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ACUTE MALNUTRITION;
MID UPPER ARM CIRCUMFERENCE (MUAC) OF CHILDREN

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ABSTRACT… Objective: To determine the frequency of low mid upper arm circumference (MUAC) of children with acute malnutrition. **Patients and methods:** This study was conducted in the department of paediatrics at Liaquat University Hospital Hyderabad from 01-06-2012 to 30-11-2012. All the children with features of malnutrition, of either gender were recruited and evaluated for their mid upper arm circumference which was measured through plastic measuring tape. **Result:** During six month study period, total 135 children with acute malnutrition were studied for their mid upper arm circumference (MUAC), of which 95(70%) were males and 40(30%) were females. The mean age ±SD of overall population was 30.24±10.57 month while the mean age of male children was 32.88±11.76 and the female child was 31.62±10.97 months. Regarding the MUAC, was low in 93(68.9%) children with acute malnutrition. The mean age ±SD of child with low MUAC was 28.99±12.52 while the mean ±age of male and female child with low MUAC was 27.63±10.73 and 29.85±11.64 respectively. The mean MUAC in children of acute malnutrition with low MUAC was 8.85±3.93 while it was 8.66±3.96 and 8.93±3.31 in male and female child with low MUAC respectively. **Conclusions:** The present study suggested that MUAC is appropriate and good tool for identifying severe malnutrition in children.

Key words: Malnutrition, Mid upper arm circumference, MUAC, Kwashiorkor and marasmus

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INTRODUCTION

Malnutrition is defined as the condition that results from taking an unbalanced diet in which certain nutrients are lacking, in excess (too high an intake), or in the wrong proportions[1]. WHO estimates that 175 million children in the developing world are malnourished as indicated by low weight for age and 230 million are stunted as indicated by height for age[2]. In Pakistan, 50-60% mortality in young children (age less than 02 years) is associated with malnutrition[3]. In South Asia, one out of two preschoolers are underweight and has stunted growth[4]. In Pakistan, 33.03% of children under the age of 05 are underweight, 53.38% of the children are stunted and wasting has been reported in 11.52% of the children,[5] which clearly shows that the nutritional status in this country is poor. Malnutrition is globally the most important risk factor for illness and was associated with 54% of deaths in children in developing countries[6]. The effect of changing environmental conditions in increasing malnutrition is multifactorial[7]. Overpopulation, more commonly seen in developing countries, can reduce food production, leading to inadequate food intake or intake of foods of poor nutritional quality[7]. Conversely, the effects of malnutrition on individuals can create and maintain poverty, which can further hamper economic and social development[7].

The mid-upper arm circumference (MUAC) is a useful tool for a fast assessment of nutritional status. It is an easy and inexpensive way to detect childhood malnutrition, and is increasingly used in developing countries for rapid and extensive

nutrition surveillance and screening programs[8]. It 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%[9,10]. In developing countries where peoples may have reduced food intake, lower subcutaneous fat and muscle mass leads to low mid upper arm circumference[11]. Arm circumference indicators of nutritional status have advantages for field use because of their simplicity and low cost while weight for age and weight for height indicators requires an accurate probable scale and knowledge of the age as well as a reference table for field use. The validity of MUAC indices in the assessment of nutritional status is still disputed. Some investigators claim that MUAC can differentiate normal children from those with malnutrition[11] whereas other contests this finding[12]. The prevalence of low MUAC in acute malnutrition was reported by Adelekan, et al was 22%[13].

Therefore keeping such theme in mind the present study was conducted at a tertiary care teaching hospital of Hyderabad, the study evaluated the performance of MUAC measurement as the screening test for identifying malnourished children by weight for height index (W/H).

PATIENTS AND METHODS

All children of either gender presenting in peadiatric department of Liaquat University Hospital Hyderabad with features of acute malnutrition were enrolled and entered in the study. The malnutrition will be labeled thru bilateral pitting edema (evaluated by clinical examination) or weight for height (W/H) index was measured using pan weight scale (a machine to measure weight in sitting or lying position) and weight balance machine (measure weight in standing position), the reading was noted. After that, the weight for height (W/H) ratio was measured through a table. The score less than -2 was considered as acute malnutrition

All the children with acute malnutrition were further evaluated for mid upper arm circumference (MUAC) that was measured through plastic measuring tape by keeping work at eye level and by sitting down when possible. The very young child was hold by their mother during this procedure. Calculation was made through the midpoint of the child's left upper arm by first locating the tip of the child's shoulder with researcher's finger tips. Bend the child's elbow to make a right angle. The tape was placed at zero, which is indicated by two arrows, on the tip of the shoulder and pulls the tape straight down past the tip of the elbow. Reading was noted on the number at the tip of the elbow to the nearest centimeter and then divides this number by two to estimate the midpoint. Alternatively, the tape was bending up to estimate the midpoint. The mark was made at midpoint on the arm with pen, straighten the child's arm and wrap the tape around the arm at midpoint. The numbers were the right side up and the tape was flat around the skin. The inspection was done for tension of the tape on the child's arm to observe that the tape has the proper tension and was not too tight or too loose. When the tape was at correct position on the arm with the correct tension, the measurement was recorded to the nearest 0.1cm. After noting the reading, the tape was loosened and then removes from the child's arm[14]. MUAC was considered as low when it was ≤ 12.5 cm[15]. The exclusion criteria of the study were, children with acute, chronic or recurrent infections of the body systems like gastrointestinal tract, respiratory tract, and urinary tract, congenital anomalies e.g. heart diseases, lung diseases, hydrocephalus, metabolic disorders e.g. diabetes mellitus, inborn errors of metabolism, diabetes insipidus, galactosemia and neurodegenerative disorders.

The approval of the study was obtained from the ethical committee of Liaquat University of Medical and Health Sciences Jamshoro. A written informed consent was taken from parents / attendant of the patients after full explanation of procedure in relation to the study and all the data of the study was recorded on the pre-designed proforma. The data was entered, saved and analyzed in statistical program SPSS version 11.00. The frequency and percentage was calculated for low MUAC in patients with acute

malnutrition as well as for gender distribution. The qualitative variables were bilateral pitting edema and gender while the quantitative variables were age, MUAC and W/H ratio (Z- score). The mean ±SD was calculated for age, MUAC and W/H ratio (Z-score). The stratification was made for age, gender, bilateral pitting edema, W/H ratio (Z-score) and MUAC in patients with acute malnutrition. The Chi-square test was applied at 95% confidence interval between categorical variables and the p-value ≤ 0.05 was considered as statistically significant.

RESULTS

During six month study period, total 135 children with acute malnutrition were studied for their mid upper arm circumference (MUAC), of which 95(70%) were males and 40(30%) were females. The mean age ±SD of overall population was 30.24±10.57 month while the mean age of male children was 32.88±11.76 and the female children 31.62±10.97 months. The acute malnutrition was diagnosed by bilateral pitting edema in 39(29%) children and W/H ratio less than -2 in 37(27%) whereas thru both components in 59(44%) children. Regarding the MUAC, was low in 93(68.9%) children with acute malnutrition. The mean age ± SD of child with low MUAC was 28.99±12.52 while the mean± age of male and female child with low MUAC was 27.63±10.73 and 29.85±11.64 respectively. Regarding the overall children with acute malnutrition, the age distribution in relation to gender is mentioned in Table 0I while the age in relation to MUAC is shown in Table II. Regarding the MUAC in overall children with acute malnutrition, the MUAC in relation to gender is shown in Table III.

The mean MUAC in overall children with acute malnutrition was 9.42±2.21 whereas it was 9.43±2.42 and 9.22±3.10 in male and female population respectively. The mean MUAC in children of acute malnutrition with low MUAC was 8.85±3.93 while it was 8.66±3.96 and 8.93±3.31 in male and female child with low MUAC respectively.

DISCUSSION

Improving health of children, aged less than 5 years, is now one of the main objectives of primary healthcare services in most developing countries. The goal of the World Health Organization (WHO), particularly for children in the absence of comprehensive primary healthcare programs in developing countries to include a provision for improving the nutritional status of mothers and young children[16,17].

In present study of children with acute malnutrition admitted or examined at Liaquat University

Age (in months)	Gender		Total	P-value
	Male	Female		
06-09	16(16.8%)	04(10.0%)	20(14.8%)	0.02*
10-19	25(26.3%)	09(22.5%)	34(25.2%)	
20-29	22(23.2%)	03(7.5%)	25(18.5%)	
30-39	16(16.8%)	17(42.5%)	33(24.4%)	
40-49	10(10.5%)	05(12.5%)	15(11.1%)	
50-59	06(6.3%)	02(5.0%)	08(5.9%)	
Total	95(100%)	40(100%)	135(100%)	

Table-I. The age distribution in relation to gender

**P-value is statistically significant*

Age (in months)	MUAC		Total	P-value
	Low	Normal		
06-09	16(17.2%)	04(9.5%)	20(14.8%)	0.047*
10-19	28(30.1%)	06(14.3%)	34(25.2%)	
20-29	18(19.4%)	07(16.7%)	25(18.5%)	
30-39	16(17.2%)	17(40.5%)	33(24.4%)	
40-49	09(9.7%)	06(14.4%)	15(11.1%)	
50-59	06(6.5%)	02(4.8%)	08(5.9%)	
Total	93(100%)	42(100%)	135(100%)	

Table-II. The age distribution in relation to mid-upper-arm circumference (MUAC)

**P-value is statistically significant*

MUAC	Gender		Total	P-value
	Male	Female		
Low	71(74.7%)	22(55.0%)	93(68.9%)	*0.024
Normal	24(25.3%)	18(45.0%)	42(31.3%)	
Total	95(100%)	40(100%)	135(100%)	

Table-III. The mid-upper-arm circumference in relation to gender

**P-value is statistically significant*

Hospital Hyderabad were evaluated for their MUAC as well as W/H in predicting severity of malnutrition. Since MUAC is inexpensive, more commonly available, does not require a chart to calculate, and is easier to measure than WHZ, it may be a useful screening tool for such children. However, there were differences in the groups of children identified by these methods, the observation that the sets of children identified by these methods of assessment do not entirely overlap has been previously reported in 2 African studies, both conducted outside the hospital setting and involving only children[18,19]. In both of these studies, the differences were attributed to age, with low MUAC values identifying younger children but not older children with a low WHZ. We found that there were statistically significant, independent associations of age and sex and identification by MUAC and W/H ratio when adjusted for the effects of other variables.

In current study the total 135 children with acute malnutrition was studied of which low MUAC was observed in 93(69%) whereas the Z-score less than -2 was observed in 37(27%) and with edema was 59(44%) children with acute malnutrition. The findings are consistent with the study by Roy NC.20 Anthropometric measurements are well established and widely used as indicators of health and nutritional status in both children and adults. Despite some limitations, anthropometry remains the most practical tool for the assessment of nutritional status among members of the community in developing countries such as Pakistan, India and Bangladesh[21]. Body mass index (BMI) is widely accepted as one of the

indicators of nutritional status in adults while Mid-upper arm circumference (MUAC) is another anthropometric measure used to evaluate nutritional status that has been found to be particularly effective in determining malnutrition among children in developing countries[22]. It is a simpler measure than BMI, requiring minimum equipment and has been demonstrated to predict morbidity and mortality as accurately as underweight[23]. An extensive study by Harries AD, et al[24] suggested that MUAC could be used for the simple screening of nutritional status. Being the simplest measure, MUAC has been suggested as a substitute for BMI when the rapid screening of a population is required as a prelude to targeting the provision of assistance to those who are undernourished[25]. The arm contains sub-cutaneous fat and muscle mass, in developing countries where the peoples may undergo a reduced food intake, low subcutaneous mass fat and muscle mass tend to parallel decreased mid upper arm circumference and as a result are useful in diagnosis of malnutrition. Research has shown that MUAC is almost as useful as most other pairs of measurements, such as height and weight.

In present series the low MUAC is observed in 69% children with acute malnutrition the difference in relation to gender is statistically significant (p=0.02), the finding is consistent with the study by Choudhury, et al[26]. Pakistan is one of the South Asian country where children experience higher mortality, especially after the neonatal period[27]. Various factors, including discrimination against female children in intra-family food distribution and healthcare, were thought to be a possible mechanism that results in inferior health and less chance of survival for children[28-30]. Health and development professionals are striving to find ways to deal with the problems of gender inequality in health and survival. While the socioeconomic and health intervention programs have shown positive impact on nutritional status and survival. Considering the socioeconomic context of developing countries, it would be correct to assume that more female children who are malnourished will have died leaving the better-nourished to be measured, in which case, the gender gap between males and females in terms of nutritional status will actually be greater than that observed whereas in present study the male children population with low MUAC was predominant 71(74.7%).

CONCLUSIONS

The present study findings, as well as considerations of cost and practicality, suggest that MUAC may be more appropriate for identifying severe malnutrition in children aged between 01 and 05 years who are admitted to rural health or tertiary care teaching health centers.

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