Note

Bangladesh Development Studies
Vol. XXXIX, March-June 2016, Nos. 1& 2

Estimates of Per Capita Consumption of Food Grains in Bangladesh

MONZUR HOSSAIN*
MOHAMMAD YUNUS*

It is generally argued that the estimates of per capita consumption of food grains in Bangladesh are grossly underestimated due to the failure of comprehensively taking into account the consumption of food items made of rice and wheat at home and outside. To give some insight into this debate, this study revisited the per capita consumption of food grains through a primary survey of a nationally representative sample in 2012 by considering a comprehensive list of 36 food grains items that are consumed at both home and outside. The findings of this study show that the per capita consumption of food grains estimated from the BIDS survey, 2012 is higher than that reported by the BBS estimates based on the HIES 2010. Using the LA/AIDS model, the projection shows that the demand for both rice and wheat will decrease in both rural and urban areas, albeit marginally. The estimated per capita consumption of rice and wheat, the price and income elasticities thereof, and the consequent projections can be used as instruments for the integrated and effective planning on food grains distribution and management in Bangladesh. Moreover, BBS and other organisations involved in foodgrain consumption estimates may consider the methodologies applied in this study in their future surveys and research studies.

Keywords: Food Grains Consumption, Income Elasticity, Own-price Elasticity, Cross-price Elasticity, LA/AIDS Model

JEL Classification: C53, D1, D12

I. INTRODUCTION

The policy makers and researchers mainly use two distinct estimates of per capita food grains consumption available in Bangladesh in their analyses: (i) per capita consumption as published in the Household Income and Expenditure Survey (HIES) conducted by the Bangladesh Bureau of Statistics (BBS), and (ii) the normative daily requirement of 489 grams as recommended by the Food

* The authors are Senior Research Fellows of BIDS.

Planning and Monitoring Unit (FPMU) of the Ministry of Food. However, the above estimates often face criticisms as these are inherently biased due to several reasons.

The BBS estimates are based on a large-scale survey on expenditures on food items by rural and urban households. However, the estimates of per capita food grains consumptions appear to be biased due to the inadequate focus on consumption aspects. For example, even though the BBS considers a large number of 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, the coverage of food items made of rice and wheat that are consumed outside home does not seem to be comprehensive. Consequently, the parsimonious inclusion of items made of food grains and less than adequate emphasis on the consumption of items made of food grains outside home may introduce an inherent downward bias in the estimates of per capita consumption of food grains from the HIES data. On the other hand, the basis of using 489 grams per person per day by the FPMU appears to lack sound empirical justification. It was learned that this figure underwent revisions a few times over the years apparently on an *ad hoc* basis without any support of credible empirical research findings. This *ad hoc* practice might have introduced biases as well although the direction cannot be ascertained *a priori*. It may be noted that the existing practice of the FPMU's use of 489 grams per person per day and the findings by Murshid *et al.* (2008) based on an extensive survey on basal metabolic rate and physical activity level are at a variant.

Thus, there might be biases in both the estimates of per capita consumption of food grains that are currently being used by the policy makers and researchers. As such, the issue of "correct estimates" of per capita consumption of food grains requires a closer look using rigorous empirical exercise. In view of these considerations, this note provides estimates of per capita daily consumption of food grains based on the primary data collected through a survey of respondents in May/June 2012.[1] The reliability of the estimates found thereof, however, needs validation using historical simulations over the last few years. Besides, since

[1]For six clusters of rice producing districts (defined in BIDS Study, 2012), a sample of 2,000 households have been randomly selected to make the sample nationally representative. In addition, from non-rice or less-rice producing areas including the urban areas, about 500 households were surveyed. Accordingly, Dhaka (300 households) and two more districts (100 households each) were purposively selected. Considering time and resources, 10 districts were selected from six clusters according to probability proportional to size (PPS) of rice production by districts (For details, see BIDS Study, 2012).

regular collection of such data is unlikely to be feasible due to, *inter alia*, physical and financial constraints, projections are necessary at least over the medium-term to estimate future consumption needs. Thus, this note aims to (i) estimate the per capita daily consumption of food grains (benchmark estimates), (ii) estimate the price and income elasticities of rice and wheat for poor and non-poor in both rural and urban areas; and (iii) make projections of the per capita daily consumption of rice and wheat for the poor and non-poor in both rural and urban areas up to 2020.

II. REVIEW OF RELEVANT LITERATURE

It appears from the HIES estimates that the average quantity of per capita daily consumption of food has changed over the years in Bangladesh. While the quantity of per capita daily consumption of food grains appears to have decreased in 2005 compared with 2000, it has increased for other food items. In contrast, the average quantity of per capita daily food consumption has increased between 2000 and 2010 nationally; it has increased from 893.1 grams in 2000 to 1,000 grams in 2010. In the cereal group, the per capita daily consumption was 464 grams in which the contribution of rice, wheat and other cereals were 416 grams, 26 grams, and 22 grams respectively in 2010. Even though the consumption of rice has declined, that of wheat has increased in 2010 compared with the 2005 estimates.

Many studies have been conducted in analysing the food demand system in Bangladesh despite constrained by data limitations. In earlier studies, the food demand system focused on only food grains, especially rice and wheat. Subsequently in the 1980s, a broader basket of food items were incorporated in the demand system analyses (Chowdhury 1982, Shahabuddin and Zohir 1995, and Murshid *et al.* 2008). Conventionally, the Almost Ideal Demand System (AIDS) model has been applied to estimate the own-price elasticity, cross-price elasticity and the income elasticity.

Mullah (2005) studied consumer demand behaviour in Bangladesh by using the Engel model and AIDS model for the HIES 2000 data. He estimated the expenditure elasticity for different food and non-food items. Huq and Arshad (2010) estimated demand elasticities for different food items by using AIDS model with corrected Stone Price Index based on HIES 2000 data. Their results suggest that the uncompensated own price elasticity for all food items except edible oil and spices are less than unity. Some other past studies also provided information on price and income (expenditure) elasticity for food and non-food items (see Sabur 1983, Talukder 1990, Islam 2002, Ali 2002, Huq, Alam and

Sabur 2004). Chowdhury (1982) estimated a complete consumer model, while Ahmed and Shams (1994) estimated a complete demand system for rural Bangladesh. Ferdous (1997) and Khanam and Ferdous (2000) analysed the food preference and consumer demand behaviour in Bangladesh. They found the expenditure elasticity for rice and wheat to be at 0.31 and 0.84 respectively.

The review in this section reveals that the linear approximate AIDS (LA/AIDS) has been a widely used model for estimating different elasticities to determine the demand system. Thus, the LA/AIDS model has also been applied in this exercise.

III. ESTIMATES OF PER CAPITA DAILY CONSUMPTION OF FOOD GRAINS

Given the *ad hoc* practice in applying the normative requirement and the inherent bias in the HIES data on per capita consumption of food grains, an alternative set of estimates is warranted that minimises the aforementioned biases to a possible extent. To obtain such improved estimates of food grains consumption, the following measures were taken:

(i) A comprehensive list of food grains items that are consumed at both home and outside is considered. It may be noted that only 12 items including sweetmeat items were considered to be consumed outside in the HIES 2010, whereas as many as 36 items including different sizes of the same items have been considered in the present exercise. For instance, information has been collected on three types of burgers—small, medium and large.

(ii) Items made of rice and wheat has been converted into actual amount of rice and wheat by surveying a number of bakers and restaurants.

With the rise of income, people now-a-days consume more outside home than before. Insofar as it is difficult to improve upon the estimates of the per capita food grains consumption without properly taking into account the consumption both at home and outside, data were collected on the consumption of rice and wheat and items made thereof both at home and outside. Since some of the food items contain other edible ingredients apart from rice and/or wheat, item-specific average conversion factors were estimated by surveying a number of bakers and restaurants. The item specific average conversion factors, reported in Table A.1, were applied to derive the actual amount of rice and wheat from items made thereof and consumed by the households.

The estimates of the per capita daily consumption of cereals (rice and wheat including the converted amount of rice and wheat from the items made of these

grains) are reported in Table I. Daily per capita consumption of cereals (rice and wheat) has been estimated at 510.5 grams, with consumption of rice and wheat at 468.9 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 the urban areas. The total cereal consumption appears to be higher in the rural areas.

The estimates of the per capita daily consumption of food grains in this study are higher than that of HIES 2010. One of the sources of difference between the two sets of estimates lies in the quantity of wheat consumption, particularly in the urban areas. The reasons may be that the present exercise has taken extra care to consider consumption of as many food items made of wheat as possible at both home and outside. In fact, the findings show that items made of rice contribute to as much as 12.6 grams in the per capita daily consumption of rice. Another strength of our consumption estimates is that it captures the consumption of food grains or items made thereof outside home at a comprehensive manner as our findings show that 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.

TABLE I
PER CAPITA DAILY CONSUMPTION OF FOOD GRAINS (RICE AND WHEAT)

(in grams)

	Authors' Estimates, 2012			HIES 2010 [2]		
	National	Rural	Urban	National	Rural	Urban
Cereals [a]	510.5	566.1	341.9	442.0	464.9	377.8
Rice	468.9	538.6	257.6	416.0	441.6	344.2
Wheat [b]	41.6	27.5	84.3	26.0	23.3	33.6

Note: a. It may be noted that the definition of "cereals" in this exercise, which comprises rice and wheat flour, differs from the one used by the BBS in its HIES which includes "all others" in addition. b. Wheat consumption in the analysis is actually wheat flour in order to make Authors' and HIES estimates comparable.

Source: BIDS Field Survey, 2012 and HIES, 2010.

[2]In HIES, BBS apparently considers items made of wheat and outside consumption as noted in Table 5.2 of the HIES, 2010. However, neither the coverage is adequate nor the treatment is meaningful. For instance, heterogeneous goods such as tea, biscuit and other items are included in miscellaneous items.

In addition to the national level, the per capita daily consumption of food grains has been disaggregated between the poor and the non-poor both in rural and urban areas. To determine the poverty status of the respondents, the division specific inflation adjusted income levels of the upper poverty line was applied from the HIES 2010 estimates (see Table 6.10 of the HIES, 2010 Report). The income of the respondents was estimated as the net income from different sources, such as agriculture, livestock, vegetables, fruits and wood produced in the homestead, services, business, wage labourers, pension and social safety nets.

TABLE II

PER CAPITA DAILY FOOD GRAINS (RICE AND WHEAT) INTAKE BY POVERTY STATUS AND PLACE OF RESIDENCE

(*in grams*)

	Rural			Urban		
	Poor	Non-Poor	Difference (sig.)	Poor	Non-Poor	Difference (sig.)
Cereals	547.33	576.20	28.87*	393.84	328.20	-65.64
Rice	525.00	546.00	21.00	324.00	240.00	-84.00
Wheat	22.33	30.20	7.8***	69.84	88.20	18.30***

Note: * and *** indicate statistically significant at 10% and 1% level respectively.
Source: BIDS Field Survey, 2012.

The estimates of per capita daily food grains consumption among the poor and the non-poor in rural and urban areas are reported in Table II. While the per capita consumption of cereals significantly differs between the poor and the non-poor in rural areas, it does not do so in the urban areas. As rice is the dominant component in the consumption of cereals in both areas, it does not differ significantly between the poor and the non-poor. On the other hand, per capita daily consumption of wheat significantly differs between the poor and the non-poor in both the rural and urban areas.

IV. MAJOR FACTORS DETERMINING FOOD CONSUMPTION

Food is one of the necessities of life—the persistent deprivation of which for a sufficiently prolonged period brings an end to life itself. In that sense, the consumption of food should be affected more by physical needs than economic forces. However, there are various kinds of food which may be substitutes, albeit imperfect to each other. Economics, thus, comes into play in determining the demand for various types of food for satisfying the same basic needs. If food

consumption is restricted to rice and wheat, its relative demand and consumption will depend, among other things, on their relative prices. Apart from prices, other variables such as income, age, sex and household size are also important. Thus, the analysis of per capita consumption and the consequent estimates of price and income elasticities provide the parameters that may be used to project per capita future demand under plausible assumptions about the relative significance of the various income groups in society.

4.1 Methods of Demand Analysis

To consider the above factors, a suitable model is required to estimate and project the demand for food grains. For this reason, the LA/AIDS model *a la* Deaton and Muellbauer (1980a) has been applied as it enjoys an immense popularity in applied demand analysis. Starting from a specific cost function, the AIDS model gives the share equations in an *n*-good system as

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

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

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

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

$$\ln P = \sum_{i=1}^{M} w_i \ln p_i \tag{3}$$

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

One advantage of the AIDS model is that the homogeneity and symmetry restrictions are easily imposed and tested. Since budget shares sum up to 1 in the system, one of the share equations in (3) needs to be dropped to deal with the singularity problem. Whichever one is eliminated should not have any effect on the results as the parameters associated with the share equation that is dropped can be recovered through the parameter restrictions implied by the homogeneity, symmetry, and conservation properties.

The LA/AIDS model implies that the Marshallian price elasticity for good *i* with respect to good *j* is

$$\in_{ij}^{M} = -\delta_{ij} + \frac{\gamma_{ij}}{w_i} - \frac{\beta_i w_j}{w_i} - \frac{\beta_i}{w_i}\left\{\sum_{k\neq j}^{M} w_k \ln P_k \left(\in_{kj} + \delta_{kj}\right)\right\} \tag{4}$$

Where $$\delta_{ij} = \begin{cases} 1 \text{ if } i = j \\ 0 \text{ otherwise} \end{cases}$$

Income elasticity in the LA/AIDS model is given by

$$\eta_i = 1 + \left(\frac{\beta_i}{w_i}\right)\left[1 - \sum_{j\neq i}^{M} w_j \ln P_j \left(\eta_j - 1\right)\right] \tag{5}$$

The demand for food grains varies due to the growth of population, urbanisation (with rural and urban disaggregation) and the growth in real income and price. Therefore, demand can be disaggregated to allow differential impact across different income groups and age groups in both rural and urban areas according to their dietary intake pattern. Thus, the projection of food grains demand is performed in this exercise by taking all the possible concerns that are relevant to the food grains demand.

4.2 Estimates of Demand Elasticities

A price index is constructed for each household, defined as a product of the log of the prices of the *i*th good and the associated expenditure share faced. The prices were derived from the BIDS survey (2012) that reports figures for the preceding one week from the date of the interview. Equation 1 was estimated using SURE (Seemingly Unrelated Regression Equations) method with cross-equation restrictions to ensure the equality of cross-substitution effects imposed by the standard neo-classical demand theory. This restriction is also necessary for SURE estimation when the set of covariates is the same across all equations, as is the case in the present exercise.

The estimates of income and price elasticities are presented in the upper panel of Table III for poor and non-poor households both in rural and urban areas. The corresponding estimates based on the HIES, 2010 have been reported in the lower panel for the purpose of comparison. The resulted expenditure elasticities obtained from the LA/AIDS model are then multiplied by the share of income spent on rice and wheat for rural and urban areas to obtain respective income elasticities. It may be noted that the estimates of income elasticities are positive for rice (for both poor and non-poor) in both rural and urban areas. However, for wheat the income elasticity estimates for rice in the rural areas (for both poor and non-poor) are negative. These estimates of income elasticity are comparable to those reported in some previous studies (e.g. Ahmed and Shams1993, Shahabuddin and Zohir 1995).

TABLE III

ESTIMATES OF PRICE AND INCOME ELASTICITIES

Elasti-cities	Rice					Wheat				
	Rural		Urban		All	Rural		Urban		**All**
	Poor	Non-poor	Poor	Non-poor		Poor	Non-poor	Poor	Non-poor	
Estimates Based on BIDS Survey										
Income	0.530	0.500	0.240	0.170	**0.431**	-0.776	-0.742	0.280	0.582	**-0.438**
Own price	-0.750	-0.670	-0.630	-0.950	**-0.680**	-0.100	-0.100	-0.240	-0.750	**-0.540**
Cross price	-0.700	-0.840	-0.240	-0.120	**-0.350**	-0.015	-0.030	-0.070	-0.140	**-0.030**
Estimates Based on HIES, 2010										
Income	0.427	0.432	0.144	0.144	**0.359**	0.77	0.88	0.29	0.45	**0.736**
Own price	-0.670	-0.640	-0.620	-0.500	**-0.590**	-0.250	-0.210	-0.340	-0.410	**-0.280**
Cross price	-0.850	-0.860	-0.710	-0.590	**-0.780**	-0.016	-0.027	-0.020	-0.040	**-0.030**

Source: BIDS Field Survey, 2012 and HIES, 2010.

All the Marshallian (uncompensated) own price elasticities are found to be negative as expected. The estimated own price elasticities for rice (rural vis-à-vis urban) are -0.75 vis-à-vis -0.63 for the poor and -0.67 vis-à-vis -0.95 for the non-poor. On the other hand, the own price elasticities for wheat (rural vis-à-vis urban) are -0.10 vis-à-vis -0.24 for the poor and -0.10 vis-à-vis -0.75 for the non-poor. The estimated own price elasticities are consistent with some previous studies. For example, the own price elasticities for rice and wheat were found to be -0.81 and -0.48 respectively by Alam (2010). Dorosh and Haggblade (1997) reported elasticities of rice and wheat for the urban poor at -0.89 and -0.43 respectively. The estimated cross-price elasticities for all groups are found to be negative from both BIDS 2012 survey data and HIES, 2010 data with the

magnitude of elasticities being high for rice and very low for wheat. The negative sign of cross-price elasticity indicates that rice and wheat are complement to each other as opposed to the conventional view that these items are substitutes. One possible explanation of this finding could be that the consumption data were collected on a daily basis rather than per meal. It is to be noted that in many cases people take at least one meal with wheat stuff (roti/bread, etc.), which may be considered complement to rice if we consider the whole consumption in a day. Thus, rather than analysing the meal-basis (per meal) consumption pattern, one cannot draw a definitive conclusion from a daily food-intake data on the substitutability or complementarities of these two food grains.

4.2.1 Projection of Per Capita Demand for Rice and Wheat

The formula for projection of per capita demand commodity *k* at time *t* (q_{ijl}^{tk}) is given by

$$q_{ijl}^{tk} = \left\{ \eta_{ijl}^{k} \frac{\left(y_{ij}^{t} - y_{ij}^{t-1} \right)}{y_{ij}^{t-1}} + e_{ijl}^{k} \frac{\left(p_{k}^{t} - p_{k}^{t-1} \right)}{p_{k}^{t-1}} + e_{ijl}^{k/} \frac{\left(p_{k/}^{t} - p_{k/}^{t-1} \right)}{p_{k/}^{t-1}} + 1 \right\} q_{ijl}^{t-1,k} \qquad (6)$$

where q_{ij}^{tk} is per capita demand and at time *t* of income group *i* in location *j*; η_{ij}^{k} is the income elasticity of income-group *i* in location *j* for commodity *k*, e_{ij}^{k} are the own price elasticities of income-group *i* in location *j* for commodity *k*, $e_{ij}^{k'}$ are the cross price elasticities of income-group *i* in location *j* for commodity *k/*, $\frac{(y_{ij}^{t} - y_{ij}^{t-1})}{y_{ij}^{t-1}}$ is the growth of per capita real income and $(\frac{p_{k}^{t} - p_{k}^{t-1}}{p_{k}^{t-1}})$ and $\frac{\left(p_{k/}^{t} - p_{k/}^{t-1} \right)}{p_{k/}^{t-1}}$ represents the change in price of commodity *k* and *k/* between period *t* and *t-1*.

Following equation 6, the projected values for the per capita daily consumption of rice and wheat are reported in Table IV using the estimates of elasticities reported in Table III. The per capita real income of the poor and non-poor was assumed to grow at 5.00 and 5.25 per cent respectively in the rural areas and 5.25 and 5.75 per cent respectively in the urban areas. The growth of the real price of rice and wheat was assumed at 1.5 and 2.0 per cent respectively. The growth of real income of the poor and non-poor was derived from two successive rounds of HIES (2005 and 2010), while the average growth of real price was derived by comparing real prices of these items for the last few years.[3]

TABLE IV

PROJECTED PER CAPITA DAILY CONSUMPTION OF RICE AND WHEAT

	Rice					Wheat				
	Rural		Urban		All	Rural		Urban		**All**
	Poor	Non-poor	Poor	Non-poor		Poor	Non-poor	Poor	Non-poor	
2012	525.0	546.0	324.00	240.0	466.9	22.3	30.2	69.8	88.2	41.6
2013	525.7	545.8	323.4	238.2	465.5	21.4	28.9	70.4	89.4	41.4
2014	526.3	545.6	322.9	236.3	463.9	20.5	27.8	70.9	90.6	41.3
2015	526.9	545.3	322.3	234.5	461.5	19.7	26.6	71.6	91.8	41.4
2016	527.6	545.1	321.7	232.7	459.4	18.9	25.5	72.1	93.0	41.5
2017	528.3	544.4	257.9	231.9	458.1	18.1	24.5	72.9	95.6	41.5
2018	528.9	544.0	257.4	230.3	456.8	17.4	23.5	73.6	97.2	41.6
2019	529.6	543.7	257.0	228.7	455.4	16.6	22.5	74.3	98.7	41.7
2020	530.3	543.4	256.6	227.1	454.1	15.9	21.6	74.9	100.3	41.8

Source: Authors' own estimates.

The projected values indicate that the per capita consumption of rice will increase for poor in the rural areas but will decrease for the other three groups over the years, albeit marginally. While the per capita consumption of wheat for both the poor and non-poor will decrease in the rural areas, it appears to increase in the urban areas for both the groups. The projected estimates suggest that urban people will consume a relatively less amount of rice than rural people and are expected to substitute rice consumption with other food items including wheat in the future.

V. CONCLUDING REMARKS

One of the debates about the food gap analysis in Bangladesh revolves around the estimates of per capita consumption of food grains. It is generally argued that the estimates of per capita consumption of food grains in Bangladesh

[3] The real prices of rice and wheat were estimated by deflating respective price with non-food CPI.

are grossly underestimated due to the failure of comprehensively taking into account the consumption of food items made of rice and wheat at home and outside. To give some insight into this debate, this exercise revisited the per capita consumption of food grains through a primary survey of a nationally representative sample in 2012 by considering a comprehensive list of 36 food items consumed outside home. The findings show that the per capita consumption of food grains estimated from the BIDS Survey, 2012 are higher than that reported by the BBS estimates based on the HIES 2010.

The estimated price and income elasticities for rice and wheat are comparable with those estimated from the HIES survey data. The projection shows that demand for both rice and wheat will decrease in both rural and urban areas, albeit marginally. The estimated per capita consumption of rice and wheat, the price and income elasticities, and the consequent projections can be used as instruments for integrated and effective planning of food grains in Bangladesh.

REFERENCES

Ahmed, A. U. and Y. Shams. 1994."Demand Elasticities in Rural Bangladesh: An Application of the AIDS Model." *The Bangladesh Development Studies*, 1-27.

Alam, M. A. 2010. "An Analysis of Consumption Demand Elasticity and Supply Response of Major Foodgrains in Bangladesh." Unpublished Master's Thesis, Humboldt University of Berlin.

Ali, Z. 2002. "Disaggregated Demand for Fish in Bangladesh: An Analysis using the Almost Ideal Demand System." *Bangladesh Development Studies*, 28: 1-45.

BBS. 2005. *Household Expenditure Survey.* Bangladesh Bureau of Statistics. Ministry of Planning, Government of the People's Republic of Bangladesh, Dhaka, Bangladesh.

BBS.2010. *Household Expenditure Survey*. Bangladesh Bureau of Statistics, Ministry of planning, Government of the People's Republic of Bangladesh, Dhaka, Bangladesh.

BIDS.2012. "Report of the Estimation of the Parameters Needed for Integrated and Effective PFDS Planning in Bangladesh."

Chowdhury, O. H. 1982."Complete Consumer Model—A Preliminary Estimate for Bangladesh." *Bangladesh Development Studies*, 10(1).

Dorosh, P., Q. Shahabuddin and N. Farid. 2004."Price Stabilization and Food Stock Policy" in *The 1998 Floods and Beyond: Towards Comprehensive Food Security in Bangladesh*" edited by P. Dorosh et al. University Press Limited, Dhaka and International Food Policy Research Institute, Washington D.C.

Deaton, A. and J. Muellbauer.1980a."An Almost Ideal Demand System." *American Economic Review*, 70(3).

Deaton, A. and J. Muellbauer. 1980b. *Economics and Consumer Behaviour*. Cambridge, England: Cambridge University Press.

Dorosh, Paul A. and S. Haggblade. 1997."Shifting Sands: The Changing Case for Monetizing Project Food Aid in Bangladesh." *World Development*, Elsevier, 25(12): 2093-2104.

Ferdous, R. 1997."Consumer Demand Behaviour in Rural Bangladesh." *Dhaka University Journal of Science*, 45(1): 109-119.

Huq, A. S. M. A., S. Alam and S. A. Sabur.2004."Estimation of Potato Demand Elasticity in Bangladesh." *Bangladesh Journal of Agricultural Economics*, 27: 1-13.

Huq, A. S. M. A. and F. M. Arshad.2010: "Demand Elasticities for Different Food Items in Bangladesh." *Journal of Applied Science*, 10(20): 2369-2378.

Islam, M. R. 2002. "Determinants of Production and Demand for Rice in Bangladesh: A Comparative Study of Aromatic Rice and Coarse Varieties." Ph.D. Thesis, Department of Agricultural Economics, Bangladesh Agricultural University, Mymensingh. (Cited in Huq et al., 2010).

Khanam, M. and R. Ferdous. 2000. "Food Preference and Consumer Demand in Bangladesh: An Application of the AIDS Model." *The Bangladesh Journal of Science Research*, 18(1): 103-117(Cited in Mullah, 2005).

Mullah, M. A. S. 2005. "Consumer Demand Behaviour in Bangladesh: Application of Engel and AIDS Models." A Submitted Unpublished Master of Science Thesis in the Department of Statistics, University of Dhaka, Bangladesh.

Murshid, K. A. S., M. N. I. Khan, Q. Shahabuddin, M. Yunus, S. Akhtar and O. H. Chowdhury. 200. *Determination of Food Availability and Consumption Patterns and Setting up of Nutritional Standard in Bangladesh*. Bangladesh Institute of Development Studies, Maxwell Stamp in collaboration with Food Planning and Monitoring Unit, Ministry of Food and Disaster Management and National Food Policy Capacity Strengthening Programme, Dhaka.

Sabur, S. A. 1983. "Demand, Supply and Price Structure of Potato in Bangladesh." Ph.D. Thesis, College of Agriculture, Haryana Agricultural University, Hisar, India. (Cited in Huq et al., 2010).

Shahabuddin, Q. and S. Zohir.1995. "Medium and Long-Term Projections of Food grain Demand, Supply and Trade Balance in Bangladesh." *Bangladesh Development Studies*, 23(3&4).

Talukder, R. K. 1990. "Food Pricing Policies and Nutrition in Bangladesh: A Welfare Analysis." Ph.D. Thesis, School of Agriculture, La Trobe University, Australia. (Cited in Huq et al., 2010).

APPENDIX

TABLE A.1: CONVERSION FACTOR OF FOOD ITEMS MADE OF RICE AND WHEAT

A. Conversion of Items Made of Flour	
Food Item	Number of items prepared 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: Authors' calculation.