to arrive at availability. There are misgivings about the Bangladesh Bureau of Statistics (BBS) practice of using a figure of 10 percent to convert gross production of cereals into net or available production. This question is reviewed here. The practice with regard to non-cereal food production estimates is also examined.

Another question that is discussed relates to the reliability of the BBS gross production data. Much of the discussion center around cereal production although production estimates of other (non-cereal) foods is perhaps even more problematic. This is also examined here. An attempt is then made to project production and availability levels of various food items/groups up to 2015.

2.1 The Food Supply Regime

Official food budget (actually cereal budget) figures show that in 2006-07 domestic production over requirement was in surplus by around a 1.1 million MT. Including imports, the volume of surplus reached 3.5 million tons (Table 3.1). Generally over the last ten years, domestic production surplus hovered around 1-2 million MT with overall surplus ranging from 3-4.5 million MT. This would appear to suggest a comfortable supply-availability situation, at least with respect to rice and wheat.

The estimates however depend on certain crucial assumptions. First, net production is derived after simply deducting 10 percent in order to adjust for 'seed, feed, wastage' (SFW). Requirements, on the other hand are computed on the assumption of 16 oz (453.6 gm) per capita per day multiplied by the total (estimated) population. The question of requirement has been addressed in Chapter 5. The question of SFW however, requires a closer look.

2.1.1 Seed, Feed, Wastage

The BBS uses the figure of 10 percent as SFW to adjust gross cereal production. No such rules of thumb exist for other food crops. A figure of 12.5 percent is used in India for rice, wheat and pulses in all Indian States (e.g. see Food Bulletin, March-April, 2005, DGCIS and FCI).

The first and only detailed study on SFW was carried out in 1991 (see UNICONSULT 1991) examining potential losses at each step of the way from the farm to the homestead, losses sustained in storage, and those involved in milling, transport and handling. The figure that was derived very painstakingly was a total SFW of 12 percent. However, this figure was never officially adopted by BBS.

Table 2.1: Food Budget for Bangladesh ('000 m. tons)

Items	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07
2. Mid-year population (Million):	129	131	133	135	137	139	141	143
3. Requirement(@16z./Capita/ Day)[1] (453.6 gm)	21357	21689	22020	22351	22683	23014	23345	23676
4. Gross Domestic Production	24907	26759	26906	26695	27443	26133	27265	27537
5. Net Domestic Production: (After 10 % deduction for seed, waste etc.)	22416	24083	24215	24026	24699	23520	24539	24783
6. Domestic Production Surplus	1059	2394	2195	1675	2016	506	1194	1107
7. Food grain Imports through Formal Sources								
Aided Imports	870	491	508	242	289	291	194	108
GOB Commercial Imports	0	0	0	0	29	102	103	121
Private Sector Imports	1234	1063	1289	2966	2481	2982	2265	2210
Total Imports	2104	1554	1797	3208	2798	3375	2562	2439
8. Net Requirement Surplus after Imports (Item 6+Item7)	3163	3948	3992	4883	4814	3881	3756	3546

Source: Ministry of Food and Disaster Management;
Note: 1: This figure has now been "updated" by FPMU at 17.2 oz. or 487.62 gm.

An attempt was made to re-examine this question in the following way: Data on SFW are available in the household expenditure surveys (HES) carried out by BBS periodically, providing an opportunity to derive independent estimates. Thus, estimates derived from HES 2000 and HES 2005 are examined. In addition, data on various aspects of agricultural production were generated on a sub-sample of HES 2005 – these data are used to derive SFW estimates for 2007 (Table 3.2). Generally, SFW reported in 2000 and 2005 vary for most crops with reported estimates tending to be somewhat higher in 2005. Thus, for all paddy, HES 2005 reports SFW at 3.2 percent while this is 2.5 percent in 2003. Much larger differences are noted for pulses and vegetables.

Table 2.2: Seed, Feed and Wastage

crop	sfw% (HES 2000)	sfw% (HES 05)	sfw% 2007
aus	-	4.05	8.16
wheat	3.06	5.93	10.2
potato	5.40	4.94	4.7
aman	-	3.40	6.19
boro	-	3.03	4.17
pulses	4.68	7.06	3.16
fruits	0.33	0.52	-
vegetables	1.17	5.64	4.7
oil seeds	3.42	3.56	15.2
spices	1.63	2.19	-
paddy	2.49	3.23	4.98
cereal		*3.26*	*5.26*

However, the estimates derived from the HES 2005 sub-sample in 2007 gives a somewhat different picture. Cereal/paddy SFW is significantly higher at around 5 percent, compared to HES 2005. For oilseeds, the difference is particularly striking (15.2 and 3.6 percent) while for pulses the trend is reversed (3.2 and 7.1 percent). This suggests that extreme caution needs to be used while using these figures. Apart from the cereal/paddy SFW estimates, estimates for other crops suffer from large standard errors reinforcing the caveat just noted.

Apart from losses/wastage suffered at the farm gate or in the paddy fields at harvest or during post-harvest operations, losses can occur at any point on the marketing chain. Thus, losses during storage need to be ascertained as well as losses during transport, handling and processing. Some insights on these aspects were derived from a series of FGD conducted with farmers, traders and millers (*chatal* owners).

Storage at the homestead level has declined in importance as people have now tended to move away from the earlier practice of buying foodgrains at harvest for storage for sale during the high-price (peak) period, discouraged by frequent government pronouncements against 'hoarders and stockists'. Surplus farmers, on the other hand have reported that storage losses are low due to a low incidence of pest attacks and infestation although weight losses do occur due to drying and shedding of moisture. Weather conditions also determine both the quality of the grain harvested and wastage. The general impression is however, that storage losses are low (and not something that farmers are particularly bothered with).

Losses during transport and handling (at least by truck) again is reported to be insignificant since during loading and unloading operations tarpaulin is spread out under the trucks and whatever is spilled over is easily gathered later on. In addition, milling technology has changed with ever more prevalence of automatic milling technology which results in higher conversion rates, reducing waste further. At the *chatal* level, as drying areas are *pucca*, there are usually no losses sustained, except in conditions where there is sudden rain or storm.

Another point that may be noted is that the larger share of *boro* has also lowered aggregate SFW rates as *boro* is less prone to climatic variations, excessive moisture content and drying constraints.

To conclude this sub-section, the following may be proposed: SFW rates of 10 percent used by BBS appear to be unjustified on the basis of the available evidence. A figure that is closer to 5 percent is much more likely. We would propose that BBS consider a figure of 5-7 percent for the purpose of estimating net cereal availability from domestic production. As for other crops, a clear figure did not emerge and it would not be prudent to adopt a figure without much greater scrutiny.

2.1.2 Production and Yields

Accuracy of BBS Food production data is frequently questioned. The methodology used by BBS to estimate paddy production is through crop-cutting exercises at harvest in a representative sample of plots taken from all over the country. While this method is superior to the 'eye-estimation' method used earlier (and which continues to be used for other crops even today) scepticism continues to be expressed about accuracy**.** Frequently, advice to 'correct' these estimates are handed out, usually by government officials who seem to be more concerned with levels or point-in-time estimates. Researchers are usually less bothered about 'correction', realising that such attempts will affect a point estimate (for better or worse) by a fixed margin of 'error' but will fail to correct for the variation in the series over time. Thus even if point estimates are over or under-estimated, if the series is able to capture the variation or fluctuations over time, then that would be a highly desirable characteristic to retain.

In this sub-section an attempt is made to assess the BBS production figures by (a) examining alternative estimates of yields per acre (especially provided by HES), and (b) re-assessing acreage estimates with available data from satellite imagery produced by SPARRSO and in the 2005 agriculture sample survey (BBS 2005).

Table 2.3: BBS (2003-04) and HES (05) Yield and Production Estimates Compared

crops	Yield/ac, kg (BBS)	Production, BBS (MT)	Yield/ac, HES '05 kg	Production HES (MT)
rice	979	26183355	967	25874497
wheat	790	1252940	629	998058
potato	5838	3905622	4370	2923329
pulses	320	332480	362	375748
fruits	3303	1770408	3262	1748644
vegetables	2565	1739070	3840	2603264
oil seeds	422	405120	399	383060
spices	913	607145	1353	899884

The yield figures in Table 3.3 indicate that generally BBS figures are higher than HES estimates for most crop items. Thus yields for rice, wheat, potato, fruits and oilseeds are 1.2, 25.6, 33.6, 1.2 and 5.8 percent higher in BBS data compared to HES estimates. For wheat and potato therefore, the discrepancy is large. For other crops like pulses, vegetable and spices, HES figures are significantly higher. Thus, the lesson to be learned from here is that the rice figures appear to be reliable suggesting that the crop-cutting method is accurate in estimating gross production. There are however, serious problems for the minor crops above compounded by the fact that it is difficult to tell from the available data very much about the nature of the bias (which could be positive or negative).

Table 2.4: Comparison of acreage of aman and boro between SPARRSO and BBS

Fiscal year	Calendar year	Acreage of Aman(Lakh acre)	
		SPARRSO	BBS
1999-2000	1999	141	140.98
2000-2001	2000	142.06	139.55
2001-2002	2001	143.45	139.55
2002-2003	2002	142.2	140.41
2003-2004	2003	145.39	140.3
2004-2005	2004	134.67	130.96
2005-2006	2005	131.34	133.43
2006-2007	2006	132.45	130.96
Fiscal year	Calendar year	Acreage of Boro(Lakh acre)	
		SPARRSO	BBS
1999-2000	2000	89.75	90.24
2000-2001	2001		93.19
2001-2002	2002	99.83	93.2
2002-2003	2003	98.35	95.01
2003-2004	2004	99.29	97.44
2004-2005	2005	106.87	101.31
2005-2006	2006	109.05	101.31
2006-2007	2007	104.77	108.72

Note: Bangladesh Space Research and Remote Sensing Organization (SPAFRRSO)

While HES data does indeed provide an independent estimate of crop yields, it is not able to say anything about acreage of different crops. Two independent sources were also consulted to see if the BBS crop acreage checks out, namely satellite imagery data available from SPARRSO and data from the recent Agricultural Sample Survey of Bangladesh, 2005.

It is gratifying to note that the BBS acreage figures for aman and boro paddy are well approximated by the (presumably more accurate SPARRSO) figures even if the Sample Survey figures appear to be on the low side. It would thus be quite safe to rely on BBS area figures to derive crop production estimates.

2.2 Food Availability in 2015

2.2.1 Cereals

Food availability depends on domestic production, imports and aid receipts. The climate with regard to food aid has changed drastically and food aid inflows are highly erratic and without any apparent trend. It would therefore be very difficult to forecast this quantity into the future. At best we can assume that the average food aid received over say the last five years will continue to be made available in the short to medium term.

Imports by the government and the private sector are much more responsive to market conditions, and given the instability witnessed in the global cereal/food market, and the predicted shortfall in world supplies, the demand for food is likely to rise slowly. An indication of demand conditions is provided separately elsewhere in this study.

The main component of availability is domestic production, and this is predicted below using simple forecasting techniques. For relatively short term forecasts (and in the absence of any rapid changes in knowledge or technology or innovation) such forecasts are likely to provide good estimates of the likely output in the terminal year (i.e. 2015).

Table 2.5: Changes in Rice and Foodgrain production and Yields (1984-90 to 2001-05)

	Rice ac	Rice prod	yield	foodgrains (Total, ac)	production	yield
Period	('000)	('000 mt)	(kg/ac)	('000)	('000 mt)	(kg/ac)
1984-85 to 1989-90	25590	15647	611	25618	16747	654
1990-91 to 1995-96	24970	17850	715	26521	19015	717
1996-97 to 2000-01	25576	21003	821	27542	22725	825
2001-02 to 2005-06	26250	25766	982	27846	26884	974

While area has remained virtually unaltered over the last 20 years yields increased from 654 kg/acre to 974 kg/acre, i.e. by almost 50 percent (Table 3.5). Thus production increased by around 60 percent (the balance being attributed to the area and inter-action effects). The forecast for the short and medium term for rice and wheat is explored below.

Rice and Wheat Forecasts

(1-a) Estimated equation of total rice production:

log(Tot_rice_prod)=1.15680+0.873946 *log(Tot_rice_prod(-1))

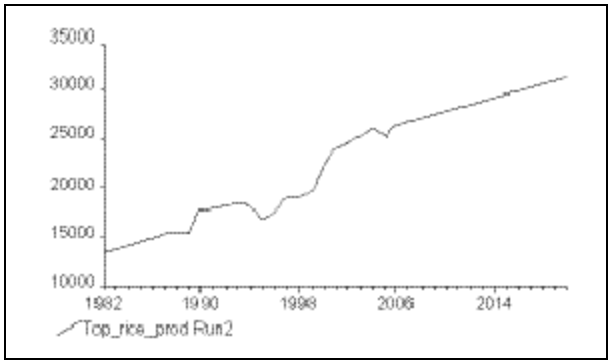
(t-ratio) (1.30) (9.00)

+0.0428928*log(time(1981));

(1.50)

R^2 =0.95

(1-b) Projection of total rice production up to 2020:



(1-c) Estimated equation of total rice production (Sub sample (1981-1993)):

log(Tot_rice_prod)=3.72231+0.601744*log(Tot_rice_prod(-1))

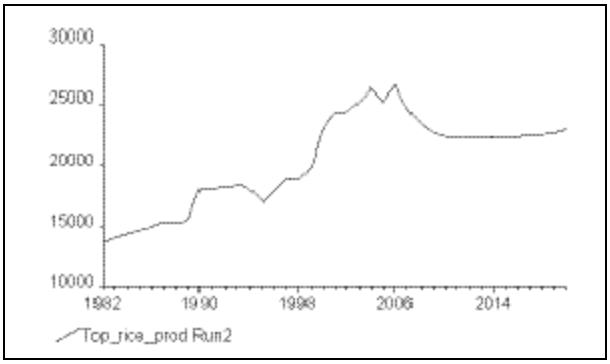
(t-ratio) (1.83) (2.77)

+0.0754001*log(time(1981));

(2.00)

R^2 =0.91

(1-d) Projection of total rice production up to 2020:



(1-e) Estimated equation of total rice production (Sub sample (1994-2006)):

log(Tot_rice_prod)=4.09007+0.453921*log(Tot_rice_prod(-1))

(t-ratio) (2.55) (2.21)

+0.461478*log(time(1981))

(2.79)

R^2 =0.94

(1-f) Projection of total rice production up to 2020:

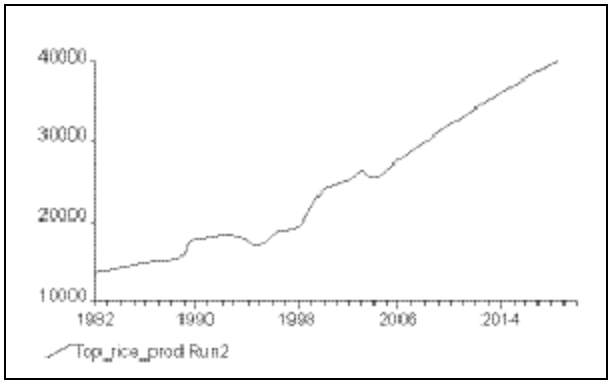
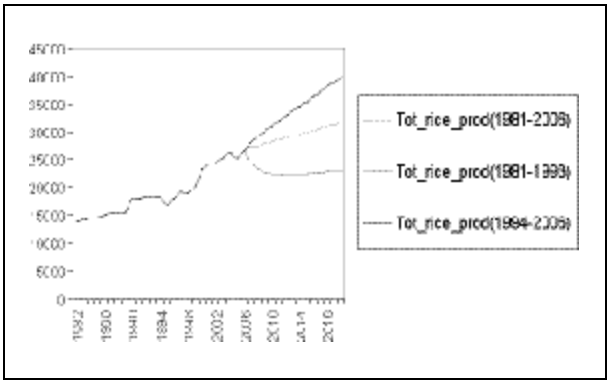
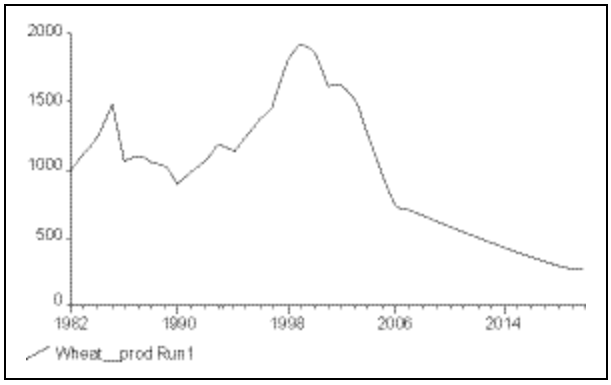


Figure: Simultaneous plot of three figures



(3-a) Estimated equation of wheat production:



log(wheat_prod)=1.01365*log(wheat_prod(-1))-0.0458339*log(time(1981))

(t-ratio) *(64.0)* *(-1.03)*

R^2 =0.66

(3-b) Projection of wheat production up to 2020:

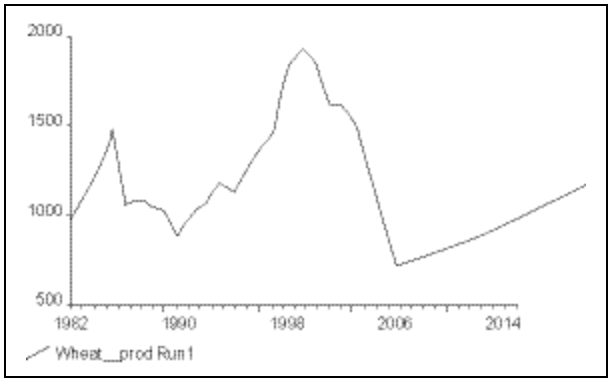
(3-c) Estimated equation of wheat production (Sub sample (1981-1993)):

log(wheat_prod)=0.996852*log(wheat_prod(-1))+0.0155085*log(time(1981))

(t-ratio) *(45.5)* *(0.199)*

R^2 = 0.89

(3-d) projection of wheat production up to 2020:



(3-e) Estimated equation of wheat production (Sub sample (1994-2006)):

log(wheat_prod)=1.22941*log(wheat_prod(-1))-0.57162*log(time(1981))

(t-ratio) *(22.793)* *(-4.353)*

R^2 =-0.27

(3-f) projection of wheat production up to 2020:

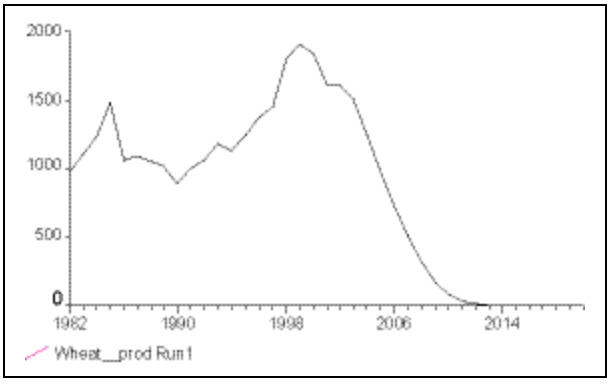
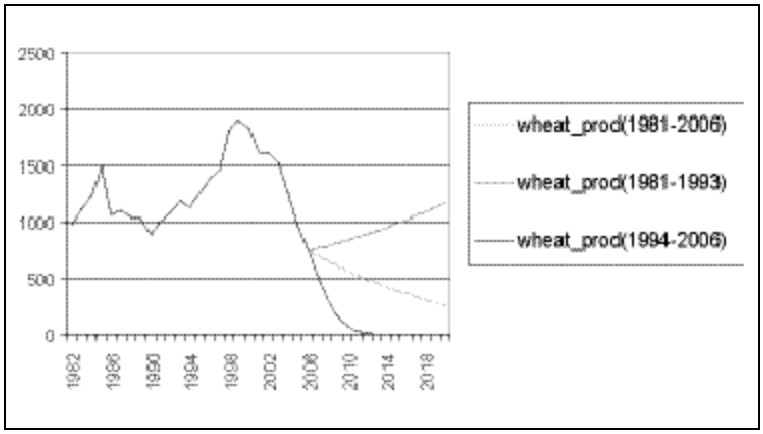


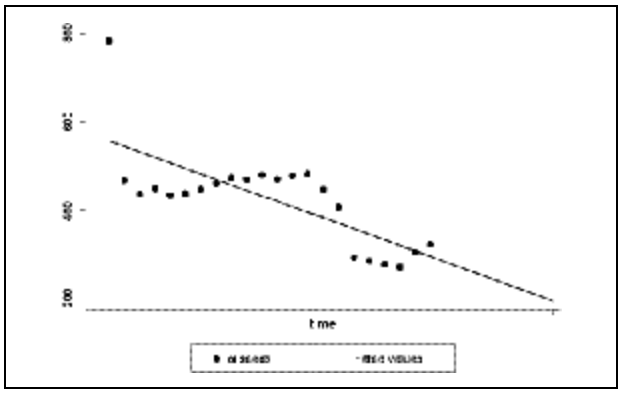
Figure: Simultaneous plot of three figures

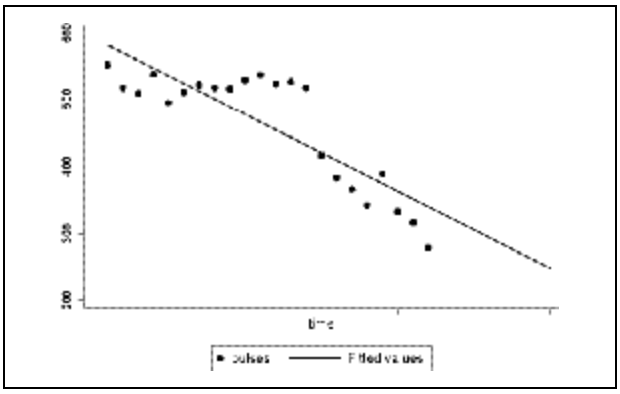


The longer run growth rate of rice/cereals (over 1981-2006) is estimated at 2.7 percent, significantly higher than the population growth rate of 1.5 percent. If we take a more recent period like 1994-2006, the growth rate accelerates to 3.75 percent, because of the excellent performance over the late 1990s and early 2000s. The more recent growth performance however, will be difficult to sustain as most of the more readily accessible potential for raising productivity has already been used up. Further growth will therefore be more difficult requiring knowledge and management intensive approaches to reduce the "yield gap", and the necessary incentives to make it attractive to farmers. Thus, for purposes of projection, the longer run trend has been adopted. For the year 2015, the resulting estimate for rice and foodgrains (rice and wheat) are 30 million MT and 31.6 million MT respectively (compared to the estimates for 2006-07 which are 26.5 and 27.3 million MT).

2.22 Non-cereal Food Crops: Pulses and Oilseeds

Among non-cereal food crops, pulses and oilseeds are of great value given their importance as sources of protein and fat in the Bengali diet. In the face of accelerating rice production, these important so-called minor crops have had to retreat. Growth rates in production have been negative for both, at -2.75 percent for pulses and -3 percent for oilseeds over the period 1984-2006. As the graphs below indicate, production has dropped off and it is estimated that between 1984 and 2015 oilseed production will have declined from 560000 MT to less than 200,000 MT – in per capita terms this is a dramatic decline by any standards. Similarly for pulses, production is expected to decline to 250,000 MT from around 555,000 MT over the same period.





2.23 Fruits and Vegetables

Trends in the production-availability of fruits and vegetables have been mixed. The most important fruit in terms of volume is Banana, which however has registered a negative growth rate over the longer period (Table 3.6). Thus, it is predicted that banana production will decline from a base estimate of 706.5 thousand MT in 2004 to less than 600,000 MT in 2015. Of next in terms of weight is jackfruit which has managed to grow at just over 1 percent per annum, with mango and pineapple not doing much better. Thus growth in total fruit production has remained virtually stagnant (.43 percent), suggesting that per capita availability from domestic production will decline at the rate of over 1 per cent a year.

Vegetable production (both winter and summer together) registered reasonable rates of growth, at 3.5 percent a year with the rate picking up further in more recent years. However, the most dramatic growth rates took place in the non-crop food sectors like fish, milk, meat (including poultry) and eggs. The most dramatic growth is seen in poultry and eggs, and if sustained, per capita availability (from own production) is set to rise significantly by 2015 (Table 3.6), particularly for meat and eggs. While this is an encouraging trend, it will need to be underpinned by suitable public policy initiatives to keep it on track.

Table 2.6: Cereals, Rice, Fruit, Vegetable and Animal Protein Production Trends

Item	Period 1981-04 gr. rte %	Period 1991-04 gr. rte %	Production Base '04 (est.) MT	Estimated Production 2015 MT
Banana	-0.44	0.3	706585	581534
Jack Fruit	1.30	0.7		
Mango	1.09	1.6		
Pineapple	1.68	0.8		
Total	*0.43*	*0.67*	*1308468*	*1380167*
Vegetable	3.5	4.15	1601975	2136930
Fish	5.9	6.8	1858824	2812924
Meat	8.2	8.7	788	1318
Poultry	13.6		342	674
Eggs	12.4	6.05	6559	12452
Milk	6.03	5.6	1962	2938
Rice (m)[1]	2.7	3.75	26.5	30
Cereals (rice and wheat)	2.67	3.7	27.3	31.6
Per capita				
meat			6.5	10.9
milk			11.3	12.5
eggs			48.2	88.9

Source and notes: Calculated on the basis of data from BBS National Income section and Dept. of Livestock and Fisheries; Growth rates based on semi-log trends fitted; Linear prediction estimates for 2015 given. [1]For rice/cereals, the terminal year is 2006 instead of 2004.

2.3 Major Findings

This brief chapter has thrown up a number of important issues and findings. It has succeeded in establishing that the BBS yield and acreage (and thus gross production) figures for rice is defensible and is consistent with other sources of data. At the same time it questions the net figures generated by adopting a standard 10 percent norm to adjust for seed, feed and wastage. It was argued that a figure of 5-7 percent would be deemed much more reasonable.

It was not possible to validate (one way or the other) data on non-rice crops and food; nor was it possible to suggest a SFW figure for these with any confidence. It seems very likely that wastage at the homestead is low for most crops; however, for perishable commodities, losses in the marketing and storage-handling chains could be high. Unfortunately, this aspect could not be captured in the present study for non-rice food crops, and is left for future work.

In terms of performance, sharp contrasts have emerged for different sub-sectors and crops. While oilseeds and pulses, along with wheat are in dramatic decline, other sectors like fisheries, meat-poultry-eggs, and milk have done well. Despite these successes however per capita availability, although rising, remains pitifully low in comparison with Asian or regional standards.

CHAPTER 3

Estimation of Food Demand System and Projection of Demand for Major Food Items in Bangladesh

3.1 Introduction

Since the 1970s analysis of food demand systems in Bangladesh underwent continuous refinement in terms of estimation methods although data limitations constrained use of more sophisticated approaches. Initially, the focus was on foodgrains, especially rice and wheat (Alamgir and Berlage, 1973a, 1973b; Mahmud, 1979). Later a broader basket of commodities were incoprporated in subsequent analyses (Chowdhury, 1982; Ahmed, 1981; Pitt, 1983; Deb, 1986; Rahman and Hossain, 1988; Bouis, 1989; Goletti and Boroumand, 1992; Ahmed and Shams, 1994; Shahabuddin and Zohir, 1995). While most of the earlier studies did not take into account the theoretical restrictions imposed on the estimation methods used, all except, Ahmed (1981) and Ahmed and Shams (1994) suffer from lack of *integrability*. This is a crucial condition: if the estimated demand system cannot be linked to an underlying utility function then estimates derived may not represent a theoretically consistent demand system. It may be noted that Ahmed and Shams (1993) used single equation estimation techniques and therefore, could not use cross equation restrictions for theoretical consistency. Therefore, this study uses the Linear Approximation of the Almost Ideal Demand System (LA/AIDS) model attributed to Deaton and Muellbauer (1980a, b). This model enjoys great popularity in applied demand analysis.

3.2 LA/Almost Ideal Demand System (LA/AIDS) Model: Methodology

Many past studies attempting to estimate demand systems have relied on using the seemingly unrelated regression (SUR) procedure, due to three main reasons: First, this allows imposition of restrictions implied by economic theory not only within an equation (such as homogeneity) but also across different equations (such as symmetry and adding up restrictions); Second, a 'system of equations' approach is more efficient than single-equation models if disturbances in different equations are contemporaneously correlated; Third, a system of equations approach is more efficient than a single-equation model if the exogenous variables are not the same in each equation (as is the case of censored demand systems). Even if the exogenous variables are the same, imposition of restrictions warrant use of the SUR procedure. Details of the model are available in the annex to this chapter.

3.3 Model Estimation and Estimated Demand Elasticities

A price index is constructed for each household, defined as a product of the log of the prices of the *i*th good and the associated expenditure share faced.[3] The prices were derived from HIES 2005, which reports figures for the preceding two weeks from the date of the interview. Equation 1 (see annex) was estimated using SUR method with cross-equation restrictions to ensure equality of cross-substitution effects imposed by the standard neo-classical demand theory. This restriction is also necessary for SUR estimation when the set of covariates is the same across all equations, as is the case here.

The estimates of income elasticity are presented in Table 5.1 for rural and urban areas respectively. It may be noted that estimates of income (expenditure) elasticity are positive for all food items in both rural and urban areas. Our estimates of income elasticity are comparable to those from previous studies (e,g, see Ahmed and Shams, 1993; Shahabuddin and Zohir, 1995). Little variation was found in the estimates of income elasticity for the rural areas, ranging from 0.758 for the first quartile to 0.600 for the fourth quartile. This may be compared with 0.698 for the first quartile to 0.379 for the fourth quartile in the urban areas.

[3] Stone's (1953) geometric price index is used to deflate the expenditures of the ith household.

In contrast, the estimates of income elasticity of wheat (flour) appear to be higher than those in found in previous studies. Consumption of wheat (flour) was found to be highly income elastic with estimates ranging from 1.816 for the first quartile to 1.456 for the fourth quartile in the urban areas. There was however, little variation in the estimates of rural income elasticity for wheat. It may be noted that wheat is no longer an inferior good as used to be the case before.

Per capita consumption of wheat (flour) and products made of wheat has declined over the last few years as evident from the net availability based on domestic production and imports reported by the BBS. While per capita availability was around 58 gm per capita per day during 1995-96, it declined to 56 gm per capita per day during 1999-00 and further to 23 gm per capita per day during 2004-05. Consequently, per capita daily consumption of wheat flour was recorded as 34, 17, and 14 grams during the 1995-96, 2000 and 2005 rounds of the HIES survey.

The estimates of income elasticity for other food items are within plausible ranges. The estimates of income elasticity for all other food items *except* vegetables, edible oil, and spices, are above unity implying that these can be treated as luxury goods to the consumers. Given the ranges of the estimates of income elasticity, vegetables and its complementary items, edible oil, and spices can be considered as necessities as expected.

The estimates of uncompensated own price elasticity[4] indicate that consumers are responsive to changes in prices in adjusting their consumption for most of the food items except spices (Tables 5.2A and 5.2B). The absolute values of the estimates of own price elasticity of spices for some income groups both in the rural and urban areas are quite small and are not statistically significant. The estimates of uncompensated own price elasticity of rice indicate if, for instance, price falls by 10 percent quantity demanded for rice would increase by 6 to 8 percent in the rural areas. However, the estimates of compensated own price elasticity imply that about half of this increase would be attributed to pure substitution effect; the rest is attributed to income effect. It may be noted that income effect of the demand for rice is rather weak in the urban area as the gap between the estimates of uncompensated and compensated price elasticity narrows down as one moveo to the upper quartiles. In contrast, a 10 percent fall in the price of wheat would lead to a major increase in its demand in the urban areas, and the responsiveness is even higher in rural areas. Again, a comparison between the estimates of uncompensated and compensated own price elasticity reveals the presence of sizeable income effects; around 60 to 80 percent of the increase in demand can be attributed to such effects.

The responsiveness of vegetables to price changes is similar to that of rice; a 10 percent increase in price of vegetables would result in a 2 to 3 percent increase in demand in the urban areas compared to around 5 percent for the rural areas.

As would be expected, income effect dominates in commodities belonging to the protein (egg, meat and poultry, except fish) and fat (milk and milk products) groups — i.e. significantly high uncompensated own price elasticity is accompanied by small compensated own price elasticity.

The estimates of cross price elasticity indicate the nature of relationship between any pair of food items; a positive sign implies substitutability, while a negative sign implies complementarity between the two goods. Further, these relationships are ‘gross’ or ‘net’ depending on whether uncompensated or compensated estimates of elasticity are used. From this perspective, rice and wheat (flour) appear to be substitutes in either sense. In contrast, rice and fish are gross complements but net substitutes. Similar observation holds between rice, vegetables and spices. As expected the protein items are, by and large, gross complements and net substitutes. Similar observations hold for milk and milk products.

[4] Uncompensated price elasticity is based on Marshallian demand function. It, therefore, involves both income and substitution effects. In contrast, compensated price elasticity is based on Hicksian (Slutsky) demand function. It, therefore, involves *only* substitution effect.

3.4 Projection of Demand for Major Food Items

Foodgrain demand over the next fifteen years is projected in terms of population growth, urbanization (with rural and urban disaggregation) and growth in real income. Also, demand is disaggregated by income-groups to allow differential impact across different income-groups in both rural and urban areas. Thus, the projection carried out in this study, disaggregates food demand with respect to rural and urban areas, and by income groups.

The total demand for commodity *k* at time *t* (D^{tk}) is given by

$$D^{tk} = \sum_i \sum_j D_{ij}^{tk} = \sum_i \sum_j q_{gj}^{tk} p_{ij}^{t} \qquad (3.1)$$

where D_{ij}^{tk} denote the demand for commodity *k* by income group *i* in location *j* (rural and urban area) at time *t* (2010, 2015, and 2020), q_{ij}^{tk} is per capita demand and π_{ij}^{tk} is the population at time *t* of income group *i* in location *j*.

The general formula for calculation of q_{ij}^{tk} is given by:

$$q_{ij}^{tk} = \left\{ \eta_{ij}^{k} \frac{\left(y^t - y^{t-1}\right)}{y^{t-1}} + e_{ij}^{k} \frac{\left(p_k^t - p_k^{t-1}\right)}{p_k^{t-1}} + e_{ij}^{k'} \frac{\left(p_{k'}^t - p_{k'}^{t-1}\right)}{p_{k'}^{t-1}} \right\} q_{ij}^{t-1,k} + q_{ij}^{t-1,k} \qquad (3.2)$$

where η_{ij}^{k} is the income elasticity of income-group *i* in location *j* for commodity *k*, e_{ij}^{k} and $e_{ij}^{k'}$ are the own and cross price elasticities of income-group *i* in location *j* for commodity *k* and its substitute *k'*, $(y^t - y^{t-1})$ is the changes in per capita real income and $(p_k^t - p_k^{t-1})$ and $(p_k^t - p_k^{t-1})$ represent changes in price of commodity *k* and its substitute *k'* between period *t* and *t-1*. In case when projection is carried out at constant (base-year) prices when the evolution of foodgrain demand is attributed to population growth and income growth alone, the formula reduces to:

$$q_{ij}^{tk} = \left\{ \eta_{ij}^{k} \frac{\left(y^t - y^{t-1}\right)}{y^{t-1}} \right\} q_{ij}^{t-1,k} + q_{ij}^{t-1,k} \qquad (3.3)$$

3.4.1 Assumptions for Alternative Projections: Growth in Population and Income

For the purpose of projection, following Goletti (1993), a very simplified population growth model is used. In this model, population of the country as a whole (π_t) is given by:

$$\pi_t = (1+v)\pi_{t-1} \qquad (3.4)$$

where *v* represents the overall population growth rate. For this study, this rate is assumed to be constant due to the steady state situation observed during the last several years. The projections assume a population of 139.57 million in 2005 (Ahmed, 2001) which grows at a rate of 1.5 percent throughout the projection period.

The distribution of population between rural and urban areas is given by:

$$\pi_t = \pi_t^r + \pi_t^u \qquad (3.5)$$

where π_t^r and π_t^u are rural and urban population at time *t*, respectively. Assuming an out-migration rate of ρ from rural area to urban area, the urban population at time *t* is given by:

$$\pi_t^u = \pi_{t-1}^u \left(1 + v + \rho \frac{1-\mu_{t-1}}{\mu_{t-1}}\right) \qquad (3.6)$$

where μ_{t-1} is the urban population growth rate at time *t-1*. The rural population is derived as the residual, $\pi_t^r = \pi_t - \pi_t^u$. The population of each income group *i* (each quartile in our study) in any location *j* is assumed to grow at the same rate and therefore, is given by:

$$\pi_{ij}^t = 0.25\, \pi_j^t \qquad (3.7)$$

The out-migration rate (ñ) from rural to urban areas is assumed to be equal to 1 per cent. As a result, the percentage of total population living in the urban areas would increase from about 28 per cent in 2005 to about 32 per cent in year 2010, 35 percent in 2015 and 38 percent in 2020. Total population would increase from 139.57 million in 2005 to 150.36 million in 2010, to 161.98 million in 2015, and finally, to 174.50 million in year 2020.

Three alternative growth rates for income are assumed. The low growth rate of 6 percent roughly corresponds to the trend observed during the last several years. Two accelerated growth rates of 6.5 and 7 percents are also assumed for the purpose of projection. It is also assumed, that income in each of the four quartiles will grow at the same rate. Further, growth of income in the rural and urban areas would be the same. The last assumption is somewhat less tenable in the light of the weight of evidence on the growth of income in the urban areas.

The demand for major food items projected for 2010, 2015 and 2020 at constant prices using (3.12) are presented in Table 5.3. Demand for foodgrains in 2015 is expected to reach 37.55 million MT (rice 35.35 million MT and wheat 2.20 million MT) under *low growth* of income, to 38.86 million MT (rice 36.50 million MT and wheat 2.37 million MT) under *medium growth* of income, and to 40.22 million MT (rice 37.68 million MT and wheat 2.54 million MT) under *high growth* of income.

It may be noted that the estimated/projected foodgrain demand in the present study is higher than those reported in Ahmed (2001). The low projection in Ahmed (2001) is partly due to low initial quantities used and partly due to an assumption of lower growth of national income.

There will also be a sizeable demand for vegetables during 2010, 2015, and 2020. Demand will reach 13.69 million MT to 14.23 million MT in 2010, 17.63 million MT to 19.05 million MT in 2015, and 22.70 million MT to 25.49 million MT in 2020 under different income growth scenarios. In contrast, demand for pulses will reach around one million MT by 2010, 1.3 million MT to 1.5 million MT by 2015 and around 2 million MT by 2020. Similar demand situation prevails for edible oil during the projection periods.

Demand for fish will reach more than 3 million MT by 2010, around 4.5 million MT by 2015 and around 6 million MT by 2020 under different scenarios. This would call for greater consumption of sea food in view of limited scope for increasing fresh water fish. Also, this underscores the need for significant investment for development of aquaculture in Bangladesh.

3.5 Conclusions

This study applies the LA/AIDS model in estimating the demand system for major food items using HIES, 2005 data. For necessities such as, rice, vegetables, edible oil, and spices, income effects are relatively small. However, for most other commodities there are significant income effects. Estimates of high income elasticity for most food items suggest that policies that lead to higher income levels among different income groups would foster higher levels of consumption for these commodities. This would in turn enhance effective demand and contribute to agricultural development. This warrants pursuit of income-augmenting policies to raise or even to maintain the current consumption demand in the country.

The presence of high income elasticity implies that there is sizeable difference between uncompensated and compensated own price elasticity for most of the food items. Even after removal of the income effect significant compensate price effect was observed. It implies that spiralling of prices of most of the food items would severely hurt the consumers.

It appears that wheat is no longer an inferior good; it has high price responsiveness both in the rural and urban areas. A comparison between the estimates of uncompensated and compensated own price elasticity reveals presence of sizeable income effects.

The estimates of cross-price elasticity indicate strong substitution effects. However, there is no systematic pattern in the gross and net substitution relationships among commodities belonging to the same category such as carbohydrate, fat, protein etc. In any case, the presence of strong substitution effects imply that public intervention in the market for one food item may lead to considerable impact on markets for other food items. This may adversely affect allocative efficiency in markets for several food items.

Finding an accurate scenario of the dynamics of demand for food items is rather difficult as future demand pattern hinges on tastes, prices, and income. We projected demand for 2010, 2015 and 2020 by taking into account only changes in income. This may introduce some bias in our estimates as income effect was found to be dominant for most commodities.

It is likely that world and domestic prices are likely to continue to register large upward movements, and thus may have a sobering effect on demand. In addition, endogeneity of expenditures in the estimated model might have introduced an upward bias in the elasticity estimates. Both these effects together may actually result in a significantly lower demand estimate than estimated by the AIDS model. Our demand estimates should therefore be regarded as constituting the upper limit with the actual position likely to be significantly less.

Annex

Details of the LA/AIDS Model

Starting from a specific cost function, the AIDS model gives the share equations in an *m*-good system as follows:

$$w_i = \alpha_i + \sum_{j=1}^{M} \gamma_{ij} \ln p_j + \beta_i \ln\left(\frac{X}{P}\right) + \sum_{s=1}^{k} \delta_{is} D_s \quad ; i = 1, 2, \ldots, M \qquad (1)$$

where w_i is the share associated with the *i*th good, α_i is the constant coefficient in the *i*th share equation γ_{ij}, is the slope coefficient associated with the *j*th good in the *i*th share equation, p_j is the price on the *j*th good, D_s are other socio-economic variables. *X* is the total expenditure on the system of goods given by $X = \sum_{j=1}^{n} p_i q_i$ in which q_i is the quantity demanded for the *i*th good. *P* is the price index defined by

$$\ln P = \alpha_0 + \sum_{i=1}^{M} \ln p_i + \frac{1}{2} \sum_{i=1}^{M} \sum_{j=1}^{M} \gamma_{ij} \ln p_i \ln p_j \qquad (2)$$

in the nonlinear AIDS model. Deaton and Muellbauer (1980a) also suggested a linear approximation of the nonlinear AIDS model by specifying a linear price index given by

$$\ln P = \sum_{i=1}^{M} w_i \ln p_i \qquad (3)$$

that gives rise to the linear approximate AIDS (LA/AIDS) model. In practice, the LA/AIDS model is more frequently estimated than the nonlinear AIDS model.

Conservation implies the following restrictions on the parameters in the nonlinear AIDS model:

$$\sum_{i=1}^{M} \alpha_i = 1, \quad \text{and} \quad \sum_{i=1}^{M} \beta_i = \sum_{i=1}^{M} \gamma_{ij} = \sum_{i=1}^{M} \delta_{is} = 0 \qquad (4)$$

However, because of the additivity restriction given by, $\sum_{i=1}^{M} w_i = 1$ parameters in the SUR model are constrained as follows:

$$\alpha_M = 1 - \sum_{i=1}^{M-1} \alpha_i, \qquad \beta_M = -\sum_{i=1}^{M-1} \beta_i, \quad \gamma_{Mj} = -\sum_{i=1}^{M-1} \gamma_{ij}, \text{ and } \delta_{Ms} = -\sum_{i=1}^{M-1} \delta_{is} \qquad (5)$$

Homogeneity is satisfied if and only if, for all *i*

$$\sum_{j=1}^{M} \gamma_{ij} = 0 \qquad (6)$$

and symmetry is satisfied if

$$\gamma_{ij} = \gamma_{ji} \qquad (7)$$

One advantage of the AIDS model is that the homogeneity and symmetry restrictions are easily imposed and tested. Since budget shares sum to unity in the system, one of the share equations in (3.1) is deleted to deal with the singularity problem. Whichever share equation is deleted should not have any effect on the results. The parameters associated with the share equation that is deleted can be recovered through the parameter restrictions implied by the homogeneity, symmetry, and conservation properties given in (3.4-3.5).

The LA/AIDS model implies that the Marshallian price elasticity (Green and Alston, 1990) for good *i* with respect to good *j* is

$$\epsilon_{ij}^{M} = -\delta_{ij} + \frac{\gamma_{ij}}{w_i} - \frac{\beta_i w_j}{w_i} - \frac{\beta_i}{w_i}\left\{\sum_{k=1}^{M} w_k \ln P_k \left(\epsilon_{kj} + \delta_{kj}\right)\right\} \qquad (8)$$

where

$$\delta_{ij} = 1 \text{ if } i = j$$
$$= 0 \text{ otherwise}$$

Income elasticity in the LA/AIDS model is given by (Green and Alston, 1991)

$$\eta_M = 1 + \left(\frac{\beta_M}{w_M}\right)\left[1 - \sum_{j=1}^{M} w_j \ln P_j \left(\eta_j - 1\right)\right] \qquad (9)$$

Table 3.1: Estimates of Income Elasticity of Major Food Items

Quartile/	I	II	III	IV	All
Commodities	**Rural**				
Rice	0.758	0.728	0.686	0.600	0.704
Wheat	1.366	1.522	1.474	1.454	1.447
Other Cereal	1.379	1.324	1.306	1.307	1.327
Pulses	1.030	1.027	1.024	1.023	1.026
Fish	1.212	1.170	1.147	1.134	1.161
Egg	1.397	1.335	1.282	1.247	1.305
Meat	5.433	3.550	2.519	1.718	2.498
Poultry	2.747	2.067	1.873	1.570	1.907
Vegetables	0.834	0.826	0.825	0.801	0.822
Milk	4.030	2.550	2.085	1.695	2.199
Milk Product	5.861	3.820	3.086	1.887	2.845
Edible Oil	0.922	0.924	0.927	0.926	0.925
Fruits	2.515	2.084	1.815	1.610	1.899
Sugar	2.899	2.114	1.777	1.516	1.860
Spices	0.809	0.810	0.811	0.816	0.811
Urban					
Rice	0.698	0.639	0.550	0.379	0.596
Wheat	1.816	1.624	1.552	1.456	1.585
Other Cereal	1.377	1.288	1.249	1.214	1.270
Pulses	0.940	0.945	0.948	0.947	0.945
Fish	1.204	1.164	1.142	1.124	1.153
Egg	1.413	1.382	1.301	1.264	1.329
Meat	3.681	2.320	1.959	1.580	2.025
Poultry	2.924	2.272	1.918	1.588	1.976
Vegetables	0.798	0.789	0.778	0.744	0.779
Milk	3.047	2.283	1.838	1.642	1.994
Milk Product	6.199	4.420	3.102	1.921	2.951
Edible Oil	0.945	0.945	0.948	0.945	0.946
Fruits	2.594	2.159	1.818	1.583	1.902
Sugar	2.502	1.982	1.691	1.554	1.809
Spices	0.808	0.814	0.819	0.813	0.813

Source: Authors' Calculation

Table 3.2A: Estimates of Own Price Elasticity of Major Food Items: Rural

Quartile/	I	II	III	IV	All
Commodities	**Estimates of Uncompensated Own Price Elasticity**				
Rice	-0.637	-0.624	-0.604	-0.564	-0.612
Wheat	-10.408	-15.474	-11.283	-8.375	-11.039
Other Cereal	-3.805	-2.710	-2.205	-1.827	-2.497
Pulses	-1.199	-1.122	-1.069	-1.036	-1.092
Fish	-0.913	-0.837	-0.810	-0.791	-0.814
Egg	-7.454	-4.600	-2.861	-1.821	-3.488
Meat	-63.184	-17.771	-5.768	-1.870	-6.172
Poultry	-36.037	-10.769	-5.534	-1.815	-6.677
Vegetables	-0.479	-0.502	-0.555	-0.553	-0.522
Milk	-45.918	-10.375	-4.473	-1.906	-5.752
Milk Product	-442.330	-118.170	-48.625	-6.103	-43.047
Edible Oil	-0.757	-0.818	-0.878	-0.927	-0.852
Fruits	-14.777	-6.766	-3.583	-2.013	-4.449
Sugar	-50.177	-14.362	-5.832	-2.273	-7.687
Spices	0.082	0.001	-0.075	-0.182	-0.052
Estimates of Compensated Own Price Elasticity					
Rice	-0.300	-0.349	-0.396	-0.449	-0.379
Wheat	-4.284	-5.678	-5.252	-5.065	-5.003
Other Cereal	-1.272	-1.226	-1.210	-1.211	-1.228
Pulses	-0.970	-0.968	-0.966	-0.965	-0.967
Fish	-0.458	-0.524	-0.555	-0.570	-0.537
Egg	-0.866	-0.884	-0.899	-0.908	-0.893
Meat	-2.552	-1.879	-1.502	-1.185	-1.495
Poultry	0.779	0.092	-0.100	-0.401	-0.067
Vegetables	-0.646	-0.639	-0.638	-0.613	-0.635
Milk	-1.179	-1.076	-1.039	-0.999	-1.049
Milk Product	-0.630	-0.783	-0.837	-0.923	-0.855
Edible Oil	-0.966	-0.965	-0.962	-0.964	-0.964
Fruits	-1.561	-1.389	-1.279	-1.189	-1.313
Sugar	-0.918	-0.947	-0.956	-0.959	-0.954
Spices	-0.208	-0.211	-0.214	-0.231	-0.216

Source: Authors' Calculation

Table 3.2B: Estimates of Own Price Elasticity of Major Food Items: Urban

Quartile/	I	II	III	IV	All
Commodities	**Estimates of Uncompensated Own Price Elasticity**				
Rice	-0.617	-0.597	-0.570	-0.523	-0.584
Wheat	-11.186	-5.540	-3.586	-2.208	-4.391
Other Cereal	-4.168	-2.377	-1.730	-1.343	-2.013
Pulses	-0.709	-0.817	-0.885	-0.927	-0.849
Fish	-0.574	-0.579	-0.597	-0.627	-0.583
Egg	-4.785	-3.259	-1.895	-1.332	-2.344
Meat	-23.501	-5.477	-2.921	-1.684	-3.477
Poultry	-29.905	-9.442	-3.563	-1.303	-4.795
Vegetables	-0.241	-0.281	-0.312	-0.281	-0.280
Milk	-17.152	-5.248	-2.051	-1.208	-2.959
Milk Product	-302.190	-91.327	-22.558	-2.852	-24.384
Edible Oil	-0.946	-0.988	-1.023	-1.053	-1.007
Fruits	-12.005	-5.235	-2.504	-1.503	-3.176
Sugar	-27.549	-9.121	-3.726	-1.975	-5.534
Spices	0.127	0.003	-0.094	-0.127	-0.033
Estimates of Compensated Own Price Elasticity					
Rice	-0.381	-0.443	-0.497	-0.533	-0.473
Wheat	-2.072	-1.811	-1.712	-1.579	-1.757
Other Cereal	-1.225	-1.163	-1.134	-1.108	-1.150
Pulses	-0.936	-0.936	-0.936	-0.936	-0.936
Fish	-0.193	-0.307	-0.362	-0.402	-0.335
Egg	-0.985	-0.984	-0.980	-0.978	-0.982
Meat	-2.964	-1.937	-1.657	-1.348	-1.710
Poultry	0.005	-0.330	-0.509	-0.670	-0.480
Vegetables	-0.414	-0.397	-0.377	-0.309	-0.378
Milk	-0.421	-0.622	-0.731	-0.773	-0.694
Milk Product	-0.154	-0.442	-0.653	-0.838	-0.677
Edible Oil	-1.034	-1.033	-1.027	-1.033	-1.032
Fruits	-1.451	-1.315	-1.202	-1.116	-1.230
Sugar	-1.599	-1.384	-1.262	-1.201	-1.312
Spices	-0.096	-0.118	-0.137	-0.116	-0.117

Source: Authors' Calculation

Table 3.3: Projection of Demand for Major Food Items

		Projected Population (million)			
Population Groups/Year		2005[a]	2010	2015	2020
Total Population		139.57	150.36	161.98	174.50
Urban Population		39.57	47.83	56.86	66.73
Rural Population		100.00	102.53	105.12	107.77
Urbanization (% urban)		28.35	31.81	35.11	38.24
Commodities	**Growth of Per Capita Income**	**Projected Demand (million MT)**			
Rice	Low	23.03	28.55	35.35	43.74
	Medium	23.03	29.01	36.50	45.88
	High	23.03	29.47	37.68	48.11
Wheat	Low	0.91	1.42	2.20	3.42
	Medium	0.91	1.47	2.37	3.81
	High	0.91	1.52	2.54	4.25
Foodgrain	Low	23.95	29.97	37.55	47.16
	Medium	23.95	30.48	38.86	49.69
	High	23.95	31.00	40.22	52.36
Pulses	Low	0.72	0.98	1.32	1.78
	Medium	0.72	1.00	1.38	1.91
	High	0.72	1.02	1.45	2.05
Fish	Low	2.18	3.05	4.26	5.96
	Medium	2.18	3.14	4.51	6.47
	High	2.18	3.22	4.76	7.03
Egg[b]	Low	357.82	524.27	767.68	1123.48
	Medium	357.82	540.88	817.16	1233.97
	High	357.82	557.92	869.51	1354.56
Meat	Low	0.45	0.94	2.06	4.79
	Medium	0.45	1.00	2.39	6.13
	High	0.45	1.08	2.79	7.86
Poultry	Low	0.36	0.63	1.10	1.94
	Medium	0.36	0.66	1.21	2.26
	High	0.36	0.69	1.34	2.63
Vegetables	Low	10.62	13.69	17.63	22.70
	Medium	10.62	13.96	18.33	24.06
	High	10.62	14.23	19.05	25.49
Milk	Low	1.70	3.14	5.95	11.52
	Medium	1.70	3.33	6.70	13.90
	High	1.70	3.52	7.55	16.77
Edible Oil	Low	0.83	1.11	1.48	1.98
	Medium	0.83	1.13	1.55	2.12
	High	0.83	1.16	1.62	2.26
Fruits	Low	1.78	2.97	4.98	8.41
	Medium	1.78	3.11	5.47	9.71
	High	1.78	3.25	6.01	11.19
Sugar	Low	0.44	0.74	1.25	2.13
	Medium	0.44	0.77	1.37	2.47
	High	0.44	0.81	1.51	2.86
Spices	Low	2.68	3.47	4.50	5.82
	Medium	2.68	3.54	4.68	6.17
	High	2.68	3.61	4.86	6.54

CHAPTER 4

Estimation of dietary energy requirements for setting nutritional standards of Bangladeshis

4.0 Introduction

Well-being and good health do not depend entirely on energy intake levels. A necessary condition for achieving good health and a sound nutritional status is consumption of adequate, good quality food in an infection-free environment. Environmental factors operate as important determinants of nutrition, and these include physical, biological and cultural influences.

Rice and other non-cereal plants are the major sources of energy for the people of Bangladesh. Cereals alone account for almost 80% of the energy requirement of the average Bangladeshi. This is symptomatic of the widespread incidence of malnutrition and the emergence of the problem as a major public health challenge for the country. According to the child nutrition survey (BBS 2002) every year 30% of children are born with low birth weight (below 2.5 kg); among pre-school children only 11.5% have normal physical growth and development while 2.4% are severely malnourished. Bangladesh Demographic Health Survey (2004) reports that 43% of children below 5 years of age are stunted and prevalence of stunting increases with age from 10% for children under 6 months to 51% for children aged 48-59 months. Thus, despite achieving significant success in improving the general health conditions of the people, the problem of malnutrition remains acute in the country, and is closely linked to child survival, mental and cognitive development of children, and physical and intellectual capacity of adults (Yusuf, 1992).

Bangladesh has made significant strides in food grain production and food availability although food security at national, household and individual levels, remain a matter of major concern for the government. The debate on food security has not given enough attention to the quality/safety of food and the need for a balanced diet. Ensuring supply of energy dense cereal food can address the problem of hunger but other manifestations of nutritional inadequacy (e.g. anaemia, night blindness) cannot be solved by energy dense foods alone but requires adequate intake of micro-nutrients. This is the well-known problem of micro-nutrient deficiency in the Bangladeshi diet.

This chapter focuses on setting a standard average cereal intake for balanced nutrition of the population, and in this context tries to determine (a) total dietary energy requirement, (b) physical activity levels of different population groups, and (c) actual calorie intakes and dietary patterns, and an assessment of the calorie gap. Nationally representative, primary data was purposefully generated to enable these exercises to be conducted.

4.1 Methodology

A major objective of the study was to determine physical activity levels, energy requirements, and setting of nutritional standards for the people of Bangladesh. Keeping this in mind, 1023 households were randomly selected from the household income and expenditure survey 2004-05 (HIES 2005) carried out by the Bangladesh Bureau of statistics (BBS). The questionnaire design included four separate components as follows: (i) socio-economic, (ii) dietary, (iii) anthropometric and (iv) activity records of individuals aged ≥ 10 years. This chapter deals principally with the analysis of the data on dietary intakes, anthropometric values and physical activity levels.

Dietary and anthropometric data were collected from all the individuals belonging to the 1023 sample households, while the activity records were taken from the household members aged >= 10 years from 120 households randomly selected from those 1023 households. A household was defined as those people who shared meals cooked from the same kitchen.

4.2 Questionnaire design, enumerators' training and pre-testing

The questionnaire included three major components: dietary, anthropometric and 24 hour activity records. This meant collecting information on food intake, height, weight and sex of all individual household members, as well as data on activity levels. The activity records were generated for all individuals aged >= 10 years from the 120 households drawn from 1023 households. A semi pre-coded formatted questionnaire was used as the basic data collection instrument to gather the household as well as individual-level information. Considering the importance of the study in the national context and its objectives, a carefully prepared questionnaire was fielded to capture the required information. This was designed in the light of experience gained from the national nutrition survey and various other large scale surveys conducted in Bangladesh with a focus on the required variables to answer the objectives of the study. The questionnaires were field tested prior to actual use and was modified on the basis of the feed-back from the field tests.

A team consisting of 23 enumerators (male=9 and female=14) and four supervisors were engaged and trained to conduct the field survey. Initially, all field staff received a few days of orientation training consisting of familiarization of survey instruments, guided readings and field trials. In addition all female enumerators were trained for one more week to provide them with hands-on training in the techniques of data collection and recording, especially related to intra-household food distribution, including weighing raw and cooked foods. All the enumerators and the supervisors spent a considerable amount of time in the office and at field-testing sites around Dhaka in scaling children and adult men and women, and practicing the techniques of anthropometric measurements, household and individual food consumption, and related data collection activity.

The entire field work was intensively supervised by experienced, senior supervisors attached to each group. An additional tier of technical supervision was also built-in to ensure data quality.

4.3 Data collection

The collection of data from the selected locations and households were undertaken through home visits during the month of September. The female members of the team were primarily responsible for collecting information on dietary intakes and physical activity levels (over a 24 hour reference period) while male members collected data on production related aspects of the study and helped with the anthropometric component. To get information on food consumption the enumerators interviewed the persons responsible for the preparation of daily meals, asking them to demonstrate the amounts of food actually consumed over the past 24 hours by each member of the household. These were then weighed and the amounts recorded in the form. The anthropometric data on height and weight were obtained from all the members of the household present in the house during the survey. Height of the individual was measured accurately in erect position without shoes, firmly with eyes looking straight up and body held as straight as possible with the knees pressed. The weights of the individuals were taken with minimum clothing and without shoes.

Observational errors were avoided by ensuring that the investigator herself recorded the height and weight of every individual using the same instrument throughout the period of survey. Instrumental errors were minimized by checking the weighing scale with known weight before each measuring session.

Activity was recorded over a 24-hour period for all individuals from the 120 households aged 10 years or more. Time and motion technique was used to estimate the energy expenditure level. Detailed records of physical activity were obtained, partly by observation and partly by questioning the respective individuals when they were away from the house. The period of time spent in every activity was recorded against the description listed in the coded questionnaire. Any activity that was not coded was then written down with a description in the questionnaire, along with time spent for that activity. The duration of each type of activity was totaled on a 24 hour basis for each individual.

Every day, the collected information from the households was checked, coded and cross checked by interviewers and their supervisors at the field sites in order to avoid any misreporting. Any confusion arising out of this matter was settled the following day during subsequent home visits.

4.4 Data management and analysis

The checked questionnaires were edited and entered into computer safe sets. Data entry was conducted by the computer data entry personnel of BIDS and this was followed by an extensive period of logical checking to identify any data entry errors. The errors were then corrected by consulting the original questionnaires.

4.5 Determination of energy requirement

Individual physical activity levels vary widely and hence energy requirements also vary. Expert consultation groups were formed at various times, and were of the view that "the energy requirement of an individual is the level of energy intake from food that will balance energy expenditure when the individual has a body size and composition, and level of physical activity, consistent with long-term good health; and that will allow for the maintenance of economically necessary and socially desirable physical activity" (FAO/WHO/UNU, 1985; IDEG, 1996).

In 1981, a group of experts was convened by FAO, WHO and UNU to evaluate the energy and protein requirements of humans, and to make appropriate dietary recommendations. Several key concepts related to energy were put forward in their report (FAO/WHO/ UNU, 1985), which included the following:

- The energy requirement is the amount of dietary energy needed to maintain health, growth, and an 'appropriate' level of physical activity.
- 'Appropriate' physical activity includes those activities that an individual must perform to survive in his/her social environment (*occupational activities*), and to pursue his/her physical, intellectual and social desires and wellbeing (*discretionary activities*). For children, this should allow for the exploration of their surroundings and interaction with other children and adults.
- Energy needs are determined by energy expenditures of a healthy person. Therefore, estimates of requirement should be based on measurements of energy expenditure and, for children, an additional allowance should be included for growth.
- Energy requirements can be calculated as multiples of basal metabolic rate (BMR). In the absence of direct measurements, BMR can be estimated with mathematical equations derived from published metabolic data.

Estimates of energy requirement are mainly determined by energy expenditure, which has two major components: Basal Metabolic Rate (BMR) and Physical Activity Level (PAL). BMR is multiplied by the PAL factor to get total energy expenditure (factorial method). Special allowance is then made for pregnant and lactating mothers.

Estimates of energy requirements for the population of age group 1-9+ years old were based on the reported energy intakes of healthy, well-nourished children, with the implicit assumption that these represented habitual intakes. These estimated requirements were derived from an extensive review of published dietary intake data on approximately 6500 children, mostly from developed countries (Ferro-Luzzi & Durnin, 1981).

The FAO/WHO/UNU Expert Committee was also concerned about a perceived secular trend towards sedentary lifestyles in developed countries. Therefore, it was felt prudent to increase by 5%, the reported energy intakes of children between 1 and below 10 years of age to accommodate a desirable level of physical activity.

For individuals belonging to the age group 10 years and above, energy expenditure estimates are expressed as multiples of BMR, providing the basis for energy requirement calculations (rather than direct energy intake data). BMR for boys and girls of a given age and weight were predicted with the mathematical equations derived by Schofield (FAO/WHO/UNU, 1985; Schofield, 1985), and the additional energy spent during the day was calculated based on the assumed energy cost of activities performed by children and adolescents in developed countries.

The expected body weight for observed height is used to estimate energy requirement for adolescent of <18 years. For those whose height does not correspond to desired weight, the Baldwin equation for calculating desired weight was used. For adults aged >=18 years the desirable body weight for observed height is calculated from the standard BMI (22 for male and 20.8 for female). The calculated BMR for the desirable weight is multiplied by occupational factor to estimate the per capita energy requirement.

Additional energy is recommended for pregnant and lactating women. The recommendations for additional energy of pregnant women should be 336 MJ or 1.2 MJ/day throughout pregnancy but may be reduced to 235 MJ (0.8 MJ/day) in women who have the option of reducing activity in pregnancy. The recommendations for additional energy of lactating mothers should be 2.21 MJ/day throughout the lactation period but may be increased to 2.93 MJ/day up to 6 months of lactation if fat utilization is not assumed (FAO/WHO/UNU, 1985).

4.6 Calculation of Energy Requirement:

As discussed above, the energy requirement estimation procedure is different for different age groups. In other words, calculation of energy requirement follows a unique technique for each age and sex group in the population.

The NCHS median age and sex specific height was taken to get the desired height for children and adolescents up to age 17+ years. Then the NCHS corresponding age and sex specific median weight was taken as the desirable weight for the children and adolescents up to 17+ years. Adolescents for whom the height and corresponding weight was not available in the NCHS list, the Baldwin regression equation for estimating desired weight for specific heights was used (Annexure B). For adults aged >=18 years the desirable body weight for observed height is calculated from the standard BMI (22 for male and 20.8 for male). The calculated BMR for the desirable weight is multiplied by occupational factor (PAL) to estimate the per capita energy expenditure, and thus the requirement. In this study, the energy requirement estimates were based on *both the existing and desired body weight and height*. The desired weight of the individuals aged 0 to 17+ were calculated using the NCHS table on age and sex specific height and the weight corresponding to that height. Where corresponding weight data was not available the Baldwin regression was used to obtain an estimate. For estimating the energy requirements from the desired weight of an individual the standard BMI was used to get the desired body weight (BMI =22 for male and 20.8 female were used as standard body weight).

On calculating the desired body weight the BMR was calculated by using the age and sex specific equation suggested in FAO/WHO/UNU to get the desired basal metabolic rate (BMR) (Annexure-B). For the existing body weight the BMR was also calculated using the same equation. Thus we have the BMR of the individuals of age group 10 and above from the expected and desired body weight.

Calculation of the desired weight varies with age and sex. To estimate the energy requirement of the children of age group 1 to 9+ on the basis of desired weight at first we get the age and sex specific median height of the NCHS standard and then for that median height, we obtain the corresponding age and sex specific weights. The energy requirement of this group was estimated by multiplying the expected body weight with the energy required per kg of body weight per day, for the specific age group in question. In addition, 5% of total energy was added on to account for expected desirable activities.

Estimation of energy requirement for the 10-17+ years age-group was calculated by multiplying BMR with Integrated Energy Index (IEI) or Physical Activity ratio (PAR). BMR was estimated from the mathematical equation of the FAO/WHO/UNU, 1985 expert consultant group by using desired and observed body weights for specific age groups. Thereafter, 24 -hours activity records of individuals were consulted with duration of each specific task carried out (in minutes) along with the BMR, to calculate the energy expenditure for the last twenty four hours. Duration (in minutes) of a specific task was multiplied by the BMR per minute and IEI or PAR of the specific task, for estimating energy requirement for that specific task. Where IEI data was unavailable, PAR was used. Summation of energy required for all tasks during the 24-hour reference period provided an estimate of individual energy expenditure. The extra energy needed during pregnancy and lactation was also added-on, if the individual in question was pregnant or lactating. Total energy requirement was divided by the corresponding BMR to obtain PAL of that individual.

4.7 Food and Energy intake

Food intake is important for the normal physiological functions of the body. It is important to determine the amount of calories that an individual derives from average daily per capita food intake. This chapter provides information on dietary intake levels of individuals and about the types of foods consumed to determine sources of energy by food groups. Foods were classified into 14 groups which were again classified into three major food groups such as energy giving, body building and body protecting foods. It is to be noted that the survey was conducted during August-September 2007, when the country was hit by devastating floods, for the second time in a year. So the nutritional deprivation in respect of grain and vegetables is believed to have reached its peak and thus it is not unlikely that average individual food intakes may have been lower than normal periods. This needs to be kept in mind while interpreting the data.[5]

4.8 Results and Discussion

Occupation has a very significant impact on daily energy expenditure, and thus, on per capita energy requirement. This is because individuals engaged in a particular occupation has to remain engaged in a specific activity for one third of the total daily available time, and the type of occupation determines the mean physical activity level (PAL) of a person.

The mean PAL of 328 individuals from 120 randomly selected households show (Table 4.1, Fig 1) that there were twenty different types of occupations covered with varying mean physical activity level (PAL), with mean PAL varying with occupation and sex. Among males, the highest mean PAL was observed among fishermen (PAL=2.80), followed by rickshaw-van pullers (PAL=2.48) and agricultural day laborer (PAL=2.28) and the lowest was among handicapped (PAL=1.38) followed by servants (PAL=1.39) and unemployed (1.45). In case of females, highest (mean) PAL was observed among hawkers (PAL=2.48) followed by grocers (PAL= 2.18) while the lowest PAL was found among the handicapped (PAL=1.28), followed by professionals (PAL+1.36) and old/retired persons (PAL=1.41). The overall mean PAL for all groups, irrespective of occupation and sex, is 1.73 with males having a value of 1.85 and females, 1.54. The Institute of Nutrition and Food Science survey (1998) reported a mean PAL value for all groups at 1.71 with the value for males being 1.77 and for females, 1.65. The INFS study did not actually conduct any activity surveys, and the PAL value was derived from different reports. Nevertheless, the estimated PAL used in their energy requirement estimation is quite close to ours. In another report (HER, 1990) it was mentioned that for developing countries the PAL value for men is 1.82 and for females, it is 1.66. Once again these values tend to confirm the validity of our estimates.

[5] It should be noted however, that large parts of the country were not flood affected. The field work was carried out in the flood-free areas first, and then other areas were covered once the waters receded. Thus, the impact on food intakes would be through price-effects resulting from market-disruption along with some entitlement losses due to adversely-affected livelihoods.

Intra individual PAL values within the similar occupational groups were found to be wide revealing a large discrepancy between maximum and minimum values and high standard errors. This is particularly pronounced among occupations associated with high PAL values (i.e. PAL greater than 2.39). This confirms the fact that individuals having PAL values higher than 2.39 can not prolong their activities for very long periods of time (Human energy requirement, FAO, 2001). Considering this the PAL values obtained from 328 individuals aged ≥10 years were grouped into three categories (Table 4.2) (Human energy requirement, FAO report, 2001). Table reveals that among the total individuals in our sample, females and males were equally divided (50%). Sixty nine percent were found to belong to 'light activity level' where male and female percentages were 28% and 41% respectively. Thirteen and eighteen percent of the individuals were found to fall in the moderate and vigorous activity levels.

In brief 69% of the population is involved in light and below light activities while 31% perform moderate to vigorous physical activities. In other words, only 31% of the total population is engaged in PAL groups that require a higher energy intake level than the average.

Energy requirement is a function of PAL and the Basal Metabolic Rate (BMR), while BMR in turn, depends on individual body weight. So, if any of these two variables change, the energy requirement will also change. The BMR here is calculated on the basis of observed and desired body weight using WHO/UNU regression equations. This gives us an indication of the amount of energy that is required to maintain the body's normal functions, on average. This also gives us an idea of the food intake required in order for Bangladeshis to attain the international median standard in terms of height and weight. Table 4.3 reveals that irrespective of age and sex, dietary energy requirements estimated by using BMR calculated from observed body weight is lower than BMR calculated from desired body weight. This of course is obvious as the desired body weight is higher than the observed weights. The dietary energy requirements calculated on the basis of observed and desired body weights were found to be 2076 kcal and 2187 kcal respectively. These energy requirements vary when disaggregated by sex. For males, the respective calorie values were higher (2348, 2526) compared to females (1839, 1908). On the average, male requirements were found to be around 600 kcal higher than of females (table 4.3). It may be noted that the mean dietary energy requirement for the population reported by INFS (Institute of Nutrition and Food Science survey 1998) was 2039 kcal. But this requirement was calculated on the basis of observed body weights and pooled PAL estimates while ours is based on desired body weight and PAL values estimated from a random sample that captures a diversified occupational distribution.

The dietary energy requirement gap between these two studies was found to be 147 kcal - which is largely due to the higher PAL values and body weights used in our study, compared to INFS 1998. FAO, in their country level energy requirement estimate report (1998) has shown that in countries like Brazil, Japan, India (Schofield, 1990) the average energy requirements were 2107, 2234 and 1925 kcal respectively. Our estimates for Bangladesh correspond well with these values. The small differences in the estimates are likely to be attributable to differences in the age structure of the population as well as in the weight data. When energy requirements are disaggregated by age and sex it appears that the requirement of dietary energy varies with sex as well as age (table 4.4 and 4.5a). Further when energy requirement is disaggregated on the basis of age and different activity levels, it appears that requirement varies with activity level and age group.

Individual food consumption per capita per day by major food groups shows that mean total food intake for all ages and sex was 681 grams (table 4.6). The energy that an individual can derive from this food is 1894 kcal. The table also reveals that of the total energy intake 76% comes from cereals, 17% from non cereal plant sources and only 6 per cent from animal sources. The composition of food reveals a high degree of nutrient imbalance in our diet pointing to the huge problem of micro-nutrient deficiency in the population.

The INFS (1998) survey showed an intake of 728 grams per capita per day compared to 681 grams in our survey; the HIES 2005 reports a figure of around 900 gm. To some extent, these differences can be explained by several contributory factors: (a) the period of our survey was associated with widespread floods – the second such floods to affect the country in a span of several months; (b) the survey was carried out during September, which also corresponds to the agricultural lean season when rural incomes and livelihoods tend to be depressed, and (c) inflationary pressures were further aggravated in the face of floods and seasonal factors, leading to an expected decline in food consumption. The discrepancy with the HIES figures however is too large to be entirely explained by the above factors, and is likely to be rooted, in addition, to different methodological approaches used in the two surveys.[6]

Individual food intake patterns by food groups show that (table 4.7) rice alone contributes 74% of our total energy intake. Pulse intake was 16 gm – which is 5 gm higher than INFS (1998). Animal food intake was found to be 71 gm which is 14 gms lower than BBS (2000) but 10 gms higher than INFS (1998). Thus, aggregate consumption of all food items has decreased relative to estimates from BBS (2000), but mainly in rice, wheat and vegetables. Consumption of food by those aged ≥ 10 years was found to be 754 gm (equivalent to 2105 kcals). This intake is obviously higher than the mean national intake although the share of cereals in total energy supply is very similar. Individual energy intake per capita per day reveals that energy intakes differ with age and sex (table 9) and the intake is comparatively higher for males compared to females, generally rising with age.

The per capita per day energy requirement and intake shows (Figure 4.2) that there is a mean gap of 292 kcal. The current mean energy intake of the average population was found to be 1894 kcal per capita per day while the average requirement calculated on the basis of estimated desired body weight, was 2187 kcal – in other words a deficit of 293 kcal per person!

Consumption patterns found shows a rice dominant energy intake which may lead to a state of severe micronutrient malnutrition. The energy requirement gap when disaggregated on the basis of age and sex (Table 4.10 and 4.11) shows that for age group ≥ 10 years males are energy deficient by (-485 kcal) while females are in surplus (estimated on the basis of desired weights). If calculated on the basis of observed body weight this deficit drops to 355 kcal for males; females continue to remain in surplus, as to be expected.

Energy deficits were found to be highest among the 0-4+ age group at 747 kcal (using desired body weights – table 4.9). Males are more energy deficient than females and this tends to decrease with age. Similar trends in energy deficiencies were noted in INFS (1998) as well.

In case of individuals aged ≥ 10 years, the energy gap between intake and requirement when calculated on the basis of estimated PAL (table 4.10) was observed among individuals engaged in 'moderate to vigorous' activity levels. Individuals experiencing light activity were found to have surplus of 173 kcal. The energy intake deficiency increases with PAL, and the highest deficiency was found to be 1269 kcal for those belonging to the 'vigorous activity level'.

A key policy objective of the government must be to create a structure of incentives and a set of market conditions that encourage people to move towards a much more diversified and balanced diet. Consumption is largely governed by income, prices and preferences. It would seem that preferences are not seriously misaligned (see FGD findings in chapter 6), so that the main thrust of policy would have to be in terms of raising incomes, especially of poorer groups, and keeping markets stable. On both counts, the government is likely to face major challenges.

A longer term strategy is advocated in order to generate the desired dietary balance, so that our final objectives can be achieved, say by 2020. As a first benchmark, it is suggested that we decrease the calorie share of cereals from 74 % to 60 % by 2015, and further down to 55 % by 2020. A proposed/recommended

[6] In our survey careful attention was paid to conversion of raw foods to edible portions and weights were taken of the cooked amounts. This is certainly not true for the HIES figures.

balanced diet is presented in table 4.12. It is shown that on average a total of 888 gm of food would need to be consumed per person per day with 380 gm coming from cereals (350 gm rice and 30 gm wheat), 368 gm from non-cereal plant sources, and 140 gm from animal foods. The total derivable energy from this diet would be 2186 kcal with cereals contributing 60%, non-cereal plants 29% and animal food 11% of total energy intakes. To persuade people to reduce rice consumption from the current level of 476 gm to 350 gm will not be easy, and will require rapid, broad-based economic growth and reduction of inequalities. Such a dietary shift will also eradicate micronutrient deficiency as a public health problem.

For short-term planning purposes the question that is of some importance is what per capita consumption figure should be adopted for foodgrain consumption currently. As observed from Table 2.1 in Chapter 2, the official figure adopted by FPMU is 17.2 oz or 487.6 gm. In this study we have recommended a calorie intake of 2186 per capita on average, and suggested that eventually, our planners need to achieve a position where the recommended diet can be achieved by 2020. We know from table 4.12 that cereals provide around 76 percent of calorie needs with rice alone contributing 74 percent. In the short term, this ratio will continue to hold true, and therefore should be used for current planning purposes. Thus, if we assume that 76 percent of calories will have to come from cereals to meet the recommended calorie intake of 2186 calories, then total cereal consumption per capita, should be 467 gm (16.5 oz.) while rice consumption should be 454.5 gm (16 oz.). It should be observed that the cereal intake figure is quite close to the one adopted by FPMU of 487.6 gm and closer to the BBS figure of 469.2 gm.

To recapitulate our major findings, it should be observed that majority of the population are engaged in light and below light activity levels (e.g. housewives and students), and are thus in energy surplus. On average, Bangladeshis are energy deficient with children below 10 years of age (both boys and girls) and men aged ≥ 10 years experiencing larger deficits. The largest deficits are experienced by individuals belonging to the 'vigorous activity' group. Those individuals in moderate to vigorous activity levels are also energy deficient. The main thrust of policy should be to focus on non-rice food (vegetable, fruits and animal products) as increased consumption of these items will automatically lead to reduced dependance on rice and cereals.

Table 4.1: Individual's mean PAL by occupation and sex

Main Occupation	Sex	Mean	N	Std. Deviation	Minimum	Maximum
Total	Male	1.85	163	0.57	1.09	3.98
	Female	1.54	165	0.30	1.20	2.85
	Total	1.699	328	0.46	1.09	3.98
Farmer	Male	1.93	20	0.48	1.36	3.30
Agri/Day labour	Male	2.28	14	0.39	1.32	2.78
	Female	2.15	17	0.28	1.54	2.85
Industrial/Construction labour	Male	1.72	4	0.17	1.55	1.92
	Female	2.18	8	0.20	1.97	2.52
Transport labour	Male	1.49	3	0.07	1.42	1.57
Rickshaw/Van driver	Male	2.48	10	0.82	1.30	3.67
Car driver	Male	1.46	6	0.05	1.40	1.52
Grocer	Male	1.71	11	0.50	1.22	2.69
	Female	2.22	2	0.51	1.87	2.58
Medium business	Male	1.65	13	0.44	1.31	2.38
Hawker	Male	1.93	2	0.05	1.89	1.96
	Female	2.48	2	0.24	2.31	2.65
Service	Male	1.62	15	0.62	1.09	3.54
	Female	1.42	2	0.02	1.41	1.44
Student	Male	1.79	36	0.53	1.28	3.98
	Female	1.45	30	0.14	1.26	1.90
Professional	Male	1.56	2	0.19	1.42	1.69
	Female	1.36	1	.	1.36	1.36
Craftsman	Male	1.39	3	0.06	1.33	1.43
Housewife	Female	1.55	115	0.16	1.20	2.21

Main Occupation	Sex	Mean	N	Std. Deviation	Minimum	Maximum
Fisherman	Male	2.80	5	0.40	2.35	3.22
Servant	Male	1.39	1	-	1.39	1.39
	Female	1.51	2	0.34	1.27	1.76
Unemployed(> 10 yrs)	Male	1.45	4	0.23	1.13	1.63
	Female	1.54	3	0.09	1.44	1.63
Old/Retired	Male	1.89	3	0.49	1.46	2.42
	Female	1.41	1	-	1.41	1.41
Handicapped	Male	1.38	2	0.09	1.31	1.44
	Female	1.28	2	0.09	1.22	1.35
Others	Male	1.90	9	0.61	1.42	3.03
	Female	1.60	3	0.09	1.50	1.67

Fig. 1: Physical activity level (PAL) by sex

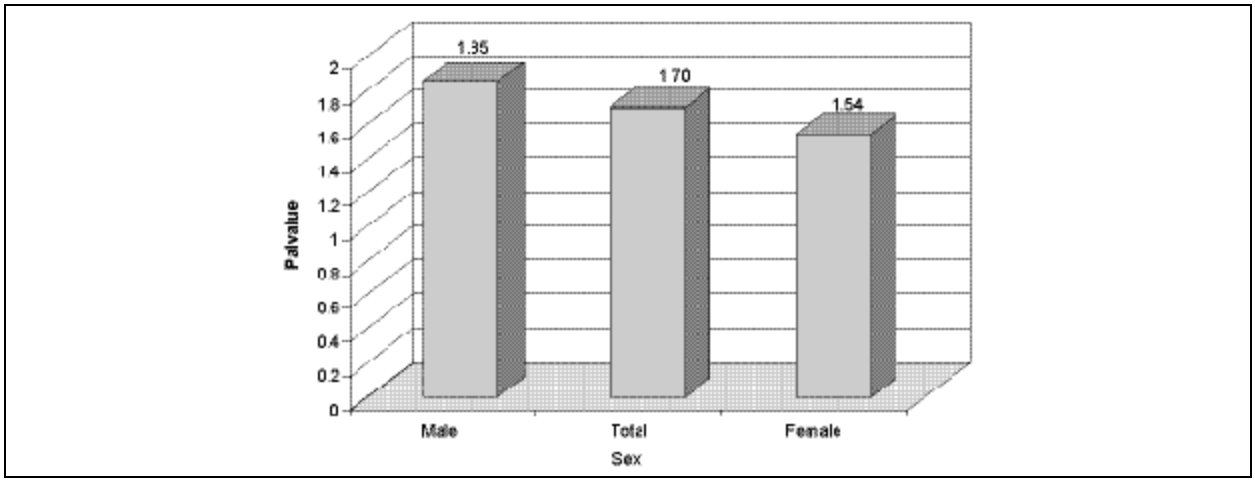


Table 4.2: Individual's mean age, desired body weight, BMR and PAL by PAL Group and Sex

PAL group	Sex	Sample size (%)	Age in years	Desired weight (Kg)	BMR	PAL
Light activity (PAL ≤ 1.69)	Male (n=92)	28	32.39 ± 17.02	55.22 ± 7.77	1511.27 ± 135.40	1.44 ± 0.15
	Female (n=135)	41	32.03 ± 15.85	47.16 ± 4.95	1241.01 ± 81.45	1.47 ± 0.10
	Total (n=227)	69	32.18 ± 16.30	50.43 ± 7.39	1350.37 ± 170.40	1.46 ± 0.12
Moderate activity (PAL= 1.70 – 1.99)	Male (n=20)	6	31.40 ± 19.34	54.59 ± 8.42	1504.58 ± 146.25	1.84 ± 0.09
	Female (n=24)	7	35.67 ± 14.15	47.43 ± 3.81	1207.59 ± 62.42	1.80 ± 0.08
	Total (n=45)	13	33.73 ± 16.64	50.68 ± 7.22	1342.58 ± 184.15	1.81 ± 0.08
Vigorous activity (PAL ≥ 2.00)	Male (n=23)	7	35.73 ± 16.62	55.99 ± 7.85	1525.66 ± 149.19	2.56 ± 0.45
	Female (n=3)	1	40.00 ± 4.73	50.92 ± 5.68	1272.03 ± 49.44	2.36 ± 0.26
	Total (n=26)	8	36.11 ± 15.96	56.46 ± 7.84	1503.41 ± 160.26	2.55 ± 0.44
ALL	Male (n=164)	50	33.33 ± 17.16	55.71 ± 7.88	1515.02 ± 140.53	1.85 ± 0.58
	Female (n=164)	50	32.80 ± 15.45	47.31 ± 4.84	1236.82 ± 78.99	1.54 ± 0.21
	Total n= 328	100	33.07 ± 16.31	51.51 ± 7.76	1375.92 ± 179.89	1.699 ± 0.46

Table 4.3: Estimation of dietary energy requirement for all population

Sex	Sample size	Estimated Energy requirement considering PAL of individuals		
		PAL value	Observed body weight basis requirement	Desired body weight basis requirement
Total	1980	1.70	2076	2187
Male	788	1.85	2348	2526
Female	1192	1.54	1839	1908

Table 4.4: Energy requirement per person (Age=10 yrs) per day by sex (Based on observed and desired body weight)

Sex	Observed Weight	BMR based on observed body weight	Desired body weight	BMR based on desired body weight	Required energy based on	
					Observed wt.	Desired wt.
Total (n=1547)	47.37 ± 11.05	1291 ± 176.65	49.47 ± 7.94	1323 ± 170.17	2193	2248
Male (n=37%)	49.97 ± 12.47	1420 ± 195.56	54.54 ± 9.03	1489 ± 154.27	2627	2755
Female (n=63%)	45.84 ± 9.82	1215 ± 108.62	46.51 ± 5.30	1226 ± 80.69	1873	1888

Table 4.5a : Energy requirement per person per day by age group and sex (Based on observed and desired body weight)

Age group	Sex	Observed body weight (kg)	Desired body weight (kg)	Energy expenditure per kg body weight	Energy required based on observed and desired body weight with and without 5% extra allowance			
					Observed without	Observed with	Desired without	Desired with
0 – 9+	All n= 433	16.56 ± 5.13	19.69 ± 5.43	95	1573	1652	1871	1965
	Male n= 218	16.23 ±5.20	19.32 ± 5.45		1542	1619	1835	1927
	Female n= 215	16.89 ± 5.05	20.06 ± 5.40		1605	1685	1906	2001
0 - 4+	Total n= 158	12.30 ± 3.10	13.83 ± 2.65	103	1267	1330	1424	1495
	Male n= 93	12.25 ± 3.14	13.92 ± 2.70		1262	1325	1433	1505
	Female n=65	12.36 ± 3.06	13.71 ± 2.59		1273	1337	1412	1483
5 - 9+	Total n= 275	19.01 ± 4.42	23.05 ± 3.38	82.4	1566	1644	1899	1994
	Male n= 125	19.20 ± 4.39	23.34 ± 2.91		1582	1661	1923	2019
	Female n= 150	18.86 ± 4.45	22.81 ± 3.71		1554	1632	1880	1974

Note: Calculation of energy required based on observed body weight and Kcal required is made on per kg body weight basis & extra allowance.

Table 4.5b :Energy requirement per person per day by age group (3 10 years) and sex (Based on observed and desired body weight)

Age group	Sex	BMR based on body weight		Activity factor			Energy required on the basis of activity factor and BMR (based on observed and desired body weight					
		Observed	Desired	Light	Moderate	Vigorous	Light		Moderate		Vigorous	
							Obs.	Des.	Obs.	Des.	Obs.	Des.
10 – 17+	Male	1300.27	1441.62	1.44	1.84	2.56	1872	2076	2393	2653	3329	3691
	Female	1204.59	1304.35	1.47	1.80	2.36	1771	2348	2168	2348	2843	3078
	Total	1245.32	1362.78	1.46	1.81	2.55	1818	1990	2254	2467	3176	3475
≥18	Male	1460.93	1505.69	1.44	1.84	2.56	2104	2168	2688	2770	3740	3855
	Female	1218.70	1206.75	1.47	1.80	2.36	1791	1774	2194	2172	2876	2848
	Total	1304.00	1312.02	1.46	1.81	2.55	1904	1916	2360	2375	3325	3346
≥10	Male	1419.78	1489.28	1.44	1.84	2.56	2002	2145	2612	2740	3635	3813
	Female	1215.86	1226.43	1.47	1.80	2.36	1787	1803	2189	2208	2869	2894
	Total	1290.99	1323.28	1.46	1.81	2.55	1885	1932	2337	2395	3292	3374
All ages	Male	1269.19	1365.41	1.44	1.84	2.56	1828	1966	2335	2512	3249	3495
	Female	1194.16	1238.96	1.47	1.80	2.36	1755	1821	2150	2230	2818	2924
	Total	1221.31	1286.64	1.46	1.81	2.55	1783	1878	2211	2329	3114	3281

Table 4.6: Individual food and energy intake per day by major food groups for all population

Food groups	Current actual intake		
	g	Kcal	% of Kcal
Cereals	407	1448	76
Non-Cereals plant	203	326	17
Animal foods	71	120	6
Total	681	1894	100

Table 4.7: Individual food and energy intake per day by food groups for all population

Food groups	Current actual intake		
	g	Kcal	% of Kcal
Total (n = 2726)	**681**	**1894**	**100**
Cereals	**407**	**1448**	**76**
Rice	395	1406	74
Wheat	12	42	2
Non-Cereals plant	**203**	**326**	**17**
Pulses	16	56	3
Potato & sweet potato	41	40	2
Leafy Vegetables	24	11	(-)
Non-leafy Vegetables	52	50	3
Fruits	7	6	(-)
Sugar & Gur	2	6	(-)
Oils	9	79	4
Other Foods	52	78	4
Animal foods	**71**	**120**	**6**
Fish	41	61	3
Meat	17	19	1
Eggs	4	4	(-)
Milk & Milk Products	9	36	2

Note: (-) contribution is less than one per cent.

Table 4.8: Individual (³ 10 yrs) per day food and energy intake by food groups

Food groups	Current actual intake		
	g	Kcal	% of Kcal
Total	**754**	**2105**	**100**
Cereals	**460**	**1636**	**78**
Rice	442	1591	76
Wheat	13	45	2
Non-Cereals plant	**220**	**345**	**16**
Pulses	18	61	3
Potato & sweet potato	44	43	2
Leafy Vegetables	26	12	(-)
Non-leafy Vegetables	76	73	4
Fruits	6	5	(-)
Sugar & Gur	2	6	(-)
Oils	10	88	4
Other Foods	38	57	3
Animal foods	**74**	**124**	**6**
Fish	44	67	3
Meat	19	21	(-)
Eggs	4	4	(-)
Milk & Milk Products	7	29	1

Note: (-) contribution is less than one per cent

Fig. 2: Gap between energy (Kcal) required and intake by all population

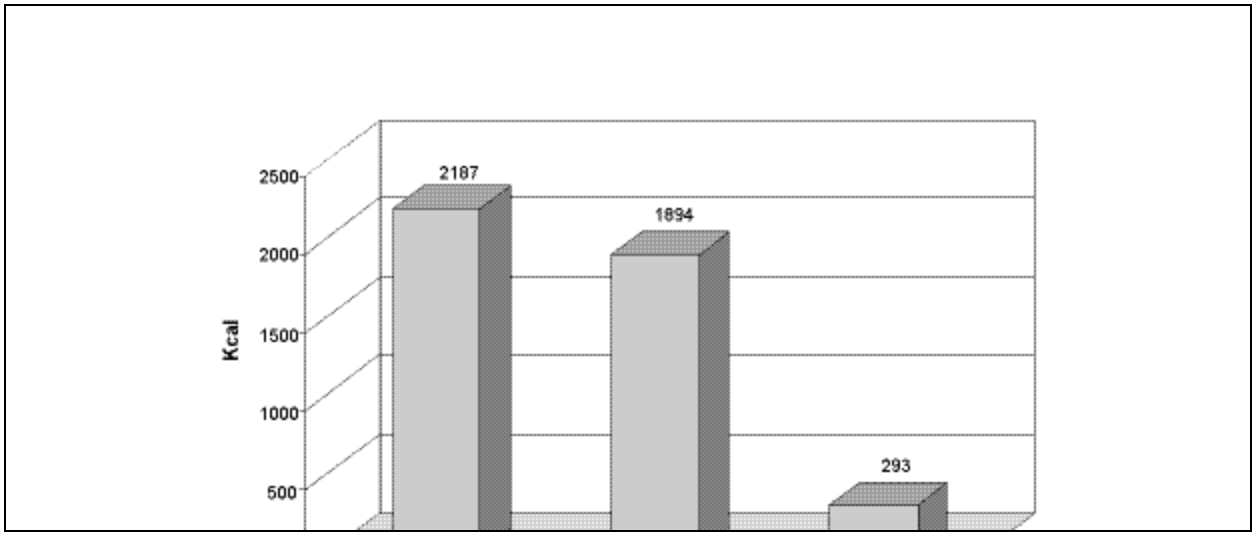


Table 4.9: Per person per day energy intake by age and sex group

Age group (Years)	Sex	Intake (kcal) (A)	Desired energy requirement (B)	Gap (A – B)
0 - 4+	Total (n = 158)	748	1495	-747
	Male (n = 93)	720	1505	-785
	Female (n = 65)	815	1483	-668
5 - 9+	Total (n = 275)	1266	1994	-728
	Male (n = 125)	1305	2019	-714
	Female (n = 150)	1230	1974	-744
≥10	Total (n = 1543)	2105	2248	-143
	Male (n = 570)	2270	2755	-485
	Female (n = 977)	1933	1888	+45

Table 4.10: Gap in individual (Age ³ 10 yrs) Daily Energy Intake and Energy Requirement (Based on desired body weight) by sex

PAL group	Sex (n=351)	Sample size (1%)	desired BMR	PAL	Kcal required IA)	Kcal intake (B)	Gap (A-B)
Light activity (PAL ≤ 1.69)	Male (n=92)	28	1489	1.44	2263	2270	+126
	Female (n=135)	41	1226	1.47	1851	1933	+131
	Total (n= 227)	69	1323	1.46	1998	2105	+173
Moderate activity (PAL ³ 1.70 – 1.99)	Male (n=20)	6	1489	1.84	2740	2270	-470
	Female (n=25)	7	1226	1.80	2195	1933	-262
	Total (n=49)	13	1323	1.81	2395	2105	-290
Vigorous activity (PAL ≥ 2.00)	Male (n=23)	16	1489	2.56	3276	2270	-1542
	Female (n=3)	2	1226	2.36	2673	1933	-960
	Total (n=26)	18	1323	2.55	2911	2105	-1269
ALL	Male (n=164)	50	1489	1.85	2755	2270	-485
	Female (n=164)	50	1226	1.54	1888	1933	-88
	Total (328)	100	1323	1.70	2249	2105	-144

Table 4.11: Gap in individuals (Age ≥ 10 years) per day energy requirement and intake by sex

Sex (%)	Sample size	Desired BMR (A)	Observed BMR (B)	PAL	Energy required (Kcal) (A)	Energy required (Kcal) (B)	Energy intake (Kcal) (C)	Gap (Kcal) (C _ A)	Gap (Kcal) (C _ B)
All (100)	1543	1323	1291	1.70	2249	2193	2105	-144	-88
Male (37)	570	1489	1420	1.85	2755	2627	2270	-485	-355
Female (63)	977	1226	1216	1.54	1888	1873	1933	45	60

Table 4.12: Proposed desirable food composition table per person per day to achieve better nutrition

Food groups	Current actual intake			Recommended desired intake		
	g	Kcal	% of Kcal	g	Kcal	% of Kcal
Total	**681**	**1894**	**100**	**888**	**2187**	**100**
Cereals	**407**	1448	**76**	**380**	**1352**	**60**
Rice	395	1406	74	350	1247	56
Wheat	12	42	2	30	105	4
Non-Cereals plant	**203**	**326**	**17**	**368**	**600**	**29**
Pulses	16	56	3	40	136	5
Potato & sweet potato	41	40	2	60	59	3
Leafy Vegetables	24	11	(-)	40	18	1
Non-leafy Vegetables	52	50	3	125	119	5
Fruits	7	6	(-)	50	42	2
Sugar & Gur	2	6	(-)	10	30	1
Oils	9	79	4	22	193	10
Other Foods	52	78	4	21	34	2
Animal foods	**71**	**120**	**6**	**140**	**237**	**11**
Fish	41	61	3	-	-	-
Meat	17	19	1	-	-	-
Eggs	4	4	(-)	-	-	-
Milk & Milk Products	9	36	2	-	-	-

Note: (-) contribution is less than one per cent.

Table 4. 13 Food consumption (gm/person/day) by surveys of different years conducted by different organizations

Food item	INFS-1997			BBS-2000			Actual intake 2007			Recommended desired intake		
	gm	Kcal	%	gm	Kcal	%	gm	Kcal	%	gm	Kcal	%
Total	**728.1**	**1892.38**	**100.0**	**893**	**2240**	**100.0**	**681**	**1894**	**100.0**	**877**	**2187**	**100**
Cereals	**436**	**1559.25**	**82.4**	**476**	**1656**	**73.9**	**407**	**1448**	**76.5**	**380**	**1337**	**60**
Rice	-	-	-	450	1566	69.9	395	1406	74.2	350	1232	56
Wheat	-	-	-	26	90	4.0	12	42	2.2	30	105	4
Non-cereal	**231.1**	**266.19**	**14.1**	**417**	**584**	**26.1**	**203**	**326**	**17.2**	**357**	**613**	**29**
Pulses	11	45.32	2.4	16	55	2.5	16	56	3.0	40	136	5
Potato & sweet potato	50	44.55	2.4	55	49	2.2	41	40	2.1	60	59	3
L. verg	23	6.97	0.4	-	-	0.0	24	11	0.6	40	18	1
Non_L veg	89	42	2.2	181	5.2	0.2	52	50	2.6	125	119	5
Fruits	14	7.22	0.4	28	20	0.9	7	6	0.3	50	42	2
Sugar & Gur	7	23.75	1.3	21	84	3.8	2	6	0.3	10	30	1
Oils	8	58.51	3.1	14	126	5.6	9	79	4.2	22	193	10
Others	29.1	37.87	2.0	17	10	0.4	52	78	4.1	10	16	2
Animal sour	**61**	**66.94**	**3.5**	**85**	**124**	**5.5**	**71**	**120**	**6.3**	**140**	**237**	**11**
Fish	33	44.87	2.4	-	-	-	41	61	3.2	-	-	-
Meat	9	7.08	0.4	-	-	-	17	19	1.0	-	-	-
Egg	4	4.52	0.2	-	-	-	4	4	0.2	-	-	-
Milk & Milk product	15	10.47	0.6	-	-	-	9	36	1.9	-	-	-

Table 4. 13a Proposed desired food consumption (gm/person/day) table by age group to achieve better nutrition

Food item	Recommended desired intake by age group											
	0 - 4+ years			5 - 9+ years			= 10 years			For all age group		
	gm	Kcal	%	gm	Kcal	%	gm	Kcal	%	gm	Kcal	%
Total	**475**	**1490**	**100**	**681**	**2019**	**100**	**892**	**2248**	**100**	**877**	**2187**	**100**
Cereals	**200**	**700**	**47**	**320**	**1120**	**56**	**379**	**1325**	**59**	**380**	**1337**	**60**
Non-cereal	**215**	**688**	**46**	**261**	**729**	**36**	**383**	**701**	**31**	**357**	**613**	**29**
Pulses	30	105	7	45	158	8	33	114	5	40	136	6
Vegetables, fruits, potato	115	145	10	156	196	10	326	411	18	285	254	12
Sugar & Gur	35	123	8	30	105	5	8	29	1	10	30	2
Oils	35	315	21	30	270	13	16	147	7	22	193	9
Animal source	**60**	**102**	**7**	**100**	**170**	**8**	**131**	**222**	**10**	**140**	**237**	**11**

Table 4. 13b Proposed desired food consumption (g/person/day) table by age group and sex to achieve better nutrition

Food item	Recommended desired intake by age group and sex (0-4+ yrs)								
	Male			Female			Total		
	gm	Kcal	%	gm	Kcal	%	gm	Kcal	%
Total	**480**	**1505**	**100**	**469**	**1471**	**100**	**475**	**1490**	**100**
Cereals	**202**	**707**	**47**	**197**	**691**	**47**	**200**	**700**	**47**
Non-cereal	**217**	**695**	**46**	**212**	**679**	**46**	**215**	**688**	**46**
Pulses	30	106	7	30	104	7	30	105	7
Vegetables, fruits, potato	117	147	10	114	143	10	115	145	10
Sugar & Gur	35	124	8	34	121	8	35	123	8
Oils	35	318	21	34	311	21	35	315	21
Animal source									
(meat, fish, egg, milk & milk product)	**61**	**103**	**7**	**59**	**101**	**7**	**60**	**102**	**7**

Table 4. 13c Proposed desired food consumption (g/person/day) table by age group and sex to achieve better nutrition

Food item	Recommended desired intake by age group and sex (5-9+ yrs)								
	Male			Female			Total		
	gm	Kcal	%	gm	Kcal	%	gm	Kcal	%
Total	**681**	**2019**	**100**	**611**	**1810**	**100**	**645**	**1912**	**100**
Cereals	**320**	**1120**	**56**	**287**	**1004**	**56**	**303**	**1060**	**56**
Non-cereal	**261**	**729**	**36**	**234**	**654**	**36**	**247**	**690**	**36**
Pulses	45	158	8	40	142	8	43	**150**	8
Vegetables, fruits, potato	156	196	10	140	176	10	148	186	10
Sugar & Gur	30	105	5	27	94	5	28	99	5
Oils	30	270	13	27	242	13	28	255	13
Animal source (meat, fish, egg, milk & milk product)	**100**	**170**	**8**	**90**	**152**	**8**	**95**	161	**8**

Table 4. 13d Proposed desired food consumption (g/person/day) table by age group and sex to achieve better nutrition

Food item	Recommended desired intake by age group and sex (= 10 yrs)								
	Male			Female			Total		
	gm	Kcal	%	gm	Kcal	%	gm	Kcal	%
Total	**1094**	**2755**	**100**	**750**	**1888**	**100**	**892**	**2248**	**100**
Cereals	**464**	**1624**	**59**	**318**	**1113**	**59**	**379**	**1325**	**59**
Non-cereal	**470**	**859**	**31**	**322**	**589**	**31**	**383**	**701**	**31**
Pulses	40	140	5	27	96	5	33	114	5
Vegetables, fruits, potato	400	504	18	274	345	18	326	411	18
Sugar & Gur	10	35	1	7	24	1	8	29	1
Oils	20	180	7	14	124	7	16	147	7
Animal source									
(meat, fish, egg, milk & milk product)	**160**	**272**	**10**	**110**	**186**	**10**	**131**	**222**	**10**

CHAPTER 5

The Question of Access

5.1 Introduction

It is important to be able to get under the picture of aggregate supply-demand requirements and needs in order to focus on the complex question of access that ultimately determines consumption levels and patterns at the micro or household level. It would be even better if one could explore determinants of access at the individual level but this is usually made difficult by lack of suitable data (for an exception, see Khondker, B. 2007).

At one level the question of access is handled in a qualitative manner through FGDs as discussed in chapter 6. This theme is explored in this chapter, in two ways. First a set of systematic *qualitative* indicators were used to *quantify* food security levels. This is followed by econometric exercises aimed at understanding access defined variously in terms of calorie adequacy ratios, poverty levels and income derived from HES 2005.

5.2 The Status of Household Food Security

While Bangladesh has made significant strides in its war against poverty, the problem remains widespread and acute. The conventional poverty data based on various rounds of HES are well-known and may be seen in Table 6 below. While moderate poverty has declined rapidly, hardcore poverty has remained virtually unchanged, especially since 2000 – something that policy makers need to worry about. Another point to note is the slow poverty reduction in urban areas, in part perhaps due to rural-urban poverty transfers through migration.

Table 5.1: Trends in Poverty and Hardcore Poverty

Year	National	Rural	Urban
2005	56.0 (40.4)	41.2(39.5)	14.8 (43.2)
2000	55.8 (42.3)	42.6 (52.5)	13.2
1995-96	55.3 (47.5)	45.7 (47.1)	09.6 (49.7)
1991-92	51.6 (47.5)	44.8 (47.6)	06.8 (46.7)
hardcore poverty <1805 kcal			
2005	27.0 (19.5)	18.7 (17.9)	8.3 (24.4)
2000	24.9 (20.0)	18.8 (18.7)	6.0 (25.0)
1995-96	29.1 (25.1)	23.9 (24.6)	5.2 (27.3)
1991-92	30.4 (28.0)	26.6 (28.3)	3.8 (26.3)

Source: BBS; Figures in brackets are percentages.

The nature of food insecurity was further explored through the BIDS-Maxwell survey fielded in 2007. A set of 14 carefully graded and structured indicator-questions were developed that systematically sought to assess the food security level of a household on a gradually rising scale of insecurity. These indicators serve to convey in quantitative terms, important aspects of household food-security, and are reported below.

Each indicator focuses on a different aspect of food security. The indicators at the end of the table (10-14) reflect the worst-case scenarios. Up to 7 percent of households appear to be in acute distress with regard to food access on a regular basis while up to 30 percent suffer such conditions 'sometimes' – marking them out as potentially highly vulnerable. In addition indicators 4 and 7 portray a situation of chronic under-consumption and worries about food access suffered by 12-15 percent of households with up to 30 percent having to confront the problem 'sometimes'.

Essentially therefore, both the physical and psychological impacts of food insecurity are borne out by these indicators drawing attention to specific dimensions of food insecurity often missed in more aggregate analyses.

Some additional indicators of food security are also given below. These relate to household deficits, sources of food and intra-household aspects of food distribution.

Table 5.2: Graded Qualitative Indicators of Household Food Security (2007) **percent hhs**

Serial No.	Indicator	Frequently	Sometimes	Never
1	Obliged to eat cheaper food instead of rice	7.1	29.0	
2	Needed to borrow food to entertain guests	7.0	47.3	
3	Need to purchase food on credit	19.8	48.9	
4	Worried frequently about where the next meal would come from	15.3	32.1	
5	Need to purchase rice frequently as own stores ran out	71.6	15.7	
6	Did not have three meals a day on regular basis	6.6	25.7	
7	Had less than three meals a day on a regular basis	12.1	30.8	
8	Cut back food consumption owing to lack of food	11.8	32.4	
9	Need to borrow food from relatives/ neighbours	9.6	47.8	
10	Main earner needed to skip one or more meals a day	5.2	27.9	
11	There were time when food stores ran out and there was no money to buy food	7.6	32.8	
12	Adults other than main worker had to skip one or more meals	3.8	18.6	
13	Children had to skip one or two meals a day	1.7	10.5	
14	Children had to skip three meals a day	1.4	4.1	

Note: The time reference for each question was the previous 3 months and 12 months while a score of 1, 2 or 3 was placed for each question as well (1= frequently, 2= sometimes and 3= never). Reported figures are for 12 month reference period.

Source: BIDS-Maxwell survey, 2007

The following findings may be noted:

- Around half the households have reported food deficits (a quarter reporting deficits all year round).
- Extremely high rates of market dependence is noted for all foods, including for staples
- Those reporting home gardening have stated that this is purely for own consumption
- Intra-household distribution: wife of head bears the brunt of shortages followed by head
- Around 40 percent households reported equal distribution of fish/meat amongst household members; 17 percent report breadwinner bias; 13 and 5 percent report boy-child and girl-child bias respectively – not really suggestive of dramatic inequality among family members.

Table 5.3: Additional Food Security Indicators (2007)

Indicator	Response (% HH)
HH Food Security Status (surplus/deficit)	
deficit all year	26
occasional deficit	22
surplus	23.9
Sources of Staples (own prod or purchase)	
entirely own produced	7.4
purchase	65.7
own prod + purchase	23.7
Sources of Meat and Fish etc	
entirely own produced	3.2
purchase	51.9
own prod + purchase	43.0
Sources of Vegetable	
entirely own produced	1.5
purchase	61.7
own prod + purchase	34.1
Homestead gardens	
for own consumption	29.1
for sale	0.6
Who gets less food when scarce	
wife of head	65.6
head	21.0
other	
Who gets more fish and meat	
equal	38.1
children, male	12.6
children, female	04.5
breadwinner	16.6
other (e.g. guests)	23.5

Source: BIDS-Maxwell survey 2007

5.3 Household Access to Food – Some Econometric Exercises Using HES 2005

Four alternative variables were specified as the dependent variable to be explained, as follows:

1. *car* : calorie adequacy ratio defined as the ratio between calorie intake and requirement;
2. *r_pcfe_fpl* : ratio of per capita food expenditure to the food poverty line
3. *r_pcfe_pl* : ratio of per capita food expenditure to the poverty line
4. *food_poor_pce*= dummy variable that designates food poor=1, 0=otherwise
5. *poor_pce*= dummy variable that assigns the value 1 to the poor, 0 otherwise

The first three dependent variables are estimated using OLS (with *car* specified in terms of logs). The remaining two variables are estimated using probit (for details see annex to this chapter). Explanatory variables used are defined/specified in the annex, and include income, education of household head, household size, gender of head, rural or urban location, land holding, remittances, price of rice, safety-net access, age-sex distribution of household members, dependency ratios and dummies for administrative-geographic Divisions.

All the estimated models perform reasonably well. Significant variables with the signs of the associated coefficients are shown below (Table 5.4). The *probit* results generally confirm the OLS findings, albeit with some important differences. The results suggest that household level access is NOT affected by female-income earnings, health-expenditures and gender and education of head. Remittances, dependency ratios, safety-nets and land-holdings were significant in some models but not in others, or even if significant, had the ' wrong sign'. Some variables consistently performed well: rural-urban location, rice price, income and divisional dummies (for Khulna and Rajshahi). The probit models yield fewer 'significant' variables compared to OLS but are likely to be more accurate, given the specification of the dependent variables.

Table 5.4: Results of the Econometric Exercises

Dependent Variable	model	Significant (expected sign)	Significant (wrong sign)	Not significant
CAR (calorie adequacy requirement)	OLS	Family size Location (rural/urban) Land-holding Rice price Income Dependency ratios Division (khulna and Rajshai – negative)	Education of head Remittance (domestic/foreign)	Female income ratio Health expenditure Safety nets
r_pcfe_fpl (ratio of per cap food exp to food poverty line) and pce_pl (ratio of pc exp to pov line)	OLS	Family size Location (rural/urban) Land-holding Rice price Income Dependency ratios Division: Khulna Safety nets	Education of head Remittance (domestic)	As above
Food_poor_pce (dummy food poverty=1)	Probit	Location (rural/urban) Remittance (foreign) Rice price Income Division: Khulna and Rajshahi (-ve)		Safety nets Dependency ratios Land-holding Female income Health expenditure
Poor_ pce (dummy poor=1)	Probit	Location (R/U) Rice price Income Divisions: Khulna and Rajshahi (-ve)	Dep ratio (male under 5)	As above plus remittances

5.4 Discussion

The question of access is often discussed subjectively in terms of what appears to be reasonable in terms of influencing household level consumption. Thus factors that are usually held up as being important include income, government transfers, assistance from NGOs or friends, credit, remittance flows, employment etc. (Rahman, S.M et al 2005). Another dimension is also brought to bear, namely the question of shocks related to weather or markets that disrupt normal livelihoods and incomes or production, leading to loss of access to food (Amin and Farid 2005). Thus, depending on the premise from which the analyst begins, a predictable set of variables then follow as being 'key' to addressing access issues.

In this chapter we tried to specify the various explanatory variables that are suggested as being important, including variables that are space-specific (proxied by rural-urban location or 'divisions'), individual and household (age, education, gender, income, land-holding), policy variables like safety nets, health expenditures, remittance), and so on. A core set of basic variables have been identified that have a clear bearing on access: rice price, income, rural-urban location and 'division'. A number of others have also been identified that may have a bearing (but requires further exploration), including remittances (both domestic and foreign), safety nets and land-holding (including tenancy).

Annex to Chapter 5

Details of Econometric Exercises on Access

Variable Specifications

* lcar=log of calorie adequacy
* lprice_rice=log of rice price
* l_pce=log of per capita expenditure
*hsize=household size
*location=rural urban dummy (1=rural, 2=urban)
*landholding=Landholding of households
*head_sex=sex dummy of household head (1=male, 2=female)
*r_male_age0_5=ratio of 0 to 5 aged male members to total members in households
*r_male_age6_11= ratio of 6 to 11 aged male members to total members in households
*r_male_age12_17= ratio of 12 to 17 aged male members to total members in households
*r_male_age18_60= ratio of 18 to 60 aged male members to total members in households
*r_male_age60plus= ratio of 60 plus aged male members to total members in households
*r_female_age0_5=ratio of 0 to 5 aged female members to total members in households
*r_female_age6_11= ratio of 6 to 11 aged female members to total members in households
*r_female_age12_17= ratio of 12 to 17 aged female members to total members in households
*r_female_age18_60= ratio of 18 to 60 aged female members to total members in households
*r_female_age60plus= ratio of 60 plus aged female members to total members in households
*safetynet=dummy of access in safetynet program (1=yes, 0=no)
*safetynet_moneyfedu= dummy of access in money for education of safetynet program (1=yes, 0=no)
*fir=female income ratio
*her=health expenditure ratio
* r_pce_pl=ratio of per capita expenditure to poverty line
* r_pcfe_fpl= ratio of per capita food expenditure to food poverty line
* head_edu_yr=years of education of household head
* rem_dom=domestic remittance
* rem_for=foreign remittance
* dummy_division1=Dummy of division (1=Barishal, 0=others)
*dummy_division2= Dummy of division (1= Chitagong, 0=others)
*dummy_division3= Dummy of division (1= Dhaka, 0=others)
*dummy_division4= Dummy of division (1= Khulna, 0=others)
dummy_division5= Dummy of division (1= Rajshahi, 0=others)
*dummy_division6= Dummy of division (1= Sylhet, 0=others)
* food_poor_pce=dummy of food poor in terms of per capita expenditure (1=food poor, o=others)

***Regression results of lcar*

reg lcar head_edu_yr hsize location landholding head_sex rem_dom rem_for lprice_rice l_pce fir her safetynet safetynet_moneyfedu r_male_age0_5 r_male_age6_11 r_male_age12_17 r_male_age18_60 r_male_age60plus r_female_age0_5 r_female_age6_11 r_female_age12_17 r_female_age18_60 dummy_division1 dummy_division2 dummy_division3 dummy_division4 dummy_division5

Source	SS	df	MS		Number of obs = 9438
Model	179.906834	27	6.66321607		F(27, 9410) = 185.77
Residual	337.520275	9410	.035868254		Prob > F = 0.0000
Total	517.427108	9437	.054829618		R-squared = 0.3477
					Adj R-squared = 0.3458
					Root MSE = .18939

lcar	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
head_edu_yr	-.0045223	.000476	-9.50	0.000	-.0054553	-.0035893
hsize	-.0056089	.0011042	-5.08	0.000	-.0077734	-.0034444
location	-.09586	.0043653	-21.96	0.000	-.1044169	-.0873031
landholding	.0022823	.0006332	3.60	0.000	.0010411	.0035235
head_sex	-.0128885	.0081449	-1.58	0.114	-.0288543	.0030772
rem_dom	-5.65e-06	2.07e-06	-2.73	0.006	-9.69e-06	-1.60e-06
rem_for	-2.06e-06	7.92e-07	-2.60	0.009	-3.61e-06	-5.05e-07
lprice_rice	-.028609	.012614	-2.27	0.023	-.0533351	-.0038828
l_pce	.2006941	.0047459	42.29	0.000	.1913911	.209997
fir	.001939	.0027547	0.70	0.482	-.0034609	.0073388
her	.0008619	.0073735	0.12	0.907	-.0135918	.0153156
safetynet	-.0028654	.0062694	-0.46	0.648	-.0151549	.009424
safetynet_~u	.0328444	.0227574	1.44	0.149	-.0117651	.0774539
r_male_age~5	-.2928098	.0254791	-11.49	0.000	-.3427544	-.2428651
r_male_ag~11	-.1046632	.0237439	-4.41	0.000	-.1512064	-.0581201
r_male_ag~17	.0724161	.024101	3.00	0.003	.0251729	.1196593
r_male_ag~60	.0949467	.0233532	4.07	0.000	.0491694	.140724
r_male_age~s	.0372883	.0309686	1.20	0.229	-.0234169	.0979935
r_female_a~5	-.3449786	.0252853	-13.64	0.000	-.3945433	-.295414
r_female_~11	-.131995	.0245088	-5.39	0.000	-.1800374	-.0839525
r_female_~17	-.0292185	.0247711	-1.18	0.238	-.0777753	.0193384
r_female_~60	.0263446	.0193286	1.36	0.173	-.0115438	.0642329
dummy_divi~1	-.0417299	.0108624	-3.84	0.000	-.0630227	-.0204372
dummy_divi~2	.0021122	.0095281	0.22	0.825	-.0165648	.0207893
dummy_divi~3	.0075907	.0091911	0.83	0.409	-.0104257	.0256072
dummy_divi~4	-.0065375	.0100365	-0.65	0.515	-.0262111	.0131362
dummy_divi~5	.0442594	.0094103	4.70	0.000	.0258131	.0627057
_cons	-1.2736	.0655738	-19.42	0.000	-1.402139	-1.145061

*predicted and actual value of lcar

Variable	Obs	Mean	Std. Dev.	Min	Max
lcar	10129	.0385177	.2335491	-2.02128	1.914699
lcar_hat	9438	.0389928	.1380724	-.5930142	.8027954

***Regression results of r_pcfe_fpl*

reg r_pcfe_fpl head_edu_yr hsize location landholding head_sex rem_dom rem_for lprice_rice l_pce fir her safetynet safetynet_moneyfedu r_male_age0_5 r_male_age6_11 r_male_age12_17 r_male_age18_60 r_male_age60plus r_female_age0_5 r_female_age6_11 r_female_age12_17 r_female_age18_60 dummy_division1 dummy_division2 dummy_division3 dummy_division4 dummy_division5

Source	SS	df	MS		
Model	1716.07676	27	63.5583984	Number of obs	= 9438
Residual	1109.8613	9410	.117944878	F(27, 9410)	= 538.88
Total	2825.93806	9437	.29945301	Prob > F	= 0.0000
				R-squared	= 0.6073
				Adj R-squared	= 0.6061
				Root MSE	= .34343

r_pcfe_fpl	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
head_edu_yr	-.0046306	.0008631	-5.37	0.000	-.0063225	-.0029387
hsize	-.0211178	.0020023	-10.55	0.000	-.0250428	-.0171928
location	-.0668366	.0079158	-8.44	0.000	-.0823534	-.0513199
landholding	.0038776	.0011482	3.38	0.001	.0016268	.0061283
head_sex	-.0163104	.0147696	-1.10	0.269	-.045262	.0126413
rem_dom	-.0000146	3.75e-06	-3.89	0.000	-.0000219	-7.23e-06
rem_for	-2.62e-06	1.44e-06	-1.83	0.068	-5.44e-06	1.92e-07
lprice_rice	-.4678627	.0228737	-20.45	0.000	-.5127001	-.4230253
l_pce	.7454149	.008606	86.62	0.000	.7285453	.7622845
fir	-.0020272	.0049953	-0.41	0.685	-.011819	.0077647
her	-.005004	.0133709	-0.37	0.708	-.0312138	.0212058
safetynet	.0020562	.0113687	0.18	0.856	-.020229	.0243414
safetynet_~u	-.0248001	.0412675	-0.60	0.548	-.1056933	.056093
r_male_age~5	-.0920518	.0462029	-1.99	0.046	-.1826195	-.0014842
r_male_ag~11	-.0531175	.0430563	-1.23	0.217	-.1375171	.0312821
r_male_ag~17	-.1066488	.0437039	-2.44	0.015	-.1923178	-.0209797
r_male_ag~60	.0007422	.0423478	0.02	0.986	-.0822686	.083753
r_male_age~s	.0202142	.0561573	0.36	0.719	-.0898663	.1302947
r_female_a~5	-.1232865	.0458514	-2.69	0.007	-.2131651	-.0334078
r_female_~11	-.1367377	.0444432	-3.08	0.002	-.223856	-.0496193
r_female_~17	-.1185775	.0449191	-2.64	0.008	-.2066286	-.0305265
r_female_~60	-.0464359	.0350498	-1.32	0.185	-.1151411	.0222694
dummy_divi~1	.0123371	.0196975	0.63	0.531	-.0262744	.0509485
dummy_divi~2	.005418	.0172778	0.31	0.754	-.0284503	.0392863
dummy_divi~3	-.018213	.0166667	-1.09	0.275	-.0508834	.0144573
dummy_divi~4	-.0897305	.0181997	-4.93	0.000	-.1254059	-.0540551
dummy_divi~5	-.031432	.0170643	-1.84	0.066	-.0648818	.0020178
_cons	-5.594181	.1189091	-47.05	0.000	-5.827268	-5.361093

*predicted and actual value of r_pcfe_fpl

Variable	Obs	Mean	Std. Dev.	Min	Max	
r_pcfe_fpl	10129	1.102958	.5403418	.1385014	12.96607	
r_pcfe_fpl_hat	9438	1.10876	.4264336	-.4267788	3.786262	

***Regression results of r_pce_pl*

reg r_pce_pl head_edu_yr hsize location landholding head_sex rem_dom rem_for lprice_rice l_pce fir her safetynet safetynet_moneyfedu r_male_age0_5 r_male_age6_11 r_male_age12_17 r_male_age18_60 r_male_age60plus r_female_age0_5 r_female_age6_11 r_female_age12_17 r_female_age18_60 dummy_division1 dummy_division2 dummy_division3 dummy_division4 dummy_division5

Source	SS	df	MS		Number of obs = 9438
Model	13717.2822	27	508.047488		F(27, 9410) = 750.05
Residual	6373.86472	9410	.67735013		Prob > F = 0.0000
Total	20091.1469	9437	2.12897604		R-squared = 0.6828
					Adj R-squared = 0.6818
					Root MSE = .82301

r_pce_pl	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
head_edu_yr	-.0191974	.0020684	-9.28	0.000	-.0232519	-.0151429
hsize	.0027143	.0047985	0.57	0.572	-.0066918	.0121203
location	-.0605681	.0189699	-3.19	0.001	-.0977531	-.0233831
landholding	.0010638	.0027516	0.39	0.699	-.00433	.0064575
head_sex	-.0336052	.0353945	-0.95	0.342	-.1029861	.0357758
rem_dom	.0000117	8.98e-06	1.30	0.193	-5.91e-06	.0000293
rem_for	.0000154	3.44e-06	4.46	0.000	8.61e-06	.0000221
lprice_rice	-.8394408	.0548155	-15.31	0.000	-.9468911	-.7319905
l_pce	2.30725	.0206237	111.87	0.000	2.266823	2.347676
fir	.0150579	.011971	1.26	0.208	-.0084077	.0385236
her	-.0229762	.0320425	-0.72	0.473	-.0857865	.039834
safetynet	.1988888	.0272445	7.30	0.000	.1454836	.252294
safetynet_~u	-.3185477	.0988951	-3.22	0.001	-.5124034	-.1246919
r_male_age~5	.4529757	.1107226	4.09	0.000	.2359354	.6700159
r_male_ag~11	.2837864	.1031819	2.75	0.006	.0815277	.4860452
r_male_ag~17	-.2117256	.1047338	-2.02	0.043	-.4170265	-.0064247
r_male_ag~60	-.1319563	.1014841	-1.30	0.194	-.330887	.0669744
r_male_age~s	-.2981922	.1345779	-2.22	0.027	-.5619939	-.0343906
r_female_a~5	.5427761	.1098803	4.94	0.000	.3273871	.7581652
r_female_~11	.4265154	.1065057	4.00	0.000	.2177412	.6352896
r_female_~17	.1079918	.1076459	1.00	0.316	-.1030175	.3190011
r_female_~60	-.1786886	.0839949	-2.13	0.033	-.3433368	-.0140404
dummy_divi~1	.1685363	.0472041	3.57	0.000	.0760062	.2610664
dummy_divi~2	-.0636654	.0414053	-1.54	0.124	-.1448288	.017498
dummy_divi~3	.0046029	.0399409	0.12	0.908	-.0736898	.0828956
dummy_divi~4	.2989691	.0436146	6.85	0.000	.213475	.3844631
dummy_divi~5	.3383232	.0408937	8.27	0.000	.2581628	.4184837
_cons	-17.76118	.2849588	-62.33	0.000	-18.31976	-17.2026

*predicted and actual value of r_pce_pl

Variable	Obs	Mean	Std. Dev.	Min	Max
r_pcfe_fpl	10129	1.102958	.5403418	.1385014	12.96607
r_pce_pl_hat	9438	1.59678	1.205638	-3.168881	9.829933

***Marginal effects of probit regression onf food poor*

```
dprobit  food_poor_pce head_edu_yr hsize location landholding head_sex rem_dom
rem_for lprice_rice l_pce fir her safetynet safetynet_moneyfedu r_male_age0_5
r_male_age6_11     r_male_age12_17     r_male_age18_60     r_male_age60plus
r_female_age0_5    r_female_age6_11    r_female_age12_17    r_female_age18_60
dummy_division1     dummy_division2     dummy_division3     dummy_division4
dummy_division5

Iteration 0:   log likelihood =  -3481.802
Iteration 1:   log likelihood = -2031.5786
Iteration 2:   log likelihood = -1376.0729
Iteration 3:   log likelihood = -964.82954
Iteration 4:   log likelihood = -723.03171
Iteration 5:   log likelihood = -602.94596
Iteration 6:   log likelihood = -566.33975
Iteration 7:   log likelihood = -562.62225
Iteration 8:   log likelihood = -562.57889
Iteration 9:   log likelihood = -562.57888
```

Probit regression, reporting marginal effects — Number of obs = 9438; LR chi2(27) = 5838.45; Prob > chi2 = 0.0000; Pseudo R2 = 0.8384

Log likelihood = -562.57888

food_p~e	dF/dx	Std. Err.	z	P>|z|	x-bar	[95%	C.I.]
head_e~r	-6.92e-18	1.72e-17	-1.23	0.219	4.15162	-4.1e-17	2.7e-17
hsize	2.84e-18	1.25e-17	0.27	0.786	4.87487	-2.2e-17	2.7e-17
location	6.67e-17	1.66e-16	1.67	0.094	1.36395	-2.6e-16	3.9e-16
landho~g	-1.94e-17	4.88e-17	-1.06	0.289	1.25713	-1.2e-16	7.6e-17
head_sex	4.09e-18	8.04e-17	0.05	0.959	1.10765	-1.5e-16	1.6e-16
rem_dom	2.50e-20	7.32e-20	0.61	0.545	205.158	-1.2e-19	1.7e-19
rem_for	3.13e-20	7.68e-20	1.81	0.071	548.416	-1.2e-19	1.8e-19
lpric~ce	2.82e-15	6.78e-15	20.03	0.000	-3.83548	-1.0e-14	1.6e-14
l_pce	-5.51e-15	1.32e-14	-27.70	0.000	6.99846	-3.1e-14	2.0e-14
fir	3.07e-17	9.40e-17	0.53	0.593	.051365	-1.5e-16	2.1e-16
her	8.72e-17	2.19e-16	1.45	0.146	.062514	-3.4e-16	5.2e-16
safety~t*	2.21e-18	4.48e-17	0.05	0.959	.130536	-8.6e-17	9.0e-17
safety~u*	-8.91e-18	1.94e-16	-0.04	0.967	.008053	-3.9e-16	3.7e-16
r_male~5	-1.30e-16	3.74e-16	-0.61	0.539	.063559	-8.6e-16	6.0e-16
r_mal~11	-1.77e-16	4.60e-16	-0.90	0.369	.073696	-1.1e-15	7.3e-16
r_mal~17	-3.11e-16	7.75e-16	-1.44	0.149	.067602	-1.8e-15	1.2e-15
r_mal~60	-1.73e-16	4.73e-16	-0.74	0.460	.254995	-1.1e-15	7.5e-16
r_male~s	-4.08e-16	1.03e-15	-1.24	0.213	.034238	-2.4e-15	1.6e-15
r_fema~5	-2.87e-16	7.12e-16	-1.40	0.161	.062359	-1.7e-15	1.1e-15
r_fem~11	-1.10e-16	3.29e-16	-0.56	0.575	.066793	-7.5e-16	5.3e-16
r_fem~17	1.61e-16	4.36e-16	-0.72	0.473	.060198	-1.0e-15	6.9e-16
r_fem~60	9.18e-17	2.76e-16	0.55	0.583	.281905	-4.5e-16	6.3e-16
dummy_~1*	1.91e-17	1.42e-16	0.16	0.869	.083598	-2.6e-16	3.0e-16
dummy_~2*	7.87e-17	2.65e-16	0.60	0.550	.180865	-4.4e-16	6.0e-16
dummy_~3*	-3.26e-17	1.01e-16	-0.44	0.659	.283323	-2.3e-16	1.7e-16

dummy_~4*	-1.68e-16	4.03e-16	-4.50	0.000	.141132	-9.6e-16	6.2e-16
dummy_~5*	-2.67e-16	6.40e-16	-3.85	0.000	.255563	-1.5e-15	9.9e-16
obs. P	.1210002						
pred. P	4.72e-17	at x-bar)					

(*) dF/dx is for discrete change of dummy variable from 0 to 1
z and P>|z| correspond to the test of the underlying coefficient being 0

*predicted and actual value of food_poor_pce

Variable	Obs	Mean	Std. Dev.	Min	Max
food_poor_pce	10152	.125394	.3311815	0	1
food_poor_pce_hat	9438	.1224341	.294955	0	1

**Marginal effects of probit regression on poor*

```
dprobit   poor_pce head_edu_yr hsize location landholding head_sex rem_dom
rem_for lprice_rice l_pce fir her safetynet safetynet_moneyfedu r_male_age0_5
r_male_age6_11     r_male_age12_17     r_male_age18_60     r_male_age60plus
r_female_age0_5    r_female_age6_11    r_female_age12_17    r_female_age18_60
dummy_division1     dummy_division2     dummy_division3     dummy_division4
dummy_division5

Iteration 0:   log likelihood = -5975.0303
Iteration 1:   log likelihood = -3170.9971
Iteration 2:   log likelihood =  -2046.351
Iteration 3:   log likelihood = -1406.1112
Iteration 4:   log likelihood = -1053.6653
Iteration 5:   log likelihood = -885.34718
Iteration 6:   log likelihood = -835.69241
Iteration 7:   log likelihood = -830.77649
Iteration 8:   log likelihood = -830.72273
Iteration 9:   log likelihood = -830.72272
```

Probit regression, reporting marginal effects — Number of obs = 9438
Log likelihood = -830.72272 — LR chi2(27) = 10288.62; Prob > chi2 = 0.0000; Pseudo R2 = 0.8610

poor_pce	dF/dx	Std. Err.	z	P>|z|	x-bar	[95%	C.I.]
head_e~r	-4.30e-08	1.19e-07	-0.36	0.716	4.15162	-2.8e-07	1.9e-07
hsize	3.37e-07	3.21e-07	1.35	0.177	4.87487	-2.9e-07	9.7e-07
location	3.94e-06	2.62e-06	4.14	0.000	1.36395	-1.2e-06	9.1e-06
landho~g	-4.13e-07	4.47e-07	-1.09	0.275	1.25713	-1.3e-06	4.6e-07
head_sex	2.14e-07	1.94e-06	0.11	0.912	1.10765	-3.6e-06	4.0e-06
rem_dom	-1.37e-10	6.46e-10	-0.21	0.830	205.158	-1.4e-09	1.1e-09
rem_for	-6.45e-10	5.72e-10	-1.42	0.156	548.416	-1.8e-09	4.8e-10
lpric~ce	.0000898	.0000553	23.94	0.000	-3.83548	-.000019	.000198
l_pce	-.0001899	.0001166	-32.90	0.000	6.99846	-.000419	.000039
fir	1.22e-06	1.56e-06	0.90	0.370	.051365	-1.8e-06	4.3e-06
her	1.16e-06	2.00e-06	0.62	0.536	.062514	-2.8e-06	5.1e-06

safety~t*	2.75e-07	1.33e-06	0.22	0.829	.130536	-2.3e-06	2.9e-06
safety~u*	1.68e-06	7.11e-06	0.30	0.764	.008053	-.000012	.000016
r_male~5	8.67e-06	7.55e-06	1.65	0.099	.063559	-6.1e-06	.000023
r_mal~11	5.90e-06	6.10e-06	1.22	0.221	.073696	-6.1e-06	.000018
r_mal~17	5.64e-07	4.98e-06	0.11	0.910	.067602	-9.2e-06	.00001
r_mal~60	1.14e-06	5.29e-06	0.22	0.828	.254995	-9.2e-06	.000012
r_male~s	7.92e-06	8.24e-06	1.21	0.227	.034238	-8.2e-06	.000024
r_fema~5	2.26e-06	5.45e-06	0.43	0.667	.062359	-8.4e-06	.000013
r_fem~11	2.02e-06	5.27e-06	0.40	0.690	.066793	-8.3e-06	.000012
r_fem~17	1.11e-06	5.46e-06	0.21	0.837	.060198	-9.6e-06	.000012
r_fem~60	1.47e-06	4.21e-06	0.36	0.721	.281905	-6.8e-06	9.7e-06
dummy_~1*	9.07e-06	.0000108	1.72	0.085	.083598	-.000012	.00003
dummy_~2*	3.95e-06	4.87e-06	1.27	0.205	.180865	-5.6e-06	.000013
dummy_~3*	-1.24e-06	1.91e-06	-0.65	0.515	.283323	-5.0e-06	2.5e-06
dummy_~4*	-6.09e-06	3.87e-06	-6.88	0.000	.141132	-.000014	1.5e-06
dummy_~5*	-8.39e-06	5.39e-06	-5.72	0.000	.255563	-.000019	2.2e-06
obs. P	.3284594						
pred. P	2.52e-06	(at x-bar)					

(*) dF/dx is for discrete change of dummy variable from 0 to 1
z and P>|z| correspond to the test of the underlying coefficient being 0

*predicted and actual value of poor_pce

Variable	Obs	Mean	Std. Dev.	Min	Max
poor_pce	10129	.3371508	.4727602	0	1
poor_pce_hat	9438	.3298992	.4381263	0	1

CHAPTER 6

Preferences, Perceptions and Consumption Patterns

6.1. Food consumption patterns in Bangladesh

Food consumption behaviour, nutritional status, health and food security are affected by underlying socio-cultural factors determining food availability, access and utilization. These factors are not well-understood although widely acknowledged, requiring a realistic assessment of the extent to which knowledge, attitudes and practices (KAP) constrain or undermine food security and nutritional status at the household level. This chapter attempts to explore these issues with evidence generated through extensive FGDs over a wide range of areas spread throughout the country.

Table 6.1 compares the consumption pattern of the top 10% of households in terms of quantities (gm) and calories with the average pattern for all households belonging to the HIES 2005 sample. It is interesting to note that total calories consumed by the top 10 percent households is somewhat lower (3339 vs. 3664 calories) while the consumption of wheat, milk, sweet, meat and fruits are significantly higher – almost double. In other words, there are large differences in nutritional intakes and consumption of quality foods across different socio-economic groups.[7]

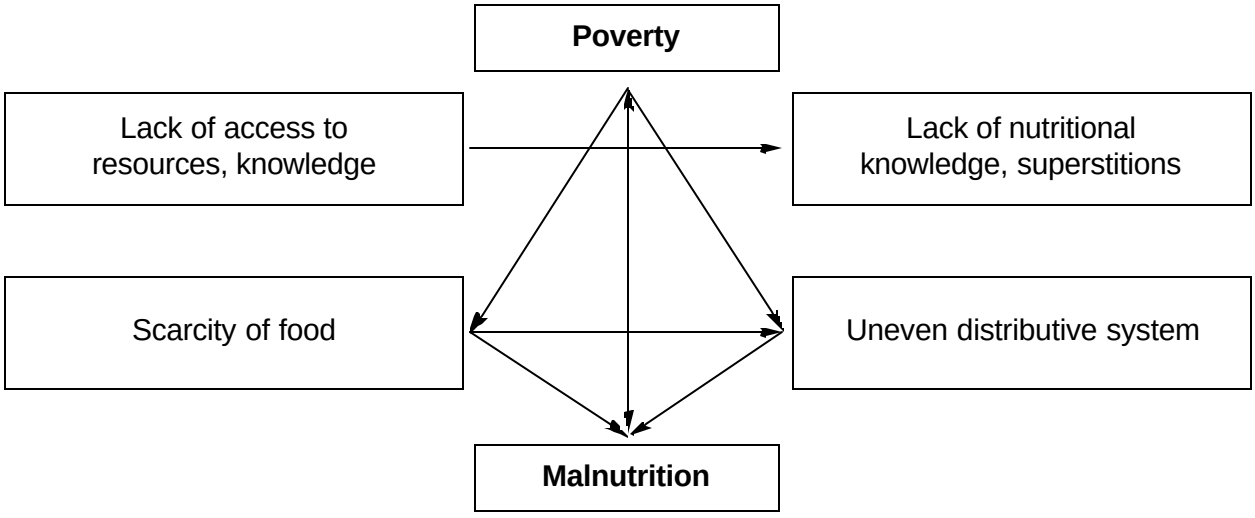
Table 6.1 : Top 10% consumption and calorie by commodity compared to all households from HIES2005

	Top 10% households by per capita expenditure		All households	
	Per capita per day consumption (gram)	Per capita per day calorie consumption	Per capita per day consumption (gram)	Per capita per day calorie consumption
Rice	613.6	2113.116	541.7001	1864
Wheat	36.4	124.8057	15.90019	54
other food grains	99.0	339	51.6	176
Pulse	75.7	264	58.1	202
Fish	504.4	614	288	318
Egg	0.79	69	0.57	50
Meat	333.4	371	130	146
Vegetables	115.7	499	887.6	399
Milk	135.2	97	62.8	44
Sweet	59.6	237	21.8	87
oil & fat	42.2	379	22.5	202
Fruits	361.0	234	183.4	121

[7] It will be observed that the calorie estimates derived from HIES 2005 is considerably higher than what was found in our own sample – presumably due to methodological differences in data collection. The point of Table 6.1 however, is to highlight the pattern of food consumption rather than on calorie levels *per se*.

Poverty and lack of food access have always closely corresponded with food insecurity and stress. Under-nourishment and morbidity result from chronic lack of access to food. While poverty is an overall denominator of food insecurity, gender, age and disability, geographical location and cultural practices are important determinants of food consumption patterns. Poverty directly influences food consumption due to lack of access to resources, knowledge and access to market. Gender discrimination in food distribution can also cause malnutrition, especially for pregnant/lactating mothers and their children. If better nutritional status is desired for the nation food consumption behaviour including choice of foods and distribution are most important. In general, food consumption behaviour is most likely to be changed by providing choices, ensuring availability, generating nutritional information and awareness through the agency of key 'gatekeepers' in rural Bangladesh.

The following diagram shows the interrelationship between poverty and nutrition, and key intervening factors.



It is widely agreed that the problem of the lack of access to food commensurate with adequate provisioning of energy and nutritional resources is fundamentally caused by the lack of incomes. The lack of incomes is the principal driver of under-consumption and malnutrition for the roughly 40 percent of Bangladeshis who still live under the poverty line. Any broad narrative of household vulnerability must involve four dimensions of deprivation, relating to the distribution of ownership entitlements[8], spatial and agro-ecological disadvantages, lack of capacity to deal with seasonal fluctuations, and some personal characteristics like disability and handicap.

Gender dimension of food consumption, distribution and utilization needs to be specially addressed in nutrition policy since women, even pregnant women, are widely believed to suffer from discriminatory practices relating to food distribution within the household. A combination of acute poverty and culturally

8 Exchange entitlements, which Amartya Sen popularized in the early 1980s, largely result from the distribution of property rights. Sen mainstreamed the thesis that famines result not just from "food availability declines" (FAD) but from wide-spread failures of exchange entitlements, the latter barring tens of thousands of households from buying virtually any food at all.

determined attitudes towards women's access to food is thought to promote poor nutritional standards and under-consumption among poor women.[9] Over 60% of all pregnant and lactating women have insufficient calorie intakes which in turn produces malnourished babies. Thus: "Amidst the pervasive hunger [in Bangladesh], we conclude —-as do most nutritionists—-that preschool children, infants, and pregnant and lactating women are the population groups facing the most acute nutritional risks" (WGTFI, 1993). We give this intra-household dimension some prominence as this is an indispensable part of an accurate narrative of the problem of social and economic access to food.

The following table provides a glimpse of the vulnerability of different household members within the household which highlights the importance of looking into the needs of particular groups in terms of relevant categories. While the figures are likely to have changed since 1991, the 'at risk' groups identified, remain vulnerable even today.

Table 6.2 Vulnerable groups within the household, 1991/92

Vulnerable population groups	Estimated population size, 1991/92, thousands	At risk population size, thousands	At risk population share (%)	Risk
Infants	3608	397 1804 2201	11 50 61	Mortality Low birth-weight
Pre-school Children:	7541	5279	70	
Boys	7539	5277	70	
Girls				Stunting
School-age Children:				Stunting
Boys	16927	7360	43	
Girls	15696	8299	53	
Women:				Caloric shortfall
Pregnant & Lactating	7608	4666	61	Caloric shortfall
Household head Other	903	472	52	
	19891	10860	52	-
Men	30287	13750	45	- - -
Total	**110,000**	**58164**	**53**	

Source: WGTFI, Appendix Table B.5

[9] These views would appear to be somewhat contradictory to the findings of Chapter 4 where we found that women over 10 years of age fare better than men from the same age group, mainly because of the much higher calorie needs of the latter compared to the former. Thus, while men do consume more than women, they also experience greater deficit because of their higher levels of physical activity and calorie needs. In much of the gender literature differences in physical activity levels by gender are rarely taken into account while focusing on consumption differentials. The case of special groups at risk is different, and these include pregnant and lactating women, children.

This study is concerned with Knowledge, Attitude and Practice (KAP) and the manner in which these interact with food production, distribution and consumption at the household level to affect particular groups of households in particular contexts - both socio-economic and locational.

6.2. Methodology

Since the mid-1990s, there has been a proliferation of activity worldwide to develop country-specific qualitative food security measurements. Techniques such as Rapid Rural Appraisal (RRA) and Participatory Rural Appraisal (PRA) were an attempt to build simpler tools for assessing communities; both RRA and PRA relied heavily on focus groups and in-depth interviews of a limited number of key individuals living in a given community. A number of countries are now in the process of developing and/or implementing a qualitative food security model.

Many countries have moved in the direction of exploring the development and use of qualitative food security measures. The increased attention to food insecurity and hunger has led to the realization that newer methods for monitoring the prevalence and severity of hunger and food insecurity are needed and that such methods need to be developed in a manner that reflects the perceptions of those directly affected, e. g. the poor.

Several techniques of measurement are popular at the household or community level:

- Wealth ranking: Communities can be stratified into different wealth groups in terms of locally defined characteristics (asset ownership, months of self-provisioning, etc) and households are allocated to these wealth groups which can then be used to generate estimated food insecure populations for targeting purposes.
- Group ratings: Single-sex or mixed-sex groups assign members of their community to one of three categories- “food secure”, intermittently insecure and “food insecure” to gather a total picture of food security in the community. Food security includes at a minimum (1) the ready availability of nutritionally adequate and safe foods and (2) an assured ability to acquire acceptable foods in socially acceptable ways (i.e. without resorting to emergency food supplies, scavenging, stealing or other coping strategies).
- Dietary diversity: The method is to generate a list of locally consumed foods (about 30 to 40) items and then ask the respondents which items they have consumed in the whole month.

This study has adopted the type of qualitative methods (FGD and key informant interviews) discussed above (after suitable modification) to capture KAP in the context of household food intake patterns and consequent nutritional outcomes. It also attempted to document household access to knowledge and resources regarding availability of food, food insecurity and crisis coping strategies in different communities. Evidence was gathered on livelihood options, seasonality, food consumption patterns, sources of knowledge regarding nutrition and health, and nutritional intake levels.

FGDs were conducted among various groups including pregnant and lactating women, adult women, teenage unmarried girls and teenage mothers. The study covered diverse regions and focused particularly on the poor and the poorest. Six districts were covered based on the severity of poverty and regional location. Thus, the six districts were chosen based on the poverty-vulnerability map of WFP – from severe /high, moderate and low poverty areas. The FGD team was led by the Social Anthropologist and comprised of 2 male and 2 female field assistants. The FGDs were conducted over more than a month during September-October. FGD participants varied from 10-20 people per group.

The study was conducted to look into KAP in the context of household nutrition and food intake. As gender, class, age, location, are likely have an impact on the gap between knowledge and practice, the study was gender and poverty sensitive.

Identification of the poor for the FGD was a challenging job. Several indicators were adopted to facilitate this, including land ownership status, per capita income-expenditures, participation in incentive-based programmes (NGO micro-credit) and social safety nets (VGD, VGF etc), involvement in the wage labour market and in non-market based activities. Different categories of farmers (big, medium, small) were included in the FGD.

FGDs with women included pregnant and lactating women, teenaged mothers and unmarried teenagers as well as other adult women. Particular emphasis was given to pregnant and lactating women who are considered to be at special nutritional risk. FGD with women covered access to food and nutrition, distribution of food within the family (including gender and age concerns), knowledge of sources of nutrition and health, knowledge regarding nutritional content of different foods, changing food habits, problem prioritization of health and nutrition, problem of changing food practices and of a balanced diet, cultural practices and other barriers impeding adequate food intakes of pregnant and lactating women. Different socio-cultural practices that discourage or prohibit certain foods for pregnant and lactating women, teenagers and widows, were noted. The major barriers and potential agents of change - people, institutions, relatives (in-laws), neighbours, health service providers, local religious leaders, local government leaders, teachers, media, the elderly, NGO workers, etc. were discussed and recorded.

Intra-household food distribution, factors determining nutritional status of a household and its members, issues influencing availability of food, social factors affecting access, utilization and distribution etc. were covered in the FGDs with women. FGDs with male farmers included seasonality as a major determinant factor of food availability and utilization along with cropping patterns as an indication of change in food choices, habits and needs. Attitudes to e.g. genetically modified (GM) foods and high yielding varieties (HYV) were also observed. FGDs with non-farmer male groups covered issues like food availability in the locality, their knowledge and food consumption behavior, and changes experienced over time.

6.3 Regional Perspective

Rangpur

Rangpur is one of the most food-insecure and one of the poorest areas of the country. Women respondents reported low income levels because of few work opportunities. Most are unable to afford meals on a regular basis. The price of food is a major concern - according to a poor widow, “if price of food increases in this way, the poor will die of starvation”. Those who depend on their own labour for a living are the worst hit. Income sources for women in the village is scarce; nor are there any NGO programs catering to their needs. They seem to be more disadvantaged compared to women in other areas. They borrow money from *mahajans* at high interest rates, and in the process often find that they have to sell off their few assets to repay. In some cases, they send their minor children off to work as domestic help in the house of better-off farmers.

NGOs do not want to give loans to those who do not own any land or a house, or to widows, because of repayment risks. Women also have to spend money according to the wishes of their husbands and sons. They can borrow from the informal market at 2 *maunds* (1maund=40 kg) of rice per 1000 takas or at 100 taka per month for 1000 takas.

As for safety nets (VGD or widow allowance), a widow said, “I am a widow and I have nothing to eat but still, I don’t get a widow allowance”. Poor women complained that “those who have a VGD card get it again and again”.

Most of the local people depend on agriculture. Natural disasters like flood, drought and storms do not create serious problems here. In the rainy season, however, and especially in the September-October period, there is little work available, and therefore, depressed earnings and food consumption. Many try to

cope through a variety of non-farm work like petty trade and transport work. Others migrate seasonally to other districts – up to 20 percent reportedly go to find work in Dhaka, Sylhet, Chittagong and Comilla. This kind of seasonal migration is not seen in Cox's Bazaar and Sylhet.

Kushtia

Poor women blame their poverty on low incomes and big families. If the head of the family falls sick or dies, then there is nobody to earn. If their crops are destroyed or damaged by various natural disasters or when the market price rises, their consumption standards fall. They also suffer from significant seasonal distress in terms of food consumption.

There have been NGO interventions to provide training to girls and women in sewing and embroidery for which there appears to be good demand. This has led to improved earnings of these women and their empowerment, expressed in their control over their own money.

Farmers have given up pulse production as it is not so profitable, though once this area was famous for pulses. Maize production is now very popular here. Once there were many (public sector) mills and industries but those have closed down.There are now a few privatized industrieal units in operation. The Mohori cloth mill was a big local employer but closed down in 1982, directly affecting 1000 workers and indirectly 5000 people were affected.

As we saw in Rangpaur, safety net access is uneven and there is a perception that the "really" eligible do not benefit.

Tangail

The FGD in Tangali was conducted mainly in handloom or weaver communities. Women work very hard here as they have to work the looms and at the same time do household work. Their husbands want them to work because engaging workers is expensive. Their work includes dyeing, colouring, *chorka kata*, sewing, designing, sewing beads etc.

During hard times, people have to take loans or sell assets like poultry and cattle. Food habits have changed as a result of high food prices: they used to eat more nutritious food when prices were lower but now their meals have become even less diversified, leading to malnutrition of both men and women. People of the community think consider that farmers and businessmen eat better, and are better off. Once upon a time, weavers were better off – that is no longer the case as price of threads have increased while that of the finished product has declined. Only 5% of poor people get VGD cards.

Sylhet (Srimangal)

Most of the people work as a day labour, grocers and rickshaw-pullers among the poor non-farm population. In the peak season, when farmers have work available, they can fulfill their food demand for a short time when they ca consume fish, meat and milk on and off, as well as have three full meals a day.

During the lean season, many have to take out loans at high interest (Tk. 100 for Tk.1000 for seven days). As a poor woman lamented, '*Suder taka dita aro fokir hoia gelam* (the high interest is turning us into beggars", and "we cannot sleep at night because we have to pay the interest money in the morning".

Women in the tea gardens are in a better position than unemployed women in the villages. Most of the women work in the tea gardens picking tea-leaves. Males are engaged in various work in the gardens such as cleaning and line checking. The garden authority allows women to take leave, including maternity leave with salary for the first two deliveries.

A few families also grow rice in adjoining plain lands for their own consumption.

Cox's Bazaar

Men work as carpenters, rickshaw pullers and boatmen outside their villages. But most of them work as rickshaw pullers, van pullers, hotel boys, shopkeepers, oyster sellers etc.

A number of well-know NGOs operate here. Women take out credit from these to give to their husbands, mainly for fish trading and making shell ornaments. They are prone to cyclonic storms that can take a heavy toll on lives and property.

Fishermen's incomes are related to the tide and ebb of the sea. From the Bengali months of *Chaitra* to *Bhadro*, fishermen are mainly busy catching fishlings for sale, and can earn Tk. 200-250 a day. However, it is not possible to work continuously for a long time due to break out of skin diseases related to over exposure to salt water. Others will venture deep into the sea, risking their lives in ill-equipped boats that do not even have a radio to listen to emergency warnings. During the lean season, people work in a variety of trading activities.

Some fishermen do not have their own nets. They will take an advance from a trader-wholesaler – up to Tk. 5000 to buy a net to be repaid in fishlings. Widows of fishermen do not get any allowance or support from any organization - no NGOs are working for the fishermen or their widows.

Narayanganj

Large, low-income families suffer from acute food shortages. Their children cannot be educated properly as they are forced to earn an income from an early age. They face a severe crisis if the main income earner falls ill, using up whatever savings are available, or otherwise taking recourse to loans.

In the *Jamdani paras*, both men and women work in their own handlooms. The designers get more money than the apprentices. Women usually do not work in other people's looms although the men do. Sometimes the buyers come to the *jamdani paras* with their own designs which are made to order for Dhaka's fashion houses.

6.4 Findings and Recommendations

The results of the FGD and key respondent interviews are provided in matrix form in the annex to this chapter. The main findings and key observations are discussed below.

It appears that poverty, gender concerns, availability of food, market conditions and inflation, livelihood options and opportunities etc. are important in ensuring food security. Poverty and low incomes/ entitlements were the primary determinant of food insecurity at the household level irrespective of occupational groups and gender. Almost all groups of women and men in different regions of the country mentioned low and irregular income as the cause of failure in meeting basic food needs. Although men were generally reported to consume more food compared to women, the majority mentioned lack of money and poverty as hindrance to a more healthy and productive life for themselves and their family. [10]

> *"Hamara bhat i paina bhai toi pustikor khabar abar koi pabo"* ("we don't even get rice to eat so how are we going to get nutritious foods"?) – Poor woman in Rangpur.

Seasonality, natural disaster and high price of agricultural products and lack of direct market access have contributed to the vulnerability of the farmers. For the non-farming households, lack or ownership of land, lack of formal sector/salaried jobs, dependence on low-skilled irregular self-employment, and price hike of food items have put huge pressure on their financial ability to afford nutritional food for their families.

[10] In the light of findings from the 'consumption' chapter (4) we would need to be careful in interpreting perceptions related to gender differentials in consumption. Thus, there may indeed be some truth to the view that men need more food because they work harder while it is undoubtedly also true that women, including those at risk, may suffer from discrimination.

People depending on more traditional occupations such as handlooms and fisheries also report great distress, arising mainly from recent inflationary pressures.

Market situation

One major reason for malnutrition of family members is the high price of almost all food items, particularly meat, egg, milk, and fruits. The field information confirms the impression that poorer families consume these items in insufficient amount and that again, women are particularly deprived. This also matches with the national data showing high consumption levels for rice but low consumption of other foods like vegetables, pulses and fish for the majority of the population. Generally where there is local availability (e.g. fish in Cox's Bazar) the poor have better access than when the product has to come from outside the locality or from imports.

Gender

Women in all groups including pregnant, lactating, teenage and adult women in different regions experience poverty and hunger harder than male members of their families.[11] So poverty has a very harsh impact on their food consumption and nutritional intakes. The most crucial point here is that pregnant, lactating women suffering from malnutrition also produce unhealthy children and babies. In addition to depressed consumption levels in general for poor women, the problem of seasonality remains acute. In other words, seasonality is not only an important factor for farmers and traders, it also affects women quite heavily.

Food consumption of women also varies depending on whether women are in nuclear families or joint families, and whether there is a single earner or multiple earners in the household, and whether women have own resources and earnings, in addition to husband's occupational status.[12]

It is evident from the study that women are well aware of their nutritional needs and the needs of their families. But even after knowing the fact that they are the most vulnerable during the pre and post-pregnancy periods, they are unable to effect any significant changes in consumption behaviour in order to address their special needs.

There is an impression from the FGD that current safety net programs do not address the needs of the poorest families. Though NGOs were found to be operating in all the sample areas covered (except for the fishing areas of Cox's Bazaar), the poorest, including widows, were excluded from micro-credit due to a perception of high default risk associated with them. The moderate poor/women were found to be involved in NGO-micro-credit, with most women actually handing over the money to their husbands – it would be rare to find women using their earnings to improve their own food intake. The safety net programs like VGD/VGF/widow allowances etc. which aim to feed the poorest and the most vulnerable have had rather limited impact. In all the FGD women mentioned of serious irregularities in the operation and coverage of these safety net programmes.[13]

[11] This is another example of a typical finding from qualitative studies. From chapter 4 we know that while women/girls (aged 10 and above) do in fact consume less than similarly placed men, a more sedentary life-style in their case ensures that they in fact are less deficit in calories, and frequently in surplus, compared to men. It should also be noted that evidence from anthropometric studies (e.g. Mother and Child nutrition Survey 2005, generally portrays a slightly better status of girls and women in terms of malnutrition and stunting.

[12] It may be noted that in the ' access' chapter, we reported some regression results to explain food insecurity where female incomes were not found to be significant. We did not try to explain female food insecurity or poverty however.

[13] It is interesting to observe that the econometric exercises on access (chapter 5) corroborates the FGD observations on safety nets.

Changing KAP

It is important to create awareness of the nutritional importance and nutrient values of different food items in order to promote a more balanced and affordable diet. Much of the public information available on these matters comes from television and radio while health workers from NGOs and the government are also important sources of health-nutrition messages in rural areas (e.g. through motivational meetings with women's groups in their homes). Women also mentioned that husbands, female relatives (especially mothers-in-law) and neighbours were also important. Thus, efforts to modify attitudes would be greatly helped if these 'gatekeepers' are used as purveyors of information and agents of change.

While there seems to be a great deal of knowledge and awareness in the community regarding nutrient value of foods and good health-hygiene practices, the main constraint to a balanced diet lies elsewhere – in poverty, low incomes and high prices.[14] The FGDs also highlight the situation of groups at risk, namely children, pregnant and lactating women. Given overall inadequacy of calorie-intakes, it is difficult to decide on what basis intra-household food distribution should take place. The traditional practice seems to be to give a higher priority to men as income earners. To an extent this may be a recognition of and respect for, traditional values but is also very likely to be embedded in survival strategies which maximize short-term incomes-earnings. Household survival strategies may be complex, and it would be superficial to assert that gender discrimination is due to power-exploitation differences in gender. The reality would appear to be more complex, based on calorie requirements and expenditures, physical activity levels and survival algorithms that have evolved over a long period of time. Thus, our basic recommendation would be to clearly focus our attention not so much on gender but on groups at risk like children and pregnant-lactating women, while at the same time recognizing differential calorie needs and household survival matrices – the latter will only change as economic circumstances improve.

[14] This is not to say that there is no need for more health-related or nutritional messages. As will be seen from the Mother and Child (2005) survey, large proportion of women still have inadequate knowledge with regard to treatment of basic/chronic diseases like diarrhea.

ANNEX

Perception and Practice: Household Food Consumption and Distribution - Field Observations

Nutrition Related Knowledge and Practice: Pregnant Women

Location	Food consumption	knowledge	Foods available
Rangpur	Fish, meat, egg, milk, fruits are eaten occasionally. Rice, vegetables are eaten regularly. People ate flour when price was cheaper than rice. Now they eat hotchpotch with vegetables mixed with rice. They eat water mixed rice in the morning.	Yellow fruits, milk, vegetables, small fish have nutrition. *Ratkana* (night-blindness) is caused by lack of vitamin-A. Green vegetables prevent night blind disease. Local doctors informed about *Ratkana*.	Vegetables- spinach, jute leaves, aubergine, arum, ladies finger, long-gourd, beans, snake gourd, tomato, bitter gourd, cucumber, lemon, are produced. Fruits-mango, jackfruits, berry, litchi, guava, shaddock, musk melon, hog plum, pear, papaw, star-apple, wood-apple are available in seaons.
	Women even sometimes cannot eat a full meal once in a day in poor agri-based HH "We have to starve or eat a little and have to depend on other's mercy" Infants do not get enough breast milk when mothers starve. Only children are given milk occasionally.	Television, doctor, health assistant sister and NGO sister teach about which food contains what kinds of nutrition	High price and disaster proneness make poor families' vulnerable and eating little or starving.
	Men work hard so they have to eat more food. *"tui ki kamai koris ge beshi khabi? Kamai kora kha*(do you earn that want to eat more? Earn and then eat)	Doctor and FWAs suggest pregnant women have to eat sufficient food and need to eat milk, egg, fruits, and vegetables regularly for healthy mother and child. But poor can not eat milk, egg, fruits, vegetables everyday Earlier a lot of food was forbidden to eat for pregnant women but now they are allowed to eat all kinds' food.	They eat locally produced fruits in season. They can hardly eat apple, grape, and orange due to high price. *Boshora akbar chokew dekhina. Khawa to dorer kotha* (we can not see it once in a year).
Kushtia	cannot eat full meals 3 times a day	Green vegetables, small fishes, egg, milk have vitamin. Small fishes prevent *Ratkana*. FWA sisters tell hat pregnant women should eat food which contain vitamin. The NGO agents also help them to know about food and nutrition. Neighbors and older relatives also provide nutrition related information.	Rice, small fish, ruhi fish, carp, puti, eel fish, hilsha fish, pulse, potato, vegetable, ladies finger, arum roots, red spinach, spinach, bitter gourd, gourd, green banana sweet pumpkin, cucumber, water melon, guava, papaya are available.
	Morning: watered rice with onion, green chilly and salt. Noon: pulse, smashed potato, arum, vegetables. Night: watered rice with onion, green chilly and salt.	Rice, fish, meat, milk, egg, arum, arum roots, yam ladies finger, potato, brinjal, gourd, sweet pumpkin, cucumber, water melon, guava, mango, jackfruit, banana, lichi, papaya contains vitamin.	Apple, orange, grape, meat, milk are favorite to all but most inaccessible for the majority.

Location	Food consumption	knowledge	Foods available
	Male members are not interested to know what women eat. Women eat after men. The old members are given more food	Radio and television. Health Assistants and NGO workers.	When the price of wheat is low, the poor people eat bread instead of rice. Potato is eaten more when its price is to reduce stresses on rice.
Tangail	Low income earning and large family can't afford meal 3 times a day. Large families even can not afford 1 Kg vegetables a day.	Fish, milk, egg, vegetables are nutritious. Mango, jackfruit, pumpkin, small fish contain vitamin A. They know from TV.	Rice, maze are produced. Fruit: Mango, starfruit, jackfruit, grapefruit, papaya are available and nutritious. Mushroom is eaten as snacks.
	Women work in family hand looms; still take less food in family.	TV, private doctors and health workers of NGOs.	Changes occurred to their food habit for price hiking price. Use soybean oil instead of mustard oil as very expensive.
Sylhet	Eat rice, arum, potato and vegetables everyday. Who rear ducks and chicken can consume eggs. Tea, puffed and flattened rice and biscuits are taken for snacks.	Rice, meat, fish, egg, red leaves, arum, potato, aubergine, beans, melon, hog-plum, cucumber, carrot, guava, water melon, mango, berry, jack fruits, banana, litchi contains vitamin.	Guava, mango, lemon jackfruits, and berry are locally produced. Rice, red leaves, arum, potato, aubergine, beans, melon, plum, cucumber, carrot, water melon, berry, jack fruits, banana, litchi are available in seasons.
	Women in poor families in off peak seasons sometimes eat twice in a day	*Ratkana* disease can be prevented by eating *mala, dhela,* and other small fish. Milk is an ideal food.	Apple, grape, orange are bought for one of two times in a month for older person, children and pregnant women of a family as these are expensive.
	Male members and children are given more food than women		Earlier poor people ate wheat-made breads now it has become rich people's food for the price hike.
Cox'sBazar	Rice, fish, bread, meat, *Kolmi* leaves, *pui* leaves, gourd leaves, red leaves, arum leaves, sweet pumpkin, gourd, beans are eaten regularly. Egg and milk are eaten from time to time.	Pumpkin contains vitamin A. Fruit contain vitamin C. Arum greens have iron.	Fish: Lobster, pangas, pomphret, poa dryfish, loitta fish are available.
	Bread and tea are taken several times. Fish is eaten several times in a month. Lobster, pangas, pomphret, are eaten more often. poa dryfish, loitta fish are eaten randomly. Small fishes, and vegetables are served in every meal.\meat is eaten occasionally.		
	Women are not discriminated in food distribution. Pregnant women are taken care of for sufficient nutritional intake.	For nutrition they get information from Radio, neighbors, TV. MCWC, sobuj chata, and private clinic are sources of health knowledge.	Mango, berry, banana, guava, grapefruit, custard apple, pomegranate, amra, amlocki, starfruit, are produced. Orange, grape, lichi, and apple are not produced but consumed
	For the large families price-hike has caused lesser intake of nutritional foods.	*Boyal, Mrigel* fishes and tamarind are not allowed to eat during pregnancy.	

Location	Food consumption	knowledge	Foods available
Narayanganj	Eat rice, lentil, fish, potato, sweet pumpkin, ladies finger and seasonal vegetables everyday. Also eat red leaves, *pui* leaves, *kalmi* leaves, jute leaves. Normally poor people cook for two times in a day, while affluent people even cook for four times in a day.	Fish, eggs, vegetables and fruits are nutririous.	Fish and vegetables are available in the market. Fruits- Mango, berry, banana, guava, lichi. grapefruit, custard apple, pomegranate, amra, amlocki, starfruit, are available in seasons too. Apple, orange, grapes are available but all cannot afford these.
	Pregnant women have to eat more, though many of them are not able to eat sufficient food for poverty. Male person eat sufficient food and women eat little.	For nutrition they get information from Radio, neighbors, TV.	Pregnant women cannot eat some food for superstition, such as *mrigel fish, bain fish*.
	Pregnant women cannot eat some food for superstition, such as *mrigel fish, bain fish.*		

Nutrition Related Knowledge and Practice: Lactating Women

Location	Food consumption	knowledge	Foods available
Rangpur	They eat rice, fish, red leaves, beans, cucumber, carrot and vegetables and fruits locally produced.	Meat, fish, egg, red leaves, beans, guava, plum, water melon, mango, berry, jack fruits, banana, litchi	Red leaves, vegetables, beans, arum, potato, abuergine, cucumber, carrot, banana, melon, guava are produced. Guava, water melon, mango, berry, jack fruits, banana, litchi are eaten in seasons occasionally.
	Male head is provided much food and in some family women even starve. Males do not want to know if women eat or starve. Older men and women are given more nutritious food but they leave this food for their grand son and grand daughter or for those going to school.	Night blind disease can be prevented by eating *mala, dhala,* and other small fish.	
	Apple, grapes, orange are bought for once or twice a month for elderly persons, children and pregnant women	Radio. TV, neighbors and relatives are sources of knowledge.	
Kustia	Generally they eat rice, lentil, fish, potato, sweet pumpkin, ladies finger and seasonal vegetables everyday. They also eat red leaves, *pui* leaves, *kalmi* leaves, jute leaves. They eat fishes as *Tangra, koi, pangas, chapla, puti,* They prepare egg curry or other curries when the price of vegetables hikes.	Egg, milk, sweetmeat, small fishes are nutritious. Small fishes increase eyesight.	They grow some fruits as Blackberry, mango, guava*, lichi*, jackfruit, starfruit*, amra.*
	Top priority is given to the father-in-laws and mother-in-laws, husbands and children.	know about nutritious food from TV, books, health workers, hospitals and from neighbors. They learn about vitamins from book and other relatives	They change their food habits as they have egg instead of fish or meat when these are costly. Eat flour and rice interchangeably. They also have rice soup.
Tangail	Eat fish, milk, egg, vegetables. They eat more or less nutritious food.	Mango, jackfruit, pumpkin, small fish contain vitamin A.	They have some fruits as mango, jackfruit, grapefruit, star fruit, papaya.
		From seeing TV, from private doctors and health workers of NGOs.	

Location	Food consumption	knowledge	Foods available
Sylhet	Usually they eat rice, vegetables. Women in well-off families eat meats, eggs too. Women in poorest households sometimes eat rice with salt and onion only. Poor family use oil only a little bit. A woman said that 'we can't arrange money for staple food let alone oil'.	vegetables contain vitamin. Mushroom contain vitamin	All kinds of vegetables are produced- aubergine, sweet pumpkin, arum, bean, potato, red leaves, radish leaves etc
	Eat mushroom if available as they know it contains high vitamin.	TV, health workers, relatives	
Cox's Bazar	Eat rice, lentil, fish, potato, sweet pumpkin, ladies finger and seasonal vegetables everyday. They also eat red leaves, *pui* leaves, *kalmi* leaves, jute leaves.	Vegetables contain vitamin, Small fishes are good for health.	Mango, guava, grapefruit, *lichi*, jackfruits are available in seasons
	People who have own tree they can eat fruits and poor people usually can not eat fruits		In past they used to eat breads but they eat rice because rice is cheaper than flower
	Women can not eat egg, milk, meat, fish vegetables and other nutritious food sufficiently		
Narayanganj	Eat rice three times in a day. They eat *pangas* fish and little fish for three or four days in a week. They eat mostly red leaves, *pui* leaves, arum leaves, potato, *potol, snake gourd, gingha, papaya, kakral,* eggplant, pumpkin regularly.	Little fish is effective for eyesight. Vegetables contains lot of vitamin, vitamin-C is in the lemon.	Verities of fish, vegetable and fruits are available in the market.
	Every time women of the family eat little food.		

Nutrition Related KAP: Adult Women

Location	Food consumption	knowledge	Foods available
Rangpur	Rice, vegetables, lentils are consumed regularly. Fish and meat are eaten occasionally for high price. Milk is consumed by children and ill members.	Nutritious Vegetables- pui leaves, spinach, jute leaves, brinjal, arum plum, ladies finger, long-gourd, bean, snake gourd, tomato, bitter gourd, beans, cucumber, Fruits-mango, jackfruits, berry, litchi, lemon, guava, shaddock, musk melon, hog plum, pear, papaya, star-apple, wood-apple. Garlic, ginger, onion, chilies, is good for health, so poor, rich all eat these.	Rice, vegetables as spinach, jute leaves, aubergine, arum, ladies finger, long-gourd, beans, snake gourd, tomato, bitter gourd, cucumber, lemon, are produced. Pulse-maskalai, kesari, Mug, buut, Red lentil are locally produced and consumed widely. Papaya, melon, jackfruits starfruits, plums are available
	Several times women have meals only once or twice and sometimes starve. Men are given more priority in this purpose. Children of the family are giver more food. They have to starve most of the time.	Learn from health assistant about which foods are nutritious. Also learn it by watching television. Neighbors, relatives also provide helpful information.	Fish is available but costly Meat is available in the local market but costly. They have to buy milk to feed their children and ill one of their family.

Location	Food consumption	knowledge	Foods available
	"hamara vat e paina bahe toi pustikor khabar abar koi pabo" (we can not even eat basic food, how will we eat nutritious food?).		
Kushtia	In poor families women eat 2 times a day, even they starve. In pick season they can have foods 3 times a day, can eat fish and meat occasionally. fish, egg and milk they can not think of buying in lean seasons	Rice, fish, meat, milk, egg, arum, arum roots, ladies finger, potato, eggplant, gourd, sweet pumpkin, cucumber, water melon, guava, mango, jackfruit, banana, lyche, papaya Grape, hog plum etc are nutritious. Green vegetables, small fishes have vitamin. *Ratkana* can be prevented by eating small fishes.	Rice, small fish, Pulse, potato, various vegetable, red and green leaves, bitter gourd, gourd, green banana are available
	Morning: watered rice with onion, green chilly and salt. Noon: pulse, smashed potato, arum, vegetables. Night: watered rice with onion, green chilly and salt.	Radio, television. FWA, NGO workers are sources of knowledge. Family Welfare Assistant sister tell pregnant women should eat food contains vitamin.	
	Women have their meal after male members and elderly.		
Tangail	Rice, vegetables are commonly consumed. Low income earning and large family can't afford meal 3 times a day.	Fish, milk, egg, vegetables are nutritious. Mango, jackfruit, pumpkin, small fish contain vitamin A. They know from TV.	Rice, maze are produced. Fruit: Mango, starfruit, jackfruit, grapefruit, papaya are available and nutritious. Mushroom is eaten as snacks.
	Women work in family hand looms; still take less food in family.	TV, private doctors and health workers of NGOs.	Changes occurred to their food habit for price hiking price. Use soybean oil instead of mustard oil as very expensive.
Sylhet	Eat rice, fish, and vegetables. Sometimes eat rice with salt. Aubergine, pumpkin, arum, bean, potato, red leaves, radish leaves are mostly consumed.	Don't know the names of foods contains vitamin	All kinds of vegetables are produced. Aubergine, pumpkin, arum, bean, potato, red leaves, radish leaves.
	Women in poor families in off pick seasons sometimes eat for twice in a day		Guava, mango, lemon jackfruits, and berry are locally produced.
Cox's Bazar	They eat Rice, small fish, different kinds of vegetables, chilly, pulse etc. Watered rice is eaten with chili when there hardship. They eat fish 2 or 3 days a week. Small fishes are eaten most as they are cheap. *Hilsha* fish is eaten 1-2 days a month as they are very expensive. Beef is eaten once a month. They eat egg from time to time. Those who have their own hen and duck eat egg regularly. They know about nutrition related information from TV, hospital, neighbors, health workers.		Fish: Lobster, pangas, pomphret, poa dryfish, loitta fish are available.

Location	Food consumption	knowledge	Foods available
		They know about nutrition related information from TV, hospital, neighbors, health workers.	
Narayanganj	They eat rice, lentil, fish, potato, sweet pumpkin, ladies finger and seasonal vegetables everyday. They also eat red leaves, *pui* leaves, *kalmi* leaves, jute leaves. Normally poor people cook for two times in a day, while affluent people even cook for four times in a day.		

Nutrition Related Knowledge and Practice: Unmarried Teenaged Girls

Location	Food consumption	knowledge	Foods available
Rangpur	Rice, vegetables, lentils are consumed regularly. Fish and meat are eaten occasionally for high price.	Nutritious food means good and costly food. Such as vegetables, red leaves, spinach, kalmi leaves, pui leaves, milk and egg. There are a lot of nutrition in maze and wheat. Arum leaves and yellow fruits contain vitamin. Starfruit. olive, shaddock, has vitamin c and litchi, jack fruits has vitamin.	Rice, vegetables as spinach, jute leaves, aubergine, arum, ladies finger, long-gourd, beans, snake gourd, tomato, bitter gourd, cucumber, pulse are produced. Papaya, melon, jackfruits starfruits, lemon, plums are available
	In poorer families nutritious food is not available for them, but in well-off families they can consume some nutritious foods.	Neighbors, relatives provided these information. Also learn it by watching television.	Due to price hike, natural disaster, many cannot afford enough and nutritious foods.
Kushtia	In pick season they can have foods 3 times a day, can eat fish and meat occasionally. fish, egg and milk they can not think of buying in lean seasons	Arum greens contains vitamin A Small fish contains vitamin A.	In ponds they cultivate Ruhi, carp, silver carp, small fishes, Mola, Dhela Rice, Pulse, potato, various vegetable, red and green leaves, bitter gourd, gourd, green banana are available
	Children eat more than parents. Boys eat more than girls	Radio, television are sources of knowledge.	Apple, orange are costly to afford though they like to eat these.
Tangail	Rice, vegetables are commonly consumed. Fish, eggs are occasionally consumed, often offered to the head of the family.	Fish, milk, egg, vegetables are nutritious. Mango, jackfruit, pumpkin, small fish contain vitamin A.	Jute, rice, maze, red leaves, pui leaves, spinach, pumpkin, aubergine, potato, cauliflower, ghinga. Are produced. Fruit: Mango, starfruit, jackfruit, grapefruit, papaya are available and nutritious. Mushroom is eaten as snacks.
	Women work in family hand looms; still take less food in family. Teenagers do not get required food and nutrition in poor families.	TV, books	Changes occurred to their food habit for price hiking price.

Location	Food consumption	knowledge	Foods available
Sylhet	Eat rice and vegetables as kalmi leaves, red leaves, spinach, potato, papaya, gourd, pumpkin. Eat few vegetables every day. Poor families cannot afford 3 meals a day. Fish and meat are eaten occasionally. Some eat fish once in 15 days. Cannot eat fruits regularly then Guava.	Donot know exactly what food contains which vitamin. Schoolteachers teach about vitamins	Mango Berry, Jack-fruit, Guava, litchi, lemon, grapefruit are produced locally. Red leaves, arum, potato, aubergine, beans, melon, hog-plum, cucumber, carrot, guava, water melon, mango, berry, jack fruits, banana, litchi are available in seasons.
	Fish, meat, eggs are usually given to earner males Somebody eat fish one time in 15 days.		
Cox's Bazar	Rice, fish, kolmi leaves, pui leaves, mola fish, pungash fish, rice is eaten 3 times. Light snacks is taken in the evening as Tea, bread and puri. Eat rice 3 times. Sometimes they eat rice with onion and chilly, Eggplants with potato during hardship.	Arum leaves contains much vitamin. They know yellow fruits and pumpkin prevent RATKANA. Kachu purifies blood, small fishes as mola increases eyesight.	Guava, mango, amloki, amra. banana, plum, jack fruit, pomegranate, custard apple, grapefruit star fruit, are grown in that area.
	Eat fish everyday. Small fishes are eaten everyday. Fishes: Lobster, powa, loita, dry fish, pungas, mola fish. are eaten regularly. Pulse is eaten 2 – 4 days a week. Eat vegetables everyday. Potato, bean, cucumber, ladies finger, kakrol, jhinga, papaya, kolmi shak, pumpkin-these are eaten regularly.	Guava is cheap. It contains much vitamin and water. So, it is eaten much.	Potato, bean, cucumber, ladies finger, kakrol, jhinga, papaya, kolmi shak, pumpkin
	Eat fruit 2 or 3 days a week. Some can not eat fruit at all.	Know from TV	
Narayanganj	Eat rice three times in a day. Eat rice, lentil, fish, potato, pumpkin, ladies finger and vegetables everyday. Also eat red leaves, pui leaves, kalmi leaves, jute leaves.	small fishes as mola increases eyesight.	Verities of fish, vegetable and fruits are available in the market.
	Eat bread, tea and potato fry and egg in the morning. Some eat rice with vegetables. Eat rice, lentil, vegetables, fish egg, at noon. Most of the people eat fish several times. Eat rice, lentil, vegetables, and fish for supper. Also eat rest food of lunch at supper. Some also take tea, biscuits in the afternoon.	Know from TV	
	Parents eat little food and try to give sufficient food for their children. Everybody has to eat according to their income. If teenager do not eat sufficient and nutritious food they will fall in problems in the long run and after marriage.		

Nutrition Related Knowledge and Practice: Non-Farmer Males

Location	Food consumption	knowledge	Foods available
Rangpur	Rice, vegetables, lentils are consumed regularly. Fish and meat are eaten occasionally for high price. Milk is consumed by children and ill members.	Vegetables, Fruits are nutritious.	Rice, pulse, vegetables as spinach, jute leaves, aubergine, arum, ladies finger, long-gourd, beans, snake gourd, tomato, bitter gourd, cucumber, lemon, are produced. Papaya, melon, jackfruits starfruits, plums are available
Kushtia	Rice, fish, meat, vegetables, pulse are eaten more often. Pui, palong, kolmi leaves, red spinach, spinach, bitter gourd, ladies' finger, potato, potol are eaten regularly	They don't know which food contain what vitamin. But they know that arum leaves (kachu shak) and lemon contain vitamin C. small fish or yellow vegetables prevent Ratkana an they increase eyesight. Big fishes, meat, milk and egg are rich in nutrition but they all can't eat them.	Pulse, potato, various vegetable, red and green leaves, bitter gourd, gourd, green banana are available Mango, jackfruit, guava, black berry, custard apple, dates, pomegranate, shofeda, amra are locally produced
	They can eat local fruits: mango, jackfruit, grapefruit, lichi, wood-apple, guava, plum. Majority cannot afford buying orange and apples.		Pulse cultivation is reduced due to increased rice cultivation. Maze is increasingly cultivated.
Tangail	Rice, vegetables are commonly consumed.	Fish, milk, egg, vegetables are nutritious.	Rice, maze are produced. Fruit: Mango, starfruit, jackfruit, grapefruit, papaya are available and nutritious. Mushroom is eaten as snacks.
Sylhet	Eat rice, fish, and vegetables. Aubergine, pumpkin, arum, bean, potato, red leaves, radish leaves are mostly consumed.	Don't know the names of foods contains vitamin	All kinds of vegetables are produced. Aubergine, pumpkin, arum, bean, potato, red leaves, radish leaves. Guava, mango, lemon jackfruits, and berry are locally produced.
COXS' BAZAR	Eat rice 2/3 times with potato, pulse, vegetables, arum. In the morning, they drink tea with bread and biscuits. They can eat fish frequently. Also eat vegetables but are expensive. Eat fruits rarely. They eat hen or duck a once in a month. Children and male person eat more egg.	They have least knowledge about nutrition	Fish: Lobster, pangas, pomphret, poa dryfish, loitta fish are available. Seasonal fruits are available but they cannot afford these.
Narayanganj	Eat rice, radish, lentil, fish, potato, pumpkin, ladies finger and seasonal vegetables everyday. Also eat red leaves, pui leaves, kalmi leaves, jute leaves. Eat tomato in the season only as it is costly at off season. Eat meat for one of two times in a week. Egg for one or two times in a month. Cannot eat sufficient food for high price. Could not eat hilsha in this year for the reason of high price. Cannot feed children properly due to high price of food.		All vegetables as radish, lentil, fish, potato, pumpkin, ladies finger and seasonal vegetables, red leaves, pui leaves, kalmi leaves, jute leaves, tomato are available in seasons. Fruits are available in seasons.

Nutrition Related Knowledge and Practice: Farmer Males

Location	Food consumption	knowledge	Foods available
Rangpur	Rice, vegetables, lentils are consumed regularly. Fish and meat are hardly eaten for high price.	Vegetables, Fruits are nutritious.	Rice, pulse, vegetables as spinach, jute leaves, aubergine, arum, ladies finger, long-gourd, beans, snake gourd, tomato, bitter gourd, cucumber, lemon, are produced. Papaya, melon, jackfruits starfruits, plums are available
Kushtia	Rice, fish, meat, vegetables, pulse are eaten more often. Pui, palong, kolmi leaves, red spinach, spinach, bitter gourd, ladies' finger, potato, *pot*ol are eaten regularly	They don't know exactly which food contain what vitamin. But they know that arum leaves (*kachu shak*) small fish are good for health.	Pulse, potato, various vegetable, red and green leaves, bitter gourd, gourd, green banana are available. Mango, jackfruit, guava, black berry, custard apple, pomegranate, *shofeda, amra* are locally produced.
	They can eat few local fruits which they produce: jackfruit, grapefruit, guava, plum, wood-apple. Cannot afford buying orange and apples.		Pulse cultivation is reduced due to increased rice cultivation. Maze is increasingly cultivated.
Tangail	Rice, vegetables are commonly consumed. Farming and large family can't afford meal 3 times a day.	Fish, milk, egg, are nutritious.	Rice, maze are produced. Fruit: Mango, starfruit, jackfruit, grapefruit, papaya are available and nutritious.
Sylhet	Rice, fish, and vegetables. Aubergine, pumpkin, arum, bean, potato, red leaves, radish leaves are mostly consumed.	Don't know the names of foods contains vitamin	All kinds of vegetables are produced. Aubergine, pumpkin, arum, bean, potato, red leaves, radish leaves. Guava, mango, lemon jackfruits, and berry are locally produced.
COXS' BAZAR	Eat rice 2/3 times with potato, pulse, vegetables, arum. In the morning, they drink tea with bread and biscuits. They can eat fish frequently. Also eat vegetables but are expensive. Eat fruits rarely. They eat hen or duck a once in a month. Children and male person eat more egg.	No knowledge about exact sources of nutrition	Fish: Lobster, pangas, pomphret, *poa* dryfish, *loitta* fish are available. Seasonal fruits are available but they cannot afford these.
Narayanganj	Eat rice, lentil, fish, potato, and seasonal vegetables everyday. Eat meat once in a month. Egg for one or two times in a month. Cannot eat sufficient food for high price. Cannot feed children properly due to high price of food.		All vegetables as radish, lentil, fish, potato, pumpkin, ladies finger and seasonal vegetables, red leaves, pui leaves, kalmi leaves, jute leaves, tomato are available in seasons. Fruits are available in seasons too.

CHAPTER 7

Conclusions and Recommendations

The population of Bangladesh depends principally on cereals for their calorie needs, with rice and wheat accounting for 76 percent of calories, non-cereal products 17 percent and animal foods only 6 percent. The gap between dietary calorie intake and requirements is wide. The problem is two fold: At one level, large sections of the population are not able to meet their calorie needs as determined by their age and physical activity levels. At another level, even those who are able to meet calorie needs suffer from the hidden hunger associated with malnutrition and the lack of access to a balanced diet.

It was estimated that around 68 percent of the population live a sedentary life (PAL values belonging to the light and below light group). These people are consuming more calories than they actually need or are in fact, in calorie surplus. On the other hand an alarming situation has been identified for children (under 10) whose calorie intakes are found to be well below their needs, along with groups belonging to the PAL levels associated with hard work. Average calorie needs have been determined to be 2187 per person per day while actual intakes are only 1894 calories – yielding a calorie deficit of 292 per person per day, on average. The corresponding deficit for children below 10 is 40 percent! Interestingly males above 10 years of age are found to have higher calorie deficits than females.

These stark figures bring out several important policy issues and provides ingredients for a future strategy.

- It is important to be able to raise calorie intakes of children and the hard-working poor, in particular;
- The nutritional status of the population is highly vulnerable suggesting that a balanced diet programme is needed for all;
- In aggregate, there is enough rice and cereals for everyone (especially if one adopts the figure of 380 gm as suggested in this report) – the problem however is (a) with distribution and access, and (b) the non-availability of non-cereal calorie sources at a price that the poor can afford.
- The strategy that now has to be developed is how to ensure adequate supply of food (cereal, non-cereal, animal); how to enable access and ensure distribution; and how to raise awareness of critical stakeholders to these concerns.

While it would be nice to be able to produce all ones food needs domestically this may not make economic sense. It may mean that the country pursue an agricultural growth strategy based on comparative advantage (and thus forfeit some important food crops like oilseeds to the market) but compensates this through growth in other sectors, using trade to meet its food and nutrition requirements. The big question here is to what extent such a market-led process will fit in with a nutritional strategy that is focused on closing the calorie and nutrition gap? Specifically, we will need to identify a set of incentives that will be needed both for consumers and producers that is in line with such a strategy as the fear is that a pure market-led approach may not help in closing this gap. An indication of the extent of the potential mismatch between supply-demand and calorie-nutritional requirements is available from this study. These point to a cereal demand-supply gap of around 5-6 million tons; this is reversed if one uses cereal requirement norms of 380 gm. per capita per day, as suggested here.

Specific findings and implications are summed up below:

Supply

Rice figures appear to be reliable suggesting that the crop-cutting method used by BBS is accurate in estimating gross production. There are however, serious problems for the minor crops compounded by the fact that it is difficult to tell from the available data very much about the nature of the estimation bias.

The study has succeeded in establishing that BBS yield and acreage (and thus gross production) figures for rice is defensible and is consistent with other sources of data. At the same time it questions the net figures generated by adopting a standard 10 percent norm to adjust for seed, feed and wastage. It was argued that a figure of 5-7 percent would be deemed much more reasonable.

It was not possible to validate production data for non-rice food crops or foods from animal sources; nor was it possible to suggest a SFW figure for these items with any confidence. It seems very likely that wastage at the homestead level is low for most crops; however, for perishable commodities, losses in the marketing and storage-handling chains could be high. Unfortunately, this aspect could not be captured in the present study for non-rice food crops, and is left for future work.

In terms of performance, sharp contrasts have emerged for different sub-sectors and crops. While oilseeds and pulses, along with wheat are in dramatic decline, other sectors like fisheries, meat-poultry-eggs, and milk have done well. Despite these successes however per capita availability, although rising, remains pitifully low in comparison with Asian or regional standards.

Projected supply of rice and wheat for 2015 was estimated at 31 million MT. Supply projections for other food items have also been provided.

Demand

For necessities such as, rice, vegetables, edible oil, and spices, income effects are relatively small. However, for most other commodities there are significant income effects. Estimates of high income elasticity for most food items suggest that policies that lead to higher income levels among different income groups would foster higher levels of consumption for these commodities.

The presence of high income elasticity implies that there is sizeable difference between uncompensated and compensated own price elasticity for most of the food items. Even after removal of the income effect significant compensate price effect was observed. It implies that spiralling of prices of most of the food items would severely hurt the consumers.

It appears that wheat is no longer an inferior good; it has high price responsiveness both in the rural and urban areas. A comparison between the estimates of uncompensated and compensated own price elasticity reveals presence of sizeable income effects.

The estimates of cross-price elasticity indicate strong substitution effects. However, there is no systematic pattern in the gross and net substitution relationships among commodities belonging to the same category such as carbohydrates, fats, proteins. The presence of strong substitution effects imply that public intervention in the market for one food item may lead to considerable impact on markets for other food items. This may adversely affect allocative efficiency in markets for some foods.

Finding an accurate scenario of the dynamics of demand for food items is rather difficult as future demand patterns hinge on tastes, prices, and income. We projected demand for 2010, 2015 and 2020 by taking into account only changes in income. This may introduce some bias in our estimates but this is not expected to be substantial.

Demand for foodgrains is expected to reach 37.55 million MT with rice 35.35 million MT and wheat 2.20 million MT under low growth of income, to 38.86 million MT with rice 36.50 million MT and wheat 2.37 million MT under medium growth of income, and to 40.22 million MT with rice 37.68 million MT and wheat 2.54 million MT under high growth of income in 2015. This clearly suggests a significant supply-demand gap in 2015 for cereal foods.

Consumption

Most of the people are engaged in light and below light activity.

Bangladeshis are on the average energy deficient. Children below 10 years of age (both boys and girls) and men age ≥ 10 years are more deficient in energy than women.

Individuals involved in more than vigorous activity are more deficient in energy. Those who are involved in light activity are on average surplus in energy intake while the others who are involved in moderate to vigorous activity are deficient in energy.

Diet is mostly cereal-based and on average 74-76 percent of the total calorie intake is still derived from cereals. Animal food contribution to total calorie is very low.

Average calorie intake was found to be low at 1894 kcal derived from 684 gm of food consumed. This compares with estimated requirements based on PAL and desired body weights at just under 2200 kcal. The intake estimates are likely to have been affected by floods and seasonality

Access

Food security indicators developed show that 7 percent of households face acute distress with regard to food access on a regular basis while up to 30 percent suffer such conditions 'sometimes' – marking them out as potentially highly vulnerable. In addition some indicators portray a situation of chronic under-consumption and worries about food access suffered by 12-15 percent of households regularly with up to 30 percent having to confront the problem 'sometimes'.

In terms of factors determining access factors that are usually held up as being important include income, government transfers, assistance from NGOs or friends, credit, remittance flows, employment etc. (Rahman, S.M et al 2005). Another dimension is also brought to bear, namely the question of shocks related to weather or markets that disrupt normal livelihoods and incomes or production, leading to loss of access to food (Amin and Farid 2005). Thus, depending on the premise from which the analyst begins, a predictable set of variables then follow as being 'key' to addressing access issues.

A number of explanatory variables that are suggested as being important, including variables that are space-specific (proxied by rural-urban location or 'divisions'), individual and household (age, education, gender, income, land-holding), policy variables like safety nets, health expenditures, remittance), and so on were tested in alternative econometric models. A core set of basic variables have been identified that have a clear bearing on access: rice price, income, rural-urban location and 'division'. A number of others have also been identified that may have a bearing (but requires further exploration), including remittances (both domestic and foreign), safety nets and land-holding (including tenancy).

Perceptions and Knowledge

A concerted approach to improve awareness among men, especially with regard to the importance of adequate nutrition for pregnant and lactating women and children, is likely to be very useful.

It appears that poverty, gender concerns, availability of food products and costs, market situation and price hike, livelihood options and opportunities are important in ensuring food security.

Seasonality, natural disasters and high price of agricultural products and lack of direct market access has contributed to the vulnerability of the farmers. For the non-farming households, land ownership, lack of industrial or permanent jobs, dependence on low-skilled irregular self-employment, and price hike of food items have put huge pressure on their financial ability to afford nutritional food for their families.

One major reason for malnutrition of family members is the high price of almost all food items, particularly meat, egg, milk, and fruits.

Food consumption trends are similar among women of different regions. Women in all groups including pregnant, lactating, teenage and adult women experience poverty and hunger harder than their male counterparts.

Women are well aware of their nutritional needs and that of their male earning members, children and the elderly. But they nevertheless remain the most vulnerable, especially during and after pregnancy.

The safety net programs like VGD/VGF/Widow allowances which aim to feed poorest and the most vulnerable do not appear to have been very useful. In all the FGDs women mentioned serious irregularities, corruption and nepotism in distributing these.

Future Outlook and Recommendations

- The food situation in Bangladesh today is deeply worrying. Although recent trends in agricultural growth rates have been satisfactory, inflationary pressures have plagued the sector resulting from unstable global markets and domestic fertilizer and power crises. In addition, the anti-corruption campaign of the government, the floods of 2007 and the impact of cyclone SIDR has compounded the crisis by causing risk perceptions to be heightened and thus, leading to a quiet panic in food markets. Under the circumstances, the short-term outlook from the point of view of food consumption and nutrition is expected to be difficult. In the longer term, food demand is expected to rise at a faster rate than domestic production, so that by 2015 the country would need to be able to procure a lot of food – largely through imports rather than aid. Given trends in world food, feed and energy markets the implications of a much larger import bill for food should give us some pause. It is important therefore to initiate urgent strategies to raise agricultural growth rates and increase export earnings/remittances, if the looming challenge is to be met successfully.

More specifically, a longer term strategy is advocated in order to generate the desired dietary balance, so that our final objectives can be achieved, say by 2020:

- It is suggested that calorie share of cereals is gradually decreased from 74 % to 60 % by 2015, and further down to 55 % by 2020.
- It is recommended that ideally, a total of 888 gm of food is consumed on average (per capita per day) with 380 gm coming from cereals (350 gm rice and 30 gm wheat), 368 gm from non-cereal plant sources, and 140 gm from animal foods.
- The total derivable energy from this diet would be 2187 kcal with cereals contributing 60%, non-cereal plants 29% and animal food 11% of total energy intakes. To persuade people to reduce rice consumption from the current level of 476 gm to 350 gm will not be easy, and will require rapid, broad-based economic growth and reduction of inequalities. **Such a dietary shift will also eradicate micronutrient deficiency as a public health problem**.
- Ultimately, the desired food balance can be obtained only if the national income continues to rise quickly, perhaps by over 8 percent a year, or 6.5 percent per capita per annum. If this increase is sustained and equitably distributed, the structure of food demand will inevitably shift and food habits will begin to approach the ideal pattern, as is already underway in China and India.
- **The main thrust must be on production, availability and accessability of non-cereal foods (fruits, vegetable, animal products) whose consumption needs to be raised.** Advocacy programmes should encourage a greater consumption of non-cereal foods, and if successful, this will automatically lead to reduced cereal consumption.
- Future supply will tend to track the evolving pattern of demand, but will need encouragement and incentives from the government in the form of infrastructure, technology, energy, inputs and markets.

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