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Per capita rice consumption in Bangladesh

Available estimates and IFPRI's validation survey results

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ACRONYMS AND ABBREVIATIONS

BBS	Bangladesh Bureau of Statistics
BIDS	Bangladesh Institute of Development Studies
BIHS	Bangladesh Integrated Household Survey
CAPI	Computer-Assisted Personal Interview
DSGD	Development Strategy and Governance Division
FPMC	Food Planning and Monitoring Committee
FPMU	Food Planning and Monitoring Unit
FtF	Feed the Future
HIES	Household Income and Expenditure Survey
IFPRI	International Food Policy Research Institute
IFPRP	Integrated Food Policy Research Program
JV	IFPRI-led Joint Venture
LA/AIDS	Linear Approximated Almost Ideal Demand System
MFSP	Modern Food Storage Facilities Project
PD	Project Director
PMU	Project Management Unit
UIUC	University of Illinois at Urbana-Champaign
USAID	United States Agency for International Development

CHAPTER 1. INTRODUCTION

1.1 Background

Reliable estimates of staple food availability are critical to designing effective food policy in developing countries. All food security programs—strategic food reserves, local procurement, emergency food assistance, distribution through safety net programs—rely on the food availability estimates for strategic planning (Jayne and Rashid, 2010). These estimates also have important implications for the private sectors, as their imports depend on government's decision on setting import and export tariffs. Yet, generating accurate estimates of food availability—particularly, its components like production, consumption, stocks, etc.—has remained a challenge for both emerging and developing countries of Asia and Africa.

Bangladesh is no exception. In fact, it has been a puzzle in the country: if official estimates of all components of cereal availability (rice and wheat) are considered, the country should have had surpluses in recent years, yet the country consistently imported large volumes of wheat, and occasionally imported rice. According to available import statistics between July 2012 and June 2017, annual wheat and rice imports to Bangladesh averaged 3.6 and 0.5 million metric tons, respectively. This has important implications for price stability and public policies as the country witnessed during the recent rice price hikes. Therefore, there is growing interest in improving the accuracy of estimates of cereal availability. However, resolving this puzzle is not an easy task. Five out of the six components of cereal availability (production; consumption; carry-over stocks; seed, feed, and wastage; net exports; and population) are based on estimates and the only component on which there is hard data is net official exports. Generating these estimates requires large scale surveys, such as Household Income Expenditure Survey (HIES), which the Bangladesh Bureau of Statistics (BBS) carries out periodically.

However, these estimates have often been challenged. Specifically, it is argued that the BBS estimates of per capita consumption of cereals are underestimated, as they do not adequately account for the consumption of food items processed with rice or wheat. On the other hand, the basis of using 489 grams per capita daily intake by the FPMU appears to lack sound empirical justification. It was learned that this figure underwent revisions a few times over the years on an apparent ad hoc basis without any support of credible empirical research findings. This ad hoc practice might have introduced biases although the direction cannot be ascertained a priori. It may be noted that the existing practice of FPMU's use of 489 grams per capita daily intake and the recommendations by Murshid et al. (2008) based on basal metabolic rate and physical activity level that determine the minimum requirement of food varieties for maintaining nutritiously balanced diet are at variance. Therefore, policy makers within different agencies of the government take these estimates with caution. This is evident from the fact that the Food Planning and Monitoring Committee (FPMC)—the highest food policy making body—decided to launch a validation study through the IFPRI-Led JV under Modern Food Storage Facilities Project (MFSP).

This report is the output of that request. It has undertaken two tasks: (a) conducted a survey on a sub-sample of households originally included in the Bangladesh Integrated Household Survey (BIHS) by the International Food Policy Research Institute (IFPRI) to estimate per capita daily consumption of rice; and (b) contrasted these estimates with the ones from other important sources to check for the reliability.

1.2 Objectives and Research Questions

As stated earlier, resolving the puzzle about cereal availability estimates is a difficult task, and is in fact beyond the scope of this report. Thus, this note will only shed light on the estimates of per capita daily

consumption that are available from different published and unpublished sources alongside the ones found from a small survey that the IFPRI-led JV has conducted in the summer of 2018. This survey is essentially a validation exercise to examine how per capita consumption estimates change if new elements that were absent in previous surveys are incorporated. In doing so, we made informed inferences about reliability of alternative estimates. Thus, the report has addressed the following questions:

- What can one learn from the available literature regarding the per capita daily consumption of rice from published and unpublished sources? How consistent are these estimates with the overall growth and change in consumption patterns postulated by economic theories? and
- What are the critical factors that ought to be considered in improving the per capita consumption estimates for informed policy making?

1.3 Organization of the Report

The report is organized as follows. After this introductory Chapter, a synthesized overview of the available recent estimates is presented in Chapter 2, which includes discussions on the estimates from the HIES, BIHS, and BIDS. The chapter sets the context in which validation survey was launched. Chapter 3 presents the approaches, methods, and results of the IFPRI-Led JV's validation survey. This chapter also discusses validation survey results in light of earlier estimates. The report ends with a summary and implications.

CHAPTER 2. OVERVIEW OF THE AVAILABLE ESTIMATES

The policy makers mainly use two available estimates of per capita food grains consumption: (i) per capita consumption generated from the Household Income and Expenditure Survey (HIES) of the Bangladesh Bureau of Statistics (BBS) and (ii) the normative daily requirement of 489 grams as recommended by the Food Planning and Monitoring Unit (FPMU) of the Ministry of Food. There has been a recurrent debate over the accuracy of these estimates of per capita consumption of food grains, especially that of rice, as it has proved difficult to reconcile these estimates. The central premise of the debate is that (a) the estimates are not based on surveys that do adequately cover rice and rice products and (b) that they do not track the historical behaviors of the agents in the food market. While the BBS and other research agencies included in this review strive to comply with the first component, there is hardly any attempt except Yunus et al. (2012) to verify the reliability of the estimates based on the records of public and private stocks, public and private imports, public procurements and distribution, etc. The following sections critically review the coverage of rice and items made thereof in different surveys.

2.1 BBS Estimates

Since 2000, the BBS has been conducting the HIES every five years. This survey generates estimates of per capita daily intake of rice and wheat along with other food items. The BBS estimates of per capita daily consumption of rice and rice products are based on a large-scale survey on quantities and expenditures on food items by rural and urban households on a period of 15 consecutive days. The survey is conducted at various months of the year in different regions to account for potential spatiality and seasonality in consumption.

The estimates of per capita daily consumption of rice are reported in Table 2.1 together with wheat for reference. The per capita consumption of rice declined from 459 grams in 2000 to 440 grams in 2005 and further to 416 grams in 2010; the decline was sharp since then to 367 grams in 2016. These estimates imply that the per capita rice consumption has declined by about 1 percent p.a. between 2000 and 2010; and by more than 2 percent p.a. in the next six years. The national trends reflect somewhat opposite trends in changes in consumption in rural and urban areas. In rural areas the decline was accelerated from less than 1 percent p.a. during the first decade to more 2 percent p.a. in recent in years. The pattern is uneven in the urban areas: stagnancy during 2000-2005, accelerated decline of about 2 percent p.a. during 2005-2010 but tapered decline at about 1 percent p.a. in recent years. In contrast, the per capita consumption of wheat shows a downward trend between 2000 and 2005, an upward trend during the next 5 years and to reverse to downward trend during recent 6 years.

Table 2.1 Per capita daily food grains consumption from HIES

(in grams)

Year	Type	Rural	Urban	National
2000	Rice	478.8	377.7	458.5
	Wheat	14.0	30.1	17.2
2005	Rice	459.7	378.5	439.6
	Wheat	8.0	24.5	12.1
2010	Rice	441.6	344.2	416.0
	Wheat	23.3	33.6	26.0
2016	Rice	386.1	316.7	367.2
	Wheat	17.4	26.2	19.8

Sources: BBS, 2001, 2007, 2011, and 2017

However, the estimates have been argued to be biased downward due to the failure to account for the changes in consumption behavior. For example, even though the BBS considers several items consumed by the households, the coverage of food grains and items made thereof appears to be rather parsimonious: it considers only 12 items including sweetmeat. Besides, BBS' coverage of food items made of rice and wheat consumed outside home does not seem to be comprehensive. Consequently, the parsimonious inclusion of items made of food grains at home and less than adequate emphasis on consumption of items made of food grains outside home may introduce an inherent downward bias in the estimates of per capita consumption.

2.2 BIDS Estimates

As an effort to assess the accuracy of food demand and supply estimates of Bangladesh, BIDS independently estimated per capita consumption of food grains along with supply side parameters of production, seed, feed, and wastage, and private stocks based on a sample of 2,000 rural households divided in 6 clusters across 10 districts, 500 urban households from Chattogram, Dhaka, and Rajshahi distributed across poor and rich areas within the cities. Consumption of food grains along with other food items were collected based on a 7-day recall. Since several items made of rice and wheat along with other food items cannot be directed added into either group, Yunus et al. (2012) took a novel approach as follows: (i) A comprehensive list of food grain items that are consumed at both home and outside home is considered. As many as 36 items including different size (small, medium, and large) of the same items were included in their survey compared to only 12 items including sweetmeat items that were included in the HIES, 2010. (ii) Items made of rice and

wheat have been converted into ideal content of rice and wheat by surveying a sample of bakers and restaurants.

With the rise of income and income-generating activities, eating out has now become more common than before. Despite the challenges of accurate data gathering, the survey collected data on consumption of rice and wheat and items made thereof both at home and outside home. Since some of the food items contain other edible ingredients apart from rice and/or wheat, item-specific average conversion factors were estimated based on the survey of bakers and restaurants. The item specific average conversion factors reported in Table A.1 in Appendix-A were applied to derive the ideal content amount of rice and wheat from items made thereof and consumed by the households.

Table 2.2 presents the estimation results for 2012. Results for 2016 were extracted from Hossain and Yunus (2016), who projected the estimates for several years including 2016 based on the estimated parameters of the Linear Approximation of Almost Ideal Demand System (LA/AIDS) model proposed by Deaton and Muellbauer (1980). It may be noted that Hossain and Yunus (2016) provided estimates individually for poor and non-poor both in rural and urban areas. These estimated were averaged using rural and urban headcount poverty rates of 2016 published by the BBS.

Table 2.2 BIDS estimates of per capita daily consumption of food grains

(in grams)

Year	Type	Rural	Urban	National
2012	Rice	538.7	257.6	469.0
	Wheat	27.5	84.3	41.6
2016 (Projected)	Rice	540.5	249.5	459.4
	Wheat	23.8	89.0	41.5

Sources: Yunus et al. (2012) and Hossain and Yunus (2016)

Daily per capita consumption of rice and wheat together was estimated at 510.6 grams, with rice and wheat accounting for 469.0 grams and 41.6 grams, respectively. As may be expected, per capita consumption of rice is relatively higher in rural areas than in urban areas, while that of wheat intake is substantially higher in urban areas. However, the total cereal consumption still appears to be higher in the rural areas. Their findings show that items made of rice contributes to be as much as 12.7 grams in the per capita daily consumption of rice. Further, consumption outside home contributes to as much as 9.2 grams of rice and 21.5 grams of wheat in the per capita daily consumption.

Projections by Hossain and Yunus (2016) imply that per capita consumption of rice decreases over the years both in rural and urban areas, albeit marginally. The per capita consumption of rice projected to decline from 469 grams in 2012 to 459 grams in 2016. This translates to annual decline in per capita rice consumption by about half a percentage point during 2012-2016. The consumption of wheat appeared to remain sticky at 42 grams during the period. The slow decline in rice consumption is due to two countervailing force: 0.1 percent p.a. growth in rural rice consumption and 0.8 percent p.a. decline in urban consumption. Similarly, there appeared to be opposing trends in wheat consumption in rural and urban areas, which resulted in unchanged per capita consumption at the national level.

2.3 IFPRI-BIHS Estimates

IFPRI has been implementing a nationally representative panel survey, called Bangladesh Integrated Household Survey (BIHS), since 2012. The first round of the survey, conducted in 2012, was based on a sample of 6,500 rural households in 64 districts. The second round of the survey, conducted in 2016, included an additional 2,215 households to assess the Feed the Future program (FtF) of the USAID. This survey is the first integrated survey of its kind as it contains data on a wide range of variables. It presents per capita daily consumption of rice and wheat estimated from a 7-day recall data on a range of consumption items. Note that rural per capita consumption of rice declined from 496 grams in 2012 to 448 grams in 2016, which means per capita consumption declines by 2.5 percent per annum—a rate very similar to HIES.

While BIHS is very carefully done survey, it does not include samples from the urban areas. Therefore, one needs to come up with alternative method to generate those estimates so as to compare with other estimates. One way is to use parameters from surveys that include both urban and rural samples and the only survey that satisfies that criterion is the HIESs. Assuming errors of measurement are systematic, one can use the rural-urban, and rural-national proportions of HIES in the nearest year to extrapolate the urban and hence the national estimates from any rural representative sample survey estimates. Making necessary adjustments with this method, BIHS estimates imply a decline in per capita daily rice consumption from 386 grams to 367 grams in the urban area between 2012 and 2016. The national level per capita daily consumption of rice declines from 467 grams to 426 grams during the same period (Table 2.3).

Table 2.3 Per capita daily consumption of food grains: IFPRI-BIHS

(in grams)

Year	Type	Rural [a]	Urban [b]	National [c]
2012	Rice	495.5	386.2	466.8
	Wheat	21.0	30.3	23.4
2016	Rice	447.8	367.3	425.9
	Wheat	29.4	44.3	33.5

Sources: a. IFPRI-BIHS Surveys, 2012, and 2016.
b & c. Based on rural estimates in column a and ratios of urban to rural and national to rural intakes from BBS, 2017.

Part of the decline in rice consumption was offset by increase in wheat consumption 21 grams to 29 grams in the rural area, from 30 grams to 44 grams in the urban area. Consequently, the national per capita consumption of wheat increased from 23 grams to 34 grams during the same period. The positive change in the consumption of wheat counteracted the decline in rice consumption, so that cereal consumption declined at a slower rate of 1.2 percent per annum during the same period.

CHAPTER 3. THE IFPRI VALIDATION SURVEY

3.1 The Issues and Approaches

In almost all countries in the world, national household surveys include food consumption modules. The HIES has been implementing this module for decades. However, some recent estimates from other household surveys—notably by IFPRI and BIDS—have generated estimates that are at odds with the HIES estimates. Besides, in recent years the consumption estimates did not balance with the other estimates such as production, imports, and population. This study hypothesizes that the reasons for such differences might be due the fact that changes in the consumption behaviors with years of economic growth have not been captured in the old surveys. Thus, we approached the problem as a validation exercise. A new small survey was conducted paying attentions to the details of sources and places of food consumption by members of the households for estimating per capita daily consumption. It also included insights from household members, consumption of rice and wheat products (both inside and outside home), the quantity of paddy/rice stored for future consumption, as well as detailed questions on seed, feed, and wastage. While the survey observes numerous aspects of a household, this report solely focuses on rice consumption aspects of households and how they relate to other surveys that observe similar consumption characteristics.

3.2 Design and Implementation of Validation Survey

This study is a practical successor to previous similar household surveys conducted in Bangladesh, such as the Household Income and Expenditure Survey (HIES) by the Bangladesh Bureau of Statistics (BBS), the Bangladesh Integrated Household Survey (BIHS) by IFPRI, and especially tailor-made surveys for estimating the per capita consumption of food grains by the Bangladesh Institute of Development Studies (BIDS). The survey design and implementation involved three main activities: (a) development and programming of survey instruments, (b) recruitment and training of enumerators, and (c) collection and analysis of data. Each of these activities is detailed below.

3.2.1 Survey Instrument

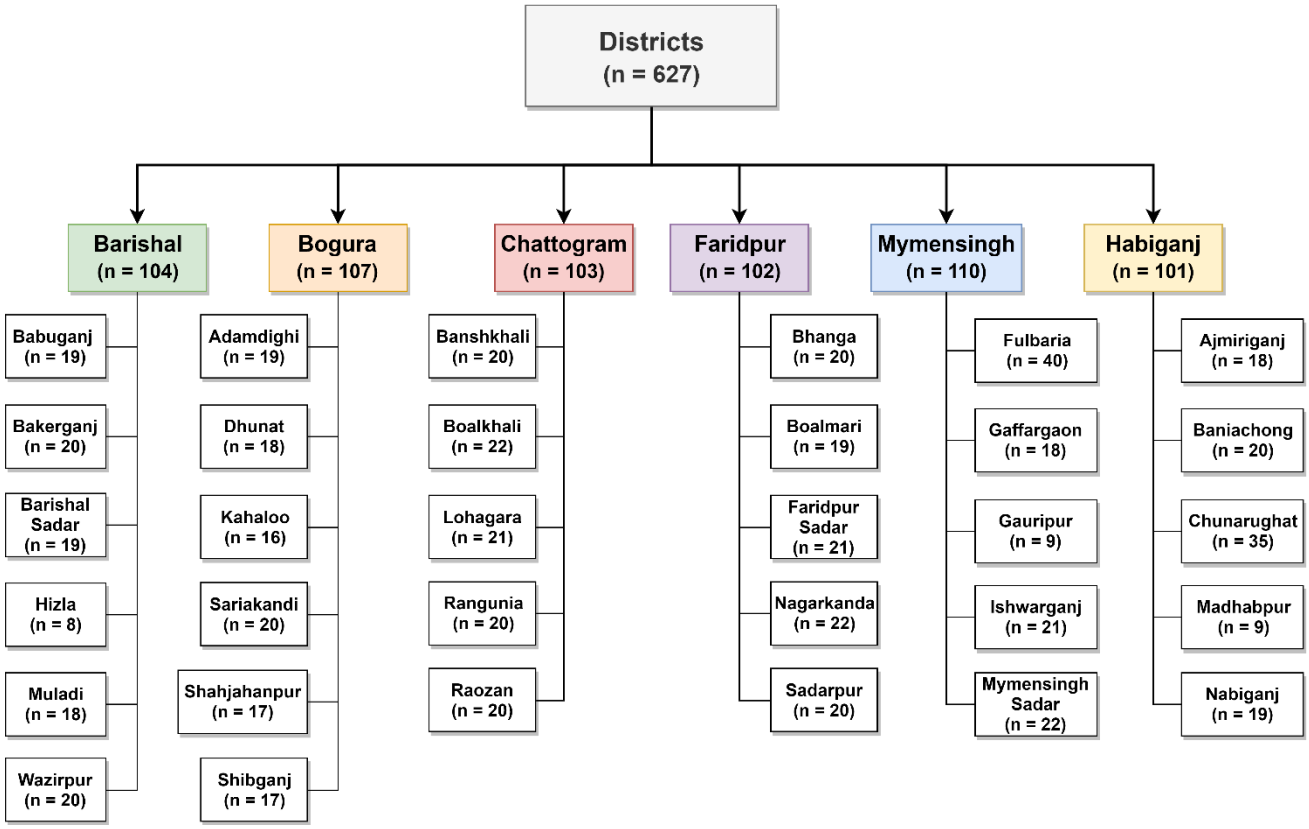
Several drafts of the questionnaire were developed and reviewed to come up with a final draft. The initial draft was used in the training of enumerators. Feedback from the training was used to develop a revised draft to be used for pre-testing. Issues identified during the pre-testing were then incorporated to develop the final questionnaire, with which the enumerators were sent to the field. Alongside the paper-based questionnaire, a customized Computer-Assisted Personal Interview (CAPI) form was developed using SurveyCTO for Android tablets. The CAPI form included skip logic and value constraints to minimize data entry error. During the training, the selected enumerators were trained to collect data using the Android tablets, and to upload the same onto a dedicated server for the study (at: https://bifprp.surveycto.com) on regular intervals.

3.2.2 Methodology of Data Generation

The sampling methodology of the study was designed with twin objectives of (a) working with a sub-sample of either BBS or BIDS or BIHS and obtaining a large enough sub-sample that would permit estimates of per capita consumption of food grains, especially rice. Unfortunately, the sample frame of the BBS could not be accessed due to legal restrictions and that of the BIDS could not be traced. Therefore, the sampling frame of the validation survey included a sub-sample of the BIHS households. It may be noted that both the first and

the second rounds of the BIHS were conducted in all 64 districts to make the estimates nationally representative in the rural area. More than 6 thousand households were interviewed under the latest round of the BIHS. Given that the present study is a validation of the other nationally representative surveys including the BIHS, it had to mimic the methodologies adopted in these studies and to expand on other critical issues that BIHS might have missed out. It should be noted that many of consumers of food grains in the rural areas are also growers of rice and wheat. Even though the production of wheat appears to have increased marginally in recent years, rice is still the staple crop and therefore the main source of cereals. Thus, this validation exercise focuses mainly on consumption of rice and products made thereof. The northwest region appears to have higher production of rice, especially irrigated Boro. In contrast, Aman is a major crop in the northeast and a few other regions. With due consideration to statistical rigor and resource availability, 6 districts from the BIHS sample were selected that represented all major agroecology in the country (Figure 3.1).

Figure 3.1 Spatial distribution of the sample



From each of the upazilas, one village was selected and on average 20 households were interviewed in the selected villages. The present survey revisited a subset of those households. Following this method, a total of 627 households were interviewed for our validation survey. The household survey questionnaire was brief but paid detail attention to food consumption, especially rice.

The interview was conducted with an adult member of the household who appeared knowledgeable about all aspects of the information being solicited. When both the spouses were available, an attempt was made to ensure that both participated in the interview, either jointly or separately depending on their convenience.

3.2.3 Selection of Enumerators, Training, and Pre-testing

A total of 33 enumerators were selected in February 2018 through proper interview and grading process that consisted of educational qualifications, experience, and ability to use computer/tablet, communication skill, and personality, etc. The selected enumerators were asked to join the training event to be held at BIDS. The multi-day training was predominantly spent in thoroughly explaining the questionnaire to the enumerators. Moreover, the enumerators were introduced to the online data collection tool, SurveyCTO, and how to input data in the software. On the final day of the training, the paper and electronic versions of the questionnaire were updated, and final versions of the tools were shared with the enumerators. After a briefing on field operations, necessary logistics and tablets for data collection from the field were handed over to the enumerators.

3.3 Field Operations and Data Collection

Data collection was started immediately after the completion of training and was completed on the second week of May 2018, with a total duration of 2 months, using both paper-based instruments as well as electronic tablets. Enumerators entered data on to the pre-programmed Android tablets using SurveyCTO. Data were uploaded on regular intervals to a dedicated server for the study. Raw data thus uploaded were extracted periodically from the server to check for logical consistency and entry errors. Enumerators were also monitored on a regular basis through phone calls, and scheduled field visits.

3.4 The Validation Survey Estimates

To provide further insights into the data collected by IFPRI-BIHS, and to affirm the representativeness, a short survey was conducted on a sample of 627 households across 6 districts covered in the two rounds of the BIHS survey (Figure 3.1). Unlike the BIHS comprehensive survey that covered all food items household members consumed during the last 7 days prior to the interview, this short survey covered only consumption of rice and items made thereof by members of the households both at home and outside home during the last 7 days prior to the interview.

Table 3.2 Per capita daily consumption of rice: IFPRI Short-Survey

(in grams)

Year	Place of Consumption	Rural[a]	Urban[b]	National[c]
	At Home	402	-	-
2018	Outside Home	15	-	-
	Both at Home and Outside Home	417	342.0	396.6

Sources: a. IFPRI Short-Survey, 2018.
b & c. Based on rural estimates in column a and ratios of urban to rural and national to rural intakes from BBS, 2017.

Table 3.2 presents estimates of rural per capita consumption of rice both at home and outside home. It is found that rural households have an overall average per capita consumption of 417 grams of rice including products made thereof. Of these 417 grams, 402 grams are consumed at home and another 15 grams are consumed outside home. Insofar, the sample of this short-survey is a sub-sample of the BIHS, the changing trend in rice consumption in the rural area was found at 3.5 percent p.a. decline by comparing the 2016 BIHS

estimates and that found in the short-survey. Similar techniques were applied to extrapolate the per capita consumption in the urban areas and the country as whole. It was found that urban and national per capita rice consumption declined from 367 grams and 426 grams in 2016 to 342 grams and 397 grams in 2018.

3.5 Contrast between Validation Survey and Other Estimates

While the magnitudes of the estimates appear to vary, the trend in per capita consumption is consistent—that is, per capita consumption exhibits a declining trend. This is perfectly consistent with the economic theories. According to Bennett's law, [1] income growth leads to decline in expenditure on starchy staple food like rice and wheat. In other words, with income growth, consumers diversify their diets away from cereals, as they consume more meat, fish and other high value food. On the other hand, it is well documented that the *real* price of rice has also declined over the years, which can increase consumption for some section of the population. Given consistent economic growth and unprecedented poverty reduction, the overall per capita rice consumption is expected to decline. Although trends are consistent, the magnitudes of the level of consumption vary; and some estimates do not seem to be in conformity with the available production, trade, and population estimates. This is indeed a puzzle! The variances in estimates across the sources and the above puzzle beg the question "What is the most accurate level of per capita rice consumption in Bangladesh?"

Three key messages come out of the above analysis. *First*, the HIES 2005 and BIDS 2012 estimates of per capita rice consumption appear to be too high. The total national consumption (generated by multiplying the per capita consumption and the population) and total availability (carry-over stock, net production, and net import) were reconciled. BIHS and BIDS 2012 estimates each yields a negative net balance of 0.5 and 2.0 million metric tons of rice. If there was such level of shortage, the country would have felt it—prices would have gone up, government would have to intervene, and open market sales would have to be launched. Review of food in those two years reveals that none of these had happened.

Second, the HIES 2016 estimate of 386 grams of per capita rice consumption appears to be an underestimate, as it leads to about 6 million metric tons of surplus, if compared with the food balance. One possible cross check for this situation is the price hike following the flash flood in the northeastern part of Bangladesh in April 2017 that ensued the loss of about 1 million metric tons of rice production. If HIES estimates were right—that is, there was a surplus of over 6 million metric tons—this would not have happened, and the country would not have to import such a big volume of wheat and rice.

Finally, the estimates of the BIHS 2016 and that from 2018 validation survey generate positive net balance. The BIHS 2016 and IFPRI validation survey 2018 generate net balances of 2.4 and 3.5 million metric tons, respectively. These are clearly plausible estimates, as households always hold precautionary stocks.

[1] For details about Bennett's law, see Timmer, Falcon, and Pearson (1983).

CHAPTER 4. KEY FINDINGS AND IMPLICATIONS

This report is prepared in response to a request from the Food Planning and Monitoring Committee (FPMC), a cabinet-level committee that provides overall leadership and oversight in the formulation of food security and nutrition policies. Accurate estimates of per capita consumption are central to the construction of the food balance sheet, which in turn is an important tool in designing the food policy of a country. However, like other developing and emerging countries, estimates of per capita rice consumption in Bangladesh vary depending on the sources and survey methodology. A low per capita consumption estimate may imply a surplus in the food balance sheet, when the country is actually in a deficit. This has indeed been the case in Bangladesh. For instance, while 2016 HIES estimates implied a large surplus, the country had to import large volume of wheat and rice. Similarly, while estimates from HIES 2005 suggested a negative balance, there was no felt shortages in the country. So, these estimates have puzzled the policy makers—as reflected by the request from the FPMC—the top food policy making body in the country.

IFPRI and its partners in the Integrated Food Policy Research Program (IFPRP) adopted a two-step approach in implementing this study. It has critically reviewed the underlying survey instruments that generated the estimates and cross checked them with current consumption behaviors with rapid rural appraisal. Based on the inputs from the first step, a new survey instrument was designed to generate alternative estimates. One key added feature of the new survey was accounting for the consumption of rice and rice products outside home. The hypothesis was that not accounting for such consumption could lead to underestimation of per capita consumption. At the final step, a set of logical arguments was made to assess as to which of the estimates could track the demand supply balance of rice in the country.

4.1 Key Findings

The following are the key findings of the study:

- Estimates of per capita rice consumption vary widely depending on the source and the survey methodologies, but the long-term trend across all sources suggests that per capita consumption is declining over time.
- Estimates range from as high as 538 grams/day (BIDS, 2012) to as low as 386 grams/day (HIES, 2016) and many estimates in between. A key factor behind such a large variance appear to emerge from the failure to account for the changing consumption behavior in the country, especially consumption of rice and rice product both at home and outside home.
- A new survey accounting for outside consumption generate an estimate (417 grams/day) that is much larger than the one reported by the HIES 2016 (386 grams/day).
- Estimates from all sources (HIES, BIHS, and validation survey) generate estimates that are much smaller than the one used by the FPMU (489 grams/day).
- Based on the review, assessment of alternative estimates, and the validation survey, this study contends that the accurate per capita rice consumption estimates will be in within the near vicinity of the following: 417 grams for rural households, 328 grams for urban households, and 396 grams for the nation as a whole.

4.2 Implications

The results of this study have important policy implications. Some of them are as follows:

- Given the importance of the estimates for policy decision, and the fact that the estimates have high variances, it might be worthwhile to conduct small sample surveys on a periodic basis. These surveys should account for changing consumption behavior of the population with the same set of survey instruments.
- FPMU should reconsider using 489 grams/day/person in constructing the food balance sheet, as it is higher than most of the available estimates. Using this estimate has the potential pitfall of policy recommendation of higher imports when such imports may not be needed in reality.
- A national stakeholder consultation might be helpful to thoroughly discuss and review the issues and estimates presented in this report.

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APPENDIX - A. SUPPLEMENTARY TABLE

Table A.1 Conversion factors of items made of rice and wheat

A. Conversion of Items Made of Flour	
Food Item	**Number of items that can be prepared from 1 kg of flour**
Bread (Large)	2.3
Bread (Medium)	4.8
Bread (Small)	8.0
Bun (Large)	9.2
Bun (Medium)	13.5
Bun (Small)	17.0
Nun	12.2
Tandur	17.0
Roti	18.8
Chapati	15.2
Porata	19.0
Moglai	9.5
Samusa/Singara	36.7
Puri	35.2
Pitha	12.5
Food Item	**Flour content (gram)**
Biscuit (1 Pound)	292.5
Cake (1 Pound)	131.0
Patties	36.7
Pizza (Large)	94.9
Pizza (Small)	56.5
Jilapi (3 kg)	1000.0
Mishti (1 kg)	15.0
Nimki (1.5 kg)	1000.0
Goja (3 kg)	1000.0
B. Conversion of Items Made of Paddy/Rice	
Food Item	**Rice content (gram)**
Paddy to rice (1 kg paddy)	700.0
Rice to puffed rice and popcorn (1 kg rice)	860.0
Rice to khoi (1 kg rice)	930.0

Source: Yunus et al. (2012)

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