

Food for Improved Nutrition in Bangladesh

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Executive summary

This report highlights the role of food and diets for improved nutrition outcomes in Bangladesh and assesses the current gaps and constraints towards improving diets for better nutrition. The report takes a human-centered approach, which is particularly crucial as food systems in Bangladesh are transforming rapidly. The report highlights part of this transformation, including rapidly changing consumption patterns, the related changes in food preparation and processing, and the need for enhanced regulation.

Part I of this report sets the context by describing the nature of the nutrition problem in the country and describes the role of food in this context. First, Bangladesh faces the double burden of malnutrition, with the coexistence of undernutrition and overweight and obesity. Poor diet is a constraint which underlies the challenges of both undernutrition and overweight. The double burden of malnutrition then urges a rethink of food system solutions that look at both types of challenges together. Second, the determinants of malnutrition are inherently multi-sectoral. While this report focuses on food and diets, it well acknowledges upfront that food-based solutions are powerless without corresponding improvements in areas of child care, health services, and water and sanitation.

In this context of nutrition, Part II of this report elaborates on the needed shift from sufficiency of food towards nutritious diets and safer food. While household diets have become more diverse over time, there is still a substantial lack of diversity in diets with gaps in consumption of vegetables, fruits, and protein-rich foods. Combined with the slow inclusion of nutritious food into household diets is the rapid increase of less nutritious food into diets such as fat-rich, sugar-rich, and salt-rich foods. Diets are also poorest in the northwest of the country and in the later lean periods of the year. Not only are household diets poor, diets are particularly inadequate for women and children, those who are in fact most vulnerable to malnutrition and its negative impacts. The gaps in nutritious diets for women and children are at least partly tied to a lack of women's empowerment and behavior and knowledge gaps related to child feeding practices. Overarching this deficiency in the quality of diets for women and children is the need for safer food. Unsafe food exposes populations to contaminants which lowers the absorption of nutrients leading to food-borne diseases. This report highlights some gaps in maintaining food safety at the farm production stage, the food importation level, the processing stage, and the food distribution level.

Part III explores the economic barriers to household access to nutritious food, as well as the rapidly evolving preferences for food. One economic barrier is low incomes. Low incomes are tied to poorer diets at the household level, but less so for children's diets, again emphasizing that women's empowerment and behavior and knowledge on child feeding practices will play an important role. At the same time, while low incomes are tied to less diverse diets, higher incomes result in the increase in the consumption of less nutritious food such as fat-rich, sugar-rich, and salt-rich foods. A second economic barrier is high food prices. In particular, the price of nutritious foods has been increasing faster than staples over time, leading to a high cost of meeting well-balanced nutritious diets. The cost of diets is higher in the northwest of the country and in later lean periods of the year, again highlighting the importance of geography and of seasonality throughout the year.

Drawing from the food-based constraints to nutrition highlighted above, Part IV outlines some opportunities towards a more nutrition-sensitive food system and outlines implications for agricultural policies of the country. While not mutually exclusive, one set of opportunities relates more to the production and distribution of nutritious food, while another set relates more to enhancing food safety.

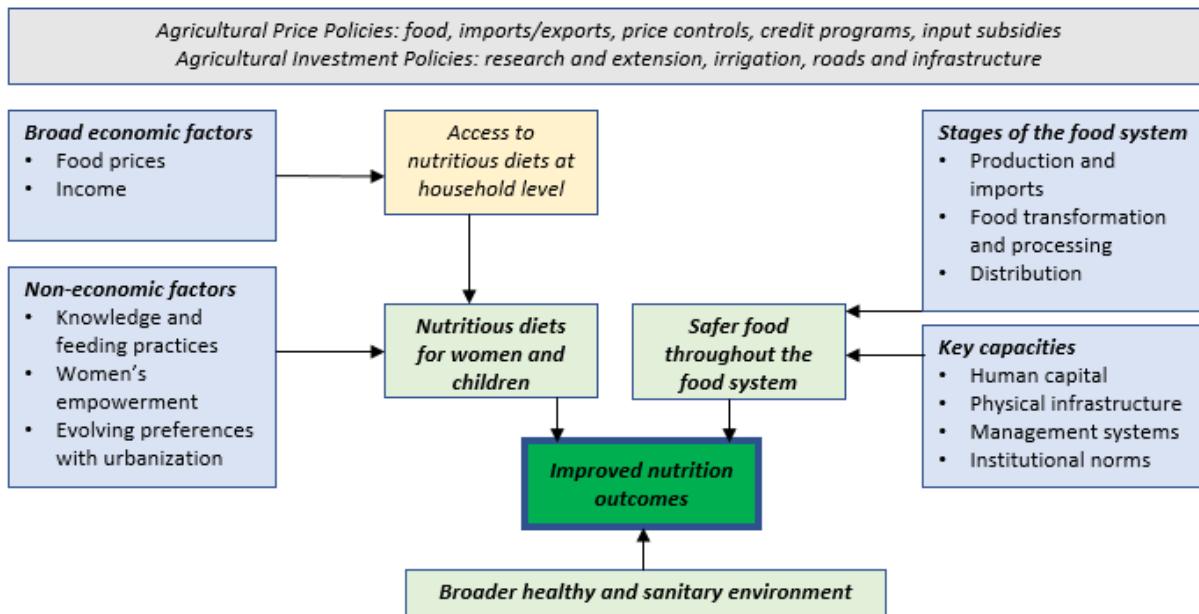
With respect to the production and distribution of nutritious food, first, the report encourages interventions to improve the production of more nutritious food, and to improve infrastructure investments, such as transport and storage, to ensure that nutritious food reaches disadvantaged areas and is available throughout the year, and especially during lean seasons. Second, the report explores implications for agricultural policies. The rice policy of the government has been highly successful in lifting Bangladesh out of its food security trap but is now slowing down the evolution towards higher quality diets. Policies to encourage production, supply and consumption of higher quality foods are now needed. These policies center around productive diversification, research and extension, value chain and market improvements, food safety management and regulation, more than around price subsidies. Rebalancing these agricultural polies needs to be done very carefully so as not to put at risk the food security status of lower-income groups. However, many of the policies are, in relative terms, less costly. They relate more to the typical public goods that can be expected of the public sector. Third, the report highlights the importance of efforts to reach poor households, and to target women and children, specifically. More integrated and coordinated approaches between programs to enhance production with programs to influence behaviors and practices would be key.

The report also describes opportunities to enhance food safety throughout the food system. First, there is a need to expedite ongoing regulatory reform along with facilitation for effective implementation of these reforms, which will also include setting food standards and enhancing the public image of enforcement agencies. Second, there is a need to invest in and upgrade processing, storage, and distribution infrastructure, as well as to modernize and expand laboratory testing and research facilities. Third, there is opportunity to build the demand for safe food through food safety awareness campaigns and education, in combination with the generation of comprehensive, credible, and high-resolution data on food quality. Fourth, a change in overall approach is needed, away from the current corrective model of end-product testing towards a more comprehensive results-oriented approach which introduces food safety in all steps of the food system. This would also entail tougher measures for defaulters.

The schematic below summarizes the logic across the issues which are explored and discussed in this report. The key focus of this report is improved nutrition outcomes. This report discusses three factors which can contribute to this key outcome. Two of the factors, discussed in more detail, are related to food: i) nutritious diets for women and children, and ii) safer food throughout the food system. The third factor, iii) a broader healthy and sanitary environment, is a critical condition which needs to be in place for food to play a positive role for nutrition.

With respect to nutritious diets for women and children, the report describes the gaps in household diets and the largely non-economic barriers in transforming nutritious household diets into better diets for women and children (Part II). The report also presents key economic

constraints to better diets at the household level, including high food prices and low household incomes (Part III). With respect to food safety throughout the food system, this report discusses gaps in securing food safety at various stages, including production and imports, food processing, and food distribution. The report also discusses the gaps in key capacities needed for enhancing food safety, including in human capital, physical infrastructure, management systems, and institutional norms (Part II). The analysis is then used to draw out general recommendations to inform agricultural policies and investments related to food and food prices (Part IV).



I. A focus on food for nutrition

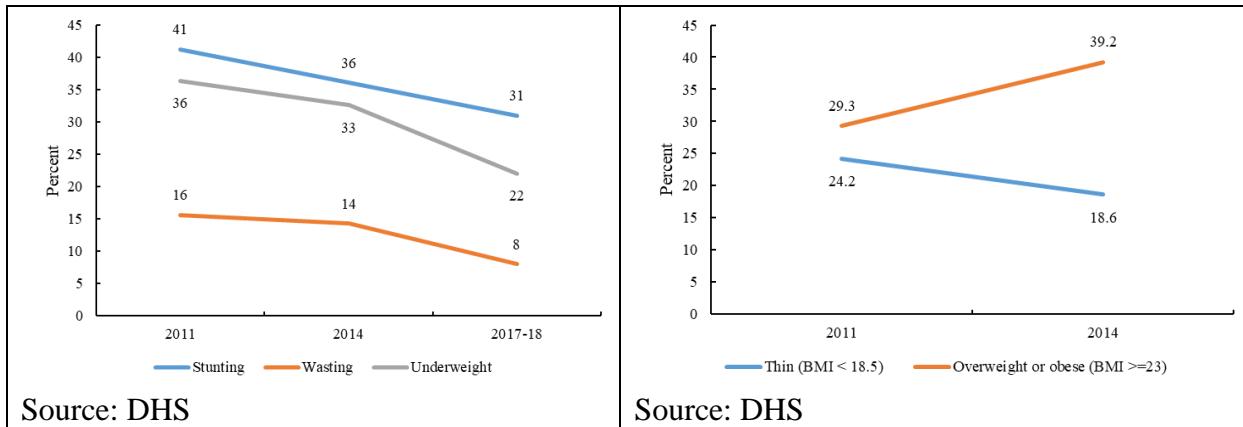
1. This section sets the stage by highlighting the complexity of poor nutrition generally and in Bangladesh. First, the country simultaneously faces undernutrition and overweight and obesity, commonly known as the double burden of malnutrition. Second, not only does malnutrition take different forms, the determinants of say one specific form of malnutrition are in and of themselves often multifaceted and varied. While this section draws the boundaries of this report, by setting food as the focus, the importance of the multisectoral factors which underlie the various forms of malnutrition are well acknowledged.

a. *The double burden of malnutrition*

2. Child undernutrition outcomes have improved over time, but the rates of undernutrition remain high, which would lead to poor cognitive development and poor adult outcomes in the future. From 2011 to 2017-18, the rate of child stunting (a measure of chronic undernutrition) has declined from 41 to 31 percent, the rate of child wasting (a measure of acute undernutrition) has declined from 16 percent to 8 percent, and the rate of child underweight has declined from 36 percent to 22 percent. Yet still close to a third of children under five remain stunted, implying that for many children today their cognitive development and adult outcomes are likely to be poorer (See Figure 1, Panel a).
3. At the same time, the prevalence of overweight and obesity is increasing over time, which translates to another set of poor health outcomes. From 2011 to 2014, the proportion of women aged 14-49 considered too thin (defined as having a BMI of less than 18.5) decreased from 24 percent to 17 percent. In contrast, the proportion of women considered overweight and obese (defined as having a BMI of over 23) has increased from 29 to 39 percent. This increase in women's overweight and obesity has increased faster than the speed of decline in women's thinness (See Figure 1, Panel b).
4. Overweight or obesity is known as one of the major risk factors for a list of non-communicable diseases (NCDs) such as cardiovascular diseases and diabetes (Nordestgaard et al., 2012; Zahangir et al., 2017). Consistent with the recent and rapid rise of overweight prevalence in the country, overweight-related NCDs are contributing an increasing proportion of disability and mortality. In 2017, stroke, ischemic heart disease, and diabetes ranked first, second, and sixth among all causes of deaths in Bangladesh, accounting for 7.7%, 6.8%, and 2.7% of total DALYs (disability-adjusted life years), respectively. The contribution of ischemic heart disease and diabetes to deaths has grown rapidly, increasing by 44.5% and 51.8%, respectively, from 2007 to 2017 (IHME, 2019).

Figure 1 Nutrition outcomes for children and women

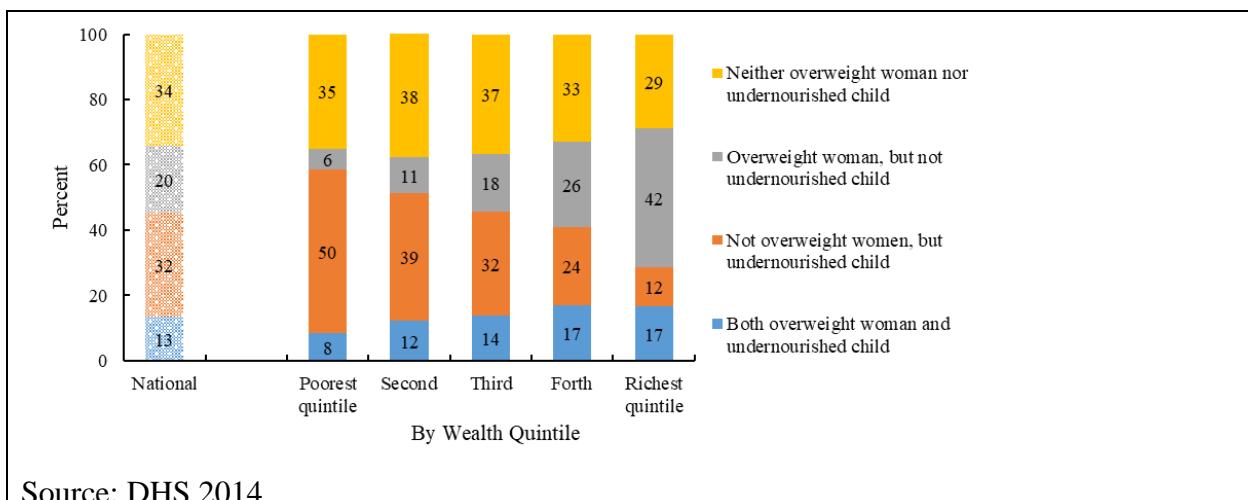
Panel a. Rates of child stunting, wasting, and underweight	Panel b. Rates of women's thinness and overweight and obesity
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5. The slow decline in the reduction of child undernutrition combined with the rapid increase in overweight and obesity is leading Bangladesh to face the double burden of malnutrition. This double burden, with both undernutrition and overweight, occurs across all divisions. In a more rural division such as Rangpur, in 2014, the proportion of children under five that were stunted was 36 percent, and the proportion of women that were overweight or obese was 31 percent. In a more urban division such as Dhaka, the rate of childhood stunting was at 36 percent while the rate of overweight or obesity among women was 41 percent.

6. For some, the double burden exists even within a household where both an overweight (or obese) woman and an undernourished or stunted child live together in the same household. While generally the prevalence of overweight increases with wealth and the prevalence of underweight decreases with it, the double burden of malnutrition exists for both the rich and the poor. Nationally, in 2014, 13 percent of households had both an undernourished child (i.e. stunted, wasted, or underweight) and an overweight (or obese) woman. Among the poorest 20 percent of households, 50 percent had only an undernourished child but not an overweight woman, while 8 percent had both an overweight woman and undernourished child living together in the same household. Among the richest 20 percent of households, 42 percent had only an overweight woman but not an undernourished child, while 17 percent had both an overweight woman and an undernourished child living together in the same household (See Figure 2).

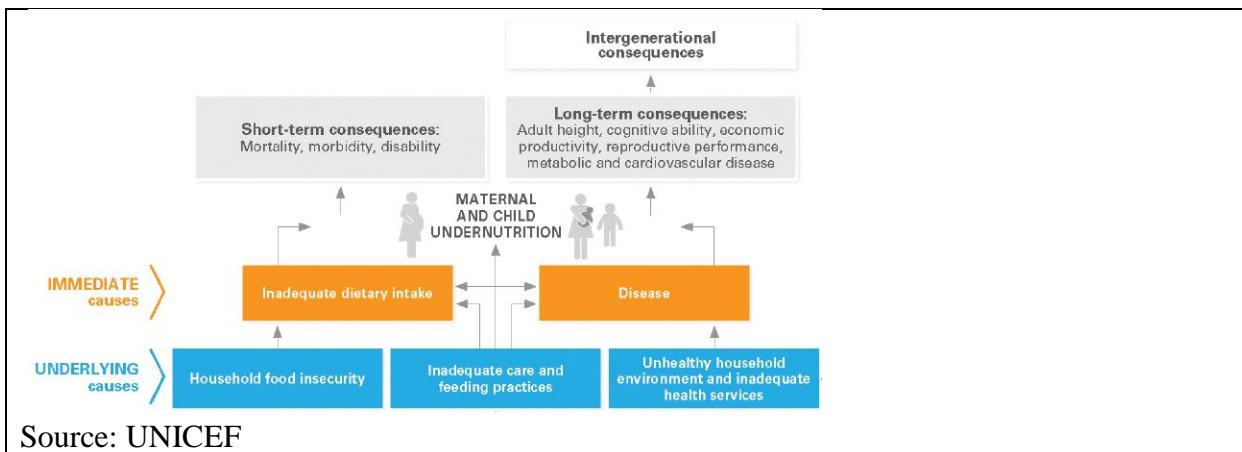
Figure 2 Double burden of malnutrition, proportion of households



b. The multisectoral nature of malnutrition

7. The coexistence of undernutrition and overweight and obesity poses a daunting challenge. More so, each form of malnutrition has its own varied set of determinants that cuts across sectors. The determinants of malnutrition are as broad and diverse as multifaceted as the problem is.
8. The UNICEF conceptual framework is the established guiding framework for the underlying and immediate causes of maternal and child undernutrition. Under the framework, the three broad underlying causes of undernutrition include household food insecurity, inadequate care and feeding practices, and an unhealthy household environment and inadequate health services (See Figure 3). These underlying causes have elsewhere been similarly grouped as Care, Health and healthy Environment, and Food (or CHEF). These underlying causes map to the two immediate causes of undernutrition which are inadequate dietary intake and disease, which then further map to poor maternal and child nutrition outcomes. The short-term consequences of undernutrition include mortality, morbidity, and disability, whereas the longer-term consequences involve adult height, cognitive ability, and economic productivity. More so, poor maternal outcomes are linked to poor child undernutrition outcomes, creating an intergenerational loop of poor nutrition.

Figure 3 UNICEF conceptual framework, underlying determinants of nutrition



9. Analysis of data from Bangladesh confirms that the underlying causes of undernutrition—care, health services, healthy environment, and food—all play a critical role for child undernutrition. Analysis of the Bangladesh Integrated Household Survey (BIHS) for 2011 and 2015, shows that these abovementioned underlying causes are correlated with child stunting, one form of undernutrition. Specifically, mother's health and nutrition, diet diversity, household food security, and a sanitary environment are all correlated with child stunting. The estimation of the correlates of stunting which follows the UNICEF conceptual framework is discussed in Box 1 below.

Box 1. Correlates of child stunting in Bangladesh

Table 1. Correlates of stunting in rural Bangladesh

	0 to 5 months	6 to 23 months	24 to 60 months
Prenatal environment			
Maternal short stature (< 145 cm)	0.059	0.109***	0.201***
Low maternal BMI (<18.5)	0.022	0.031	0.073***
Had at least 4 antenatal visits	0.022	-0.019	
Birth assisted by skilled practitioner	0.012	-0.036	
Care, feeding practices, food security			
Currently exclusively breastfed	0.001		
Any protein rich food		0.040	
Any vitamin-A rich vegetable or fruit		-0.066	
Diet diversity score (0-7)			-0.020*
Household Food Insecurity Access Scale (0-9)	-0.023	0.007	0.019**
Healthy environment			
Improved source of drinking water	-0.072	-0.073	-0.003
Toilet is water sealed	-0.019	0.034	-0.060**
Constant	0.459***	0.584***	0.746***
Observations	500	1473	3103
R-Squared	0.189	0.088	0.087

Notes: Significance level *** <1%, ** <5%, * <10%; standard errors used are cluster robust, clustered at the district level; income, district fixed effects, and a year dummy are included in the regressions.

To shed light on the various correlates of child undernutrition in Bangladesh, we use the Bangladesh Integrated Household Survey (or BIHS for 2011 and 2015). The dataset is representative of rural households in Bangladesh.

We follow the UNICEF framework to test for correlations for the following determinants under i) prenatal environment (closely linked to health services): specifically, short maternal stature, low maternal BMI, having at least 4 antenatal visits, and birth being assisted by a skill practitioner, ii) care and feeding practices: specifically, currently exclusively breastfed (for those 0-5 months), consuming protein rich or vitamin A rich food (for those 5-23 months), individual diet diversity score (for those 2-5 years), and a measure of household food insecurity, and iii) a healthy environment: specifically, access to an improved source of drinking water, and having an improved toilet.

In the pooled OLS estimations, we control for household income, district fixed effects, and a year dummy. We separately estimate the correlation of these determinants with stunting for those 0-5 months, 6-23 months, and 2-5 years. We do note that stunting is a cumulative (largely irreversible) experience, so that the stunting which occurs earlier in life (0-5 months), carries on to when they are 6-23 months of age, and so on to when they are 2-5 years of age. Throughout, we find that the correlations are more precisely estimated for the 2-5 year-old age group, possibly because of this cumulative nature of stunting, but also because the sample size is larger for the older age group.

For prenatal environment, we find that maternal short stature and low maternal BMI are correlated with higher stunting. Having at least four antenatal visits and having an assisted birth seem to reduce stunting, but there does not seem to be enough power to detect these correlations for the 6-23-month age group. For care practices and food, a more diverse diet at the individual level is correlated with lower stunting, while household food insecurity is correlated with higher stunting—suggesting the importance of food at both the household and individual levels. Finally, for a healthy environment, an improved toilet is correlated with reduction in stunting. Altogether, these estimates suggest that the various underlying determinants of stunting do matter.

10. The determinants of undernutrition are likely to vary with the context, the type of the undernutrition problem, and for various stages of the life cycle. Wasting, a measure of acute undernutrition for children under five, was found to be affected by socio-economic status and Water, Sanitation, and Hygiene (WASH) in Bangladesh (Raihan et al., 2017). Adolescent nutrition, as measured by BMI Z-scores, were overall suboptimal, and household wealth was positively associated with higher BMI Z-scores and the probability of adequate energy and micronutrient intake (Leroy et al., 2018). A recent report highlights that for younger adolescent girls (aged 10-14), undernutrition was associated with lower maternal education, while for older adolescent girls (aged 15-19), undernutrition was associated with household food insecurity, while overnutrition was associated with food security and urban residence (Mridha et al., 2019).
11. Like for undernutrition, there are also multiple factors beyond food which influence overweight and obesity. Regardless, the food system will similarly play a critical role. For

example, a few studies have noted that food security alongside age, education, wealth, unemployment, and indicators of a more sedentary lifestyle such as watching television are associated with women's overweight and obesity (Chowdhury et al. 2017; Sarma et al., 2016).

12. A recent report highlights the evidence which links obesity to four various stages of the food system: agricultural production, postharvest which includes food storage, transport, and trade, agroprocessing or food transformation, and retail (including private retail markets and government provisioning). The production and postharvest levels of the food system are linked to obesity in as much as they do or do not lead to the increased production of diversified and healthy foods. The evidence shows that a diversified and healthy diet can lower blood pressure, reduce risk of heart disease and stroke, prevent certain types of cancer, lower the risk of digestive problems, and have positive effects on blood sugar (Htenas et al., 2017).
13. Beyond production and postharvest, at the agroprocessing level, the rapid expansion of ultra-processed foods is considered to be the major factor in the obesity epidemic. Ultra-processed foods are those characterized as durable, accessible, convenient, attractive, ready-to-eat, or ready-to-heat. These foods are problematic, first, because their principal ingredients make them excessive in fat, sugar, and sodium, and short of micronutrients and fiber, thereby increasing the risk of various serious diseases. Second, because their high energy density, high palatability, their marketing in large sizes and in aggressive advertising all undermine appetite control, leading to overconsumption. Finally, at the retail (and provisioning) level, being the point of final consumption, this stage is the most effective in changing the food environment and consumption behavior away from obesity (Htenas et al., 2017).
14. The focus of this report is to highlight the role of food and diets as part of a set of underlying determinants of malnutrition, to aid in the identification of food-based solutions to address malnutrition. The complexity of malnutrition is two-fold. First, malnutrition takes multiple forms. There are different problems of undernutrition such as stunting, wasting, and underweight, as well as the coexistence of undernutrition and overweight which are seemingly contradictory problems. Yet the double burden of malnutrition can and should be tackled simultaneously. Food system solutions can encourage better dietary intake towards improved nutrition outcomes overall. Second, the determinants of malnutrition are multi-sectoral. The success of food-based solutions for improved nutrition are only likely to succeed if the broader context of care, health, and a healthy environment is in place.

II. From enough food to safe and nutritious diets

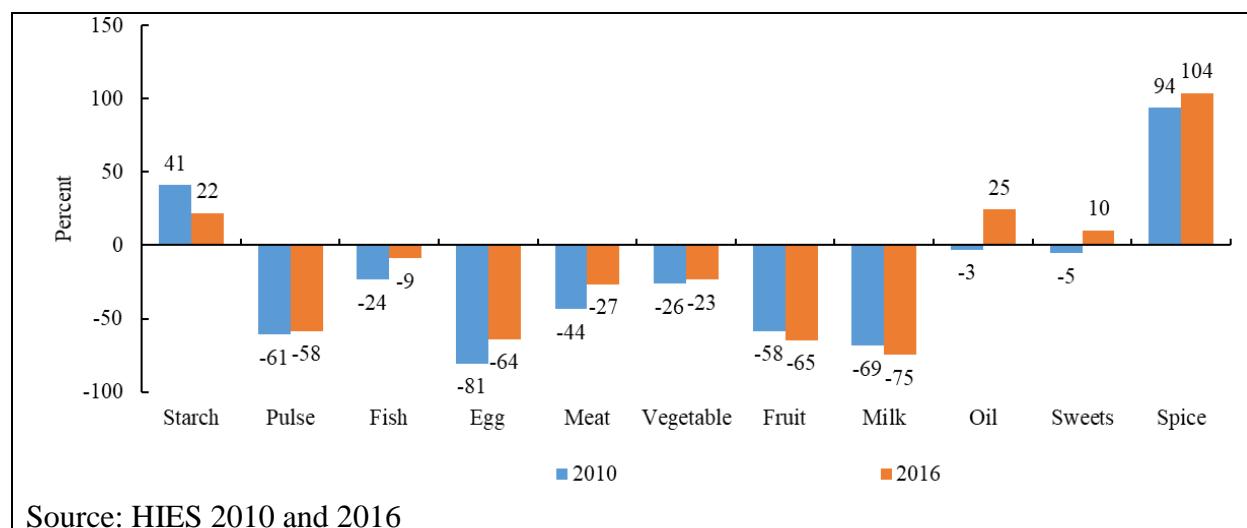
15. Given the complexity of the problem of malnutrition, with a slow decline in undernutrition and a rapid rise in overweight and obesity, our understanding of the role of food for improved nutrition requires a transition away from a focus on having enough food towards an emphasis on safe and nutritious diets. This section first describes food consumption in Bangladesh and assesses this consumption against the benchmark of a nutritious diet. The discussion focuses on both household diets as well as diets for those most vulnerable to the impacts of malnutrition, women and children. This section then describes the constraints to food safety in Bangladesh at various stages of the food system. This section concludes by emphasizing the importance of an overarching healthy environment.

a. Nutritious diets

At the household level

16. Nutritious diets should go beyond the amount of calories consumed and should consider a healthier balanced diet which includes a diversity of foods. A diverse balanced diet would include more nutritious foods such as protein-rich pulses, fish, eggs, milk, and meat, as well as vitamin-rich fruits and vegetable, while tempering the consumption of more energy-dense foods such as starchy staples, oils, and sweets.
17. Diets have been increasing in diversity over time, with more non-starch foods being introduced in the diet (Waid et al., 2018). Over the 15-year period from 1985 to 2010, two food groups have seen a decline in their average consumption. Starchy staple consumption has decreased by 7 percent, while consumption of pulses has decreased by 32 percent. Another two food groups have seen more than a doubling of their consumption. Oil consumption has increased by 169 percent and meat consumption has increased by 124 percent. Over the same period, egg consumption increased by 67 percent, fish by 21 percent, and milk by 29 percent. Fruit consumption has close to doubled over the period increasing by 91 percent, and vegetable consumption has also increased but only by 24 percent.
18. However, the changes in food consumption between 2010 and 2016, suggest that improvements in diets are slowing. Food-based dietary guidelines (FBDG) is one benchmark of how much should be consumed of a given food group. With nutrition as the desired outcome, these guidelines give a sense of how much consumption of a particular food group is too much and how little is too little. A comparison of the average consumption of each food group with the recommended consumption of that food group based on the Bangladesh FBDG demonstrates how diets may not be sufficiently nutritious and diverse. Figure 4 presents consumption against guidelines for 11 food groups: starch, pulses, fish, eggs, meat, vegetable, fruits, milk, oils, sweets, and spices.

Figure 4 Consumption of food relative to recommended consumption

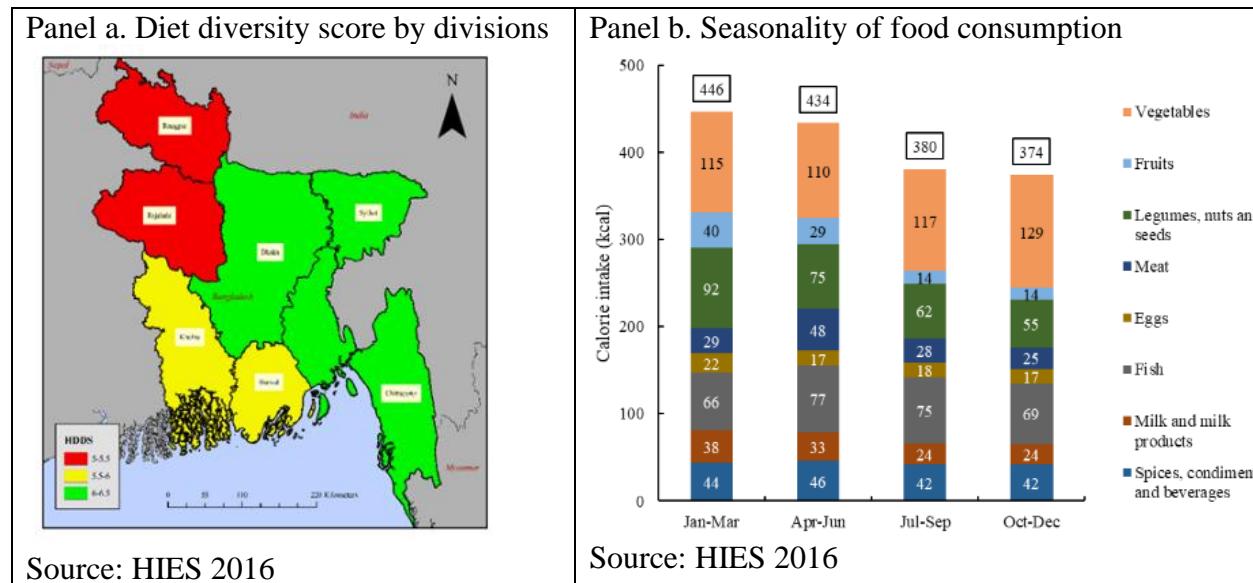


19. Reflecting the slow progress in child undernutrition outcomes, the consumption of more nutritious foods has remained largely unchanged between 2010 and 2016. While there have been some slight improvements in consumption between 2010 and 2016 for some nutritious protein-rich food groups average consumption in 2016 still fell below the recommended amount by 58 percent for pulses, by 9 percent for fish, by 64 percent for eggs, and by 27 percent for meat. Vegetables and fruit also fell short of the recommended consumption, particularly by 23 percent for vegetables and by 65 percent for fruits. The underconsumption of fruits has even worsened over time between 2010 and 2016. Average underconsumption of fruits was at 58 percent in 2010. Dairy underconsumption has also worsened over time. Underconsumption of milk (relative to the FBDG) worsened from 69 percent in 2010 to 75 percent in 2016.
20. In contrast, reflecting the increase in overweight and obesity over time, the consumption of less nutritious energy-dense foods has increased rapidly. While overconsumption of starchy staples has declined from 41 percent of the recommended amount in 2010 down to 22 percent in 2016, the overconsumption of fat-rich, sugar-rich, and salt-rich foods has increased. In particular, the consumption of oils, sweets, and spices have increased over the same period. Average oil consumption in 2010 was under the dietary guideline by 3 percent, but by 2016 the consumption of oil was over the guideline by 25 percent. Average consumption of sweets in 2010 was under the dietary guideline by 5 percent, but by 2016 the consumption of sweets was over the guideline by 10 percent. Average consumption of spices (which includes salt) was over the guideline by 94 percent in 2010, and by 2016 this has increased further to 104 percent over the guideline.
21. Moreover, there is an important geography and seasonality to the quality of diets. Some regions are doing more poorly, such as areas in the northwest. Another measure of diet quality is the Household Dietary Diversity Score (or HDDS) which measures the number of food groups out of 12 food groups that an average household consumes in a day. Households in Rangpur and Rajshahi in the northwest have the poorest diets. Households in Rangpur consume only 5.3 food groups and household in Rajshahi consume only 5.2 food groups. Diets in Sylhet,

Chittagong, and Dhaka are slightly better, where households there consume 6.4, 6.3, and 6 food groups out of the total 12 possible food groups, respectively (See Figure 5, panel a).

22. Not only are diets worse in some areas, diets are also worse in certain seasons during the year. Total calorie consumption is lower in the later part of the year than in the beginning of the year. Calorie consumption is on average 2,697 kcal from January to March, 2,753 kcal from April to June, and only 2,640 kcal from July to September and 2,626 kcal from October to December. This seasonal decline in total food consumption is more pronounced for more nutritious foods. Comparing the period October to December with April to June, the decline in cereal consumption is only 1 percent, and the decline in the consumption of oils and fats is 9 percent. In contrast, the largest seasonal declines are observed for fruits with a 53 percent decline, meat with a 48 percent decline, legumes (nuts and seeds) with a 27 percent decline, and milk with a 27 percent decline (See Figure 5, panel b).

Figure 5 Geography and seasonality of diets



For women and children

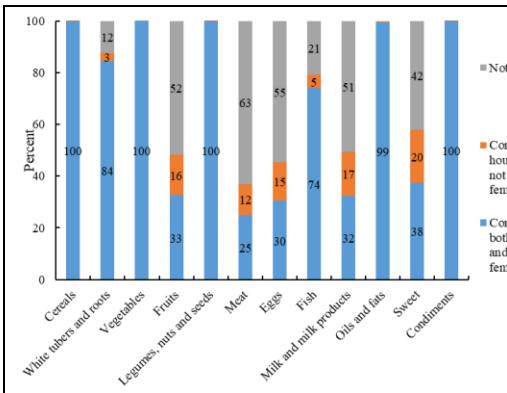
23. Not only are diets poor at the household level, diets are even poorer for those who are more vulnerable to the impacts of poor nutrition outcomes: women and children. While poor diets for women and children are partly linked to poor diets at the household level, another part of the problem involves gender roles and women's empowerment as well as child feeding practices.
24. The diets of women and children in Bangladesh do not meet the minimum diet diversity thresholds. The Minimum Dietary Diversity for Women (or MDD-W) specifies that women should consume at least five out of 10 food groups. However, for example in rural areas, only 60 percent of women met the MDD-W in 2015, only a slight improvement from 2011 where then only 47 percent of women met the MDD-W. The threshold of five for MDD-W is important as it spells differences in nutrient intakes. Take, for example, intake of iron, zinc,

and vitamin A. Based on nutrient intake calculations of the BIHS 2011 by the Global Dietary Database (GDD) at Tufts University, women who met the MDD-W in 2011 met on average 67 percent of the Recommended Dietary Allowance (RDA) of iron versus only 55 percent of the RDA of iron for women who do not meet the MDD-W. For zinc, women who met MDD-W met on average 125 percent of the RDA versus only 114 percent for those who did not meet the MDD-W. For vitamin A, those who met the MDD-W consume 46 percent of their RDA versus only 24 percent for those who do not.

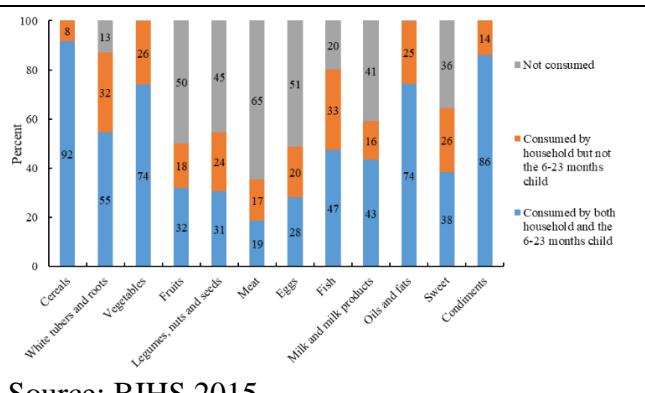
25. The Minimum Dietary Diversity for children (or MDD) specifies that children under two should consume at least four of seven defined food groups. However, for example in rural areas, only 28 percent of children met the MDD in 2015, a slight improvement from 2011 where only 19 percent of children met the MDD. Like for women, the MDD threshold spells differences in nutrient intake for children. For example, based on the GDD nutrient intake calculations from BIHS 2011, children who met the MDD met on average 32 percent of their iron RDA versus 21 percent of the iron RDA for children who did not meet the MDD. For zinc, the average intake of the RDA was 67 percent for children who meet the MDD versus only 50 percent for those who did not meet the MDD. For vitamin A, the average consumption of the RDA was 32 percent for children who met the MDD versus only 18 percent for those who did not meet the MDD.
26. While a large part of the deficiencies in diets for women and children is due to the overall deficiencies in household diets, women's and children's diets are even poorer than the household diet for some. For example, for households with HDDS under nine, only 32 percent of women met the MDD-W. However, even for households with HDDS equal to 11 still only 69 percent of women met the MDD-W, so that another 31 percent of women did not have sufficiently diverse diets even if diets at the household were diverse enough. For households with HDDS equal to 12 some 18 percent of women still did not meet the MDD-W. The situation is even more perverse for children 6-23 months. For households with HDDS under 9 about 86 percent of children failed to meet the MDD. However, even for those households with high HDDS many children failed to meet the MDD. For those with HDDS equal to 11 about 63 percent of children did not meet the MDD, and for those with HDDS equal to the maximum 12 still about 59 percent of children did not meet the MDD.
27. A closer look unveils which food groups are typically lacking in the diets of women and children, and whether this was due to household access to that food group or other factors such as gender roles and child feeding practices. Based on the BIHS 2015, while women's diets tend to include grains (or roots and tubers) and some meat (or poultry or fish), overall dietary diversity for women is typically insufficient due to a lack of dark green leafy vegetables, other types of fruits (non-vitamin A-rich), pulses, nuts and seeds, eggs, and dairy. Children's diets tend to include grains (or roots and tubers) and to a lesser extent other types of fruits and vegetables (not vitamin A-rich), but broadly lack all the other food groups recommended for young children such as flesh foods, dairy, eggs, legumes and nuts, and vitamin A-rich fruits and vegetables (See Figure 6).

Figure 6 Access at household level vs access for women and children

Panel a. Women's food consumption	Panel b. Children's food consumption
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Source: BIHS 2015



Source: BIHS 2015

28. For each of the food groups for which a woman or child was deficient in, part of the problem is a lack of broader access at the household level, but another part of the problem is a lack of access for specific individuals within the household. Take for example women's deficiency in their consumption of fruits, eggs, and dairy. For 52 percent of households (with women aged 15-49), fruits are not consumed in the household (so women in those households will also not be able to consume them), while for 16 percent of households, fruits are in fact consumed in the household but women in those households do not consume them. Similarly, for 55 percent of households, eggs are not consumed in the household, while for 15 percent of households, eggs are consumed in the household but women in those households do not consume them. For 51 percent of households, milk is consumed in the household, while for 17 percent of households, fruits are consumed in the household but women in those households do not consume them.
29. Similarly, for children, take for example their lack of consumption of flesh foods (meat or fish), eggs, and vegetables. For 66 percent of households (with children age 6-23 months), meat is not consumed in the household (so children in these households will also not be able to consume them), while for 17 percent of households, meat is consumed in the household but children in those households do not consume them. Similarly, for 51 percent of households, eggs are not consumed in the household, while for 20 percent of households, eggs are consumed in the household but children in those households do not consume them. For almost all of the households vegetables are being consumed, while for 26 percent of these households, vegetables are being consumed in the household but children in those households do not consume them.
30. That access at the household level does not automatically translate into access for women and children suggests two things: either the quantity of a food group at the household level even when available is not sufficient and/or that women and children are prioritized last, or that there is enough of that food group at the household level, but certain norms and practices inhibit women from consuming those food groups. These imply the need to close this gap to improve women's and children's diets by emphasizing the relative importance of women's and children's food consumption or reshaping norms and practices.
31. These within-household or intra-household discrepancies tend to be associated with women's empowerment and economic well-being in rural Bangladesh. Analysis of the BIHS 2011 show

inequitable intra-household (within household) distribution of both calories and nutrients. Male household heads have significantly smaller shortfalls of calories (and of a number of other nutrients) relative to other household members such as spouses, boys, girls, and other adults. These smaller shortfalls for male heads are reflected in smaller BMI shortfalls for heads relative to spouses and other adults. These intra-household inequities were not driven by higher energy requirements of male heads. Instead, these inequities were correlated with several measures of women's empowerment and with economic well-being (i.e. higher levels of per capita non-food expenditures) (D'Souza and Tandon, 2019). Other analysis of the BIHS 2011 shows that women's empowerment increases total calorie availability and diet diversity at the household level, and that there were also negative impacts of female group membership and credit access on male BMIs, suggesting that intra-household tradeoffs do exist. Empowerment gaps for women in rural Bangladesh are found to be greatest in terms of leadership in the community and control and access to resources. The positive effects of female empowerment on food security outcomes are greater for less well-off households (Sraboni et al., 2014). Elsewhere, in northeast Bangladesh, schooling and having a voice with one's husband were positively associated with individual dietary diversity (Sinhary et al., 2018).

32. To support broader research and efforts on nutrition and diets in urban areas a survey was conducted with a sub-sample of respondents from the 2018 Dhaka low-income area GeNder, Inclusion, and poverTY (DIGNITY) survey¹. Conducted from June-July 2019, the survey aimed to understand how best to increase dietary diversity, nutrition and consumption behaviors of adults, children, and families, including healthy eating habits, female empowerment, and more in slum and non-slum areas of Dhaka, Bangladesh. The survey was conducted with over 600 women.
33. Female empowerment also plays a critical role for diets in urban Bangladesh. Different forms of empowerment have different correlations with diet diversity and knowledge on nutrition. The survey finds that household dietary diversity is positively correlated with female literacy and education, but negatively correlated with an empowerment index which was focused on income generation. This can likely be explained by the tradeoff between women's time at work versus her time spent providing care to the child. In addition, there are negative correlations with some components of environmental empowerment. The survey reveals a positive correlation of female education with level of agreement with importance of monitoring growth, and with confidence in knowledge and nutrition topics and resources. These same indicators on knowledge are negatively correlated with income empowerment—such as knowledge on what type of food is nutritious, on the importance of nutrition, on where to get nutritional information, and knowledge on liquid and solid food in baby's diet. Other work has found a similar result that distinguishes between income vs education-based empowerment. In a survey conducted in Dhaka City Corporation, female schooling was associated positively with both individual and household diets, while income-earning by women was negatively associated with household diet (Sinhary et al., 2019).

¹ The sample was chosen by the World Bank based on an interest in urban areas, which currently houses 37 percent of Bangladesh's population, but will soon grow to up to 58 percent (UNDESA 2018). Slum areas, of which a portion of our sample resides, are also growing quickly (Kotikula, Hill, & Raza, forthcoming). While we chose a subset of this sample and focus largely on female respondents, the initial sample is representative of poor urban areas.

34. Media and new sources of information in urban areas can be used for positive influence. The survey conducted in Dhaka identifies potential ways to reach individuals with information about nutrition and health. Radio has the least coverage, whereas television will have the broadest coverage. While SMS can be another means to communicate with a smaller subset, there are still gender gaps in urban areas in which women have less access to phones and are less likely to read SMS messages, even in Dhaka.

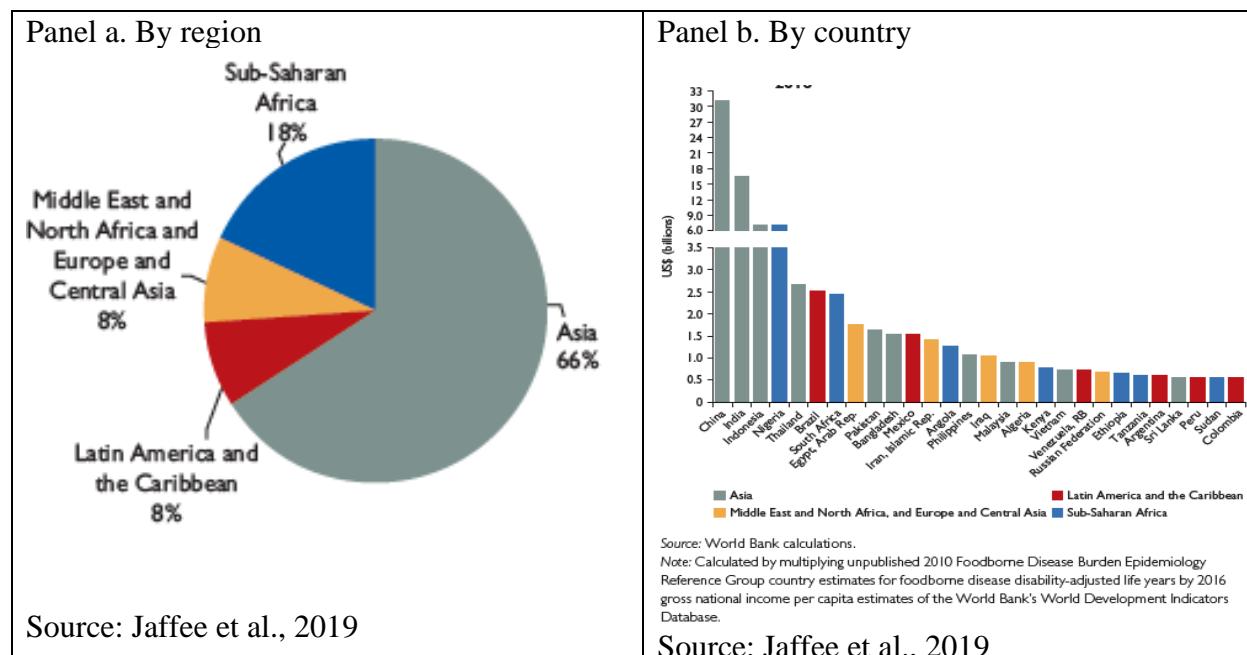
b. Safer food

35. A nutritious diet is unlikely to contribute to improved nutrition if the food is anyway unsafe. With unsafe food, populations are exposed to a range of contaminants including microbial pathogens, zoonotic diseases, parasites, adulterants, naturally occurring toxins, antibiotic drug residues, pesticide residues, and presence of heavy metals (Jaffee et al., 2019). These contaminants result in low absorption of nutrients leading to many food-borne diseases. The ultimate outcome is malnutrition. It is the poor and the vulnerable sections of the society who are the most exposed to the effects of unsafe food. The magnitude of the burden of unsafe food varies with the level of economic development – the life cycle of the burden of FBD (Jaffee et al., 2019). Starting from the traditional stage, when a country is at a very low level of development, to the transitioning, modernizing and finally postmodern stage, the scale and source of the burden of FBD differ across these stages, with the burden being at its peak in the transitioning stage. Countries reaching the lower-middle-income status fall within the transitioning stage of the food safety life cycle burden. The transformation taking place in the food system in Bangladesh categorizes it as being in the transitional stage. Thus, Bangladesh is amongst one of those countries where the economic burden of food safety is the highest.
36. In recent years, food safety concerns have taken up significant attention of the general public in Bangladesh, particularly in the light of sustained reporting on widespread adulteration and the sale of unsafe food. Apart from being a major public health issue, this has had serious economic consequences for Bangladesh, as consumer confidence has dwindled leading to a decline in the demand for several products. For instance, a recent testing of some samples of pasteurised and raw milk, found the presence of antibiotics and heavy metals above acceptable limits, which has caused the demand for locally produced milk to plummet and the import of powdered milk to spiral. This has, understandably, affected the dairy industry adversely, particularly the poor local farmers (The Daily Star, July 30, 2019). Food safety is also important in determining trade relations between countries, particularly with developed countries. Bangladesh has faced restrictions on its exports to EU and the US on several occasions due to non-compliance. The costs of these restrictions have been heavy, both in monetary terms as well as in terms of loss of credibility, leading to uncertainty of sustained access to export markets. A study estimated that the EU ban in 1997 hurt Bangladesh's shrimp exports by US\$ 25 million in the short run and about US\$ 5 billion in the long run (Yunus, 2009).
37. An added food safety concern in LMICs such as Bangladesh, is the differential food safety standards that exist for rich urban consumers and the poor consumers in rural and urban informal markets. Food markets for the former typically have higher food safety standards than

the latter. Such traits have also been observed with respect to imports of processed food products. Often imported foods have very short expiration periods or past expiration dates and/or are amongst those that have low demand in developed countries (for reasons such as the presence of substances injurious to human health such as, monosodium glutamate). To cite an instance, in June 2018, authorities seized imported food products worth more than 65 thousand dollars that had crossed the expiration date two years back (The Daily Star, June 3, 2018). Such underlying discrimination makes Bangladesh's poor masses highly vulnerable to food-borne hazards which has led to larger medical expenses and productivity losses associated with morbidity and mortality.

38. The domestic costs of unsafe food far outweigh the trade costs. Jaffee et al. (2019) estimate the total productivity loss associated with FBD in LMICs at US\$95.2 billion, the share of which between the upper-middle-income and lower-middle-income countries is 53 percent and 43 percent respectively while the low-income countries account for 4 percent (Jaffee et al., 2019). Bangladesh is amongst the 15 LMICs that have an economic burden of FBD exceeding US\$1 billion a year. With a productivity loss of US\$1.7 billion, Bangladesh loses approximately 2.6 percent of its national food expenditure on account of costs associated with FBD. Unsafe animal foods account for about 16 percent of the total DALYs lost due to FBD. Across the globe, on an average, about US\$27 per case is spent on medical treatment and out-of-pocket expenses relating to FBD. Using this figure, an approximate cost-of-illness estimate for FBD in LMICs is US\$15.1 billion as of 2010. If the "human capital loss" is added to this, the estimate for the public health burden of FBD for LMICs amounts to a staggering \$110.2 billion.

Figure 7 Productivity losses from food-borne diseases



39. Food gets contaminated at various stages in the food system - at the farm level, through food imports, during food processing, and during food distribution. In addition to these activities, a food system also encompasses the social, political and economic institutions that characterize the environment in which these activities take place, suggesting the importance of food safety

capacity and governance. We first take a look at how food can potentially get unsafe during the different stages in the food system and then move onto examine the food safety capacity and management in the country.

40. Food production in Bangladesh is dominated by poor and uninformed farmers, who have little education and training. Their farming knowledge is largely acquired from forefathers, fellow cultivators and/or through on-farm experience. In the face of limited role by the public extension workers, farmers frequently depend on private extension workers and are often misled by the latter's advice, which is largely driven by concerns of maximizing private profits. The result is an application of uninformed farming practices. A classic example is the inappropriate and excessive use of pesticides in food production. Such unintentional contamination poses disastrous consequences for human health as it did in 2012 and again in 2014 when many children died after consuming the seasonal fruit, litchi, that had been overly sprayed with pesticides just prior to harvest. In fact, pesticide use has more than doubled in the past two decades from 1997 -2017 (BBS, various issues) and the so-called "dirty dozen" pesticides which are banned globally for their hazardous impact on health including cancer, DNA damage and birth defects, are still being used in Bangladesh. The contamination of agricultural produce extends to non-crop agriculture as well. The use of banned protein concentrate, meat and bone meal (MBM), and leather tanneries wastes in poultry and animal feed is a case in point.
41. Increased imports is a channel for unchecked and quiet entry of potentially unsafe agri-products. The booming urban population has increased the demand for food, both in terms of quantity as well as range of products. A substantial part of the widening demand is met through imports. Trade equations are changing and trade with developing countries is increasing. While food imports from developed countries largely maintain strict standards, imports from developing countries are fraught with problems such as the lack of adherence to standards, guidelines, rules and regulations. To make things worse, the presence of some unscrupulous local traders coupled with anomalies in the administration create fertile ground for such imports. To cite an example, in 2017, 32,000 metric tons of parboiled rice of Thai origin, that arrived at the Chittagong Port, had to be rejected by the Food Department over quality concerns (The Daily Star, 29 Sep 2017). The consignment had arrived to replenish government stocks for the uninterrupted running of the food-aided safety net programs but the quality of rice was so low that it had to be rejected at a time when its need was high. In a blatant disregard for public health safety and fully cognizant of the malleable administration, the ships were docked for a month at the outer anchorage in search of private buyers.
42. Food processing or the physical transformation of food is possibly where the maximum food fraud takes place in Bangladesh. A typical feature of most LMICs, the predominant reason for food fraud is economic. During processing, intentional adulteration is done with sub-standard or banned products or an overdose of restricted products, which renders the ingredients of the end-product different from the original composition, partially or entirely. A very recent report released by the Bangladesh Standards and Testing Institute revealed that 52 out of 406 items that were tested for standards were found either adulterated or sub-standard (Dhaka Tribune, 12 May 2019). These included foods such as powdered spices, vermicelli, salt, mustard oil and ghee among others. Harmful coloring agents, like fabric dyes and brick powder, have been found in spice powder, sauces and juices in several instances in the past (Daily Sun, 30 May

2018; Daily Star, 17 May 2014). Another typology of food fraud is misinformation or lack of complete information in the product label. Food forgery or replacing the food entirely with a similar and inexpensive product is also prevalent in Bangladesh. Between 2014 and 2016, spot chemical tests by the Livestock Department in some remote areas of the north-western districts of Sirajganj and Pabna revealed that most of the ‘milk’ was produced using ingredients like glucose, soybean oil, palm oil and water (The New Age, 2 June 2018). Food can also get contaminated during primary processing due to lack of modern infrastructure. Veterinary processing facilities are such that the animals can seriously infect the meat with germs and other hazardous elements. The risk of transmission of zoonotic diseases from animals to humans is also very high in the conventional abattoirs.

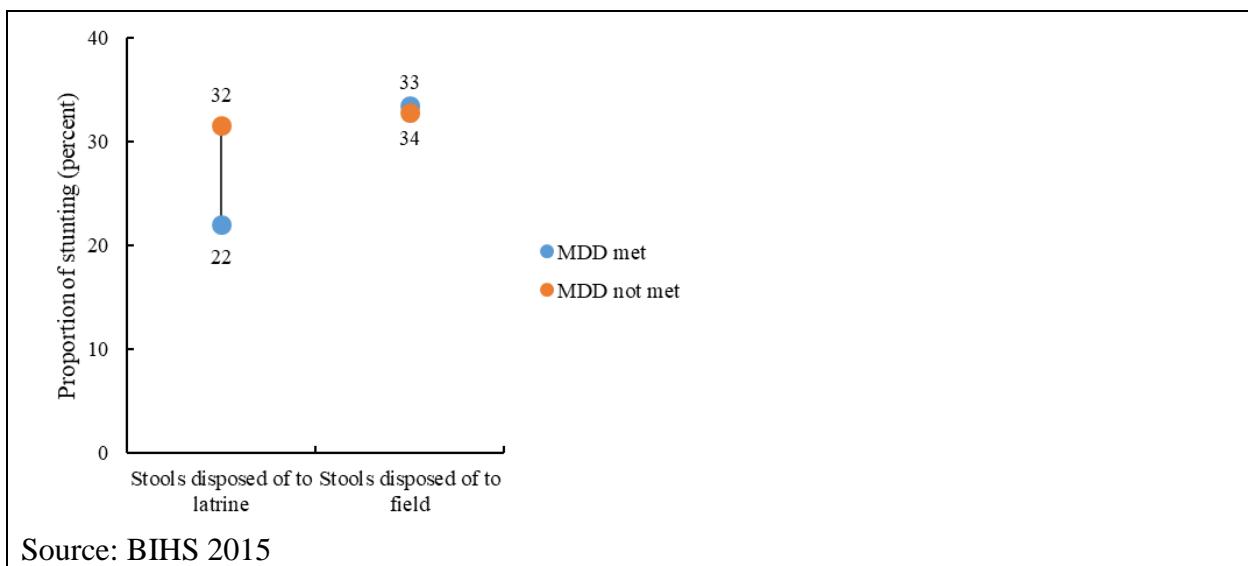
43. Majority of the food in Bangladesh is distributed through informal distribution channels and traditional community markets. This is particularly so for highly perishable fresh foods including meat, fish, and vegetables— the wet markets. Small convenience stores serve the demand for other agri-products and processed foods. In the face of lack of infrastructure and marketing facilities coupled with poor connectivity to growth centers, the presence of middlemen has emerged as a predominant feature of the food distribution system in Bangladesh. Often the food passes through a series of middlemen before reaching the final point of sale. Infrastructural constraints such as outdated modes of transportation, lack of cold-holding transport, inappropriate storage facilities, etc., imply that a substantial amount of time elapses before the food reaches the final consumer. The longer the length of the distribution channel, the greater the chances of contamination and adulteration, and higher the need to enhance the ‘longevity’ of the food. Thus, greater is the food tampering. A typical example of food contamination during storage and distribution is that of fresh water fish and seasonal fruits. The lack of suitable collection centers, where fish can be temporarily kept at appropriate temperatures, and poor transport facilities, compel sellers to mix formalin in fish in order to keep it ‘fresh’ for a long time. Artificial ripening of fruits, especially during the beginning of a fruit season when the demand is high, is rampant. The inadequate storage facilities, drive traders to ripen them using carcinogenic calcium carbide and other harmful chemicals in large doses to hastily get them ready for sale.
44. Overarching the food system is the need for the establishment and effective operation of four key capacities – (i) human capital at different levels in the food system, (ii) physical infrastructure to support the functioning of human capital, (iii) management systems such as laboratories and certification bodies, that require internal management setups for the effective use of the information they generate and (iv) institutional norms and systems that guide the actions of food system participants (Jaffee et al., 2019).
45. The first capacity involves human capital at various layers – a) basic knowledge of food safety hazards and hygiene, b) appropriate food handling techniques and, c) specialized and technically sophisticated expertise in prevention and control (Jaffee et al., 2019). Bangladesh’s record on all three counts are poor. Moreover, the application of expertise in food safety management is constrained by a multiplicity of food safety legislations that are in operation in Bangladesh. There are more than fifteen directives on food safety alone, in addition to the regulations that govern ministries which have food safety as either a direct or a corollary responsibility. An outcome of this is the overlapping of roles and legal provisions, the ultimate effect of which is compromised implementation.

46. The second capacity- physical infrastructure, hygienic market and distribution centers, and food processing facilities- are under developed in Bangladesh. Although recent years have seen some developments, these are still significantly inadequate.
47. The third capacity, which relates to the management systems within enterprises handling food, is undeveloped in Bangladesh. There is a stark absence of reporting systems in the laboratories, to make public the evidence they generate. The BSTI, with a huge mandate of inspecting and certifying both food and non-food products, has only a handful of Field Officers who have inadequate training specifically related to food safety and inspection.
48. The fourth capacity, which deals with the broader institutional and cultural norms, is perhaps amongst one of the most deep-rooted problems in the country. There is no strong mechanism in place to ensure accountability of the controlling bodies resulting in a lack of transparency and impartiality in the application of legislation and controls. Poor enforcement of punitive measures along with low penalties add to the problem.

c. A broader healthy environment

49. The consumption of safe and nutritious food does not operate in a vacuum. A healthy and sanitary environment can influence how nutritious diets translates into nutrition outcomes. Diets are a necessary but not sufficient condition for improved nutrition. For example, as described earlier, based on GDD calculations from the BIHS 2011, even for women who met the MDD-W their iron intake was only on average 67 percent of RDA, and for children who met the MDD iron intake their iron intake was only 32 percent of RDA.
50. Diverse diets for women and children improve nutrition outcomes likely much more so in the context of a healthy and sanitary environment. Take, for example, stunting rates for those who properly dispose of children's feces (i.e. in a latrine vs in the field). Based on BIHS 2015, the stunting rates for children who do and do not meet the MDD are similar when stool is improperly disposed. In contrast, in the context of proper disposal of stool, those who meet the MDD have much lower stunting rates (22 percent) compared to those who do not (32 percent) (See Figure 8). This suggests that diverse diets can reduce stunting only to the extent that there exists concurrently a broader sanitary environment.
51. A recent cross-country report in Africa highlights the importance of simultaneous access to the core underlying determinants of undernutrition (Skoufias et al., 2019). The report looks at data across 33 countries in Africa, relating the sets of core underlying determinants of child undernutrition— food security and child care, WASH, and health—with child stunting. Both in cross-country analysis and within-country analysis the report finds that there is an added impact of the interaction of two or three of the underlying determinants. This argument for multi-sectoral action was also emphasized in a report which focused even beyond the health, education, and sanitation sectors, and looked at the evidence for solutions from the agriculture sector and finance (i.e. credit) (Somanathan and Mahmud, 2008). Overall, this implies the need for a multisectoral strategy for nutrition which involves joint targeting of interventions across sectors, or at the least a strategic sequencing of interventions.

Figure 8 Stunting rate by MDD and by sanitary environment



III. Access to nutritious diets and evolving food preferences

52. The above section highlighted the existing gaps with respect to safe and nutritious diets in Bangladesh. This section focuses on the economic factors which constrains access to better diets by exploring in detail how income and wealth, food prices, and access to markets correlate with nutritious diets. For most people who acquire their food from markets, access to nutritious food are constrained by low incomes and high prices. For others, certain food is sourced from home production or provided for through various public food transfer programs. These various platforms through which people access food involve different opportunities and constraints for improving nutrition. In addition, this section describes how urbanization is leading to changing food preferences.

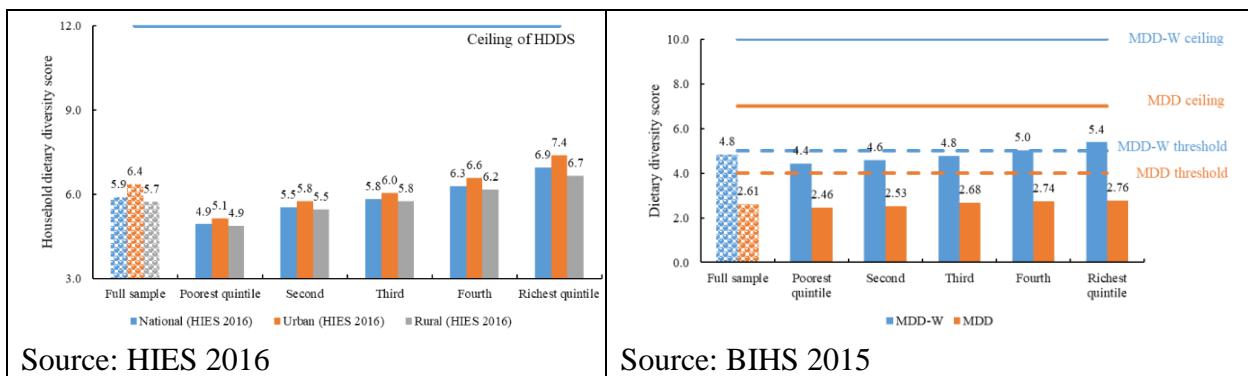
a. Incomes

53. Consumers' income, an important economic factor, affects purchases and consumption of various food groups and thereby implicitly impacts the nutrient intake of households. Given complexity in the conversion of food intake into nutrient intake, this report presents estimations of how consumers' food expenditure could influence the consumption patterns of food demand and influences the dietary diversity in daily food consumption.

54. Higher incomes translate into better household diets. Higher incomes also translate into better diets for women, but children's diets are less determined by income than by other factors, such as child feeding practices. In 2016, among the poorest 20 percent of households, an average household consumed 4.9 food groups, whereas among the richest 20 percent of households, an average household consumed 6.9 food groups. These gaps in diet quality between the rich and the poor occur independently of whether the households being compared are urban or rural households (see Figure 9, panel a). The quality of women's diets also improves for households with higher incomes. In 2015, for the poorest 20 percent of rural households the average number of food groups consumed by women (out of 10) was 4.4 (below the threshold of five), whereas for the richest 20 percent of rural households the average number of food groups consumed by women was 5.4. In contrast, children's diet quality do not seem to improve much with income. For the poorest 20 percent of rural households, the average number of food groups consumed by children (out of 7 food groups) was 2.4, and similarly for the richest 20 percent of rural households, the average number of food groups consumed was still a low 2.76 (still below the threshold of four) (See Figure 9, panel b).

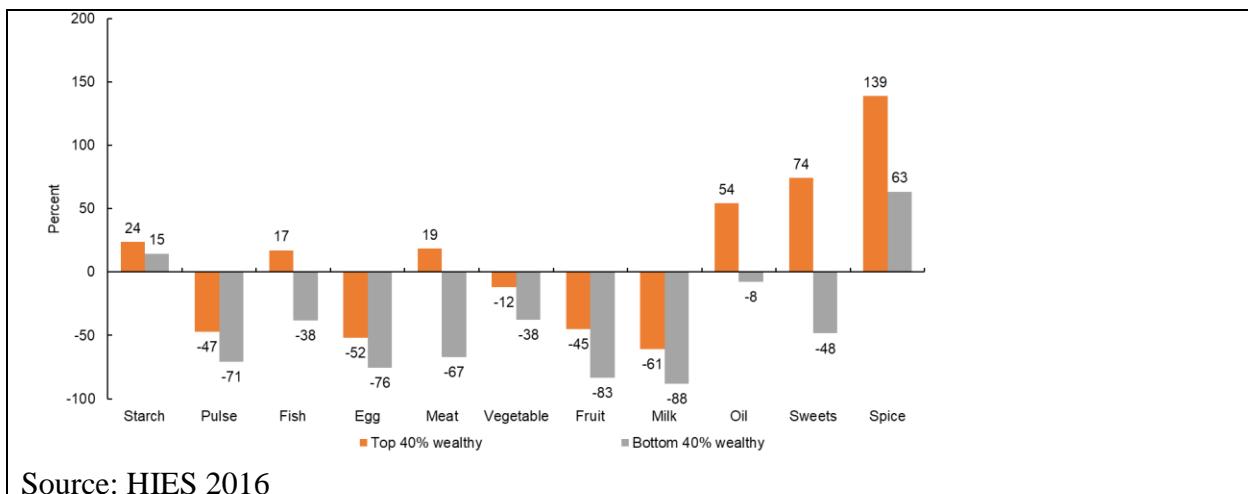
Figure 9 Income and diets

Panel a. HDDS by per capita expenditures	Panel b. MDD-W and MDD by expenditures
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55. While higher incomes increase the quality of diets at the household level, higher incomes also increase the consumption of less nutritious foods which are rich in fat, sugar, and sodium. Thus, while higher incomes curb undernutrition, they are likely to increase overweight and obesity. Figure 10 compares the consumption of different food groups for the wealthiest 40 percent of the population and the poorest 40 percent of the population. The wealthiest 40 percent overconsume oil by 54 percent of the dietary guideline, sweets by 74 percent, and spices by 139 percent. In contrast, the poorest 40 percent underconsume oil by 8 percent of the dietary guideline and sweets by 48 percent, and overconsume spices by 63 percent (which is still less than the overconsumption of the rich).

Figure 10 Consumption of food relative to recommended consumption, by per capita expenditure



56. Another important comparison is to look more closely into the share of the household budget that is spent on different food groups. While cereals still account for the largest share of food expenditure, there is a declining trend in both cereal consumption and expenditure share for cereals in total food expenditure. Cereal expenditure share in 2000 was 41.9% and it went down to 29.2% in 2016. In contrast, Bangladesh experienced a steady increase in the share of vegetables, meat and fish in their food basket. The shares of vegetables, meat, and fish in total food expenditure went from 9.1 percent, 5.4 percent, and 12 percent in 2000 to 11 percent, 8.8 percent, and 16.2 percent in 2016 respectively.

57. When poor households (bottom 25% of the food expenditure distribution) are compared with the rich households (top 25% of the distribution), the study finds that the expenditure share of cereals for the poor is about 9.9 percentage points higher than the rich. The poor also spend a larger share of their food expenditure on white tubers and roots, vegetables, oil and fats, and spices than the rich. The rich, on the other hand, spend a larger share of their food expenditure on fruits, meat, fish, milk, dairy products, and sweets. The largest difference is in meat consumption—the expenditure share of meat is about 8.11 percentage points higher for the rich than the poor. The difference in fish consumption is about 4.6 percentage points, for fruit consumption, about 2.7 percentage points, for milk and milk products about 2 percentage points, for sweets about 1.7 percentage points. All other differences are small and less than 1.5 percentage points.
58. While at the aggregate the rich have more diverse diets than the poor, the note takes a closer look at the role of income by looking at the responsiveness of food consumption to changes in income, and how this income responsiveness is different for the poor and the rich, and how this responsiveness has changed over time.
59. The expenditure elasticities show that Bangladeshi consumers increase their purchase of all goods with the rise of their income, albeit the increase in purchases vary across food items (See Table 1). Bangladeshi consumers, regardless of poor or rich, increase their consumption of fruit, meat, milk and dairy products, egg, fish, sweet, and spices at rates faster than their income growth. On the contrary, they increase their consumption of cereal, white tuber and root, vegetable, legume, and oil at slower rates than their income growth. For the poor people, the consumption of cereal, vegetables, meat, fish, milk and dairy products, and spices are more responsive to their income changes than the rich people. For example, in 2016, a 10% increase in income increases the consumption of milk and milk product by 16.5 percent for the poor and 11.8 percent for the rich. The income elasticities imply that most nutrient-rich foods (e.g. fruits, meat, milk and dairy products) are income elastic and thus luxury goods to both poor and rich; while, cereals, oil, and fats are necessary goods for both poor and rich.
60. The results suggest that, with fast income growth and poverty reduction in recent years, consumers have moved towards healthier diets. These results are also reflected in earlier section that the gap between actual consumption and recommended diets has been narrowed down over time since 2010. While the demand for nutrient-rich commodity groups are expected to rise with the income growth, the results also imply that income shocks to the poor can induce them to move towards calorie-dense food groups. Another emerging pattern from the estimated income elasticities over time is that magnitudes are declining over time and moving towards one, especially for the poor, for the nutrient-rich food groups implying that these nutrient-dense food groups are becoming more regular to the diets of the poor as average income for the poor are also rising over time. Thus, income vulnerabilities of poor households can be associated with poor nutrition outcomes in the long run.

Table 1 Expenditure elasticities of demand for food, poor vs rich, 2016

Food category	National	Poor	Rich
Cereals	0.748*** (0.004)	0.939*** (0.009)	0.842*** (0.016)
White tubers and roots	0.629***	0.733***	0.866***

	(0.007)	(0.018)	(0.038)
Vegetables	0.722*** (0.004)	0.851*** (0.012)	0.772*** (0.019)
Fruits	1.804*** (0.020)	1.509*** (0.065)	1.568*** (0.047)
Meat	1.918*** (0.017)	1.295*** (0.051)	1.126*** (0.039)
Eggs	0.884*** (0.011)	0.733*** (0.033)	1.040*** (0.040)
Fish	1.054*** (0.006)	1.086*** (0.018)	0.947*** (0.018)
Legumes- nuts and seeds	0.945*** (0.010)	0.939*** (0.029)	1.173*** (0.037)
Milk and milk products	1.720*** (0.024)	1.654*** (0.088)	1.177*** (0.056)
Oil & Fats	0.780*** (0.005)	0.803*** (0.013)	0.997*** (0.030)
Sweets	1.710*** (0.019)	1.236*** (0.062)	1.248*** (0.045)
Spices & other food items	1.017*** (0.006)	1.154*** (0.018)	1.078*** (0.022)

1. Household characteristics included are household size, share of female in the household, share of children (5 years or less) in the household, share of members with 5 or more years of schooling, cultivable land ownership of the household, and division fixed effects.

2. Standard errors are in parentheses.

3. ***, ** and * represent significance at 1%, 5% and 10%, respectively

b. Food prices

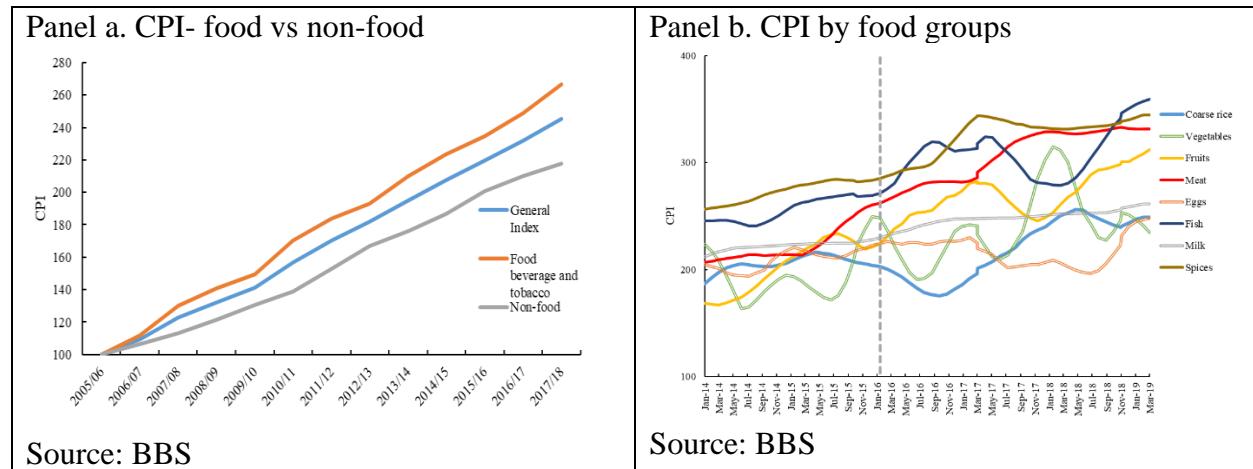
61. The affordability of a nutritious diet is a combination of incomes and food prices. This section first explores trends over time and spatial patterns in the price of nutritious food and less nutritious food. It shows that the price of nutritious foods has been increasing faster than staples over time, and that the price of nutritious food relative to staples is higher in Bangladesh relative to other neighboring countries. Second, this section shows the relationship between food prices and food consumption through estimated food price elasticities.

Trends and patterns in food prices

62. Food prices overall have been increasing faster than non-food prices. Moreover, the price of nutritious food has been increasing faster than the price of other types of food, except for spices which have also seen a rapid increase in prices. From 2005 to 2018, food, beverage, and tobacco inflation has been higher than that for non-food inflation (See Figure 11, panel a). More specifically, the higher food price inflation is driven by faster increases in the prices of more nutritious foods. From 2014 to 2019, the price of meat, fruits, and fish have been increasing faster than the price of coarse rice (See Figure 11, panel b.). While vegetable prices do not necessarily seem to have increased faster than rice prices, vegetable prices are notably the most seasonal, with large swings in prices in any given year. Interestingly, the price of

spices has also been increasing faster over time. Demand and consumption for spices remains high, however, suggesting that the increase in prices is demand driven.

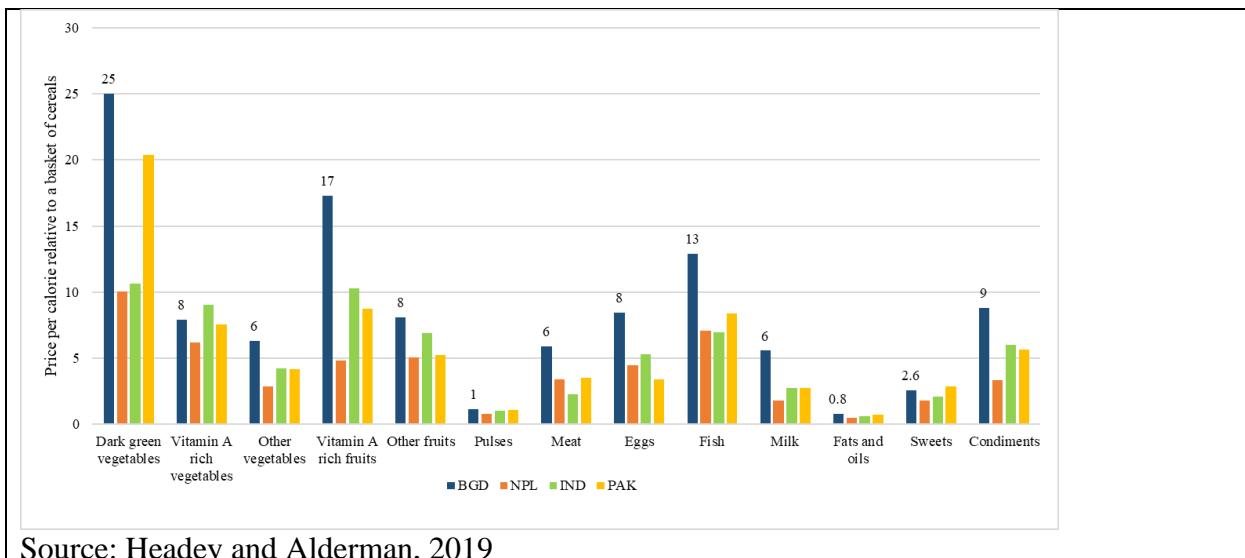
Figure 11 Food and non-food inflation



63. Consequentially, the price per calorie of nutritious foods was much higher than of energy-dense foods, particularly for the products for which prices have been increasing faster than rice over time, specifically meat, fish, fruits. Recent work using 2011 data from the International Comparison Program (ICP), analyzes -relative calorie prices across different countries (or RCPs) (Headey and Alderman, 2019). RCP is the price per calorie of a given food relative to the price per calorie of a basket of cereals. In 2011, relative to that for Pakistan, India, and Nepal, Bangladesh had higher RCPs for many food groups. For example, in Bangladesh the RCP of meat was six, whereas it was only four in Pakistan, two in India, and three in Nepal. For fish, in Bangladesh the RCP was 13, whereas it was only 8 in Pakistan, 7 in India, and 7 in Nepal. For vitamin A-rich fruits, in Bangladesh the RCP was 17, whereas it was only 9 in Pakistan, 10 in India, and 5 in Nepal (See Figure 12). These high RCPs indicate that nutrient-dense foods are much more expensive than cereals in Bangladesh relative to other countries, which in turn keeps food consumption locked in the cereals and slows down dietary diversification. Rice, which makes up most of the cereal basket in Bangladesh, is cheaper than in other South Asian countries, due to long standing government policies. The emphasis on rice has helped Bangladesh to escape the food security trap that it found itself in a generation ago, but is now becoming a constraining factor in the transformation of diets towards more healthy foods, and subsequently in the transformation of the food system.

64. Based on more recent HIES 2016 data, relative to coarse rice, the price per calorie of meat was 33 times higher than that of rice, the price per calorie of fish was 22 times higher than that of rice, and that of fruits 22 times higher per calorie than that of rice. These three food groups had the most expensive price per calorie relative to rice in 2016. These were also the same food groups for which food prices have been increasing the fastest over time.

Figure 12 Cereal-relative calorie prices for different countries in 2011

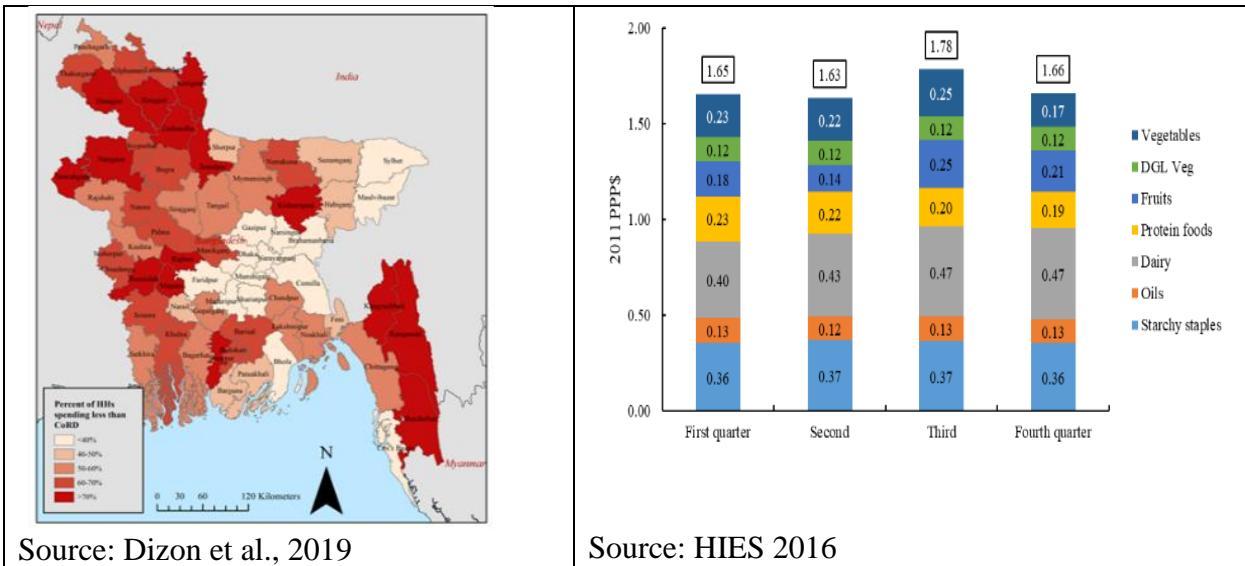


Source: Headey and Alderman, 2019

65. The higher prices of nutritious food relative to less nutritious food translates to an overall high cost of meeting a nutritious diet. One way to cost a nutritious diet is to calculate the minimum cost of meeting FBDGs. In Bangladesh, based on the HIES 2016, the cost of meeting a regional FBDG or CoRD was \$1.7 (in 2011 PPP\$) (Dizon et al., 2019). When comparing this figure to per AME food expenses, about 53% of households in Bangladesh spent less on food than \$1.7 on CoRD. Particularly, in Bangladesh, households tend to overspend on starchy staples, and underspend on dairy, fruits, and to some extent on vegetables.
66. Like for diet quality, there is an important geography and seasonality to the cost of nutritious diets. In districts in the Northwest and Southeast, a larger proportion of households spend less on food than CoRD. Districts in the far Southeast, however, are less populous, and so the number of households there who seem unable to afford a nutritious diet are quite few relative to other districts. Apart from this geography of affordability, there is also some seasonality. CoRD is highest in July to August than any other period of the year. In particular, prices increase the most for fruits, and as well for vegetables and dairy during the lean seasons (See Figure 13). This seasonality follows the patterns of agricultural production, particularly for cereals which forms a substantial share of household consumption and hence affects overall demand for all other commodities. While there are up to three cycles for rice production, *boro* (harvesting around April, following the Robi season), *aman* (harvesting around November), and *aus* (harvesting in July/August), *boro* still remains the most significant harvest, followed by *aman*. The *boro* production cycle involves transplanting in November, crop growth in December-March and harvesting in April, which creates a lean period during July-September, and less of a lean period in January-March as a result of improved *aman* harvest. Like for *boro* rice production, wheat production also follows the Robi season, with harvest in April.

Figure 13 Geography and seasonality of cost of nutritious diets

Panel a. CoRD vs food expenses across districts	Panel b. CoRD across seasons
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67. Nutritious diets will be more expensive for women and girls, but in fact cheapest for children. This is because the nutrient requirements for women and girls are typically highest. WFP's Fill the Nutrient Gap analysis uses linear programming methods to calculate the cost of the diet for five different types of individuals: children under two years of age, school-aged children, adolescent girl, lactating mother, and an adult man. The WFP estimates that the cost of the diet is most expensive for women and girls, than for men or for school-aged children and children under two.

Food prices and food consumption

68. The time trends and spatial patterns on food prices suggest that food prices can be a critical constraint to access to nutritious diets. We next take a closer look at how food prices correlate with food consumption.
69. The price elasticities also highlight varying degree of demand responsiveness to price changes for different food groups. All the compensated own price elasticities (Table A1 in Annex A), which account for substitution effects only, are found to be negative, ranged between -0.192 to -1.15, implying the varying degree of substitutability of different food groups in response to their price changes. The demand for cereals, vegetables, fish, legumes, nuts and seeds, oil and fats, and sweets are price inelastic (less responsive); while the demand for nutrient-dense foods such as fruit, milk, and dairy products are price elastic (highly sensitive). A 10 percent decrease in the price of fruits, and milk and dairy products would increase the consumption of fruits, and milk and dairy products by about 9.6 percent and 12 percent respectively. Because of the high price responsiveness of nutrient-rich food groups, food policies might now focus on reducing the prices of nutrient rich food thereby stimulating consumption. Such policies might take very different forms, for example focusing on reducing value chain losses (fruits and vegetables), enhancing processing systems (dairy) and ensuring food safety (fruits, dairy and meat), rather than subsidizing the price of those foods directly.

70. Given the fact that many rural households in Bangladesh consume a certain share from their own production of foods, especially cereals, the estimated uncompensated own price elasticities, which account both substitution effects and income effects, provide more insights about the consumers' responsiveness to their respective price changes. All the uncompensated own price elasticities are found to be negative and higher than the compensated price elasticities implying that both income effects and substitution effects move in same direction (Table 2). An increase in price of a food group reduces the consumption of that food commodity due to both the income effect and substitution effect.
71. However, the differences between the uncompensated price elasticities and the compensated price elasticities vary across food groups implying that the income effects are much strong for some food groups while the income effects are less strong for some other food groups. The results indicate strong differences between uncompensated and compensated own price elasticities for cereals, vegetables, meat, fish, and spices as the share of food expenditure dedicated to these foods are high, ranged from 8.8 percent to 29.2 percent. Despite about half of employed population in the country is engaged in agriculture, most of these households are net buyers of food, as much as 80 percent of rural households are net buyers of cereals, and thus, the strong negative income effects in response to price increases are aligned with theoretical predictions.
72. However, the price elasticities are not static over time; and both the compensated and uncompensated own price elasticities for most commodities, except milk and milk products, sweets, and spices; show a downward trend in magnitudes since 2000 (Table A2 in Annex A). The declining price elasticities imply that most food groups are becoming less responsive to their price changes over time and their price changes induce consumers less to substitute these commodities with other commodities. The results also indicate that the uncompensated price elasticity for cereals has declines substantially, from -0.87 in 2000 to -0.74 in 2016, over time compared to the compensated price elasticity of cereals, from -0.54 in 2000 to -0.52 in 2016; which implies that the income effects for cereals has been moderated over the years. The declining income effects to the changes in cereal prices make sense as the overall income level of the country is growing fast in recent years and the expenditure share of cereal consumption in overall food expenditure has declined over time. Yet the agricultural policy regime still prioritizes the growth and price stabilization of rice and other cereals. The current policy environment makes rice production the secure option for most farmers and may discourage agricultural diversification.
73. The estimation of price elasticities for the poor and rich show that the patterns of price responsiveness are similar across income groups (See Table 2). The demand for cereals, vegetables, meat, fish, legumes, nuts and seeds, oil and fats, and sweets are price inelastic for both poor and rich; while the demand for milk and dairy products, and spices and other food items are price elastic for both income groups. An increase in prices of earlier food groups would have less effects, regardless poor or rich, on the consumption of those foods; while an increase in prices of later food groups would have much stronger effect, regardless income groups, on the consumption of these foods. It appears that eggs are price inelastic for poor, but elastic for rich; on the other hand, fruits are price elastic for the poor and inelastic for the rich. The poor are generally more responsive to the price changes of nutrient-dense foods such as meat, white tubers, and roots, fruits, fish, milk & dairy products; while rich people are more

responsive to cereals, vegetables, eggs, legumes, nuts, & seeds, oil & fats, and spices. A reorientation from the on-going rice-focused agricultural policies towards higher density higher quality foods (vegetables, fruits, animal products) can enhance availability of the higher quality foods throughout the year and could improve their intake among both the poor and the rich.

Table 2 Uncompensated own price elasticities of demand for food for the poor and the rich.

Food category	National	Poor	Rich
Cereals	-0.744*** (0.005)	-0.744*** (0.011)	-0.865*** (0.012)
White tubers and roots	-0.490*** (0.011)	-0.547*** (0.021)	-0.473*** (0.030)
Vegetables	-0.923*** (0.006)	-0.894*** (0.011)	-0.950*** (0.014)
Fruits	-0.957*** (0.012)	-1.222*** (0.031)	-0.767*** (0.018)
Meat	-0.342*** (0.014)	-0.672*** (0.040)	-0.141*** (0.020)
Eggs	-0.891*** (0.031)	-0.671*** (0.075)	-1.056*** (0.058)
Fish	-0.609*** (0.007)	-0.731*** (0.017)	-0.529*** (0.011)
Legumes- nuts and seeds	-0.800*** (0.016)	-0.765*** (0.034)	-0.948*** (0.035)
Milk and dairy products	-1.188*** (0.014)	-1.419*** (0.045)	-1.086*** (0.017)
Oil & Fats	-0.495*** (0.014)	-0.462*** (0.026)	-0.605*** (0.039)
Sweets	-0.809*** (0.007)	-0.907*** (0.018)	-0.694*** (0.011)
Spices & other food items	-1.250*** (0.004)	-1.178*** (0.008)	-1.295*** (0.008)

Notes: 1. Household characteristics included are household size, share of female in the household, share of children (5 years or less) in the household, share of members with 5 or more years of schooling, cultivable land ownership of the household, and division fixed effects.

2. Standard errors are in parenthesis

3. ***, ** and * represent significance at 1%, 5% and 10%, respectively

c. Markets, home production, and public provision

74. In the rural areas, farm household with own production of food commodities has better nutrition outcomes compared to those household consuming from markets. Households with better nutrition outcomes produce and consume more livestock and poultry products, meat, milk, eggs. However, the proportion of food consumed via market purchase- for both types of household- has increased for cereals and dairy products from 2011 to 2015. For fruits and vegetables, this proportion has decreased, while the share of food consumption via other sources has increased. For both household types, on average, the share of food consumption via own production has declined for all major food groups considered. Households with adverse outcomes relying more on market purchases may consume more processed foods which are often less nutrient-rich.

75. However, the advantage of home production over market consumption in terms of better nutrition outcomes disappears once the women agency, households/ assets, parents' education, and main occupation of household heads are accounted (See Table 3). These factors are important in terms of influencing the choice of households' food consumption and the purchasing capability of consumers. Households with strong women agency over the farm production decision has better nutrition outcomes than the households with less women's participation in the decision-making of production practices. Households assets are negatively associated with adverse nutrition outcomes, except for adult obesity, implying the superior purchasing capability that can ensure better and safe food even through markets. Similarly, parent's education ensures better choice for food consumption from market and reduce the adverse nutrition outcomes relying on markets only. Salaried income households that rely on market for food commodities experience better nutrition outcomes due to higher and steady income flow. Thus, own production helps nutrition outcomes of the people engaged in informal employment; but the advantage of own production disappears with stable and better incomes from formal employment opportunities.
76. The consumption of food via government/NGO transfers is higher among the malnourished households and this is likely indicative of these food-based welfare programs having the desired effect in terms of reaching the target population. While food-based social welfare programs improve poor household's access to food, their association with nutrition outcomes is tiny. However, school-based welfare programs (e.g. female stipend, school meal program, etc.) are positively associated with the improvement of nutrition outcomes among the beneficiary households.

Table 3 Correlates of nutrition outcomes in rural areas (coefficient of Probit models)

	Stunting (Under- 5)	Wasting (Under- 5)	Under Weight (Under-5)	Over Weight (Under-5)	Obese Adolescent	Obese Adult
main						
Whether Female has decision-making control over which crop to be planted or over	-0.046 (0.037)	-0.151*** (0.046)	-0.089** (0.039)	-0.123** (0.060)	-0.106*** (0.036)	-0.070** (0.029)
Log (Household Assets)	-0.092*** (0.014)	0.000 (0.017)	-0.083*** (0.014)	0.093*** (0.021)	0.009 (0.014)	0.137*** (0.011)
Mother's Schooling 6-9 years Dummy	0.016 (0.051)	0.056 (0.061)	0.008 (0.053)	-0.142* (0.084)	-0.067 (0.053)	0.137*** (0.039)
Mother's Schooling 10+ years Dummy	-0.015 (0.080)	-0.118 (0.102)	-0.208** (0.087)	-0.059 (0.121)	0.039 (0.078)	0.173*** (0.056)
Father's Schooling 0-5 years Dummy	0.030 (0.137)	0.230 (0.174)	0.182 (0.145)	0.032 (0.208)	0.274*** (0.106)	0.120 (0.077)
Father's Schooling 6-9 years Dummy	-0.064 (0.140)	0.183 (0.178)	0.054 (0.148)	-0.074 (0.212)	0.198* (0.112)	0.052 (0.081)
Father's Schooling 10+ years Dummy	-0.099 (0.157)	0.103 (0.200)	-0.050 (0.168)	-0.121 (0.239)	0.197 (0.139)	0.023 (0.098)
Employment						
Wage Labor Dummy	0.084* (0.045)	0.056 (0.055)	0.019 (0.047)	-0.037 (0.074)	0.167*** (0.043)	0.274*** (0.036)
Self-Employment Dummy	0.053 (0.047)	-0.070 (0.058)	0.034 (0.048)	-0.088 (0.077)	0.080* (0.045)	0.246*** (0.036)
Trading Processing Dummy	-0.019 (0.050)	-0.099 (0.063)	-0.109** (0.053)	0.091 (0.075)	0.139*** (0.046)	0.242*** (0.038)
Salaried Worker Dummy	-0.194*** (0.072)	0.077 (0.084)	-0.167** (0.075)	0.017 (0.105)	0.124** (0.060)	0.291*** (0.048)
Has family member in urban areas	0.010 (0.056)	-0.116 (0.071)	0.028 (0.058)	0.057 (0.087)	0.061 (0.054)	0.216*** (0.042)
Cereal: Ref. Cat. Subsistence Households						
Net Buyer	-0.004	0.026	0.006	-0.122	-0.024	-0.050

	(0.072)	(0.091)	(0.075)	(0.108)	(0.065)	(0.053)
Net Seller	0.048	-0.009	0.088	-0.264 ^{**}	-0.060	-0.073
	(0.085)	(0.107)	(0.088)	(0.132)	(0.077)	(0.063)
Complete market consumption	-0.129 [*]	0.040	-0.061	-0.071	-0.025	0.023
	(0.073)	(0.091)	(0.076)	(0.108)	(0.065)	(0.054)
Non-Cereal (Ref-Net buyer)						
Complete market consumption	0.047	-0.013	0.050	0.056	-0.030	-0.027
	(0.039)	(0.048)	(0.040)	(0.062)	(0.039)	(0.032)
Poultry, Fisheries, Livestock and Dairy (Ref-Net buyer)						
Complete market consumption	-0.008	0.003	0.019	-0.078	0.060	-0.007
	(0.041)	(0.050)	(0.042)	(0.068)	(0.041)	(0.033)
School Related Welfare Dummy	-0.024	-0.069	-0.061	-0.286 ^{***}	-0.077 ^{**}	-
	(0.036)	(0.045)	(0.037)	(0.066)	(0.031)	(0.029)
Vulnerable Group Welfare Dummy	0.042	0.152 ^{**}	0.171 ^{***}	-0.004	-0.145 ^{***}	0.184 ^{***}
	(0.052)	(0.062)	(0.053)	(0.086)	(0.053)	(0.039)
2015	-0.149 ^{***}	0.172 ^{***}	0.002	0.051	0.120 ^{***}	0.119 ^{***}
	(0.037)	(0.045)	(0.038)	(0.058)	(0.036)	(0.029)
Divisions Controls	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.970 ^{***}	-1.497 ^{***}	0.453 [*]	-2.535 ^{***}	-1.362 ^{***}	-
	(0.242)	(0.301)	(0.252)	(0.371)	(0.229)	3.128 ^{***} (0.182)
Observations	5621	5621	5621	5621	7572	12938
Adjusted R ²						

Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

d. Urbanization

77. Along with economic growth, rapid urbanization² since independence is also associated with changes in food habit. There is a current rural-urban divide, with rural and urban areas facing different nutrition problems. Rural areas are typically poorer, but food in rural areas is not necessarily cheaper. Insufficient diets are prevalent in rural areas relative to urban areas. In contrast, there is excess in urban areas for less nutritious foods, processed foods, and food away from home.
78. Rural people spend more on cereals, white tubers, roots, and spices; while urban people dedicate more expenditure shares to nutrient-dense foods such as fruits, meat, eggs, fish, legumes-nuts& seeds, milk and milk products. Urban people also spend more on oils, fats, sugar and sweets that are often linked with the increasing obesity problem in the urban areas. The share of expenditure on cereals are generally lower in the urban area than the rural areas, although the gap is declining. In 2000, the share of cereals in rural areas was 9.35 percentage points higher than that of urban areas, whereas the difference was only 4.16 percentage points in 2016 (See Table 5). White tubers and roots consumption share is also lower in urban areas. Expenditure shares of all other items are generally larger in urban areas.
79. While the general trends are same for rural and urban population, the demand for fruit, egg, meat, fish, legumes, milk and dairy products are more responsive for the rural people compare to the urban people (See Table 4). Therefore, inclusive rural growth will support the increase of the demand for nutrient-rich foods relatively more in the rural areas compared to the urban areas. Urban population consume less cereals compared to rural people and the average cereal intake is decreasing fast among urban people over time. The changing patterns of food

² The proportion of the urban population in Bangladesh increased from a mere 7.9% in 1971 to 35.9% in 2017.

consumption with rapid urbanization reflects the growing concern for the rise of obesity. While the consumption for nutrient-dense foods such as vegetables, meat, eggs, fish, milk, and dairy products is increasing among the urban people; the consumption of foods that are often associated with obesity such as oil, fats, sweets, and sugar is also increasing fast among urban people. Thus, rapid urbanization in the coming years is expected to increase the demand for non-cereal commodities significantly, while the growth of cereal demand is expected to decline more in response to urbanization. Thus, agricultural policies need to focus improving the supply and food safety of nutrient-rich foods (e.g. egg, milk, meat, and vegetables) in the coming years, while the increasing demand for oil, sweets, and sugar needs to be regulated to avoid the growing concern of obesity among adults.

Table 4 Per capita per day intake of major food items (in grams) by residence

	Rural			Urban		
Food Item	2010	2016	Change	2010	2016	Change
Total	1005.16	974.32	-30.84	985.49	978.74	-6.75
Rice	441.61	386.09	-55.52	344.20	316.70	-27.50
Wheat	23.30	17.44	-5.86	33.60	26.22	-7.38
Potato	71.50	65.89	-5.61	67.70	62.01	-5.69
Pulses	13.23	15.12	1.89	17.20	16.88	-0.32
Vegetables	170.04	164.78	-5.26	154.95	174.06	19.11
Edible oil	18.28	25.70	7.42	26.60	29.57	2.97
Onion	20.20	29.75	9.55	27.80	34.50	6.70
Beef	4.70	6.54	1.84	12.50	10.22	-2.28
Mutton	0.50	0.48	-0.02	0.89	0.76	-0.13
Chicken/duck	9.01	15.30	6.29	17.42	22.73	5.31
Eggs	5.80	12.73	6.93	10.90	15.85	4.95
Fish	45.80	60.59	14.79	59.91	67.91	8.00
Milk and milk products	31.78	26.29	-5.49	39.16	30.04	-9.12
Fruits	42.60	32.24	-10.36	50.40	45.23	-5.17
Sugar/Gur	7.40	6.65	-0.75	11.30	7.57	-3.73
Food taken outside	28.00	27.51	-0.49	34.97	39.47	4.50
Miscellaneous foods	71.41	81.23	9.82	76.99	79.00	2.01

Source: HIES Preliminary Report 2018, BBS.

Table 5 Differences in food expenditure share between rural and urban areas

	2000	2005	2010	2016
Cereals	0.0935***	0.0751***	0.0729***	0.0416***
White tubers and roots	0.00415***	0.00281***	0.00258***	0.00612***
Vegetables	0.000827	-0.00458***	-0.00227***	0.000893
Fruits	-0.0105***	-0.00445***	-0.00836***	-0.00745***
Meat	-0.0315***	-0.0178***	-0.0258***	-0.0211***
Eggs	-0.00668***	-0.00502***	-0.00615***	-0.00333***

Fish	-0.0143***	-0.0148***	-0.0182***	-0.00951***
Legumes- nuts and seeds	-0.00623***	-0.00629***	-0.00539***	-0.00142***
Milk and milk products	-0.00688***	-0.00573***	-0.00568***	-0.00512***
Oil & Fats	-0.00366***	-0.00419***	-0.00293***	-0.000459
Sweets	-0.00771***	-0.00355***	-0.00428***	-0.00430***
Spices & other food items	-0.0109***	-0.0115***	0.00354**	0.00405***

80. While the expenditure elasticities are similar between rural and urban consumers for most commodities, the expenditure elasticities of meat, fish, milk and dairy products, and legumes, nuts, and seeds are higher for the rural people than the urban people implying the higher responses to the consumption of these nutrient-dense foods to the changes of incomes in the rural areas (See Table 6). Thus, inclusive growth in the rural areas could support increasing the consumption of these nutrient-dense food commodities. Urban uncompensated price elasticities are higher for cereal, meat, eggs, milk, dairy products, and spices than in rural areas (Table 6). On the contrary, the uncompensated demand elasticities for vegetables, fruit, fish, legumes and nuts, and oils and fats are higher in the rural areas compared to the urban areas.

Table 6 Expenditure and uncompensated price elasticities of demand for food in 2016.

	Rural		Urban	
	Expenditure	Price	Expenditure	Price
Cereals	0.743*** (0.004)	-0.731*** (0.007)	0.739*** (0.006)	-0.777*** (0.009)
White tubers and roots	0.599*** (0.009)	-0.524*** (0.013)	0.646*** (0.012)	-0.489*** (0.019)
Vegetables	0.722*** (0.006)	-0.932*** (0.007)	0.725*** (0.007)	-0.894*** (0.011)
Fruits	1.824*** (0.025)	-0.993*** (0.015)	1.790*** (0.033)	-0.851*** (0.020)
Meat	2.012*** (0.024)	-0.256*** (0.019)	1.682*** (0.026)	-0.432*** (0.020)
Eggs	0.890*** (0.014)	-0.884*** (0.038)	0.864*** (0.018)	-0.904*** (0.053)
Fish	1.096*** (0.007)	-0.637*** (0.009)	1.023*** (0.009)	-0.532*** (0.011)
Legumes- nuts and seeds	0.997*** (0.012)	-0.857*** (0.020)	0.872*** (0.016)	-0.784*** (0.030)
Milk and milk products	1.774*** (0.030)	-1.168*** (0.016)	1.688*** (0.041)	-1.191*** (0.022)
Oil & Fats	0.779*** (0.006)	-0.512*** (0.016)	0.780*** (0.009)	-0.456*** (0.026)
Sweets	1.718*** (0.023)	-0.805*** (0.008)	1.714*** (0.034)	-0.802*** (0.012)
Spices & other food items	1.008*** (0.007)	-1.213*** (0.006)	1.056*** (0.012)	-1.312*** (0.008)

Notes: 1. Household characteristics included are household size, share of female in the household, share of children (5 years or less) in the household, share of members with 5 or more years of schooling, cultivable land ownership of the household, and division fixed effects.

2. Standard errors are in parenthesis

3. ***, ** and * represent significance at 1%, 5% and 10%, respectively

IV. Opportunities for a more nutrition-sensitive food system

81. The sections above provide insights into the role of food for improved nutrition. Part 2 discusses the inadequacy of diets at the household level and particularly for women and children, as well as the lack of food safety at various stages of the food system, and the need for a broader healthy environment only within which can food potentially lead to improved nutrition outcomes. Part 3 focuses on the economic factors which constrain access to diets, including income, prices, and access to markets. This final section maps the insights from above to existing and potential programs and policies which can foster a more nutrition-sensitive food system.

a. Producing and distributing nutritious food

Box. 2 The National Agricultural Technology Program – Phase II (NATP- II)

The development objective of NATP-II is to increase agricultural productivity of smallholder farms and improve smallholder farmers' access to market in selected districts. It comprises five components:

A. Extension and advisory services: NATP-II will provide in ensuring that extension workers are sufficiently skilled to improve the quality and relevance of the advisory services they provide to farmers.

B. Enhancing agricultural technology generation: to improve the performance of the national agricultural research system (NARS) by supporting the development of innovative agricultural technologies and by strengthening agricultural research institutions.

C. Supporting crop development: to increase crop productivity, quality and output through the enhanced transfer of improved technologies, as well as to facilitate farmer access to markets.

D. Supporting fisheries development: to promote an integrated approach to achieve productivity and output increases through technology transfer, as well as better market access for fish farmers.

E. Supporting livestock development: to promote an integrated approach to achieve productivity and output increases through enhanced technology transfer, service delivery as well as a better market access for smallholder livestock farmers.



Production of more nutritious food

82. As discussed above, over time the price ratio of nutritious foods to staple foods has been increasing and is higher in Bangladesh than in other South Asian countries. Encouraging the production of more nutritious foods can lead to lower prices for these foods. Small-scale production of nutritious foods such as fruits, vegetables, and animal-source protein-rich foods can enhance access and affordability of these foods. Making less nutritious foods more nutritious through post-harvest fortification and biofortification can also improve the nutrient

content of diets. At the same time, strategies to curb the consumption of less nutritious foods such as fat-rich, sugar-rich, and salt-rich foods are needed. These strategies should particularly focus on urban households and the wealthy. At a much larger scale, investments in transport and storage infrastructure such as roads, cold storage, and other innovative technologies can address the geographical disparities and seasonal differences in access to nutritious diets that is documented in the analysis in this report. Such investments in infrastructure can and should promote both the availability of nutritious food and food safety in the food system. Programs such as the National Agricultural Technology Program (NATP-2) (see Box 2) and the Livestock and Dairy Development Project (LDDP) are such programs which enhance the production of nutritious food.

Box 3: A summary of agricultural policies in Bangladesh

Bangladesh had enacted significant policy reforms in the 1980s and 1990s which largely contributed to agricultural growth. In the 1980s, the country had initiated reforms to liberalize input markets, including fertilizer, irrigation, and seed markets. Retail and wholesale markets for fertilizer were liberalized. The liberalization of the irrigation system, which then consisted of large public irrigation projects, transitioned towards an increase in private sector involvement in irrigation. Initially farmers used low-lift pumps and small-scale tubewells, and then later farmers started using shallow tubewells following the elimination of restrictions on importation of agricultural equipment in 1988. Throughout the 1990s, reforms in the seed sector were introduced via the National Seed Policy and the Seeds Act and Seeds Rule. Altogether, these allowed for less of a public sector orientation in the seed sector, with more involvement of private sector and liberalization of the regulations for seed certification. Together with the liberalization of input markets, Bangladesh had also deregulated imports of rice and scaled back public procurement and distribution to allow for more private sector activity in the market. However, in the late 1990s and following the 2007 food crisis, reform towards market liberalization was stalled and partially reversed. Input subsidies and public intervention in grain markets via procurement of rice and wheat increased significantly. To date, the policy framework grants significant advantage to rice through output price support, procurement, and price stabilization. Moreover, public expenditures lack an orientation towards investments in high-return technology and infrastructure, and due to regulatory barriers, the private sector is still constrained from participating in input markets, such as in seeds.

Source: Gautham and Faruqee, 2016

83. Encouraging the production of nutritious food will not only be driven by refocusing investments, but also by shifting the policy environment. A recent World Bank study, the Dynamics of Rural Growth in Bangladesh, also emphasized the need to rebalance agricultural policies focusing on food-security (as up to now) as well as on the nutrition of the population. A summary of the agricultural policies over the last 25 years, as described in the Dynamics of Rural Growth Report is presented in Box 3. Such a balanced strategy will be more effective than staple-focused agricultural policies in delivering higher productivity and growth in agriculture. It is increasingly obvious that agriculture must diversify more rapidly if Bangladesh is to meet the changing food demand and improve the overall nutrition in the country. The slow progress on diversification partly reflects the still on-going emphasis of

agricultural strategies on the production of cereals, principally rice, to achieve food security. Carefully rebalancing the agricultural development strategy may promote diversification, encourage more nutritious consumption patterns and improve nutritional outcomes, while not sacrificing basic food security. To induce farmers towards the production of non-rice agricultural products, their returns need to be further stabilized and solidified through investments in technology, markets, and infrastructure.

Targeting the poor and integrating behavior change

84. Another key finding from the analysis is that household diets do not necessarily translate into better diets for women and children, and diets do not improve automatically with higher incomes and lower prices. Women's diets, for example, are still lacking despite access to nutritious diets at the household level. Children's diets, for example, are poor in quality regardless of household income. This suggests that other factors matter, such as women's empowerment and interventions to improve child feeding practices. Moreover, the analysis highlights that there has been a declining trend in both cereal consumption and expenditure share for cereals in total food expenditure and a steady increase in the share of vegetables, meat and fish in the food basket but with that there are still gaps in nutritious diets particularly for the poor.
85. Interventions that directly target poor women and children are likely to address these constraints. The Income Support Program for the Poorest (ISPP) is one such typical program (see Box 4). The Shombhab pilot which preceded ISPP documents significant impacts on food and nutrition (Ferre and Sharif, 2014). The Shombhab study finds that there was a significant increase in the household consumption of beneficiaries, about 95 percent of the benefit size of BDT 400 or 70 percent of the average size of transfers received by the sample. This increase in consumption is mostly passed on to food expenses: 89 percent of the increase in consumption constitutes food consumption. Shombhab recipients spend about BDT 340 per month more on food than the control group a year after Shombhab started. This significant increase occurred despite controlling for the fact that food expenses went up by BDT 250 for both the treatment and control group between the baseline and the endline surveys. Given that the total food consumption prior to the program was on average of BDT 3,168 for families who were about to become beneficiaries, BDT 340 represents an increase of 11 percent. From a nutrition point of view, the study further finds an impact of the intervention on food consumption pattern of beneficiaries, where particularly food expenses on proteins – meat, eggs, dairy, fish and pulses – increased significantly for Shombhab beneficiaries.
86. IFRPI's Transfer Modality Research Initiative (TMRI) also documents the success of such targeted cash transfer programs. TMRI studies the impacts of transfers to 4,000 poor women (and their families) in the Northwestern and Southern parts of Bangladesh. It studies the impacts of the transfer modality— cash vs food vs cash and food combined with behavior change and communications (BCC) interventions – on consumption, knowledge, and anthropometry. This work finds that cash and food have impacts on consumption and diets, but impacts are larger with cash/food combined with BCC interventions. Moreover, there are large reductions in stunting with cash and BCC on stunting. Other studies from TMRI further show that the IYCF impacts are sustained over time, that there are positive spillover effects, and that such interventions reduce partner violence. Social protection programs in general can

be used as a platform to reach poor and vulnerable households with appropriate messages on health and nutrition, especially since the beneficiaries are generally female and recipients of cash and food transfers. At least in Dhaka, results from the DIGNITY survey indicate that utilizing partners and families in decision-making is vital when developing nutrition campaigns, as is taking into account poverty and lack of education. Nutrition campaigns should target women who are working, making household purchasing decisions, and less-educated females to have the greatest marginal impact. Such BCC campaigns should integrate information on health, nutrition, and child feeding practices, as well as food safety awareness.

Box 4. Income Support for the Poorest Program – ISPP

The development objective of ISPP is to i) increasing the mothers' use of child nutrition and cognitive development services, and (ii) enhancing local level government capacity to deliver safety nets. It comprises three components:

A. Cash transfers for beneficiary mothers: eligibility will be determined by the following two characteristics: (a) household will have to belong to the bottom two expenditure quintiles and b) such households must have pregnant women and/or mothers of children below the age of 60 months. Cash transfers will be given conditional on utilizing the following services: (a) ANC service for pregnant women; (b) monthly growth monitoring for children aged 0-24 months; (c) quarterly growth monitoring for children aged 25-60 months; (d) monthly CNCD (child nutrition & cognitive development) sessions.

B. Enhancing local level government capacity: This component would provide the necessary inputs to LGD to facilitate the implementation of the proposed cash transfers.

C. Monitoring and evaluation: to assess progress in achieving the project's objectives, and the impact of cash transfers on household poverty and on Child Nutrition & Cognitive Development (CNCD) outcomes.



87. The most crucial is not the implementation of programs to enhance the production of nutritious food or the implementation of programs to enhance women's empowerment or to influence child feeding practices. Instead, progress towards a more nutritious-sensitive food system involves the coordinated action across upstream programs that influence access and production, with more downstream programs that directly target women and children and influence child feeding practices.

b. *Enhancing food safety through the supply chain*

88. The government of Bangladesh has recognized the enormity of the problem of unsafe food in the country and has begun to take measures to tackle the issue. A fairly comprehensive

regulatory framework already exists, which is an advantage, but the implementation mechanism is weak and, in some cases, non-existent. Strong and coherent efforts are needed to assess the full scope of hazardous food-related problems; come up with a strategy to rapidly reform food regulations; and devise an effective action plan to implement it. Along these lines, a set of recommendations for moving forward follows.

Expedite ongoing regulatory delivery reform and facilitate effective implementation

89. *Expeditious completion of regulatory delivery reform:* The international trends in the reform of regulatory delivery indicate streamlining of administrative structures to be a starting measure (World Bank, 2016). Towards that end, Bangladesh has already formulated the Food Safety Act 2013, which consolidates all acts and ordinances relating to food safety, and has also formed the Bangladesh Food Safety Authority (BFSA) in 2015. However, despite these developments, progress has been limited. Even with four years into the formation of the Authority, its capacity has not been developed. Instead of having officers with specific duties under the Authority, the organization is being run by officials on deputation from different ministries. Although the process of finalizing the operational modalities is ongoing, it is yet to be completed. Such a situation, understandably, gives rise to a lack of ownership since these officials are aware of the temporary nature of their responsibilities. Consequently, their work performance also gets compromised.
90. *Facilitating effective implementation of regulatory reform:* To make optimal use of the regulatory reforms that Bangladesh has started, documentation changes must be accompanied by effective facilitation with a focus on outcomes rather than on output. The food regulatory reforms that has started needs to be complemented by adequate manpower and endowed with appropriate capacities. Periodic trainings on food safety standards, and procedures is recommended to build capacity of the agencies entrusted with ensuring safe food. Such measures would help concerned personnel overcome the inertia and perform respective duties responsibly and honestly without the need for constant supervision. They should be able to work with a sense of urgency and priority. More transparency and accountability needs to be instilled in the bureaucracy through a performance management system. Although annual performance appraisals for public sector personnel are in practice, these need to be made more meaningful and participatory. Additionally, good work can be expected only if it entails good remuneration. The current pay structure needs revision, with incentives for exceptional performance, especially at the lower tiers.
91. *Setting food standards:* For a risk based approach to food safety, a critical step in the reform pertains to setting food standards. Although the BFSA has initiated the process of harmonizing limits and standards with Codex Alimentarius, not much headway has been made. There is an urgent need to accelerate this process as food producers and processors are not guided properly in the absence of precise information on permissible limits and residues. Enterprises with good intentions of compliance to food safety rules sometimes get in the red due to lack of specifications.
92. *Enhancing image of enforcement agencies:* The public administrators need to boost the confidence that the general public has in their activities. Inactivity and inconsistency on the part of the concerned authorities have led the masses to hold the former in low-esteem. In the

recent incident, where 52 food items were declared adulterated by the BSTI, the suspension of 26 of the ‘defaulting’ companies was withdrawn in less than a month because they had ‘managed to ensure the required standards’ (Dhaka Tribune, 11 June 2019). The highest certification for food safety, HACCP, has been obtained by a few food processing companies in Bangladesh. Interestingly, the products of some of those companies was also in the substandard items list. Such incidents weaken credibility for the law enforcers and regulators.

Investments and upgrades in infrastructure

93. *Investments and upgrades in processing, storage and distribution infrastructure:* A transformation in agri-food systems is leading to value chains which are longer, as the distances between the producer points and the final consumers are increasing. Modern value chains, which involve an aggregation of foods for transportation, storage and processing are very few in Bangladesh. This is a major hindrance to producers, who have no option but to resort to the use of indigenous, unproven techniques and other contaminants including the uninformed use of chemical contaminants to prolong the onset of decay. The presence of middlemen aggravates the situation. Investments in modern cold-holding transport, appropriate processing and chilling facilities as well as cold storage amenities are essential. In the absence of these, huge quantities of vegetables and fruits, which have prolific growth in Bangladesh, either perish or are deliberately tampered with to prevent rot. Thus, investment in supply chain infrastructure are crucial to enhance both the availability and overall safety of nutritious food. Such investments need private participation as well, to maximize reach. This calls for providing conditions conducive to business in the country. It may be noted that the Doing Business Report 2019 of the World Bank ranks Bangladesh the lowest amongst the South Asian nations in terms of ease of doing business (World Bank, 2019).

94. *Modernization and expansion of laboratory testing and research facilities:* Some recent initiatives by the government towards augmenting laboratory testing facilities of food samples have taken place in Bangladesh that include opening of the modern National Food Safety Laboratory, establishment of the Bangladesh Food Safety Laboratory Network (comprising of more than 20 food analysis laboratories all over the country), and upgrading of existing laboratory facilities. Although these developments have somewhat eased the crisis of food analysis and testing facilities, limitations posed by inadequate equipment still exist.

Increasing food safety awareness and generation of a sound data base on food quality

95. *Building knowledge through awareness campaigns and education:* Increasing awareness about the critical importance of consuming safe food, through comprehensive awareness campaigns can be an effective measure to stimulate public conscience and, thus, create a demand-driven check on the availability of hazardous food. Such campaigns should include imparting practical knowledge about the different ways in which food can get contaminated. Inculcating food safety lessons in school and college curricula is recommended as a long-term measure. Moreover, integrating food safety awareness in existing and well-evidenced nutrition BCC campaigns is an immediate opportunity. Intentional food adulteration for profit motives, which has taken alarming proportions, has much to do with an individual’s principles and ethics. This, combined with informed knowledge on food safety, should make the regulatory efforts easier to achieve their objective.

96. Generation of comprehensive, credible and high-resolution data on food quality: Strategies for ensuring food quality³ need to be based on solid, empirical data rather than on pockets of incidents and anecdotal evidence. Generating a volume of science-based data on food safety is not only a mammoth task but a complicated and resource-intensive one as well. That said, the frequency and spread of occurrences relating to unsafe food in Bangladesh, demands a thorough inquiry into the extent of the problem. The data that exists at present is fragmented, incomplete and, sometimes, even conflicting. For instance, a study on human health risk of chromium intake from consumption of poultry products in Dhaka, did not find excessive chromium levels in any of the samples, which meant no potential health risks to consumers (Hossain et al., 2017). This is contrary to the popular belief and media reports that chicken meat and eggs have excessive levels of chromium which bear adverse consequences for human health. A nation-wide repository of data needs to be created through surveillance and monitoring programs.

Change in modus operandi and imposition of tough penalties

- 97. Change in mode of enforcement:* The current mode of enforcement to food safety standards is basically through random spot checks of food facilities, food testing (usually following consumer grievances or during the fasting month of *Ramadan*) and a system of punitive measures for malpractice and violation of food norms. This corrective model of end-product testing is conspicuous and holds appeal amongst the general public, media, and therefore decision makers. However, it may not be very effective in securing consumer confidence. A comprehensive approach which takes into account all the stages in the production process would be a more result-oriented one. Implementing codes of practices such as good agriculture practices (GAP), good aquaculture practices and veterinary practices would ensure safety at the primary production level. The Department of Agriculture Extension already has some programs that incorporates variants of these practices such as the Integrated Crop Management (ICM) programme aimed at developing awareness and judicious use of pesticides and fertilizers among farmers. What is needed is the institutionalization of these practices. Other practices such as establishing GMP leading to a HACCP certification are recommended for stages further along the production chain. Such an approach would be a preventive one in which risks are managed or minimized.
- 98. Tough measures for defaulters:* The punitive measures that currently exist for food fraud are too lenient and are not successful in deterring defaulters from repeating the fraud. Jail term for food adulteration is rare in Bangladesh. In most cases, defaulters are able to evade facing any penalty and, in cases where they are fined, the perpetrators soon return to their unscrupulous activities, often in full knowledge of law enforcers. A sincere effort must be made to stop this trend. The regulators must take full cognizance of Bangladesh's poor performance on account of Transparency International's CPI. An inflexible law, coupled with exemplary punishments, should be lasting lessons for food related crimes, just as it worked in China in the melamine in milk powder case.

³ Food quality is a broader concept which encompasses food safety, nutritional adequacy, and diversity of food.

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Annex A. Methodological framework for the estimation of expenditure and demand elasticities

To estimate the elasticities, the study uses Quadratic Almost Ideal Demand System (QUAIDS). The QUAIDS, an extension to former Almost Ideal Demand System (AIDS) developed by Deaton & Muellbauer (1980)⁴. Banks, Blundell, and Lewbel (1997)⁵ proposes an extension of the model that allows for non-linear Engel curves. The additional feature of the QUAIDS is that it adds a quadratic term of expenditure to the system. They show that expenditure share equations quadratic in the logarithmic of total expenditure sufficiently approximate the Engel relationship in microdata. The QUAIDS is based on the following indirect utility function.

$$\ln V(p, m) = \left[\left\{ \frac{\ln m - \ln a(p)}{b(p)} \right\}^{-1} + \lambda(p) \right]^{-1}$$

where m is the expenditure, p is the vector of prices, and z is the vector of household and demographic characteristics. The $a(p, z)$, $b(p, z)$ and $\lambda(p)$ are nonlinear price aggregators defined in the following manners.

$$a(p) = \alpha_0 + \sum_{i=1}^k \alpha_i \ln p_i + \frac{1}{2} \sum_{i=1}^k \sum_{j=1}^k \gamma_{ij} \ln p_i p_j$$

$$b(p) = \prod_{i=1}^k p_i^{\beta_i}$$

and

$$\lambda(p) = \sum_{i=1}^k \lambda_i \ln p_i$$

Adding up, homogeneity, and Slutsky symmetry require that

$$\sum_{i=1}^k \alpha_i = 1, \sum_{i=1}^k \beta_i = 0, \sum_{i=1}^k \gamma_{ij} = \sum_{j=1}^k \gamma_{ij} = 0, \sum_{i=1}^k \lambda_i = 0 \text{ and } \gamma_{ij} = \gamma_{ji}$$

Applying Roy's identity to the indirect utility function ([eq:indi_V]), it is possible to derive the expenditure share equation for group i .

$$w_i = \alpha_i + \sum_{j=1}^k \gamma_{ij} p_j + \beta_i \ln \frac{m}{a(p)} + \frac{\lambda_i}{a(p)} \left[\ln \frac{m}{a(p)} \right]^2, \quad i = 1, \dots, k$$

⁴ Deaton, Angus, and John Muellbauer. "An almost ideal demand system." The American economic review 70.3 (1980): 312-326.

⁵ Banks, James, Richard Blundell, and Arthur Lewbel. "Quadratic Engel curves and consumer demand." Review of Economics and statistics 79.4 (1997): 527-539.

When $\lambda_i = 0$, the quadratic term drops out and QUAIDS reduces to AIDS. As Banks et al (1997) point out, demographic and other household characteristics can enter all terms in the expenditure share equations.

From equation ([eq:exp]) expenditure, uncompensated and compensated price elasticities as follows.

The expenditure elasticity for good i :

$$\varepsilon_i^e = 1 + \frac{1}{w_i} \left(\beta_i + \frac{2\lambda_i}{b(p)} \left[\ln \frac{m}{b(p)} \right] \right)$$

The uncompensated price elasticity of good i with respect to the price of good j :

$$\varepsilon_{ij}^u = -\delta_{ij} + \frac{1}{w_i} \left(\gamma_{ij} - \left(\beta_i + \frac{2\lambda_i}{b(p)} \left[\ln \frac{m}{b(p)} \right] \right) \left(\alpha_i + \sum_{l=1}^k \gamma_{jl} p_l \right) - \frac{\lambda_i \beta_j}{b(p)} \left[\ln \frac{m}{a(p)} \right]^2 \right)$$

where δ_{ij} is the Kronecker delta.

The compensated price elasticity of good i with respect to the price of good j :

$$\varepsilon_{ij}^c = \varepsilon_{ij}^u + \varepsilon_i^e w_j$$

These elasticities for a given year can be used to explain short term changes in consumption behavior. To address the longer term (medium and long term) changes in diet, elasticity measures from various survey periods can be used.

Data

The current study utilizes 4 rounds of Household Income and Expenditure (HIES) data collected from 2000 to 2016 by the Bangladesh Bureau of Statistics (BBS). The surveys collect data on the quantity of consumption goods and monetary value of those quantities. The quantities and values are used to calculate the prices of individual items. The survey collects data on seventeen food categories including 'dining out' as a separate category. The different items in these seventeen categories are then merged into twelve categories mostly following the household dietary diversity classification (Swindale and Bilinsky, 2006)⁶.

Table A1 Compensated own price elasticities of demand for food.

Food category	National	Poor	Rich	Rural	Urban
Cereals	-0.521*** (0.005)	-0.432*** (0.010)	-0.667*** (0.013)	-0.499*** (0.007)	-0.576*** (0.009)

⁶ Swindale, Anne, and Paula Bilinsky. "Household dietary diversity score (HDDS) for measurement of household food access: indicator guide." Washington, DC: Food and Nutrition Technical Assistance Project, Academy for Educational Development (2006).

	-0.469***	-0.515***	-0.453***	-0.502***	-0.470***
White tubers and roots	(0.011)	(0.021)	(0.030)	(0.013)	(0.019)
Vegetables	-0.842***	-0.787***	-0.880***	-0.852***	-0.812***
	(0.006)	(0.011)	(0.014)	(0.007)	(0.011)
Fruits	-0.904***	-1.193***	-0.696***	-0.944***	-0.792***
	(0.012)	(0.031)	(0.018)	(0.015)	(0.020)
Meat	-0.192***	-0.604***	0.002	-0.112***	-0.278***
	(0.014)	(0.040)	(0.019)	(0.018)	(0.020)
Eggs	-0.871***	-0.653***	-1.035***	-0.865***	-0.883***
	(0.031)	(0.075)	(0.057)	(0.038)	(0.053)
Fish	-0.435***	-0.579***	-0.351***	-0.461***	-0.355***
	(0.006)	(0.017)	(0.011)	(0.009)	(0.010)
Legumes- nuts and seeds	-0.773***	-0.737***	-0.915***	-0.829***	-0.758***
	(0.016)	(0.034)	(0.035)	(0.020)	(0.030)
Milk and dairy products	-1.151***	-1.397***	-1.047***	-1.132***	-1.150***
	(0.014)	(0.045)	(0.017)	(0.016)	(0.022)
Oil & Fats	-0.455***	-0.413***	-0.565***	-0.473***	-0.416***
	(0.014)	(0.026)	(0.039)	(0.016)	(0.026)
Sweets	-0.779***	-0.894***	-0.660***	-0.778***	-0.769***
	(0.007)	(0.018)	(0.011)	(0.008)	(0.012)
Spices & other food items	-1.104***	-1.008***	-1.144***	-1.067***	-1.165***
	(0.004)	(0.009)	(0.008)	(0.006)	(0.009)

Table A2: Uncompensated and compensated price elasticities of demand for food: 2000-2016

	2000		2005		2010		2016	
	Uncompensate d	Compensated	Uncompensate d	Compensate d	Uncompensate d	Compensate d	Uncompensate d	Compensate d
Cereals	-0.871*** (0.009)	-0.534*** (0.009)	-0.836*** (0.012)	-0.498*** (0.011)	-0.871*** (0.009)	-0.534*** (0.009)	-0.744*** (0.005)	-0.521*** (0.005)
White tubers and roots	-0.932*** (0.029)	-0.907*** (0.029)	-0.765*** (0.022)	-0.745*** (0.022)	-0.932*** (0.029)	-0.907*** (0.029)	-0.490*** (0.011)	-0.469*** (0.011)
Vegetables	-1.030*** (0.016)	-0.965*** (0.016)	-0.904*** (0.013)	-0.828*** (0.013)	-1.030*** (0.016)	-0.965*** (0.016)	-0.923*** (0.006)	-0.842*** (0.006)
Fruits	-1.320*** (0.034)	-1.274*** (0.034)	-1.292*** (0.031)	-1.243*** (0.031)	-1.320*** (0.034)	-1.274*** (0.034)	-0.957*** (0.012)	-0.904*** (0.012)
Meat	-1.684*** (0.088)	-1.578*** (0.088)	-1.666*** (0.093)	-1.558*** (0.093)	-1.684*** (0.088)	-1.578*** (0.088)	-0.342*** (0.014)	-0.192*** (0.014)
Eggs	-0.760*** (0.091)	-0.744*** (0.091)	-1.314*** (0.098)	-1.301*** (0.098)	-0.760*** (0.091)	-0.744*** (0.091)	-0.891*** (0.031)	-0.871*** (0.031)
Fish	-0.772*** (0.020)	-0.645*** (0.019)	-0.586*** (0.017)	-0.463*** (0.017)	-0.772*** (0.020)	-0.645*** (0.019)	-0.609*** (0.007)	-0.435*** (0.006)
Legumes- nuts and seeds	-0.942*** (0.027)	-0.918*** (0.027)	-0.974*** (0.029)	-0.949*** (0.029)	-0.942*** (0.027)	-0.918*** (0.027)	-0.800*** (0.016)	-0.773*** (0.016)
Milk and milk products	-1.257*** (0.030)	-1.207*** (0.030)	-1.249*** (0.027)	-1.206*** (0.027)	-1.257*** (0.027)	-1.207*** (0.030)	-1.188*** (0.014)	-1.151*** (0.014)
Oil & Fats	-0.678*** (0.019)	-0.643*** (0.019)	-0.871*** (0.022)	-0.833*** (0.022)	-0.678*** (0.019)	-0.643*** (0.019)	-0.495*** (0.014)	-0.455*** (0.014)
Sweets	-0.919*** (0.019)	-0.884*** (0.019)	-0.742*** (0.022)	-0.710*** (0.022)	-0.919*** (0.019)	-0.884*** (0.019)	-0.809*** (0.014)	-0.779*** (0.014)
Spices & other food items	-1.215*** (0.019)	-1.081*** (0.019)	-1.229*** (0.016)	-1.092*** (0.016)	-1.215*** (0.019)	-1.081*** (0.019)	-1.250*** (0.007)	-1.104*** (0.007)

(0.009)	(0.009)	(0.009)	(0.010)	(0.009)	(0.009)	(0.004)	(0.004)
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Notes: 1. Household characteristics included are household size, share of female in the household, share of children (5 years or less) in the household, share of members with 5 or more years of schooling, cultivable land ownership of the household, and division fixed effects.

2. Standard errors are in parenthesis

3. ***, ** and * represent significance at 1%, 5% and 10%, respectively

Annex B. List of existing regulatory framework on food safety in Bangladesh

Penal Code, 1860
Control of Essential Commodities Act, 1956
Food (Special Courts) Act, 1956
The Animals Slaughter (Restriction) and Meat Control Act, 1957
Pure Food Ordinance, 1959
Agricultural Pest Ordinance, 1962
Cantonments Pure Food Act, 1966
Pesticide Ordinance, 1971
Special Powers Act, 1974
Fish and Fish Products (Inspection and Control) Ordinance, 1983
The Breast-Milk Substitutes (Regulation of Marketing) Ordinance, 1984
Bangladesh Standards and Testing Institution Ordinance, 1985
Radiation Protection Act, 1987
Iodine Deficiency Disorders Control Act 1989
Atomic Safety and Radiation Control Act, 1993
Fish and Fish Product (Inspection and Quality Control) Rules, 1997
The Livestock Disease Act, 2005
The Livestock and Livestock Product Quarantine Act, 2005
Consumers Rights Protection Act 2009
Mobile Court Act, 2009
Fish Feed and Animal Feed Act, 2010
Safe Food Act, 2013
Pesticides Act, 2018