

Factors influencing double burden of malnutrition among pre-school children in Bangladesh: Survey in Rajshahi City

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ABSTRACT

Malnutrition is one of the major health problem in pre-school children cause of mortality and morbidity in Bangladesh. The aim of the study was to determine the associated factors of double burden of malnutrition among pre-school children in Rajshahi City, Bangladesh. By using standard procedure, 250 pre-school children were randomly selected for measuring nutritional status, during March 2017 to September 2017. Data was collected by using a semi-structured questionnaire, consisted of socio-economic, dietary and feeding pattern related information. Measurements of weight and height were obtained with digital machine according to standard procedure. Multistage random sampling, chi-square test and multinomial logistic regression were used in this study. Body mass index for age was used for determining malnutrition. The prevalence of malnutrition was 44.8% among children in this study. Normal weight was considered as reference category in multinomial logistic regression analysis, which demonstrated that the predictors of child malnutrition was parent's education, income, source of drinking water, hygienic latrine and environment, initial breastfeeding, living conditions and mother's occupation. Multinomial logistic regression analysis showed that a mother, who was uneducated (OR= 6.19 CI: 2.110-18.159; $p < 0.01$), primary educated (OR= 4.33 CI: 2.089-8.989; $p < 0.01$) and secondary incomplete (OR= 3.46 CI: 1.416-8.486; $p < 0.01$) had more chance to get underweight children than their counterparts. Likewise, children who were living in soil made (OR= 6.30; CI: 0.168-1.365; $p < 0.01$) and tin shade houses (OR= 2.05; CI: 0.960-4.388; $p < 0.05$) had more chance to get underweight than who lived in building. Poverty alleviation program would be provided for eradication of child malnutrition in Bangladesh.

Keywords: Malnutrition, Multinomial Logistic Regression, Multistage sampling, Pre-school children, Rajshahi

INTRODUCTION

Malnutrition defines to a pathological state as a result of a relative or absolute deficiency or excess of one or more essential nutrients and is the most alarming risk factor for the burden of disease causing about 300, 000 deaths per year directly and indirectly responsible for more than half of all deaths in children (Müller & Krawinkel M, 2005). It appears to be a tremendous public health problem throughout the developing countries, particularly in South Asia and Sub-Saharan Africa (Kimokoti & Hamer, 2008). The more far-reaching impact is that double burden of malnutrition (Undernutrition and overnutrition) in childhood may negatively affect their school performance, cognitive development, and continual attack by infectious diseases, thus lowering adult incomes, which in turn has negative implications for national long-term sustainable development (Khanam *et al.*, 2011). The problem of malnutrition is much higher in South Asia as half of the world's malnourished children are found in Bangladesh, India and Pakistan (Rattan, 1997). Though the government has undertaken many steps for eradicating malnutrition, the magnitude of malnutrition in children under five years of age is one of the major health problems in developing countries (Bharati *et al.*, 2008). The alarming prevalence of malnutrition is not only a challenge for South Asia or Sub-Saharan Africa but also a challenge across individual countries, individual societies, individual families as well as individual person also. In worldwide, proper nutrition is being increasingly emphasized as a human right. The nutrition of pre-school children has a great importance not only because of concern over their nutrition in initial stage of life but also is widely understood to have significant and comparatively permanent impact on their various kinds of developments such as physical, mental, social, moral etc. and improved their health status and productivity in future (Huq, 2012).

Malnutrition can cause diseases as measles, pneumonia and diarrhea among younger children hampers proper growth and brain development. This is in turn strongly related with their living environment, and with different sociocultural measures such as average disposable income, expenditure on food and education, mother's educational status and age, family size and the overall living standard of the household (Kant & Graubard, 2013). Individuals are malnourished, or suffer from under nutrition if their diet does not provide them with adequate vitamins, minerals, in a word calories and protein for maintenance and growth, or they cannot fully utilize the food they eat due to illness (Michaelsen *et al.*, 2009). World health Organization states that malnutrition is responsible for mortality of 54% children in the world (de Onis & Blössner, 2003).

According to NFHS-2 (National Family Health Survey 2, India) data of 1998-1999, 47% of children, age less than 3 years were moderately or severely underweight (Bharati *et al.*, 2011). Though Bangladesh government has taken many relevant actions for reducing the proportion of under 5 children suffering from malnutrition but still the magnitude of problem is the cause of anxiety. Malnutrition rate in Bangladesh is the highest globally, higher than 54% pre-school children are underweight. Maternal and child malnutrition are the cause of many avoidable death and a long adverse consequences among the development of children. Socioeconomic factors, such as economic status, water, sanitation, education and hygiene condition are important determinants of health outcomes in many low-income countries. Low socio-economic, demographic factors also another criterion that affects children nutritional status adversely (Zere & McIntyre, 2003). Bangladesh is an over populated country, and most of the people of Bangladesh are not aware about their health condition. Due to immense poverty, less education level and poor nutritional knowledge of caregivers, they don't know about acceptable nutritional status of their children. Pre-school children are the most vulnerable group. In recent days, Bangladeshi pre-school children are suffering not only in under nutrition but also over nutrition, as a consequence overweight and obesity are becoming a cause of anxiety for the future generation especially in urban area and responsible for non-communicable chronic diseases (Mendez *et al.*, 2005; Thakur & Gautam, 2016). The World Health Organization (WHO) reveals that 1.5 billion overweight people which comprises one third of entire population in the world are obese (Kamau *et al.*, 2011). Overweight and obesity are defined as abnormal or excess accumulations of fat that damage health (Kamau *et al.*, 2011). It is estimated that 2.3 billion adults will be overweight and 700 million adults will be obese in 2015 (Kamau *et al.*, 2011).

In Bangladesh, malnutrition assessment program has been carried out in slum area of Dhaka and some rural areas of Bangladesh, however the picture of this city area is still neglected. Here, this study was undertaken to assess the prevalence of double burden of malnutrition among pre-school children of Rajshahi city in Bangladesh and to establish the relationship between children's nutritional status and socio-economic and behavior factors.

METHODS

A cross sectional study was designed accompanied for collecting samples from all pre-school children ($36 \geq \text{Age} \leq 71$ months) were living in Rajshahi City, Bangladesh. The average age of the pre-school children was 54.24 ± 11.33 months. The study sample was consisted 250 pre-school children (boys, 131; girls, 119). All samples were selected from Rajshahi City

Corporation area, Bangladesh. The data were collected from March 2017 to September 2017 using a standard pre and post-test questionnaire, which was prepared in English and translated into Bangla and retranslated back to English by language experts to increase measurement accuracy and for field work purpose. Pre-test of the questionnaire was done on 5% of sample size in study area, which was not included in study before the actual data collection to see for the accuracy of responses and to estimate time needed. Body mass index (BMI) of mothers and their children were calculated using the formula, $BMI = \text{weight (kg)} / [\text{height (meter)}]^2$ (National Institutes of Health & National Heart, Lung, and Blood Institute, 2000; Khosla & Lowe, 1967).

Sample size determination and sampling

An appropriate mathematical formula was used to calculate adequate sample size for this study. We considered 80% power of study, 95% confidence interval and 5% non-respondents rate. All information for calculating sample size was taken from the previous study that was done by a previous study (Sarwar *et al.*, 2015). The mathematical formula provided that 225 samples were sufficient for this study, we initially considered 275 samples but 25 parents did not agree to give data. Consequently, 250 pre-school children were included in this study to determine the prevalence of malnutrition and association with parent's socio-demographic factors.

Two stages random sampling was used in the present study for selecting sample from Rajshahi City Corporation, Bangladesh. Rajshahi City Corporation consists of 30 wards. In the first stage, we selected 10 wards by random sampling. In the second stage, the household having pre-school children was selected by using simple random sampling from selected wards. All information about household having pre-school children was collected from respective ward councilor office.

Anthropometric measurement

Age of the children was determined by the help of birth registration card or immunization card. Weight was measured by electronic digital weight scale with minimum/lightly/clothing and no shoes. Calibration was done before weighing every child by setting it to zero and weight was taken into three times for increasing validity and finally average of three measurement was taken into consideration. Whereas, height of study children was measured using a vertical wooden height board by placing the child on the measuring board, and child standing upright in the middle of board by touching child's head, shoulders, buttocks, knees and heels to the board. Height also was measured three times and average of three measurements was included in the data set.

Out come and independent variables

The outcome variable of this study was BMI categories for children. According WHO, BMI is classified as (i) underweight (undernutrition; <5th centile), (ii) normal weight (healthy weight, ≥ 5 to <85th centiles) and (iii) overweight (85th to <95th) and obese ($\geq 95^{\text{th}}$) (World Health Organization Expert Committee, 1995). Healthy weight was considered as reference category for separately comparing under nutrition and over nutrition (Overweight and obese). The pre-coded standard questionnaire was developed for obtaining valid information about the socio-economic and demographic condition such as age, sex, number of children, parental educational qualification, their economic status, their occupations, environmental sanitation, their expenditure for household purposes etc. and these factors were considered as independent variables.

Statistical Methods

First the data were checked for entirety and reliability and coded and entered in the computer using Statistical Package for Social Sciences IBM (SPSS) version 20.0 for analyses. Chi-square test was utilized in this study to find the association between nutritional status and some selected socio-economic and demographic factors. Multinomial logistic regression analysis was used to find the effect of socio-economic and demographic factors on malnutrition among pre-school children. A value of $p < 0.05$ was regarded as statistically significant in the analysis.

RESULTS

In the present study, the information about the nutritional status was collected from 250 pre-school children and their parents from Rajshahi City, Bangladesh.

Gender wise malnutrition

The prevalence of undernutrition of pre-school children was 27.2% (male, 15.6% and 11.6%) while the overnutrition was found in 17.6% (Male 8.4%, and female 9.2%) (Table1).

Table 1: The prevalence of malnutrition among pre-school children in Rajshahi city, Bangladesh by gender

Gender	Children's BMI for age			Total
	Underweight	Normal weight	Overweight and obese	
Male	39(15.6%)	71(28.4%)	21(8.4%)	131(52.4%)
Female	29(11.6%)	67(26.8%)	23(9.2%)	119(47.6%)
Total	68(27.2%)	138(55.2%)	44(17.6%)	250(100%)

Age wise malnutrition

The highest prevalence of undernutrition (12%) was found among children in age group 48 - 59 months, while the highest number of overnutrition (8.4%) child was observed in the age group 60 - 71 months (Table2).

Table 2: The prevalence of malnutrition of pre-school (36 months-71 months) children in Rajshahi City, Bangladesh by age group

Age group of child (in months)	Children's BMI for age			Total
	Underweight	Overweight and obese	Normal weight	
36 - 47	17 (6.8%)	13(5.2%)	46(18.4%)	76(30.4%)
48 - 59	30(12%)	10(4.0%)	34(13.6%)	74(29.6%)
60 - 71	21(8.4%)	21(8.4%)	58(23.2%)	100(40.0%)
Total	68(27.2%)	44(17.6%)	138(55.2%)	250(100%)

Association between nutritional status and socio-economic and demographic factors

Chi-square test was used to find the association between the categories of nutritional status and socio-economic factors among pre-school children in Rajshahi City in table 3. This test demonstrated that the parental age, education and occupation, having TV and refrigerator, mothers' BMI, housing and hygienic conditions, initial breastfeeding, sources of drinking water, hygienic latrine, age of the children, family income and expenditure for food were significantly associated with pre-school children nutritional status.

Table 3: Association between malnutrition and socio-economic and demographic factors among pre-school children

Variables	Group	BMI-Percentile			Total	χ^2 -test	p-value
		Under-weight 68 (27.2%)	Normal weight 138 (55.2%)	Overweight & obesity 44 (17.6%)			
Mother's occupation	Home maker	46(26%)	99(55.9%)	32(18.1%)	177	10.78	p <0.05
	Service	3(13.6%)	11(50%)	8(36.4%)	22		
	Others	19(37.3%)	28(54.9%)	4(7.8%)	51		
Father's occupation	Service	13(15.1%)	58(67.4%)	15(17.4%)	86	12.05	p < 0.05
	Business	33(32%)	49(47.6%)	21(20.4%)	103		
	Others	22(36.1%)	31(50.8%)	8(13.1%)	61		
Mother's education	No education	10(58.8%)	7(41.2%)	0(0%)	17	37.90	p < 0.001
	Primary	25(45.5%)	25(45.5%)	5(9.1%)	55		
	Secondary	12(41.4%)	15(51.7%)	2(6.9%)	29		
	SSC and above	21(14.1%)	91(61.1%)	37(24.8%)	149		

Father's education	No education	12(48%)	12(48%)	1(4%)	25	29.27	p < 0.001
	Primary	14(34.1%)	22(53.7%)	5(12.2%)	41		
	Secondary	14(53.8%)	12(46.2%)	0(0%)	26		
	SSC and above	28(17.7%)	92(58.2%)	38(24.1%)	158		
Refrigerator access	No	46(43.8%)	53(50.5%)	6(5.7%)	105	33.62	p < 0.001
	Yes	22(15.2%)	85(58.6%)	38(26.2%)	145		
Having TV	No	36(47.4%)	35(46.1%)	5(6.6%)	76	25.52	p < 0.001
	Yes	32(18.4%)	103(59.2%)	39(22.4%)	174		
Maintaining hygienic condition	No	37(49.3%)	25(33.3%)	13(17.3%)	75	38.23	p < 0.001
	Yes	16(12%)	90(67.7%)	27(20.3%)	133		
	Don't understand	15(35.7%)	23(54.8%)	4(9.5%)	42		
Mother's age	16-25	39(42.4%)	51(55.4%)	2(2.2%)	92	33.56	p < 0.001
	26-34	24 (20.9%)	62(53.9%)	29(25.2%)	115		
	35-45	5(11.6%)	25(58.1%)	13(30.2%)	43		
Father's age	16-25	8(50%)	8(50%)	0 (0%)	16	19.68	p < 0.001
	26-34	35(34.3%)	57(55.9%)	10(9.8)	102		
	35-45	25(18.9%)	73(55.3%)	34(25.8%)	132		
BMI of mother	Under weight	17(48.6%)	15(42.9%)	3(8.6%)	35	26.92	p < 0.001
	Normal weight	38(34.2%)	60(54.1%)	13(11.7%)	111		
	Over weight	12(12.6%)	58(61.1%)	25(26.3%)	95		
	Obese	1(11.1%)	3(55.6%)	5(33.3%)	9		
Housing	Soil made	32(54.2%)	22(37.3%)	5(8.5%)	59	47.42	p < 0.001
	Tin shade home	18(31%)	38(65.5%)	2(3.5%)	58		
	Building	18(13.5%)	78(58.6%)	37(27.8%)	133		
Initial Breast feeding	No	26(51%)	20(39.2%)	5(9.8%)	51	18.49	p < 0.001
	Yes	42(21.1%)	118(59.3%)	39(19.6%)	199		
Sources of drinking water	Tube well	53(30.6%)	100(57.8%)	20(11.6%)	173	25.93	p < 0.001
	Tap water	13(38.2%)	11(32.4%)	10(29.4%)	34		
	Filtered water	2(4.7%)	27(62.8%)	14(32.6%)	43		
Latrine	Sanitary	28(15.6%)	112(62.6%)	39(21.8%)	179	43.43	p < 0.001
	Others	40(56.3%)	26(36.6%)	5(7%)	71		
Environmental sanitation	Hygienic	21(13%)	107(66.5%)	33(20.5%)	161	45.86	p < 0.001
	Unhygienic	47(52.8%)	31(34.8%)	11(12.4%)	89		
Age of children in months	36-47	17(22.4%)	46(60.5%)	13(17.1%)	76	9.95	p < 0.05
	48-59	30(40.5%)	34(45.9%)	10(13.5%)	74		
	60-71	21(21%)	58(58%)	21(21%)	100		
Family Income in BDT	<10000	42(53.2%)	34(43%)	3(3.8%)	79	58.88	p < 0.001
	10001-20000	10(21.3%)	34(72.3%)	3(6.4%)	47		

	20001-60000	14(13.5%)	61(58.7%)	29(27.9%)	104	
	60001 and above	2(10%)	9(45%)	9(45%)	20	
Expenditure for food in BDT	2000-10000	57(41.9%)	73(53.7%)	6(4.4%)	136	53.63 p < 0.001
	11000-25000	9(9%)	57(57%)	34(34%)	100	
	26000-40000	2(14.3%)	8(57.1%)	4(28.6%)	14	
Gender	Male	39(29.8%)	71(54.2%)	21(16%)	131	1.104 P > 0.05
	Female	29(24.4%)	67(56.3%)	23(19.3%)	119	

Factors influencing pre-school children's malnutrition

Only significantly associated factors were considered as independent variables in multinomial logistic regression model. BMI categories were considered as dependent variable, and normal weight was judged as reference case in this model for comparing with separately under nutrition and over nutrition. Multinomial logistic regression analysis showed that children who were living in soil made (OR = 6.30; 95% CI: 0.168 - 1.365; p < 0.01) and tin shade houses (OR = 2.05; 95% CI: 0.960 - 4.388; p < 0.05) had more chance to get underweight than those who lived in building, on the other hand children who lived in tin shade house (OR = 0.11; 95% CI: 0.25 - 0.485; p < 0.01) were less likely to get overweight and obese than who lived in building. Children in household without refrigerator, were more likely to get underweight than those in households with refrigerator (OR = 2.16; 95% CI: 0.927 - 5.032; p < 0.05) whereas opposite results were noted when data of overweight and obese was compared with normal weight (OR= 0.21; 95% CI: 0.055 - 0.831; p < 0.05). Parent's education is very important social factor that affects children's nutritional status. A mother who was uneducated (OR= 6.19; 95% CI: 2.110 -18.159; p < 0.01), primary educated (OR= 4.33; 95% CI: 2.089 - 8.989; p < 0.01) and secondary incomplete (OR= 3.46; 95% CI: 1.416 - 8.486; p < 0.01) had more chance to get underweight children than their counterparts of more educated mothers (SSC and above). Parents who were in some service (father OR = 0.29; 95% CI: 0.127 - 0.680; p < 0.01 and mother OR = 5.09; 95% CI: 1.270 - 20.401; p < 0.05) had more chance to get normal weight child than farmers and others occupation like labor. Family that used tube-well water (OR = 3.74; 95% CI: 0.827 - 16.908; p < 0.05) or tap water (OR = 7.83; 95% CI: 1.436 - 42.728; p < 0.05) for drinking purpose was more likely to get underweight children than who used filter water, but opposite result was observed for getting overweight or obese children (OR = 0.42; 95% CI: 0.185 - 0.964; p < 0.05). The family which

used unhygienic latrine was more likely to get underweight children (OR = 0.20; 95% CI: 0.104 - 0.393; $p < 0.01$) than their counterparts using hygienic latrine. The family which lived in unhygienic environmental condition had more likely to get underweight children than the family who lived in hygienic environmental condition (OR = 0.13; 95% CI: 0.065 - 0.251; $p < 0.01$). A poor family was more likely to get underweight children than comparatively richer family (OR = 5.55; 95% CI: 1.125 - 27.464; $p < 0.05$). Mother who did not provide breastfeeding (OR = 2.95; 95% CI: 1.423 - 6.118; $p < 0.01$) had more chance to get underweight baby than those who provided breastfeeding.

Table 4: Effects of demographic and socioeconomic factors on child nutritional status using multinomial logistic regression

Variable		Odd ratio (OR)	95% CI of OR (Upper – Lower)		Odd ratio (OR)	95% CI of OR (Upper – Lower)	
Under weight	Variable	category					
	Housing	Soil made	6.30**	13.30-2.98		0.47	1.365-0.168
		Tin shaded	2.05*	4.39-0.96		0.11**	.485-0.025
		Building	ref	Ref		ref	ref
	Refrigerator	No	2.16*	5.03-0.93		0.21*	.831-0.055
		Yes	Ref	Ref		ref	ref
	TV	No	1.30	5.84-0.29		1.30	5.840-0.293
		Yes	Ref	Ref		ref	ref
	Maintaining hygienic condition	No	2.04*	4.76-0.88		3.07*	10.810-0.872
		Yes	0.28**	0.68-0.12		1.70	5.363-0.541
		Don't understand	Ref	Ref		ref	ref
	Mother's education	No education	6.19**	18.159-2.110		1.51**	1.519-1.519
		Primary	4.33**	8.989-2.089		0.492	1.383-0.175
		Secondary	3.46**	8.486-1.416		0.328	1.506-0.071
		SSC and above	Ref	Ref		ref	ref
	Father's education	No education	3.28**	8.123-1.329		0.202	1.606-0.025
		Primary	2.09*	4.618-0.947		0.550	1.560-0.194
		Secondary	3.83**	9.237-1.591		1.45**	1.45-1.45
		SSC and above	ref	Ref		ref	ref
	Mother's occupation	Home maker	0.685	1.351-0.347		2.26	6.941-0.738
Service		0.402	1.635-0.099		5.09*	20.401-1.270	
Other		Ref	Ref		Ref	Ref	
Father's occupation	Service	0.29**	.680-.127		0.79	2.136-0.296	
	Business	0.92	1.883-.458		1.56	4.013-0.610	
	Farmer	Ref	Ref		Ref	Ref	
Sources of Drinking Water	Tube well	3.74*	16.908-.827		0.42*	0.964-0.185	
	Tap water	7.83*	42.728-1.436		1.94	5.821-0.648	
	Filtered water	Ref	Ref		Ref	Ref	
Latrine	Sanitary	0.20**	0.393-0.104		1.59	4.680-.542	
				Over weight			

condition	Unhygienic latrine	Ref	Ref	Ref	Ref
Environmental Sanitation	Hygienic	0.13**	0.251-0.065	0.83	1.850-.372
	Unhygienic	Ref	Ref	Ref	Ref
Age of children in months	36-47	0.693	1.583-0.303	0.75	1.694-.340
	48-59	1.848	4.006-0.852	0.79	1.899-.335
	60-71	Ref	Ref	Ref	Ref
Family Income	<10000	5.55*	27.464-1.125	0.08**	0.395-0.020
	10001-20000	1.32	7.149-0.245	0.08**	0.395-0.020
	20001-60000	1.03	5.317-0.201	0.475	1.324-0.171
	60001 & above	Ref	Ref	Ref	Ref
Initial Breast feeding	No	2.95**	6.118-1.423	1.184	3.875-0.362
	Yes	Ref	Ref	Ref	Ref
Expenditure for medicine	0-500	0.39	1.615-0.096	.223*	1.258-0.039
	600-2000	0.50	1.891-0.134	.634	2.823-0.142
	2001-5000	Ref	Ref	Ref	Ref
Expenditure for food	2000-10000	3.12	15.281-.638	.164*	0.708-0.038
	11000-25000	0.63	3.462-0.115	1.193	4.261-0.334
	26000-40000	Ref	Ref	Ref	Ref

N.B.: *: 5% level of significance, **: 1% level of significance

DISCUSSION

The present empirical study observed that the prevalence of undernutrition of pre-school children in Rajshahi City was 27.2% (male, 15.6% and female 11.6%) while the overnutrition was found in 17.6% (Male 8.4%, and female 9.2%). The highest prevalence of undernutrition (12%) was found among children in age group 48-59 months, while the highest percentage of overnutrition was observed in children of age group 60-71 months (Table 2). A recent almost similar study performed in three districts of Bangladesh revealed that 57% under 5 years children were underweight, 60% stunted and 24.5% wasted (Mostafa, 2014). A better nutritional status reinforces better health development, on the other hand, malnutrition makes various kinds of physical and mental developmental problems with underweight, stunting and wasting (Baranwal *et al.*, 2010). Parental education, family income, living condition played a prominent role among nutritional status of children. Correspondingly educated parent, high income generating family, developed living condition helped to grow the children properly with healthy weight. A similar study carried out in urban slum area of Varanasi, which prevailed socio-economic factors, mother's literacy, feeding practice and caste are associated with nutritional status of under-five children (Oche *et al.*, 2011). A case control study was carried out in Oromia region of West Ethiopia, that showed that malnutrition was associated

with suffering from diarrheal diseases in the previous two weeks [AOR (95 % CI) = 3.94 (2.01 – 7.73)], mothers less frequently hand washing habit [AOR (95 % CI) =14.39 (7.33 – 28.22)], Improper breastfeeding [AOR (95 % CI) = 2.63 (1.29 – 4.82)], having larger family sizes [AOR (95 % CI) =2.59 (1.34 – 5.0)], absence of latrine [AOR (95 % CI) =2.99(1.23 – 7.06)], uneducated mothers [AOR (95 % CI) =2.16(1.14 – 4.11)] and febrile illness in the previous two weeks [AOR (95 % CI) =1.89 (1.0 – 3.59)] (Ayana *et al.*, 2015). Present study was found to be in agreement with an earlier study having similar findings in North West Ethiopia (Bantamen *et al.*, 2014). Children, in North West Ethiopia whose family use drinking water from unprotected source were 3 times more likely to have malnutrition as compared to those children whose family use drinking water from protected source [AOR=3.04, 95%CI (1.01, 9.17)]. In the present study, children coming from poor socio economic class had six times more chance to be underweight than those belonging to high socio economic class. Similar results were obtained in a study which was conducted in Alexandria, Egypt, that revealed that high-socioeconomic condition was associated with lower prevalence of stunting and underweight (AOR = 0.67, confidence interval (CI) = 0.55 - 0.8 and AOR = 0.75, CI = 0.58 - 0.96 respectively) (el-Sayed *et al.*, 2001). Maternal and environmental factors affected nutritional status in the present study. The prevalence of underweight was lower among children who lived in hygienic environmental condition (8.4%) than the counterpart (18.8%) in unhygienic conditions. World Health Organization Estimates that about half of total under nutrition is caused by infections from unsafe water, poor sanitation arrangement and insufficient hygiene (UNICEF, WHO & World Bank Group, 2015). Breast feeding provides a lot of health benefits for both baby and mother. It decreases various health problems such as respiratory tract infection, pneumonia, diarrhea worldwide. We got in present study, mothers who gave their children initial breast milk, had got almost five time healthy children (47.2%) than those who didn't gave initial breast milk (8%). For all the children, breast feeding is the healthiest, nutrient enriched, cheapest diet for ensuring children nutritional status (Khan, 2011). Childhood obesity is now a burning issue for urban area of developing countries. Obesity may cause serious psychological problem such as shyness, introvert, social discrimination, reduced self-confidence and physical problem such as possibilities of Type-2 diabetes, cardiovascular diseases etc. and obesity tends to continue in the future life of the child (Must and Strauss, 1999). This study revealed that more than 17% children were suffering from overweight and obese problem. The Government of Bangladesh has laid out abundant nutrition plans and policies over the past 15 years. The recently developed Health, Population and Nutrition Sector Development Program 2011-

2016 includes an operational plan for mainstreaming and scaling up nutrition services nationally through the National Nutrition Services (NNS), which proposes to decrease the prevalence of under nutrition, especially among women and girls (Millennium Development Goals, Bangladesh Progress Report, 2012-2013). As a vulnerable and loving group of population, pre-school children need special concerned, affection, proper food habit, security, protection from hunger and violence for growing up properly (Black *et al.*, 2008).

Conclusion

The present study revealed that 27.2% pre-school children were suffering from life threatening underweight condition. Pre-school years are categorized by prominent changes in the physical and cultural development, language, cognitive and social behavior. Pre-school age is the most vulnerable age. So their nutritional demand and measurement is a serious concern. Among three group of children (36-47, 48-59, 60-71 months), the prevalence of underweight is more in middle group (12%) than the other groups.

The χ^2 -test and multinomial logistic regression showed that parental education, their occupation, sources of water, environmental hygiene, latrine condition, housing, having refrigerator, initial breast feeding practice, expenditure for food and medicine play an important role for being a child malnourished. However, in recent days, overweight and obesity are appeared to be a burden for our country. Children are the most precious citizens in our society. Our future development lies in the hand of our children. It is, therefore, mandatory for a society to provide optimal environment for the children to achieve their maximum prospective and to reach Millennium Development Goals.

Ethical Approval

Ethical clearance was obtained from Institutional Animal, Medical Ethics, Biosafety and Biosecurity Committee (IAMEBBC) for Experiments on Animal, Human, Microbes and Living Natural Sources of Institute of Biological Sciences, University of Rajshahi, Bangladesh. Memo no: 78/320/IAMEBBC/IBSC, date: 22 February, 2017.

Conflict of interest

All authors declare that there are no conflicts of interests in relation to this study. In addition, this research received no specific grant from any institute, funding agency in the public or commercial sectors.

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