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THE IMPACT OF FEEDING CHILDREN IN SCHOOL: EVIDENCE FROM BANGLADESH

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EXECUTIVE SUMMARY

In July 2002, in order to diminish hunger in the classroom as well as to promote school enrollment and retention rates, the Government of Bangladesh and the U.N. World Food Programme launched the School Feeding Program (SFP) in chronically food-insecure areas of Bangladesh. SFP is the first effort in Bangladesh to provide incentives directly to primary-school children themselves, as opposed to cash or food to parents for sending their children to school.

The SFP provides a mid-morning snack consisting of eight fortified wheat biscuits to some one million children in approximately 6,000 primary schools in highly food-insecure rural areas, plus four slum areas in Dhaka City. At a cost of U.S. 6 cents per packet of eight, the biscuits provide 300 kilocalories and 75 percent of the recommended daily allowance of vitamins and minerals.

The International Food Policy Research Institute (IFPRI) conducted a comprehensive evaluation of the impact of the SFP in Bangladesh. The evaluation is based on a number of surveys at the household, school and community levels in addition to achievement tests for the schoolchildren, carried out in late 2003. Some of the major findings are highlighted here.

SFP has raised school enrollment by 14.2 percent, reduced the probability of dropping out of school by 7.5 percent, and increased school attendance by about 1.3 days a month. These results are obtained from econometric models that captured the impact of the SFP alone, isolating the effects of income and other factors.

SFP improves children's diets. Energy (calories) consumed from SFP biscuits are almost entirely (97 percent) additional to the child's normal diet. The child's family does not give him or her less food at home for eating the SFP biscuits at school. Even poor households do not substitute child energy intakes from SFP biscuits. These findings are based on a specifically designed experiment and an econometric model to assess the impact of SFP on child energy intake.

SF biscuits are the single most important source of vitamin A in the diet of program participants. After rice, they are the most important source of energy, protein, and iron. Average energy intake of participating students is 11 percent and 19 percent higher in rural and urban slum areas, respectively, than energy intake of primary school students in corresponding control areas. Participating students also appear to share SFP biscuits with younger siblings and sometimes other household members. Sharing creates an interesting spillover effect: energy from SFP biscuits account for 7 percent of total energy intake of children ages two to five in beneficiary households in the rural area.

An extremely high percentage of mothers report several positive effects of the SFP on their children. They note that children's interests in attending school and concentration on studies have increased; they are livelier and happier than before, and their incidence of illness has declined.

SFP improves child nutritional status. It increases the body mass index (BMI) of participating children by an average of 0.62 points. This represents a 4.3 percent increase compared to the average BMI of schoolchildren in the control group—a sizable increase that is partly due to the fact that most participating children were malnourished to begin with. Most of the program children had been eating SFP biscuits every school day for more than a year before the IFPRI surveys.

SFP improves academic performance. Participation in the SF program increases test scores by 15.7 percent. Participating students do especially well in mathematics. Students from urban slums do better in achievement tests than do students from rural areas, probably due to the difference in quality between urban and rural primary schools.

Urban slums are underserved. SFP is the only national intervention that operates in urban slums, but it only covers four slum areas in Dhaka City. This evaluation shows that about half of all primary school-age children in control urban slums, and 41 percent in participating urban slums, do not go to school. The corresponding figures in rural areas are 15 percent and 6 percent. In control urban slums, only about half of those who enter primary school stay to complete it. Direct and opportunity costs of schooling are likely to be the main reasons why children from poor households in slums not to attend school. Besides low enrollment and high dropout rates, urban slum children are threatened by violence and other social disruptions. Some of these threats can be mitigated if children can be drawn to school.

The encouraging findings of this study suggest that the SFP could well be scaled-up to benefit many more children—but care must be taken with targeting. To achieve maximum benefit for the cost, the program should cover those areas where undernutrion is a serious problem, school enrollment and attendance rates are low, and dropout rates are high.

Urban slums are promising areas for expansion. In rural areas, the Primary Education Stipend Program—a cash-for-education incentive program—is already active throughout the country. For SFP expansion in rural areas, geographical targeting methods—such as Vulnerability Analysis and Mapping (VAM)—could be refined to better identify places with the highest concentration of undernourished children and lowest educational attainment.

1. INTRODUCTION

School feeding programs are common in both developing and industrialized countries. The objectives of school feeding programs are to provide meals or snacks to reduce short-term hunger in the classroom in order to increase the ability of students to concentrate and learn, to attract children to school, and to increase their attendance. There is evidence from a number of countries that school feeding programs have fulfilled some or all of these objectives (see Section 2).

In Bangladesh, feeding children in school is a recent phenomenon.[1] In July 2002, in order to diminish hunger in the classroom as well as to promote school enrollment and retention rates, the Government of Bangladesh (GOB) and the World Food Programme (WFP) launched the School Feeding Program (SFP) in chronically food insecure areas of Bangladesh. The program distributes nutrient-fortified biscuits to all children in the intervention schools. In addition, a small pilot project, also started in 2002, distributes 'tetrapack' milk and fortified biscuits to children in project schools in one of the 64 districts in Bangladesh. This pilot project is funded by the U.S. Department of Agriculture (USDA) and implemented by the Land O'Lakes Foundation.

The GOB has devoted a significant share of its budget to providing incentives to families to send their children to school for over a decade. In an effort to increase primary school enrollment of children from poor families, the GOB had launched the Food for Education (FFE) program in 1993. The FFE program provided a free monthly ration of foodgrains (rice or wheat) to poor families in rural areas whose children attended primary school. A number of studies suggest that the FFE did raise primary school enrollment (Ahmed 2000; Ahmed and Arends-Kuenning 2003; Ahmed and Billah 1994; Ahmed and del Ninno 2002; Khandker 1996; Meng and Ryan 2004; Ravallion and Wodon 1997). The Primary Education Stipend program (PESP), which replaced the FFE program in 2002, provides cash assistance to poor families who send their children to primary school. The GOB also provides cash assistance to girls in secondary schools through four stipend programs. All of these conditional cash transfer programs aim to increase the enrollment and retention rates of students in primary and secondary schools throughout rural Bangladesh. A recent study indicates positive influence of these programs on educational attainment (Ahmed 2004).

As a result of these educational investments, Bangladesh has made commendable progress in the education sector over the past decade. Over 90 percent of children eventually enroll in school, and few disparities now exist between boys and girls. A recent World Bank report on poverty in Bangladesh notes that Bangladesh and Sri Lanka are the only countries in South Asia that have achieved gender as well as urban-rural parity in school enrollments (World Bank 2002).

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[1] Some government schools in Dhaka City introduced in-school distribution of snacks (tiffin) as early as in the 1950s, but students were required to pay a monthly fee for the snacks.

While the education interventions have been successful in meeting many of their objectives, academic achievement remains disappointing, especially in primary schools. Hunger is a likely reason. Widespread undernutrition in Bangladesh is a critical barrier to children's learning. The newly introduced school feeding program has the potential to improve children's learning performance.

Does the SFP increase school enrollment and attendance? What are the effects on food consumption and nutrition of participating children? Has the program made any impact on children's learning? The United Nations University commissioned the International Food Policy Research Institute (IFPRI) to conduct an evaluation of the school feeding program to answer these questions. The information generated through this evaluation would strengthen the empirical basis on which the GOB and WFP can make informed policy choices to refine the school feeding program in order to realize the greatest benefits from investments.

This paper reports on findings drawn from surveys undertaken in Bangladesh in 2003 to gather information on the effects and outcomes of the school feeding program. The paper is organized into seven sections. Following this introduction, Section 2 presents a review of literature on the impact of school feeding programs. Section 3 provides an overview of the school feeding program in Bangladesh. Section 4 discusses the data used in the empirical work. Section 5 presents the findings of descriptive analyses of the data from village and urban community census, and household and school surveys. Section 6 reports on the results of multivariate analyses of program impact. Section 7 presents conclusions and policy implications.

2. REVIEW OF INTERNATIONAL EXPERIENCE ON THE IMPACT OF SCHOOL FEEDING PROGRAMS

This section reviews the literature on the impact of school feeding programs on school enrollment, attendance, and dropout rates; dietary intake; nutritional status; and academic performance of participating children.

2.1 Educational Attainment

A study conducted in Malawi by WFP showed that a small, pilot, school feeding program over a three-month period led to a 5 percent increase in enrollment and up to 36 percent improvement in attendance (WFP 1996). An evaluation of a school meal program in Jamaica found that, after the first semester, the treatment class showed improved school attendance compared to the control classes (Powell, and Grantham-McGregor 1983). Another evaluation of a school feeding program in Burkina Faso found that school canteens were associated with increased school enrollment, regular attendance, consistently lower repeater rates, lower dropout rates, and higher success rates on national exams, especially among girls (Moore, and Kunze 1994). However, in a study conducted in Kenya, the investigators did not find a difference in the attendance rates between schools with and without the school feeding program (Meme et al. 1998).

School feeding programs have also proven effective in reducing the education gap between girls and boys. For example, program evaluation results from Pakistan, Morocco, Niger and Cameroon show that while food is the initial motivation for sending girls to school, parents of participating girls develop an interest in the education of their daughters. This change in attitudes is an important factor in enhancing parents' commitment to education beyond the duration of food assistance (WFP 2002a).

2.2 Dietary Intake

School feeding programs are likely to improve the nutrient intake of participating children. A study in Huaraz, Peru shows that, for children who received breakfast at schools, dietary intake of energy increased by 2 percent, protein by 28 percent, and iron by 4 percent compared to the control group (Jacoby et al. 1996). An evaluation of a school feeding program in Jamaica assessed the dietary impact of school breakfast consisting of a bun and half pint of milk. Results show that the program provided 32 percent and 45 percent of daily energy and protein requirements, respectively (Chambers 1991). Another study examined the impact of a large school lunch program[2] on consumption of calories and protein by school children in Sao Paulo, Brazil. Participation in the program was associated with an increased availability of 357 calories and 8.5 grams of protein (Dall'Acqua 1991).

[2] The program covered 25 million students that represented 80 percent of school children in 1986.

Very few studies meticulously measured whether food intake from a school feeding program is additional to the child's normal food intake at home, or the food is substituted away from the child at home. Jacoby (2002) explores the existence of an "intra-household flypaper effect" by which in-school intake of calories from SF snacks and meals "stick" to the child. Based on an experimental design and rigorous econometric analysis, the study assessed the impact of an SF program on child calorie intake in the Philippines. The empirical results confirm the existence of an intra-household flypaper effect, where virtually all calories from SF food remain with the participating child. In other words, there is no evidence of intrahousehold reallocation of calories in response to feeding program.

Iron and iodine are critical for cognitive development. Iron deficiencies may render children inattentive and uninterested in learning. Iron supplementation was shown to improve IQ scores of previously iron deficient children (Seshadri and Gopaldas 1989). Evidence also shows that children who suffer from iodine deficiencies are more likely to perform poorly than those without (del Rosso 1999). To counter the harmful effects of micronutrient malnutrition, some school feeding programs provide fortified food. The provision of such food was shown to increase the dietary intake of micronutrients. For example, in Peru, researchers studied the effect of a breakfast program that included iron-fortified rations. The program had a major impact on iron intake, increasing it by 46 percent, in addition to increasing energy and protein by 25 percent and 28 percent, respectively (Jacoby et al. 1996).

2.3 Nutritional Status

Evidence of the impact of school feeding programs on child nutritional status is limited, due partly to the cost and complexity of obtaining accurate and reliable anthropometric and food intake data, and partly to the methodological difficulties in isolating the effect of food intake from other factors affecting nutritional status.

Several studies have shown that food alone does not guarantee improved nutritional status. For example, a study in Ethiopia found that differences in food availability and access had limited effect on the differences observed in child nutritional status (Pelletier et al. 1995). This could be because a child's nutritional status is a function of not only the quality and quantity of the dietary intake but also a function of morbidity, child caring and feeding practices, and household variables such as income and parental education. Further, in developing countries, poor health status of children is exacerbated by poor and inadequate health facilities and services, immunization, safe water and sanitation, and health education programs. Some reviews even show that food-based interventions alone have little measurable impact on nutritional status, morbidity or mortality levels except in crisis situations (Clay, and Stokke 2000).

Nevertheless, there is evidence from school feeding program evaluations that some programs do improve children's nutritional status. For example, a randomized, controlled trial in which breakfast was given to undernourished versus adequately nourished children in Jamaica showed positive results; compared to the control group, both height and weight improved significantly in the breakfast group (Powell et al. 1998).

2.4 Academic Performance

In most developing countries, academic achievement is disappointing, especially at the primary education level. There are numerous causes for this problem that can be addressed in several ways through both supply-side and demand-side interventions. Health and nutrition inputs have often been included in strategies to improve academic performance because poor health and nutrition are known to affect children's ability to learn (Pollit 1990; Simeon, and Grantham-McGregor 1989). It is likely that giving children a daily breakfast or a meal at school may improve their scholastic achievement through several mechanisms: increasing the time spent in school, improving certain cognitive functions and attention to tasks and, perhaps indirectly, improving nutritional status (Grantham-McGregor, Chang, and Walker 1998). However, it is hard to infer a causal relationship since other confounding factors are also likely to affect learning. For example, poor social backgrounds and low socio-economic household characteristics are often linked to both poor diet and poor school performance (Chandler et al. 1995).

Evaluations to determine the impact of school feeding programs on academic achievement are scarce and most of them lack scientific rigor. Only a few investigators have examined the effects of school meals on school achievement levels using quasi-experimental designs with matched treatment and control groups. Furthermore, these few rigorous evaluations did not show consistent results. The inconsistencies may be because of the limited degree of control over experimental conditions, the differences in the analytical approaches and the initial characteristics of the children (Simeon, and Grantham-McGregor 1989).

One of the first papers that reviewed the impact of feeding children in school on educational outcomes appeared in 1978 (Pollit et al. 1978). The authors looked at the U.S. school feeding programs and noted that most of the earlier studies had lacked well-defined hypotheses, were ambiguous in the definition of variables and lacked valid and reliable data. The authors concluded that provision of breakfast seemed to benefit students emotionally and enhance their performance on school-type tasks but no conclusion could be drawn upon the long-term effects.

Pollit (1995) reviewed several studies conducted in Chile, United Kingdom and the United States from 1978 to 1995. The author concluded that brain function is sensitive to short-term variations in the availability of nutrient supplies. This indication is particularly strong for undernourished children, for whom omitting breakfast alters brain function, particularly in the speed and accuracy of information retrieval in working memory. This evidence has strong implications for the developing world where a large percentage of school children are nutritionally at-risk.

Three rigorous studies conducted in Jamaica that investigated the impact of school feeding programs on cognitive functions and learning outcomes provide evidence of the beneficial impact of FFE on cognitive outcomes.

First, a study in 1983 examined 115 children aged 12 to 13 years who were enrolled in three classes in a poor rural school. One class was served school breakfast with the other two

classes serving as controls. The impact evaluation included school achievement, attendance, and weight gain. School achievement was measured using tests that included arithmetic, spelling and reading. Children were followed over two semesters. After the first semester, the treatment group showed improved school attendance and arithmetic scores compared to the control classes, but no difference in weight gain. After controlling for school attendance, academic improvement remained significant showing some evidence that reducing hunger during school hours could affect learning of arithmetic (Powell and Grantham-McGregor 1983).

The second study examined the effect of breakfast on cognitive functions among 90 children 9-10 years old with different nutritional conditions. The study examined the effects of omitting breakfast on the cognitive functions of three groups of children: stunted, non-stunted control, and previously severely malnourished. Using a crossover design, the investigators tested each child on two mornings one week apart (where the first week the child had received breakfast and the second week the child had not). In order to have greater control over the experiment, children's meals on the previous evening were standardized and children subsequently fasted until they received the treatment breakfast or the placebo. Fluency and digit span tests were conducted and results showed that there was a detrimental effect of missing breakfast. Results also indicated that cognitive functions were more vulnerable in poorly nourished children (Simeon, and Grantham-McGregor 1989).

The third study conducted in Jamaica investigated the short-term effects of breakfast on cognitive performance in primary school children who were mildly undernourished as compared with adequately nourished children. The experiment took place in four primary schools in rural Jamaica. Children were randomly assigned to a group and either provided breakfast or a quarter of an orange as a placebo. Researchers then administered four cognitive tests (visual search, digit span, verbal fluency and speed-of-information-processing tests). After a few weeks the treatments were reversed and the tests repeated. Undernourished children's performance improved significantly on a test of verbal fluency when they received breakfast. Adequately nourished children did not experience any significant improvement (Chandler et al. 1995). These and the findings of Simeon and Grantham-McGregor (1989) indicate that targeting of school meals to undernourished children should achieve greater impact in terms of improving children's cognitive ability.

However, results from a study in Chile did not find omission of school breakfast to be detrimental to cognitive performance (Lopez et al. 1993). This research examined 279 children from low socioeconomic backgrounds and categorized as normal, wasted or stunted. No consistent association was found between school breakfast and performance in short-term visual memory, problem solving, or attention tasks in any of the three nutritional groups. Results suggested that, given a motivating short-term task and maintaining routine conditions, missing breakfast does not affect the cognitive performance of children. However, the researchers had no control over the food intake the night before the experiment as children stayed at home.

Besides studies based on experimental design, some studies have examined school feeding programs directly to determine the impact on academic performance. In 22 out of 30 provinces in Burkina Faso, the success rate on a national exam for sixth grade pupils was higher for schools that had school feeding programs (Moore and Kunze 1994). Other studies of the

determinants of academic achievement in Benin, Burkina Faso and Togo found that a school meal was positively related to children's performance on year-end tests. In Benin, children in schools with canteens scored 5 points higher on second-grade tests than did children in schools without canteens (WFP 2001).

3. SALIENT FEATURES OF BANGLADESH'S SCHOOL FEEDING PROGRAM

Pervasive undernutrition remains the most serious obstacle to children's physical and cognitive development in Bangladesh. Hunger reduces children's ability to concentrate and retain what they have learned at school. Further, hungry children are less likely to stay in school. These children come from poor and ultra poor families, many of whom live in high food-insecure areas of the country such as remote rural regions, urban slums, and flood-prone areas.

In July 2002, the GOB and WFP launched the SF program in chronically food insecure areas of Bangladesh.[3] The objectives of the SF program are to:

- Contribute to increased enrollment, improved attendance, and reduced dropout rates in GOB and NGO schools, particularly among children from food insecure areas.
- Improve the attention span and learning capacity of students by reducing short-term hunger and micronutrient deficiency.
- Sensitize and build capacities of local communities to operate SF.

The SF program provides a mid-morning snack to all children in the intervention schools. The snack consists of a packet of 8 biscuits weighing 75 grams, providing a total of 300 kilocalories (kcal) and meeting 75 percent of the recommended daily allowance of vitamins and minerals. Appendix 1 provides the nutrient composition of the fortified biscuits. Each student is entitled to one packet of biscuits for each day of school attendance. These biscuits are produced locally at a cost of US$0.56 a packet. Since there are 240 school days in a year, this amounts to US$13.5 per child per year. The cost includes storage, transportation, vitamin-mineral premix, freight cost, quality assurance, and NGO service provider cost (i.e. monitoring, reporting, and distribution). Appendix 2 presents the calculations of biscuit production costs.

Under the SF program, the private sector manufactures and delivers the required biscuits. The WFP provides biscuit manufacturers with wheat and micro-nutrient mix, and acts in an advisory capacity to improve hygiene and quality control. WFP-imported wheat earmarked for SF is bartered against biscuits from contracted local factories. The biscuits are delivered to WFP's partner NGOs and stored at regional warehouses before sending to schools. The selected service-providing NGOs are responsible for preparing delivery plans, checking attendance and distribution, inspecting the schools for good storage practices, hygiene and sanitation, and for reporting back to WFP. For each school, a school management committee (SMC) — comprised of parents, teachers and school officials — oversees the distribution process. Each SMC has at least one female member. SMCs, NGOs and GOB officials are provided with training to operate the SF program (management, food storage and handling, hygiene and sanitation, etc.).

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[3] This description of the SF program is mainly adapted from various documents prepared by the WFP-Bangladesh Country Office.

In 2003, the SF program covered 1.21 million primary school children in 6,126 schools (3,748 GOB and 2,378 NGO schools) in 36 upazilas (rural areas of 32 upazilas and urban slums in 4 upazilas in Dhaka City) in 9 districts of Bangladesh.[4] From 2002 to 2004, a total of 160,000 metric tons of wheat were allocated to the SF program, for a total estimated cost of US$27.1 million to the WFP and US$3.2 million to the GOB. The wheat is to be bartered for local production of about 46,000 metric tons of biscuits.

[4] The administrative structure of Bangladesh consists of divisions, districts, upazilas, and unions, in decreasing order by size. There are 6 divisions, 64 districts, 489 upazilas (of which 29 are in four city corporations), and 4,463 unions (all rural).

4. THE DATA

This evaluation of the school feeding (SF) program in Bangladesh is based on primary data from school, household, and community surveys that gathered information on a broad range of issues relating to educational attainment, food consumption, and nutritional status. Special attention was given to the collection of gender-disaggregated information. The study assesses the impacts of the SF program on household and school-level outcomes using household survey data from SF program beneficiary and nonbeneficiary (control) households, and school survey data from SF program and non-program (control) schools. The community survey provides information on area-specific contextual factors.

IFPRI designed these surveys, and the Data Analysis and Technical Assistance Limited (DATA), a Bangladeshi consulting firm, carried out the surveys under IFPRI supervision. Surveys took place in September–October 2003. Table 4.1 summarizes the types of information collected and the methods of information collection.

Table 4.1—Types of information collected for the evaluation and methods of collection

Type of Information	Method of Collection
Demographic composition of the communities, literacy rates, enrollment rates (gross and net), and educational attainment.	Village census
Household-level information on demographic composition, level of education, school participation, costs of education, occupation and employment, dwelling characteristics, assets, food and nonfood expenditures, individual level dietary intake data from 24-hour recall, morbidity, anthropometric measurements, and participation in the school feeding program.	Household survey
School enrollment, attendance, and dropout rates; teachers' academic qualification, training, and salaries; students' academic achievement; school building and facilities; and school resources and expenditures.	School survey
Community-level infrastructure, facilities, and services; level of agricultural technology and irrigation; and market prices.	Community survey

A baseline study for the SF program in Bangladesh was conducted in 2002 by the Tufts University (Coats and Hassan 2002). To facilitate comparison, IFPRI designed the sampling procedure to conduct the surveys in the same areas as the baseline surveys. The sampling method used in the baseline survey, summarized from Coates and Hassan (2002), is described below:

- The baseline survey was conducted only for schools—no household survey was carried out. A two-stage cluster sampling methodology was employed to select schools in rural SF program areas. In the first stage, four upazilas from two districts in northern Bangladesh (two upazilas from each district) and two upazilas from two

districts in southwestern Bangladesh were randomly selected from among those scheduled to have the SF program. In the second stage, from each of the six upazilas, 16 schools were randomly selected from type of schools in which WFP intended to implement the SF program.

- A simple random sampling approach was used to select urban program schools from the three upazilas in Dhaka city where WFP planned to implement the SF program.
- Control schools were chosen using the same two-stage cluster sampling method for rural areas and simple random sampling method for urban sites. The sample of three control upazilas (two rural and one urban) was selected based on the comparability of certain characteristics to program sites. The upazilas chosen to have the SF program were classified as highly food insecure according to Vulnerability Analysis and Mapping (VAM) designation. Control upazilas exhibiting the same rating as program upazilas were selected.

The IFPRI study selected five of the six program upazilas that were included in the baseline study. Due to budget constraints, one upazila was randomly excluded. However, the IFPRI study retained only one of the three control upazilas from the baseline survey areas, and selected three new control upazilas. The rationale for and the method of selecting control upazilas for the IFPRI study are:

- Two of the upazilas used as control area in the baseline survey (one rural and one urban) were eventually included in the SF program. Therefore, these two upazilas were replaced by two new control upazilas.
- The baseline survey selected one control upazila for four program upazilas in northern Bangladesh. IFPRI retained the baseline control upazila, and selected one additional upazila from northern Bangladesh for a more balanced comparison between program and control areas.
- The three new control upazilas were matched with characteristics of the respective program upazilas. The VAM food insecurity classification was used to match the two new control rural upazilas with program rural upazilas. The new urban control upazila was matched with the urban program upazila on the basis of observation of characteristics, and in consultation with WFP-Bangladesh.

Since the baseline study did not include a household survey, the IFPRI study designed a sampling method to select households for the household survey. The sampling process for selecting program and control households and survey administration included the following steps:

- Eight program villages and urban slum-communities were selected for the study. From the five baseline survey program upazilas, two villages from each of the three upazilas in rural area (i.e., six program villages in rural area), and one slum community from each of the two urban upazilas in Dhaka City (i.e., two program slum-communities) were randomly selected from the list of villages and urban slum-communities in the baseline survey.

- Four control villages and slum-communities were selected for the study. From the retained baseline survey control upazila, one village was randomly selected from the list of villages in that upazila. For the three new control upazilas (two rural and one urban) mentioned above, one village from each of the two new rural control upazilas was randomly selected from the upazila list of villages. One urban slum-community was selected from the new control urban upazila, by observing community characteristics that resemble those of the selected urban program slum-communities.
- A complete census of households was carried out in each of the selected villages and urban slum-communities.
- From the census list of households: (a) 30 households, with each household having at least one primary school-aged child (ages 6–12), were randomly selected from each of the selected villages in the rural sample; and (b) 45 households, with each household having at least one primary school-aged child (ages 6–12), were randomly selected from each of the selected urban slum-communities.
- Only those primary schools attended by children in the sample households were selected for the school survey.
- A community survey was conducted in the 12 selected villages and urban slum-communities to collect primary data on area-specific contextual variables.

Table 4.2 provides the list of survey locations. In total, 4,453 households (3,193 program and 1,260 control households) were surveyed in the village and urban slum-community census. In addition, 408 households (270 program and 138 control households) were included in the household survey, and 68 primary schools (34 program and 34 control schools) in the school survey.

Table 4.2—Survey locations by program and control, and rural and urban areas

District	Upazila	Union	Village/slum-community	Program/ control	Rural /urban
Lalmonirhat	Aditmari*	Bhadai	Dakshin Batris Hazari	Program	Rural
			Kismot Chandpur	Program	Rural
Kurigram	Fulbari*	Fulbari	Balatari	Program	Rural
			Kismat Prankrishna	Program	Rural
Chuadanga	Chuadanga Sadar*	Shankarchandra	Bashuvandar Daha	Program	Rural
			Fulbari	Program	Rural
Gaibandha	Gaibandha Sadar*	Ballamjhar	Madhyapara	Control	Rural
Rangpur	Badargonj	Gopalpur	Uttarpara	Control	Rural
Kushtia	Mirpur	Fulbaria	Noapara Krishnapur	Control	Rural
Dhaka	Mirpur*	--	Mirpur	Program	Urban
	Kamrangirchar*	--	Kamrangirchar	Program	Urban
	Shabujbag	--	Dakshin Gaon	Control	Urban

Note: * denotes a upazila where the baseline survey was conducted.

In addition, information was gathered on children's academic achievement test scores. Tests were administered to 1,648 grade 5 students (697 boys and 951 girls) attending the sample primary schools. The tests were standard academic achievement tests designed to assess the

quality of education received by students. The test score data have the advantage of a large sample that relate to school characteristics, as well as a number of welfare indicators of the households of students who took the tests. The achievement tests included three subjects—Bangla, English, and mathematics. An expert from the Institution of Education and Research at the University of Dhaka developed the achievement tests.

5. DESCRIPTIVE ANALYSIS OF PROGRAM PERFORMANCE

5.1 The Census Results

This section presents the findings from the village census of households and individuals, disaggregated by gender and SF program and control locations. The data from the census of all households, carried out in all 12 sample villages and urban slums and covering 4,453 households, were used to select the sample households and schools. The data were also used to estimate literacy rates, enrollment rates (gross and net), and the highest levels of educational attainment of individual household members in SF program and control areas. The census dataset has the advantage of being a large sample, but it has the disadvantage of not being able to be linked directly with the detailed information collected in the household survey.

5.1.1 Literacy

A person who can read and write a sentence in Bangla is considered to be literate. Table 5.1 presents the literacy rates in SF program and control areas. While literacy rates are quite similar between rural program and rural control areas, the rate is considerably higher in control urban slums than that of program urban slums.

Overall, the female population has a lower literacy rate than the male population. Nevertheless, a comparison of the male-female gaps in literacy between the two population groups—one age 7 and over and the other age 15 and over—shows that, over time, the female literacy rate has been improving more rapidly than that of males.

Table 5.1—Literacy rates

	SF program area			Control area		
	Male	**Female**	**All**	**Male**	**Female**	**All**
			(percent)			
Population age 7 and over						
Rural	53.9	43.0	48.5	49.0	44.4	46.7
Urban slum	50.1	42.7	46.4	63.3	57.8	60.6
Population age 15 and over						
Rural	50.0	34.5	42.2	46.6	37.7	42.2
Urban slum	50.5	38.5	44.4	62.4	55.3	58.8

Levels at which mean literacy rates are significantly different:

Population age 7 and over	
SFP rural versus Control rural	0.080
SFP urban slums versus Control urban slums	0.000
Population age 15 and over	
SFP rural versus Control rural	n.s.
SFP urban slums versus Control urban slums	0.000

Source: Based on data from IFPRI's "School Feeding Program Evaluation, 2003: Village Census," Bangladesh.
Notes: A person who can read and write a sentence in Bangla is considered to be literate.
Levels of significance are based on t-test; n.s. means not significant at the 0.10 level.

5.1.2 Enrollment

Table 5.2 presents three types of enrollment rates for primary education: gross enrollment rate, net enrollment rate 1, and net enrollment rate 2. The definitions of these three types of enrollment rates are provided in the footnote of the table. The results of the disaggregated analysis show that, enrollment rates are higher in program areas than those in control areas. Gross enrollment rates in rural and urban areas, respectively, are 15.2 percentage points and 11.1 percentage points higher in SF program areas than control areas, which indicates the influence of the SF program on enrollment.

Table 5.2—Enrolment rates in primary schools

	SF program area			Control area		
	Boys	**Girls**	**All**	**Boys**	**Girls**	**All**
			(percent)			
Gross enrollment	109.5	107.0	108.2	90.4	97.7	94.2
Rural	127.6	123.4	125.5	106.0	114.7	110.3
Urban slum	68.6	70.0	69.3	56.1	60.2	58.2
Net enrollment 1	73.9	75.7	74.8	61.7	67.7	64.8
Rural	87.1	86.9	87.0	73.5	77.3	75.5
Urban slum	44.1	50.2	47.2	36.0	46.3	41.4
Net enrollment 2	20.8	24.8	22.8	17.9	22.2	20.2
Rural	25.5	30.7	28.1	23.7	25.5	24.1
Urban slum	10.2	11.4	10.8	5.3	17.1	11.4

Levels at which mean enrolment rates are significantly different: *Net enrolment 1*	
All SFP area versus All control area	0.000
All SFP rural versus All control rural	0.000
All SFP urban slums versus All control urban slums	n.s.
SFP rural boys versus SFP rural girls	n.s.
SFP urban boys versus SFP urban girls	n.s.
Control rural boys versus Control rural girls	n.s.
Control urban boys versus Control urban girls	n.s.

Source: Based on data from IFPRI's "School Feeding Program Evaluation, 2003: Village Census," Bangladesh.
Notes: Gross enrollment rate = all primary school going children/all children ages 6–10.
Net enrollment rate 1 = all primary school-going children ages 6–10/all children ages 6–10.
Net enrollment rate 2 = all children age 6 and enrolled in Class I/all children age 6; all children age 7 and enrolled in Class II/all children age 7; and so on up to Class V.
Levels of significance are based on t-test; n.s. means not significant at the 0.10 level.

In urban slum-communities, enrollment rates in both program and control areas are higher for girls than for boys. However, primary school enrollment rates are extremely low in the sample Dhaka City slum areas. In urban program and control areas, respectively, only 47 percent and 41 percent of all children ages 6-10 are enrolled in school (net enrollment 1). Overall

enrollment rates are considerably lower for children in Dhaka City slum areas than those living in rural areas. The GOB's incentive programs for primary education that target children from poor households (i.e. the former food for education and the present cash stipend programs) do not cover urban areas. The GOB started the Primary Education Stipend Program (PESP) in July 2002 in all 4,463 unions in rural Bangladesh.[5]

About 28 percent (in program rural) and 24 percent (in control rural) of the children ages 6–10 are enrolled at their proper-age grade in primary school. This is evident in "net enrollment 2." In urban slum-communities, only 11 percent of the children are enrolled at their proper-age grade in primary school.

5.1.3 Educational Attainment

Large proportions of the population in both program and control areas have never attended school, and females have been particularly disadvantaged (Table 5.3). However, findings presented in Table 5.3 indicate that, in rural areas, the share of the female population that never attended school declined at a faster rate than that of the male population over a decade.

Table 5.3—Share of population that never attended school

	SF program area			Control area		
	Male	**Female**	**All**	**Male**	**Female**	**All**
			(percent)			
Population age 5 and over						
Rural	37.4	48.1	42.7	40.7	45.8	43.4
Urban slum	41.0	48.6	44.8	34.4	39.1	36.7
Population age 15 and over						
Rural	45.7	61.2	53.5	47.9	56.5	52.2
Urban slum	44.1	54.7	49.4	33.6	41.2	37.4

Levels at which mean shares of population are significantly different:	
Population age 5 and over	
SFP rural All versus Control rural All	n.s.
SFP urban slum All versus Control urban slum All	0.000
Population age 15 and over	
SFP rural All versus Control rural All	n.s.
SFP urban slum All versus Control urban slum All	0.000

Source: Based on data from IFPRI's "School Feeding Program Evaluation, 2003: Village Census," Bangladesh.
Note: Levels of significance are based on t-test; n.s. means not significant at the 0.10 level.

Table 5.4 provides information on the highest education levels completed by males and females aged 25 and over. The levels of educational attainment are low in general, and extremely low for the female population. The levels are, however, relatively high in control urban slums.

[5] Before its demise in June 2002, the Food for Education program covered about one-third of the relatively backward unions of each of the 460 rural upazilas.

Table 5.4—Highest level of education attained by population age 25 and over

	SF program area			Control area		
	Male	Female	All	Male	Female	All
			(percent)			
No schooling	54.8	74.4	64.2	50.8	66.3	58.0
Rural	55.8	76.0	65.6	56.7	71.7	63.9
Urban slum	51.9	69.4	60.0	38.7	52.6	44.6
Primary passed	23.0	13.8	18.6	23.2	17.0	20.3
Rural	22.7	13.2	18.1	21.7	14.5	18.2
Urban slum	23.7	15.5	19.9	26.4	23.3	25.1
Secondary passed	5.4	1.5	3.6	5.9	2.1	4.1
Rural	5.7	1.6	3.7	4.9	1.0	3.0
Urban slum	4.7	1.2	3.1	7.8	4.9	6.5
Higher secondary passed	2.6	0.5	1.6	3.7	1.2	2.5
Rural	2.5	0.5	1.5	2.7	0.5	1.6
Urban slum	2.8	0.6	1.8	5.9	2.7	4.5
Received Bachelor's degree	1.9	0.4	1.2	3.0	1.2	2.1
Rural	1.8	0.5	1.2	1.4	0.3	0.9
Urban slum	2.2	0.2	1.2	6.3	3.3	5.0
Received Master's degree	0.6	0.1	0.4	1.8	0.1	1.0
Rural	0.7	0.2	0.5	0.6	0.0	0.3
Urban slum	0.4	0.0	0.2	4.3	0.3	2.6

Source: Based on data from IFPRI's "School Feeding Program Evaluation, 2003: Village Census," Bangladesh.

5.2 The Household Survey Findings

Using household survey data, this section addresses household-level issues relating to primary education and nutrition, focusing on participation in the school feeding program. As noted in Section 4, the sample of households was randomly drawn from the village and urban slum-community census list of households with at least one primary school-aged child (ages 6–12).

In this study, consumption expenditures are considered the principal indicator of household welfare. Per capita expenditures are chosen over income to serve as a proxy for consumption for two reasons: first, expenditures are more likely to reflect permanent income, and hence are a better indicator of consumption behavior (Friedman 1957). Second, data on expenditures are generally more reliable and stable than income data. Because per capita expenditures are used an indicator of household wealth, the terms "expenditure" and "income" are used interchangeably.

The measure of total consumption expenditure is quite extensive and draws upon responses to several sections of the household survey. In brief, consumption is measured as the sum of total food consumption, total nonfood consumption, nondurable good expenses, and estimated use value of durable goods. Expenditures on individual consumption items were aggregated to construct total expenditures. Quantities of goods produced by the household for home consumption were valued at the average unit prices obtained from the community survey.

5.2.1 Profile of Survey Households

The results suggest that 6 percent of all households with primary school-aged children (6-12 years) in rural SF program villages do not send their children to school, compared to 15 percent in rural control villages, despite higher income levels in control villages. This pattern could be an indication of the success of the SF program in attracting children to attend school.

An alarming finding, however, is that almost half of all primary school-age children in control and 41 percent in program urban slum-communities do not go to school.

Table 5.5 presents the characteristics of households living in SF program and control areas. Per capita expenditure of 69 percent of the sample households in program villages and 54 percent in control villages is less than half-a-dollar-a-day (Table 5.5).[6]

Rural survey villages are disaggregated by per capita expenditure terciles constructed separately for program and control villages.[7] Because of the relatively small sample size, urban slum-communities are not disaggregated by expenditure terciles.

Although the rural expenditure terciles are classified by "low," "middle," and "high," most households in rural areas are poor. According to the latest poverty estimates, 53.1 percent of the rural population fell below the poverty line in 2000 (BBS 2003). Moreover, the sample households are expected to be poorer than the average rural households in Bangladesh, because both program and control villages belong to areas classified as highly food insecure. As mentioned in Section 4, control areas were matched with characteristics of the corresponding program areas. The results in Table 5.5 however indicate that the program areas are poorer than the control areas. The average household income (in terms of per capita expenditure) in rural program villages is 14.3 percent lower than the average income in control villages. The same difference for urban areas is 13.1 percent. This suggests that household incomes (and other factors) need to be controlled for in a multivariate framework to assess the true impacts of the SF program. This is done in Section 6.

In both program and control rural areas, relatively fewer children from households in the low-income tercile do not go to school compared to those in the middle-income tercile, which may be a reflection of the effects of the GOB's incentive programs for primary education that target children from poor households (i.e., the former Food for Education and the present cash stipend programs).

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[6] Calculated at the official exchange rate prevailing at the time of the survey. The official exchange rate for the Taka (Tk), the currency of Bangladesh, was Tk 58.00 per US$1.00 in 2003, on average.

[7] Terciles are based on household terciles ranked by total per capita expenditures.

Table 5.5— Characteristics of respondent households

	Rural: Per capita expenditure tercile				
	Low (1)	Middle (2)	High (3)	All rural	Urban slum
SF program area					
Primary-school-age children (6-12 years) who do not go to school (percent of households)	4.5	9.5	3.8	6.0	41.2
Years of schooling, father	1.1	2.4	3.4	2.4	2.7
Years of schooling, mother	0.7	1.5	2.6	1.6	1.3
Years of schooling of adult male aged 15 years and above	1.6	2.9	4.1	3.0	2.9
Years of schooling of adult female aged 15 years and above	0.8	2.0	3.5	2.1	1.7
Per capita monthly expenditure (Tk)	418	695	1,332	815	1,307
Per capita monthly expenditure on education (Tk)	5	8	25	13	24
Percent of households with per capita expenditure less than $1 a day	100.0	100.0	83.3	94.4	83.3
Percent of households with per capita expenditure less than $0.50 a day	100.0	100.0	8.3	69.4	26.7
Control area					
Primary-school-age children (6-12 years) who do not go to school (percent of all households)	13.6	19.5	12.8	15.3	49.3
Years of schooling, father	2.1	2.3	3.9	2.8	3.5
Years of schooling, mother	0.8	1.3	2.6	1.6	2.5
Years of schooling of adult male aged 15 years and above	2.0	3.6	4.0	3.2	3.8
Years of schooling of adult female aged 15 years and above	1.1	2.5	2.7	2.1	2.7
Per capita monthly expenditure (Tk)	527	841	1,486	951	1,478
Per capita monthly expenditure on education (Tk)	3	5	18	9	26
Percent of households with per capita expenditure less than $1 a day	100.0	100.0	80.0	93.3	77.1
Percent of households with per capita expenditure less than $0.50 a day	100.0	63.3	0.0	54.4	16.7

Levels at which means are significantly different:	
Primary school age children (6-12 years) who do not go to school	
SFP all rural versus Control all rural	0.003
SFP urban slums versus Control urban slums	n.s.
Per capita monthly expenditure	
SFP all rural versus Control all rural	0.041
SFP urban slums versus Control urban slums	n.s.
SFP all rural versus SFP urban slums	0.000
Control all rural versus Control urban slums	0.000

Source: Based on data from IFPRI's "School Feeding Program Evaluation, 2003: Household Survey," Bangladesh.
Note: Levels of significance are based on t-test; n.s. means not significant at the 0.10 level.

Educational attainment of parents and other adult family members is positively associated with income. Educational expenses range from 0.9 percent to 1.8 percent of total household expenditure across program, control, rural, and urban areas.

5.2.2 Primary Education Completion Rates

Table 5.6 presents the findings on primary education completion rates. Household incomes in rural areas tend to have a strong and positive influence on completion rates. In rural program areas, around 71 percent of both boys and girls who had entered primary school completed it, which gives the primary school dropout rate of 29 percent. The overall completion rate in rural program areas is 6 percentage points higher than rural control areas. Although the SF program has started in 2002, the program might have caused the dropout rate to reduce from 2002 to 2003, thereby improving the overall completion rate for the cohort of children in rural program areas.

For the children living in urban slums, not only are their school enrollment rates very low; their dropout rate is also extremely high. Among those who had entered primary school, only about half of them completed it. Completion rates in urban program and control slums are 21 and 17 percentage points lower than those in rural program and control areas, respectively.

Table 5.6—Primary education completion rates

	Rural: Per capita expenditure tercile				
	Low (1)	Middle (2)	High (3)	All rural	Urban slum
			(percent)		
SF program area					
Boys	50.0	73.1	75.9	70.6	56.2
Girls	60.0	65.9	79.2	71.6	42.4
All	54.3	69.9	77.6	71.1	50.0
Control area					
Boys	50.0	73.9	67.7	65.3	51.0
Girls	63.6	71.4	60.0	64.9	45.2
All	55.2	72.7	64.3	65.1	48.4

Levels at which mean completion rates are significantly different:	
SFP rural high tercile All versus Control rural high tercile All	0.070
SFP rural high tercile boys versus Control rural high tercile boys	n.s.
SFP rural high tercile girls versus Control rural high tercile girls	0.075
All SFP rural versus All Control rural	n.s.
All SFP urban slum versus All Control urban slum	n.s.

Source: Based on data from IFPRI's "School Feeding Program Evaluation, 2003: Household Survey," Bangladesh.
Note: Levels of significance are based on t-test; n.s. means not significant at the 0.10 level.

5.2.3 Effects on Food Consumption Patterns

The analysis presented here is based on individual food intake data, collected in the dietary intake module of the household survey, using a 24-hour recall methodology. Female enumerators with expertise and long experience in administering the dietary intake module (including past IFPRI surveys in Bangladesh) collected the dietary intake data.

The data include two 24-hour recalls capturing 2 days' food consumption per household. The person with primary responsibility for preparing and distributing meals in the family was asked about recipes prepared, ingredients for these recipes, the sources of these ingredients (own-production, purchased in the market, collected, given by others), and amounts of recipes eaten by various family members and guests. In addition, individual-level information was collected on leftovers/recipes eaten from the previous day, meals taken away from home, food given away, and food fed to animals. If meals were purposely missed or skipped by particular family members, respondents were asked to provide a reason (e.g. felt ill). In some cases family members were absent from home for one, two, or all three meals, and it was not known what was eaten. This information was also recorded. Persons missing meals due to being absent from home whose food intakes were not known are excluded from the analysis. The analyses are based on approximately 3,800 individual daily intakes (two 24-hour recalls x 408 households x 4.7 household members present).

Table 5.7 presents the composition of energy, protein, iron, and vitamin A intakes for the SF program participating students in rural and urban program areas. Nutrient-fortified biscuits from the SF program account for 16.4 percent and 14.8 percent of total daily energy intakes in kilocalories (kcal), respectively, in rural and urban areas. After rice, SF biscuits are the second most important source of energy in the diet of program participants in both rural and urban areas. The results also show the overwhelming dominance of rice in the diet. Rice accounts for about two-thirds of total energy intake by program students in rural areas, implying little diversity in their diet. Diets of program participants living in urban slums are relatively more diversified.

For the SFP participating students, SF biscuits are also the second most important source of protein and iron in the diet after rice. SFP children living in rural areas consume almost twice as much vitamin A as those living in urban slums. Vegetables are the principal source of vitamin A in their diet, followed by SF biscuits. For the urban sample of SFP participants, SF biscuits are by far the main source of vitamin A in their diet, accounting for two-thirds of total vitamin A intake.

Table 5.8 provides the findings on energy intakes and energy adequacies for SF participating students in the program area and primary school students in the control area, disaggregated by age-group and gender. For the participating children, energy intakes from SF biscuits are also reported in the table. To determine energy adequacy of a household member, the energy intake of an individual is compared with his or her energy requirements. Energy requirements by age and sex are presented in Appendix 3.

Table 5.7—Contribution of individual food items to total nutrient intakes: SFP participating students (age 6 -12 years)

	Energy intake (kcal)		Protein intake (gram)		Iron intake (milligram)		Vitamin A intake (microgram)	
	Rural	**Urban slum**	**Rural**	**Urban slum**	**Rural**	**Urban slum**	**Rural**	**Urban slum**
Total nutrient intake/person/day	1,808	1,778	42	44	30	25	1,038	530
Food Items	(percent of total nutrient intake)							
Rice	67.0	57.9	54.8	43.1	46.4	46.3	0.1	0.0
Wheat	1.1	5.6	1.5	7.3	1.3	5.5	0.0	0.4
Other cereals	1.4	0.9	1.7	1.5	1.5	0.1	0.0	0.0
Pulses	1.4	3.6	3.5	10.1	1.9	4.1	0.1	0.7
Potatoes	0.7	2.4	0.5	1.6	0.3	1.3	0.1	0.5
Edible oils and fats	2.7	5.1	0.0	0.0	0.0	0.0	0.0	0.0
Vegetables	5.2	1.9	9.4	3.1	17.9	8.1	53.1	21.5
Fruits	0.6	1.2	0.2	0.4	0.3	0.9	0.2	0.6
Fish	1.2	2.7	7.5	13.8	1.5	2.7	0.6	1.2
Meat	0.2	0.3	1.2	2.4	0.1	0.1	0.2	1.3
Eggs	0.1	0.4	0.4	1.2	0.1	0.4	0.7	3.7
Milk	0.5	0.3	0.8	0.6	0.1	0.1	0.6	1.5
Spices	0.6	0.5	1.0	0.8	1.7	1.6	0.2	0.3
Sugar and *gur*	0.5	1.7	0.0	0.0	0.2	1.6	0.0	0.0
Other foods (except SF biscuits)	0.5	0.5	0.6	0.3	0.8	0.5	0.0	1.7
SF biscuits	16.4	14.8	16.7	13.9	25.9	26.6	44.1	66.6
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Based on data from IFPRI's "School Feeding Program Evaluation, 2003: Household Survey," Bangladesh.

Average energy intakes and energy adequacy ratios are considerably higher for the SF participating students than those for non-participating students in control areas. This is evident in both rural and urban areas. Average energy intakes of participating students are 11 percent and 19 percent higher in rural and urban program areas, respectively, than energy intakes of primary school students in corresponding control areas. These findings indicate that the SFP improves net food consumption of the participating children—that is, the extra energy from the SF biscuit food supplement do not seem to be substituted by the household. This issue is further examined in a multivariate framework in Section 6 of this report.

Table 5.8—Energy intake and adequacy of primary school students by age group

	SF program participants			Control group children	
Age group	Total energy intake	Actual energy intake from SF biscuits	Energy Adequacy	Total energy intake	Energy adequacy
	(kcal/day)	(kcal/day)	(percent)	(kcal/day)	(percent)
Rural					
6-8 years	1,702	287	87.2	1,447	73.4
Boys	1,781	304	90.7	1,460	73.7
Girls	1,629	271	84.0	1,437	73.3
9-11 years	1,856	286	88.4	1,672	78.6
Boys	1,945	289	91.6	1,810	82.7
Girls	1,757	282	85.0	1,520	74.2
12 years and above	2,042	280	87.1	1,810	78.5
Boys	2,154	291	86.2	1,833	73.3
Girls	1,937	271	88.0	1,796	81.6
All children	1,821	285	87.7	1,634	77.0
Boys	1,912	295	90.3	1,714	78.3
Girls	1,731	276	85.1	1,566	75.9
Urban					
All children	1,779	252	82.9	1,495	70.6
Boys	1,831	250	82.2	1,594	73.7
Girls	1,716	254	83.8	1,364	66.4

Levels at which means are significantly different:	
Rural	
SF program participants versus Control children	
6-8 years	0.002
9-11 years	0.021
12 years and above	0.025
All children	0.000
SFP boys versus SFP girls	0.001
Control boys versus Control girls	0.073
Urban	
SFP urban slum children versus Control urban slum children	0.015
SFP boys versus SFP girls	n.s.
Control boys versus Control girls	n.s.

Source: Based on data from IFPRI's "School Feeding Program Evaluation, 2003: Household Survey," Bangladesh.
Note: Levels of significance are based on t-test; n.s. means not significant at the 0.10 level.

Table 5.9 shows that total energy intakes of SFP participating students increase with their household income. Consequently, average energy adequacy of children from relatively high-income households is 12.7 percentage points higher than that of children from low-income households. Further, for children from low-income households, actual energy intake from the consumption of SF biscuits is about 7 percent lower than the average intake of all children.

Table 5.9—Energy intake by SFP participating students in rural area, by expenditure terciles

	Per capita expenditure tercile			
	Low (1)	Middle (2)	High (3)	All
Total energy intake (kcal/day)	1,711	1,816	1,929	1,821
SF biscuit energy intake (kcal/day)	266	305	285	285
Share of SF biscuit calories in total calories (percent)	16.2	17.3	15.4	16.3
Energy adequacy (percent)	83.3	86.7	92.7	87.7

Source: Based on data from IFPRI's "School Feeding Program Evaluation, 2003: Household Survey," Bangladesh.

There is evidence that SFP participating students share SF biscuits with other household members, mostly with their younger siblings. Indeed, findings in Table 5.11 below suggest that the majority of the participating students bring SF biscuits home either regularly or intermittently. Table 5.10 demonstrates the spillover effect of SF biscuits on food consumption of children ages 2-5 years in SFP beneficiary households in rural area. Calories from SF biscuits account for 7.2 percent of total calories these preschoolers consume on average.

Table 5.10—Energy intake and adequacy of children ages 2-5 years in SFP beneficiary households: Rural area

	Boys	Girls	All
Total energy intake (kcal/day)	1,070	1,042	1,060
SF biscuit energy intake (kcal/day)	69	88	76
Share of SF biscuit calories in total calories (percent)	6.5	8.4	7.2
Energy adequacy (percent)	74.1	72.2	73.4

Source: Based on data from IFPRI's "School Feeding Program Evaluation, 2003: Household Survey," Bangladesh.

5.2.4 Mothers' Perceptions of the SF Program

The household survey collected information on the perceptions of mothers of participating students about the SFP. Table 5.11 provides the responses to the questions, which are self-explanatory. In general, the extremely high percentage of responses reflects positive effects of the SF program on participating children's concentration on studies, interest in attending school, liveliness, health, and morbidity.

Table 5.11—Mothers' perceptions of the school feeding program: Beneficiary households

Description	Response
	(percent)
Did your child receive biscuits everyday he/she attended school last month?	
Yes	82.4
No	17.6
Did your child complain about biscuits received last month?	
Did not complain	81.5
Fewer than 8 biscuits per packet	2.4
Most of the biscuits were broken	6.8
Taste was not good	2.9
Biscuits were old and damp	3.4
Other complaints	2.9
Does your child bring biscuits home from school?	
Yes, always	16.9
Yes, most of the days (3-4 days per week)	15.5
Some times (1-2 days per week)	24.2
Rarely	14.5
Never	29.0
Has there been any change in your child's concentration on studies?	
Same as before participating in the SF program	18.9
Concentration on studies has increased	81.1
Has there been any change in your child's health status?	
Same as before participating in the SF program	35.8
Health status has improved	64.2
Has there been any change in your child's interest in attending school?	
Same as before participating in the SF program	14.2
Child shows more interest in attending school than before	85.8
Has there been any change in your child's interest in playing outdoor games?	
Same as before participating in the SF program	22.2
Child shows more interest in playing outdoor games than before	77.8
Is your child happier and livelier than before participating in the SF program?	
Yes	87.7
No	12.3
Does your child get less sick now than before participating in the SF program?	
Yes	77.8
No	22.2
Has there been any change in giving pocket money to your child for spending at school?	
Give the same amount of pocket money as before	22.6
Give less now than what I used to give before	50.0
Never gave pocket money to child for spending at school	27.4

Source: Based on data from IFPRI's "School Feeding Program Evaluation, 2003: Household Survey," Bangladesh.

5.3. Program Performance in the Schools

General information on surveyed schools and major findings of the assessment of school-level performance of the SF program and control schools are presented here.

5.3.1 General Information on Schools and Teachers

Table 5.12 suggests that the average size of the SF program schools (in terms of number of students per school) is 11.7 percent larger than that of the control schools. This is probably due to the higher enrollment rates in program areas than control areas, as shown above from the census results (Table 5.2). As a result, the number of students per teacher is higher in SF schools, since the average number of teachers is the same in SF program and control schools. Slightly over half of all students in SF program and control schools are girls. The proportion of female teachers to all teachers is about 6 percentage points lower in SF program schools than that in control schools. Other characteristics of schools and teachers are quite similar between SF program and control schools.

Table 5.12—General information about schools and teachers

Information	SF program schools	Control schools
Number of students per school	411	368
Proportion of girls (percentage of total)	50.6	52.1
Number of teachers per school	5.7	5.7
Number of students per teacher	72	65
Female teachers (percentage of all teachers)	45.6	51.4
Inspection made by school inspectors in 2002 (percentage of schools)	97.1	100.0
Number of inspections in 2002	6.3	5.8
Teachers who received teacher training (percentage of teachers)	94.1	97.1
Teachers' educational qualification (percentage of teachers)		
S.S.C	30.4	23.1
H.S.C	31.4	38.0
B.A. / B.A. B. Ed.	29.4	25.1
M.A. / M.A. M. Ed.	8.3	13.9
Other	0.5	0.0
Number of classes taught per day	4.0	4.4
Number of subjects taught	4.6	4.5
Primary source of income (percentage of teachers)		
School salary	90.2	90.3
Agriculture	6.2	5.6
Small business	0.5	0.5
Large business	1.0	1.0
Other	2.1	2.6

Source: Based on data from IFPRI's "School Feeding Program Evaluation, 2003: School Survey," Bangladesh.

5.3.2 School Attendance

The attendance rates have increased in both program and control schools, probably due to the Primary Education Stipend Program of the GOB that started in July 2002 throughout rural Bangladesh.

From the school attendance register, the survey enumerators collected retrospective information on school attendance before the SF program (April 2002) and during the program (April 2003) for both program and controls schools. Table 5.13 shows the percentages of total enrolled students attending school before and during the SF program. The rate of change in attendance is slightly higher (1.1 percentage points) for the program schools than control schools.

Table 5.13—Attendance rates

Information	SF program schools	Control schools
	(percent of enrolled students)	
April, 2002 (before SFP)		
Boys	71.3	73.3
Girls	71.6	74.6
Total	71.4	73.9
April, 2003 (after SFP)		
Boys	79.1	82.2
Girls	83.2	80.0
Total	81.1	80.7

Levels at which attendance rates are significantly different:	
SFP 2002 Total versus SFP 2003 Total	0.000
Control 2002 Total versus Control 2003 Total	n.s
SFP 2002 Total versus Control 2002 Total	n.s.
SFP 2003 Total versus Control 2003 Total	n.s.

Source: Based on data from IFPRI's "School Feeding Program Evaluation, 2003: School Survey," Bangladesh.
Note: Levels of significance are based on t-test; n.s. means not significant at the 0.10 level.

5.3.3 Dropout Rates

From the school records, the school survey collected information on students enrolled, transferred (in and out), and repeated in 2001, 2002, and 2003 for boys and girls in each grade, which was necessary to calculate the dropout rates using a formula.

Table 5.14 provides results of annual dropout rate calculations for SF program and control schools. Changes in dropout rates before the SF program (2001 to 2002) and after the program was introduced (2002 to 2003) are reported in the table. The variation of the change in dropout rates between program and control schools suggests net reduction in dropouts by 1.6 percentage points for the program schools. The econometric analysis, however, shows a significantly larger reduction in dropout rates attributable to the program (see Section 6.4).

Table 5.14—Annual school dropout rates

	SF program schools						Control schools					
	Class I	Class II	Class III	Class IV	Class V	Class I-V	Class I	Class II	Class III	Class IV	Class V	Class I-V
	(percent)											
2001 to 2002 (before SFP)												
All students	7.2	9.4	11.7	11.1	10.2	9.7	6.5	8.8	10.0	10.6	8.1	8.5
Boys	8.3	9.8	11.3	10.7	11.9	10.2	6.1	9.2	9.9	9.9	7.5	8.2
Girls	5.7	8.7	12.3	11.2	8.6	9.2	6.8	8.6	10.3	11.2	8.3	8.8
2002 to 2003 (after SFP)												
All students	6.1	9.2	10.6	10.5	8.4	8.9	8.3	8.1	9.9	10.5	9.2	9.3
Boys	5.5	8.5	10.0	11.4	7.8	8.6	8.4	8.8	10.4	11.1	10.4	9.8
Girls	6.4	9.8	11.0	9.1	8.5	9.1	7.5	8.0	9.3	10.2	8.2	8.7

Source: Based on data from IFPRI's "School Feeding Program Evaluation, 2003: School Survey," Bangladesh.

6. ASSESSING PROGRAM IMPACT IN A MULTIVARIATE FRAMEWORK

The descriptive statistics presented in Section 5 do not permit the separation of program effects from the effects of other factors. Therefore, appropriately formulated multivariate analyses are carried out to isolate the effects of income and other factors and capture the true effects of the SF program on various outcomes. This section presents the conceptual framework for testing the hypotheses, empirical specification of the econometric models, and results of the regression analyses.

The four primary issues to be addressed in this section are:

- Is the amount of food eaten by a child at school from the SF program additional to the child's "normal" food intake at home, or does the household substitute it?
- Does the SF program fulfill its objectives of increasing enrollment and attendance, and reducing dropouts?
- Is there any effect of consumption of nutrient-fortified SF biscuits on a participating-child's nutritional status?
- Does the SF program have any impact on a participating-child's learning?

6.1 Dietary Impact of the SF Program

6.1.1 Conceptual Framework

This analysis adopts the conceptual framework and analytical approach developed and used by Jacoby (2002) to study the impact of a school feeding program on child energy intake in the Philippines.

This study investigates whether a child's household neutralizes his or her intake of SF biscuits in school, or the SF biscuits provide additional nutrition to the child. That is, does a child's household give less food to the child at home because he or she eats the SF biscuits at school?

The dietary impact of the SF program can be identified from intrahousehold food intake data on school days and non-school days, for children attending SF program and non-program schools. For children going to schools that offer SF biscuits, comparing their average energy intake on school days with that of non-school days will identify the average dietary impact of the program plus the effect of attending school (which may require more energy expenditure than staying at home). The same comparison for the children attending non-SFP schools will isolate the effect of attending school. The difference between these estimates is the impact of the SF program on child energy intake.

6.1.2 Design of Experiment and Data

The household survey was designed to do the above experiment. In Bangladesh, schools are closed on Fridays. However, Fridays were not used as non-school days for this experiment, because households often have better than usual meals on Fridays, which may produce a biased estimate of the impact of the program. To avoid this potential bias, survey enumerators asked parents from sample households in both program and control areas not to send their children to school the next school day. This was done randomly. The enumerators told the parents that this was a scientific experiment; but did not explain the purpose in order to avoid any bias. All parents in sample households in program and control areas agreed, and did not send their children to school, arbitrarily, one school day. Head teachers of schools in program and control areas were also informed about the experiment, and they assured the enumerators that the students would not be penalized in any way for remaining absent for one day. Upon completion of the survey, enumerators distributed SF biscuits (supplied by the WFP-Bangladesh for this study) to children to compensate for the loss of their one day's ration. However, this was not announced during the survey. Much care was taken in all aspects of the experiment to ensure that no bias was introduced.

The dietary impact analysis is based on individual food intake data, collected in the dietary intake module of the household survey using a 24-hour recall methodology (see Section 5.2.3 above for detail).

6.1.3 Empirical Model Specification

The abovementioned conceptual framework indicates that the specification of the empirical model for estimating the dietary impact of the SF program essentially suggests the "difference-in-differences" or the "double-difference" estimation method.

Let C_{is}^{T} represent a variable for total daily energy intake of a child *i* enrolled in school *s*, D_{is}^{A} be a variable indicating whether child *i* attended school the previous day, and D_{s}^{P} be an indicator for SF program school.[8] Note that the program covers all primary schools in the sample SF program upazilas. The expected (E) dietary impact of the SF program ($\hat{I}_{is}$) is

$$\begin{aligned}\hat{I}_{is} &= \left\{E\left[C_{is}^{T} \mid D_{s}^{P}=1, D_{is}^{A}=1\right]- E\left[C_{is}^{T} \mid D_{s}^{P}=1, D_{is}^{A}=0\right]\right\} \\ &- \left\{E\left[C_{is}^{T} \mid D_{s}^{P}=0, D_{is}^{A}=1\right]- E\left[C_{is}^{T} \mid D_{s}^{P}=0, D_{is}^{A}=0\right]\right\},\end{aligned} \tag{1}$$

which is a double-difference estimator. The sign (|) stands for "given that" or "conditional on." The first term in curly brackets is the difference in average energy intake, C_{is}^{T}, between attendees (i.e. $D_{is}^{A}=1$) and absentees (i.e. $D_{is}^{A}=0$) in SF program schools (i.e. $D_{s}^{P}=1$). The second term in curly brackets is the same average difference in control area schools

[8] *D* stands for a "dummy" variable that takes the value of either 0 or 1.

(i.e. $D_s^P = 0$). The difference between the first and the second terms (i.e., difference-in-differences) is the impact of the SF program on child energy intake.

The equation for total daily energy (calories) intake, C_{is}^T, is

$$C_{is}^T = \alpha_p D_s^P D_{is}^A + \alpha_A D_{is}^A + \delta_s + u_i \ , \quad (2)$$

where α_p is the average dietary impact of the SF program, α_A is the average dietary impact of attending school (as mentioned above, children may have greater energy requirements for attending school), δ_s is a school fixed effect, and u_i is a child-specific error term representing unobserved determinants of caloric intake.

For estimation, equation (2) is modified following Jacoby (2002). Since data on the actual calorie intake by child *i* from the SF program biscuits, C_{is}^P , are available, the equation for total daily calories is estimated by including C_i^P on the right-hand side,[9] instead of D^P x D_i^A as

$$C_{is}^T = \alpha_p C_{is}^P + \alpha_A D_{is}^A + \beta X_i + \delta_s + u_i \ , \quad (3)$$

where X_i is a vector of additional control variables including age, age squared, gender of the child, body mass index (BMI) of the child, travel time to school, household size, number of male and female children under 5 years of age in the household, the gender of the household head, total monthly household income, total land holding of the household, whether the land is irrigated or not, whether the household head is a day laborer or not, and whether the child lives in urban slum-community or not. A set of school dummies are used to control for school level fixed effects. An interaction term, multiplying C_{is}^P with total household income, is added to equation (3) to determine whether income of participating child's household has any effect on child's total calorie intakes. The model is estimated using the ordinary least square (OLS) regression. The standard errors are corrected for the sampling effects.

Endogeneity problems could arise in the econometric model specification in equation (3) if child/household characteristics and the outcome variable (i.e., child calorie intakes) are both caused by factors that were not observed by the researcher. In Appendix 4 it is argued that endogeneity will not be a problem in the settings of sample program and control sites in this study even though it often arises in other settings. The same argument applies to the other econometric model specifications in this study.

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[9] C_{is}^P may be measured with error, because the dependent variable C_{is}^T is partly composed of C_{is}^P . However, the consequences of classical measurement error in this case differ from the standard case. Jacoby (2002) shows that measurement error bias approaches zero as the true value of α_p approaches unity.

6.1.4 Results

The results of the OLS model estimation are presented in Table 6.1. The program-participating child's calorie intake from SF biscuits has a statistically significant positive impact on his or her total daily calorie intake. This implies that the SF program has a significant impact on increasing calorie intake of participating children. The value of the coefficient of energy from SF biscuits is 0.97, which means that an intake of 100 calories (kcal) from SF biscuits increases the child's total daily energy intake by 97 kcal (i.e., by 97 percent). This result suggests that the energy consumed from SF biscuits are almost entirely additional to the child's normal diet—the child's household does not give him or her less food at home for eating the SF biscuits at school.[10]

The SF calorie-household income interaction term is statistically not different from zero (i.e. not significant), implying that the dietary impact of the program does not depend on the income of the participating child's household. This indicates that even poor households do not substitute child energy intakes from SF biscuits.

Table 6.1—Impact of school feeding program on energy intake: OLS regression results

Variable	Coefficient	t-statistic
Energy intake from SF biscuits (kcal)	0.974	4.26***
SF biscuit calorie x total household expenditures[a]	-0.021	-0.47
Attended school the previous day=1	-41.848	-1.00
Child's age	241.518	3.51***
Child's age squared	-8.672	-2.38**
Child's gender: male=1	204.366	4.22***
Child's body mass index (BMI)	35.414	1.78*
Time for going to school (minutes)	-3.644	-0.90
Household size	24.653	0.86
Boys age 0-5 in household	-123.311	-2.33**
Girls age 0-5 in household	-18.225	-0.39
Gender of household head: male=1	-90.582	-0.98
Total household expenditures (Taka/month)[a]	40.772	2.77**
Total landholding of household (decimals)[a]	297.378	2.12*
Cultivated land is irrigated=1	0.880	0.34
Household head is a day-laborer=1	11.825	0.22
Urban area=1	272.561	0.85
School dummies	Yes	
Constant	-769.516	-1.23
R-squared	0.33	

Notes: Significance levels: * significant at the 10 percent level; ** significant at the 5 percent level;
*** significant at the 1 percent level.
Dependent variable is child's total calorie intake in kcal per day. The standard errors are corrected for sampling effects by estimating the equation using the '*svyreg*' command of the Stata statistical software.
[a] The coefficients of household expenditures and land holding are multiplied by 1,000.

[10] Jacoby (2002) found comparable results for a school feeding program in the Philippines.

To confirm the validity of the estimated coefficient of energy intake from biscuits (Table 6.1), two additional OLS regression models are estimated. Model 1 includes only C_i^P , D_{is}^A , and school dummies—all X_i variables in equation (3) are excluded from the model (i.e. $\beta = 0$). Model 2 estimates equation (2), where the equation for total daily energy intake is estimated by including D_s^p x D_{is}^A on the right-hand side (instead of C_{is}^P), and a set of dummy variables to capture school-level fixed effects. The results of these two models are shown in Table 6.2. In Model 1, the value of the coefficient of energy (kcal) from SF biscuits is 0.996, and the coefficient is statistically significant. This result indicates that excluding X_i variables from the model hardly affects the average dietary impact of the SF program. The statistically significant coefficient of child attending SFP school (i.e. D_s^p x D_{is}^A) in Model 2 is 283. This means that attending SF schools (hence, consuming SF biscuits) increases the child's total daily energy intake by 283 kcal, which accounts for 94 percent of the total energy SF biscuits provide.

Table 6.2—Alternative models to test the impact of school feeding program on energy intake: OLS regression results

	Model 1		Model 2	
Variable	**Coefficient**	**t-statistic**	**Coefficient**	**t-statistic**
Energy intake from SF biscuits (kcal)	0.996	6.59***	-	-
Child enrolled in SFP school and attending school the previous day	-	-	282.994	5.34***
Attended school the previous day=1	-60.760	-1.65	-94.904	-2.11*
School dummies	Yes		Yes	
Constant	1360.387	35.32***	1235.962	29.09***
R-squared	0.18		0.17	

Notes: Significance levels: * significant at the 10 percent level; ** significant at the 5 percent level; *** significant at the 1 percent level.
Dependent variable is child's total calorie intake in kcal per day. The standard errors are corrected for sampling effects by estimating the equations using the '*svyreg*' command of the Stata statistical software.

As specified in equation (1), the difference-in-differences estimator of the dietary impact of the SFP is also applied directly by: (a) comparing the average energy intake on school days with that of non-school days for SFP students; and (b) comparing the same for the students attending non-SFP schools. The difference between (a) and (b) is the impact of SFP on child energy intake, isolating the effect of attending school. The results presented in Table 6.3 indicate that child dietary intake is lower on school days than on non-school days. These results suggest that, due to the school feeding program, participating students' energy intake increases by 297 kcal per day, or by 99 percent of total energy supplied by SF biscuits.

Table 6.3—Average energy intake by SFP and control groups of students on school and non-school days

Student groups	Energy intake on the day students attended school (1)	Energy intake on the day students did not attend school (2)	Difference (1) – (2)
		(kcal/day)	
SFP participants	1,801	1,611	190
Control	1,656	1,763	-107
Levels at which means are significantly different			
SFP participants: school day versus non-school day			0.000
Control: school day versus non-school day			n.s.
School day: SFP participant versus control			0.014
Non-school day: SFP participant versus control			0.022

Source: Based on a specifically designed experiment (see section 6.1.2) and data from IFPRI's "School Feeding Program Evaluation, 2003: Household Survey," Bangladesh.
Note: Levels of significance are based on t-test; n.s. means not significant at 0.10 level.

6.2 Impact on Enrollment

6.2.1 Empirical Model Specification

Here, the purpose is to evaluate the effects of the SF program on primary school enrollment in program communities. In the model specification, the treatment group is all primary school enrolled children and all non-enrolled primary school-age children (ages 6-12 years) living in SF program communities. The control group consists of enrolled and non-enrolled primary school-age children living in control communities. The household survey reveals that 97.5 percent of the enrolled children in sample program communities participate in the SF program. Controlling for child and household characteristics, and location-specific fixed effects; the difference in the number of enrolled and non-enrolled primary school-age children between program and control areas gives the impact of the program on enrollment.

Let D_i^E be a variable indicating whether child *i* is enrolled in a primary school, and D^P be an indicator for SF program area. The estimating equation takes the form

$$D_i^E = \alpha_P D^P + \beta X_i + u_i \ , \qquad (4)$$

where α_P is the impact of SF program on school enrollment, and u_i is a child-specific error term representing unobserved determinants of enrollment. X_i is a vector of control variables including age, age squared, and gender of the child, body mass index (BMI) of the child, travel time to school, household size, number of male and female children under 5 years of age in the household, father's and mother's years of schooling, the gender of the household head, total monthly household income, total land holding of the household, whether the land is

irrigated or not, whether the household head is a day laborer or not, whether the child lives in urban slum-community or not, and a group of dummy variables indicating the upazila of the child's residency. Equation (4) is estimated using a probit regression.

Two equations are estimated: one for gross enrollment and the other for net enrollment. For gross enrollment, the dependent variable, D_i^E, is 1 if a child is enrolled in primary school irrespective of his or her age; 0 if a child between ages 6 and 12 years is not enrolled in school. For net enrollment, the dependent variable, D_i^E, is 1 if a child between ages 6 and 12 years is enrolled in primary school; 0 if a child between ages 6 and 12 years is not enrolled in school.

6.2.2 Results

Children living in SF program area have a higher probability of being enrolled in school compared to children in control area. The program raises gross enrollment by 14.2 percent and net enrollment by 9.6 percent. Table 6.4 presents the results of the estimated probit regressions for gross and net enrollment. The SF program has statistically significant positive impacts on both gross and net enrollment rates.

Further results on enrollment include:

- A mother's education level has a strong and positive impact on enrollment--but a father's education does not.
- For both program and control students, the results of both equations suggest that the probability of being enrolled in school decreases as children grow older.
- Child enrollment rates increase as household income rises.
- Household size and the number of preschooler boys in household are negatively correlated with enrollment.
- The net enrollment rate is lower in urban slum communities than in rural areas.

6.3 Impact on School Attendance

6.3.1 Empirical Model Specification

The household survey was designed to assess whether the SF program has any effect on school attendance of children that are enrolled in primary school. The survey collected information on the number days a child was absent from school in August 2003—the month preceding the survey. This information was converted into the number of days present out of a total of 24 school days in August 2003 in both program and control area primary schools.

The difference in the number of school-attended days in the reference month between SF program participant and non-participant students is the impact of the program on attendance, controlling for child and household characteristics, and location-specific fixed effects.

Table 6.4—Impact of school feeding program on school enrollment: Probit regression results

Variable	Gross enrollment		Net enrollment	
	dF/dX	z-statistic	dF/dX	z-statistic
SF program area=1	0.142	2.18**	0.096	1.84*
Child's age	0.396	7.60***	0.214	2.94***
Child's age squared	-0.020	-7.14***	-0.010	-2.56**
Child's gender: male=1	-0.008	-0.24	-0.004	-0.14
Child's body mass index (BMI)	0.008	0.71	0.005	0.55
Time for going to school (minutes)	0.003	1.37	0.002	0.98
Household size	-0.034	-2.12**	-0.030	-2.25**
Boys age 0-5 in household	-0.067	-1.99**	-0.048	-1.64*
Girls age 0-5 in household	0.007	0.23	0.012	0.43
Father's years of schooling	-0.010	-1.52	-0.005	-0.89
Mother's years of schooling	0.030	3.05***	0.030	3.41***
Gender of household head: male=1	0.021	0.28	0.018	0.27
Total household expenditures[a]	0.018	2.33**	0.014	2.12**
Total landholding of household (decimals)[a]	-0.008	-0.06	0.026	-0.27
Cultivated land is irrigated=1	0.052	1.09	0.030	0.74
Household head is a day-laborer=1	-0.023	-0.54	-0.016	-0.43
Urban area=1	0.015	0.27	-0.182	-2.23**
Location dummy	Yes		Yes	
Pseudo R-squared	0.34		0.32	

Notes: Significance levels: * significant at the 10 percent level; ** significant at the 5 percent level; *** significant at the 1 percent level.
Dependent variable for gross enrollment is 1 if a child is enrolled in primary school irrespective of his or her age; 0 if a child between ages 6 and 12 years is not enrolled in school.
Dependent variable for net enrollment is 1 if a child between ages 6 and 12 years is enrolled in primary school; 0 if a child between ages 6 and 12 years is not enrolled.
dF/dX represents the change in probability for an infinitesimal change in each independent, continuous variable and, by default, the discrete change in the probability for the dummy variables. Standard errors of the coefficients are conventional. The equation has been estimated using the *'dprobit'* command of the Stata statistical software.
[a] The coefficients of household expenditures and land holding are multiplied by 1,000.

Let A_i^S denote the number of days child *i* attended school in August 2003, and D_i^P be a variable indicating whether child *i* is a participant of the SF program. The equation for school attendance is estimated as

$$A_i^S = \alpha_P D_i^P + \beta X_i + u_i \ , \qquad (5)$$

where α_P is the impact of SF program on school attendance, and μ_i is a child-specific error term representing unobserved determinants of attendance. X_i is a vector of control variables that includes all the X_i variables in equation (4) above, plus a variable representing the number of days the child was sick the previous month. Equation (5) is estimated using the OLS regression, with standard errors corrected for the sampling effects.

6.3.2 Results

The results of the estimated OLS regression equation are provided in Table 6.5. The SF program has a statistically significant positive impact on school attendance. The SF program increases school attendance of participating students by 1.34 days per month (or 6 percent of total school days a month).

The results also indicate that absenteeism is higher among children from wealthy families than those from poorer families. Moreover, urban slum-dwelling children attend school 1.5 days less per month than do children in rural areas.

Table 6.5—Impact of school feeding program on school attendance: OLS regression results

Variable	Coefficient	t-staistic
SF program participant=1	1.344	6.65***
Child's age	0.547	0.89
Child's age squared	-0.023	-0.73
Child's gender: male=1	-0.223	-1.35
Days sick the previous month	-0.001	-0.06
Child's body mass index (BMI)	-0.099	-0.91
Time for going to school (minutes)	-0.000	-0.02
Household size	0.028	0.21
Boys age 0-5 in household	0.175	0.49
Girls age 0-5 in household	0.287	1.24
Father's years of schooling	0.011	0.23
Mother's years of schooling	-0.007	-0.12
Gender of household head: male=1	0.040	0.06
Total household expenditures[a]	-0.087	-2.12*
Total landholding of household (decimals)[a]	0.192	0.29
Cultivated land is irrigated=1	0.089	0.20
Household head is a day-laborer=1	-0.658	-2.20*
Urban area=1	-1.467	-9.99***
Location dummy	Yes	
Constant	21.659	5.35***
R-squared	0.10	

Notes: Significance levels: * significant at the 10 percent level; ** significant at the 5 percent level; *** significant at the 1 percent level.
Dependent variable is number of days an enrolled child attended primary school in August 2003. The standard errors are corrected for sampling effects by estimating the equation using the '*svyreg*' command of the Stata statistical software.
[a] The coefficients of household expenditures and land holding are multiplied by 1,000.

6.4 Impact on School Dropout

6.4.1 Empirical Model Specification

The household survey collected information on whether any child in the household dropped out of primary school in 2003.[11] The difference in the number of school dropouts between SF program participant and non-participant students is the impact of the program on dropout, controlling for child and household characteristics, and location-specific fixed effects.

Let D_i^D be a variable indicating whether child *i* dropped out of primary school in 2003, and D_i^P be a variable indicating whether child *i* is a participant of the SF program. The specification of the estimating equation is

$$D_i^D = \alpha_P D_i^P + \beta X_i + u_i \ , \qquad (6)$$

where α_P is the impact of SF program on school dropout, and u_i is a child-specific error term representing unobserved determinants of dropout. X_i is a vector of control variables that include all the X_i variables in equation (4) above. Equation (6) is estimated using a probit regression.

6.4.2 Results

The SF program has a statistically significant negative impact on dropout. Table 6.6 provides the results of the estimated probit regression. The value of the coefficient is –0.075, which indicates that the participation in SF program reduces the probability of dropping out of school by 7.5 percent.

Other statistically significant determinants of dropping out of school are household income and whether a child resides in an urban slum. The likelihood of school dropout decreases as household income increases. Children living in urban slums are highly at risk of dropping out of school—they are 23.2 percent more likely to drop out of school than children living in rural areas.

6.5 Impact on Child Nutritional Status

6.5.1 Empirical Model Specification

The household survey included a module to collect data on anthropometric measurements (weight and height) of all children ages 0-18 years and their mothers.[12] Information was also collected on incidence of morbidity of all household members. Based on these and other data from the household survey, this study assesses the impact of SF program on primary school-age

[11] Note that the SF program started in July 2002.

[12] Body weight was measured by UNISCALE—a scale developed by the United Nations Children's Fund (UNICEF) for weighing children and their mothers to assess their nutritional status.

(6-12 years) children's nutritional status, measured by body mass index (BMI).[13] The empirical model estimated the impact of the SF program on child BMI as the difference between BMI of program participant and non-participant students.

Table 6.6—Impact of school feeding program on school dropout: Probit regression results

Variable	dF/dX	z-statistic
SF program participant=1	-0.075	-2.51**
Child's age	-0.006	-0.48
Child's age squared	0.000	0.46
Child's gender: male=1	-0.013	-1.70*
Child's body mass index (BMI)	0.001	0.59
Time for going to school (minutes)	-0.000	-0.61
Household size	0.007	1.89*
Boys age 0-5 in household	0.000	0.01
Girls age 0-5 in household	0.004	0.60
Father's years of schooling	-0.003	-1.39
Mother's years of schooling	-0.003	-0.93
Gender of household head: male=1	-0.008	-0.46
Total household expenditures[a]	-0.005	-2.36**
Total landholding of household (decimals)[a]	0.023	1.17
Cultivated land is irrigated=1	-0.001	-0.09
Household head is a day-laborer=1	0.004	0.45
Urban area=1	0.232	3.20***
Location dummy	Yes	
Pseudo R-squared	0.38	

Notes: Significance levels: * significant at the 10 percent level; ** significant at the 5 percent level; *** significant at the 1 percent level.
Dependent variable is 1 if any child in household dropped out of primary school in 2003; 0 if no child dropped out of school.
dF/dX represents the change in probability for an infinitesimal change in each independent, continuous variable and, by default, the discrete change in the probability for the dummy variables. Standard errors of the coefficients are conventional. The equation has been estimated using the *'dprobit'* command of the Stata statistical software.
[a] The coefficients of household expenditures and land holding are multiplied by 1,000.

Let N_i be a variable representing the nutritional status (BMI) of child *i*, and D_i^P be a variable indicating whether child *i* is a participant of the SF program. The equation takes the form

[13] Body mass index is defined as weight (in kilograms) / height^2 (in meters). BMI is the appropriate measurement of nutritional status for children over 6 years of age, adolescents, and adults.

$$N_i = \alpha_P D_i^P + \beta X_i + u_i \ , \qquad (7)$$

where α_P is the impact of SF program on child nutritional status (BMI). X_i is a vector of control variables that include all the X_i variables in equation (4) above, plus six additional variables representing months (duration) in SF program, months in program squared, number of days the child was sick the previous month, whether the child had diarrhea the previous month, and BMI of the child's mother. The model is estimated using the OLS regression, with standard errors corrected for the sampling effects.

6.5.2 Results

The SF program has a statistically significant positive impact on child nutritional status, with a coefficient of 0.619. This suggests that the average BMI of SF program participating students is 0.62 points higher than the average BMI of enrolled children in control area. This represents a 4.3 percent increase from the average BMI of primary school children in control area. Table 6.7 presents the OLS regression results.

Other statistically significant determinants of child nutritional status are child age, mother's BMI, mother's education, household size, number of female children under 5 years of age in the household, and the child living in an urban slum. Mother's education has a positive effect on her child's nutritional status. Moreover, mother's BMI is positively associated with child nutritional status— healthy mothers have healthy children. Children in urban slums have lower nutritional status than children in rural areas.

Table 6.7—Impact of school feeding program on child nutritional status: OLS regression results

Variable	Coefficient	t-statistic
Child is SFP participant=1	0.619	4.49***
Months in program	-0.017	-0.26
Months in program squared	0.000	0.07
Child's age	-0.844	-2.82**
Child's age squared	0.063	3.86***
Child's gender: male=1	-0.260	-1.67
Child had diarrhea the previous month=1	-0.423	-1.69
Days sick the previous month	0.002	0.29
Mother's BMI	0.091	3.46***
Household size	-0.172	-1.90*
Boys age 0-5 in household	0.126	0.60
Girls age 0-5 in household	0.349	2.72**
Father's years of schooling	-0.024	-0.86
Mother's years of schooling	0.060	1.94*
Total household expenditures (Taka/month)[a]	0.000	1.45
Child lives in urban slum area=1	-0.527	-4.65***
Location dummy	Yes	
Constant	15.547	11.30***
R-squared	0.33	

Notes: Significance levels: * significant at the 10 percent level; ** significant at the 5 percent level; *** significant at the 1 percent level.
Dependent variable is body mass index (BMI) of the child between ages 6 and 12 years enrolled in primary school. Standard errors of the coefficients are corrected for sampling effects. The standard errors are corrected for sampling effects by estimating the equation using the '*svyreg*' command of the Stata statistical software.
[a] The coefficient of household expenditures is multiplied by 1,000.

6.6 Impact on Learning

6.6.1 Empirical Model Specification

The SFP aims to enhance concentration span and learning capacity of school children by reducing short-term hunger in classroom, and by contributing to the alleviation of undernutrition. A standard achievement test was administered to primary school students in program and control areas, and the test scores used to assess the impact of SFP on learning performance of SFP participating students. The test was given to all grade 5 students, and included Bangla, English, and mathematics. Because the students did not complete their grade at the time of the survey, grade 5 students were given grade 4 standard test. The test score data have the advantage of a large sample (1,648 grade 5 students) that relate to school characteristics; as well as information collected from students on household level characteristics, such as parents' education and a number of welfare indicators of the households of students who took the test.

The difference in test scores between SF program participant and non-participant students is the impact of the program on learning; controlling for child, household, and school characteristics, and location-specific fixed effects.

Let T_i be the test score of child i in terms of percentage of total points the child obtained in a subject, and D_i^P be a variable indicating whether child i is a student of a school with the SF program.[14] The estimating equation takes the form

$$T_i = \alpha_P D_i^P + \beta X_i + u_i \ , \qquad (8)$$

where α_P is the impact of SF program on test scores, and u_i is a child-specific error term representing unobserved determinants of test scores. X_i is a vector of control variables representing child characteristics (gender of the child, and whether the child has footwear); child's household characteristics (father's and mother's years of schooling, and whether the child's household has electricity); school level characteristics (total number of students in grade 5 classroom the child attends, percentage of female teachers in school, whether school runs on single shift, teachers' monthly salary, whether any teacher in school received teaching award, percentage of teachers who received training in teaching, whether school has parent-teacher association, whether school has separate toilet for girls, and number of classrooms in school); and child's place of living (whether the child lives in urban slum-community or not, and a series of dummy variables representing the upazila of the child's residency to control for upazila-level fixed effects).

[14] All students in SFP program schools receive SF biscuits.

The regression analysis takes into account the nature of the dependent variable and the survey design so as to make correct statistical inferences. The achievement test scores represent percent of correct answers and range from 0 to 100. Therefore, equation (8) is estimated using a Tobit regression model using the *"svyintreg"* command of the Stata statistical software. This command takes into account the fact that the dependent variable is censored at 0 and 100, instead of a continuous variable that goes from positive to negative infinity. The command also corrects the standard errors for sampling effects. Four equations are estimated: one for test scores from all three subjects (i.e., Bangla, English and mathematics), and one each separately for Bangla, English, and mathematics.

6.6.2 Results

Table 6.8 provides the results of the four estimated Tobit regressions. The SF program has a statistically significant positive impact on learning, as measured by achievement test scores. In the first equation for all subjects, the value of the coefficient is 15.687, which suggests that the participation in SF program increases test scores by 15.7 percent points. Interestingly, participating students do especially well in mathematics—they score 28.5 percent higher in mathematics than do their counterpart students in the control group.

Of the remaining variables in the first equation for all subjects, child's gender, whether the child has sandals (an indicator of the child's economic wellbeing), mother's education, whether school has separate toilet for girls (a composite indicator of the feature of school facilities), number of classrooms in school, and the child living in urban slum are statistically significant determinants of learning.

- Boys do better on achievement tests than girls.
- Mother's education level has a positive impact on students' test score.
- Students score high in tests if there are more classrooms in school.
- The positive impact of girls' separate toilet in school on test score is sizable.
- Students from urban slum areas do better in tests than do students from rural areas, probably due to the difference in quality between urban and rural primary schools.

Table 6.8—Impact of school feeding program on fifth-grade students' achievement test scores: Tobit regression results

Variables	(1) All subjects		(2) Bangla		(3) English		(4) Mathematics	
	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic
Child characteristics								
Child is a SFP school student=1	15.687	2.00**	4.935	1.30	22.178	1.83*	28.516	2.27**
Child's gender: male=1	4.019	2.21**	2.253	1.83*	1.898	0.68	11.485	2.73***
Child has sandals=1	8.935	2.32**	8.449	1.56	7.695	1.56	15.260	1.85*
Child's household characteristics								
Father's years of schooling	0.004	0.02	0.140	1.01	0.119	0.54	-0.253	-0.59
Mother's years of schooling	0.558	2.45**	0.175	0.95	0.556	2.02**	1.343	2.22**
House has electricity=1	1.132	0.78	1.272	1.21	1.183	0.54	2.438	0.69
School level characteristics								
Total number of students in classroom	-0.201	-1.40	-0.045	-0.71	-0.382	-2.01**	-0.353	-0.98
Percentage of female teachers in school	0.052	0.72	0.041	1.42	0.077	0.75	0.002	0.01
School runs on single shift=1	-3.060	-0.72	3.485	2.00*	-4.470	-0.77	-13.214	-1.33
Teachers' average salary per month	0.000	-0.42	0.000	-0.93	-0.001	-0.40	0.000	0.09
Teacher(s) received teaching award=1	1.524	0.55	-0.793	-0.49	-0.547	-0.13	11.088	1.63
Percentage of teachers who received training on teaching	0.016	0.33	-0.035	-1.02	0.024	0.35	0.212	1.45
School has parent-teacher association=1	0.434	0.11	3.558	1.86*	0.981	0.18	-2.221	-0.26
School has separate toilet for girls=1	6.999	2.54**	3.507	2.81***	8.576	2.02**	14.985	1.99*
Number of classrooms in school	1.289	1.68*	0.136	0.38	1.495	1.15	3.711	1.97*
Child's place of living								
Lives in urban area=1	10.678	1.86*	9.893	2.85***	3.996	0.52	25.277	1.87*
Location dummy	Yes		Yes		Yes		Yes	
Constant	43.872	6.47***	69.494	10.99***	21.652	2.00**	22.823	1.71*
Sigma (goodness of fit)	2.88	61.55***	2.66	53.63***	3.28	110.27***	3.70	66.80***

Notes: Significance levels: * significant at the 10 percent level; ** significant at the 5 percent level; *** significant at the 1 percent level.
Dependent variable is percentage of total points the student obtained in a subject. Standard errors of the coefficients are corrected for sampling effects. The equations have been estimated using the *'svyintreg'* command of the Stata statistical software.

7. CONCLUSIONS FOR POLICY

The Government of Bangladesh devotes significant funding to provide incentives for rural families to send their children to school. The effort appears to be working: today more than 90 percent of children eventually enroll in school, and few disparities exist between boys and girls.

However, academic achievement is unsatisfactory, especially in primary schools. Hunger is a likely reason.

The School Feeding Program

In July 2002, in order to diminish hunger in the classroom as well as to promote school enrollment and retention rates, the Government of Bangladesh and the World Food Programme (WFP) launched the School Feeding Program (SFP) in chronically food-insecure areas of Bangladesh. SFP is the first effort in Bangladesh to provide incentives directly to primary-school children themselves, as opposed to cash or food to parents for sending their children to school.

The SFP provides a mid-morning snack consisting of eight fortified wheat biscuits. One million children in approximately 6,000 primary schools receive the biscuits. The schools are located in highly food-insecure rural areas plus four slum areas in Dhaka City. At a cost of US 6 cents per packet of eight, the biscuits provide 300 kilocalories and 75 percent of the recommended daily allowance of vitamins and minerals.

IFPRI's Evaluation

In late 2003, the International Food Policy Research Institute (IFPRI) conducted a comprehensive evaluation of the impact of the school feeding program. The study was commissioned by the United Nations University. Most of the program children had been eating SFP biscuits every school day for more than a year before the IFPRI surveys. Based on survey data, econometric models captured the impact of the SFP alone, isolating the effects of income and other factors.

Key Research Findings

The SFP significantly increases rates of enrollment and attendance, and reduces dropout. It has raised school enrollment by 14.2 percent and increased school attendance by 1.3 days a month. It has reduced the probability of dropping out of school by 7.5 percent.

The SFP also substantially improves the diet of the children in the program. Energy (calories) consumed from SFP biscuits are almost entirely (97 percent) additional to a child's normal diet. In other words, the child's family does not give him or her less food at home for eating the SFP biscuits at school. These findings are based on a specifically designed experiment and an econometric model to assess the impact of SFP on children's energy intake.

The biscuits are the single most important source of vitamin A in the diet of program participants. After rice, they are the most important source of energy, protein, and iron. The average energy consumption of participating students are 11 percent and 19 percent higher in rural and urban slum areas, respectively, than in corresponding control areas.

Many participating students appear to share SFP biscuits with younger siblings and sometimes other household members. Sharing creates an interesting spillover effect: SFP biscuits account for 7 percent of total energy for children aged two to five in beneficiary households in the rural area. Clearly, sharing dilutes the benefit of supplemental nutrition for individual schoolchildren. However, it can be quite beneficial for the young siblings, since nutrient supplements have a proportionally greater effect on the nutritional status of the younger children.

The SFP improves child nutritional status: it increases the body mass index (BMI) of participating children by an average of 0.62 points. This represents a 4.3 percent increase compared to the average BMI of schoolchildren in the control group—a sizable increase that is partly due to the fact that most participating children were undernourished to begin with.

In addition to diet and nutritional status, the SFP improves academic performance. Participation in the SFP increases test scores by 15.7 percent. Participating students do especially well in mathematics. Students from urban slums do better in achievement tests than do students from rural areas, probably due to the difference in quality between urban and rural primary schools.

An extremely high percentage of mothers report several positive effects of the SFP on their children. They note that children's interests in attending school and concentration on studies have increased; they are livelier and happier than before, and their incidence of illness has declined.

The study also emphasizes that urban slums in Bangladesh are considerably underserved, since other programs designed to encourage enrollment and attendance operate only in rural areas. SFP is the only national intervention that operates in urban slums—and it only covers four slum areas in Dhaka City. This evaluation shows that about half of all primary school-age children in control and 41 percent in program urban slums do not go to school. The corresponding figures in rural areas are 15 percent and 6 percent. In control urban slums, only about half of those entering primary school stay to complete it.

Direct and opportunity costs of schooling are likely to be the main causes for children from poor households in slums not to attend school. Besides low enrollment and high dropout rates, urban slum children are threatened by violence and other social disruptions. Some of these threats can be mitigated if children can be drawn to school.

Other Findings

The econometric analyses underline factors beyond the SFP that also have interesting policy implications. The study corroborates effects found in much of the recent literature, such as

that a mother's education has a positive effect on her child's nutritional status as well as school enrollment and test scores. A mother's BMI is positively associated with child nutritional status: healthy mothers have healthy children.

Child enrollment rates increase and dropout rates decrease as household income rises. However, absenteeism is higher among children from wealthy families than those from poor families, for reasons not yet clear.

The research revealed significant differences between children in urban slums and rural areas: children in urban slums have lower nutritional status (BMI) than children in rural areas. Both enrollment rates and attendance rates are considerably lower in urban slum communities than in rural communities, and dropout rates are higher.

The Way Forward

The encouraging findings of this study suggest that the SFP could well be scaled up to benefit many more Bangladeshi children—but care must be taken with targeting. To achieve maximum benefit for the cost, the program should cover those areas where undernutrition is a serious problem, school enrollment and attendance rates are low, and dropout rates are high. Urban slums, in particular, are promising areas for expansion.

The Primary Education Stipend Program—a cash-for-education incentive program—is already active throughout rural Bangladesh. For SFP expansion in rural areas, geographical targeting methods—such as Vulnerability Analysis and Mapping (VAM)—could be refined to better identify places with the highest concentration of undernourished children and lowest educational attainment.

Implications for Food Assistance Programs

Bangladesh's SFP is highly cost effective. It is inexpensive compared to related programs. The SFP costs $18 per child per year, of which $13.50 goes to produce the biscuits. On average, WFP-supported school feeding programs in other countries cost $34 a year per child.

The SFP is a far simpler and less expensive program to implement and manage than a full school lunch program. Since SFP in Bangladesh uses pre-packaged biscuits, it avoids the costs of cooking at the schools and diminishes teachers' responsibility for food management. The packaged biscuits also offer better quality control and hygiene than school-cooked meals. Because of their low cost and high impact, nutrient-fortified snacks may in many countries prove a better program option than a full meal. One way to make snacks even more palatable would be to vary their flavor, taste and texture. On the other hand, the advantages of school-cooked meals would seem to be that (1) local women, such as members of self-help groups, can be employed to prepare and distribute the meals; and (2) cooked meals would likely rely on locally grown food.

In fact, either school meals or snacks could be produced from domestic crops, opening a new market opportunity to local farmers. Local procurement must be done with care, however, since such an initiative could also increase the risk of poor farmers' taking their children out of school to help with farmwork to grow more food—thus defeating the very purpose of school feeding programs.

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APPENDIX 1

NUTRIENT COMPOSITION OF FORTIFIED BISCUITS

Each school day, a packet of 75 grams of nutrient-fortified biscuits is provided to each child attending primary school in selected food insecure areas of Bangladesh where the school feeding program implemented. The fortified biscuits, manufactured in selected local biscuit factories, are composed of the following ingredients:

- Wheat flour 75%
- Full-fat soy flour 5%
- Sugar 10%
- Vegetable fat 10%
- Vitamin-mineral pre-mix, and iodized salt and baking ingredients as required

Nutritional Value of Fortified Biscuits

A daily ration of 75 gram of fortified biscuits will provide about 300 kilocalories (kcal) of energy and 75 percent of the recommended daily allowances of common vitamins and minerals for a primary school-age child (ages 6-11 years). The approximate nutritional values of a daily ration of 75 gram of biscuits are:

- Energy (calorie)300 kcal
- Protein 7.5 grams
- Fat or oil 9 grams
- Carbohydrate 55 grams
- Vitamin and mineralsAs required

Appendix 1 Table 1 provides the recommended daily allowance of nutrients for primary school age children (ages 6-11 years) and the corresponding nutrient contents of fortified biscuits for the school feeding program.

Appendix 1 Table 1: Fortified biscuits and recommended dietary allowance (RDA) of selected nutrients for primary school-age children (6-11 years)

Energy and nutrients	Recommended daily allowance (RDA)[a]	Energy and nutrients in 75 gm Fortified SF biscuits	Percentage of RDA met from 75 gm fortified biscuits[b]
Energy	2,190 kcal	322 kcal	15
Protein	25 gm	7.5 gm	30
Vitamin A	400 ug	354 ug	89
Vitamin D3	2.5 ug	2.0 ug	80
Vitamin E	7 mg	601 mg	87
Vitamin B1	0.9 mg	0.7 mg	78
Vitamin B2	1.3 mg	0.6 mg	46
Vitamin B5 (Cal-D-- pantothenate)		2.7 mg	-
Vitamin B6	1.4 mg	1.0 mg	71
Vitamin B12	1.5 ug	0.6 mg	40
Folic Acid	100 ug	84 ug	84
Nicotinamide	14.5 mg	6.6 mg	46
Vitamin C	20 mg	33 mg[c]	165
Iron	10 mg	8.2 mg	82
Zinc	10 mg	5.3 mg	53
Iodine	120 ug	74 ug	62

Source: WFP-Bangladesh.

[a] As per (a) Food and Nutrition Handbook, WFP 2000 (b) Tables of Nutrients Composition of Bangladeshi Foods, HKI-WFP, 1988 and (c) Recommended Dietary Allowance Table, USAID, 1989.

[b] Proportions of some micronutrients were kept low, in consideration of the less prevalence of deficiency symptoms from those in this region. By weight, the micronutrient-premix is about 93 percent of RDA of a primary school child (6-11 yrs.) on avearge; but after discounting for processing and storage loss, it is likely to meet 75 percent of his/her RDA.

[c] Increased amount of vitamin C has been added, as the processing loss of vitamin C is more. Also there are opinions that RDA of vitamin C possibly should be more. Since it is a water soluble vitamin, no harm is expected from such increased level of intake.

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APPENDIX 2

Cost of Production of Fortified Biscuits for the School Feeding Program in Bangladesh

In November 2003, WFP-Bangladesh issued new barter contracts to seven biscuit factories in Bangladesh to produce fortified biscuits for the School Feeding Program. The contracts were issued for a period of five months from November 2003 with an estimated 7,750 metric tons of fortified biscuits for about 28,000 metric tons of wheat (an average barter rate of 1: 3.61).

Implication of this barter arrangement on the cost of production of biscuits at various stages is as follows:

Cost per metric ton of fortified biscuits as per barter rate (excluding premix cost, transportation and warehouse costs)	Tk 27,097 (US$ 497)
Cost per metric ton of fortified biscuits (excluding premix) (including, local transportation and warehouse costs)	Tk. 29,000 (US$ 500)
Cost per metric ton of fortified biscuits (including premix and air-freight costs)	Tk. 29,948 (US$ 516)
Cost per metric ton of fortified biscuits (including NGO service providers' costs)	Tk. 43,500 (US$ 750)
Cost per packet of 75 gm biscuit ((including premix, transportation and all service provider's cost)	Tk. 3.26 (US$ 0.056)

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Source: WFP-Bangladesh.

APPENDIX 3

Recommended Energy Allowances

Category	Age (years) or condition	Weight (kg)	Kcal per kg	Total Kcal/day[a]
Infants	0.0-0.5	6	108	650
	0.5-1.0	9	98	850
Children	1-3	13	102	1300
	4-6	20	90	1800
	7-10	28	70	2000
Females	11-14	46	47	2200
	15-18	55	40	2200
	19-24	58	38	2200
	25-50	63	36	2200
	51+	65	30	1900
Males	11-14	45	55	2500
	15-18	66	45	3000
	19-24	72	40	2900
	25-50	79	37	2900
	51+	77	30	2300
Pregnant	1st trimester			+0
	2nd trimester			+300
	3rd trimester			+300
Lactating	1st 6 mo.			+500
	2nd 6 mo.			+500

Source: Adapted from Table 3-5 in Recommended Dietary Allowances, National Research Council, National Academy Press, Washington, D.C. 1989.

[a] In the range of light to moderate activity, the coefficient of variation is about 20 percent. Figures are rounded.

APPENDIX 4

Potential Sources of Endogeneity

Endogeneity problems could arise in the econometric models employed in this study if the left hand-side variables and the right hand-side variables were both caused by characteristics that were not observed by the researcher. In the case of the School Feeding Program (SFP), one might imagine that the following endogeneity problems would arise:

- The participation in SFP is a function of school enrollment choices. Such choices may be influenced by the presence of SFP in program areas, because program-area households may have different schooling (and other) preferences than the preferences of households in non-program areas.
- All children may not be willing to participate in SFP.

It is argued that in the settings of this evaluation of the SFP, endogeneity is not the problem that often arises in other settings. The GOB and WFP have jointly selected program upazilas that are classified as highly food insecure according to the Vulnerability Analysis and Mapping (VAM) designation. The SFP is implemented in 36 upazilas (rural areas of 32 upazilas and slums in 4 upazilas in Dhaka City), out of the total of 489 upazilas in the country. In the econometric model specification in each of the 6 equations, the selection of upazilas is controlled for by including upazila dummy variables for SFP program and control upazilas, which control for all observed and unobserved characteristics of the upazilas, including those that are used to select the upazilas for the program.

All primary schools in the program upazilas are covered by the SFP. Survey data collected for this study suggest that virtually all students (97.5 percent) in these schools participate in the SFP. Parents are unlikely to send their primary school-age children to school outside the upazila they live in. In the rural areas, where most of the data were collected, often only one school is available in the village. Parents' preferences for their children's schooling are likely to be influenced by their own levels of education. Survey data suggest that, in sample areas, around half of all male and two-thirds of all female age 25 and over never attended school. In rural areas on average, fathers have 2.4 years of schooling in program and 2.8 years in control areas, and mothers in both program and control areas have 1.6 years of schooling. In this setting, therefore, the choices of school enrollment and program participation do not create as large of an endogeneity problem as it would be in other settings.