

## Original Research Article

# Complicated severe acute malnutrition: anthropometric status from Southern Rajasthan, India

Rupali Jain, Rameshwar Lal Suman\*, Suresh Goyal,  
B. L. Meghwal, Suresh Kumar Meena

Department of Pediatrics, RNT Medical College, Udaipur, Rajasthan, India

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### \*Correspondence:

Dr. Rameshwar Lal Suman,

E-mail: [sumanrl@yahoo.co.in](mailto:sumanrl@yahoo.co.in)

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### ABSTRACT

**Background:** Childhood under-nutrition is an important public health and development challenge in India. Undernourished children have significantly higher risk of mortality and morbidity. Objective of present study was to identify the anthropometric status of complicated Severe acute malnutrition (SAM) in Southern Rajasthan, India.

**Methods:** It was a retrospective study conducted in children admitted at Malnutrition Treatment Centre attached to a tertiary hospital. Basic socio-demographic and anthropometric records of all children between 6 months to 5 years of age were analysed.

**Results:** Out of the total 1554 SAM children admitted in last two years, 855 (55.01%) were males and 699 (44.98%) were females. Mean weight was  $6.17 \pm 1.59$  kg, mean height was  $71.65 \pm 8.6$  cm and Mid upper arm circumference (MUAC) was  $10.99 \pm 1.53$  cm. Among these, 1375 (88.48%) children fulfilled weight for height (WFH) criteria, 919 (59.13%) fulfilled MUAC criteria and 246 (15.83%) had edema. On WFH Zscore analysis, 53% had  $< -3SD$  and  $< -4SD$ , 19.88% had  $< -5SD$ , 9.97% had  $< -6SD$ , 3.47% had  $< -7SD$  and 1.67% had  $< -8SD$ . Also, we observed that lower values of MUAC ranging from  $< 11.5$ cm to  $< 9$ cm. MUAC of 11.5-10cm was in 43.43% of children and 15% had MUAC  $< 10$ cm. Among the children of all age group, we observe that males of 6-24 months of age are more significantly affected as compared to females.

**Conclusions:** The study highlights the fact that extreme grades of malnutrition exist in our area ranging upto Z-score of  $-8SD$  and beyond, and is not limited to  $-3SD$  and  $-4SD$ . Also, males are the more affected of the two sexes in our rural and tribal area setting.

**Keywords:** Anthropometry, Complicated SAM, Rural and tribal area

### INTRODUCTION

Childhood under-nutrition is an important public health and development challenge in India. Undernourished children have significantly higher risk of mortality and morbidity. Besides increasing the risk of death and disease, under-nutrition also leads to growth retardation and impaired psychosocial and cognitive development.<sup>1</sup>

WHO and UNICEF have jointly formulated a class among these under nourished children named as Severe Acute Malnutrition (SAM). A child with SAM is defined by weight-for-height/length (WFH) Z- score below  $-3SD$  of the median WHO child growth standards, a mid-upper arm circumference (MUAC)  $< 115$  mm, or by the presence of nutritional oedema or visible severe wasting. They require urgent attention and management.<sup>2</sup>

Children with SAM have nine times higher risk of dying than well-nourished children. In India, the prevalence of SAM in children remains high despite overall economic growth. The National Family Health Survey-4 revealed that 7.5 percent of all children under-five years of age are severely wasted. With appropriate nutritional and clinical management, many of the deaths due to severe wasting can be prevented.<sup>3</sup>

SAM can be classified as with and without medical complications. While in-patient treatment is advised for SAM with medical complications, community management of acute malnutrition (CMAM) strategies have been advocated for SAM without complications.<sup>2</sup>

WHO provides charts for managing these children in facility upto <-4SD. For severity beyond these charts are not available and treatment protocols have not been defined. In present set up authors have observed that even more severe degree of malnutrition is present. This calls for an attention to these children which may be required to looked upon by and managed differently. Hence to highlight the severity of SAM beyond the usual limits, this study was planned. Objective of present study was to identify the anthropometric status of complicated severe acute malnutrition (SAM) in Southern Rajasthan, India.

**METHODS**

It was a retrospective study conducted in children admitted at Malnutrition Treatment Centre (MTC) of Tertiary hospital attached to a medical college, over a period of two years- 2015 and 2016. Records of all children of age between 6 months to 5 years admitted in MTC were analysed. Anthropometry of these patients was measured by a health personnel trained in facility based management of SAM. Ethical clearance from the ethical committee of the institute was taken. Only complicated SAM were getting admission in our MTC. Uncomplicated SAM were treated on outpatient basis.

Criteria to define SAM with complications were taken as severe bilateral pitting edema grade 3 or bilateral pitting edema grade 1 or 2 and /or MUAC<115mm and /or WFH<-3SD and one of the following: anorexia, not alert, medical complications e.g. - lower respiratory tract infection, high grade fever, anaemia, hypoglycaemia, severe dehydration.<sup>2</sup>

Anthropometry of all admitted children was measured in our MTC following WHO guidelines using electronic weighing scale, tricolour MUAC tape, stadiometer and infantometer by a qualified health personnel who has been trained in Facility based management of SAM.

Z-score for WFH was calculated from WHO Anthro Calculator and All the collected data was analysed statistically with standard software of Biostatistics (SPSS Version 20). Chi square test and 't' test were applied and p values were calculated.

**RESULTS**

Out of 1781 SAM children admitted in MTC of our hospital in last two years, 227 were below 6 months of age and hence excluded from the study. The data of remaining 1554 children was analysed. There was a total of 855 (55.01%) males and 699 (44.98%) females. Maximum children were in age group of 6-12months 829 (53.34%), followed by 12-24months 526 (33.84%), and least among 2-5years of age 199 (12.80%).

**Table 1: WFH wise distribution of SAM children.**

WFH-WHO Z-score	No. of children	% of children
>-2SD	64	4.11
<-2SD	115	7.40
<-3SD	342	22.00
<-4SD	489	31.46
<-5SD	309	19.88
<-6SD	155	9.97
<-7SD	54	3.47
<-8SD	26	1.67
Total	1554	100

Distribution of these children based on their residence showed that 457 (29.4%) were from urban areas and the rest 1097 (70.6%) were from rural and tribal areas. Also, 1205 (77.54%) children were from schedule caste, schedule tribe and other backward classes.

In the study, the Mean weight was 6.17±1.59 kg, mean height was 71.65±8.6 cm and Mean MUAC was 10.99±1.53 cm.

Among these, 1375 (88.48%) children fulfilled WFH criteria, 919 (59.13%) fulfilled MUAC criteria and 246 (15.83%) had bipedal edema.

Only 53% of children had Z-score <-3SD and <-4SD, while more than one-third (35%) of the children had extended Z-scores upto <-8SD. 11.5% of children had Z score >-3SD but they had edema as criteria of SAM for admission as shown in Table 1.

**Table 2: Distribution of SAM children based on MUAC.**

MUAC (cm)	No. of children (n=1554)	% of children
<9	87	5.59
9-<9.5	86	5.53
9.5-<10	71	4.56
10-<10.5	221	14.22
10.5-<11	118	7.59
11-<11.5	336	21.62
11.5-<12	147	9.45
12-<12.5	236	15.18
≥12.5	252	16.21%

While WHO defines its criteria as MUAC <11.5cm, we observe that about 15% of children had MUAC <10cm. Forty one percent of children had MUAC ≥11.5cm but

were fulfilling other criteria of admission as either WFH or presence of edema as shown in Table 2.

**Table 3: Sex wise distribution of SD Z score.**

SD Z score	Male	%	Female	%	Total	%	P value
>-3SD and above	84	9.82	95	13.59	179	11.52	0.02
<-3SD and <-4SD	437	51.11	394	56.37	831	53.47	0.03
<-5SD and below	334	39.06	210	30.04	544	35.01	0.001
	855	55.02	699	44.98	1554	100.00	

Males are more affected in all the SD Z score and this difference is statistically significant as shown in Table 3. Mean of WFH for males was -4.24±1.57 and for females was -3.88±1.44.

In children of all age group, we observe that males are more affected as compared to females but this difference is statistically significant in 6-24 months of age as shown in Table 4. Also mean of WFH for 6-12 months of age is -4.12 ± 1.63, for 12-24 months is -4.01±1.37 and for 2-5 years is -4.08±1.42.

On comparing MUAC, we observed that mean MUAC of males was 11.06±1.41 cm and females was 10.97±1.41cm, but this difference was not statistically significant (p>0.05).

**Table 4: Age and sex wise distribution of mean of SD Z score.**

Age	Mean of SD Z score in males	Mean of SD Z score in females	P value
6-<12 months	-4.32±1.52	-4±1.52	0.02
12-<24 months	-4.18±1.52	-3.75±1.52	0.001
24-60 months	-4.23±1.52	-3.95±1.52	0.06
Total	-4.24±1.52	-3.88±1.52	0.001

**DISCUSSION**

The nutritional status of children is the best indicator of their wellbeing. Malnutrition in children is one of the most common health problems affecting almost 45% of children in developing countries like India. As already stated, effects of malnutrition on the body are protean involving almost all the organ systems in the body.<sup>4</sup>

In comparison to the standard definition of WHO for SAM which includes one of the diagnostic criteria as WFH <-3SD, we have observed in this study that many children with extremely low Z scores i.e. upto -8SD and beyond are also present. And this severe degree of

malnutrition when assessed in gender, we found that males were having lower SD Z score which was statistically significant. Also, age wise distribution shows males were more significantly affected in 6-24 months. Looking at the second criteria of malnutrition by WHO i.e. MUAC<11.5cm, we observed that many children had MUAC of upto 9cm and lower but there was no statistical significant difference between sex and age distribution. This clearly reflects the extent to which these children have been deprived of their nutritional needs, thus putting a restriction on their physical growth.

The severity of malnutrition in this area can be explained as most of our children were from rural, low socioeconomic, tribals and they had poor access to health facilities.<sup>5</sup>

Our data is contrary to previous known knowledge that females are more sufferers of malnutrition. At present, there is evidence in the literature to suggest that females have a biological advantage in survival over male's due to being less vulnerable to congenital disease, infection, and perinatal illness including perinatal trauma, intrauterine hypoxia, birth asphyxia, prematurity, neonatal tetanus and acute respiratory distress syndrome. Despite this advantage, females may be more vulnerable to infections such as measles, which are the primary causes of death in later infancy and childhood between 1-5 years old, and the advantage soon diminishes.<sup>6</sup> Male children might be affected more because of recurrent infections in past which leads to a vicious cycle of malnutrition and infection. As number of studies have shown that males are more sufferer of infection because of single X chromosome while double X in female is protective. This is well highlighted in the study by Davidson et al in 2013.<sup>7</sup> Also, though the tribes too have son preference as seen in rest of the communities, they do not discriminate against girls by female infanticide or sex determination tests. Girls do not inherit land but they are not abused, hated, or subjected to rigid social norms.<sup>5</sup>

Aprameya HS et al, conducted a prospective observational study in a medical college on SAM children aged 6 months to 5 years over 1 year. Socio-epidemiological risk factors were recorded. Of 91 SAM

children, there were 50 males and 41 females. Sixty (65.93%) children had weight for height/length z score (WHZ) below -3 SD, fourteen (15.38%) had an MUAC <115 mm, 17 (18.68%) had both a WHZ below -3 SD and an MUAC <115 mm. Majority were <2 years (41.8%). Forty-three children (47.3%) were referred.<sup>8</sup>

Sakshi S et al, conducted a study in Paediatric emergency department of a tertiary care hospital catering to semi-urban and rural population in Delhi, India in which hospitalized children (*n* 1663) aged 6 months to 5 years, for whom discharge outcome was available, were consecutively recruited over 14 months. It was found that both MUAC <11.5 cm and WHZ<-3 served as independent predictors of inpatient mortality. However, MUAC was a significantly better predictor of mortality compared with WHZ.<sup>9</sup>

## CONCLUSION

Hence to conclude, present study clearly highlights the fact that extreme grades of malnutrition exists ranging upto Z-score of -8SD and beyond, and is not limited to -3SD and -4SD and males are more affected of the two sexes in our rural and tribal area setting. We recommend that more studies need to be done on children with such extreme grades of malnutrition. Protocols regarding their length of stay in hospital, diet plan, discharge criteria, requirement of longer periods of follow up need to be standardised and implemented.

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