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PATTERNS OF FOOD CONSUMPTION AND NUTRITION IN RURAL BANGLADESH

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Funded by USAID under Contract No. 388-0027-C-00-9026-00

September 1993

The auhtor accepts full responsibility for the views expressed in this report as well as for any errors for omissions. The contents do not necessarily reflect the position of USAID or the Ministry of Food, Government of Bangladesh.

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1. SUMMARY

This study attempts to provide an understanding of the food consumption and nutritional patterns in rural Bangladesh. The analyses are based on primary data from rural household survey on consumption and nutrition, conducted by IFPRI in 1991/92.

About half of Bangladesh's 112 million people cannot afford an adequate diet. A well-managed and appropriately targeted intervention can improve food consumption and nutrition of the poor in a cost-effective way. The patterns of food consumption and nutrition of rural households, as revealed in this study, may facilitate policymakers' efforts in identifying the appropriate targeting mechanisms for interventions.

The findings of the study suggest that rural households, particularly, the poor are highly responsive to changes in income in adjusting their food consumption patterns. Thus, a targeted intervention of transferring income can be an efficient way of improving food consumption and nutrition of the poor.

Preschool children are the most vulnerable to undernutrition among all family members. The study suggests that among all preschoolers, children aged 12-35 months from the poorest households are at the greatest risk. Therefore, to achieve greater cost-effectiveness, targeting interventions to malnourished children may be limited to this group, rather than targeting all children under five years of age.

The food consumption patterns across income groups indicate that wheat is an inferior commodity in rural Bangladesh, and thus has the self-targeting characteristics. Wheat is also the cheapest source of calorie, protein, and iron among all food items consumed in rural areas. These attributes make wheat an ideal commodity for targeted food interventions.

The findings show a high degree of regional and seasonal variations in food consumption and nutritional status. Thus, limiting interventions to specific distressed areas of the country, and operating the programs only during the lean seasons may considerably improve cost-effectiveness of such interventions.

The study documents that the recent sharp decline in rice price significantly improved food consumption and nutritional status of low-income rural households. However, such an unusual fall in rice price may be a temporary phenomenon. Nevertheless, real rice prices have declined steadily over the past two decades, and the landless and other poor consumers have been the principal beneficiaries of declining rice prices.

2. INTRODUCTION

Bangladesh has achieved impressive growth in food production during the recent past. Yet, the poor section of the population, millions of them, are too poor to capture the gains from the increased food production. About half of the country's 112 million people cannot afford an adequate diet. Due to their inadequate purchasing power, they lack access to enough food and thus remain seriously underfed. Freedom from hunger and undernutrition is a basic human right. Therefore, food security and adequate nutrition are beneficial outcomes in themselves. Enhanced labor and intellectual productivity, and hence economic growth is an additional benefit of food security.

The severity and magnitude of the poverty problem in Bangladesh dictate that policy interventions need to be targeted to provide some minimum level of support to those who are most vulnerable to undernutrition. A well-targeted intervention improves the real income and food security of a target group without providing benefits to non-needy members of the population. Hence, successful targeting improves cost-effectiveness of intervention programs.

The design of effective programs to improve nutrition requires an understanding of the patterns of food consumption and nutritional status of target as well as non-targeted groups. In this context, important questions to answer would include: who are the individuals most vulnerable to undernutrition, to what extent the geographical locations and seasonal variations influence food intake and nutritional status, and how do the households adjust their food consumption patterns when food prices and income change. Appropriately designed household surveys on expenditure, consumption and nutrition provide answers to these questions.

This report attempts to provide such an understanding by analyzing the patterns of food consumption and nutritional status of rural population in Bangladesh. The report is organized in six sections. Following the summary and the introductory sections, the survey design and data collection procedures are presented in section 3. Section 4

provides the food consumption and nutritional patterns of rural households as related to household income. The regional and seasonal differences of food consumption and nutrition are highlighted in section 5. The report concludes with a synthesis of policy issues that have emerged from the analysis.

3. SURVEY DESIGN AND DATA COLLECTION

The Bangladesh Food Policy Project of IFPRI conducted a household survey on consumption and nutrition in rural Bangladesh. The data used for analysis in this study are taken from this survey. The survey was repeated seasonally to obtain three observations over one year. The first survey round was conducted in 1991 during the October-November lean season; the second, January-March 1992 peak season; and the third, September-November lean season.

The survey was conducted in eight villages in eight *thanas*, located in the four divisions of the country. In selecting the sample villages, the focus was on achieving adequate variation in the factors such as distress-proneness, and developed and un-developed areas, that might affect household consumption patterns.

The first part of the household survey consisted of a census (100 percent of the households) of the eight selected villages. A total of 3,194 households were surveyed in the census. The basic purpose of the census was to select sample households. A sample of 553 households was chosen in the first round, using the standard sampling procedure based on statistical theory. The first survey round included only low-income households. The sample size was enlarged from 553 households in the first round to 737 households in the second and third survey rounds to include households from the higher income groups.

The original objective of the survey was to assess the consumption and nutritional effects of the two targeted food intervention programs--the Rural Rationing (RR) and the Vulnerable Group Development (VGD) programs. Besides the program beneficiaries, the survey also included 236 control households comparable to the program households, and 184 households from higher income groups.

The RR program was suspended in December of 1991, and was finally abolished in May of 1992. Therefore, only the first survey round included the RR beneficiary households. A recent IFPRI study found that the RR program did not produce any measurable food consumption benefits for the beneficiaries (Ahmed 1993). Thus, the inclusion of RR beneficiary households in this analysis should not have any significant impact of the program on the consumption patterns of the sample households. In contrast, the IFPRI study suggested a significant positive effect of the VGD program on food consumption and nutrition of the VGD beneficiaries. The VGD program distributed a large quantity of free wheat ration among the beneficiaries. Since the presence of VGD households in the sample could bias the general consumption patterns, data on 117 VGD households are excluded from the data set used in this analysis.

Two questionnaires were designed to obtain information from the respondents. One questionnaire was used to collect socio-economic information including household income and expenditures, and the other to record data on sanitation, health, individual food intakes and anthropometric measurements (age, weight, height, and arm circumference).

Three survey teams were formed, each consisting of three female and three male investigators, and a supervisor. A team of two investigators, one male and one female, collected information from each sample household. A survey coordinator harmonized the activities of the survey teams.

4. INCOME, CONSUMPTION, AND NUTRITIONAL PATTERNS

This section presents the findings of the household survey. These findings represent the average of three rounds of the survey data over one year period during 1991/92. The results are disaggregated by income groups to illustrate the effects of household income on the consumption and nutritional patterns. Major findings are highlighted as follows.

Household Characteristics

Table 1 presents the characteristics of rural households disaggregated by expenditure quartiles. Although household income data are available from the IFPRI survey, household consumption expenditures are used as a proxy for income in disaggregating the households for two reasons. First, based on the permanent income hypothesis, Friedman (1957) argues that expenditures are likely to reflect permanent income and hence a better determinant of consumption behavior. Second, data on expenditures are generally more reliable than income data.

- The average family size of the entire sample households (5.9 persons) is slightly higher than the average rural family size . The 1988/89 Households Expenditure Survey (HES) reports the average rural family size of 5.6 persons (BBS 1991).

- Average years of schooling of rural parents are very low in general, and extremely low for the poor households and the mothers. Among adult household members, 60 percent of the male and 83 percent of the female never attended school.

- A high proportion of the poorest households are headed by female, compared to other income groups. This is a reflection of the vulnerability of women in the

Table 1—Characteristics of respondent households

Characteristics	Expenditure Quartile				
	First	Second	Third	Fourth	All
Household size (person)	5.9	5.8	5.8	6.1	5.9
Years of schooling, father	1.1	1.5	1.8	3.4	2.0
Years of schooling, mother	0.3	0.6	0.7	1.4	0.7
No schooling, adult male (%)	72.9	69.4	61.8	41.6	59.6
No schooling, adult female (%)	92.8	88.0	84.6	68.6	83.0
Female-headed household (%)	11.9	3.0	2.7	2.7	5.1
Own cultivable land (acre)	0.1	0.2	0.7	2.2	0.8
Per capita monthly income (taka)	139	217	278	580	304
Per capita monthly expenditure (taka)	140	224	303	546	303
			(percent)		
Principal occupation of household head					
Farmer	5.5	12.9	22.7	44.4	21.4
Wage earner	53.4	59.5	44.9	26.5	48.6
Craftsman	1.6	1.4	1.8	1.1	1.5
Small business	10.8	14.0	16.0	12.4	13.3
Salaried professional	2.1	3.0	2.3	7.1	3.6
Fisherman	0.7	1.1	3.2	2.1	1.8
Other	16.0	8.0	9.2	6.4	9.9

Source: International Food Policy Research Institute, "Consumtption and Nutrition Survey 1991/92", Bangladesh.

social system. Most female-headed households are either divorced or widowed, and their income-generating opportunities are very limited. Consequently, the female-headed households are among the poorest in rural Bangladesh. On the average, the proportion of female-headed households in the entire sample is slightly higher than the rural average of 4.4 percent as reported in the 1988/89 HES.

- Since the majority of the poor households are landless, wage earning is by far their major occupation. Farming is the principal occupation of the household-heads of 44 percent of high-income rural households.

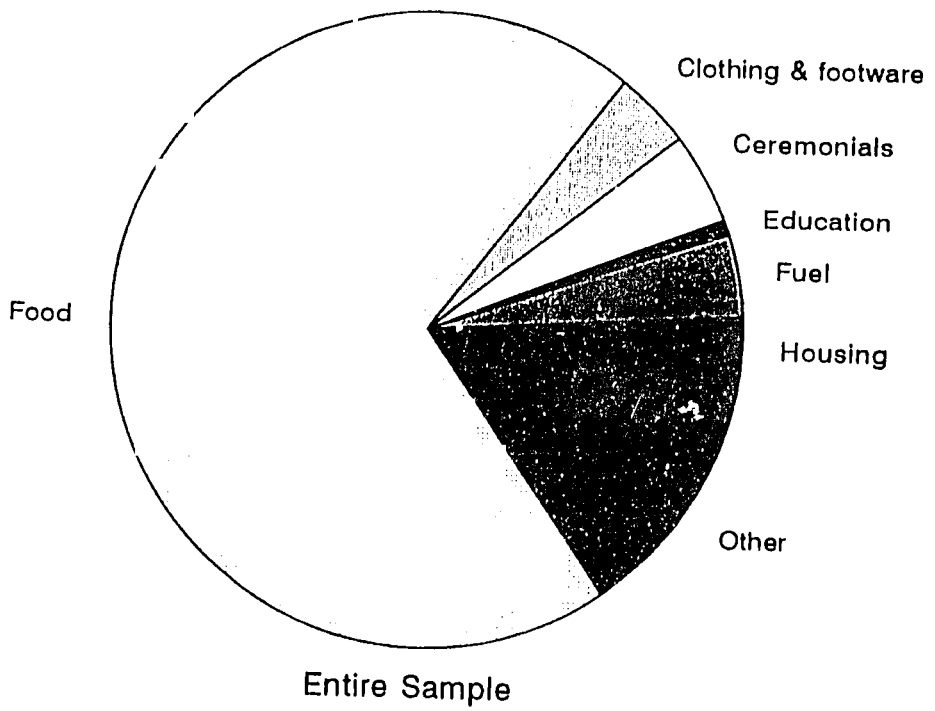
Income and Expenditure

- Table 1 shows that per capita monthly expenditures of 75 percent of the households (i.e. first to third quartiles) are higher than their income, showing a dissaving by the low-and middle-income households. The high-income households (25 percent) save about 11 percent of their income.

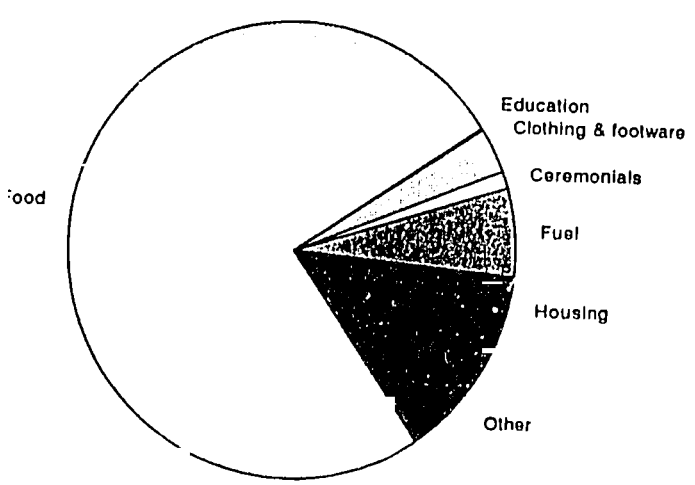
- Figure 1 illustrates the shares of households expenditures spent on major consumption items. On the average, 70 percent of total household expenditures are spent on food (Appendix 1, Table 1.1). As household income rises, the share spent on food falls conforming with the Engelian relationships. The shares spent on nonfood items increase as income rises, particularly for ceremonials and entertainment, medical services, and clothing and footwear.

- Figure 2 presents the breakdown of the household food budget allocated to each food group for the entire sample. On the average, rice accounts for 60 percent of total food budget. A comparison of the patterns of food expenditures across expenditure groups indicates major variations in rice and wheat expenditures (Appendix 1, Table 1.2). The breakdown of intake quantities of different food

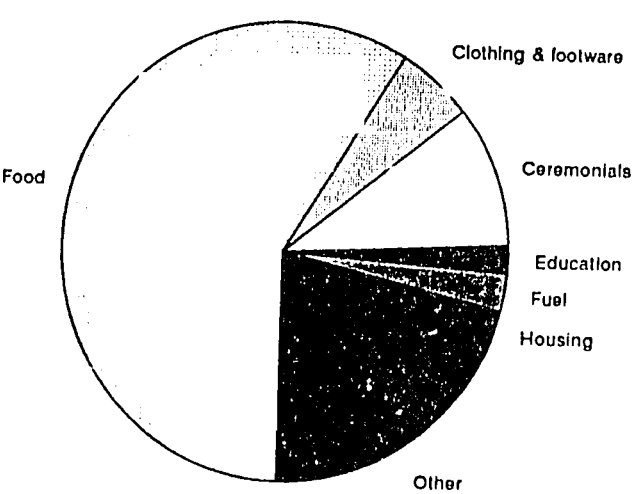
Figure 1-Share of household expenditures on major items



Entire Sample



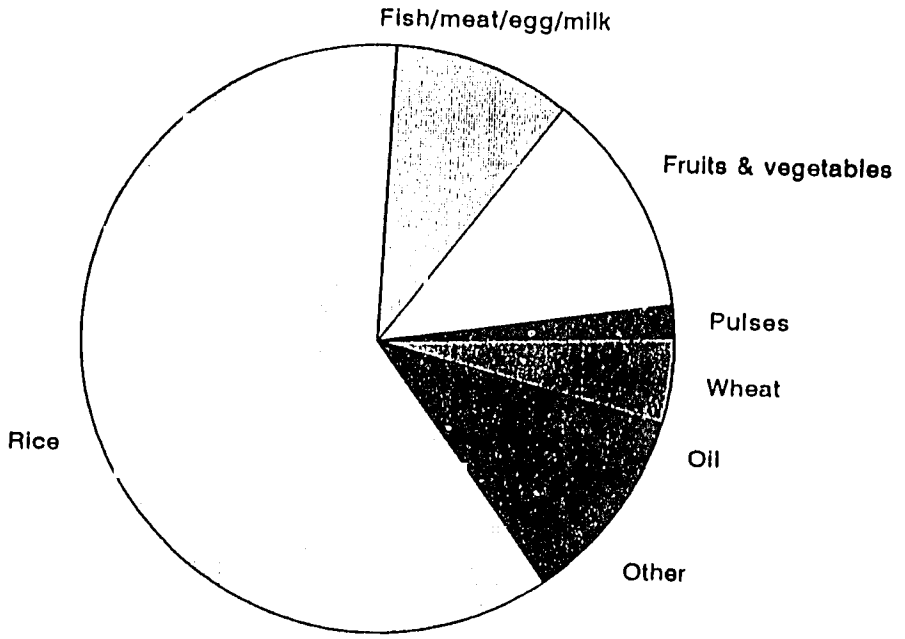
First Quartile



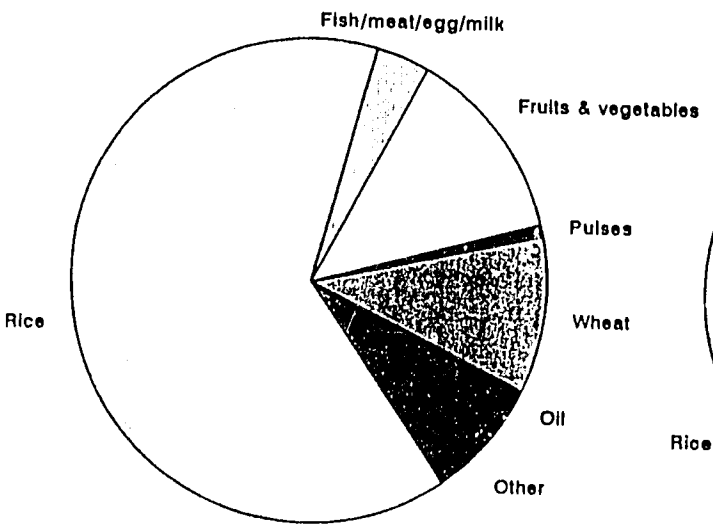
Fourth Quartile

Source: IFPRI Household Survey, 1991/92

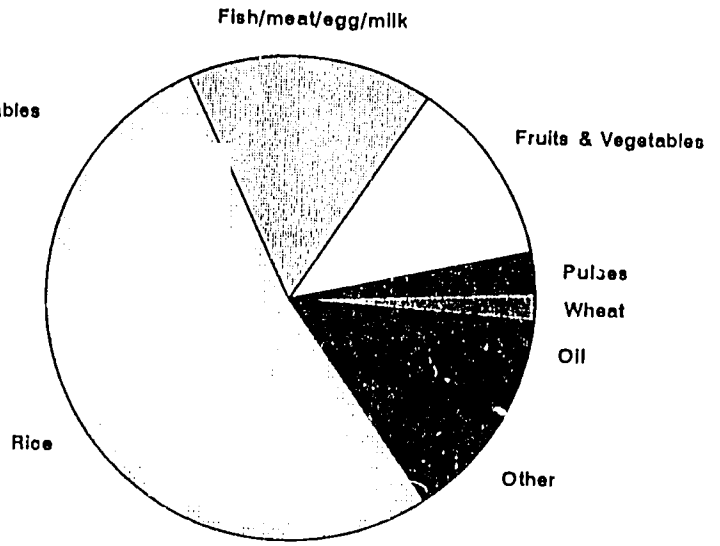
Figure 2-Food budget allocation



Entire Sample



First Quartile



Fourth Quartile

Source: IFPRI Household Survey, 1991/92

items is shown in Table 2. Except for wheat, quantities consumed of all other food items increase as household incomes rise. The quantity of wheat consumption, however, sharply declines as income rises, indicating that wheat is an inferior good. This finding conforms with the findings of several other studies showing a negative income elasticity of demand for wheat in rural Bangladesh. (Ahmed and Shams 1993; Goletti 1993; Ahmed and Hossain 1990; Bouis (1989); and Pitt 1983).

- Estimates of daily nutrient intakes are determined by weighing food intakes at the household as well as individual levels. Recall method was used for recording food consumed outside home. Date were collected for every member of the household over a 24-hour period in each survey round. The results represent the average of three measurements recorded in three rounds of the survey over a one year period.

- Table 3 shows the pattern of nutrient intakes across expenditure groups. Average calorie and protein intakes for the entire sample are lower than that reported in 1988/89 HES, probably because the proportion of under-five children in the sample population is larger than that in average rural population. Households with preschool children were purposively included in the sample. Figure 3 demonstrates that, while per capita intakes of all four nutrients increase as incomes rise, calorie and protein intakes are more responsive to changes in income (expenditures) than the two micronutrients, iron and vitamin A. The changes in average intakes from first quartile to fourth quartile households are 61 percent and 70 percent, respectively, for calorie and protein, while 25 percent and 39 percent for iron and vitamin A, respectively.

- The results presented in Table 3 also reveal that the intakes of all four nutrients by the female household members in all income groups are consistently lower than that of the male household members.

Table 2—Quantity of food intakes per capita

Item	Expenditure Quartile				All
	First	Second	Third	Fourth	
	(grams/person/month)				
Rice	9,461	12,788	13,864	15,134	12,816
Wheat	1,585	889	738	617	956
Pulses	71	177	222	385	214
Potatoes	733	896	1,194	1,768	1,145
Edible oil	55	101	146	250	138
Vegetables	4,335	5,029	5,525	6,192	5,272
Fruits	28	51	153	253	121
Fish	271	702	941	1,366	821
Meat	0	12	74	406	123
Eggs	6	11	20	34	18
Milk	14	102	185	520	206
Spices	122	197	281	387	247
Onion	51	95	149	228	131
Salt	176	193	213	245	207
Sugar and gur	9	15	64	199	72
Other food	25	85	366	745	306

Source: International Food Policy Research Institute, "Consumption and Nutrition Survey, 1991/92", Bangladesh.

Note: Estimates are based on 24-hour food weighing data.

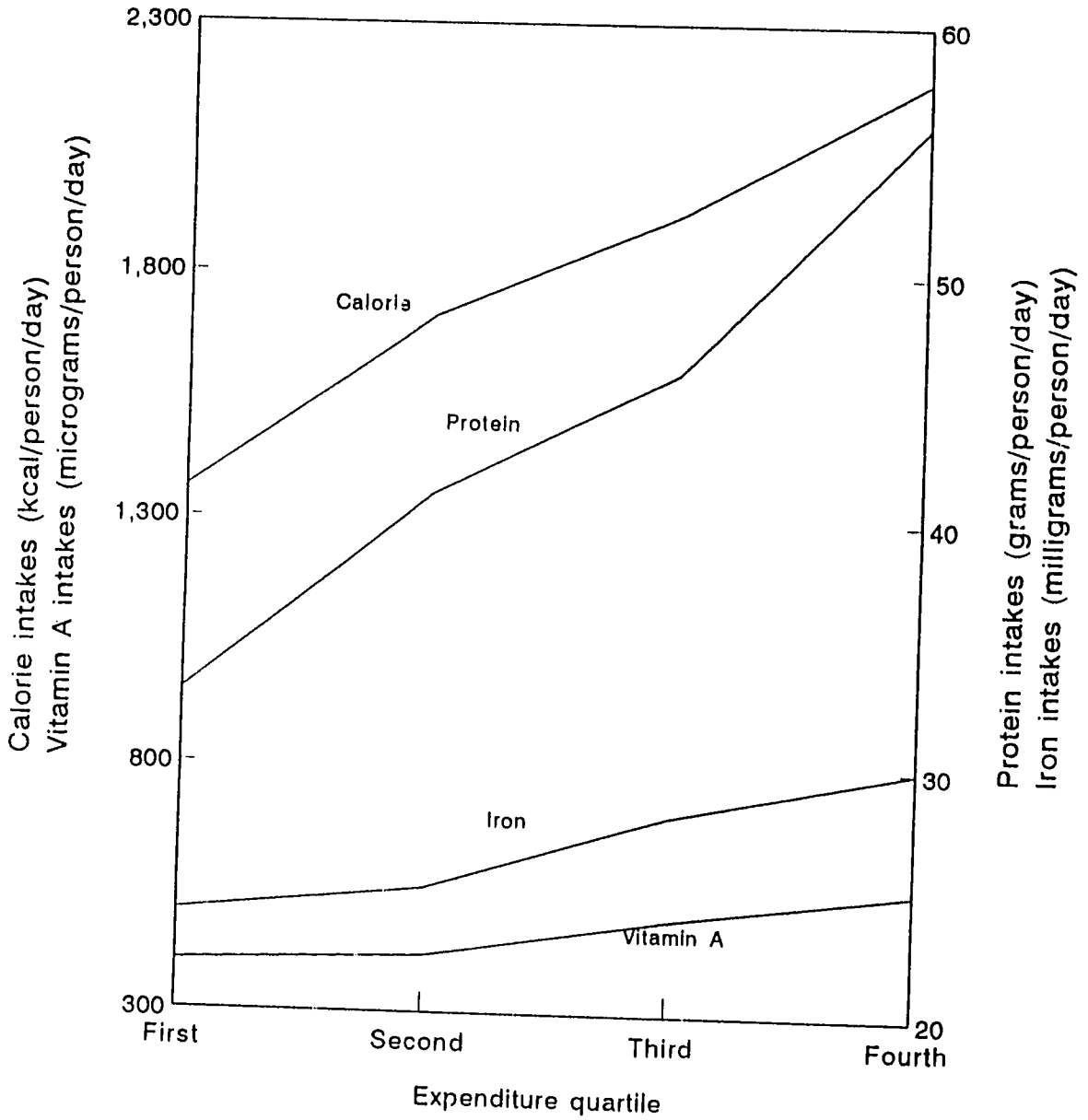
Table 3—Nutrient intakes of groups of household members

Nutrients	Expenditure Quartile				All
	First	Second	Third	Fourth	
	(intakes in person/day)				
Calorie intakes (kcal)					
All family members	1,360	1,714	1,921	2,189	1,814
All male	1,517	1,911	2,125	2,415	2,028
All female	1,229	1,527	1,718	1,942	1,607
Calorie adequacy (intake as % of requirement)					
All family members	72.4	87.6	97.3	107.4	92.0
All male	77.2	92.1	101.3	112.5	97.2
All female	68.3	83.4	93.2	101.8	86.8
Calorie deficient population (%)					
All family members	83.8	68.3	55.2	42.4	61.5
All male	80.3	63.6	48.2	34.6	54.8
All female	86.6	72.8	62.3	51.1	68.0
Protein intakes (gram)					
All family members	33	41	46	56	45
All male	36	46	51	62	50
All female	30	37	41	50	40
Iron intakes (milligram)					
All family members	24	25	28	30	27
All male	26	28	31	33	30
All female	22	23	25	27	24
Vitamin A intakes (microgram)					
All family members	398	414	491	553	468
All male	415	423	523	621	504
All female	384	405	460	478	432

Source: International Food Policy Research Institute, "Consumption and Nutrition Survey 1991/92", Bangladesh.

Note: Estimates are based on 24-hour food weighing data.

Figure 3-Nutrient intakes by income groups



Source: IFPRI Household Survey, 1991/92

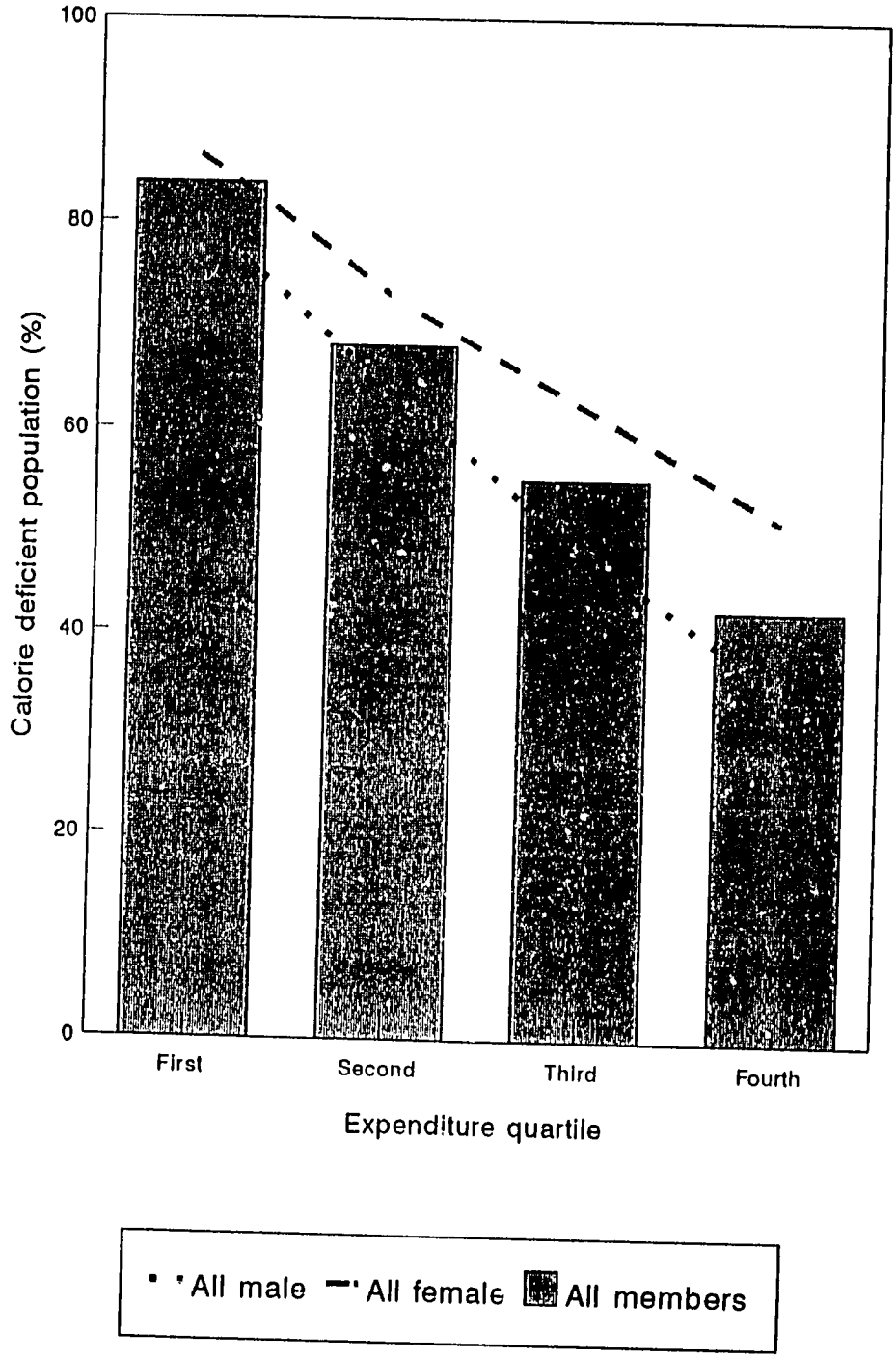
- To determine calorie adequacy of a household member, the actual calorie intakes of that individual is compared with his or her calorie requirement. The method of estimating calorie requirements of individual family members is presented in Appendix 2.

- Table 3 presents the estimates of calorie adequacies (intakes divided by requirements, expressed in percentage terms) disaggregated by expenditure and gender groups. For the poorest 25 percent of all rural households, the average calorie intakes of all household members are far below requirements, and the female members are much worse-off than their male counterparts. This may be an indication of gender-biased behavior of households in allocating food, discriminating against the female members.

- Figure 4 shows the shares of calorie deficient population across expenditure groups, disaggregated by gender. About 62 percent of the sample rural population are below the poverty level. The percentages of both male and female population deficient in calorie intakes decline as household incomes rise. The gap between male and female calorie deficient population widens with the rise in household income.

- Table 4 presents the costs of nutrients and income relations. Except for vitamin A, the unit costs of calorie, protein, and iron increase as incomes rise. This pattern indicates that with rising income, households tend to diversify their food consumption to include higher priced nutrients.

Figure 4-Calorie deficient rural population



Source: IFPRI Household Survey, 1991/92

Table 4—Costs of nutrients and income relations

Nutrient	Expenditure Quartile				
	First	Second	Third	Fourth	All
Calorie (taka/thousand kcal)	3.45	3.88	4.26	5.08	4.17
Protein (taka/10 gram)	1.49	1.68	1.84	2.06	1.77
Iron (taka/10 milligram)	2.49	3.01	3.33	4.10	3.24
Vitamin A (taka/10 microgram)	1.83	1.37	1.88	0.95	1.51

Source: International Food Policy Research Institute, "Consumption and Nutrition Survey 1991/92", Bangladesh.

Note: Estimates are based on 24-hour food weighing data.

- Figure 5 illustrates the food expenditure, food quantity (in calories), and food quality relations with household incomes[1]. Food quality (represented by the average calorie price) rises with income, indicating that households spend a portion of increased income in upgrading the quality of their diet.

- The average costs of nutrients in the diet from different food sources are calculated and presented in Table 5. Wheat is the cheapest source of calorie, protein, and iron. This indicates that even very poor households can improve their nutrition by altering their diet patterns. Substitution of wheat for rice will improve nutrition substantially, and will result in a more balanced diet. This finding also justifies the distribution of wheat in targeted food intervention programs. A recent IFPRI study suggests that the wheat ration given in the Vulnerable Group Development (VGD) program significantly increases wheat intakes of the VGD beneficiaries (Ahmed 1993).

Nutrient Composition of Diet

- Figures 6 through 9 provide illustrative summaries of how nutrient intake patterns change by income groups. These illustrations, and a more detailed breakdown by food items (provided in Appendix 1, Tables 1.3 through 1.6) suggest the overwhelming dominance of rice in the diet. For the entire sample, rice accounts for about 78 percent of total calorie, 65 percent of protein, and 69 percent of iron intakes, implying a very little diversity in average diet. Vegetables are by far the major source of vitamin A in the diet, accounting for about 65 percent of total vitamin A intakes by the average households.

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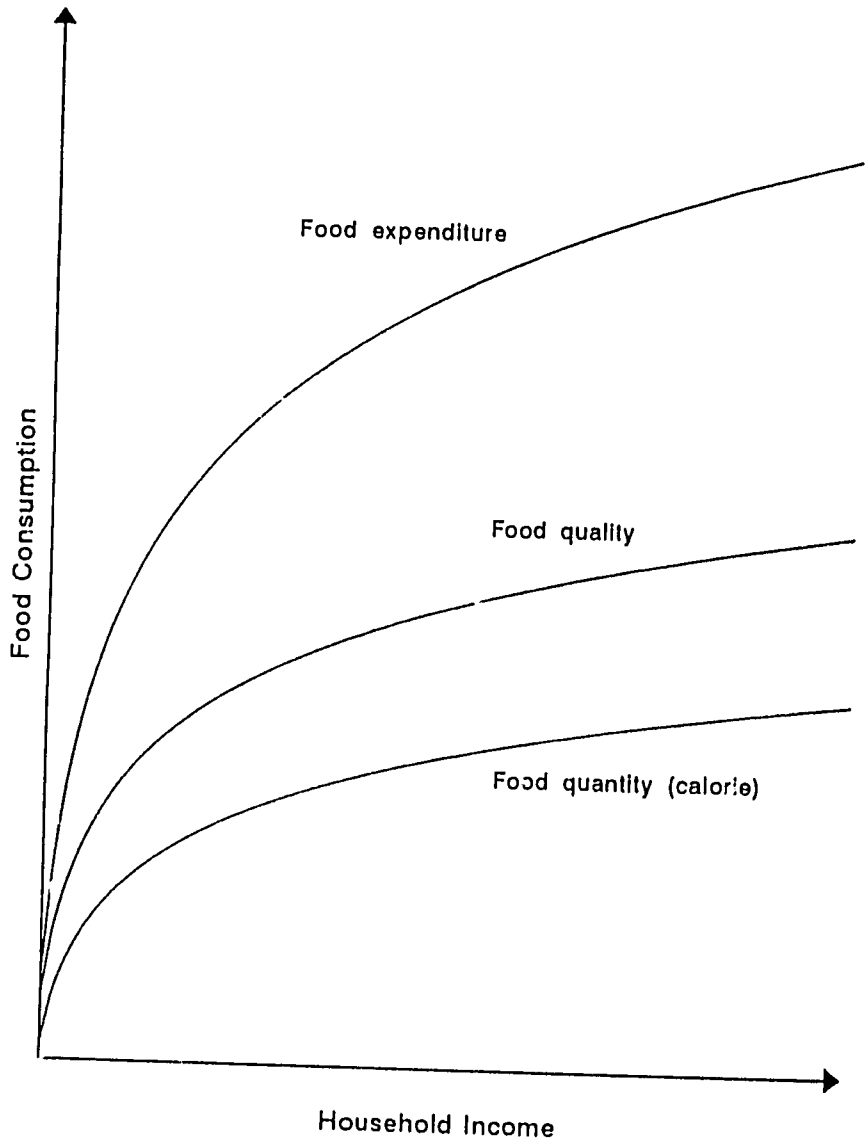
[1]The food expenditure, and the calorie relations with income are estimated from the survey data. Only the 1992 peak season (second survey round) cross-section survey data are used for this analysis to avoid the effects of seasonal variations in food prices on food consumption. The relationships are estimated using the Ordinary Least Squares (OLS) method, in double-logarithmic functional form. As a proxy for income, total household expenditure is used as the explanatory variable. The dependent variables in the two regression equations are food expenditure, and calorie intakes, both in adult equivalent units. From the predicted values of food expenditure and calorie, food quality (that is, calorie price) is derived for each household as follows:

ln Food quality = ln food expenditure - ln food quantity (calorie).

Figure 5-Food quality-income relation



Source: IFPRI Household Survey, 1991/92

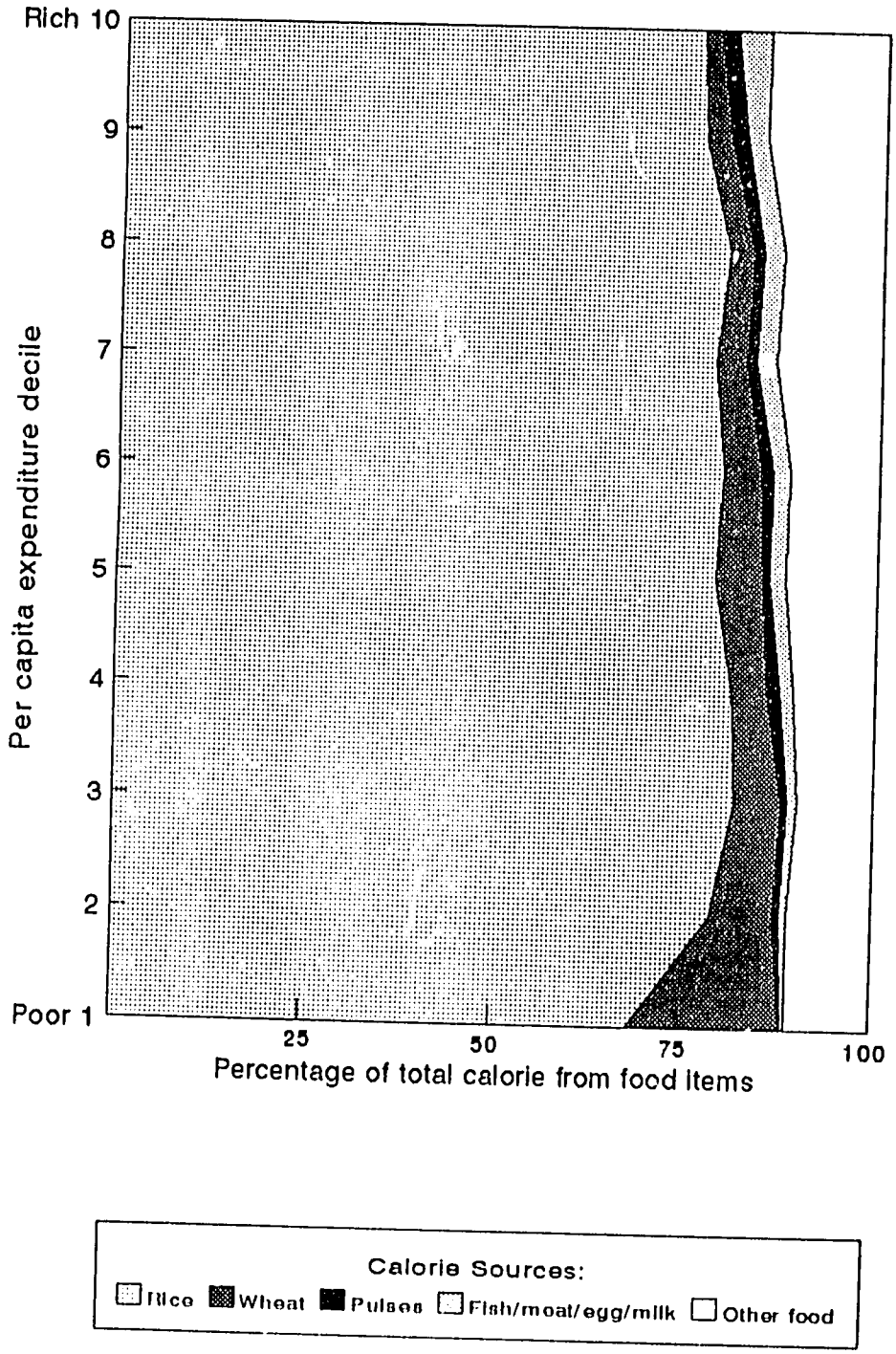
Table 5—Costs of nutrients by food sources

Item	Costs of			
	Calorie	Protein	Iron	Vitamin A
	(taka/1000 kcal)	(taka/10 gram)	(taka/10 milligram)	(taka/10 microgram)
Wheat	2.65	0.75	0.81	0.53
Rice	3.11	1.63	2.77	20.24
Potatoes	5.15	3.12	5.40	0.37
Sugar and gur	5.39	29.33	2.88	0.35
Edible oil	5.79	-	-	-
Pulses	6.10	0.81	3.24	0.25
Vegetables	6.98	1.80	1.42	0.01
Fruits	7.38	6.12	14.01	0.06
Milk	16.35	3.32	53.75	3.86
Onion	20.96	7.82	17.43	1.55
Fish	21.56	1.59	18.05	-
Spices	21.89	5.00	6.66	0.42
Eggs	24.37	3.22	17.09	0.15
Meat	43.38	2.19	161.18	-

Source: International Food Policy Research Institute, "Consumption and Nutrition Survey, 1991/92", Bangladesh.

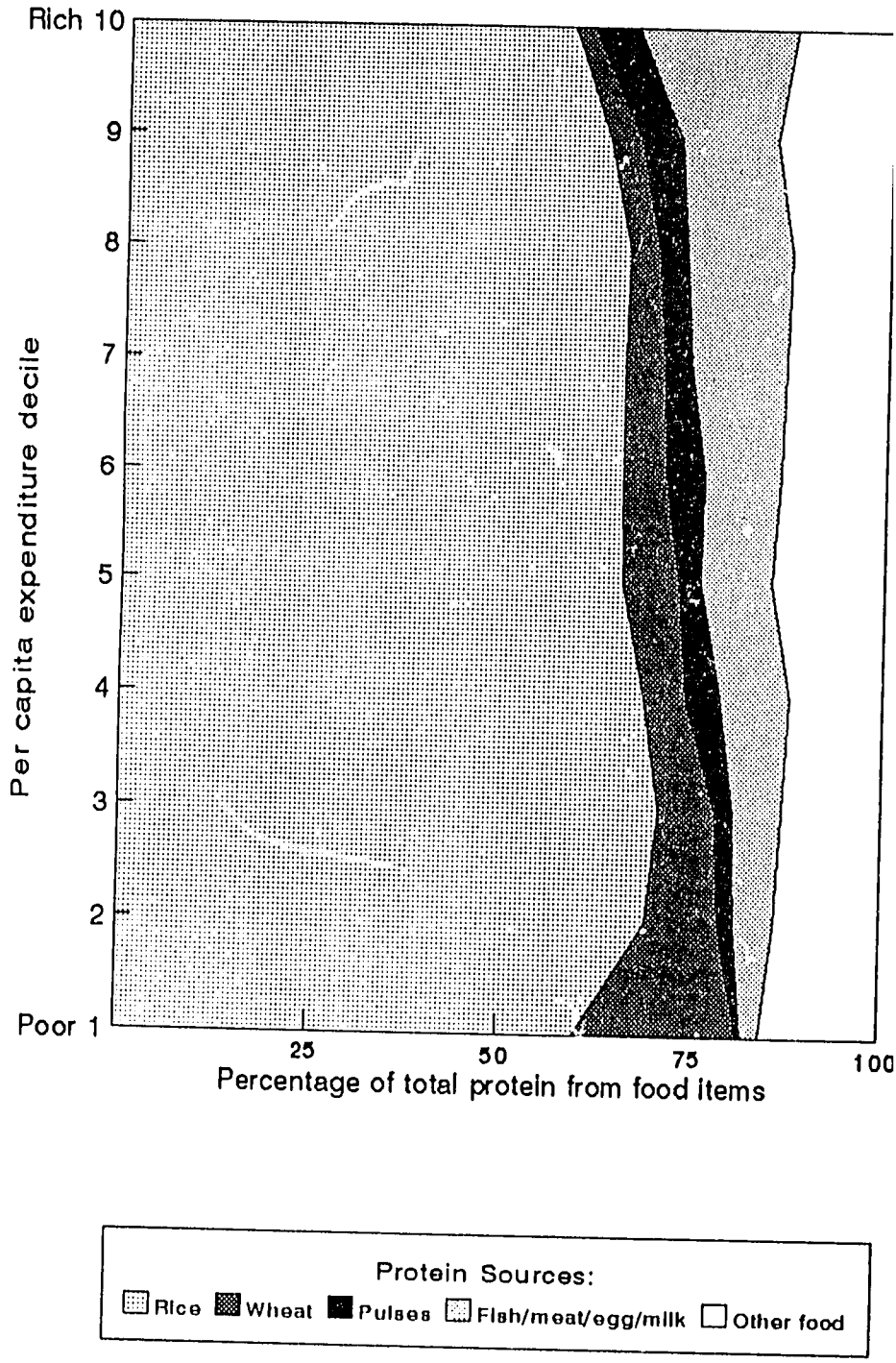
Note: Estimates are based on 24-hour food weighing data.

Figure 6-The effect of income on calorie composition of diet



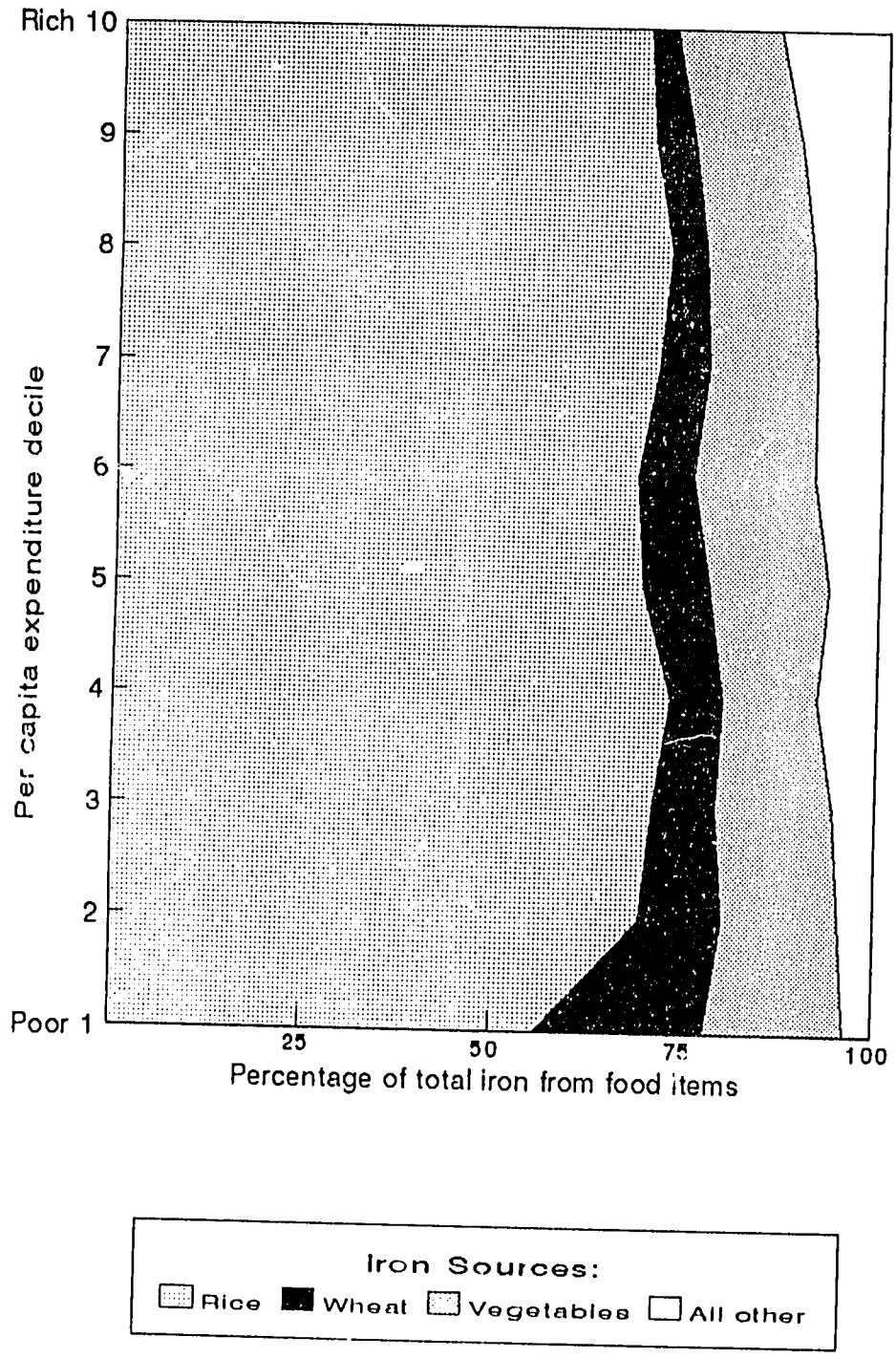
Source: IFPRI Household Survey,1991/92

Figure 7-The effect of income on protein composition of diet



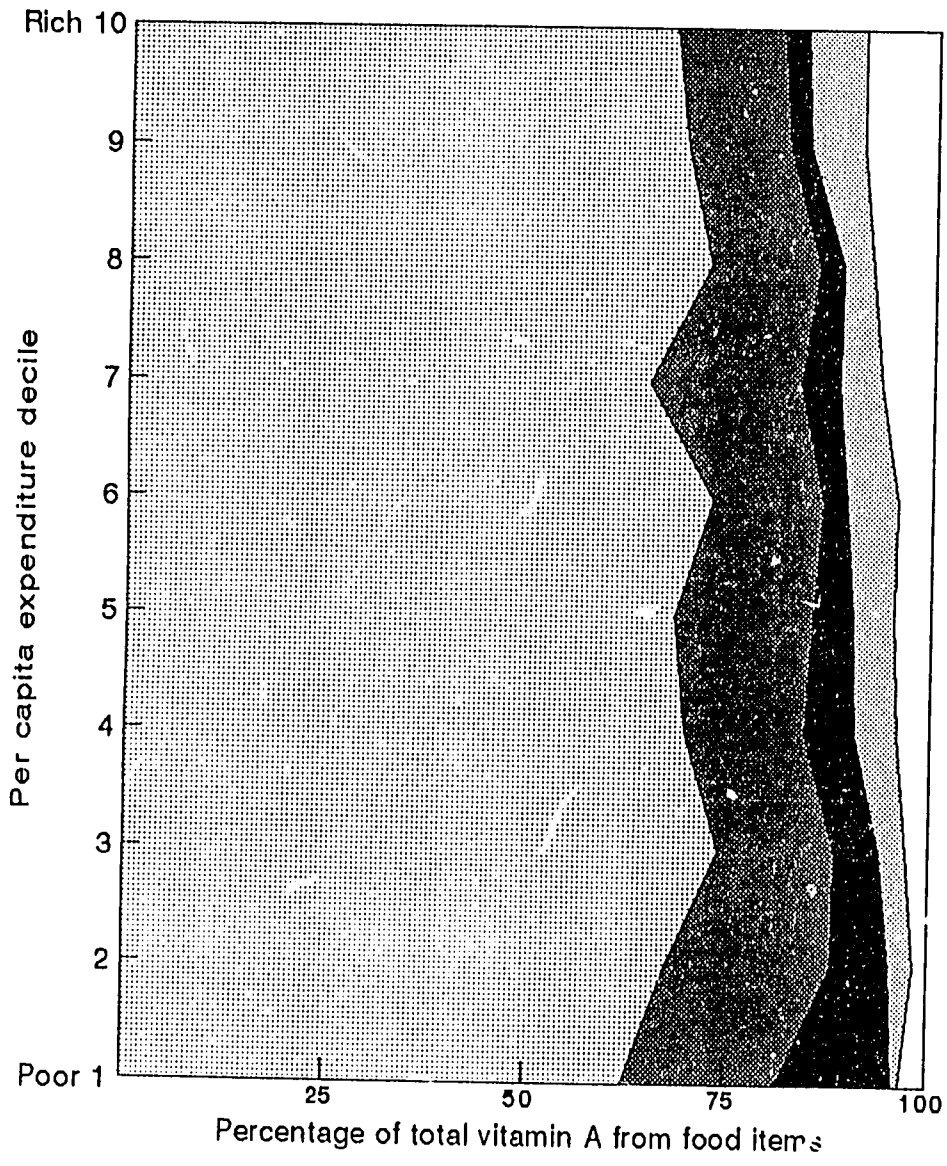
Source: IFPRI Household Survey, 1991/92

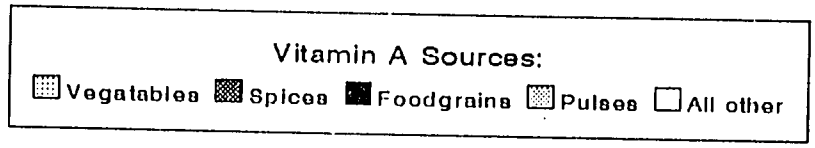
Figure 8-The effect of income on iron composition of diet



Source: IFPRI Household Survey, 1991/92

Figure 9-The effect of income on vitamin A composition of diet





Source: IFPRI Household Survey, 1991/92

- Commodity targeting can be used in a food intervention program to improve nutrition of the poor in a cost-effective manner. Knowledge of food consumption patterns of the poor and the non-poor is essential to commodity targeting. An ideal self-targeting food is one that has a negative income elasticity of demand and provides a significant share of the calories in the diets of the poorest households (Kennedy and Alderman 1987). As mentioned earlier, consumption studies in Bangladesh have shown wheat to have a negative income elasticity of demand in rural Bangladesh. The pattern of calorie composition of diet shown in Figure 6 reveals that wheat looms a sizable share in the diets of the poorest households.

- Figure 10 shows the food cor sumption patterns of rural households as a function of income[2]. The concept of this graphical presentation has been adopted from Timmer, Falcon and Pearson (1983). Three sources of calories (rice, wheat, and "other foods") and their intakes are shown in the figure along with the total calorie intakes as a function of household income (total expenditure). C^* denotes the individual calorie requirement, and Y^* Indicates the income level at which such a calorie requirement is met. The patterns of calorie intakes from food sources suggest that rice does not have the characteristics of a self-targeting commodity. Calorie intakes from rice rises sharply with income, particularly among the poor, indicating rice has a high income elasticity. In contrast, the consumption of wheat behaves very differently. Calories from wheat decline with rising income, which suggest wheat is an inferior good--it has a negative income elasticity for income groups at both sides of Y^*. Figure 10 also shows what an "ideal" self-targeting commodity's consumption pattern may look like. It is the mirror image of the calorie-income curve from C^*. If such a commodity is available, then its free distribution would exactly eliminate the entire calorie deficit of the population (Timmer, Falcon and Pearson 1983). However, in real world, such a commodity is most likely not available.

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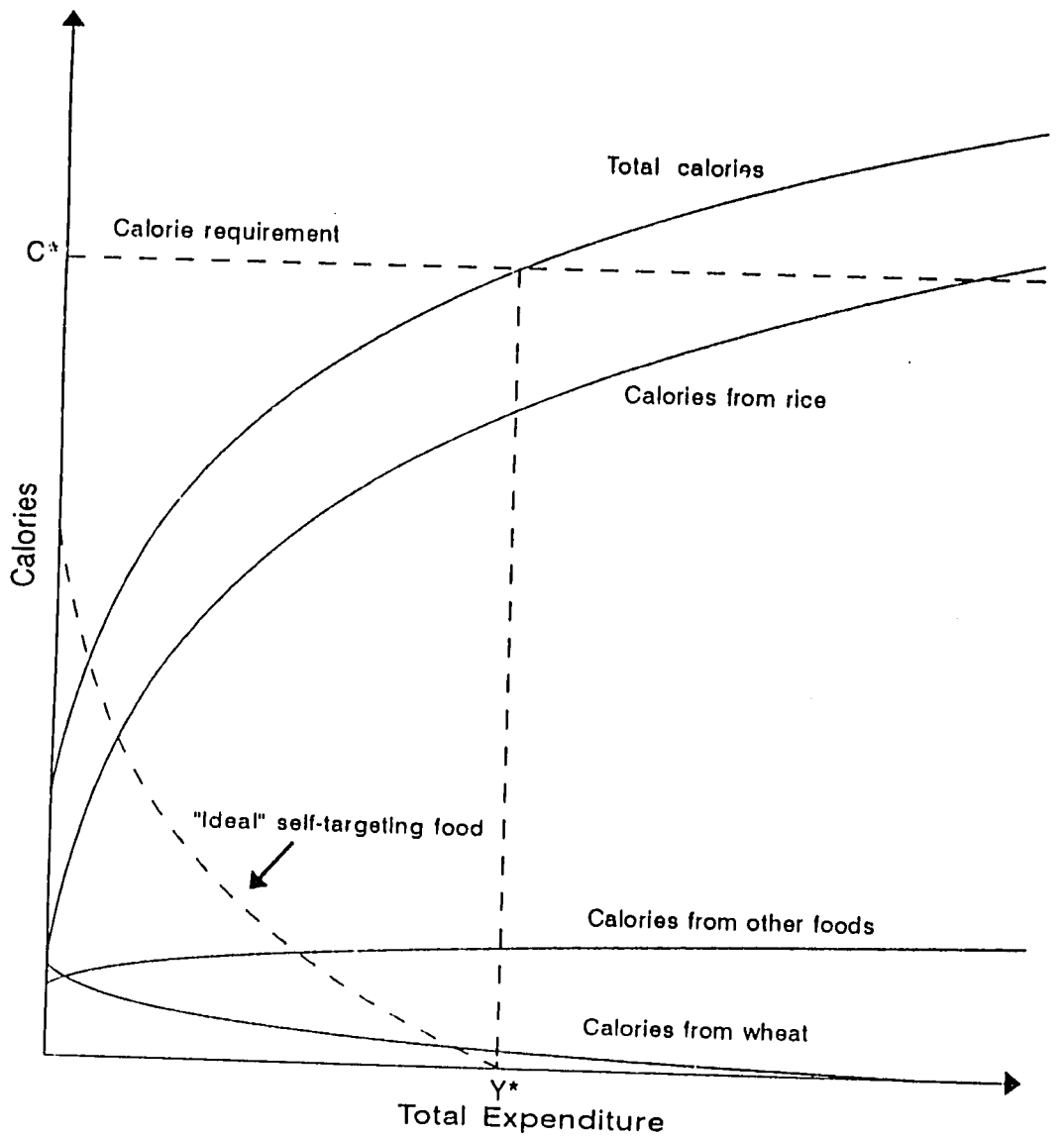
[2]The curves are estimated from the survey data using the OLS method in semi-logarithmic functional form.

Figure 10-Calorie intake pattern as a function of income



Source: IFPRI Household Survey, 1991/92

Nutritional Status of Vulnerable Household Members

- Within households, some members are at greater nutritional risk than others. It is well-demonstrated in various studies that preschool children and women, particularly pregnant or lactating women suffer from malnutrition more severely than other household members. Indeed, a recent IFPRI study (based on the same data set used in this study) finds that preschoolers are at the greatest risk of undernutrition, followed by pregnant and lactating women (Ahmed 1993). In the present analysis, the patterns of nutritional status of preschool children and child-bearing age women are presented in relation with household income levels.

- The nutritional status of preschool children (aged zero to 59 months) is determined on the basis of anthropometric data for all preschool children in the sample households relative to a particular growth standard. The standards devised by the U.S. National Center for Health Statistics (NCHS) are used in this study. The levels of nutritional status are expressed in Z-score values[3].

- Table 6 reports Z-scores for height-for-age, a measure of stunting; weight-for-height, a measure of wasting; and weight-for-age, a measure of underweight. Weight-for-height is a short-run measure (indicating acute undernutrition), while height-for-age indicates nutritional status of children over the long-run (indicating chronic undernutrition). Weight-for-age can be viewed as a medium-term indicator, which reflects both acute and chronic undernutrition.

- Figure 11 provides illustrative comparisons of the Z-score results (from Table 6) between children of the lowest (first quartile) and the highest (fourth quartile) income groups, disaggregated by age. the Z-scores for children less than one

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[3]Z-score = Actual measurement - 50th percentile standard/standard deviation of 50th percentile standard.

Levels of nutritional status in comparison with a reference population can be conveniently expressed in terms of Z-score values. A Z-score value of zero indicates a child who is "normal", and a negative Z-score value indicates an anthropometric measurement below the one in the reference population. The standards devised by the U.S. National Center for health Statistics (NCHS) are used in the study.

Table 6—Nutritional status of preschool children by age and expenditure quartil

Expenditure Quartile	Age of Preschoolers (months)					
	0-11	12-23	24-35	36-47	48-59	0-59
			Height-for-Age Z-score			
1	-2.14	-3.16	-2.87	-2.72	-2.17	-2.61
2	-2.05	-2.85	-2.28	-2.61	-2.31	-2.43
3	-2.08	-2.86	-2.74	-2.76	-2.30	-2.57
4	-1.88	-2.73	-2.41	-2.65	-2.17	-2.38
All	-2.04	-2.91	-2.57	-2.69	-2.24	-2.50
			Weight-for-Age Z-score			
1	-1.83	-2.97	-2.99	-2.63	-2.18	-2.54
2	-1.96	-2.59	-2.53	-2.54	-2.23	-2.40
3	-1.95	-2.63	-2.76	-2.43	-2.12	-2.39
4	-1.94	-2.47	-2.39	-2.41	-2.13	-2.27
All	-1.92	-2.67	-2.68	-2.52	-2.17	-2.41
			Weight-for-Height Z-score			
1	-0.45	-1.49	-1.54	-1.44	-1.26	-1.31
2	-0.59	-1.11	-1.41	-1.39	-1.22	-1.22
3	-0.54	-1.17	-1.37	-1.13	-1.11	-1.12
4	-0.79	-1.09	-1.09	-1.15	-1.22	-1.09
All	-0.60	-1.22	-1.37	-1.30	-1.20	-1.19

Source: International Food Policy Research Institute, "Consumption and Nutrition Survey 1991/92", Bangladesh.

Figure 11-Nutritional status of preschool children

Figure 11.1-Height-for-age Z-score by age and income groups

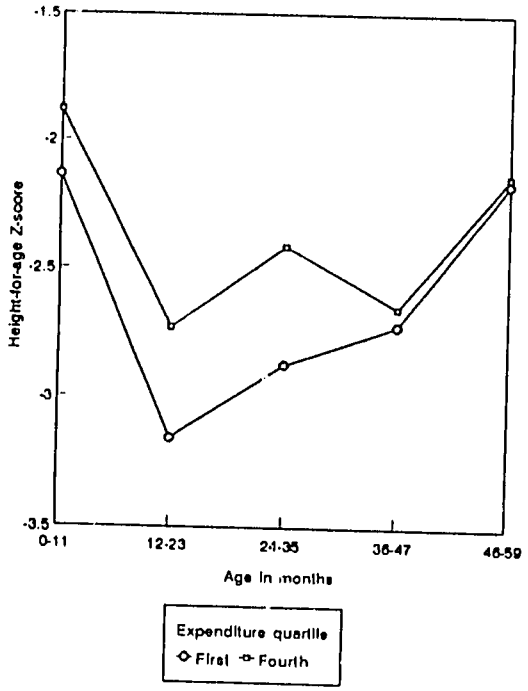


Figure 11.2-Weight-for-age Z-score by age and income groups

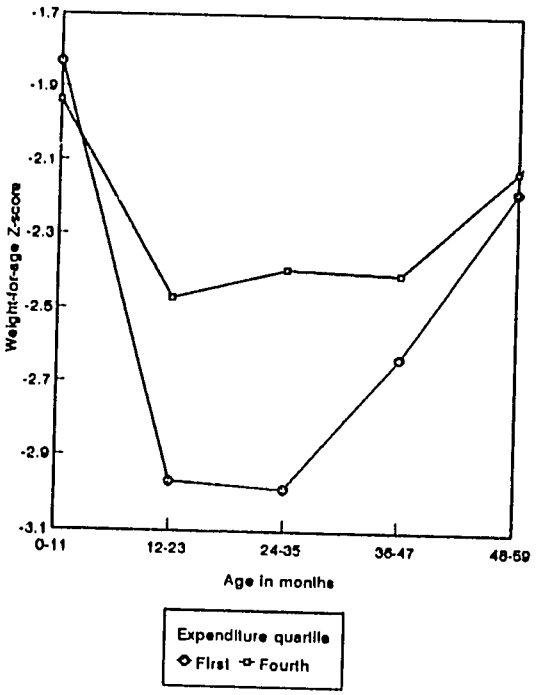


Figure 11.3-Weight-for-height Z-score by age and income groups

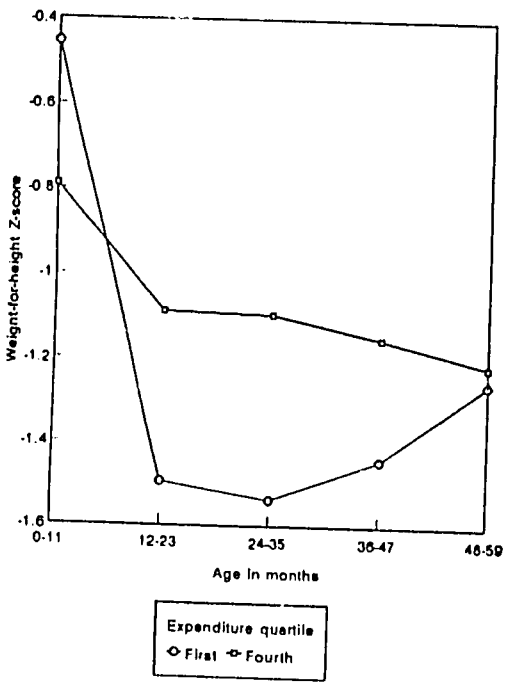
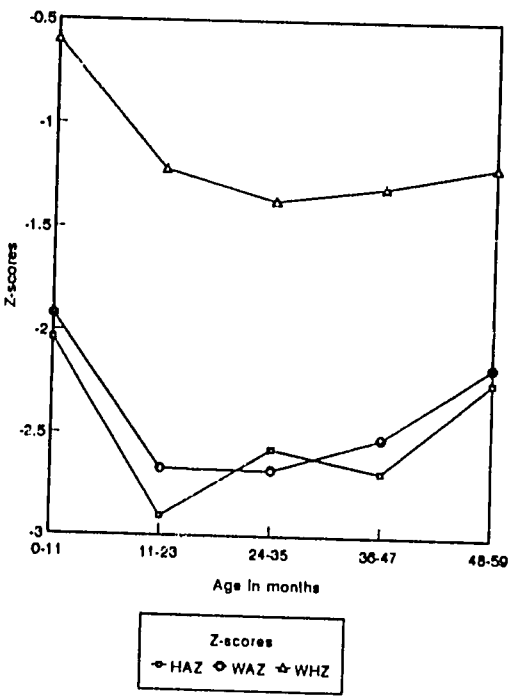


Figure 11.4-Overall Z-scores by age groups



Source: IFPRI Household Survey, 1991/92

year old indicate that the nutritional status of these predominantly breastfed children is much better than the older children, in both low-and high-income groups. As age increases and children are weaned, their nutritional status worsens, and this decline is more rapid for the children of low-income households. The pattern of weight-for-age Z-scores (which is a mix of the patterns of height-for-age and weight-for-height scores) of low-income children shows a sharp rise from the third year of age. By the age of five years, there is little difference of nutritional status of children between low-and high-income groups.

- All Z-scores between low-and high-income children for age groups 0-11 months and 48-59 months are not statistically significantly different. The differences of all Z-scores between low-and high income children are statistically significant for age groups 12-23 months and 24-35 months, while for age group 36-47 months only weight-for-height Z-scores are significantly different.

- Death is the ultimate consequence of severe malnutrition. Of the total children who died between three to five years of age, 35.5 percent belonged to the lowest income (first quartile) households, while 15.0 percent belonged to the fourth quartile households.

- Figure 12 shows the nutritional status and income relations of the other high risk group, the child-bearing age women (aged between 15 and 49 years). The Body Mass Index (BMI) is used as the nutritional status indicator for this group[4]. A BMI of 18.5 is considered normal for adults (James, Ferro-Luzzi and Waterlow 1988). The percentage of the child-bearing age women below 18.5 BMI consistently declines with rising household income.

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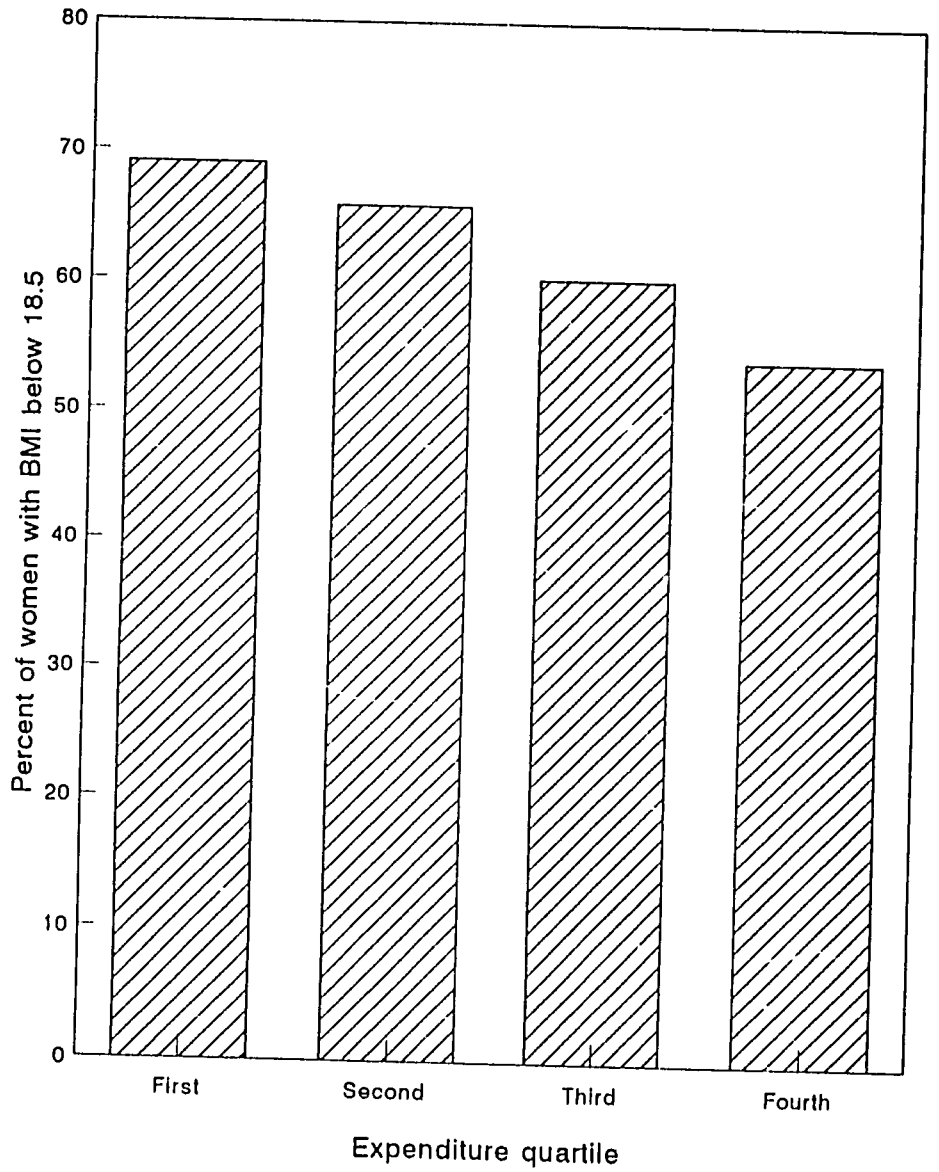
[4]BMI is defined as weight (in kilograms)/height^2 in meters. Pregnant women are excluded from BMI calculation. Weight gain during pregnancy could bias the results if pregnant women were included.

Figure 12-Percent of women with low body mass index by income groups
(Women, 15-49 years old)



Source: IFPRI Household Survey, 1991/92.

5. REGIONAL AND SEASONAL VARIATIONS IN FOOD CONSUMPTION AND NUTRITION

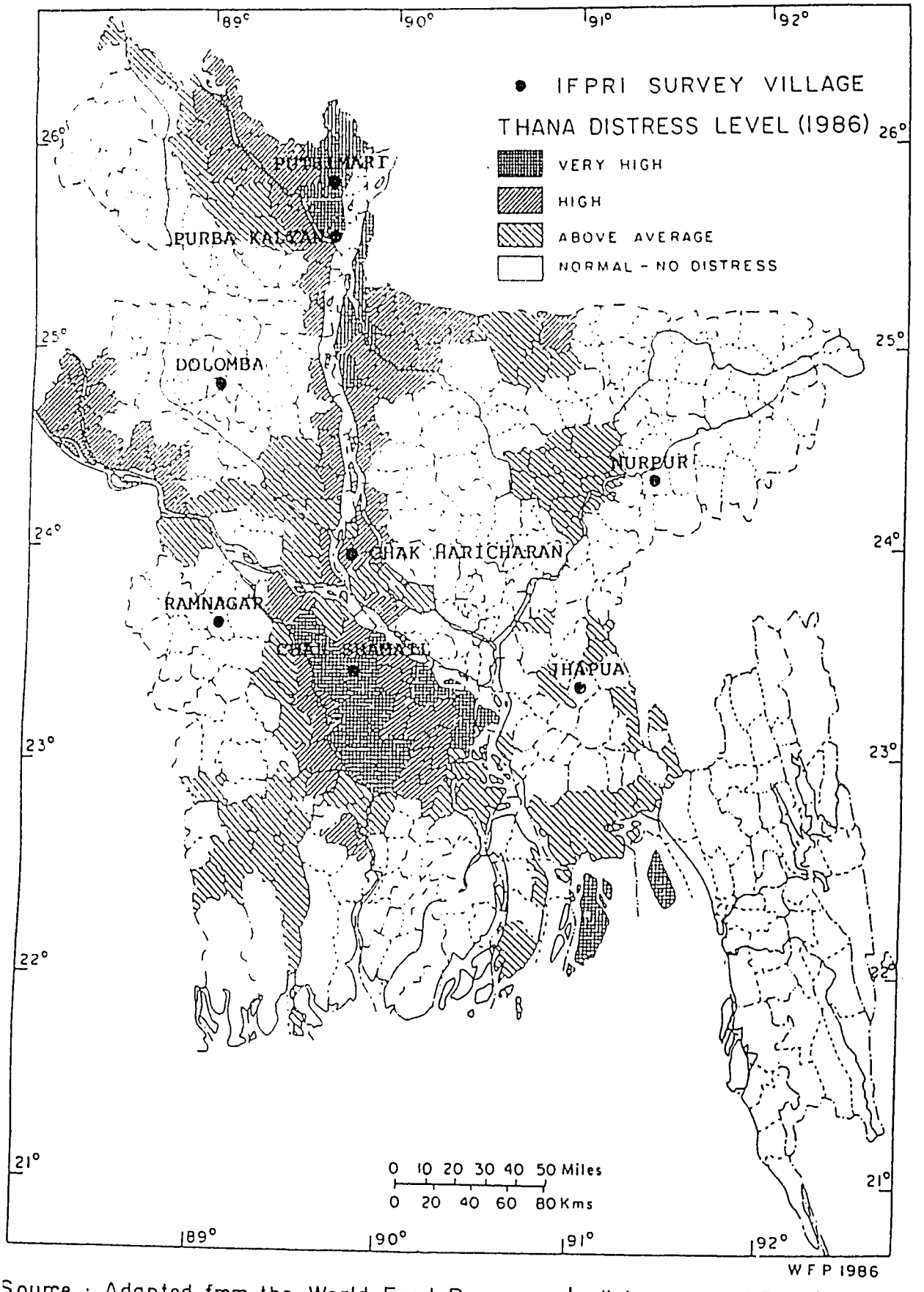
To what extent the geographical locations and seasonal variations in welfare indicators influence food intakes and nutritional status? An understanding of the effects of these variations on the patterns of food consumption and nutrition can strongly condition the cost and nature of alternative interventions. Based on prior information, the IFPRI household survey was conducted in selected regions and seasons to achieve adequate variation in the factors that might affect consumption and nutrition. This section provides the regional and seasonal comparisons of the survey findings.

Regional Variation

- IFPRI conducted the household consumption and nutrition survey in eight villages in eight *thanas*, located in the four divisions of the country. Four of the survey villages are located in distressed areas and the other four in non-distressed areas. The four distressed areas have been identified using the World Food Programme's distress map where each of the 460 rural *thanas* of the country has been categorized by its relative distress level. The distress level is determined by factors such as foodgrain surplus or deficit, agricultural wage rate, population density, landless households, employment opportunities, and susceptibility to natural disasters. The locations of the survey villages are spotted on the World Food Programme's distress map of Bangladesh, as shown in Figure 13. Employment opportunities, the incidence of natural calamities, agricultural technology, infrastructural development, disease, sanitation, and food prices all vary substantially across the survey villages.

- Table 7 presents the results of the analysis according to some major indicators of household welfare. The values of the coefficients of variation (standard deviation divided by the mean) suggest extreme regional variations in wheat consumption. The difference in per capita income (expenditure) between the

Figure 13-Locations of the survey villages



Source : Adapted from the World Food Programme's distress map of Bangladesh.

Table 7—Regional variation in expenditures, rice price, and food consumption

Village	Thana	Total Expenditure	Food Expenditure	Foodgrain Consumption		Rice price	Calorie Intake	Calorie Adequacy
				Rice	Wheat			
		(taka/person/month)		(grams/person/day)		(taka/kg)	(kcal/person/day)	(percent)
Puthimari	*Chilmari	224	145	359	73	9.7	1,697	86.7
Purba Kalyan	*Kurigram	252	165	449	10	9.6	1,737	86.9
Chak Haricharan	*Daulatpur	268	188	427	57	11.2	1,848	91.0
Nurpur	Hobiganj	304	212	409	52	11.3	1,744	90.5
Dolomba	Adamdighi	317	201	460	2	10.6	1,790	91.1
Char Shamail	*Shibchar	349	214	420	19	11.3	1,799	91.3
Jhapua	Barura	369	255	476	11	11.0	1,964	99.6
Ramnagar	Harinakundu	419	243	444	9	10.6	2,018	99.5
All		303	198	427	32	10.6	1,814	92.0
Coefficient of Variation (%)		20.7	18.2	9.4	93.2	6.9	6.3	5.4

Source: International Food Policy Research Institute, "Consumption and Nutrition Survey 1991/92" Bangladesh

Note: Food consumption estimates are based on 24-hour food weighing data.

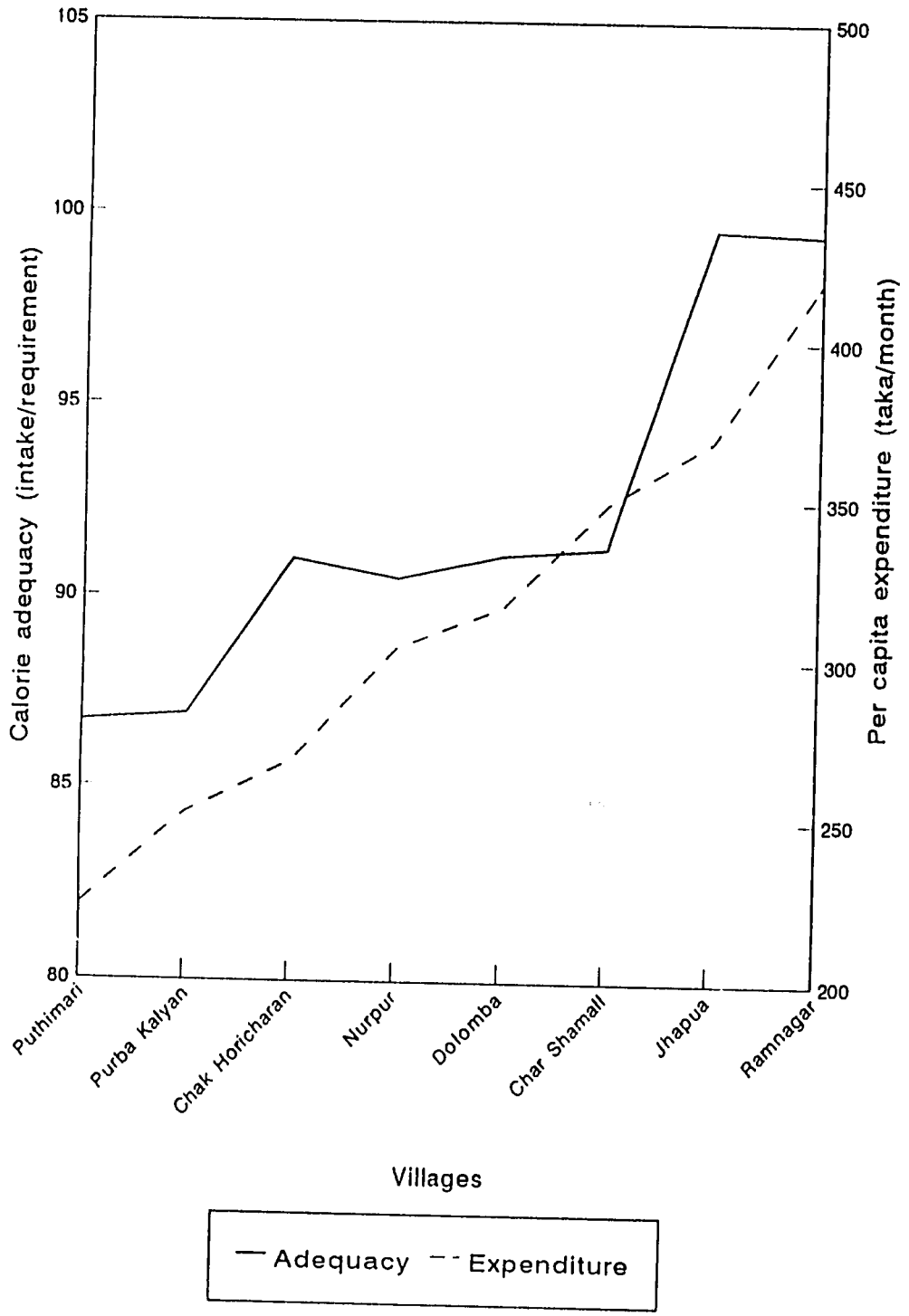
*Distressed thanas.

lowest-income village (Puthimari) and the highest-income village (Ramnagar) is as high as 87 percent. These two villages are also two extremes in per capita calorie intakes. The Puthimari village belongs to Chilmari *thana*, which is one of the most distressed areas in Bangladesh. Severe land erosion caused by the Jamuna river is the principal cause of misery in Puthimari. The village is also characterized by a very high concentration of landless households, most of whom lost their land to the river. Cultivated land in the village is mostly unirrigated, and local variety of Aman rice is the major crop grown by predominantly subsistent farmers. Rice accounts for 92 percent of all agricultural income, yet the average marketable surplus of rice is only 19 percent.

- In contrast, the Ramnagar village in Harinakundu *thana* is quite advanced in agricultural technology. The village is located in the Ganges-Kapatakh (GK) irrigation project area, and the entire cultivated land is irrigated during the dry season. Most farmers grow two crops of high-yielding variety of rice, and the average marketable surplus of rice is 50 percent. However, rice accounts for only 41 percent of agricultural income. Betel leaf, an entirely commercial crop in the village, is widely grown by the farmers in Ramnagar, and constitutes about 54 percent of agricultural income, on the average. Indeed, betel leaf is the principal source of cash income of the village households.

- Figure 14 shows the calorie adequacy and income across the survey villages, indicating quite a strong correlation between the two indicators of household welfare. Table 8 and figures 15 and 16 show the variability in the nutritional status of preschool children and child-bearing age women, the nutritionally most vulnerable groups. The villages are arranged from low-to-high income in the graphs. There is no noticeable association between village-level household income and nutritional status of children. However, the variation in nutritional status of children and women is quite substantial between villages.

Figure 14-Regional variation in calorie adequacy



Sorce: IFPRI Household Survey, 1991/92.

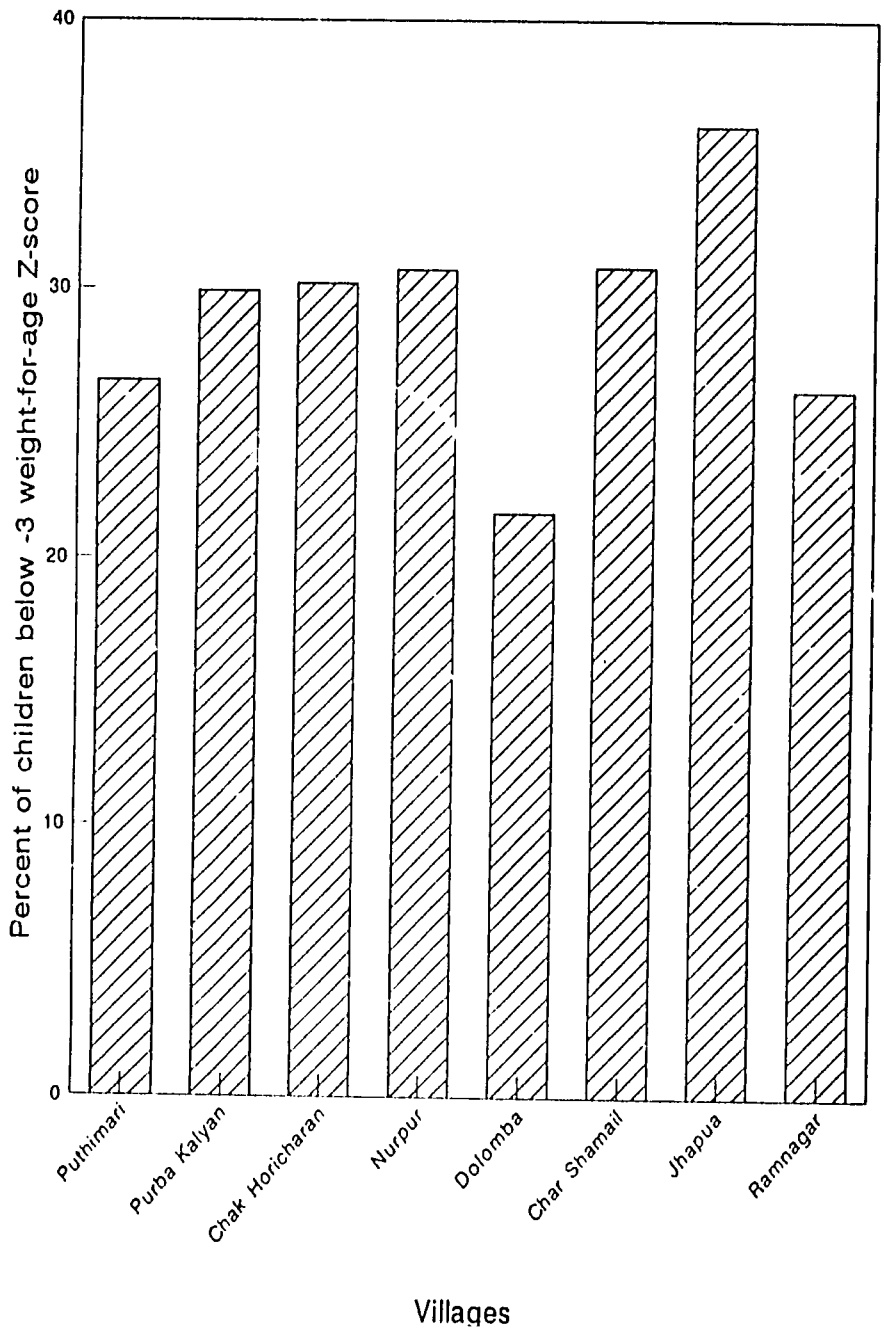
Table 8—Regional variation in nutritional status of the vulnerable groups

Village	Thana	Preschool Children		Child-bearing Age Women	
		Calorie Deficients	Weight for Age below -3 Z-score	Calorie Deficients	BMI Less than 18.5
			(Percent)		
Puthimari	*Chilmari	73.5	26.6	85.6	68.6
Purba Kalyan	*Kurigram	82.0	29.9	83.5	59.1
Chak Haricharan	*Daulatpur	72.5	30.2	75.5	56.5
Nurpur	Hobiganj	66.7	30.7	79.2	76.4
Dolomba	Adamdighi	80.2	21.7	76.6	57.1
Char Shamail	*Shibchar	85.6	30.8	72.4	59.8
Jhapua	Barura	65.2	36.0	63.5	66.1
Ramnagar	Harinakundu	64.8	26.3	71.4	51.6
All		74.2	29.5	76.3	62.2

Source: International Food Policy Research Institute, "Consumption and Nutrition Survey 1991/92", Bangladesh.

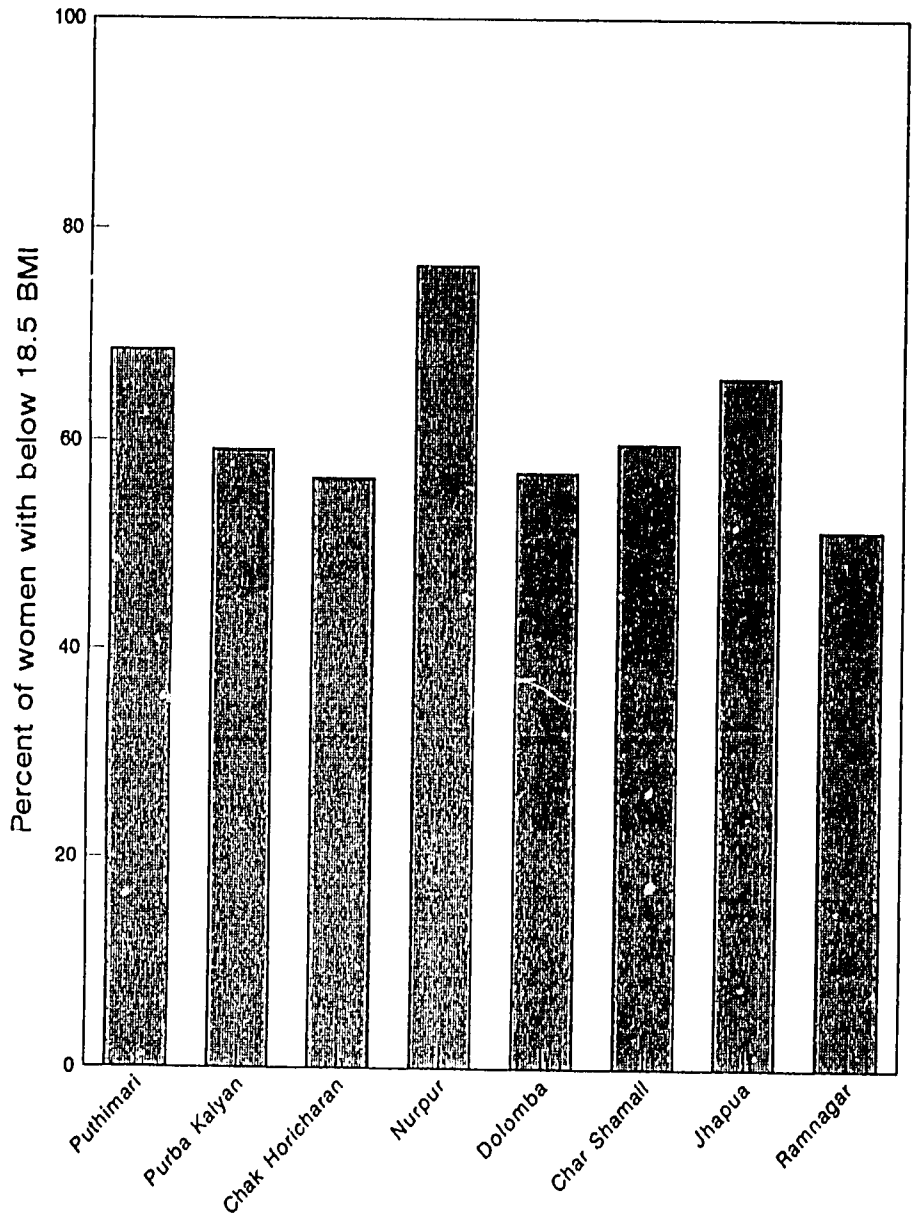
* Distressed thanas

Figure 15- Percent of underweight children by regions
(Children, 0-59 months old)



Source: IFPRI Household Survey, 1991/92

Figure 16- Percent of women with low body mass index by regions
(Women, 15-49 years old)



Source: IFPRI Household Survey, 1991/92

Seasonal Variation

- IFPRI repeated the household consumption and nutrition survey three times over the one year period to capture the seasonal effects on consumption and nutritional patterns. The first survey round was conducted in 1991 during the October-November lean season; the second, January-March 1992 peak season; and the third, September-November 1992 lean season. The first survey round included only low-income households. Although higher income households were included in the second and third survey rounds, seasonal comparisons are made only for low-income households for the analytical consistency.

- In rural Bangladesh, September to mid-November is the worst season in the year in terms of food insecurity. Absence of employment before the Aman rice harvest in November makes this lean season especially acute (Clay 1981); particularly for the rural landless who depend on wage labor for their income. Foodgrain prices are also typically high during this season in normal years. In contrast, the months of December through March represent the peak season when rice price falls, and employment opportunities increase substantially due to Aman rice harvest, Boro rice, wheat and other winter season crop plantations and harvests. With the rapid advancement of irrigation-induced technological change in agriculture, employment opportunities continue to increase during this season.

- Table 9 highlights the improvements in major welfare indicators from lean to peak seasons for low-income rural households. Appendix 1, Tables 1.7 and 1.8 provide detailed results of the effects of seasonality on household budget allocation and food intake patterns. Figure 17 indicates a significant improvement in preschooler nutritional status from lean to peak season, in terms of the middle-upper arm circumference (MUAC) measure. A MUAC of less than 125 millimeter indicates severe wasting or acture undernutrition of children under five years of age.

Table 9—Nutrient intakes of low-income household members

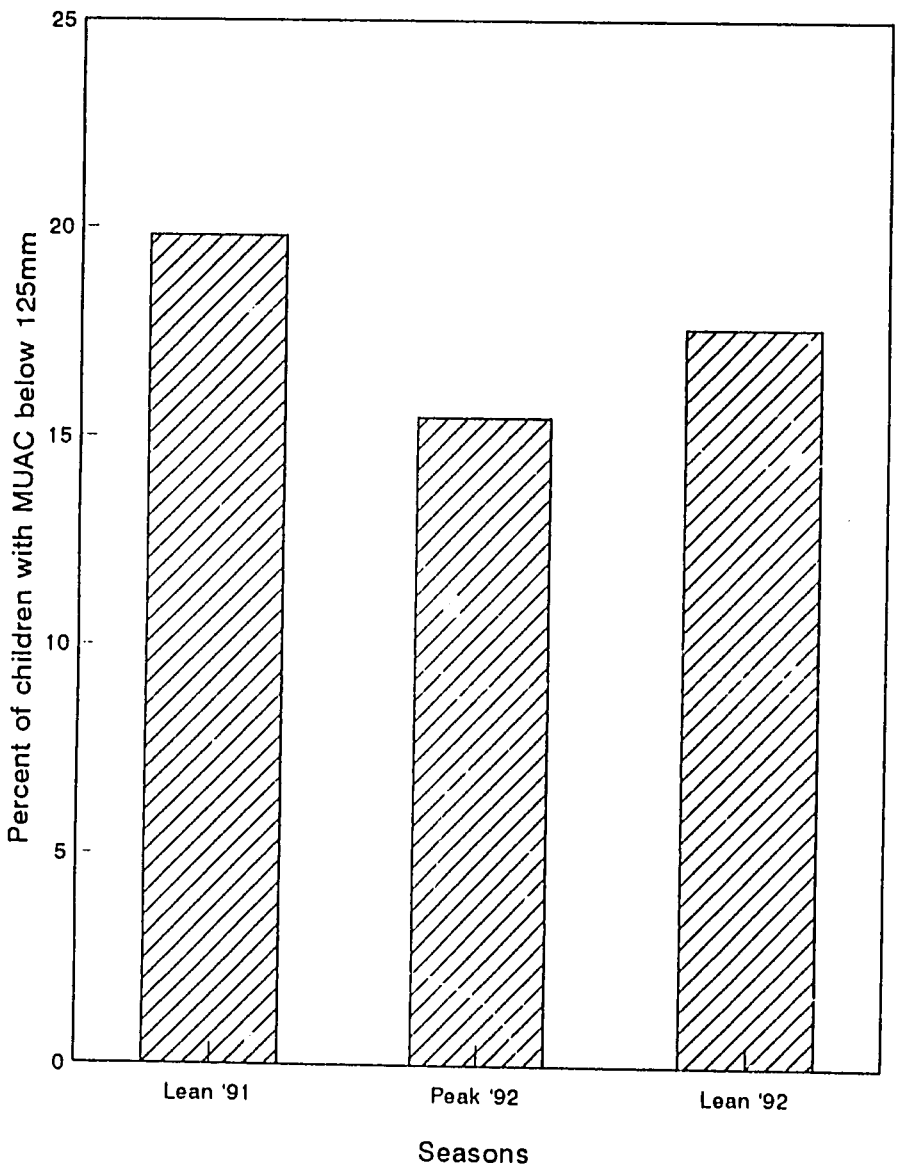
Indicators	Lean Season (1991)	Peak Season (1992)	Change from Lean to Peak Season
Income(taka/person/month)	190	267	40.5%
Expenditure (taka/person/month)	257	266	3.5%
Food expenditure (taka/person/day)	188	194	3.2%
Calorie intake (kcal/person/day)			
All family members	1,573	1,752	11.4%
All male	1,757	1,921	9.3%
All female	1,401	1,597	14.0%
Calorie adequacy (percent)			
All family member	79.5	89.9	13.1%
All male	81.7	94.8	16.0%
All female	77.4	85.3	10.2%
Calorie deficient population (percent)			
All family members	77.1	62.8	-18.5%
All male	75.2	57.3	-23.8%
All female	78.9	67.7	-14.2%
Protein intake (grams/person/day)	41	43	4.9%

Source: International Food Policy Research Institute, "Consumption and Nutrition Survey 1991/92", Bangladesh.

Note : Estimates of calorie and protein intakes are based on 24-hour food wieghing data.

Figure 17-Seasonal variation in acute undernutrition of children

(Children aged 12-59 months)



Source: IFPRI Household Survey, 1991/92.

Effects of Falling Rice Price. Rice accounts for about 40 percent of all spending by low-income rural families. Because of this, rice price is a powerful determinant of real income, consumption and nutrition of the poor. In normal years, rice price falls in June during the Boro crop harvest, then rises gradually through November, and falls sharply in December during Aman harvest. The pattern in the 1992 Boro to Aman season was, however, very unusual. Rice price declined throughout the season, instead of rising as the season progressed. A recent IFPRI study explains this unprecedented behavior in the rice market in 1992 (Haggblade and Rahman 1993). For this study, the 20 percent fall in rice price from lean season of 1991 to lean season of 1992 provides a rare opportunity to capture the effects of rice price on consumption and nutrition of the same households. These effects are summarized in Table 10, and highlighted as follows.

- The survey findings suggest that welfare indicators other than consumption and nutrition, such landholdings and employment, were quite similar in the lean seasons over the one year period. However, compared to 1991, the households paid about 20 percent less price to purchase rice in 1992. This fall in rice price offered increased consumption opportunities to the poor families. They availed those opportunities by not only consuming about 38 percent more rice, but also more high-protein foods, such as milk, meat and eggs. Moreover, these families increased their purchases of nonfood commodities, such as clothings, by 17 percent.

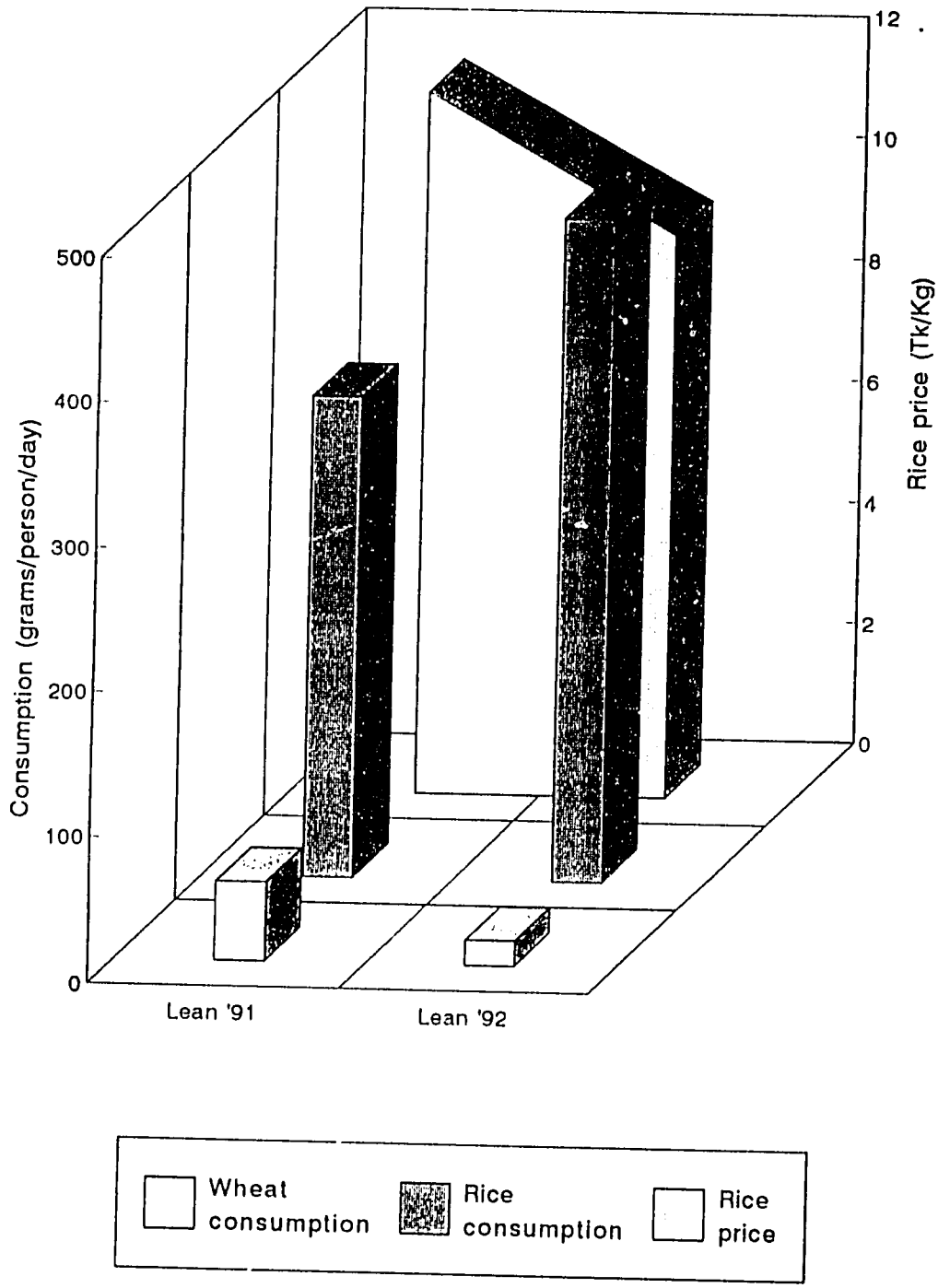
- The rural poor, however, drastically reduced their wheat consumption. Because rice is their preferred cereal, poor families responded to falling rice price by shifting from wheat to rice. Nevertheless, this decrease in wheat consumption was more than offset by the large increase in rice consumption, and the net effect was a 23 percent increase in total foodgrain consumption. Figure 18 illustrates the fall in rice price, and changes in rice and wheat consumption between 1991 and 1992 lean seasons.

Table 10—Changes in consumption and nutrition of low-income rural people

Indicators	Changes from 1991 to 1992 Lean Seasons
Rice price	-19.6%
Food consumption	
Foodgrains	23.0%
Rice	37.9%
Wheat (atta)	-68.3%
Meat, milk and eggs	76.6%
Calorie intakes	
All family members	12.2%
Adults	10.2%
Children under five	19.7%
Nutritional status	
Body-weight of adult male	0.6%
Body-weight of adult femle	0.8%
Undernourished children (MUAC<125 mm)	-2.2%
Poverty incidence	-15.3%

Source: International Food Policy Research Institute, "Consumption and Nutrition Survey 1991/92", Bangladesh

Figure 18-Effects of falling rice price on rice and wheat consumption



Source: IFPRI Household Survey, 1991/92.

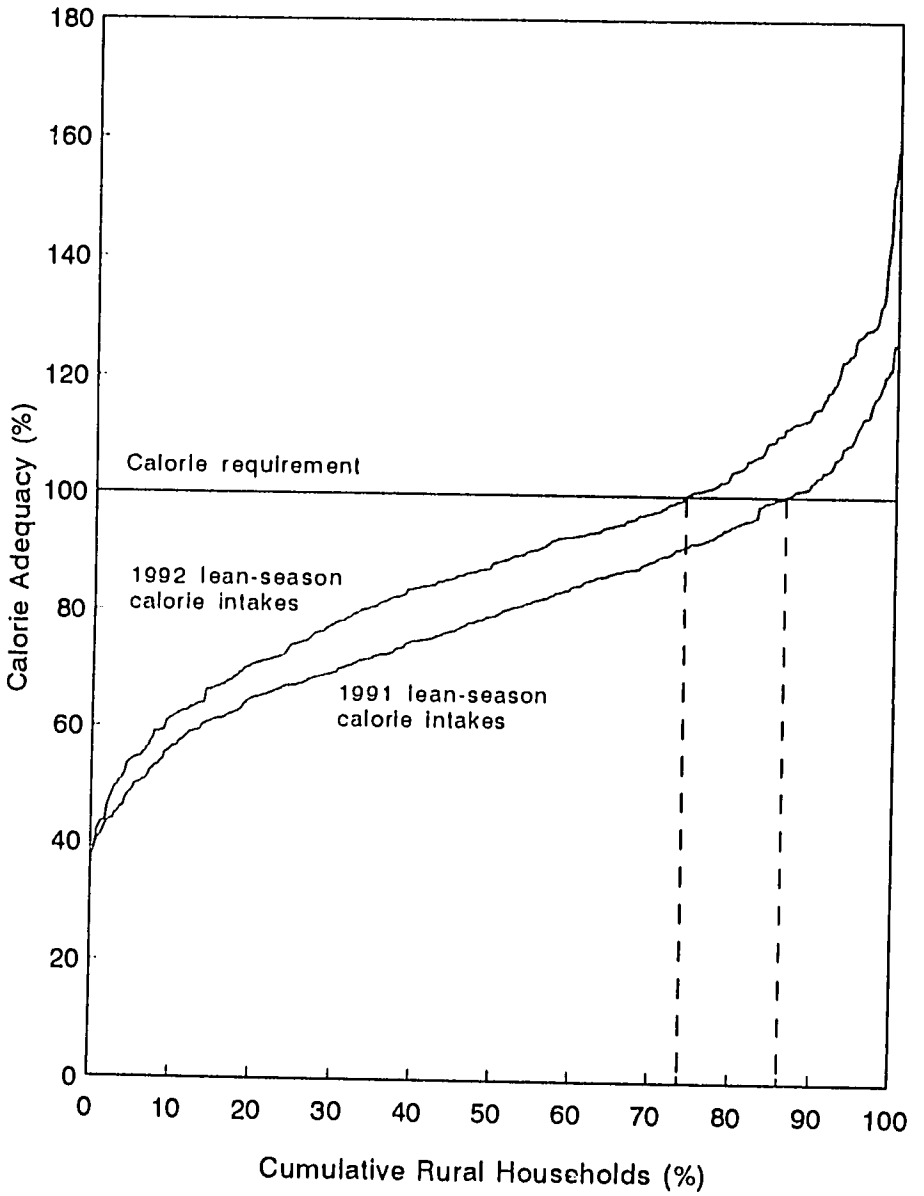
- The combined effect of the change in the food consumption patterns resulted in about 12 percent increase in calorie intakes by low-income families. Among the family members, children appears to have gained considerably more than the adults in percentage terms.

- The findings reveal that the gains in body-weight of the adults were only marginal between 1991 and 1992. The percentages of severely malnourished children (MUAC<125 millimeter) suggest a modest decline in child malnutrition from 1991 to 1992.

- Finally, an attempt has been made here to estimate the changes in rural poverty incidence between 1991 and 1992 lean seasons. In most poverty analyses, a common poverty line is usually set on the basis of recommended daily caloric requirements of the population. The availability of data on individual calorie intakes and physical measures enabled the present analysis to estimate the poverty incidence more precisely by calculating each individual's actual caloric shortfall from his or her estimated requirement. The results suggest that poverty was alleviated quite significantly from 1991 to 1992. About 15 percent of the low-income sample population moved above the poverty level.

- Figure 19 shows the poverty gaps in terms of shortfalls in calorie intakes from requirement. The cumulative sample households are ranked from low to high levels of calorie intakes. The actual calorie intakes relative to requirements (that is, calorie adequacies) at the household level are depicted by the calorie intake curves for the 1991 and 1992 lean seasons. The aggregate calorie gaps during the two periods are represented by the areas between the calorie requirement (poverty line) and the calorie intake curves.

Figure 19-Gaps in calorie intakes



Source: IFPRI Household Survey, 1991/92

- The recent sharp decline in rice price and its consequential benefits were most likely a temporary phenomenon. Nevertheless, real foodgrain prices have declined steadily over the past two decades as input liberalization and investment in agricultural research have payed off in the form of major increases in per capita foodgrain output. The landless and other poor consumers have been the principal beneficiaries of declining real foodgrain prices in Bangladesh.

6. CONCLUSION

Bangladesh is at the verge of attaining "self-sufficiency" in foodgrain production. The recent trends in rice production indicate that the country may emerge as a surplus rice producer in the near future. However, the poor section of the population, millions of them, are too poor to capture the gains from rice surplus or self-sufficiency. Due to their inadequate purchasing power, they lack access to enough food and thus remain seriously underfed. Self-sufficiency will not of itself solve this poverty problem.

Economic growth that creates employment for the poor, raises their real incomes, and consequently, increases their purchasing power. Economic growth, however, is a slow process to improve food security. As a transient solution to the problem of food insecurity, a well-managed and appropriately targeted intervention can improve the nutritional status of the poor in a cost-effective way by excluding the non-needy members of the population. The food consumption and nutritional patterns of rural households, as revealed in this study, may facilitate policymakers' efforts in identifying the appropriate targeting mechanisms for interventions.

The findings of the study suggest that rural households, particularly, the poor are highly responsive to changes in income in adjusting their food consumption patterns. Thus, a targeted intervention of transferring income can be an efficient way of improving food consumption and nutrition of the poor.

A recent IFPRI study in Bangladesh indicates that preschool children and women, particularly pregnant or lactating women, are at the greatest risk of undernutrition among all family members. The present study suggests that income has no significant impact on nutritional status of three to five years old children. However, children aged 12-35 months belonging to high-income households are much better-off nutritionally than those from the poorest households.

The findings also suggest that among all preschooler, children aged 12-35 months are at the greatest risk of undernutrition. Thus, targeting interventions to malnourished children may be limited to this age-group from the poorest households, rather than targeting all children under five years of age. Such a targeting strategy will be more cost-effective in improving the nutritional status of children.

The food consumption patterns across income groups show that the consumption of wheat declines as incomes rise, suggesting wheat is an inferior commodity in rural Bangladesh. This attribute makes wheat a self-targeting commodity for targeted food interventions, and thus has the potential to increase cost-effectiveness of such programs. In contrast, rice consumption increases sharply with income. This pattern suggests that distributing rice in food intervention programs is not an efficient mechanism for targeting the poor.

Wheat is the cheapest source of calorie, protein, and iron among all foods consumed in rural areas. This indicates that even very poor households can improve their nutrition by altering their diet pattern. Substitution of wheat for rice will result in a more balanced diet. This finding also justifies the distribution of wheat in targeted food intervention programs to alleviate the protein-energy-iron deficiencies at a least cost.

Apparently, the recent success of Bangladesh's green revolution, which has resulted in an impressive increase in rice production, is becoming problematic for the continued justification for food aid. However, in spite of the likely self-sufficiency in rice production, wheat deficit continues to exist. The findings of this study stress that wheat should be distributed for targeted food interventions, instead of rice, and thus the need for food aid in wheat remains to serve this purpose.

The findings show a high degree of regional and seasonal variations in food consumption and nutritional status. Thus, limiting interventions to specific distressed areas of the country, and operating the programs only during the lean seasons may considerably improve cost-effectiveness of such interventions.

Expenditure on rice accounts for a large budget share of the poor families. Because of this, a falling rice price significantly increases real income, and consequently, improve food consumption and nutritional status of the poor. This study documents such improvements from the recent fall in rice price. However, the sharp decline in rice price in 1992 was most likely a temporary phenomenon. Nevertheless, real rice prices have declined steadily over the past two decades as input liberalization and investment in agricultural research have payed off in the from of major increases in per capita rice output. The landless and other poor consumers have been the principal beneficiaries of declining rice prices.

APPENDIX 1

SUPPLEMENTARY TABLES

Table 1.1—Proportion of total household expenditures spent on major commodity groups

Commodity	Expenditure Quartile				All
	First	Second	Third	Fourth	
	(taka/person/month)				
Total expenditure	140	224	303	546	303
	(percent)				
Food	75.3	74.5	71.7	58.6	70.0
Housing	3.8	3.1	2.9	2.5	3.1
Fuel	6.3	4.2	3.6	2.7	4.2
Clothing and footwear	3.2	3.4	3.8	5.5	4.0
Medical services and medicines	2.2	2.6	3.5	5.5	3.5
Education	0.2	0.5	0.7	1.9	0.8
Ceremonials/Entertainment	1.2	2.9	4.6	10.0	4.7
Tobacco	1.9	2.1	1.8	1.6	1.8
Durable goods	0.1	0.1	0.1	0.4	0.2
Other goods and services	6.0	6.4	7.3	11.2	7.8
Total	100.0	100.0	100.0	100.0	100.0

Source: International Food Policy Research Institute, "Consumption and Nutrition Survey 1991/92", Bangladesh.

Note: Components may not add to totals because of rounding.

Table 1.2—Proportion of food budget allocated to various foods

Food Items	Expenditure Quartile				All
	First	Second	Third	Fourth	
	(taka/person/month)				
Food expenditure	106	166	217	302	198
	(percent)				
Rice	64.0	64.6	60.4	52.6	60.4
Wheat	10.5	4.0	2.8	1.9	4.8
Other cereal	0.4	0.3	0.2	0.1	0.3
Pulses	0.8	1.9	1.9	2.7	1.8
Potatoes	1.9	2.1	2.2	2.6	2.2
Edible oil	1.8	2.5	3.0	3.7	2.7
Vegetables	11.0	9.5	9.4	9.0	9.7
Fruits	0.1	0.2	0.5	0.7	0.4
Fish	3.4	7.2	8.6	10.4	7.4
Meat	0.0	0.2	1.2	3.9	1.3
Eggs	0.1	0.2	0.4	0.5	0.3
Milk	0.1	0.5	0.7	1.5	0.7
Spices	4.1	5.1	6.0	6.5	5.4
Onion	0.3	0.5	0.7	0.8	0.6
Salt	1.1	0.6	0.7	0.5	0.7
Sugar	0.1	0.2	0.4	1.0	0.4
Other food	0.3	0.4	0.9	1.6	0.8
Total	100.0	100.0	100.0	100.0	100.0

Source: International Food Policy Research Institute, "Consumption and Nutrition Survey1991/92", Bangladesh

Note: Estimate of food expenditure based on 24-hour food weighing data.

Components may not add to totals because of rounding.

Table 1.3—Calorie composition by food groups

Category	Expenditure Quartile				All
	First	Second	Third	Fourth	
	(kcal/person/day)				
Calorie intake	1,360	1,714	1,921	2,189	1,814
	(percent of total calorie intake)				
Rice	75.06	80.82	79.50	76.97	78.09
Wheat	12.86	5.36	4.10	2.89	6.29
Other cereal	0.56	0.47	0.34	0.08	0.36
Pulses	0.51	1.25	1.34	2.02	1.28
Potatoes	1.66	1.58	1.86	2.45	1.89
Edible oil	1.11	1.69	2.24	3.32	2.09
Vegetables	6.25	5.64	5.99	5.06	5.74
Fish	0.76	1.59	1.99	2.29	1.66
Meat	0.00	0.02	0.16	0.64	0.21
Eggs	0.02	0.03	0.06	0.10	0.05
Milk	0.02	0.12	0.22	0.49	0.21
Fruits	0.05	0.12	0.19	0.53	0.22
Spices	0.96	1.00	1.24	1.49	1.17
Onion	0.06	0.09	0.14	0.19	0.12
Sugar & gur	0.08	0.11	0.37	0.92	0.37
Other food	0.04	0.10	0.28	0.57	0.25
Total	100.00	100.00	100.00	100.00	100.00

Source: International Food Policy Research Institute, "Consumption and Nutrition Survey 1991/92", Bangladesh.

Note: Estimate are based on 24-hour food weighing data.

Components may not add to total because of rounding

Table 1.4—Protein composition by food groups

Category	Expenditure Quartile				All
	First	Second	Third	Fourth	
	(grams/person/day)				
Protein intake	33	41	46	56	45
	(percent of total protein intake)				
Rice	65.78	68.17	66.18	61.14	65.31
Wheat	14.23	6.44	4.96	3.66	7.31
Other cereal	0.66	0.49	0.36	0.08	0.40
Pulses	1.54	3.45	4.03	5.30	3.58
Potatoes	1.30	1.23	1.39	1.74	1.42
Vegetables	10.53	9.20	8.81	8.09	9.15
Fish	4.03	8.33	9.76	11.46	8.40
Meat	0.00	0.18	1.05	3.79	1.26
Eggs	0.07	0.12	0.20	0.32	0.18
Milk	0.05	0.26	0.44	0.97	0.43
Fruits	0.02	0.06	0.13	0.28	0.12
Spices	1.67	1.87	2.38	2.50	2.11
Onion	0.07	0.11	0.17	0.19	0.14
Sugar and gur	0.00	0.00	0.02	0.10	0.03
Other food	0.03	0.08	0.13	0.37	0.15
Total	100.00	100.00	100.00	100.00	100.00

Source: International Food Policy Research Institute, "Consumption and Nutrition Survey 1991/92", Bangladesh.

Note: Estimates are based on 24-hour food weighing data.

Components may not add to totals because of rounding

Table 1.5—Iron composition by food groups

Category	Expenditure Quartile				All
	First	Second	Third	Fourth	
	(milligrams/person/day)				
Iron intake	24	25	28	30	27
	(percent of total iron intake)				
Rice	63.90	71.53	70.38	69.76	68.90
Wheat	15.26	7.74	6.32	4.63	8.48
Other cereal	0.78	0.58	0.47	0.06	0.47
Pulses	0.74	1.73	1.92	2.81	1.80
Potatoes	0.99	0.96	1.14	1.47	1.14
Vegetables	15.51	13.05	13.54	12.35	13.61
Fish	0.65	1.40	1.85	2.17	1.52
Meat	0.00	0.01	0.05	0.16	0.06
Eggs	0.03	0.04	0.06	0.12	0.06
Milk	0.01	0.03	0.05	0.12	0.05
Fruits	0.03	0.06	0.11	0.23	0.11
Spices	1.90	2.45	2.98	4.07	2.85
Onion	0.08	0.13	0.20	0.25	0.16
Sugar and gur	0.10	0.15	0.58	0.94	0.44
Other food	0.04	0.13	0.34	0.88	0.35
Total	100.00	100.00	100.00	100.00	100.00

Source: International Food Policy Research Institute, "Consumption and Nutrition Survey 1991/92", Bangladesh.

Note: Estimates are based on 24-hour food weighing data.

Components may not add to totals because of rounding.

Table 1.6—Vitamin A composition by food groups

Category	Expenditure Quartile				
	First	Second	Third	Fourth	All
	(microgram/person/day)				
Vitamin A intake	398	414	491	553	468
	(percent of total vitamin A intake)				
Rice	2.34	1.50	1.02	1.18	1.51
Wheat	7.22	4.29	2.62	1.71	3.95
Other cereal	0.75	0.11	0.27	0.00	0.28
Pulses	2.02	4.55	5.26	6.24	4.53
Potatoes	4.70	4.16	4.28	3.64	4.19
Vegetables	62.43	65.22	65.53	65.16	64.59
Eggs	0.47	0.83	1.01	1.46	0.94
Milk	0.00	0.24	0.11	0.33	0.17
Fruits	0.00	0.16	0.44	0.58	0.30
Spices	18.00	15.71	15.22	12.58	15.37
Onion	0.47	0.52	0.61	0.58	0.54
Sugar and gur	0.27	0.24	0.78	1.10	0.60
Other food	1.31	2.48	2.83	5.44	3.02
All	100.00	100.00	100.00	100.00	100.00

Source: International Food Policy Research Institute, "Consumption and Nutrition Survey 1991/92", Bangladesh.

Note: Estimates are based on 24-hour food weighing data.

Compontns may not add to totals because of rounding.

Table 1.7—Seasonal variation in household budget allocation by low-income households

Commodity groups	Lean Season (1991)		Peak Season (1992)	
	(taka/month)	(percent)	(taka/month)	(percent)
Total expenditure per capita	257	100	266	100
Food	188.1	74.8	193.7	73.8
Housing	6.8	2.9	6.8	2.8
Fuel	9.1	4.0	9.3	4.1
Clothing and footwear	6.0	2.1	10.6	4.0
Medical services and medicines	11.7	3.8	7.2	2.4
Education	0.8	0.3	1.5	0.5
Ceremonials/ Entertainment	10.3	3.0	11.9	3.2
Tobacco	4.9	2.0	5.5	2.1
Durable goods	0.0	0.0	1.3	0.4
Other goods and services	19.4	7.1	18.7	6.7

Source: International Food Policy Research Institute, "Consumption and Nutrition Survey 1991/92", Bangladesh.

Table 1.8. Seasonal variation in prices, and food intakes by low-income households

Food Item	Lean Season (1991)		Peak Season (1992)		Lean Season (1992)	
	Food Intake	Purchase Price	Food Intake	Purchase Price	Food Intake	Purchase Price
	(grams/person/month)	(taka/kg)	(grams/person/month)	(taka/kg)	(grams/person/month)	(taka/kg)
Rice	9,927	11.59	12,659	11.42	13,690	9.32
Wheat	1,625	8.81	1,254	9.53	517	8.65
Total Foodgrains	11,552	-	13,913	-	14,207	-
Pulses	260	20.64	97	22.19	197	21.60
Potatoes	491	7.26	2,364	4.29	287	7.56
Edible oil	108	51.65	127	52.16	115	52.52
Vegetables	5,435	4.99	5,792	4.17	4,421	5.25
Fish	1,080	22.07	370	28.09	852	30.23
Meat	51	42.81	127	47.24	84	50.82
Eggs	6	-	19	-	19	-
Milk	85	10.95	154	10.40	145	11.27
Fruits	52	9.44	218	11.62	65	10.41
Spices	240	-	212	-	239	-
Onion	72	19.70	112	12.04	142	9.95
Salt	184	7.91	231	7.04	197	5.76
Sugar and gur	22	17.90	94	17.40	34	20.77

Source: International Food Policy Research Institute, "Consumption and Nutrition Survey 1991/92", Bangladesh.

Note: Food intake estimations are based on 24-hour food weighing data.

APPENDIX 2

ESTIMATION OF ENERGY REQUIREMENTS

Estimates of individual energy (calorie) requirements in this study are based on the methodology provided in FAO/WHO/UNU Expert Consultation (1985), and James and Schofield (1990). Energy requirements need to be calculated for individuals in each sex and in specific age groups. The principal components of energy requirements are Basal Metabolic Rate (BMR), weight, age, sex, and level of physical activity. BMR is measured under conditions of absolute rest in the fasting state. Equations for calculating BMR from body weight of different age and sex groups from 10 years and above are listed in Table 2.1.

The total daily energy requirement (R) of an individual (aged 10 years and above) is calculated as:

$$R = (BMR \times PAL) + PLF \qquad (2.1)$$

Individual BMR is determined from actual body weight, using the anthropometric data collected in the survey. Although physical activities of individual household members were recorded in the survey, the information could not be processed in time for this report. Therefore, a rather crude method of estimation of the physical activity level (PAL) is adopted. Table 2.3 presents PALs for the average physical activity of each age and sex group in rural areas of less developed countries, as provided in James and Schofield (1990). These PAL values are used in equation (2.1) to estimate the individual energy requirements. For a woman who is pregnant or lactating or both, the pregnancy/lactation factor (PLF) is included in equation (2.1) to estimate her energy requirements. Three values of PLF allowances are adopted from James and Schofield (1990): allowance for pregnancy, 285 kcal/day; for lactation, 500 kcal/day; and for both, 785 kcal/day.

Energy requirements for children from birth to 9+ years are given in James and Schofield (1990) in kilocalories of (kcal) per kilogram of body weight. Table 2.2 provides energy

requirements for children. Energy requirement for a child is calculated by multiplying the child's actual body weight by requirement per kilogram.

Individual calorie intakes are measured in this analysis by a combination of 24-hour food weighing and recall (for food consumed outside home) method. Using the estimates of individual calorie requirements, calorie adequacy is computed for each individual as follows:

$$\text{Individual calorie adequacy (\%)} = \frac{\text{Calorie intake of individual}}{\text{Calorie requirement of individual}} \times 100 \qquad (2.2)$$

Table 2.1—Basal metabolic rate (BMR) for adolescents and adults

Age Range	Male	Female
(years)	(kcal per day)	
Adolescents		
10-17+	17.5W*+ 651	12.2W + 746
Adults		
18-29+	15.3W + 679	14.7W + 496
30-59+	11.6W + 879	8.7W + 829
>60	13.5W + 487	10.5W + 596

Source: Report of a Joint FAO/WHO/UNU Expert Consultation, "Energy and Protein Requirements", World Health Organization, Technical Report Series 724 (Geneva 1985).

*W is the average weight in kilograms.

Table 2.2—Energy allowance for children aged under ten years

Age	Male	Female
(years)	(kcal per kg of body weight)	
0+	109	109
1+	108	113
2+	104	102
3+	99	95
4+	95	92
5+	92	88
6+	88	83
7+	83	76
8+	77	69
9+	72	62

Source: W.P.T. James and E.C. Schofield, "Human Energy Requirements: A Manual for Planners and Nutritionists", published for FAO by Oxford University Press (Oxford 1990).

Table 2.3—Allowances for physical activity expressed in terms of PAL values

Age Group (years)	Male	Female
	(PAL value)	
Children		
0-9+	Children's energy needs are based on intake related to body weight	
Adolescents		
10+	1.76	1.65
11+	1.72	1.62
12+	1.69	1.60
13+	1.67	1.58
14+	1.65	1.57
15+	1.62	1.54
16+	1.60	1.52
17+	1.60	1.52
Adult[a] 18-59+	1.86	1.69
Elderly[b] (>60)	1.51	1.56

Source: W.P.T. James and E.C. Schofield, "Human Energy Requirements: A Manual for Planners and Nutritionists", published for FAO by Oxford University Press (Oxford 1990).

[a] Assumed 75 percent moderate and 25 percent heavy activity levels for adults in rural LDCs.

[b] For elderly (>60 years) assumed 100 percent light activity levels.

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