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ASSESSMENT OF NUTRITIONAL STATUS AMONG 6-60 MONTHS OLD CHILDREN IN RURAL BANGLADESH

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ABSTRACT

Background Nutritional status of children is one of the major predictors of child survival. However, malnutrition is a major public health problem in most of the developing countries and occurs prominently among 6-60months old children. In context of Bangladesh, nearly 41% children are suffering from malnutrition. These children are at a substantially greater risk of severe acute malnutrition and death. **Objective** The objective of the study was to assess the nutritional status of children in between 6-60months age in rural Bangladesh and to find the factors associated with malnutrition. **Method** A cross-sectional study was conducted in Gazipur district of Bangladesh for assessing the nutritional status of children in between 6-60months age and associated factors. A total of 364 children of 6-60months old were included from three purposively selected villages. Statistical Package for the Social Sciences (SPSS) 18 Version and Excel Software Version Windows 2007 were used for analyzing the data. **Result** Out of 364 children, the prevalence of anemia was found to be 23.1% according to the hemoglobin content. Age of the child had statistically significant association with anemia. Children aged 23–36 months were the most affected age groups with anemia prevalence of 7.1% which is almost two times higher than those aged 48–60 months (3.8%). MUAC is an important anthropometric parameter to assess malnutrition. The prevalence of malnutrition in the present study clearly showed 8.5% children were found with MUAC less than 11.5cm. Children in the age group 25-36 months showed higher prevalence and then followed 37-48, 48-60, 13-24 and 6-12 months age groups. By considering oedema parameter to assess malnutrition status no children was found with oedema. **Conclusion** In the study population, there is high prevalence of malnutrition, especially hemoglobin content. Taking into account Mid Upper Arm Circumference (MUAC) measurements of children malnutrition was found close to three times less than hemoglobin content. As per oedema no children was found with protein energy malnutrition (PEM).

KEYWORDS: Anemia, Hemoglobin, MUAC, Oedema, PEM, Children.

INTRODUCTION

Malnutrition continues to be a major health burden in the world, particularly in the developing world. Globally, children with moderate and severe acute malnutrition are approximately 60 million and 13 million respectively. Malnutrition is globally the most important risk factor for illness and death, with hundreds of millions of young children particularly affected. It is associated with more than one third of the global disease burden for children. Between 8 to 11 million under-five children die each year globally, and more than 35% of these deaths are attributed to malnutrition.[1]

Malnutrition continues to be a major public health problem throughout the developing world, particularly in southern Asia and sub-Saharan Africa. Diets in populations there are frequently deficient in macronutrients (protein, carbohydrates and fat, leading to protein–energy malnutrition), micronutrients (electrolytes, minerals and vitamins, leading to specific micronutrient deficiencies) or both.[2]

Rates of malnutrition in Bangladesh are among the highest in the world, with six million children estimated to be chronically undernourished. The decline in chronic malnutrition seen previously- from 60% in 1997 to 41% in 2011- now appears to be slowing down. Policies and practice in Bangladesh need to have a greater focus on nutrition, at large scale and across different sectors, in order to accelerate progress on tackling the country's substantial malnutrition burden of 41% stunting and 16% wasting across a population of 156.5 million.[3]

Malnutrition in children and women is a major public health problem in most of the developing countries and Protein Energy Malnutrition (PEM) is more common among under five years children. Childhood malnutrition is major underlying cause (>50%) of the under 5 years children deaths. Every year 7.6 million children die such preventable malnutrition and its related causes. Similarly, next prevalent cause of infant and child mortality is low birth weight which leads to the intergeneration cycle of malnutrition especially in female.[4]

Malnutrition in young children may lead to severe wasting alone (marasmus), or may be associated with oedema (kwashiorkor).[5]

In children, MUAC is useful for the assessment of nutritional status. It is good at predicting mortality and in some studies, MUAC alone or MUAC for age 10, predicted death in children better than any other anthropometric indicator. This advantage of MUAC was greatest when the period of follow-up was short.[6]

The four most important forms of malnutrition worldwide are protein-energy malnutrition, iron deficiency and anemias (IDA), vitamin A deficiency (VAD), and iodine deficiency disorders (IDD).[7]

Anemia is a decrease in the total amount of red blood cells (RBCs) or hemoglobin in the blood,[8][9] or a lowered ability of the blood to carry oxygen.[10] When anemia comes on slowly, the symptoms are often vague and may include feeling tired, weakness, shortness of breath or a poor ability to exercise.[11] Anemia that comes on quickly often has greater symptoms, which may include confusion, feeling like one is going to pass out, loss of consciousness, or increased thirst.[11] Anemia must be significant before a person becomes noticeably pale.[11] Additional symptoms may occur depending on the underlying cause.[11]

Anemia is said to be a severe public health problem when its prevalence is 40% or more in any group (all types of anemia). Severe anemia (hemoglobin <7 g/dL) is a public health problem if prevalence exceeds 2%.[12] According the 2004 World Health Organization (WHO) report, more than 2 billion people worldwide are anemic and about 47.4% of preschool children are affected by the problem. It affects most of countries in Africa and South Asia and some countries in East Asia and the Pacific. The highest prevalence of anemia is in Africa, but the greatest numbers of children affected are found in Asia.[13]

Furthermore, according to 2008 WHO report, more than half of the world’s preschool-age children (56.3%) reside in countries where anemia is a severe public health problem.[7] In sub-Saharan Africa, it is a sever public health problem among preschool-age children. In this region, much of the national prevalence is estimated to be above 40% among this group.[14]

In Ethiopia, more than four out of ten under-five children (44%) were anemic. From these, about 21% of children were mildly anemic, 20% were moderately anemic, and 3% were severely anemic. In Tigray region, the reported prevalence (37.5%) was lower than the national prevalence.[15]

Factors associated with anemia among children are complex and multidimensional. These involve socioeconomic, nutritional, biological, environmental, and cultural characteristics.[16] Because of this, understanding these factors in a given population is important for evidence based interventions and policies towards anemia. Many researches have been conducted to show its associated factors. But it remains the main public health problem, especially in developing countries. So, identifying factors associated with anemia is needed to develop appropriate interventions.

Undernutrition during infancy and childhood substantially raises vulnerability to infection and disease and increases the risk of premature death. Among children in developing countries, malnutrition is an important factor contributing to illness and death. Malnutrition during childhood can also affect growth potential and the risk of morbidity and mortality in later years of life.[17] In developing courtiers like India, undernutrition is one of the greatest problems among children. The country is still being confronted with this problem. As in other developing nations, malnourishment is a burden on a considerable proportion of population, the most vulnerable being the youngest of the country.[18]

It is well known that undernutrition in childhood is one of the reasons behind the high child mortality rates in developing countries. It is highly detrimental for the future of those children who survive.[19] Chronic undernutrition in childhood is linked to slower cognitive development and serious health impairments later in life that reduce the quality of life of individuals.[20] Nutritional status is an important index of this quality.[21] Improved child health and survival are considered universal humanitarian goals. In this respect, understanding the nutritional status of children has far reaching implications for the better development of future generations.[22]

Child growth is universally used to assess adequate nutrition, health and development of individual children, and to estimate overall nutritional status and health of populations.

Compared to other health assessment tools, measuring child growth is a relatively inexpensive, easy to perform and non-invasive process.[23] Therefore anthropometric examination is an almost mandatory tool in any research on health and nutritional condition in childhood and the study of nutritional status is of great importance for the understanding of the social well being in a population.[23] Moreover, in community based studies, mid-upper arm circumference (MUAC) appears to be a superior predictor of childhood undernutrition than many other anthropometric indicators.[23]

During preschool age period, children have special nutritional needs because of their extensive growth and development.[25] Therefore the MUAC is an important measurement which is often used for the assessment of nutritional status among pre-school children. Undernutrition among pre-school children is an important public health problem in rural India[26] including West Bengal.[27] However, there exists scanty information of the prevalence of undernutrition among preschool children in India.[28] and West Bengal.[27, 29]

The MUAC is a relatively simple measurement/index, but with a fixed cutoff, it ignores age related changes. Compared with weight-for-height, MUAC has a sensitivity of 24.6% and a specificity of 94.8%[30] and appears to be a better predictor of childhood mortality than weight-for-height.[31]

Keeping these in mind, the aim of the present study was to evaluate the nutritional status of rural Bengalee preschool children from Gazipur District, Dhaka Division, Bangladesh, using the World Health Organization[32] age and sex specific MUAC cut-off points.

In children who are 6–59 months of age, severe acute malnutrition is defined by a very low weight-for-height/weight-for-length, or clinical signs of bilateral pitting oedema, or a very low mid-upper arm circumference. Severe acute malnutrition affects an estimated 19 million children under 5 years of age worldwide and is estimated to account for approximately 400,000 child deaths each year.[33]

Oedema is a swelling caused by the accumulation of fluid in the body tissues and can be categorized as, Mild (+): oedema in both feet/ankles, Moderate (++): oedema in both feet plus lower legs, hands or lower arms, Severe (+++): generalized oedema including both feet, legs, hands, arms and face. Children with severe acute malnutrition who have severe oedema (+++) have an increased risk of mortality compared to children with severe acute malnutrition but with lesser degrees of oedema.[33]

Oedematous malnutrition, represented by its most severe form kwashiorkor, is rampant in many parts of the world and is associated with a high case fatality rate. Despite being first described more than a century ago, the pathogenesis of kwashiorkor is still not clear. The traditional thinking is that it results from a deficiency of dietary protein and is usually associated with an infection. This has now been challenged by the finding that there is no difference in diets of children developing marasmus or kwashiorkor. Nutritional oedema is associated with an increased secretion of anti-diuretic substance (probably antidiuretic hormone) which prevents the normal excretory response to water administration. Experimental studies have shown that feeding low-protein, low-calorie diets results in delayed and incomplete response to a water load, and that the livers of the animals show a reduced capacity for inactivating anti-diuretic hormone. There is now evidence that links generation of free radicals and depletion of anti-oxidants with the development of oedema in kwashiorkor.[34]

Oedema is facilitated by two biological processes;[35] filtration is the movement of fluid out of the capillary and, reabsorption is the movement of fluid back into the distal end of the capillary and small venules. When capillary fluid filtration exceeds reabsorption, fluid accumulates within the interstitium over time if it were not for the lymphatic system that removes excess fluid from the interstitium and returns it back to the intravascular compartment. Circumstances, however, can arise where net capillary filtration exceeds the capacity of the lymphatics to carry away the fluid (i.e., net filtration > lymph flow). When this occurs, the interstitium will swell with fluid and become oedematous. Decreased plasma oncotic pressure, as occurs in hypoproteinaemia during malnutrition, precipitates oedema.[35]

Our aim of this study was to assess the nutritional status of the 6-60 months old children by considering MUAC, anemia and hemoglobin level; and oedema.

MATERIALS AND METHODS

This cross sectional study was undertaken at Gazipur Sadar, Gazipur District, Dhaka Division, Bangladesh. The study area is situated at Gazipur Sadar 35 km from Banani, Dhaka the capital of Bangladesh. The area is remote and mostly inhabited by Bengalee Muslims. All preschool children (6–60 months old) living in Pirojaly, Monipur and Bhabanipur villages, Gazipur Sadar, Gazipur.

Hemoglobin Measurement

Sysmex analyzer XT-2000i uses the SLS detection method[36, 37] to measure the content of blood hemoglobin. Sodium Lauryl Sulphate (SLS) is a surfactant which both lyses erythrocytes and rapidly forms a complex with the released hemoglobin. The product SLS-MetHb (Methemoglobin) is stable for a few hours and has a characteristic spectrum with maximum absorbance at 539 nm.[38] The complex obeys Beer-Lambert's law so there is precise linear correlation between Hb concentration and absorbance of SLS-MetHb. The method simply involves mixing 25 μL of blood with 5.0 mL of a 2.08-mmol/L solution of SLS (buffered to pH of 7.2), and reading absorbance at 539 nm. The results of ctHb (total hemoglobin concentration) by the SLS-Hb method have been shown to correlate very closely (r=0.998) with the reference HiCN (hemoglobincyanide) method.[36] The method has been adapted for automated hematology analyzers and is as reliable in terms of both accuracy and precision as automated HiCN methods.[37, 39, 40] A major advantage is that the reagent is non-toxic. It is also less prone to interference by lipemia and increased concentration of leukocytes.[37] The long-term instability of SDS-MetHb precludes its use as a standard so the method must be calibrated with blood whose ctHb has been determined using the reference HiCN method.

Measuring MUAC

MUAC should be measured on the left arm, using a flexible non-elastic tape, at the mid-point of the upper arm, with the arm hanging freely by the child‘s side. Measurements should be made to the nearest millimeter. MUAC should be measured for all children aged 6-60 months. The decision to include MUAC in SMART (as an independent indicator for wasting) is based on the recognition that agencies frequently collect and use MUAC to estimate selective feeding program needs as it is a recommended indicator for admission into management of acute malnutrition. MUAC is also a better predictor for risk of death then weight for height. To date, there is no universal recommendation to use MUAC to estimate the prevalence of acute malnutrition, however in Somalia MUAC is used to predict the nutrition situation, the prevalence usually indicating a severity phase behind that predicted by GAM and SAM rates.[41]

Steps in measuring MUAC

1. Explain the procedure to the child‘s mother or career. 2. Keep your work at eye level. Ask the mother to remove clothing that may cover the left arm of the child. 3. Calculate the midpoint of the child‘s left upper arm by first locating the tip of the child‘s shoulder with your finger tips. Bend the child‘s elbow to make a right angle. Place the tape at zero, which is indicated by two arrows, on the tip of the shoulder and pull the tape straight down past the tip of the elbow. Read the number at the tip of the elbow to the nearest centimeter. Divide this number by two to estimate the midpoint. As an alternative, bend the tape up to the middle length to estimate the midpoint. A piece of string can also be used for this purpose. 4. Mark the mid-upper arm point with a pen. 5. Straighten the child‘s arm and wrap the tape around the arm at midpoint. Make sure the numbers are right side up. Make sure the tape is flat around the skin. 6. Read the measurement at the window of the tape measure. 7. Record the measurement to the nearest 0.1cm.[41]

Oedema measurement

Oedema is the retention of water in the tissues of the body. Bilateral oedema is a sign of kwashiorkor, a form of severe acute malnutrition. Children presenting oedema must be referred to the closest health centre.[41]

To diagnose oedema, normal thumb pressure is applied to the tops of the feet for about three seconds (if you count "one thousand and one, one thousand and two, one thousand and three" in English, pronouncing the words carefully, this takes about three seconds). If there is oedema, an impression remains for some time (at least a few seconds) where the oedema fluid has been pressed out of the tissue (see below).[41]

The child should only be recorded as oedematous if both feet present pitting oedema. These children are at high risk of mortality and need to be treated in a therapeutic feeding program urgently.[41]

Nutritional oedema always starts from the feet and extends upwards to other parts of the body.[41]

RESULTS

Total of 364 children participated in this study with the 100% response rate. Table-1, showed the percentage distribution of sex amongst children. Among the participated 364 children 188 (51.6%) were male and 176 (48.4%) were female.

Table 1: Sex distribution among the participants.

Sex		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	188	51.6	51.6	51.6
	Female	176	48.4	48.4	100.0
	Total	364	100.0	100.0	

Table-2, showed sex distribution of the participants among different age (months) groups. Age groups were categorized as 0-12, 13-24, 25-36, 37-48 and 49-60 months. In the 0-12 months group male were 4 (1.1%) and female were 5 (1.4%). Among 13-24, 25-36, 37-48 and 49-60 months age group male and female were 34 (9.3%) and 23 (6.3%); 62 (17%) and 58 (15.9%); 51 (14.0%) and 54 (14.8%); and 37 (10.2%) and 36 (9.9%) respectively.

Table 2: Sex distribution of the participants among different age (months) groups.

Sex		Age (Months)					Total
		0-12	13-24	25-36	37-48	49-60	
	Male	4	34	62	51	37	188
	%	1.1	9.3	17.0	14.0	10.2	51.6
	Female	5	23	58	54	36	176
	%	1.4	6.3	15.9	14.8	9.9	48.4
Total		9	57	120	105	73	364
%		2.5	15.7	33.0	28.8	20.1	100.0

Among the participated children (*n*=364) 280 children (76.9%) were found non-anemic and with standard hemoglobin level (11.0-14.0g/dL); and rest 84 children (23.1%) were found anemic and with sub-standard hemoglobin level (<11.0g/dL). For age group 6-12 months children male were 2 (0.5%) and female were 2 (0.5%) ; and found with sub-standard hemoglobin level (<11.0g/dL). Among 13-24, 25-36, 37-48 and 49-60 months age groups male and female were with sub-standard hemoglobin level 11 (3.0%) and 10 (2.7%); 16 (4.4%) and 10 (2.7%); 10 (2.7%) and 9 (2.5%); and 7 (1.9%) and 7 (1.9%) respectively (Table-3).

Table 3: The degree of non-anemic, anemic and hemoglobin value among children aged 6–60 months in relation to their sex (n = 364).

Hb (g/dL)	Sex		Age (Months)					Total
			0-12	13-24	25-36	37-48	49-60	
11.0-14.0 (Total Non-anemic)		**Male**	2	23	46	41	30	142
		%	0.5	6.3	12.6	11.3	8.2	39.0
		Female	3	13	48	45	29	138
		%	0.8	3.6	13.2	12.4	8.0	37.9
	Total		5	36	94	86	59	280
	%		1.4	9.9	25.8	23.6	16.2	76.9
<11.0 (Total Anemic)		**Male**	2	11	16	10	7	46
		%	0.5	3.0	4.4	2.7	1.9	12.6
		Female	2	10	10	9	7	38
		%	0.5	2.7	2.7	2.5	1.9	10.4
	Total		4	21	26	19	14	84
	%		1.1	5.8	7.1	5.2	3.8	23.1

Among the anemic children (*n*=84) 12 children (14.3%) found mild anemic (Hb=10.0-<11.0g/dL), 2 children (2.4%) found moderate anemic (Hb=7.0-<10.0g/dL) and no children were found with severe anemia (Hb=<7.0g/dL). In respect to mild anemia (Hb=10.0-<11.0g/dL) for age group 6-12 months children male was 1 (1.2%) and female was 1 (1.2%). Among 13-24, 25-36, 37-48 and 49-60 months age groups male and female were with 10.0-<11.0g/dL hemoglobin level 9 (10.7%) and 8 (9.5%); 12 (14.3%) and 8 (9.5%); 10 (11.9%) and 7 (8.3%); and 7 (8.3%) and 5 (6.0%) respectively. In the case of moderate anemia (Hb=7.0-<10.0g/dL) for age group 6-12 months children male was 1 (1.2%) and female was 1 (1.2%). Among 13-24, 25-36, 37-48 and 49-60 months age groups male and female were with 7.0-<10.0g/dL hemoglobin level 2 (2.4%) and 2 (2.4%); 4 (4.8%) and 2 (2.4%); 0 (0.0%) and 2 (2.4%); and 0 (0.0%) and 2 (2.4%) respectively. No children was found with severe anemia (Hb=<7.0mg/dL) (Table-4).

Table-4: The degree of mild, moderate and severe-anemia and hemoglobin value among anemic children aged 6–59 months in relation to their sex (n = 84).

Hb (g/dL)	Sex		Age (Months)					Total
			0-12	13-24	25-36	37-48	49-60	
10.0-<11.0 (Mild Anemia)		Male	1	9	12	10	7	39
		%	1.2	10.7	14.3	11.9	8.3	46.4
		Female	1	8	8	7	5	29
		%	1.2	9.5	9.5	8.3	6.0	34.5
	Total		2	17	20	17	12	68
		%	2.4	20.2	23.8	20.2	14.3	80.9
7.0-<10.0 (Moderate Anemia)		Male	1	2	4	0	0	7
		%	1.2	2.4	4.8	0.0	0.0	8.3
		Female	1	2	2	2	2	9
		%	1.2	2.4	2.4	2.4	2.4	10.7
	Total		2	2	4	2	2	16
		%	2.4	4.8	7.2	2.4	2.4	19.1
<7.0 (Severe Anemia)			None	None	None	None	None	

Among the participated children (n=364) 31 children (8.5%) were found with >11.5cm MUAC and rest 332 children (91.2%) were found with standard MUAC. For age group 6-12 months male were 0 (0.0%) and female were 0 (0.0%) were found with sub-standard MUAC (<11.5cm). Among 13-24, 25-36, 37-48 and 49-60 months age groups male and female were with sub-standard MUAC 34 (9.3%) and 23 (6.3%); 62 (17%) and 58 (15.9%); 51 (14.0%) and 54 (14.8%); and 37 (10.2%) and 36 (9.9%) respectively (Table-5).

Table-5: The degree of Mid-Upper Arm Circumference (MUAC) value among children aged 6-60 months in relation to their sex (n = 364).

MUAC (cm)	Sex		Age (Months)					Total
			6-12	13-24	25-36	37-48	49-60	
<11.5		Male	0	2	5	3	4	14
		%	0.0	0.5	1.4	0.8	1.1	3.8
		Female	0	2	7	5	3	17
		%	0.0	0.5	1.9	1.4	0.8	4.7
	Total		0	4	12	8	7	31
	%		0.0	1.1	3.3	2.2	1.9	8.5
>11.5		Male	4	32	57	48	33	174
		%	1.1	8.8	15.7	13.2	9.1	47.8
		Female	5	20	51	49	33	158
		%	1.4	5.5	14.0	13.5	9.1	43.4
	Total		9	52	108	97	66	332
	%		2.5	14.3	29.7	26.6	18.1	91.2

Among the participated children (n = 364) no children was found with edema in different age and sex groups (Table-6).

Table-6: The distribution of edema among children aged 6–60 months in relation to their sex (n = 364).

Edema	Sex		Age (Months)					Total
			0-12	13-24	25-36	37-48	49-60	
Yes/No		Male	4	34	62	51	37	188
		No	4	34	62	51	37	188
		Female	5	23	58	54	36	176
		No	5	23	58	54	36	176
	Total		9	57	120	105	73	364
	No		9	57	120	105	73	364

DISCUSSION

This study assessed the prevalence of anemia and factors associated with it among children aged 6–60 months. The prevalence of anemia was found to be 23.1%. Prevalence of anemia reported from several developing countries varied. It is about 16.1% in the Philippines during the year 2008[42] and 87% in Tanzania.[43] This level of prevalence is considered moderate public health problem according to WHO classification[44], but it is lower than the estimated global anemia prevalence (47.4%).[45]

We found that the prevalence decreased with age. It is decreased among children aged above 36 months. This may be attributable to lower iron requirements per kg body weight associated with decreasing growth rate and the shift in diet from complementary foods to table foods. This is found that children under three years of age groups were more anemic than children aged 3–5 years. The first 2 years of life carry the highest risk for developing anemia.[46, 47] Iron requirements are related to growth velocity and so requirement per kg of body weight decreases with age. The prevalence of the problem in under-24-month-old children is likely to be a combined result of the increased iron requirements due to rapid growth, low availability of foods rich in iron, and lack of diet variety. Iron intake is also likely to improve with age as a result of a more varied diet, including the introduction of meat and other iron containing foods.[48]

In addition to this, age of the child had statistically significant association with anemia. Children aged 23–36 months were the most affected age groups with anemia prevalence of 7.1% which is almost two times higher than those aged 48–60 months (3.8%).

In this study, mild and moderate anemia were highest for 25-36 months old children then followed 13-24, 37-48, 49-60 and 6-12months age groups respectively.

Available evidences show that MUAC is the best (i.e. in terms of age independence, precision, accuracy, sensitivity and specificity) case–detection method for severe and moderate malnutrition and that it is also simple, cheap and acceptable.[49] Consistently high case of fatality rates in hospitalized Kenyan children of all ages between 12-59 months with low MUAC values, (≤ 11.5 cm.) has been reported; this result[50] suggested that unadjusted (i.e. by age) MUAC may be useful in clinical settings. Velzeboer and others[51], reported in a comparison of W/H and MUAC in Guatemala, that, younger children tended to become upset and agitated during both height and weight measurements and that no such behavior was observed during the measurement of MUAC. They also opined that, this measurement can be taken by minimally trained health workers. Therefore measurement of MUAC is a quick and reliable method for screening children to identify those who are seriously malnourished.[52] There are several practical and theoretical advantages of using MUAC rather than weight-for-height for the determination of nutritional status.[50]

The prevalence of undernutrition in the present study clearly showed 8.5% children were found with MUAC less than 11.5cm. Children in the age group 25-36 months showed higher prevalence and then followed 37-48, 48-60, 13-24 and 6-12 months age groups.

Most studies on Severe Acute Malnutrition (SAM) have focused on children under the age of five years. However, as shown Grima *et al.*[53], a great proportion of children above the age of 5 were admitted with SAM. Overall, oedematous malnutrition affected around 60% of the children. Additionally, among children under the age of five years a positive relationship was found between age and edema, whereas in the older children this relationship was reversed.[53] In our study we found no children with oedema.

Our study clearly indicated that the nutritional status of these 6-60 months old children was serious with 23.1% anemia, 8.5% malnutrition in respect to MUAC. By considering oedema malnutrition status was satisfactory.

CONCLUSION

In conclusion, our study clearly indicated that the nutritional status, based on hemoglobin content, MUAC and oedema. As per hemoglobin content prevalence of anemia is high. That means malnutrition regarding iron deficiency is high. MUAC is another parameter to assess malnutrition. Nutritional oedema measurement could help us to find out protein energy malnutrition. We suggest that more studies dealing with undernutrition based on hemoglobin content, MUAC and oedema should be undertaken among preschool children from different parts of Bangladesh. Since the vast majority of the Bangladeshi population reside in rural areas where the rates of childhood undernutrition are very high, such studies should concentrate on rural pre-school children. Effective health and nutritional promotion programmes can be formulated based on the findings of these researches with the ultimate objective of areas.

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