# Hematological profile of children with Severe Acute Malnutrition admitted in a tertiary care centre of Western Rajasthan

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## Abstract

**Background:** Severe acute malnutrition (SAM) is associated with various pathophysiological changes in the body including hematological system. This study was done to understand the hematological profile of severely malnourished children.

**Methods:** This observational study was conducted in the Department of Pediatrics, Sardar Patel Medical College, Bikaner from August 2016 to January 2017. 200 children, aged 6 months- 5years admitted in the hospital with SAM were enrolled as cases. The hematological parameters were analyzed using an automated blood Analyzer.

**Results:** 81.5% of the children with SAM had anemia. 15% were severely anemic and 36.5% were moderately anemic. Mean value for hemoglobin was significantly lower in oedematous group (6.09±2.82gm/dl) as compared to non oedematous SAM (7.16±2.81gm/dl). The mean value of WBC in oedematous SAM  was 10017.95±5150.72 , while it was 10545.09± 9079.87 in non oedematous group. The mean platelet count was significantly lower in chidren with oedematous SAM.

**Conclusions:** Children with oedematous  SAM had lower mean hemoglobin, lower mean value of total leukocyte and platelet counts as compared to non oedematous SAM. This study recommends that more frequent studies should be done to describe the trend of hematopoietic changes in children with SAM to enhance anticipatory care and outcome of the affected children.

**Keywords:** Anemia, Hematological profile, Severe acute malnutrition

## Introduction

Protein Energy Malnutrition (PEM) is defined as a spectrum of diseases arising as a result of an absolute or relative deficiency of calories and/or protein in the diet.[1] In 2009, the World Health Organization (WHO) estimated that 20 million children under 5 years suffered from severe acute malnutrition (SAM) worldwide, which attributes to more than half of their deaths each year in developing countries.[2] SAM has been a real obstacle to the achievement of the fourth Millennium Development Goal (MDG).[3] Severe acute malnutrition is a major public health issue, which affects 7.5% of under-five children in India according to NFHS-4survey.[4] Nearly 0.6 million deaths and 24.6 million DALYs (disability adjusted life years) are attributed to this condition.[5]

It results in various pathophysiological changes in the body systems including significant changes in hematological parameters. Low red cell counts resulting in anemia has always been a constant feature of protein energy malnutrition and may be normochromic normocytic, microcytic hypochromic or macrocytic.[6,7] White cell changes demonstrates the synergistic

relationship which SAM has with infections and thymic atrophy.8

In India, there is paucity of data on hematological profile of severely malnourished children. So, this study was undertaken in order to guide the appropriate management of hematological abnormalities of the children admitted at our nutritional rehabilitation centre to improve their prognosis.

## Methods

This observational study was conducted in the Department of Pediatrics, Sardar Patel Medical College, Bikaner over a period of six months From August 2016 to January 2017.

A total number of 200 children admitted at our hospital with a diagnosis of severe acute malnutrition based on the WHO criteria between age group of 6 month to 5 years were enrolled as cases.9 .Children having obvious or suspected congenital malformation or genetic disorder including thalassemia or any other organic cause of malnutrition were excluded from the study.

A written and informed consent was obtained from the parents. A detailed and thorough history along with complete anthropometry and physical examination was done.

Under aseptic conditions, 3 ml of venous blood was collected into a sample bottle containing ethylene diamine tetra acetate (EDTA) and gently mixed to prevent clotting. The sample was analyzed using an automated blood Analyzer . Peripheral blood smears were looked into and other laboratory tests were done to find out the type of anemia, as required.

## Data analysis

The data was analyzed using Statistical Package for the Social Sciences (SPSS)

The Independent-Samples t- test was used to examine the association between different variables and strength of the

relationship. P-value <0.05 was considered as statistically significant.

## Results

Out of 200 cases of severe acute malnutrition, 81.5% children had anemia. 60 (30%) cases had mild Anemia, 73 (36.5%) cases had moderate anemia and 30 (15%) cases had severe anemia

Table 1: Hemoglobin (gm%) levels in children with SAM

| Hb (gm%) | Non Oedematous | | Oedematous | | Total | |
|---|---|---|---|---|---|---|
| | No. | % | No. | % | No. | % |
| <4 Severe | 18 | 11.2 | 12 | 30.8 | 30 | 15.0 |
| 4-6.9 Moderate | 61 | 37.9 | 12 | 30.8 | 73 | 36.5 |
| 7-9.9 Mild | 48 | 29.8 | 12 | 30.8 | 60 | 30.0 |
| $\geq$10 Normal | 34 | 21.1 | 3 | 7.7 | 37 | 18.5 |
| Total | 161 | | 39 | | 200 | |
| Mean | 7.16 | | 6.09 | | | |
| SD | 2.81 | | 2.82 | | | |
| T | 2.146 | | | | | |
| P | 0.033 | | | | | |

Moderate to severe anemia was found in 51.5% of children with SAM. It was found in 61.6% of oedematous children with SAM and 49.1% of non oedematous group. The mean Hemoglobin level in cases of oedematous SAM was significantly lower than in non oedematous group (6.09±2.82 vs 7.16±2.81; p =0.033).

Table 2: Total Leucocyte Count in children with SAM

| TLC | Non Oedematous | | Oedematous | | Total | |
|---|---|---|---|---|---|---|
| | No. | % | No. | % | No. | % |
| <4000 | 8 | 5.0 | 3 | 7.7 | 11 | 5.5 |
| 4000-12000 | 113 | 70.2 | 24 | 61.5 | 137 | 68.5 |
| >12000 | 40 | 24.8 | 12 | 30.8 | 52 | 26.0 |
| Total | 161 | | 39 | | 200 | |
| Mean | 10545.09 | | 10017.95 | | | |
| SD | 9079.87 | | 5150.72 | | | |
| T | 0.349 | | | | | |
| P | 0.728 | | | | | |

Leucocytosis/leucopenia was observed in 31.5% cases of SAM. The mean leucocyte count did not significantly

differ between oedematous and non oedematous group of SAM.

Table 3: Platelet count in children with SAM

| Platelet Count (lacs) | Non Oedematous | | Oedematous | | Total | |
|---|---|---|---|---|---|---|
| | No. | % | No. | % | No. | % |
| <1.5 | 45 | 28.0 | 17 | 43.6 | 62 | 31.0 |
| 1.5-4.0 | 70 | 43.5 | 19 | 48.7 | 89 | 44.5 |
| >4.0 | 46 | 28.6 | 3 | 7.7 | 49 | 24.5 |
| Total | 161 | | 39 | | 200 | |
| Mean | 2.92 | | 1.81 | | | |
| SD | 1.90 | | 1.32 | | | |
| T | 3.452 | | | | | |
| P | 0.001 | | | | | |

Platelet abnormalities were observed in 55.5% cases of SAM. Thrombocytopenia was observed in 31.1% cases while thrombocytosis was seen in 24.5% cases of SAM. The mean platelet count was significantly lower in children with oedematous SAM (p=0.001)

Table 4: PBF abnormalities observed in SAM

| Expert | Total | |
|---|---|---|
| | No. | % |
| Dimorphic Anemia | 40 | 20.0 |
| Leucocytosis | 52 | 26.0 |
| Macrocytic anemia | 2 | 1.0 |
| MCHC anemia | 84 | 42.0 |
| Leukopenia | 11 | 5.5 |
| Megaloblastic anemia | 5 | 2.5 |
| NCNC anemia | 17 | 8.5 |
| Pancytopenia | 6 | 3.0 |
| Thrombocytopenia | 62 | 31.0 |

Most common PBF abnormality in children with SAM was microcytic hypochromic anemia (42%) followed by thrombocytopenia (31%), Leucocytosis (26%) and dimorphic anemia (20%). Pancytopenia was observed in 3% of cases.

## Discussion

The current study confirms that anemia is a constant feature of severe acute malnutrition, as reported by previous studies.

In present study, 81.5% children with SAM were found to be anemic, 15% were severely anemic and 36.5% were moderately anemic.

Anemia associated with severe malnutrition is the consequence of multiple factors and represents an interaction between adaptation to inadequate food intake and the impact of other stresses associated with infection or dietary imbalance.10 Lower mean values were observed for hemoglobin in children with oedematous SAM as compared to non oedematous group. Micronutrient deficiencies such as iron, zinc and copper have also been implicated as a contributory factor.11

Table 1 shows that moderate to severe anaemia was found in 51.5% of children affected with SAM. 30% had mild anaemia. Mean Hemoglobin was significantly lower in oedematous SAM as compared to non oedematous group (6.09±2.82 vs 7.16±2.81gm%). Studies conducted by Kumar et al[12], Choudhary et al[13] have also observed high incidence of anaemia in children affected with SAM. They have observed the prevalence of mild, moderate and severe anaemia to be 7.6%, 55.7%, 24%; 10.9%, 59.3%, 29.7% respectively.

Torun[14] (2006) and Chitambar and Antony[15] (2006) also showed that haemoglobin is lower in kwashiorkor than in marasmus.

Table 2 and 3 shows that leucocytosis/leucopenia was observed in 31.5% cases of SAM, thrombocytosis in 24.5% while thrombocytopenia in 31.1%.

Babitha et al[16] (2014) has observed thrombocytopenia in 18.75% cases of children affected with SAM.

Table 4 shows that the most common abnormality noted in PBF of children with SAM was microcytic

hypochromic anaemia (42%). Dimorphic anaemia was the next commonest type of anaemia seen in 20% cases.

Thakur et al[17] has also observed the most common type of anaemia to be microcytic hypochromic anaemia (38.6%) followed by megaloblastic anaemia (30.5%). It thus emphasises the need of iron, vitamin $B_{12}$ and folate supplementation in children affected with SAM.

## Conclusion

The study shows that nearly all patients with severe acute malnutrition had anaemia as a common co-morbid condition. Most of them suffered from moderate to severe anaemia. Children with oedematous SAM had significantly lower hemoglobin, platelet count as compared to non oedematous SAM.

Protein energy malnutrition is a condition that constantly modifies the body's defence mechanism and thus altering the haematopoiesis at all levels. This study recommends that more frequent studies should be done to describe the trend of hematopoietic changes in children with SAM to enhance anticipatory care and outcome of the affected children.

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