R E S E A R C H
Monograph Series

Impact of the Food Price Hike on Nutritional Status of Women and Children

Munshi Sulaiman
Monira Parveen
Narayan Chandra Das

January 2009
Research Monograph Series No. 38

Research and Evaluation Division, BRAC

Impact of the Food Price Hike on Nutritional Status of Women and Children

Munshi Sulaiman
Monira Parveen
Narayan Chandra Das

January 2009

Research Monograph Series No. 38

Research and Evaluation Division, BRAC, 75 Mohakhali, Dhaka 1212, Bangladesh
Telephone: 88-02-9881265-72, 8824180-7 (PABX) Fax: 88-02-8823542, 8823614
E-mail: research@brac.net, Website: www.brac.net/research

January 2009

Cover design
Sajedur Rahman

Printing and publication
Altamas Pasha

Design and Layout
Md. Akram Hossain

Published by:

BRAC
BRAC Centre
75 Mohakhali
Dhaka 1212, Bangladesh
Telephone: (88-02) 9881265, 8824180-87
Fax: (88-02) 8823542, 8823614
E-mail: research@brac.net
Website: www.brac.net/research

This study was conducted under the financial support of DFID Bangladesh.

Printed by BRAC Printers, 87-88 (old) 41 (new), Block C, Tongi Industrial Area, Gazipur, Bangladesh

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ANNEXURE

RURAL

URBAN

LIST OF ACRONYMS

BDHS	Bangladesh Demographic and Health Survey
BINP	Bangladesh Integrated Nutrition Project
BMI	Body Mass Index
BRAC	Bangladesh Rural Advancement Committee
CPD	Centre for Policy Dialogue
DFID	Department for International Development
FANTA	Food and Nutrition Technical Assistance
FAO	Food and Agriculture Organization
FGD	Focus Group Discussion
GDP	Gross Domestic Product
GLV	Green Leafy Vegetables
GNI	Gross National Income
GoB	Government of Bangladesh
HAZ	Height for age Z-score
HH	Household
HKI	Helen Keller International
IPHN	Institute of Public Health Nutrition
MoFDM	Ministry of food and Disaster Management
NCHS	National Centre for Health Statistics
NFPCSP	National Food Policy Capacity Strengthening Programme
NGO	Non-Governmental Organization
NNP	National Nutrition Project
NSP	Nutrition Surveillance Programme
PCN	Price Consumption and Nutrition
PRA	Participatory Rapid Appraisal
RED	Research and Evaluation Division
SD	Standard Deviation
SPSS	Statistical Package for the Social Sciences
UP	*Union Parishad*, the lowest tier of local government
UZ	*Upazila* sub-district with an average population of 250,000
WAZ	Weight-for-age Z-score
WFP	World Food Programme
WHZ	Weight for-height Z-score

ACKNOWLEDGEMENT

The research team of this study were (in alphabetical order of surname), Mr. Narayan Chandra Das, Dr. Monira Parveen and Mr. Munshi Sulaiman. They are all researchers at BRAC Research and Evaluation Division.

The authors gratefully acknowledge the technical inputs of the experts of the National Food Policy Capacity Strengthening Programme (NFPCSP), FAO and the Food Policy Monitoring Unit of the Ministry of Food and Disaster Management (FPMU/MoFDM), Government of Bangladesh, at various stages of the study. The design of the present study was sharpened and refined through several workshops and meetings with the NFPCSP and FPMU/MoFDM experts.

Members of PCN advisory panel: Dr. Mahabub Hossain, Executive Director, BRAC, Prof. MA Sattar Mondal, Vice Chancellor, Bangladesh Agricultural University and Dr. Qazi Shahabuddin, Director General, Bangladesh Institute of Development Studies (BIDS) are also gratefully acknowledged for their continuous guidance and advices.

This study has been enriched with the close supervision of Dr. Imran Matin, Deputy Executive Director, BRAC; the authors appreciably acknowledge his contribution.

The study could not have been done without the active cooperation of Helen Keller International (HKI) Bangladesh who helped us by providing the data and other relevant information which formed the benchmark for this study.

DFID, Bangladesh not only supported this study by funding it, but by setting up the PCN Advisory Group and actively participating in it to ensure quality and relevance of all the studies. This has been a model of engagement that we have found to be of great value.

We also gratefully acknowledge the help and guidance provided by Professor Nick Mascie-Taylor of the University of Cambridge, UK, Professor Atiur Raham, Dhaka University and Mr Steve Jones (DFID consultant).

EXECUTIVE SUMMARY

Malnutrition levels in Bangladesh, particularly among children, are among the highest in the world. The consequences of this have been studied extensively, though progress has been slow and not sustained. Poor nutritional outcomes of children have lifelong consequences: in terms of productivity, cognitive ability, educational attainment, vulnerability to disease and overall quality of life. Life in utero and the first six months of life when the child should be breastfeeding are critical moments in a child's development, during which permanent patterns of poor nutrition are often established. This intrinsically links maternal health and nutrition to that of the child's.

The cost of malnutrition and the economic benefits of sustained reduction are huge. It is estimated that Bangladesh loses three billion dollars each year as a result of lower productivity and treatment costs arising from undernutrition and that a sustained elimination of micronutrient deficiencies could increase the country's GDP by 5%, at a cost of only 0.3% of GDP (Gillespie and Haddad 2001).

Malnutrition, globally, tends to be closely linked to consumption poverty. In Bangladesh, however, this fairly steady relationship demonstrates some peculiarities. The first is a puzzle at cross country level: when compared to other countries, malnutrition levels in Bangladesh are approximately 16 percentage points higher than what would be expected based on income levels (Deolaikar 2004). The second is that within the country, while, unsurprisingly, malnutrition levels among the poorest quintiles are high, they are also unexpectedly high among the richest quintiles. This puzzling phenomenon places the average malnutrition levels of the richest 20 percent of Bangladesh's population for example, on par with Myanmar's national average (Hellen Keller International, 2006a).

This backdrop of persistence and peculiarities of the malnutrition question in Bangladesh has motivated this study to examine how child and maternal nutritional status has been affected due to the sharp rise in food prices.

How sharp has this been rise? Using data from DAM, NFPCSP estimates that the national wholesale price of rice increased from Taka 15.9 per kg in January 2006 to Taka 30.8 per kg in August 2008, the month in which the data for this study was collected. That is an increase of over 94% during this period. However, the domestic rice price rise has been

lower than the global one. The FAO world rice price index during January-November 2007 and January-November 2008 increased by almost 95% in US$, while the increase in domestic wholesale rice price of Bangladesh has been just over 52% during the same period.

For wheat prices, the rise has been even more dramatic. NFPCSP estimates that the national wholesale price of wheat increased from Taka 14.1 per kg in January 2006 to Taka 29.1 per kg in August 2008: an increase of over 106% during this period. Domestic wholesale wheat price rise has been, however, at par with the global price rise: NFPCSP estimates for domestic wholesale wheat price rise during January-November 2008 is 38.1%, against a global rise of 38.7% during the same period.

In all counts, the rise in food price has been dramatic. The poor spend a large part of their expenditure on food and the rising food price is likely to have a net worsening effect in terms of already low nutritional status. How much? How are the effects distributed within different wealth groups and spatially? What have been the coping mechanisms? What are the lessons for policy and practice? These are some of the questions that we sought to examine in this study.

We find strong evidence of rice consumption smoothening and substitution across space (rural and urban) and across wealth groups. Not only has per capita daily rice consumption has been steady, it has somewhat increased from the 2006 benchmark survey of HKI. Given the increase in rice price, this has led to an increase in share of rice in total food expenditure—in rural areas, from 45% in 2006 to 51% in 2008 and from over 29% in 2006 to over 40% in 2008 in urban areas. The increase in the rice share has been more dramatic in urban areas; perhaps due to the fact that urban livelihoods are more directly linked to those having fixed salary, whose real income may have eroded the most due to rising food price rise. As expected, the increase in rice share in total food expenditure has been the most dramatic for the poorest groups (from 49% in 2006 to 62% in 2008) and near stable for the richest (from 37% in 2006 to 39% in 2008).

Poorer areas already had much higher levels of reliance on rice in their food basket, measured in terms of direct consumption. This made it difficult for them to further increase rice consumption to substitute and adjust their food basket in face of rising food prices. We find that in Jamalpur, one of the poorest regions of the country, the 0.41 kg per capita daily rice consumption in 2006, which was already very high, increased to 0.42 kg per capita per day in the 2008 survey of this study. In contrast, in Comilla, a better off region, we find that per capita daily rice consumption increased from 0.28 kg in 2006 to 0.32 kg in 2008. Yet, due to rising rice prices, the small increase in per capita per day rice

consumption in Jamalpur led to the average share of rice in total food expenditure rise from 51% in 2006 to 62% in 2008. This indicates that on average, in Jamalpur, households have reduced non-rice consumption but have not been able to make up that reduction with additional consumption of rice. Thus, the nutritional impact is likely to be spatially different and higher in poorer areas such as Jamalpur. This has important policy implications.

Adjustments in the labour market, especially through nominal increase in agricultural wage plays an important role in channeling the net effects of rising food price on consumption. We find that during the one year period (the time between this survey and the year prior), agricultural wages in all surveyed districts, on average, increased by 41%. Non-agriculture wages also increased during the same period in all surveyed districts by an average of 38% - marginally lower than the percentage increase in agricultural wages. We estimated real wages in terms of rice equivalent of money wages. On the one hand, rice equivalent of agricultural wage decreased from 3.76 kg in 2006 to 3.35 kg in 2008. On the other hand, non-agricultural wage, measured in quantity of rice, decreased from 5.32 kg in 2006 to 4.65 kg in 2008. In other words, the rate of the nominal wage increase was lower than that of the rate of rice price increase, though the nominal wage increases did dampen the overall impact of the rising food prices.

The key coping strategy seems to have been one where rice consumption has been further increased leaving the overall food basket even less diversified than before. Food consumption in terms of frequency (days/week) showed that, among the food groups studied, the most frequently consumed item was fish in both 2006 and 2008, but there was significant decrease in 2008 compared to 2006. *Dal* (lentil) consumption also decreased significantly between 2006 and 2008. Fish and *dal* have been replaced by relatively cheaper vegetables (green leafy and non-leafy) and also to some extent by eggs. Meat consumption (poultry and other meats) which is extremely low (not even once a week) remained unchanged in average. The level of protein consumption (mostly through fish and lentil) was already very low among the poorest quintile in 2006 and declined even further in 2008. The increase in the consumption of green leafy vegetables was predominantly among the poorer quintiles.

This worsening diet is likely to have serious impacts on children's short and long-term nutritional status as they require protein to sustain their growth and to prevent anemia. We designed the study to be a panel for the rural sample and thus followed up a sub sample of children who were 0-59 months in the 2006 sample in 2008. These children were 24-82 months in 2008. In order to get an idea of the impact of rising food price on child nutrition, we compared the fitted Z scores of weight-for-height (WHZ) of children who were 24-59 months in 2006 with 24-59 months

old children in 2008. We find an interesting pattern: the fitted WHZ trend line for 24-30 months old children is very similar between 2006 and 2008, but the 2008 WHZ trend line starts dropping and remains below the 2006 WHZ trend line for >30-59 months old children.

What about children who are 0-24 months old? For the rural sample, children of this age group could not be compared due to the panel design of the study. For the urban sample, we could not do a panel as it was difficult to trace back households. The design was cross sectional instead which means that we can cross sectionally compare 0-59 month old children. What we find when we carry out a similar exercise of plotting WHZ scores of 2006 and 2008 is that the 2008 trend line lies below the 2006 trend line for 0-6 months age group, follows the 2006 trend line very closely for 6-30 months age group and drops below the 2006 trend line for 30-59 month old age group of children.

Notwithstanding the methodological difficulties in comparing rural and urban, and panel and cross sectional design, we find an interesting pattern in terms of nutritional impact on children due to the rising food price rise and consequent food basket adjustments. It seems to be more pronounced for the very young (0-6 months) and older groups (30-59 months) of children. The route is likely to be indirect for 0-6 months old: through the impact of rising food prices on maternal nutrition for the 0-6 months old and direct for 30-59 months old children: through worsening nutritional quality of the overall household food basket. This possible age-specific impact of rising food price on child nutrition has important policy implications.

The change in the average intra-child weight-for-height Z-score between 2006 and 2008 translates into an increase in the prevalence of wasting of 5.5% in the age range 24-59 months in the rural sample. In the urban sample, the corresponding increase is 6.7% for the 24-59 months age group.

We find troubling patterns when we examine moderate to severe wasting across wealth quintiles. The increase in wasting has taken place across the board, but is much more pronounced for households among the moderate poor and moderate non-poor (3rd and 4th quintiles) making the overall relationship between child under nutrition and wealth status even less tenuous—the rapid price hike seems to have evened out under nutrition in a way that deepens the Bangladesh malnutrition puzzle further.

Spatial differences also feature importantly in our analysis. Jamalpur and Moulvibazar appear to be most severely affected since the prevalence of both underweight and wasting has significantly increased. These two districts have also witnessed lower increases in nominal wage rates

compared to other districts studies. The increase in under nutrition was the least in Jhenaidaha, which also had the lowest level of under nutrition of the six districts in 2006.

In order to better understand the child malnutrition findings, we also carried out qualitative studies. When asked about malnutrition and rising food price, the mothers provided an insightful story. Before the food price rise, most mothers stated that they prepared separate food for their children, especially for those who were older, consisting of milk, rice, banana and *khichuri*. Now, with the rising food prices, they could no longer afford to do that, and children ate from the family meal which has deteriorated in terms of quantity and quality. The mothers were very aware of the longer term detrimental impact of this, arguing that this adjustment is particularly harmful for children in their growing age (*baronto boyosh*).

What has been the impact of rising food prices on other non food expenses? In the survey, we asked preset questions on coping strategies to deal with rising food prices. Not unexpectedly, the predominant reported coping mechanism has been reduction in number and quality of meals and this has been the predominant strategy among the poorer population. In terms of cutting back on other non food expenses to cope, in order of priority, clothing, health, transport and cooking fuel use have been reported as important ones. Cutting back on educational expenses has not been reported as an important coping mechanism, though it is likely that this is underreported. Reducing private health expenses which are already low, is likely to have detrimental effects in terms of health status, especially of the more vulnerable members of the households, such as women and children.

One of the interesting reported coping mechanisms has been taking credit—both formally and informally. It is likely that informal money lending became more active to cash in on immediate cash flow and consumption shortfalls, especially of the poorer segments of the population. It is possible that management of repayment difficulties of outstanding debt obligations from microfinance institutions have also been dealt with through taking informal loans. However, microfinance institutions have been reported to allow greater flexibility in savings withdrawal, existing loan repayments and even offered instant consumption loans to alleviate the immediate crisis due to rising food prices. Given the importance of the financial market, both formal and informal, in coping mechanisms, especially for the poor, it is important to better understand the exact workings and dynamics of the financial market in response to crises such as rising food prices. This would enable microfinance institutions better respond to help alleviate the difficulties faced by the poor.

In conclusion, let us raise a few key points by the way of summarizing. Rising food prices have forced a food basket re composition response that has contributed to a worsening of nutritional status in Bangladesh. Children, especially those who are relatively older (24-59 months) have suffered the most. The impact has been across the board--- wealth-group wise, the impact has been most severe for the moderate poor and moderate non poor households, though the children from poorer households already had very low nutritional status to begin with. This has flattened out further the under nutrition-income relationship that is characteristic of the malnutrition phenomenon in Bangladesh. Poorer areas have suffered more, where wage adjustments have been relatively modest. In general, adjustments in nominal wage have not been adequate to totally compensate for the rise in food price. Health expenditure cutbacks have been a predominant response as a coping mechanism and this is likely to further deepen the malnutrition impacts, especially for women and children.

The persistent and puzzling phenomenon of malnutrition has been deepened and made to become more widespread due to the rapid rise in food prices. One would hope that this would create greater the urgency and energize a cross-sectoral, coordinated and scaled up initiative to reverse this worrying trend and bring about sustained progress against malnutrition in Bangladesh.

INTRODUCTION

The recent increase in the price of food, especially rice, has been a cause of concern all over the world and has been critically important issue in Bangladesh; as a net importer of food, the price has closely followed the trend of international markets. The result of this unusually high rate of inflation has had a direct bearing on the poverty status of the country as the incidence of poverty is intimately related to the change in food prices due to the fact that food constitutes a considerable portion of the expenditure of the poor.

Several studies have assessed the impact of food price increase on the level of poverty in Bangladesh. According to the World Bank (2008), a reduction in poverty by 5%, between 2005 and 2008, was expected in Bangladesh resulting from the strong GDP growth during that period. However, the study instead projects around a 3% increase in the incidence of poverty from the baseline rate of 40% in 2005 as a result of the increase in food prices. Therefore, the net impact on poverty, from the combined effects of economic growth and the inflation of food prices, is likely to result in a decline of about 2%; from 40% in 2005 to 38% in 2008. On the other hand, the Centre for Policy Dialogue (CPD) estimates that in fact an additional 8.5% of households have actually fallen below the poverty line because of the high inflation (CPD 2008). Their estimates take the Household Income Expenditure Survey of 2005 as the benchmark, and their projection considers the increase in cumulative Gross National Income (GNI). However, they concluded that the cumulative impact of high inflation (particularly the weighted inflationary impact of the price of rice) has resulted in significant income erosion of the low income groups in Bangladesh.

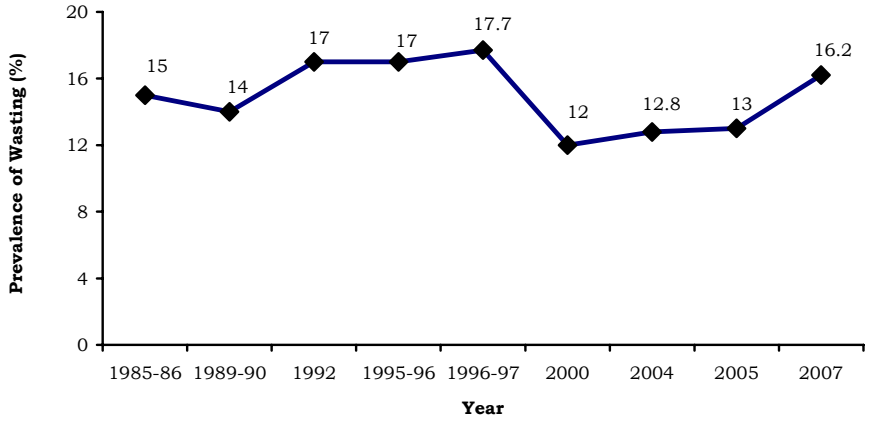
The focus of this study is to examine the impact of the price of food on the change in nutritional status of groups of children and their mothers between 2006 and 2008, living in rural areas, especially in poorer parts of Bangladesh. It was not possible to however undertake a panel survey for poor urban areas as only a few of families studied in 2006 could be located. As a result a cross-sectional survey was conducted instead within the same slum area.

This report is divided into 6 sections. The next section gives a brief overview of the nutritional status in Bangladesh and of the impact of increasing food prices on nutrition. The methodology used in this study is presented in the third section. Findings from surveys are presented in the fourth section, while excerpts from a few qualitative exercises are presented in section Five to complement survey results. The final section concludes the paper with some policy suggestions based on the salient findings.

REVIEW OF EXISTING EVIDENCE

Since the mid 1990's there has been some evidence of improvement in nutritional status of children under the age of 5, however, the prevalence of undernutrition in Bangladesh remains very high; a recent nationwide study (HKI, 2006a) found that 39.2%, 45.7% and 11.4% of rural children under 5 were stunted, underweight and wasted, respectively, indicative of both acute and chronic undernutrition. The extent of stunting is very similar between rural and urban areas; in 2005 40.3% of girls and 38.3% of boys in rural areas were found to be stunted, while in urban slums the corresponding percentages were 38.8% and 39.5% (HKI, 2006a). Although there have been fluctuations around this figure there is no evidence of a consistent improvement in the prevalence of wasting over the last 20 years. As we can see in the figure below the prevalence of wasting in 2007 is higher than that of 1985.

Figure 1. Trend in prevalence of wasting among children aged 6-59 months[1]



Source: CMNS-Bangladesh (2005) & BDHS (2007)[2]

There is also the issue of seasonality in undernutrition in Bangladesh. HKI (2006a) showed that proportion of underweight and wasted children in the rural Bangladesh was lowest during December-January and highest during June-July in 2005. For urban slums, the proportion of underweight children was lowest in February-March and highest in October-November and June-

[1] Estimates used NCHS-1977 reference. However, using WHO reference, prevalence of wasting was 14.5% in 2005.
[2] Figures for 1996-97, 2004 and 2007 were taken from BDHS (2007)

July. However, proportion of wasted children in urban slums was lowest in December-January and highest in June-July. The fall in proportion of underweight and wasted children during December-March may be due to the period being post-harvest seasons (Aman rice) where there are an abundance of winter vegetables compared to other months. Although, it is important to note that seasonality is not a big concern for this study as the survey in 2008 was undertaken during the same period of the year as HKI survey had been conducted in 2006.

Several studies have been conducted in Bangladesh examining the relationship between household income, food security and nutritional status. Through household level information, HKI/IPHN Nutrition Surveillance Project (NSP) data showed that there are strong relationships between household expenditure and nutritional sufficiency ratio.[3] The nutritional sufficiency ratio, in turn, was found to be a key determinant of undernutrition. Dancer *et al.* (2008) also found a strong effect of wealth on child nutrition. However, it is sometimes contended that though there is an association between household expenditure and child undernutrition, the relationship is not strong enough (WFP 2004). Prevalence of underweight and stunting was 38% and 30% respectively even among the children from richest quintile of population in 2002. Poel *et al.* (2008) also showed that undernutrition (measured as stunting) was observed among all socio-economic groups in Bangladesh, although the proportion of malnourished children was highest among the poor.[4]

Bangladesh Demographic and Health Survey (BDHS) 2004 reported a remarkable difference between extent of asset ownership and stunting. Prevalence of stunting was only 7% among children from households from the highest quintile, while it was 26% if the household belonged to the lowest quintile.

The prevalence of undernutrition of mothers and children among the non-poor may be attributed to other factors besides food expenditures. For example, Haddad *et al.* (2004) highlighted the inability of women to claim key rights, and the low priority placed on the care of infants and women contribute substantially to undernutrition in Bangladesh.

The key issues of food price increase are the changes in food expenditure and nutritional status of the children. Torlesse *et al.* (2003) showed that as the price of rice decreased, the nutritional status of the children improved in Bangladesh. They also showed that when rice prices fall, households

[3] Measured by the actual household expenditure on food with the cost of an optimal diet required to provide at least one Recommended Dietary Allowance (RDA) of macro and key micronutrients (HKI 2006b)

[4] This study analyzed socioeconomic inequality in undernutrition in 47 developing countries. The study did not find association between average undernutrition rates of the countries and socioeconomic inequality. Based on the findings it was suggested that not only degree of socioeconomic inequality in undernutrition but also its pattern should be of concern in formulating health policies.

continue to consume a similar amount of rice but they spend more on non-rice food, thus diversifying their diet, with concomitant improvement in children's nutritional status.

The high prevalence of undernutrition has serious impacts on both quality of life and economic growth. About half of the deaths among pre-school children in low-income Asian countries have been attributed to undernutrition. Quantification of the economic losses shows that Bangladesh loses three billion dollars each year as a result of lower productivity and treatment costs arising from undernutrition; sustained elimination of micronutrient deficiencies could increase the country's GDP by 5%, at a cost of only 0.3% of GDP (Gillespie and Haddad 2001).

Currently, there are several types of safety net programmes being implemented in Bangladesh. These programmes, which take short to medium term approaches, have had varying success in reducing seasonal or chronic food insecurity. The National Nutrition Project (NNP) is currently the key intervention specifically targeted to mother and child nutrition.

Although there was mixed evidence in the effectiveness of the Bangladesh Integrated Nutrition Project (BINP), the predecessor of NNP, the performance of NNP implementation process has been less than satisfactory (World Bank 2007). Furthermore, NNP covers a relatively small portion of the nutrition-relevant set of actions, as well as not achieving national coverage (Haddad *et al.* 2004).

Public transfer and relief programs targeted to the poor, such as the Vulnerable Group Feeding program, the Food-for-Work program, and interventions by Non-Governmental Organizations (NGO) have had significant impacts on reducing child undernutrition, especially among the poor (Deolalikar 2005, Pitt *et al.* 1998). Chowdhury and Bhuiya (2004) evaluated the poverty reduction programme of an NGO and found better child survival and nutritional status among the participating households; the intra-household food allocation was found to be more equitable, although there was still a tendency to favor boys.

As the literature reviewed here suggests, there is association between food expenditure and nutritional status of children in Bangladesh. Undernutrition was also found to be a leading cause of death among the youth which in turn contributes to a considerable economic loss of the country. Examining the impact of the recent price hike of essentials in Bangladesh should be thus taken into careful consideration. Increasing food prices may change the overall food expenditure and the quality of food of the poor. This in turn may have an effect on nutritional status of the children and their mothers, the two most disadvantaged groups in households. Findings on examining such relationship will provide medium-term and long-term policy guidelines in the face of massive prevalence of child and mother undernutrition in the country.

METHODOLOGY

The primary objective of this study was to assess whether, and to what extent, the increase in price of food resulted in a deterioration in children's nutritional status in Bangladesh. It was therefore desirable to examine the intra-child change in nutritional status before and after the price hike (i.e. a panel study design). It is important to note here that this study does not intend to provide an estimate of the prevalence of children's undernutrition through a cross-sectional study design. In order to look at before and after changes in nutritional status this study followed up children and their mothers who had been measured in the HKI/IPHN Nutritional Surveillance Project (NSP-2006) conducted in August-September 2006. In this respect the NSP-2006 survey provides a benchmark to assess the impact of the recent food price hike.

Sampling

A sub-sample of NSP-2006 was revisited during July-August, 2008. The sample was drawn separately for rural and urban populations. The rural sample was drawn with an intention of observing the change in poorer nutritional areas, while the slums in Dhaka were the natural choice for the urban poor. However, the combination of insufficient information and high levels of migration meant that most of the urban slum children could not be identified. For this reason a cross-sectional survey was conducted in the same slums where NSP-2006 survey took place. However, adequate numbers of households from the rural sample were able to be revisited.

For the rural population, the *upazilas* in NSP-2006 were ranked by their mean weight-for-height *z*-score (WHZ)[5]. From each of the 6 divisions[6], the *upazilas* with the lowest mean scores were selected as the primary survey sites, although the variation in means was not large and ranges and variances were very similar. Within each *upazila*, NSP conducted surveys in 15 villages. Out of these 15, 10 villages were selected randomly. All the 25 households of NSP-2006 survey in each village were revisited, making a total of 1500 households, of which 1163 households were successfully visited. Non-randomness in attrition may bias the results. However, it is difficult to have any prior reasoning about the direction of the bias. Nonetheless, we have observed no significant difference in 2006 in any of

[5] NSP-2006 conducted the survey in one upazila in each sampled district.

[6] NSP-2006 considered Chittagong Hill Tracts as separate division because of the unique geographical and population structure. This division is not being considered for this survey because of the difficulties of conducting survey in short period of time.

the nutritional indicators between the children who could and could not be surveyed[7].

The *upazilas* that were covered in the survey were Patharghata (in Barguna), Chauddagram (in Comilla), Sadar (in Jamalpur), Kaliganj (in Jhenaidaha), Sreemangal (in Moulvibazar) and Sadar (in Naogaon). Although these had the lowest mean WHZ in their respective divisions, there were wide variations in the extent of poverty among them. According to the latest WFP mapping, the values of poverty index (measuring the extent of poverty) in these six *upazilas* were 27%, 19%, 31%, 24%, 24% and 33% respectively while the national estimate is 30%. This therefore leaves scope for constructing comparisons across *upazilas*, reflecting spatial poverty and nutritional change.

For the urban slum population, only the slums in Dhaka were considered due to time and logistical constraints. This survey intended to revisit all the 600 households from 41 slums in 12 wards in Dhaka city from NSP-2006. However, very large attrition (around 90%) was observed in the urban sample which was due to a combination of inadequate identification information as well as high mobility and slum evacuation. Therefore, the sampling method was revised and a cross-sectional method was used in which 435 households with under-five year old children, from the same 41 slums in the 12 wards of NSP-2006, were randomly selected.

Data collection

The key data collected in the survey was the heights and weights of the children and their mothers. The main nutritional status indicator of the children was their weight-for-height (extent of wasting) since this reflects short-term (acute) changes. Child nutrition is important not only in its own right but also it reflects the households' access to food. Although nutritional status of mothers is usually measured by BMI (weight (kg)/height (metre)^2), in a panel survey change in weight is more interpretable than BMI, since adult height does not change. Household food security was assessed by the change in food consumption (specifically by food frequency of cereal and non-cereal items, as per NSP-2006) as well as using self-reported food security status.

Information on household assets was gathered to form a wealth index in the NSP-2006 survey. Although this may not be representative of different wealth groups, it may provide valuable insight into the differences in changes of nutritional status across these groups in rural

[7] Mean *z*-scores of weight-for-height in 2006 for the surveyed and attrited sample were -1.19 and -1.23 respectively and the difference was not statistically significant at 10% level. Differences in mean scores of weight-for-age (-1.20 and -1.95 respectively) and of height-for-age (-1.73 and -1.65 respectively) were not significantly different either.

areas. A similar comparison is made across different occupation groups for the urban slum population. The amount of rice/wheat purchased by the households and the prices they paid has been related to the level of change in the nutritional status of the children. In addition, a few self-perceived poverty status and dynamics questions were also asked and there was an attempt to determine the mechanisms that these households used to cope with the price hike.

Qualitative methods are always considered as an essential complement to the quantitative assessments. It contributes in better understanding the quantitative findings. In order to explore the underlying facts of the key findings observed in the quantitative analysis, qualitative assessment following participatory rapid appraisal (PRA) methods was conducted. The tools used were: focus group discussions (FGD), participatory drawing, matrix ranking/scoring by percentage, number, symbol or picture, diagramming, calendar analysis, timeline, trend analysis and case studies. Participants were the women included in the survey, as well as their husbands and neighbors. Comparative investigations were made through participatory methods between the situation in 2008 and one year ago (i.e. before food price hike) and at present (during Sraban-Vadra period in Bengali calendar). Key issues addressed in this qualitative assessment were income changes (wage rate, total income), proportion of income spent on food and non-food items, quality of food in terms of meal composition, quantity of food in-terms of number of full meals a day, frequency of staple foods (rice/*ata*), animal foods (meat and fish), vegetables and potato consumption.

Among the six sample districts, Jamalpur was chosen for this PRA as it was found from initial quantitative analysis that declines in both economic and nutritional status were relatively higher in this district than others. PRAs were conducted in 5 of the villages, randomly selected from the10 villages surveyed in Jamalpur. The results were from 10 FGDs (2 in each of the 5 villages) and 5 case studies.

Anthropometrical measurements

All the selected mothers and children had their weight and height/recumbent length measured following international standard procedures as described in the FANTA technical report (Bruce Cogill,

2003). Weight was measured with a Digital Bathroom Scale (TANITA, Japan) to the nearest 0.1kg; subjects were barefoot and wore light clothes when they were weighed. Height/length was measured to the nearest 0.1cm with a locally constructed portable wooden height/length board. The weighing scales were checked for performance (with known weight) everyday before use.

Quality control measures

A four days extensive training course, followed by field-testing, was conducted for the selected enumerators on the use of questionnaire and anthropometrical measurements. Instrument error, intra and inter-measurer Technical Error of Measurements (TEMs) and the coefficient of reliability (R) were determined through standard calculations. The coefficient of reliability (R) as determined for the 44 Enumerators (using repeated measurements on the same 10 subjects) was 0.996 for weight and 0.997 for height indicating almost no inter-measurer errors. A coefficient of reliability of above 0.95 is indicative of good quality control. In addition to regular and random spot checks on the interviews and anthropometric measurement techniques by each team supervisor, field manager and survey coordinator, all the completed questionnaires were cross-checked everyday by each team at the field office and all corrective measures were undertaken as and where necessary.

Data management and analysis

The collected data was rechecked and edited for inconsistency, wrong recordings and codings in the field. Questionnaires were further checked by a separate Data Management Section in Dhaka before entering the data on the computer using Fox-Pro. After recording all data, distributions and ranges were examined for consistency and extreme values and outliers were identified and necessary corrections were made where the values were due to entry errors. The data were analysed using both SPSS (version 11.5) and STATA (version 9.2 se). Statistical significance was tested using paired t-tests, independent sample t-tests and chi-square tests, as and where applicable. Bivariate analyses were used to test the significance of the relationship between predictor variables and nutritional status. Regression models were used to identify significant predicators of nutritional status in the study children. A p value of <=0.05 was considered as the cut-off for statistical significance although p-values of <=0.10 are also reported. Insignificant results were signified by p ns (not significant).

Raw child anthropometric data were converted into Z-scores using the new WHO growth standard reference values (software ANTHRO 2005, WHO). Nutritional status of the children was estimated using standard cut-off points for each of the indices. Wasting was defined as weight-for-

height Z-scores <-2 Standard Deviations (SD) below the reference median, underweight as weight-for-age Z-scores <-2 SD and stunting as height-for-age Z-scores <-2 SD below the reference median (Gibson 1990).

Besides estimating proportions based on these cut-offs, weigh-for-height Z-score was analyzed as scale variable. Since Z-scores are known to be significantly influenced by the age and sex of children, the scores were regressed by these two variables in a cubic specification using data from both survey years. This allowed us to estimate the Z-score that a group of children of a particular age and sex should have if they have average characteristics in all other variables. Variation from this estimated/predicted Z-scores (i.e. residuals) reflect the nutritional status of a child from an "average child". A positive value reflects better nutritional status and vice versa. These variations/residuals are compared across year and different household characteristics. One usefulness of this residual analysis is that when comparing children from different groups (for instance, from poor and non-poor households), we only need to look at the differences in their mean residuals. The other critical advantage is that we can do paired t-tests of residuals for children in the panel even when they are 2 years older since their age is already controlled for in calculating residuals.

Maternal BMI was calculated from weight and height data. Low BMI, which is often considered as an indicator of chronic energy deficiency, was defined as BMI <18.5. This cut-off for BMI is also used as one of the eligibility criteria in the feeding program of malnourished pregnant and lactating women in National Nutrition Programme in Bangladesh (Jahan and Hossain 1998).

RESULTS

Findings from the rural and urban-slum surveys are presented separately. The socio-economic profile of rural households reflects the intra-household changes between 2006 and 2008, while in the urban-slum comparisons of 2006 and 2008 reflect sampling differences as well as changes over time. Changes in food consumption, both rice and non-rice, were used to evaluate how the change in price may have affected food intake patterns of households across different socio-economic groups and regions. Households have suffered different levels of stress and have taken a variety of coping strategies, which have also in turn been explored. Changes in nutritional status of the children and mothers are presented with an effort to relate these changes with coping mechanisms.

Rural (Quantitative)

Basic socio-economic profile (rural)

The advantage of having a panel survey is that it is examining the same households over time and so any changes are not confounded by sampling. There has not been any change in the basic demographic status of the sampled households as their family sizes and headship remains unchanged (Table 1). However, the extent of female headship is much lower than national estimates; this is largely due to households having at least one under five year old child in 2006 to be considered in the sampling frame. Since female headed households often do not meet that criterion, they are under-represented in such surveys. Similar to demographic structure, no significant change was observed in the occupational patterns of the main earners.

Table 1. Socio-economic profile of the rural sample households

Variables	2006	2008	Change	p
Family size (mean)	5.34	5.19	-0.15	ns
Female headship (%)	5.4	4.4	-1	ns
Occupation of the main earners				
Unskilled labor (%)	23	22	-1	ns
Skilled labor (%)	21	20	-1	
Agriculture (%)	24	28	4	
Non-farm business (%)	19	18	-1	
Salaried employment/professional	14	12	-2	
Main material of walls of the house				
Cement/brick (%)	22	27	5	<0.01
Tin (%)	33	38	5	
Bamboo (%)	46	34	-12	
Have electricity connection (%)	48	45	-3	ns
Type of latrine used				
Sanitary (%)	37	54	17	<0.01
Kancha (%)	50	34	-16	
Open space (%)	14	11	-3	
Household owns homestead land (%)	67	72	5	<0.01
Own cultivable land (%)	45	39	-6	<0.01
Own livestock (%)	62	59	-3	ns

It is encouraging to observe that households over time have managed to improve their housing and sanitation, which can also have an impact on health and nutritional status through non food environment pathways. Although the extent of ownership of homestead land increased between 2006 and 2008, there was a significant decline in ownership of cultivable land.

One of the key objectives of this study was to reflect on the differences in nutritional status among different poverty groups. In the absence of detailed income/expenditure data, some simpler indicators are often taken as proxy variables of poverty status. For this study, a wealth index was formed in 2006 using 10 such indicators viz. number of adult males in the household, size of the house, main material of the walls, having electricity connection, type of latrine used, ownership of cows, occupation of the main earner is day labor, log (amount of cultivable land owned), log (amount of homestead land owned) and education of the female. Estimates of the wealth index suggest a very good level of internal consistency (Annex 1A). Based on the score in this index, the households have been classified into five quintiles. Cross-checking of the quintile distribution shows that it is better in reflecting household socio-economic status compared to any single indicators such as housing or occupational groups (Annex 1B-1D). However, the quintiles should be interpreted with care since the richest are not reflective of the richest quintile in rural Bangladesh but only of the sample.

Change in food consumption (rural)

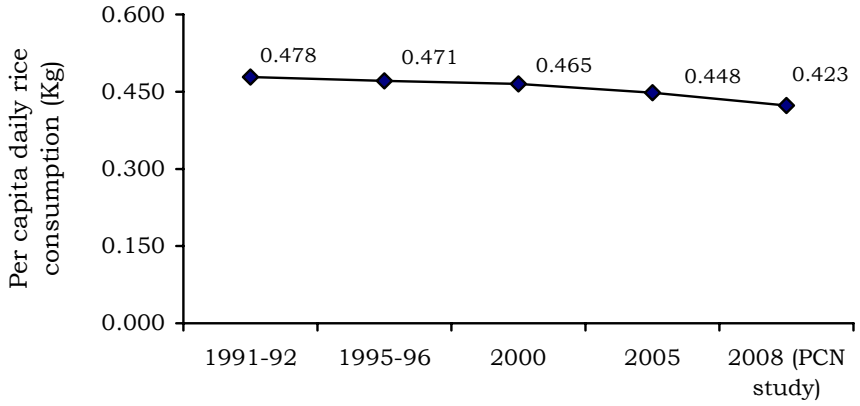
Three major indicators have been used to assess the possible impact of increase in food price, (1) per capita rice consumption per day (2) proportion of food expenditure spent on rice and (3) consumption frequency of non-rice foods.

Table 2. Rice consumption by wealth quintiles

Year	Poorest Quintile	2nd Quintile	3rd Quintile	4th Quintile	Richest Quintile	All
Per capita per day rice consumption (mean in Kg)						
2006	0.361	0.367	0.367	0.369	0.346	0.362
2008	0.446	0.429	0.411	0.401	0.425	0.423
Amount increased (g/day/capita)	85	62	44	32	79	61
p-value	<0.01	<0.01	<0.01	<0.05	<0.01	<0.01
Per capita weekly food expenditure (mean in absolute Taka)						
2006	99	104	131	137	156	125
2008	185	200	228	256	323	238
P	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Share of rice in total food expenditure (%)						
2006	49	48	47	45	37	45
2008	62	57	52	46	39	51
p-value	<0.01	<0.01	<0.01	Ns	ns	<0.01

Per capita rice consumption has substantially increased across all household quintiles between 2006 and 2008 (Table 2). Because of the increase in rice price, household income eroded in real terms (at least in the short term until adjustment in income takes place). Since the price of all major food items increased, and rice is the cheapest source of energy, households had to substitute other foods with more rice. Consequently, rice's share in total food expenditure increased. However, such an effect is more likely to be noticeable among the lower income groups. This is exactly what was observed in this study, with the poorest three quintiles reporting a significantly increased expenditure on rice within the total food budget. However, a comparison with the trend in rice consumption in Bangladesh based on HIES indicates (Figure 2) that the HKI 2006 estimate of per capita daily rice consumption that we used as the benchmark in this study may have been underestimated.

Figure 2. Trend in per capita daily rice consumption in rural area



Source: Based on HIES1991/92 – 2005; Information for 2008 from the present study

Households in the poorest quintile in the sample have increased their per capita rice consumption from 361 gram/per day to 446 gram/per day. They spent 62% of their total food expenditure on rice in 2008 while the percentage in 2006 was only 49%. For the richest quintile, per capita rice consumption also increased by 79 gram/day, although the share of rice in food expenditure increased only slightly.

A study conducted by the 'Unnayan Shamunnay' published in the 'Bangladesh Economic Outlook' also showed that, as much as 75% rural and more than 80% of the urban households did not reduce the consumption of rice as a result of food price hike (Shamunnay 2008).

Table 3. Per capita daily rice consumption by districts

Year	Barguna	Comilla	Jamalpur	Jhenaidaha	Moulvibazar	Naogaon
Per capita per day rice consumption (mean in Kg)						
2006	0.39	0.28	0.41	0.39	0.34	0.38
2008	0.45	0.32	0.42	0.44	0.45	0.44
p	<0.01	<0.01	ns	<0.01	<0.01	<0.01
Share of rice in total food expenditure (%)						
2006	57	34	51	48	42	43
2008	61	35	62	47	51	56
p	<0.05	ns	<0.01	ns	<0.01	<0.01

However, there is significant variation across regions. In Jamalpur, by far the poorest cluster in the sample, the amount of rice consumed has not

increased, while the share of rice in total food expenditure has increased by 11% (Table 3). This indicates that on average, these households have reduced non-rice consumption but have not been able to make up that reduction with the additional consumption of rice. The share of rice to total food expenditure in 2008 was also the highest in Jamalpur among the 6 districts. Such findings indicate that nutritional impact, if any, is likely to be spatially different and higher in poorer areas such as Jamalpur.

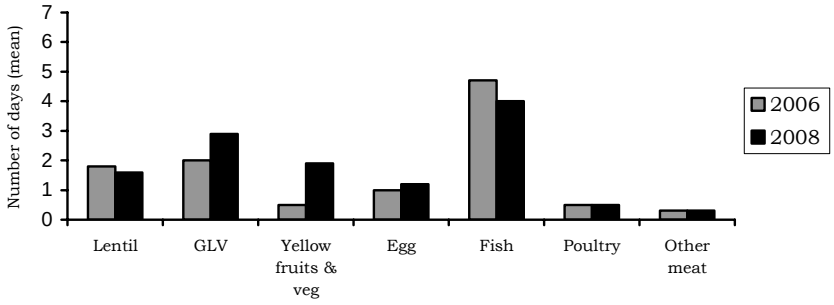
Quality of food intake

Food consumption in terms of frequency (days/week) data showed that, among the food groups studied, the most frequently consumed item was fish in both 2006 and 2008, but there was significant decrease in 2008 compared with 2006 (Figure 3). *Dal* (lentil) consumption also decreased significantly between 2006 and 2008. Fish and *dal* were seen to have been replaced by relatively cheaper vegetables (green leafy and non-leafy) and also to some extent by eggs. Meat consumption (poultry and other meats) which is extremely low (not even once a week) remained unchanged.

Differences across wealth groups reflect similar levels of changes (Annex 2A). However, the level of protein consumption (mostly through fish and lentil) was already very low among the poorest quintile in 2006 and declined even further in 2008. Increase in the consumption of green leafy vegetables (GLV) was predominant among the poorer quintiles (Annex 2B).

The worsening diet is likely to have serious impacts on children's short and long-term nutritional status as they require protein to sustain their growth and to prevent anemia.

Figure 3. Frequency of consumption of different food items in the last week (rural)



GLV= green leafy vegetables

Wage adjustment, self-reported effect and coping mechanisms (rural)

Adjustments through wages, if any can play an important role in the net effect of food price hikes (Table 4). During the one year period (the time between this survey and the year prior), agricultural wage in all surveyed districts, on average, increased by 41%. In percentage terms the highest increase in agricultural wage was found in Comilla, while the lowest increase was in Moulvibazar, where the agricultural wage had also been found to be the lowest in the previous year. Non-agriculture wage also increased during the same period in all surveyed districts by an average of 38% - marginally lower than the percentage increase in agricultural wages. The range was between a 28% increase in Comilla to 52% in Borguna.

To have an idea about the extent nominal wage increase compared to food prices, estimates of the rice equivalent of money wages were formulated. The reasoning behind this is that day laborers, mainly from poor households, spend a majority of their income on rice. Nominal wage (the average from all districts) was divided by corresponding period's retail price of coarse rice (Boro HYV). The retail price was found to be Tk. 20.5 per Kg in July-August 2007, and Tk. 32.5 per Kg in the same period in 2008.[8] It appears from Table 5 that agricultural wage measured by amount of rice, decreased from 3.76 Kg to 3.35 Kg, an 11% fall, during a one year period. On the other hand, non-agricultural wage, measured in quantity of rice, decreased from 5.32 Kg to 4.65 Kg, a 13% drop, during the same period. In other words, the rate of the nominal wage increase was lower than the rate of the rice price increase.

[8] This was based on average price for selected districts in all six divisions of Bangladesh. Price data was collected from Department of Agricultural Marketing (www.dam.gov.bd)

Table 4. Male agricultural and non-agricultural wage rate (nominal, with food), by districts

(in Tk.)

	Barguna	Comilla	Jamalpur	Jhenaidaha	Moulvi bazar	Naogaon	All
Agricultural wage							
Wage a year ago (July-August, 2007)	92	116	132	68	55	88	77
Wage now (July-August, 2008)	140	178	176	101	71	141	109
% change	52	53	34	48	28	60	41
p (paired t-test of change)	<.05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Non-agricultural wage							
Wage a year ago (July-August, 2007)	99	170	116	107	114	90	109
Wage now (July-August, 2008)	151	218	158	147	147	134	151
% change	52	28	37	37	30	48	38
p (paired t-test of change)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

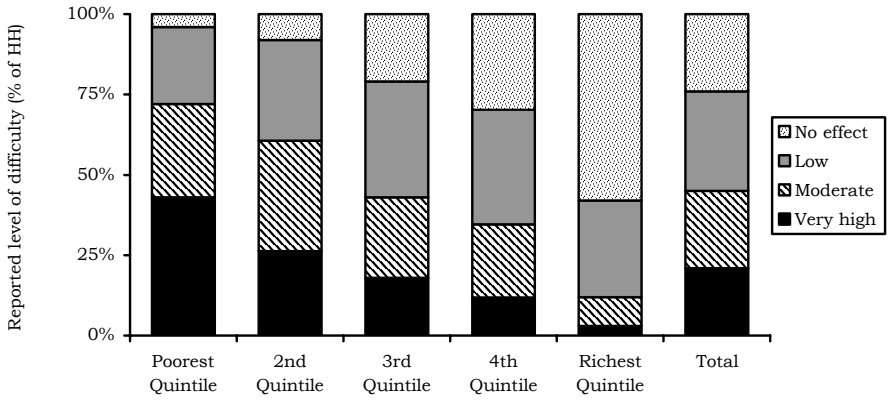
Table 5. Male agricultural and non-agricultural wage rate measured in rice

(Kg of rice)

	Agriculture	Non-agriculture
Wage a year ago (July-August 2007)	3.76	5.32
Wage now (July-August, 2008)	3.35	4.65
% change	-11	-13

Respondents were asked to rank the level of difficulties that they faced because of the increase in food price. Overall, about 21% of the respondents reported very high levels of difficulties, while over 24% reported not facing any difficulty at all (Figure 4). In addition, 31% reported low and 24% moderate levels of difficulties. However, these overall levels mask the very significant variation between wealth quintiles. There was a significant trend of increasing difficulty from richest to poorest quintile, and nearly 75% of the poorest quintile reported suffering moderate or very high difficulty in managing price hikes.

Figure 4. Reported level of difficulty because of food price increase by quintiles (% of HH)



Respondents were also asked to rank their current food security status compared with a year ago on a scale from chronic deficit to surplus (Table 6). It was found that 41% of households were in deficit a year ago, while the percentage this year had increased to 47%. This increase was apparent across all quintiles, especially among households in the 3rd and 4th quintile.

Table 6. Change in self-perceived food security status

	Poorest Quintile	2nd Quintile	3rd Quintile	4th Quintile	Richest Quintile	All	p
Deficit a year ago	79	59	33	26	9	41	<0.01
Deficit now	82	64	42	36	13	47	<0.01
p (Paired t-test of change)	<0.10	<0.10	<0.01	<0.01	<0.05	<0.01	

Given that the households have suffered varying levels of difficulties and some of them moved into deficit status (self-reported), it is important to try and determine the mechanisms that they have adopted to cope with this crisis (Table 7).

Table 7. Adoption of different coping mechanisms (% of HH)

Means of coping	Poorest Quintile	2nd Quintile	3rd Quintile	4th Quintile	Richest Quintile	p-value
Consumption smoothing using credit						
Informal borrowing in cash	13	14	12	9	4	<0.01
Informal borrowing in kind	9	8	4	6	0	<0.01
Use borrowed money from NGO	22	21	19	13	6	<0.01
Social safety nets (formal/informal)						
Informal charity from relatives	6	11	9	6	2	<0.01
Collect VGF card	3	6	5	6	2	<0.10
Collect relief	3	0	0	0	0	<0.01
Purchase from OMS/BDR shops	0	0	0	0	0	ns
Reducing food consumption						
Reduce number of meals	39	23	17	5	2	<0.01
Reduce quality of meals	88	72	62	45	21	<0.01
Reduce amount of food	70	49	45	25	10	<0.01
Consume collected/uncultivated food	37	22	14	8	5	<0.01
Reduce non-food consumption	79	64	53	44	26	<0.01
If reduced non-food consumption						
Fuel/kerosene	33	19	16	18	10	<0.01
Health expenses	18	26	28	25	20	<0.01
Housing	5	2	0	0	2	ns
Clothing	78	72	73	73	77	ns
Transport expenses	11	11	12	9	18	ns
Education	2	6	4	2	2	ns
Other non-food	28	35	36	41	43	<0.01
Miscellaneous						
Mortgage assets	0	1	6	6	5	<0.01
Start new earning activity	3	4	3	0	1	ns
Temporary migration for work	2	1	0	1	0	ns
Engaging new member in work	1	5	2	2	1	<0.01
Getting children out of school	2	1	2	0	0	ns

The main coping mechanisms were reducing the quality and number of meals. Reducing non-food expenditure was also a key mechanism adopted to deal with food price increase. Reducing expenses, especially related to clothing, was also a key coping mechanism. Rural financial markets also appear to have played a vital role since a good number of the households, 27%, used informal credit, cash or in kind, and loans from NGOs to finance their increased food expenditure. Poorer

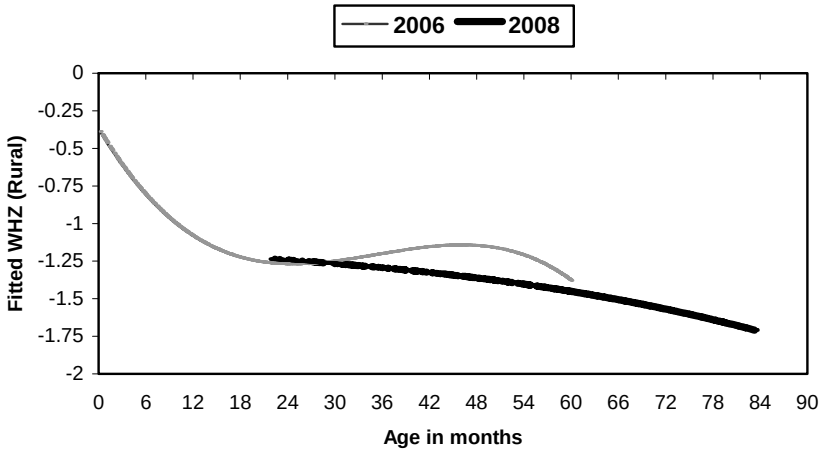
households were found to be more likely to adopt any of these coping mechanisms than richer households.

Consumption of collected (uncultivated) foods was highly prevalent among the households belonging to the poorer quintiles. This also partially explains the rise in GLV consumption, especially among the poorest quintile. It was encouraging to observe that costly coping mechanisms such as distress sales of assets or removing children from school was not being adopted. Greater prevalence (5-6%) of asset mortgage among the richer quintiles reflected their greater stock of assets. Purchase of food from open market sales (OMS) was reported by less than 1% households; this appears to be more of an urban phenomenon.

Nutritional status of children (rural)

The relationship between weight-for-height Z-score and age of the child for the two surveys in 2006 and 2008 is presented in Figure 5. The light line (2006) shows that there is a decline in Z-score from birth to about 20 months of age, then a small improvement, followed by a leveling off and then by a further fall until 60 months of age. The dark line (2008) shows the same children from 24 months up to 84 months of age. What is evident is that those children who were between 24 and 30 months of age in 2006 show a very similar profile to children who were in the same age range in 2008. However, between 30 and 60 months of age children in 2008 had on average lower (worse) Z-scores, indicating greater wasting and more undernutrition.

Figure 5. Fitted WHZ of children by age in 2006 and in 2008 (rural)



Simple paired analysis (after controlling for sex, curvilinear effects of age and the interaction between sex and age (see Annex 3A)) showed that, on average, a child was -0.073 SD worse in 2008 compared with his/her Z-score in 2006 (Table 8). Multiple regression analyses revealed that this worsening increased to about -0.11SD across all age ranges and to -0.115 if only the 25-60 months old age range were taken into consideration.

Table 8. Estimated change in WHZ (rural)

Estimation method	Effect	t-value
Paired t-test of residual after controlling for age, sex and their interaction	-0.073	3.00***
Coefficient of dummy for Year-2008 after controlling for age, sex and age*sex (Column 3 in Annex 3A)	-0.110	2.39**
Coefficient of dummy for Year-2008 after controlling for age, sex, age*sex and household level fixed effect (Column 4 in Annex 3A)	-0.111	2.41**
Coefficient of dummy for Year-2008 after controlling for age, sex and age*sex among the 25-60 months old children (Column 6 in Annex 3A)	-0.115	2.44**

Comparisons of the changes across districts indicated deterioration in 5 of the 6 areas, with the greatest deterioration in Jamalpur (Table 9); the district which had shown no increase in per capita per day rice consumption, but very significant increase in the share of rice in the total food expenditure. It is interesting to note that there was improvement in Comilla, which is also the relatively richest region of the six studied.

Table 9. Paired t-test of residual of WHZ of children by districts

	Barguna	Comilla	Jamalpur	Jhenaidaha	Moulvibazar	Naogaon
2006	0.125	0.021	0.012	0.076	-0.047	0.065
2008	0.080	0.131	-0.254	0.047	-0.221	0.026
Change	-0.045	0.110	-0.266	-0.029	-0.174	-0.039
p	ns	<0.1	<0.01	ns	<0.01	ns

This worsening in the mean intra-child weight-for-height Z-score translates into an increase in the prevalence of wasting of over 8.5% for the total sample and 5.5% in the age range 24-59 months (Table 10). There was no significant change in prevalence of stunting, however this is quite logical as nutritional impact are likely not to be reflected in stunting in a one or two year period. But the prevalence of underweight children increased significantly in all age groups by 10.1% and by 3% in the 24-59 month olds.

Table 10. Proportion of undernutrition in children by age group

Age group	Underweight (moderate-severe)			Stunting (moderate-severe)			Wasting (moderate-severe)		
	2006	2008	p	2006	2008	p	2006	2008	p
24-59 months	49.4	52.4	ns	51.3	45.7	ns	17.4	22.9	<0.05
All age group (2006= 0-59 m & 2008= 24-84 m)	43.6	53.7	<0.01	44.1	42.4	ns	17.1	25.6	<0.01

When the increase in the proportion of undernutrition was investigated according to wealth quintiles, it was found that an increase in both wasted and underweight children varied across the wealth categories (Table 11). It was found that chronic undernutrition as stunting was similar in all wealth groups. In addition, the proportion of underweight and wasting of children were progressively higher in poorer quintiles.

However, worsening in wasting between 2006 and 2008 occurred to a greater extent for households in the middle quintiles compared to those in the poorest and richest quintiles. The increase in proportion was significantly higher in the 3rd and 4th quintiles which is consistent with the rice consumption pattern by quintiles reported previously (in Table 2) which showed that increase in consumption was lower in these two groups. The relatively lower increase in wasting for children coming from the bottom two quintiles (poorest and 1st quintile) can be explained by the fact that short term undernutrition as wasting in particular was already higher (19-21%) in these groups compared to others (by 14-16%).

Table 11. Proportion of undernutrition in children by wealth quintiles

	Poorest Quintile	2nd Quintile	3rd Quintile	4th Quintile	Richest Quintile
Underweight (moderate-severe)					
2006 (NSP)	51.0	48.8	43.9	42.6	31.5
2008 (PCN)	60.3	59.7	55.2	52.3	40.6
P-value	<0.05	<0.01	<0.01	<0.05	<0.05
Stunting (moderate-severe)					
2006 (NSP)	48.6	54.1	44.3	43.5	29.8
2008 (PCN)	52.1	50.6	39.4	38.0	31.2
P-value	ns	ns	ns	ns	ns
Wasting (moderate-severe)					
2006 (NSP)	21.4	18.9	13.9	16.0	15.3
2008 (PCN)	27.7	23.6	27.9	27.2	21.6
P-value	ns	ns	<0.01	<0.05	ns

The changes in the prevalence of undernutrition across districts are diverse (Table 12). Jamalpur and Moulvibazar appear to be most severely affected areas since the prevalence of both underweight and wasting have significantly increased. These two districts have also witnessed lower

increases in nominal wage rate compared to other districts studied. While Jamalpur is known for its high concentration of poverty, a possible cause of the high increase in undernutrition, in Moulvibazar, it can be attributed to the relative weights of tea-garden workers in the sample. The increase in prevalence in Moulvibazar could also be due to lower wage adjustment in this district compared to others. Although the survey did not collect detailed earning activities of individual household members, the likelihood of the main earner being an unskilled laborer was estimated at over 40% in Moulvibazar, compared with 22% in the total sample. The increase in undernutrition was the least in Jhenaidaha, which also had the lowest level of undernutrition of the six districts in 2006.

Table 12. Proportion of undernutrition in children by districts

	Barguna	Comilla	Jamalpur	Jhenaidaha	Moulvibazar	Naogaon	All
Underweight (moderate-severe)							
2006 (NSP)	45.5	42.5	46.7	34.4	51.9	42.5	43.6
2008 (PCN)	56.7	52.9	60.8	37.3	64.9	52.3	53.7
p	<0.05	<0.05	<0.01	ns	<0.01	<0.05	<0.01
Stunting (moderate-severe)							
2006 (NSP)	51.5	42.0	49.2	29.5	52.4	44.3	44.1
2008 (PCN)	50.0	43.8	44.7	27.6	53.6	38.5	42.4
p	ns	ns	ns	ns	Ns	ns	ns
Wasting (moderate-severe)							
2006 (NSP)	17.2	18.4	17.1	15.4	17.0	17.8	17.1
2008 (PCN)	18.0	21.0	35.4	21.5	33.8	22.1	25.6
p	Ns	ns	<0.01	ns	<0.01	ns	<0.01
n	134	212	199	227	212	219	1203

We also examined the relationship between prevalence of wasting and coping mechanisms (Table 13). We found that children from households that reported coping mechanisms such as reducing the number of meals, consuming gathered food or mortgaging assets, are more likely to be malnourished. The extent of mortgaging assets, albeit very limited, was higher among wealthier households and the higher prevalence of wasting among such households is indicative of their distress. On the other hand, a households' ability to borrow from an NGO is positively associated with better nutrition status of the children. However, such comparisons are not reflective of change since they look only at the prevalence in any particular year.

Table 13. Proportion of wasting (<-2 WHZ) in children in 2008 by coping mechanisms

Coping mechanism	Adopted	Not adopted	p-value
Reducing number of meals a day	33	24	<0.01
Borrowing money from NGOs for food	19	27	<0.05
Mortgaged assets	47	25	<0.01
Borrowing cash from informal sources	22	26	ns
Borrowing kind from informal sources	32	25	ns
Gathering food	32	24	<0.05

It was found that children suffering from diarrhea or dysentery in the 15 days preceding the survey are more likely to show a decline in WHZ (Annex 3F). In addition, findings showed that a change in mothers' nutritional status strongly correlated with that of their children's nutrition. The negative association between change in WHZ and wealth score indicates that children from wealthier households had relatively better WHZ in 2006 and showed larger absolute declines in WHZ.

However, reported levels of difficulty as a result of the price hike were not significantly related to changes in WHZ, suggesting that the changes are not entirely the effect of the food price hike. Another key variable used to assess possible effects of price hike is the adjustment in wage rate (both agricultural and non-agricultural). Where wage rate has appreciated, the decline in WHZ was lower. An increase in wage by 10 Taka is associated with an increase in Z-score by 0.07 (Colum 4 of Annex 3F). Based on these estimates, the predicted value of residual for a child with average characteristics in all the variables is -0.07. However, the corresponding figure for a child with the same characteristics but from a village with no adjustment in agricultural wage is -0.35.

Nutritional status of mother (rural)

In contrast to the nutritional status of children in this study, mother's nutritional status has shown an improvement between 2006 and 2008. The proportion of mothers with low BMI (<18.5) decreased by 5% (Table 14).This improvement was consistent across all wealth groups (Annex 4B). However, unchanged or relatively improved nutritional status of adults does not necessarily explain the lack of effect of low food consumption in a short period of time.

Table 14. Mean anthropometry and proportion of Chronic Energy Deficiency (CED) in rural mothers

	Mean weight	Mean height	Mean BMI	% of Chronic Energy Deficiency (BMI <18.5)
2006	44.8	150.5	19.8	36.2
2008	46.2	150.7	20.3	31.2
P	<0.01	ns	<0.01	<0.01

In 2006, the prevalence of chronic energy deficiency was quite high and the reduction is still in line with national levels. During the 2006 survey, the majority of mothers were breastfeeding (0-24 months children were included) and by not meeting the extra food requirement for lactation, this practice may have resulted in weight loss. When they stopped breastfeeding energy conservancy has led to weight gain. Mothers who had a child less than 2 years of age in 2006 gained, on average, 1.94 kg in weight by 2008, while mothers with older children gained only 1.05 kg.

There was a strong relationship between self-reported difficulty due to price increase and nutritional status of the mother (Annex 4D). Although nutritional status of the mother (both in terms of weight and BMI) improved at aggregate level, the perceived effect of the price increase is negatively associated with those variables. Similar to child-nutrition, mothers' nutrition improved significantly with higher increase in wage rate.

Urban (Quantitative)

A panel survey could not be conducted for the urban sample because of the lack of identification information in the 2006 HKI survey, slum eviction and high mobility in the urban poor population. Therefore, a cross-sectional survey was conducted in 2008 and the results compared with the 2006 data through independent sample tests.

Basic Socio-economic profile (urban)

Comparison of the basic socio-economic profiles of the 2006 and 2008 samples shows that there were significant differences between the two groups (Table 15). Female headship was higher among the 2008 sample. Differences were also found between the two surveys in the occupation of the main earner of the households, with a greater proportion of them being rickshaw/van pullers or drivers of small taxis in 2008. Regarding the housing condition, although proportion of households with dwelling room made of cement/brick walls decreased, on the other hand proportion of households with inferior wall material such as bamboo also decreased. There was no significant difference in the sanitation condition.

Table 15. Socio-economic profile of the urban sample households

Variables	2006	2008	P
Family size (mean)	4.86	4.83	ns
Female headship (%)	3.2	8.8	<0.01
Occupation of the main earners			
Unskilled labor (%)	12	9	
Skilled labor (%)	9	13	
Rickshaw-van puller/baby taxi driver (%)	19	27	<0.01
Non-farm business (%)	34	22	
Salaried employment (%)	25	24	
Other (%)	1	6	
Main material of walls of the house			
Cement/brick (%)	62	53	<0.01
Tin (%)	20	34	
Bamboo (%)	18	12	
Have electricity connection (%)	95	93	ns
Type of latrine used			
Sanitary (%)	92	87	<0.10
Kancha (%)	8	13	
Open space (%)	1	1	
n	600	435	

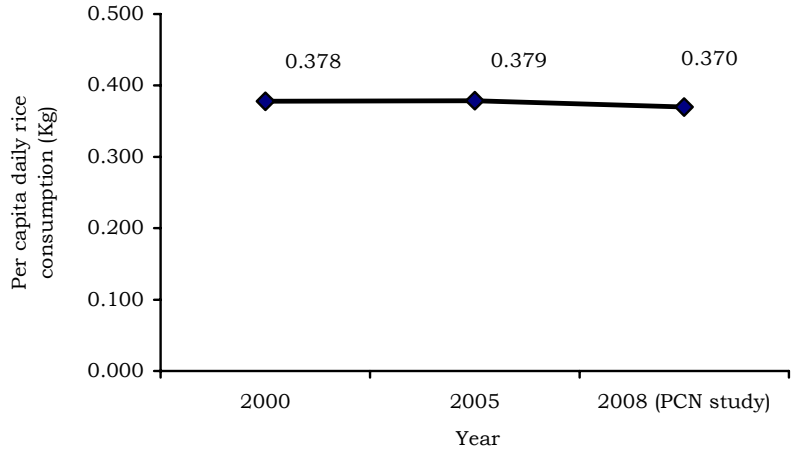
Change in food consumption (urban)

Similar to the rural areas the amount of rice consumed and rice's share of total food consumption increased in the urban slum population between 2006 and 2008. While per capita rice consumption was 0.31 kg/day in 2006, it increased to 0.37kg/per day in 2008 (Table 16). However, rice consumption was consistently lower among urban slum population compared with rural areas. However, the share of rice as part of the total food expenditure increased dramatically by 10.9% in these two years. In addition rice constitutes to 40% of total food consumption in urban slums. Like rural, per capita rice consumption trend for urban population in Bangladesh also indicates an underestimation of consumption that reported in HKI 2006 survey (Figure 6).

Table 16. Per capita daily rice consumption by urban poor

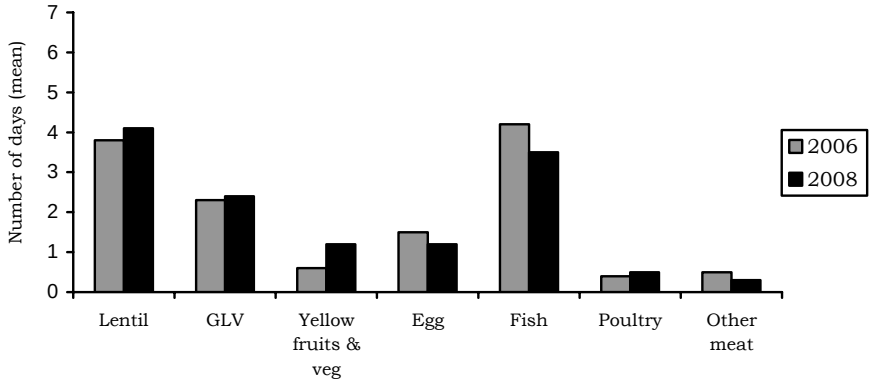
	2006	2008	p
Per capita consumption of rice/per day (mean in kg)	0.31	0.37	<0.01
Per capita weekly food expenditure (mean in absolute Taka)	177	267	<0.01
Share of rice in total food expenditure (%)	29.5	40.4	<0.01

Figure 6. Trend in per capita daily rice consumption in urban area



Source: HIES 2005, BBS (2007). Information for 2008 from present study

Figure 7. Frequency of consumption of different food items in the last week (urban)



In the urban slums the most frequently reported non-rice item consumed was fish followed by *dal* (lentil) in 2006 (Figure 7). Similar to the rural scenario, poultry or other meat consumption was lowest. A decline in fish consumption was also found in the urban population but other food consumption changes were not consistent, reflecting rural-urban differences in food availability, accessibility and preference. After the food price hike, leafy vegetables consumption increased significantly in rural areas but it remained unchanged in urban slums. This is mostly due to unavailability of uncultivated vegetables to be gathered in urban areas, which is also reflected in coping mechanism.

Self-reported effect and coping mechanisms (urban)

The urban slum population is more likely to report very high or moderate levels of difficulty because of food price increase compared with the rural sample (Figure 4). Since the urban sample was concentrated in slum areas, a wealth ranking exercise does not produce any meaningful results. Instead of wealth ranking, differences by the main occupation of the household head were examined. However, there were no significant differences between professional groups. Having said this, unskilled laborers and rickshaw puller households appeared to be facing higher levels of difficulty (Table 17). Overall, two-thirds of the urban sample households reported facing deficit (either chronic or occasional) in 2008 and the comparable rate was 39% in 2006.

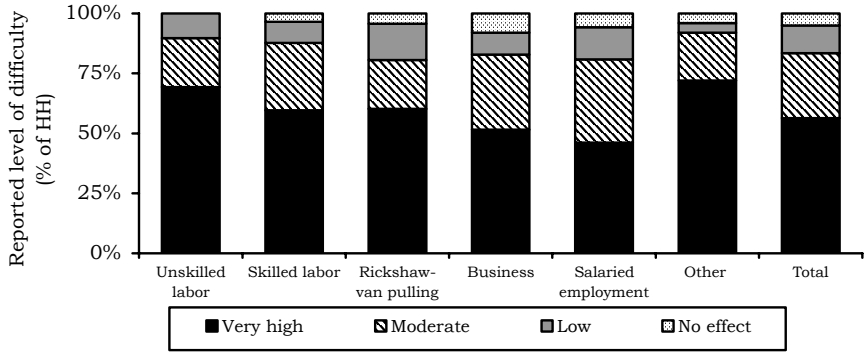
Urban poor's livelihoods are more likely to be linked with those of the middle class households who have fixed salary incomes. That could be the reason why the level of difficulty perceived is high across the different occupational groups and of course the perceived level of difficulties are not standardized across the different occupational groups. In the rural areas, the link of the poor's livelihoods is more with farmers whose nominal income increased and so did nominal wage rate—the dynamics being very different.

Table 17. Change in self-perceived food security status by occupation

	Unskilled labor	Skilled labor	Rickshaw/ van puller	Business	Salaried worker	Other	All	p-value
Deficit a year ago	49	37	47	27	39	44	39	<0.10
Deficit now	67	56	71	68	62	68	66	ns
p-value	<.005	<0.05	<0.01	<0.01	<0.01	<0.05	<0.01	

In terms of the self-reported level of difficulties due to the food price increase, households with an unskilled laborer as the main earner appeared to be most disadvantaged (Figure 8). On the other hand, households with salaried workers as the main earner reported least difficulty. This is somewhat contrary to the assumption that households depending on fixed salaried income will be more affected [the differences are not that great].

Figure 8. Reported level of difficulty because of food price increase by occupation



In reported coping mechanisms, urban households reported reducing the quality of meals as well as their numbers (Table 18). However, consumption of collected/uncultivated food is much lower because of unavailability of such sources. Purchasing food from OMS is much higher for the urban than rural sample. Moreover, reducing non-food consumption is a more important coping strategy in Dhaka slum areas compared to the rural areas.

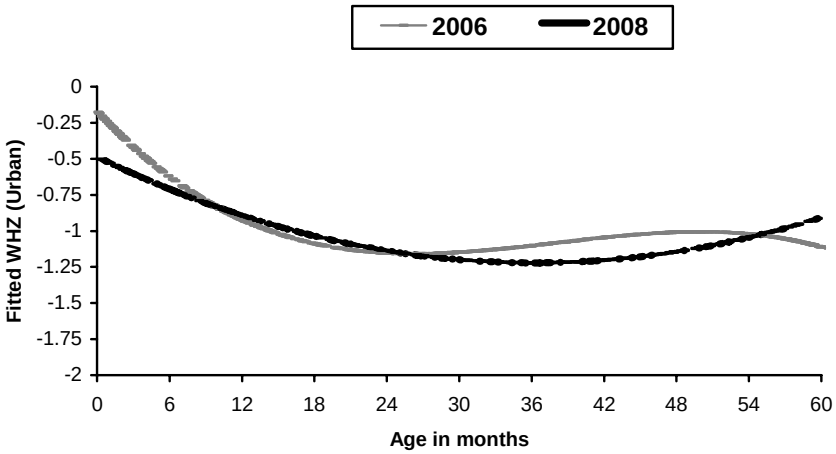
Table 18. Adoption of different coping mechanisms (% of HH) by occupation

means of coping	Unskilled labor	Skilled labor	Rickshaw-van pulling	Busi-ness	Salaried employment	All	Chi sq
Informal borrowing in cash	15	14	17	11	12	14	ns
Informal borrowing in kind	5	5	8	0	7	5	<0.10
Borrowed from NGO	10	7	9	4	2	6	ns
Informal charity from relatives	5	7	3	2	8	5	ns
Collect VGF card	0	0	0	0	0	0	ns
Collect relief	5	2	2	2	0	2	ns
Purchase from OMS	21	19	16	15	14	16	ns
Reduce number of meals	28	12	16	5	8	13	<0.01
Reduce quality of meals	87	89	88	88	86	88	ns
Reduce amount of food	62	35	37	31	31	36	<0.05
Consume gathered food	15	2	8	3	4	7	<0.01
Reduce non-food consumption	79	74	64	81	69	72	<0.10
If reduced non-food consumption							
Fuel/kerosene	0	0	1	0	3	1	
Health expenses	29	31	28	10	14	21	
Housing	16	14	13	15	10	13	
Clothing	81	74	86	76	88	82	
Transport expenses	13	14	25	46	18	26	
Education	10	2	1	1	0	2	
Other non-food	16	14	17	20	15	17	
Mortgage assets	3	2	1	0	0	1	ns
Start new earning activity	3	2	2	1	4	2	ns
Temporary migration for work	3	0	2	0	2	1	ns
Engaging new member in work	3	4	7	2	4	4	ns
Getting children out of school	8	2	3	1	3	3	ns

Nutritional status of children (urban)

Figure 9 shows the predicted values of WHZ for age by the best fit model in 2006 and in 2008. Since the samples in the two years are different, the function was calculated separately for them. It is clear that less than 9 months old infants and about 24 to 54 months old children in the 2008 sample have a lower predicted WHZ score.

Figure 9. Fitted WHZ of children by age in 2006 and in 2008 (urban)



After controlling for age, sex and their interaction, WHZ worsened by about -0.1SD, on average, between 2006 and 2008, which is significant at less than 10% level (Table 19). Although the estimates for urban slum have relatively lower statistical significance, the average effect was very similar to the rural estimates.

Table 19. Estimated change in WHZ (urban)

Estimation method	Effect	t-value
Independent sample t-test of residual after controlling for age, sex and their interactions	-0.107	1.65*
Coefficient of dummy for Year-2008 after controlling for age	-0.110	1.68*
Coefficient of dummy for Year-2008 after controlling for age and sex	-0.108	1.65*
Coefficient of dummy for Year-2008 after controlling for age, sex and interaction	-0.109	1.66*

Note: * denotes significant at <10% level

The prevalence of underweight, stunting and wasting was found to increase in all age groups (Table 20) with a 7.6% increased in wasting, 7.9% increase in stunting and 5.5% increase in underweight children. These differences may have underestimated the true worsening since the 2008 sample was, on average, nearly 3 months younger than the 2006 children and all three indices usually worsen with age.

Table 20. Proportion of undernutrition by age group

Age group	Underweight (moderate-severe)			Stunting (moderate-severe)			Wasting (moderate-severe)		
	2006	2008	P	2006	2008	P	2006	2008	P
0-6 months	13.3	24.4	ns	11.7	24.4	ns	3.3	28.9	<0.01
7-11 months	25.8	29.8	ns	23.0	31.9	ns	14.5	17.0	ns
12-23 months	46.3	48.4	ns	55.7	62.5	ns	14.6	19.8	ns
24-59 months	48.1	55.5	<0.05	53.8	62.9	<0.05	14.4	21.1	<0.05
All age group	42.4	47.9	<0.05	47.5	55.4	<0.01	13.5	21.1	<0.01
n	661	435		661	435		661	435	

Nutritional status of mother (urban)

Nutritional status (in terms of weight or BMI) of mothers in urban slums did not show any significant difference between 2006 and 2008 although there was an overall reduction in weight by 0.8 kg (Table 21). Adults can conserve their energy and can meet their energy requirements through cheaper sources of calories, so although mean weight did not change there is a strong possibility of animal protein and micronutrient deficiencies which may have serious longer term consequences.

Table 21. Mean anthropometry and Chronic Energy Deficiency (CED) in urban slum mothers

	Age	Weight (kg)	Height (cm)	BMI	CED (BMI <18.5) %
2006	25.4	47.0	149.9	20.9	26.3
2008	26.2	46.2	149.6	20.6	26.2
p	<0.05	ns	ns	ns	ns

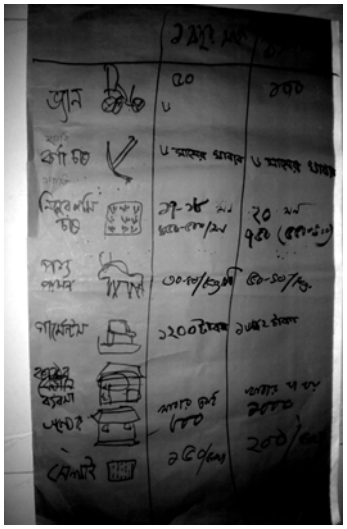
QUALITATIVE EXPLORATION ON THE LIVELIHOOD CHANGES

Income/wage rate

Comparison of earnings from various income sources (usually engaged in for more than one year) was obtained though qualitative assessment. It was obvious from the collective statements of the FGD participants that wage rate had increased from 2006 to 2008. The amount of income, before and after, the food price hike (approximated by the last 1 year) as reported by them is compiled (Table 22).

Table 22. Income changes in last one year period

Occupation	Income/wage rate	
	1 year ago	Now a days
Van pulling	Tk. 50/day	Tk. 100/day
Share-cropping	Food supply for 6 months (HH consumption.)	Food supply for 6 months (HH consumption.)
Agriculture (own land)	Produced 17-18 maund and sold at Taka 450-500/ maund	Produced about 20 maund and sold at Taka 550-700/maund
Cow rearing	Tk. 30-40/kg milk	Tk. 50-60/kg milk
Garments worker	Tk. 1200/month	Tk. 1662/month
Housemaid	3 meals as house owner eat or Tk. 800/month	3 meals as house owner eat or Tk. 1000/month
Sewing	Tk. 150/kantha	Tk. 200/kantha



Changes in wage rates

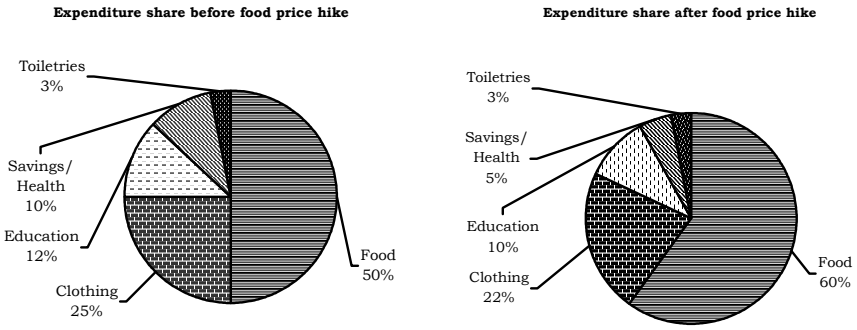
For van pulling, which was the main source of earning of one third of the participant households, wage rate (income per day) has doubled compared to the same season a year ago. Similarly, income from other occupations such as agriculture, garment workers were also reported to have increased as shown in the table.

Income share on food and non-food items

When participants were asked to prioritize the areas of expenditure, food was naturally ranked as first, followed by clothing/toiletries and education. It was noticeable that the participants did not name other essential areas like health or housing for example. Participants said that

although total income or wage rate had increased, due to the price increase on food as well as on other essential commodities, their life was harder than before. For example, of the total income a year ago they used to spend 50% on food, 25% on clothing, and the remaining 25% were shared between children's education and savings for health or housing. On the other hand, although their income had increased, they needed to increase their expenditure on food to 60%, which is consistent with the findings of the quantitative analysis. However, the increase in income was not enough to meet earlier levels of quantity and quality of food as will be shown later. Change (before and after food price hike) in expenditure is shown in Figure 10.

Figure 10. Division of household expenditure before and after the food price hike



Food quantity (frequency of consumption)

Some of the groups said that although they continue to eat three times a day as before, their food is compromised in terms of both the quantity and quality (type and kinds). FGD groups reported that previously they used to take three *full* meals (*pet bhore*) a day, nowadays they hardly ever take three full meals a day. Meat was consumed rarely by the groups consulted as was also observed in the quantitative analysis. The majority in the groups mentioned that previously they would consume meat/poultry at least once a month but now they consume meat/poultry occasionally or hardly once in every two months.

As was evident in the quantitative survey, varieties of fish (big, medium or small) were consumed in 2006 almost every day of the week, but in 2008, many households reported not being able to consume fish even half of the time in a week. Vegetables which were mostly gathered are consumed 3-5 days in a week, whereas before the food price hike vegetables were consumed in similar frequency but majority of them were purchased.

Food quality (meal composition)

It was clearly mentioned by the FGD participants that after the food price hike they did not only consume less, but are also forced to omit food items from the meal (Table 23). Thus their meals became less diversified as compared to earlier in 2006. One year ago when food price was lower, rice as well as *rooti* were consumed as staple item making 3 meals/day for most of the time. However, presently *rooti* is no longer consumed in meals. Also in 2006 the groups stated that their meals used to include big or small fish almost every day. However, now they cannot afford big fish or even small fish (expensive), but instead mainly consume certain medium fish e.g., *Pangas* or dry fish as they are relatively cheaper.

Vegetable consumption was also better as most seasonal vegetables (either bought or gathered) were included in the daily meals. The majority in the FGD groups reported that, although *dal* consumption in terms of frequency remains almost same as before, cheaper variety e.g., black gram (*mash koli*) took the place of more expensive lentil (*mosur).* For the same price of a quarter of a kilogram of *mosur* lentils, households could instead buy double of cheaper varieties. In addition, after the food price hike no meat at all is consumed on a weekly or monthly basis and is consumed very occasionally. Furthermore, milk and fruits, mostly bananas, were consumed a year ago, but now only consumed occasionally for the children, sick or elderly members of the family. Potatoes are still consumed now as before (used for curry, fry, mash) although their quantity is reduced.

Figure 11. Frequency of usually consumed food items and meal composition before and after food price hike as drawn by the participants of FGD

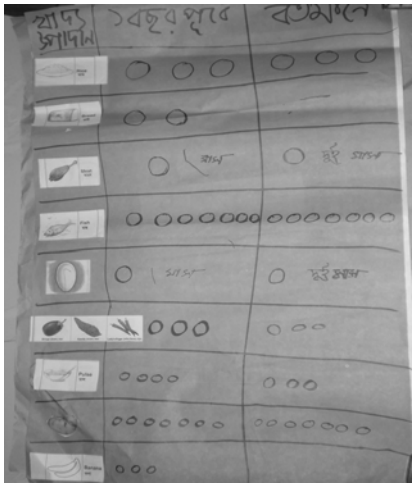


Table 23. Quantity and quality of meal (compiled from all groups reported) in 2007 and 2008

	Before Food Price Hike (1 year ago)		After Food Price Hike (Now a days)	
	Quantity	Quality	Quantity	Quality
Meal Frequency	3 meals /day (1 meal *rooti*) Full meal to appetite	Cereal, animal foods, fish and variety of seasonal vegetables	2 meals /day not always a full meal to appetite	Cereal, some leafy vegetables and fish or *dal*
Rice	2-3 times/day 7 days/week	Coarse (medium)	2 times/day 7 days/week	Coarse (medium to poor quality)
Rooti	1-2 times/day 2-3 days/week	Medium		
Meat	Once in a month	Chicken/beef	Once in 2 months	Chicken/beef
Fish	7 days/week	Big/medium/small fishes	3-7 days/week	Cheaper medium (pangas) or dry fish
Egg	Once in a month		Once in 2 months	
Dal	3-4 days/week	lentil/bengal gram/black gram	2-3 days/week	Cheaper khesari, orhar, black gram
Vegetables	3-5 days /week	leafy & non-leafy seasonal varieties vegetables, mostly bought	3-5 days/week	leafy vegetables or arum mostly gathered,
Potato	5-7 days/week		5-7 days/week	
Fruits	1-3 days/week	Banana and sometimes other fruits for children	1-3 times/month	Only banana

Table 24. Composition of a usual meal (food items) before and after the food price hike as described by the FGD participants

Food Items	Consumption before price hike (1 year ago)	Consumption after price hike (now a days)
Rice	√	√
Rooti	√	X
Chicken/other meat	√	X
Egg	√	X
Lentil *dal*	√	X
Other cheaper *dal*	X	√
Big fish	√	X
Medium fish	√	√
Small fish	√	X
Dry fish	X	√
Leafy vegetables bought	√	X
Leafy vegetables gathered	√	√
Non-leafy vegetables bought	√	X
Potato	√	√
Fruits (banana)	√	X
Chilli and salt	X	√

Changes in children's food consumption

One year ago when the children were younger, they were fed milk (cerelac, any powder milk or liquid), sometimes with rice and banana; *khichuri* (rice, *dal*, vegetables, liver) was also prepared for them. Apart from these food specially arranged for children, they used to eat family foods as well. But now children are given only family foods, those that are prepared for the entire family. Therefore, as the family diet has deteriorated the children are also not meeting their requirements needed to support their growth. It was noticed that, when they were asked to put food items (symbol/picture) in two plates drawn before and after the food price increase, all animal sources like chicken, other meat (beef), milk, fish and varieties of vegetables were included in earlier plate while only a few items appeared on the later plate.

Children's meal composition

Changes in nutritional status of children and mother

Interestingly, while discussing about the nutritional status of both children and their mothers, mothers drew a picture (shown below) which clearly indicated that children have become more malnourished than before, while parents remained the same. On questioning why children have become more malnourished in the last 1-2 years while mothers have not, they replied with several answers. Firstly, they expressed that two years ago children were younger and many of them were breastfeeding, however the mothers were not obtaining sufficient nutrition to facilitate the energy to lactate. Moreover, the mothers had less sleep as they had to feed the children during the night, as well as having to look after the child when performing productive tasks. Now, as the children are growing up, they are no longer breastfeeding and mothers have to care for them less intensively. In sum, the caring practice during the lactation period is somewhat responsible for the mother's poor nutritional status.

FGDs with mothers on the question of why children's nutritional status has worsened revealed interesting dynamics. They explained that prior to the sharp food price rise, they could afford to buy the staple and have separate weaning meals for their children consisting of milk with rice and

banana, and *khichuri*, which they could no longer afford as they had to devote a much larger share of their income to buying staples. Children now are fed out of family meals, the quality of which has deteriorated due to rising food price leading to poorer nutritional status of children. This adjustments, they further pointed out has far greater impact on their children's nutritional status at an age when they are growing.

Children at growing age

RECOMMENDATIONS

The food price hike is a worldwide issue and a concern for all poor countries where the poor spend a large share of their expenditure on food. This study reveals that the primary route through which the rising food price has had a deteriorating nutritional outcome, especially for children, has been through the adjustment mechanism where the poor have had to narrow down the diversification of their food basket, by excluding certain items and substituting with cheaper options.

The general quality of the food basket in Bangladesh is poor in nutritional terms. This has worsened further, especially for the poor who have been hardest hit by the sharp rise in food prices. Consuming only rice and almost no other foods has resulted in a meal which lacked in protein and micronutrient sources. The nutritional deterioration has already taken an immediate toll on the nutritional status of the children of poor households which is likely to have long term consequences. This will increase the cost of irreversible damage through increased morbidity, reduced cognitive development, physical growth and productivity, especially for the growing children and women who are in a critical state.

With more than 20% of wasting reported across wealth categories against the standard level of 10% indicative of nutritional insecurity, the study indicates a worsening of the overall levels of nutritional insecurity due to rising food prices. To counteract the negative consequences of the food price hikes on nutritional status of the vulnerable populations, following recommendations towards nutritional improvement could be suggested:

1. For the poor, lentil and fish are the main sources of protein as they can not afford to consume meat and egg sufficiently as is revealed from this study. The open market sale of lentil, especially in the rural areas, can help the poor to increase consumption of this item. Other legumes like dry beans which are also a substitute source of protein should also be promoted among this population.

   Micronutrient deficiencies in the long run should be addressed through food based safety nets i.e, advocating/counseling on developing diversified nutritious food habits at affordable cost as well as through supplements or fortified foods as partial and immediate response. Fortified foods such as *ata*, oil and snacks could be included as items for open market sale or food aid in addressing overall nutritional deficiencies among the poor.

2. School-feeding programme (SFP) as mid-day nutritious meal for the school age children in the area where extreme poverty is more concentrated might provide a window of opportunity for children who are acutely malnourished now (wasted) and not likely to meet up their requirements from family diet to catch up growth. SFP found to be effective in many developing countries including India especially for the nutritionally vulnerable children where the intervention was targeted to compensate meal not substituted at home (Greenhalgh *et al.* 2007). Children would benefit if the meal provides high energy, protein and essential micronutrients.

   Special emphasis should be given to appropriate complementary feeding practices (age and culture specific, and easy to follow) for the infant and young children throughout the community

3. Income generating or social safety net programmes aiming at improving household food security of the poor, may include energy dense and nutritious foods in place of money as wage. This could improve the nutritional status of those beneficiary households.

4. Maternal and child undernutrition is rooted in the status of women within our society. Child bearing and child rearing, especially during the initial years are periods where women become the most vulnerable in terms of their decision making abilities. This disempowerment leads women being unable to protect their own health and nutrition and that of their children. Social safety net programmes should give priority to the vulnerable women and make it possible for them to participate by offering child care facilities or taking into account distance.

   A sustained national campaign to build awareness that children and mothers, particularly pregnant mothers, should be prioritized in family food distribution may be very effective to improve their nutritional status. Male and older members must be especially included in the target audience for awareness and behavior change on nutritional improvement. Alongside the government initiative, for this purpose, non-governmental organizations can emphasize this aspect in their social awareness movement.

5. In order to prevent widespread malnutrition in the long run, the issue should be made to become everyone's business, i.e. cross sectoral. Interventions in livelihood protection and promotion, education, health, agriculture and social development, should all integrate a nutrition focus in their programme design and objectives.

ANNEXURE

RURAL

Annex 1. Wealth quintiles and its consistency check

Annex 1A. Principal component analysis for wealth index

Variables	Factor Loading	KMO test	Scoring coefficients
Number of adult males (15+ years old)	0.39	0.86	0.12
Size of the main house (square feet)	0.49	0.88	0.15
Main material of walls (1=Cement/brick, 2=Tin/wood, 3=Other)	-0.56	0.87	-0.17
Whether owns cow (1=Yes, 0=No)	0.30	0.73	0.09
Main earner is a day labourer (1=Yes, 0=No)	-0.58	0.89	-0.18
ln(Amount of cultivable land owned- in decimal)	0.74	0.78	0.23
ln(Amount of homestead land owned - in decimal)	0.65	0.77	0.20
Education of the female (years of schooling)	0.66	0.85	0.20
Whether has electricity connection (1=Yes, 0=No)	0.49	0.81	0.15
Type of latrine used (1=Sanitary, 2=Kancha, 3=Open)	-0.67	0.84	-0.21

Note 1: Factor loadings show the correlation of each variable with the principal component, which appears to be wealth status. Overall test of KMO sample adequacy was 0.82, which is considered 'highly acceptable' in principal component analysis. Final column shows the scoring coefficients in the regression to form the wealth index.

Note 2: To assess how good the wealth quintiles are in reflecting socio-economic status, a comparison is done among wealth quintiles, housing status and occupation of main earner. Four indicators were considered for this verification, which are: (a) self-reported poverty status (whether suffering deficit), (b) self-reported effect of price increase in relation to the effects on majority in the community, (c) access to safety net for the poor (Vulnerable Group Feeding-VGF) and (d) amount of rice currently stored in the households. Clearly all three groupings of socio-economic status show consistent patterns. However, the differences are much sharper for wealth quintiles compared to the other two proxies of poverty status.

Annex 1B. Validation of quintiles

	Poorest Quintile	2nd Quintile	3rd Quintile	4th Quintile	Richest Quintile	p
Self-rated poverty (deficit)	82	64	42	36	13	<0.01
Reported greater difficulty for price hike than majority in the community	69	56	32	24	6	<0.01
% received VGF rice in 2006	20	16	10	7	1	<0.01
Current rice stock (mean-kg)	20	40	57	109	214	<0.01

Annex 1C. Validation of housing categories

	Misc wall and 1 room	Misc wall and 1+ rooms	Tin wall and 1 room	Tin wall and 1+ rooms	Brick wall	p
Self-rated poverty (deficit)	66	66	54	44	22	<0.01
Reported greater difficulty for price hike than majority in the community	59	56	36	31	18	<0.01
% received VGF rice in 2006	14	13	13	14	3	<0.01
Current rice stock (mean-kg)	35	54	64	95	154	<0.01

Annex 1D. Validation of occupation groups

	Manual labor	Skilled labor	Farmer	Non-farm	Profess-ional	p
Self-rated poverty (deficit)	79	62	35	29	24	<0.01
Reported greater difficulty for price hike than majority in the community	66	54	23	20	19	<0.01
% received VGF rice in 2006	17	16	7	9	2	<0.01
Current rice stock (mean-kg)	22	36	152	114	106	<0.01

Annex 2. Food consumption

Annex 2A. Frequency of non-cereal food consumption (mean days last week)

Food items	Year	Wealth quintiles					All
		Poorest	2nd	3rd	4th	Richest	
Lentil	2006	1.7	1.3	1.5	1.9	2.6	1.8
	2008	1.1	1.3	1.4	1.8	2.1	1.6
	p	<0.01	ns	ns	ns	<0.01	<0.01
Green leafy vegetables	2006	1.6	1.9	2.0	2.0	2.3	2.0
	2008	3.5	2.9	2.6	2.7	2.8	2.9
	p	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Yellow fruits and vegetables	2006	0.4	0.5	0.5	0.5	0.8	0.5
	2008	1.0	1.6	1.8	2.0	2.9	1.9
	p	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Egg	2006	0.7	0.6	1.0	1.2	1.6	1.0
	2008	0.5	0.9	1.0	1.5	2.1	1.2
	p	<0.05	<0.05	ns	<0.05	<0.05	<0.05
Fish	2006	3.3	4.6	4.9	5.1	5.8	4.7
	2008	2.6	3.7	3.9	4.5	5.3	4.0
	p	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Poultry	2006	0.4	0.3	0.5	0.5	0.9	0.5
	2008	0.2	0.4	0.4	0.6	1.0	0.5
	p	<0.05	ns	ns	ns	ns	ns
Meat other than fish or poultry	2006	0.1	0.2	0.2	0.3	0.6	0.3
	2008	0.1	0.2	0.2	0.4	0.5	0.3
	p	ns	ns	ns	ns	ns	ns

Annex 2B. Proportion of households consumed non-cereal foods at certain frequency

Year	Poorest Quintile	2nd Quintile	3rd Quintile	4th Quintile	Richest Quintile
Lentils ≥3 days/week					
2006	21	20	19	25	39
2008	12	21	20	30	37
Change	-9***	1	1	5	-2
Leafy vegetables ≥3 days					
2006	24	24	27	30	38
2008	56	48	45	49	46
Change	32***	24***	18***	19***	8*
Yellow fruits/vegetables ≥3 days/week					
2006	3	5	5	4	10
2008	14	24	30	36	52
Change	10***	19***	24***	32***	42***
Eggs ≥3 days/week					
2006	7	7	12	14	24
2008	4	10	10	24	34
Change	-3	3	-1	10***	10**
Fish ≥3 days during/week					
2006	58	77	82	88	93
2008	43	68	70	81	91
Change	-15***	-9**	-13***	-7**	-2
Poultry ≥ 1 day/week					
2006	21	24	31	31	52
2008	15	23	30	36	54
Change	-6	-1	-1	4	2
Poultry ≥ 3 days/week					
2006	3.7	1.2	2.9	2.9	7.2
2008	0.8	2.0	2.5	4.6	11.9
Change	-2.9	0.8	-0.4	1.7	4.7
Meat other than fish or poultry ≥ 1 day/week					
2006	8	14	12	20	31
2008	9	15	17	24	30
Change	1	1	4	4	-2
Meat other than fish or poultry ≥ 3 days/week					
2006	1.2	1.6	1.2	2.5	6.0
2008	0.8	2.0	1.2	4.6	2.6
Change	-0.4	0.4	0	2.1	-3.4

Note: *, **, *** paired t-test is significant at <10%, <5% and <1% level respectively

Annex 3. Nutritional status of children (rural)

Annex 3A. Age and sex adjusted coefficients for WHZ

	Full sample				25-60 months old		
	1	2	3	4	5	6	7
Age (in months)	-0.046 (4.95)***	-0.056 (4.49)***	-0.053 (4.26)***	-0.052 (4.14)***	0.182 (0.85)	0.169 (0.80)	0.167 (0.78)
Age^2	0.001 (4.13)***	0.001 (3.84)***	0.001 (3.74)***	0.001 (3.61)***	-0.004 (0.75)	-0.004 (0.69)	-0.003 (0.67)
Age^3	-0.000 (4.07)***	-0.000 (3.72)***	-0.000 (3.62)***	-0.000 (3.49)***	0.000 (0.64)	0.000 (0.58)	0.000 (0.56)
Female	0.004 (0.12)	-0.182 (0.91)	-0.178 (0.89)	-0.176 (0.89)	3.630 (0.88)	3.356 (0.81)	3.788 (0.91)
Female*Age		0.022 (1.18)	0.021 (1.13)	0.019 (1.02)	-0.250 (0.81)	-0.230 (0.75)	-0.262 (0.85)
Female*Age^2		-0.001 (1.13)	-0.001 (1.07)	-0.000 (0.94)	0.006 (0.76)	0.005 (0.70)	0.006 (0.79)
Female*Age^3		0.000 (1.00)	0.000 (0.95)	0.000 (0.81)	-0.000 (0.72)	-0.000 (0.66)	-0.000 (0.75)
Year 08			-0.110 (2.39)**	-0.111 (2.41)**		-0.115 (2.44)**	-0.111 (2.33)**
Household fixed effects	-	-	-	Yes	-	-	Yes
Constant	-0.602 (6.01)***	-0.517 (3.91)***	-0.535 (4.04)***	-0.539 (4.07)***	-3.957 (1.38)	-3.749 (1.31)	-3.730 (1.29)
Observations	2394	2394	2394	2394	1454	1454	1454
R-squared	0.04	0.04	0.04	0.06	0.01	0.01	0.03

Note: *** and ** denote significant at <1% and <5% level respectively

Annex 3B. Mean anthropometry (Z-score) between 2008 (24-84 months) and 2006 (0-59 months) by districts

	Barguna	Comilla	Jamalpur	Jinaidha	MoulviBazar	Naogaon	All
Wt for age Z-score							
2006	-1.9	-1.8	-1.9	-1.6	-2.1	-1.8	-1.8
2008	-2.1	-2.0	-2.2	-1.8	-2.4	-2.0	-2.1
P	<0.05	<0.05	<0.01	<0.05	<0.01	<0.05	<0.01
Ht for age Z-score							
2006	-2.0	-1.8	-1.9	-1.4	-2.1	-1.8	-1.8
2008	-2.0	-1.9	-1.8	-1.4	-2.1	-1.8	-1.8
P	ns	ns	ns	ns	ns	ns	ns
Wt for ht Z-score							
2006	-1.0	-1.2	-1.2	-1.1	-1.2	-1.1	-1.1
2008	-1.3	-1.3	-1.7	-1.3	-1.6	-1.4	-1.4
P	<0.05	ns	<0.01	<0.05	<0.01	<0.05	<0.01
n	134	212	199	227	212	219	1203

Annex 3C. Proportion of undernutrition by districts

	Barguna	Comilla	Jamalpur	Jinaidha	Moulvibazar	Naogaon	All
Underweight (moderate-severe)							
2006	45.5	42.5	46.7	34.4	51.9	42.5	43.6
2008	56.7	52.9	60.8	37.3	64.9	52.3	53.7
P	<0.05	<0.05	<0.01	ns	<0.01	<0.05	<0.01
Stunting (moderate-severe)							
2006	51.5	42.0	49.2	29.5	52.4	44.3	44.1
2008	50.0	43.8	44.7	27.6	53.6	38.5	42.4
P	ns	ns	ns	ns	ns	ns	ns
Wasting (moderate-severe)							
2006	17.2	18.4	17.1	15.4	17.0	17.8	17.1
2008	18.0	21.0	35.4	21.5	33.8	22.1	25.6
P	ns	ns	<0.01	ns	<0.01	ns	<0.01
n	134	212	199	227	212	219	1203

Annex 3D. Proportion of undernutrition by sex

Age group	Underweight (moderate-severe)		Stunting (moderate-severe)		Wasting (moderate-severe)		Thinness (moderate-severe)	
	2006	2008	2006	2008	2006	2008	2006	2008
Boy	41.0	51.8	42.9	41.0	18.0	24.8	12.8	22.4
P-value	<0.01		ns		<0.01		<0.01	
Girl	46.6	55.8	45.5	43.8	16.1	26.5	13.0	23.2
P-value	<0.01		ns		<0.01		<0.01	
n	1203	1197	1203	1197	1203	1191	1203	1197

Annex 3E. Proportion of undernutrition in 24-59 months by wealth quintiles

	Poorest Quintile	2nd Quintile	3rd Quintile	4th Quintile	Richest Quintile
Underweight (moderate-severe)					
2006	55.1	50.0	51.5	50.3	39.0
2008	63.8	57.7	53.9	53.1	35.0
P-value	<0.1	ns	ns	ns	ns
Stunting (moderate-severe)					
2006	53.8	58.6	52.1	52.3	38.3
2008	61.1	55.7	43.3	38.8	30.6
P-value	ns	ns	ns	<0.05	ns
Wasting (moderate-severe)					
2006	21.2	18.5	15.0	14.8	17.7
2008	26.2	22.1	25.5	27.2	14.4
P-value	ns	ns	<0.05	<0.01	ns

Annex 3F. Determinants of change in residual of WHZ

	(1)	(2)	(3)	(4)	(5)
Whether suffered from diarrhea or dysentery in the last 15 days (1=Yes, 0=No)	-0.243	-0.185	-0.191	-0.216	-0.226
	(2.17)**	(1.66)*	(1.72)*	(1.93)*	(2.02)**
Change in mother's weight between 2006 and 2008	0.019	0.017	0.018	0.018	0.018
	(2.83)***	(2.54)**	(2.74)***	(2.78)***	(2.81)***
Took credit (cash or in kind) to meet food requirement (1=Yes, 0=No)	-0.064	-0.133	-0.121	-0.099	-0.112
	(1.11)	(2.25)**	(2.03)**	(1.68)*	(1.88)*
Reduced number of meals (1=Yes, 0=No)	-0.007	0.026	0.002	-0.009	-0.018
	(0.10)	(0.34)	(0.02)	(0.12)	(0.24)
Took collected food (1=Yes, 0=No)	0.121	0.237	0.221	0.108	0.128
	(1.73)*	(3.12)***	(2.87)***	(1.49)	(1.75)*
Mortgaged assets to buy food (1=Yes, 0=No)	-0.271	-0.216	-0.232	-0.280	-0.268
	(2.15)**	(1.71)*	(1.83)*	(2.20)**	(2.11)**
Faced moderate to severe difficulty for price increase (1=Yes, 0=No)	-0.012	-0.025	-0.042	-0.063	-0.080
	(0.22)	(0.43)	(0.70)	(1.06)	(1.34)
Score of wealth index		-0.066	-0.029	-0.022	-0.029
		(2.27)**	(0.91)	(0.70)	(0.91)
District (1=Barguna, 0=Others)		0.326	0.305		
		(3.26)***	(3.04)***		
District (1=Comilla, 0=Others)		0.467	0.479		
		(5.23)***	(5.32)***		
District (1=Jhenaidaha, 0=Others)		0.289	0.264		
		(3.34)***	(3.02)***		
District (1=Moulvibazar, 0=Others)		0.039	0.023		
		(0.45)	(0.27)		
District (1=Naogaon, 0=Others)		0.247	0.229		
		(2.86)***	(2.65)***		
Main occupation (1=Skilled labor, 0=Others)			-0.104	-0.129	-0.129
			(1.34)	(1.66)*	(1.67)*
Main occupation (1=Farmer, 0=Others)			-0.149	-0.170	-0.155
			(1.85)*	(2.10)**	(1.93)*
Main occupation (1=Business, 0=Others)			-0.203	-0.230	-0.223
			(2.30)**	(2.60)***	(2.52)**
Main occupation (1=Professional/salaried employment, 0=Others)			-0.274	-0.273	-0.257
			(2.71)***	(2.73)***	(2.58)**
Change in agri wage rate in the *upazila* (in Taka)				0.007	
				(3.80)***	
Change in non-agri wage rate in the *upazila* (in Taka)					0.019
					(3.79)***
Constant	-0.071	-0.300	-0.146	-0.165	-0.698
	(1.96)*	(4.04)***	(1.49)	(1.72)*	(3.20)***
Observations	1185	1185	1185	1185	1185
R-squared	0.02	0.05	0.06	0.04	0.04

Note: ***, ** and * denote significant at <1%, <5% and <10% level respectively

Annex 4. Nutrition status of mothers (rural)

Annex 4A. Mean anthropometry and Proportion of Chronic Energy Deficiency (CED) by districts

	Barguna	Comilla	Jamalpur	Jinaidha	Moulvibazar	Naogaon	All
Mean weight							
2006	45.0	47.0	43.7	47.1	41.2	44.6	44.8
2008)	47.0	49.0	44.4	48.4	41.8	46.9	46.2
p	<0.05	<0.05	ns	ns	ns	<0.05	<0.01
Mean height							
2006	151.2	151.1	150.5	151.8	148.6	150.0	150.5
2008	151.2	151.1	150.9	151.8	149.0	150.1	150.7
p	ns	ns	ns	ns	ns	ns	ns
Mean BMI							
2006	19.7	20.5	19.3	20.5	18.7	19.8	19.8
2008	20.6	21.3	19.4	21.0	18.8	20.8	20.3
p	<0.05	<0.05	ns	ns	ns	<0.05	<0.01
Chronic Energy Deficiency (BMI <18.5) %							
2006	38.1	26.7	41.5	22.1	53.4	36.9	36.2
2008	30.4	21.8	39.9	17.5	50.5	27.8	31.2
p	ns	ns	ns	ns	ns	<0.05	<0.01
n	134	212	199	227	212	219	1203

Annex 4B. Mean weight and CED of mothers by wealth quintiles

	Poorest Quintile	2nd Quintile	3rd Quintile	4th Quintile	Richest Quintile
Mean weight					
2006	42.0	43.0	44.8	46.1	48.4
2008	42.6	44.5	46.1	47.9	50.0
p	<0.01	<0.01	<0.01	<0.01	<0.01
CED (<18.5 BMI)					
2006	48.6	44.3	34.1	30.8	22.6
2008	44.3	40.2	27.6	26.0	17.6
P-value	ns	ns	ns	ns	ns
n (2006)	243	244	244	237	235
n (2008)	242	243	241	237	234

Annex 4C. Change in weights by wealth quintiles

Change in weight	Poorest Quintile	2nd Quintile	3rd Quintile	4th Quintile	Richest Quintile	All	P
Decreased	38	32	36	28	32	33	
Unchanged	2	2	1	1	1	1	ns
Increased	59	66	63	71	67	65	

Annex 4D. Determinants of change in mothers' nutritional status

	Change in mothers'			
	Weight		BMI	
Took credit to meet food requirement	0.206	0.241	0.066	0.096
(1=Yes, 0=No)	(0.75)	(0.89)	(0.54)	(0.80)
Reduced number of meals (1=Yes, 0=No)	-0.307	-0.319	-0.113	-0.139
	(0.87)	(0.92)	(0.72)	(0.91)
Took collected food (1=Yes, 0=No)	-0.708	-0.902	-0.261	-0.398
	(1.99)**	(2.72)***	(1.66)*	(2.71)***
Mortgaged assets to buy food (1=Yes, 0=No)	-0.247	-0.244	-0.053	-0.069
	(0.42)	(0.42)	(0.20)	(0.27)
Score of wealth index	0.015	-0.042	-0.013	-0.034
	(0.10)	(0.28)	(0.20)	(0.52)
District (1=Barguna, 0=Others)	0.916		0.567	
	(1.98)**		(2.77)***	
District (1=Comilla, 0=Others)	0.326		0.265	
	(0.76)		(1.40)	
District (1=Jhenaidaha, 0=Others)	0.109		0.180	
	(0.27)		(1.01)	
District (1=Moulvibazar, 0=Others)	-0.033		-0.034	
	(0.08)		(0.19)	
District (1=Naogaon, 0=Others)	1.291		0.670	
	(3.27)***		(3.83)***	
Main occupation (1=Skilled labor, 0=Others)	0.422	0.361	0.199	0.160
	(1.18)	(1.01)	(1.26)	(1.01)
Main occupation (1=Farmer, 0=Others)	0.153	0.100	0.111	0.076
	(0.41)	(0.27)	(0.67)	(0.46)
Main occupation (1=Business, 0=Others)	0.871	0.822	0.367	0.332
	(2.13)**	(2.01)**	(2.03)**	(1.84)*
Main occupation	0.710	0.511	0.358	0.250
(1=Professional/salaried, 0=Others)	(1.51)	(1.10)	(1.72)*	(1.21)
Mother's age (in years)	0.019	0.010	0.009	0.005
	(0.93)	(0.47)	(1.01)	(0.52)
Age of youngest child in 2006 (in months)	0.093	0.096	0.044	0.046
	(3.48)***	(3.58)***	(3.75)***	(3.85)***
Age^2 of youngest child in 2006	-0.002	-0.002	-0.001	-0.001
	(4.46)***	(4.55)***	(4.56)***	(4.65)***
Faced moderate to severe difficulty for price	-0.620	-0.590	-0.287	-0.271
increase (1=Yes, 0=No)	(2.23)**	(2.15)**	(2.34)**	(2.23)**
Change in agri wage rate in the *upazila* (in Taka)		0.020		0.011
		(2.43)**		(3.00)***
Constant	-0.085	-0.206	-0.290	-0.318
	(0.12)	(0.29)	(0.91)	(1.02)
Observations	1089	1089	1089	1089
R-squared	0.08	0.07	0.08	0.07

Note: *** and ** denote significant at <1% and <5% level respectively

URBAN

Annex 5. Frequency of non-rice food consumption

Annex 5A. Proportion of households consumed non-cereal foods at certain frequency in combined wealth groups

Food Items	2006	2008	Change
Consumed lentils ≥3 days	68	71	ns
Consumed green leafy vegetables ≥3 days	38	45	**
Yellow fruits/vegetables ≥3 days	3	14	***
Eggs ≥3 days	16	18	ns
Fish ≥3 days	85	71	***
Poultry ≥ 1 day	30	40	***
Poultry ≥ 3 days	2	3	ns
Meat other than fish or poultry ≥ 1 day	40	24	***
Meat other than fish or poultry ≥ 3 days	1	1	ns

, * paired t-test is significant at <5% and <1% level respectively

Annex 6. Child nutrition

Annex 6A. Mean Z-score by age group

Age group	Wt for age Z-score			Ht for age Z-score			Wt for ht Z-score		
	2006	2008	P	2006	2008	P	2006	2008	P
0-6 months	-0.9	-1.4	<0.05	-0.8	-1.2	ns	-0.3	-0.7	ns
7-11 months	-1.4	-1.4	ns	-1.3	-1.2	ns	-0.8	-0.9	ns
12-23 months	-1.9	-1.8	ns	-2.1	-2.1	ns	-1.1	-1.0	ns
24-59 months	-2.0	-2.1	<0.05	-2.2	-2.3	ns	-1.1	-1.2	ns
All age group	-1.8	-1.9	ns	-2.0	-2.0	ns	-1.0	-1.1	ns

Note: Wt=weight, Ht=height

Annex 6B. Proportion of undernutrition by sex

Age group	Underweight (moderate-severe)			Stunting (moderate-severe)			Wasting (moderate-severe)		
	2006	2008)	P	2006	2008	P	2006	2008	P
Boys	44.1	47.9	ns	51.7	63.6	<0.01	16.6	23.7	<0.05
Girl	40.6	47.9	ns	42.7	47.5	ns	10.0	18.6	<0.05

Annex 6C. Determinants of WHZ

	(1)	(2)	(3)	(4)
Age (in months)	-0.092(3.49)***	-0.071(3.94)***	-0.071(3.97)***	-0.091(3.46)***
Age^2	0.002(2.41)**	0.002(2.63)***	0.002(2.65)***	0.002(2.37)**
Age^3	-0.000(1.74)*	-0.000(1.86)*	-0.000(1.87)*	-0.000(1.71)*
Female	-0.388(1.53)		-0.047(0.74)	-0.377(1.49)
Female*Age	0.037(1.01)			0.034(0.94)
Female*Age^2	-0.001(0.71)			-0.001(0.63)
Female*Age^3	0.000(0.52)			0.000(0.44)
Year08		-0.110(1.68)*	-0.108(1.65)*	-0.109(1.66)*
Constant	-0.116 (0.62)	-0.285(2.21)**	-0.258(1.93)*	-0.074(0.39)
Observations		1096	1096	1096
R-squared		0.04	0.04	0.04

Note: ***, ** and * denote significant at <1%, <5% and 10% level respectively

REFERENCES

BBS (2007). "Report of the Household Income & Expenditure Survey 2005", Bangladesh Bureau of Statistics (BBS), Planning Division, Ministry of Planning, Government of Bangladesh.

BDHS (2004). Bangladesh Demographic and Health Survey-2004, NIPORT/ USAID/MA, Dhaka, Bangladesh

BDHS (2007). Preliminary Report of Bangladesh Demographic and Health Survey, NIPORT/USAID/MA, Dhaka, Bangladesh.

Bruce Cogil (2003). Anthropometric Indicators Measurement Guide, 2003. Revised Edition. Food and Nutrition Technical Assistance (FANTA) Project. Academy for Educational Development. Washiton D.C., USA.

Chowdhury AMR and Bhuya A (2004). "The Wider Impacts of BRAC Poverty Alleviation Programme in Bangladesh" Journal of International Development: Vol. 16:369–386.

CMNS (2005). Child and Mother Nutrition Survey, Bangladesh Bureau of Statistics (BBS)

CPD (2008). "Bangladesh Economy in FY2007-08: An Interim Review of Macroeconomic Performance", A Report prepared by the Centre for Policy Dialogue (CPD) under the Independent Review of Bangladesh's Development (IRBD) Programme, June, 2008.

Dancer D, Rammohan A and Smith MD (2008). "Infant mortality and child malnutrition in Bangladesh", Health Economics, Vol 17(9): 1015-103.

Deolalikar AB (2005). "Poverty and Child malnutrition in Bangladesh", Journal of Developing Societies: Vol. 21(1-2):55-9.

Deolalikar, A. (2004). "Attaining the millennium development goals in India: role of public policy and service delivery", Washington dc: the World Bank.

Gibson RS (1990). Principles of Nutritional Assessment. New York: Oxford University Press.

Gillespie H and Haddad (2001). Attacking the Double Burden of malnutrition in Asia and the Pacific, Asian Development Bank, Manila, Philippines and International Food Policy Institute, Washington D.C.

Greenhalgh T *et al.* (2007). Realist Review to Understand the efficacy of school feeding prigrammes, BMJ, October 2007.

Haddad L, Wiggins S, Garrett J and Ahmed A (2004). "Accelerating malnutrition Reduction in Bangladesh: The Potential Role of DFID", International Food Policy Research Institute (IFPRI), Washington D.C.

HKI/IPHN (2006a). "Bangladesh in Facts and Figures: 2005 Annual Report of the Nutritional Surveillance Project", Dhaka: Helen Keller International/Bangladesh, May, 2006.

HKI (2006b). "Household and community level determinants of malnutrition in Bangladesh", Nutritional Surveillance Project Bulletin No. 17, Helen Keller International and Institute of Public Health Nutrition.

Jahan K and Hossain M (1998). Nature and extent of malnutrition in Bangladesh: Bangladesh National Nutrition Survey 1995-96. 1998. Dhaka, Institute of Food Science and Nutrition, Dhaka University.

Pitt MM, Khandker SR, Chowdhury OH, Millimet DL (1998). "Credit programs for the poor and the nutritional status of children in rural Bangladesh", Working Papers no 98-01, Department of Economics, Brown University.

Poel EV de P, Hosseinpoor AR, Speybroeck N, Ourti TV and Vega J (2008). "Socioeconomic Inequality in malnutrition in Developing Countries", Bullentin of the World Health Organization, 86(4).

SHAMUNNAY (2008). Price Hike: Impacts on Consumption of rice, edible oil and pulses, Bangladesh Economic Outlook, Vol. 2(1), September 2008.

Torlesse H, Lynnda Kiess and Martin W Bloem (2003). "Association of Household Rice Expenditure with Child Nutritional Status Indicates a Role for Macroeconomic Food Policy in Combating malnutrition".

WFP (2004). "The food security atlas of Bangladesh: towards a poverty and hunger free Bangladesh", World Food Programme and The Government of Bangladesh.

World Bank (2007). Implementation completion and results report on National Nutrition Project, Report no. ICR0000242.

World Bank (2008). 'Poverty Assessment for Bangladesh: Creating Opportunities and Bridging the East-West Divide,' Report No. 44321-BD, Poverty Reduction, Economic Management, Finance and Private Sector Development Sector Unit, South Asia Region, The World Bank, July 10, 2008.