

Effects of Nutrition on Educational Performance of Young Children in an Urban Primary School in Bangladesh

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Introduction

The prevalence of malnutrition is very high in Bangladesh and the children are one of the worst sufferers. A recent survey indicates that 93% of the children aged 6-71 months in the country are underweight, 88% are short and 61% are thin. Classified by the combined height for age and weight for height criteria 31% of the children are nutritionally normal and 69% suffer from chronic protein energy malnutrition.¹ Micronutrient deficiencies are also common. Approximately 75% of the children suffer from nutrition deficiency anaemia.² 50% suffer from prevalence of goiter.³ and 4% suffer from overt vitamin A deficiency symptoms.⁴ It is estimated that 30000 children become blind every year due to vitamin A deficiency and one-half of them die within one year of blindness.

Malnutrition has many adverse consequences. In young children

prolonged malnutrition retards growth, increases illness and delays learning. It is often argued that a malnourished child is mentally and physically fatigued. He lacks in curiosity and he is unresponsive to environmental stimulation. As a result he is inattentive in class and performs less well than his well nourished counterparts. He is also frequently attacked by illness leading to higher absenteeism which is considered as another cause for his poor performance.⁵

Empirical studies relating nutritional status with educational performance are however limited. An earlier study in Bangladesh, using data from a primary school in Dhaka, showed that absenteeism of young children was unrelated to their nutritional status but their examination performance was significantly related to their nutritional status irrespective of the measure used for nutritional status.⁶ The study used bivariate

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analysis to examine the relationship which is subject to criticism and did not quantify the effects of nutritional status on educational performance.

The present study examines the relationships of nutritional status of young children with their educational performance using the same data set and multivariate regression technique. It allows us to control for the effects of other variables and quantify the effects of the variables on the educational performance of the children.

Materials and Methods

Sample

The study was conducted in Nilkhet Primary School which is a government free primary school located in Nilkhet, Dhaka. The data were collected from 193 male children of class 1-4, but upon scrutiny the data from 189 children were found complete and used in this study. The selection of the children was made on the basis of their availability and willingness to participate in the research project.

Data Collection

The height and weight data of the children were collected in the school

by measuring the children without shoes and with minimum of cloths. The weights were measured using a Detecto scale (Brooklyn, N. Y.) and the measurements were recorded to the nearest 0.1 kg. The heights were measured using a Microtoise (Stanley, France) and the measurements were recorded to the nearest 0.1 cm. Before taking the measurements every day the weight scale was standardized using known standard weights and the height scale was calibrated using standard measuring tapes made of steel. Socioeconomic data on the households and the age of the children were collected by interviewing the parents through home visits. Attendance in school and examination scores of the children were collected from the school records. The data collection began in January and ended in February 1991.

Evaluation of Nutritional Status

The nutritional status of the children was evaluated by comparing their weights and heights with the United States National Center for Health Statistics (NCHS) reference weights and heights of children of the same age and height. According to the weight for age (WFA) criteria children weighing 80% or more than the NCHS reference median weight for

age were classified as nutritionally normal, otherwise they were classified as malnourished. According to the combined height for age and weight for height (HFA-WFH) criteria⁷ children measuring 90% or more than the NCHS reference median HFA and 80% or more than the reference median WFH were classified as nutritionally normal, otherwise they were classified as malnourished.

Statistical Analysis

Dependent Variables and Specification. The dependent variable in this study was the educational performance of the children. Two measures of the dependent variable were used : the annual attendance of the children in the school and the annual examination scores of the children. The attendance was estimated by dividing the total number of days the children attended the school last year by the total number of days the school remained open last year and specified as percentages. The examination scores were estimated by dividing the total marks obtained by the children in the half-yearly and annual examinations held by the school last year by the total marks in the examinations and specified as percentages.

Independent Variables and Specification. Theoretically several variables can be considered as influencing the educational performance of children. In this study nutritional status of children, fathers' literacy, private tutor, grade of study, other school going children in the household, and household income were used as independent variables for the regression on attendance in school as the dependent variable. The variables and attendance in school were used as independent variables for the regression on examination scores as the dependent variable. Other variables were excluded. The exclusion of the variables will introduce specification bias in the equations, but since there is no reason to believe that the excluded variables are correlated with the included variables, standard estimators will produce unbiased and efficient parameter estimates of the included variables.

Two measures of nutritional status of children were used, WFA and HFA-WFH. WFA was specified as percentages of the NCHS reference weight for the same age. For HFA-WFH, the nutritionally normal children were specified as 1 and the malnourished children were specified as 0. Grade was specified by the grade of study of the children

(1-4), and household income was specified in thousand taka per year. Others' literacy were specified by the duration of schooling completed by them. For schooling equal to secondary school certificate and more 1 otherwise 0 was used. For presence of private tutor 1 otherwise

0, and for presence of other school going children in the household 1 otherwise 0 were used.

Results

Characteristics of the Children

Table 1 shows the characteristics of the children. 10% of the children

Table 1. Characteristics of the study participants.

items	Value
Grade of study (%)	
Grade 1	10.05
Grade 2	35.98
Grade 3	30.69
Grade 4	23.28
Age (mo)	
Range	70 - 120
Mean	90.60
Nutritional status by WFA ¹	
Normal (%)	43.39
Malnourished (%)	56.61
Nutritional status by HFA-WFH ²	
Normal (%)	51.85
Malnourished (%)	48.15
Fathers' schooling	
Range (yrs)	0 - 16
SSC and more (%)	29.10
Less than SSC (%)	70.90
Other school going sibling	
Present (%)	59.26
Absent (%)	40.74
Family income (000 Tk/yr)	
Range	5 - 36
Mean	17.53
Private tutor	
Present (%)	46.56
Absent (%)	53.44
Attendance (% of annual school days)	
Range	29.8 - 92.9
Mean	69.93
Examination score (% of annual marks)	
Range	18.8 - 93.0
Mean	59.47

1. Children weighing 80% or more than the NCHS reference median weight for age were classified as nutritionally normal. Otherwise they were classified as malnourished (WFA classification).
2. Children measuring 90% or more than the NCHS reference median height for age and weighing 80% or more than the reference median weight for height were classified as nutritionally normal. Otherwise they were classified as malnourished (Waterlow classification).

belonged to grade 1, 36% belonged to grade 2, 31% belonged to grade 3 and 23% belonged to grade 4. The average age of the children was 91 months, 43% of the children were nutritionally normal by the WFA criteria and 52% were normal by the HFA-WFH criteria. The average household income was 17000 taka per year, 29% of the children had more literate fathers, 59% had other

school going children in the households and 47% had private tutor. The average attendance in school was 70% of school days and the average examination score was 59%.

Regression Estimates

Table 2 shows the ordinary least squares estimates of the regression

Table 2. Regression results.

Independent variables	Dependent variable Examination score			Dependent variable Attendance	
	Eq. 1	Eq. 2	Eq. 3	Eq. 4	Eq. 5
Constant	55.85	53.09	44.51	67.98	65.88
Nutritional status ¹ (Normal 1 Otherwise 0)	4.56 * (2.35)	4.43 * (2.34)		-3.62 (2.46)	
Nutritional status ² (WFA %)			0.15 (0.11)		0.00 (0.12)
Fathers' schooling (SSC & more 1 Otherwise 0)	6.49 * (2.69)	5.74 * (2.51)	5.67 * (2.54)	-1.28 (2.83)	-1.56 (2.87)
Private tutor (Present 1 Otherwise 0)	5.23 * (2.32)	4.90 * (2.30)	5.03 * (2.30)	3.84 (2.42)	3.60 (2.44)
Grade (1 - 4)	-3.70 * (1.24)	-3.53 * (1.23)	-3.42 * (1.30)	1.03 (1.30)	1.44 (1.38)
Attendance (% of school days)	0.12 * (0.07)	0.12 * (0.07)	0.11 (0.07)		
Student sibling (Present 1 Absent 0)	1.18 (2.35)			0.27 (2.48)	0.35 (2.49)
Household income (000 Tk/yr)	-0.20 (0.17)			-0.01 (0.18)	-0.02 (0.18)
R square	0.147	0.140	0.131	0.031	0.019
Deg. of freedom	181	183	183	182	182
SE of Y estimate	15.47	15.45	15.52	16.28	16.38

1. Based on HFA-WFH (Waterlow) classification

2. Based on WFA classification

*. The coefficients are significantly different from zero at p < 0.05

Note : Standard errors are shown in the parenthesis

results. Multicollinearity was not a particular problem in this study. The highest correlation coefficient that was obtained between any two independent variables was 0.11 between fathers' schooling and household income. The coefficients were too small to cause inefficient (large variance) parameter estimates in the regression.

The results indicate that attendance in school was unrelated to the variables studied. In the regression analysis using attendance as the dependent variable (equation 4), nutritional status measured by HFA-WFH criteria, fathers' schooling, children's grade and household income had theoretically inconsistent signs and none of the coefficients were significantly different from zero. Use of nutritional status measured by WFA criteria (equation 5) did not improve the results. The regression analysis using examination score as the dependent variable produced better results. When all the independent variables were included, and the nutritional status was measured by the HFA-WFH criteria (equation 1), the coefficients of nutritional status, fathers' schooling, private tutor and children's grade had theoretically expected signs and they were significantly different from zero ($p < 0.05$). The coefficient

of household income had inconsistent sign and that of 'other school going sibling' was insignificant. When these two variables were excluded (equation 2)

the results did not change much. The variables explained 14% of the variations in the dependent variable which is substantial considering the cross sectional data. When the HFA-WFH measure was replaced by the WFA measure (equation 3), the coefficients of nutritional status and attendance were insignificant and the explanatory power of the equation reduced. Considering these, equation 2 was considered as a better specification explaining the examination scores of the children.

Discussions

The study agreed with Bhuyan et al 1993 that attendance of young children in school was unrelated to their nutritional status. It agreed that examination performance of the children was significantly related to their nutritional status as measured by the combined HFA-WFH criteria but disagreed that it was related to it as measured by the WFA criteria. The findings mean that either attendance is a random variable or it is related to some other variables not included in this study. They further mean that either

the WFA criteria is a poor measure of children's nutritional status specially in determining their examination performance, or the disagreement was due to the differences in the methodologies used. The negative sign of grade in all the equations indicate that for children of lower grades teachers mark examinations more liberally which is consistent with prior expectation. The inconsistent signs and insignificant parameter estimates of household income in all the equations could mean that either it has no bearing on the educational performance of lower grade children or the variable was enumerated unreliably.

Equation 2 indicates that adequate nutrition contributed 4 marks, higher level of schooling of fathers contributed 6 marks, presence of private tutor contributed 5 marks, each higher grade reduced 3 marks and a 10 percentage point increase

in the attendance in school contributed 1 mark in the annual examination scores of the children. The results imply that adequate nutrition can almost replace a private tutor and substantially replace an educated father in the examination performance of the children.

The contribution of nutrition can better be seen in the predicted annual examination scores of the children for variable levels of independent variables. Table 3 provides the estimates for grade 1 children for the mean level of attendance. It indicates that if a child of grade 1 of average attendance is malnourished, has less literate father and has no private tutor, then his expected examination score is 58%. For the nutritionally normal children the score is 62%. At the other extreme, if the child is malnourished, has more literate father and has private tutor then his

Table 3. Predicted examination scores of grade 1 children of average attendance

Nutritional status ¹	Father's schooling	Private tutor	Predicted score
Malnourished	Less literate	Absent	57.9
Normal	literate	Absent	62.3
Malnourished	More literate	Absent	63.7
Normal	More literate	Absent	68.1
Malnourished	Less literate	Present	62.8
Normal	Less literate	Present	67.2
Malnourished	More literate	Present	68.6
Normal	More literate	Present	73.0

1. HFA-WFH (Waterlow) classification

expected examination score is 67%. For the nutritionally normal child the score is 73%.

The results highlight the large contribution that nutrition can make to the educational performance of young children and justify investment in nutrition for better performance in education of young children in the country.

Summary

A multiple regression analysis using data from 189 male children studying in class 1-4 in an urban free primary school in Dhaka indicates that the attendance of the children in school was unrelated to their nutritional status. The examination performance of the children was significantly related to their nutritional status as measured by the combined height for age and weight for height criteria, but unrelated to it as measured by the weight for age criteria. Adequate nutrition contributed 4 marks while higher level of schooling of fathers contributed 6 marks, presence of private tutor at home contributed 5 marks, each higher grade of study reduced 3 marks and a 10 percentage point increase in the attendance in school contributed 1 mark in the annual examination scores of the children.

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