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RESEARCH ARTICLE

EVALUATION OF NUTRITIONAL STATUS BY USING OF MID-UPPER ARM CIRCUMFERENCE AMONG CHILDREN IN A FOOD INSECURE RURAL AREA OF BANGLADESH

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ABSTRACT

The community based cross sectional study explored age and sex variations in under nutrition using mid-upper arm circumference (MUAC) cut-off values among 2196 (1037 boys and 1159 girls), 3-5 years old children in a food insecure rural Bera sub district of Pabna district in Bangladesh. MUAC was measured using standard technique. The response rate was approximately 96%. Mean MUAC among boys was higher than girls at all ages except 5 years. Significant sex differences were not observed over ages. The age-combined rates of overall (moderate and severe) under nutrition among boys (38.49%) was higher than among girls (32.22%).The age combined rates of moderate under nutrition were 36.34% and 31.03% among boys and girls, respectively. The rates of severe under nutrition were 2.15% and 1.20% among boys and girls, respectively. There were sex differences in both moderate and severe under nutrition. There was an increasing trend in the rates of overall under nutrition from 3 to 5 years in both genders. Education of mothers, housing space, family size, religion, and sex of children had significant effects on the nutritional status of children. Results of the study suggest that MUAC is a potential anthropometric indicator of child nutrition.

INTRODUCTION

Among children in developing countries, malnutrition is an important factor contributing to illness and death. Under nutrition during infancy and childhood substantially raises vulnerability to infection and disease and increases the risk of premature death. Malnutrition during childhood can also affect growth potential and the risk of morbidity and mortality in later years of life (Alderman *et al.,* 2003).In developing courtiers like Bangladesh, under nutrition 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 (Tahmid *et al.,* 2008). It is well established that under nutrition 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 (Pelletier *et al.,* 1994). In food insecure area children are suffering from chronic under nutrition which is linked to slower cognitive development and serious health consequences later in life that reduce the quality of life and performances of individuals (Scrimshaw NS, 1996).

Nutritional status is an important index of this quality (Pelletier *et al.,* 1995). Improved child health and survival are considered universal goals. In this respect, understanding the nutritional status of children has far reaching implications for the better development of future generations (Briend *et al.,* 1989). 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.

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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 (Marins *et al.,* 2002). Moreover, in community based studies, mid-upper arm circumference (MUAC) appears to be a superior predictor of childhood under nutrition than many other anthropometric indicators (WHO, 1995). During preschool age period, children have special nutritional needs because of their extensive growth and development (Bishnoi *et al.,* 2004). Therefore, the MUAC is an important measurement which is often used for the assessment of nutritional status among pre-school children. Under nutrition among pre-school children is an important public health problem in rural Bangladesh. There exists scanty information of the prevalence of under nutrition among preschool children in food insecure rural area of Bangladesh. 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% (Joseph *et al.,* 2002) and appears to be a better predictor of childhood mortality than weight-for height (Briend *et al.,* 1996).

MATERIALS AND METHODS

This cross sectional study was undertaken at Bera sub district of Pabna District of Bangladesh. The study area is situated at the Bera sub district of Bangladesh which is 270 km from the capital city Dhaka. The area is remote and mostly inhabited by Muslims and their main profession is agricultural works. The World food programme (WFP) Bangladesh launched a food security project called food security for the ultra poor project (FSUP) through asset and cash transfer for the beneficiary in this rural area All preschool children of the beneficiaries (3–5 years old) living in project area of Bera sub district are enrolled for the study. The FSUP project authorities are

allocated 1000 Taka (approximately 13USD) per household as food allowance for a period of 24 months and seed capital of 12000 Taka (approximately 154USD) for running income generating activities. The subjects were randomly selected from the beneficiary list through a computer generated random number table. The response rate was approximately 96%. A total of 2196 children (1037 boys and 1159 girls) aged 3–5 years were measured. Age and religion of the subjects were verified from the individual beneficiary database. Age estimation of the subjects: Ages of the children were ascertained from the birth registration and subsequently confirmed by parents of the children. For analyses, age was grouped into twelve months intervals. Anthropometric measurement: The MUAC measurement was taken (in centimeters) on each subject following the standard techniques (Loman *et al*., 1988). Technical errors of measurements (TEM) were found to be within reference values (Ulijaszek *et al*, 1999). Between sexes differences in means of MUAC was tested by Student's t-test. Age–group variation in MUAC was tested by One Way ANOVA test. Statistical significance was set at $P<0.05$.

Assessment of nutritional status

Nutritional status of the children was evaluated using following scheme (WHO, 1995).
Moderate under nutrition: < -2 standard deviation (SD) Z-score value
Severe under nutrition: < -3 SD Z-score value
Where SD refers to the age and sex-specific WHO standard deviations Z-score value of MUAC.
The – 2 SD and – 3 SD of age and sex-specific cutoff points are given in Table 1.

Table 1. The WHO (1995) recommended cut-off points for mid-upper arm circumference (cm) by age and sex

Age in years	Boys		Girls	
	−2SD	−3SD	−2SD	−3SD*
3	13.8	12.4	13.6	12.2
4	14.1	12.6	13.9	12.4
5	14.2	12.6	14.1	12.5

*SD: Standard Deviation

Table 2. Age and sex specific distribution of mid-upper arm circumference

Age in years	No	Boys	No	Girls	t−value	P value
		Mean (SD)		Mean (SD)		
3	387	14.21 (0.87)	478	14.13 (0.91)	1.11	0.27
4	348	14.38 (0.92)	368	14.35 (0.90)	0.44	0.66
5	302	14.52 (0.93)	313	14.53 (0.97)	-0.09	0.93

F (boys)=1.195, P=0.20; F (girls)=3.129, P<0.001; SD: Standard Deviation

RESULTS

The age and sex specific mean (SD) of MUAC are presented in Table 2. Results revealed that mean MUAC among boys was higher than girls at all ages except 5 years. Significant sex differences were not observed over ages. The prevalence of under-nutrition among the pre-school children is presented in Table 3. The age-combined rates of overall (moderate and severe) under nutrition among boys (38.49%) was higher than in girls (32.22%). The age- combined rates of moderate under nutrition were 36.34% and 31.03% among boys and girls, respectively. The rates of severe under nutrition were 2.15% and 1.20% among boys and girls, respectively. These results indicated that there existed sex differences in both moderate and severe under nutrition. In general, there was an increasing trend in the rates of overall under nutrition from 3 to 5 years in both sexes.

Table 3. Assessment of nutritional status of the studied pre-school children

Age in	Boys Undernutrition				Girls Undernutrition				Sex
year	No	Severe	Moderate	Overall	No	Severe	Moderate	Overall	Combined
3	387	4 (1.24)	126 (32.61)	131 (33.85)	478	7 (1.41)	150 (31.36)	154 (32.77)	285 (32.94)
4	348	10 (2.88)	130 (37.38)	140 (40.26)	368	3 (1.01)	104 (28.39)	108 (29.40)	248 (34.63)
5	302	8 (2.15)	118 (39.34)	126 (41.69)	313	3 (1.20)	103 (33.83)	110 (35.30)	236 (38.37)
Total	1037	22 (2.12)	374 (36.05)	397 (38.28)	1159	13 (1.21)	357 (31.03)	372 (32.22)	769 (35.01)

Figures in parentheses indicate percentages.

DISCUSSION

Several studies shows that, in terms of age independence, precision, accuracy, sensitivity and specificity, MUAC is the best case–detection method for severe and moderate malnutrition and that it is also simple, cheap and acceptable (Myatt M *et al*., 2006). 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 (Hogness 2005), suggested that unadjusted (i.e. by age) MUAC may be useful in clinical settings. Velzeboer and others (Velzrboer *et al*., 1983), 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 (Kaur *et al*., 2005). There is several practical and theoretical advantages of using MUAC rather than weight-for-height for the determination of nutritional status. The prevalence of under nutrition in the present study clearly showed a higher rate than the pre-school children of Jaffna, Sri Lanka in post-Exodus period (Elankumaran *et al*., 2003). That study had reported that the percentages of the preschool children. That study had reported that the percentages of the preschool children under the age groups 5 years affected by severe and moderate acute malnutrition were 5.1% and 19.1%, respectively. The nutritional status of these pre-school children was serious with high rates of under nutrition in both sexes. Considering stunting, underweight and wasting among the same population, high prevalence of under nutrition was also noticed. It has been reported that there is little improvement in child under nutrition for the last decade in the remote rural area of Bangladesh.

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Conclusion

The study clearly indicated that the nutritional status, based on MUAC, of these pre-school children was serious with high rates of under nutrition in both sexes. More studies dealing with under nutrition based on MUAC should be undertaken among preschool children from different rural area of Bangladesh. Such investigations will allow us to not only to compare the rates of three conventional measures of under nutrition with MUAC, but also help to demonstrate the enhanced utility and effectiveness of the latter measure. Since the vast majority of the Bangladeshi population reside in rural areas where the rates of childhood under nutrition 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 reducing childhood nutrition in these areas.

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